Archaeological Resources

Airport Vicinity Development Checklist

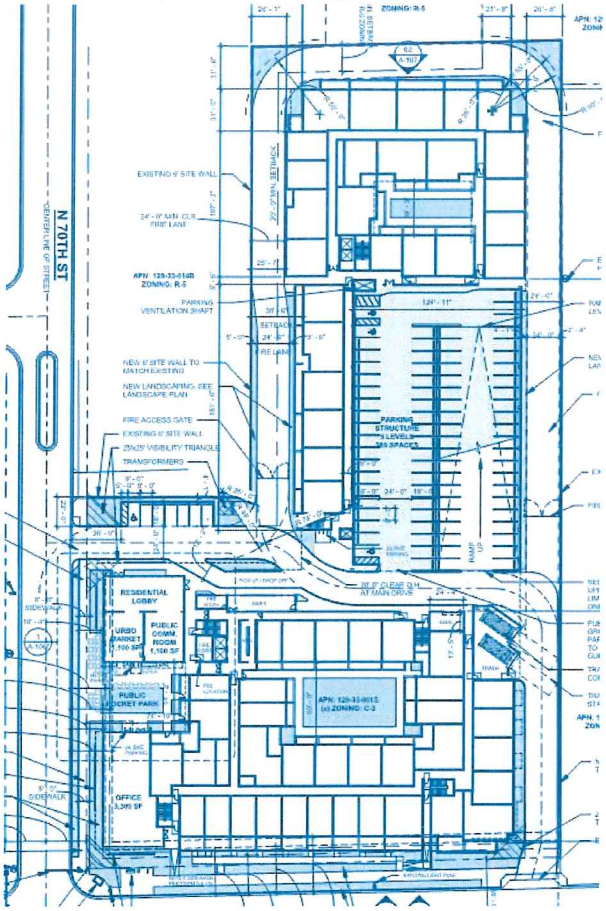
Parking Study

Trip Generation Comparison

Parking Master Plan

Southdale

Traffic Impact & Mitigation Analysis



ACCEPTED
CITY OF SCOTTSDALE
TRANSPORTATION DEPARTMENT

DATE: 2020-08-04

REVIEWER: Doug Ostler

Registered Professional Engineer (Civil)
CERTIFICATE NO.
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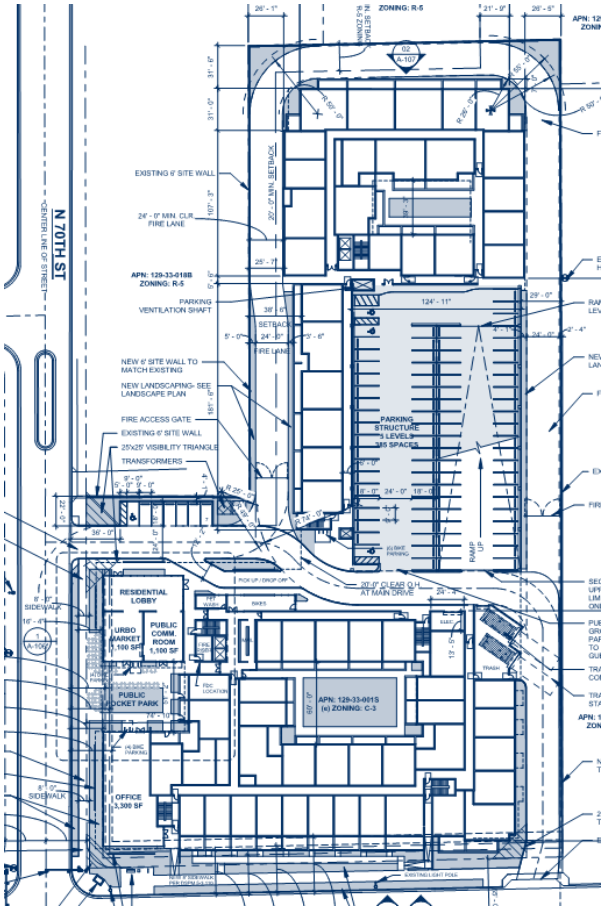
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Project Number: 20.5076
June 30, 2020

5-ZN-2020
8/7/2020

Southdale

Traffic Impact & Mitigation Analysis



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1. INTRODUCTION AND EXECUTIVE SUMMARY

1.1. PURPOSE OF REPORT AND STUDY OBJECTIVES

Lōkahi, LLC (Lōkahi) was retained by Hawkins Companies to complete a Traffic Impact & Mitigation Analysis for the proposed Southdale development. The development is located on the northeast corner of McDowell Road and 70th Street in Scottsdale, Arizona.

The objective of this Traffic Impact & Mitigation Analysis is to analyze the traffic related impacts of the proposed development to the adjacent roadway network. See **Figure 1** for the vicinity map.

1.2. EXECUTIVE SUMMARY

The proposed Southdale development will be located on the northeast corner of McDowell Road and 70th Street, in Scottsdale Arizona.

The proposed development will include the following land uses:

- Multi-Family Residential — 267 units
  - *52 studio units*
  - *150 one-bedroom units*
  - *65 two-bedroom units*
- Office — 3,300 square feet
- Retail — 1,100 square feet

This Traffic Impact and Mitigation Analysis includes:

- Level of service analysis of existing conditions for the weekday AM and PM peak hours
- Trip Generation for the proposed development
- Most recent 3-year collision history
- Level of service analysis for the opening year (2022) weekday AM and PM peak hours
  - 2022 No Build
  - 2022 Build

The following are the five (5) intersections included in this study:

- McDowell Road and 68th Street (1)
- McDowell Road and 70th Street (2)
- McDowell Road and Scottsdale Road (3)
- McDowell Road and Driveway A (4)
- 70th Street and Driveway B (5)

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Existing Capacity Analysis

The AM and PM peak hour existing conditions capacity analysis were completed for the five (5) existing study intersection. The results of the capacity analysis reveal the following location with an existing level of service (LOS) E or F:

McDowell Road and 68th Street (1) – Signalized

- EB left AM and PM peak hours operate at LOS F and E, respectively
- WB left AM and PM peak hours operate at LOS F and E, respectively
- NB left AM peak hour operates at LOS F
- SB through PM peak hour operates at LOS E

McDowell Road and 70th Street (2) – Signalized

- NB left PM peak hour operates at LOS E
- SB left AM and PM peak hours operate at LOS E

McDowell Road and Scottsdale Road (3) – Signalized

- Overall intersection PM peak hour operates at LOS E
- EB left AM and PM peak hour operates at LOS F and E, respectively
- EB through PM peak hour operates at LOS E
- WB left AM and PM peak hours operate at LOS E
- WB through AM peak hour operates at LOS E
- WB right PM peak hour operates LOS E
- NB left AM and PM peak hours operate at LOS E
- SB left AM and PM peak hours operate at LOS E and F, respectively

Trip Generation and Trip Distribution

The proposed development is anticipated to generate 1,515 weekday trips, with 109 trips occurring during the AM peak hour and 130 trips occurring during the PM peak hour. All site traffic entering and exiting 70th Street and Driveway B (5) will be encouraged to enter and exit via McDowell Road to the south and will be discouraged from using 70th Street to the north.

Trip Generation Comparison

Prior Development vs. Proposed Development

A comparison between the trips generated by the prior automobile sales and repair shop development and the proposed Southdale development was calculated.

The proposed mixed-use Southdale development will produce **205 (12%) fewer weekday daily trips** will occur, **33 (23%) fewer trips during the AM peak hour**, and **89 (41%) fewer trips during the PM peak hour** than the prior development.

Existing Development vs. Proposed Development

A comparison between the trips generated by the existing development (BDG Maintenance and Scottsdale Christian Church) and the proposed Southdale development was calculated. The peak hour trips generated by the existing development were calculated based upon operations of the existing site.

The proposed mixed-use Southdale development will produce 601 (66%) more weekday daily trips, with **61 (36%) fewer trips during the AM peak hour**, and **40 (24%) fewer trips during the PM peak hour** than the existing development. It should be noted that the peak hour for the existing development occurs between 5:00 am to 6:00 am, and 1:30 pm to 2:30 pm, while the proposed development occurs between 7:00 am to 9:00 am, and 4:00 pm to 6:00 pm.

Therefore, an additional comparison was completed between the trips generated by the existing development (BDG Maintenance and Scottsdale Christian Church) and the proposed Southdale development was calculated based on the traffic counts that were collected at the existing site driveways

The proposed mixed-use Southdale development will produce 1,235 (441%) more weekday daily trips, with 61 (127%) more trips during the AM peak hour, and 69 (113%) more trips during the PM peak hour than the existing development.

Existing Zoning vs. Proposed Development

Currently, this parcel is zoned for C-3 (Highway Commercial) development with an allowed floor area ratio of 0.8. The build out of a 3,500 square foot fast-food restaurant, paired with a 2,400 square foot coffee shop is a reasonable build out for this site under the existing zoning, due to its convenient location on an urban major arterial. This translates to a floor area ratio of 0.035 which is less than 5% of the allowed.

A comparison between the trips generated with the build out under the existing zoning, assuming a fast-food restaurant and a coffee shop, and the proposed Southdale development was calculated.

The proposed mixed-use Southdale development will produce **2,102 (58%) fewer weekday daily trips, with 246 (69%) fewer trips during the AM peak hour, and 88 (40%) fewer trips during the PM peak hour** than the build-out under existing zoning.

Future Conditions - Year 2022

Year 2022 analyses was completed with and without the build out of the proposed development. An annual growth rate of 2.0% was applied to the existing traffic volumes.

A capacity analysis was completed for both the AM and PM peak hours for year 2022, with and without the build out of the proposed development. All movements operate at a LOS D or better or are maintained at the year 2022 no build level of service with the exception of the following:

McDowell Road and Scottsdale Road (3) – Signalized

- NB left AM peak hour operates at LOS E

Recommendations

The recommendations with the build out of the proposed Southdale development include:

McDowell Road and 70th Street (2) – Signalized

Modify signal provide eastbound and westbound permitted plus protected left turn movements

Signal Timing

As with any new development and potential change in traffic patterns, the following is recommended:

- **Monitor and Adjust Signal Timing**
  Monitor traffic patterns in the area and if necessary, adjust nearby signal timing

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2. PROPOSED DEVELOPMENT

The study area is located in the City of Scottsdale, Arizona, approximately two and one-half miles west of State Route Loop 101 (SR 101L) and 2 miles north of State Route Loop 202 (SR 202L). The proposed site will be located on the northeast corner of McDowell Road and 70th Street.

The proposed development will include the following land uses:

- Multi-Family Residential — 267 units
  - *52 studio units*
  - *150 one-bedroom units*
  - *65 two-bedroom units*
- Office — 3,300 square feet
- Retail — 1,100 square feet

See **Figure 2** and **Appendix A** for the proposed site plan.

There are two (2) access points to the proposed site, one along McDowell Road and one along 70th Street.

McDowell Road Driveway A (4) is located approximately 360 feet east of 70th Street and will allow right in and right out movements only into the site.

70th Street and Driveway B (5) is located approximately 275 feet north of McDowell Road and will allow all movements into and out of the site.

See **Figure 3** for study area.

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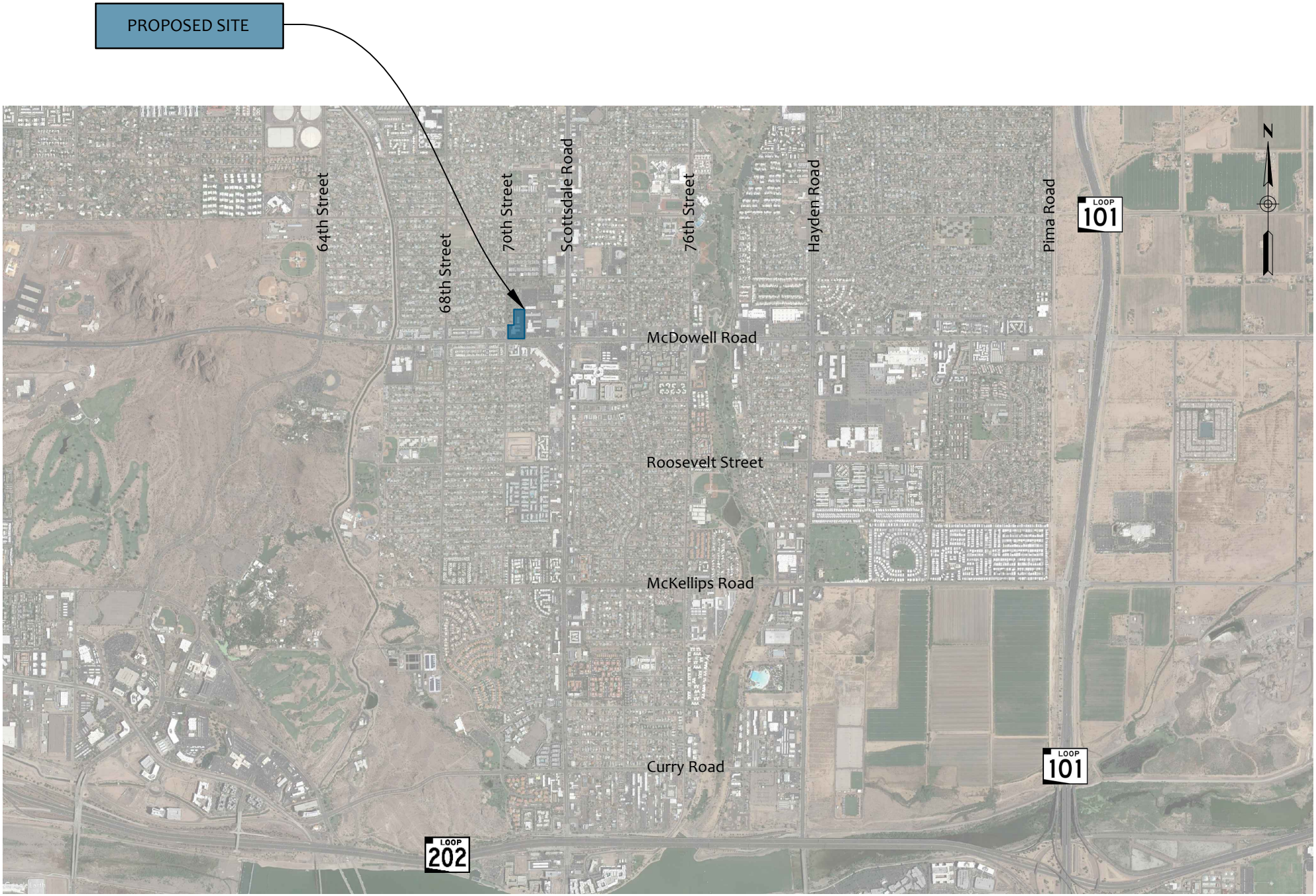


FIGURE 1 | VICINITY MAP

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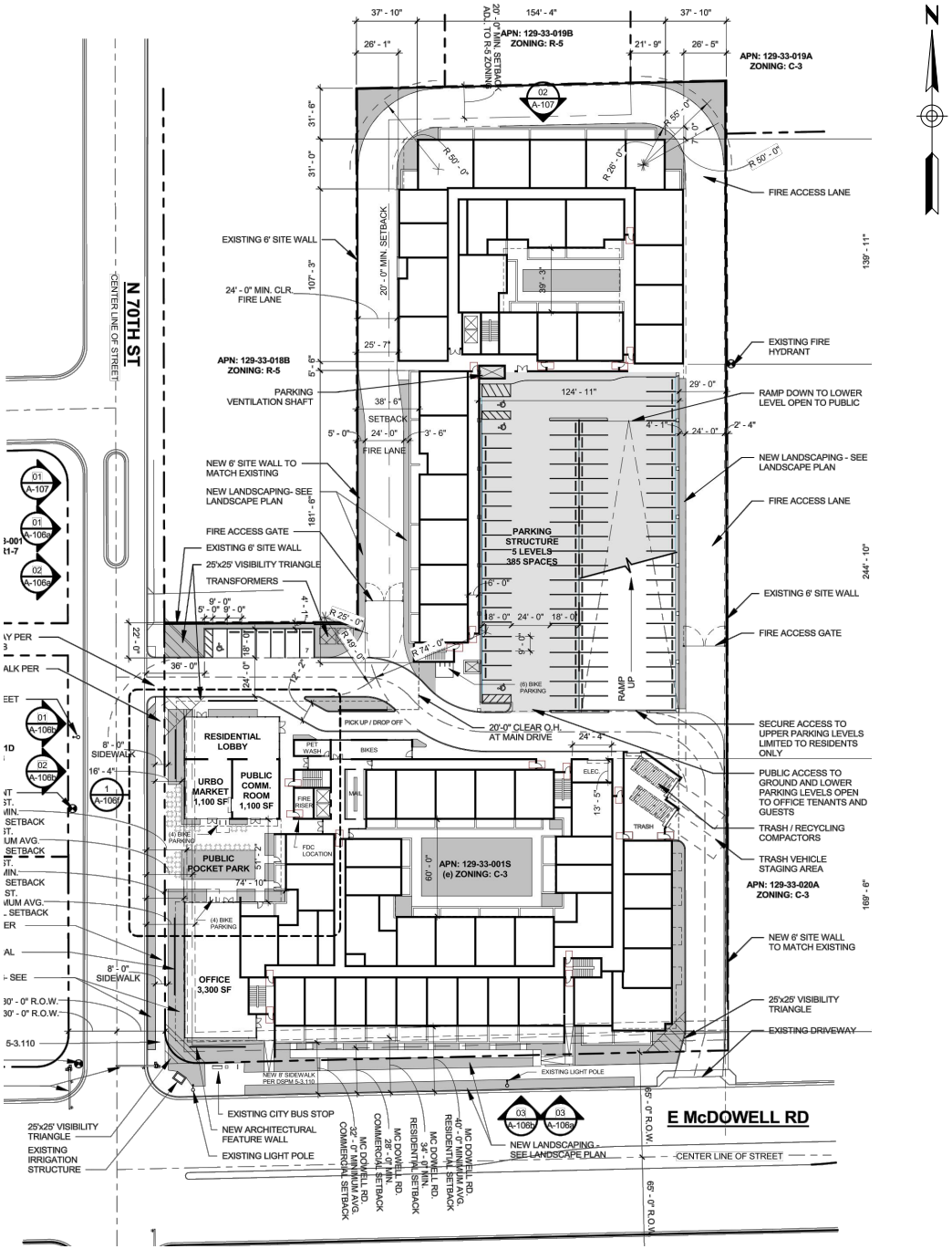


FIGURE 2 | SITE PLAN

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Legend

- Intersection
- Proposed Site

FIGURE 3 | STUDY AREA

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3. AREA CONDITIONS

The study area is located in the City of Scottsdale, Arizona. **Sections 3.1** and **3.2** provide detailed descriptions of the study roadway segments and intersections.

3.1. STUDY ROADWAY SEGMENTS

McDowell Road runs east-west and in the vicinity of the site provides three (3) through lanes for each direction of travel with a landscaped median. McDowell Road is the southern border of the proposed development. There is a posted speed limit of 40 miles per hour (mph). The City of Scottsdale classifies McDowell Road as an urban major arterial within the study area, according to *The Scottsdale Master Transportation Plan,* dated July 2016. The City of Scottsdale's *2018 Average Daily Segment Traffic (ADT) Volumes* map reports an ADT of 33,000 vehicles per day along McDowell Road, west of 68th Street.

Scottsdale Road runs north-south, approximately two-tenths (0.2) of a mile east of the proposed site and provides three (3) through lanes and a bike lane in each direction of travel with a landscaped median. There is a posted speed limit of 40 mph. The City of Scottsdale classifies Scottsdale Road as an urban major arterial within the study area, according to *The Scottsdale Master Transportation Plan,* dated July 2016. The City of Scottsdale's *2018 Average Daily Segment Traffic Volumes* map reports an ADT of 35,600 vehicles per day along Scottsdale Road, north of McDowell Road.

68th Street runs north-south and provides one (1) through lane and a bike lane for each direction of travel with a two-way left-turn lane. 68th Street is located approximately one-fourth (0.25) of mile west of the proposed development. There is a posted speed limit of 35 mph.

70th Street runs north-south and provides one (1) through lane for each direction of travel. 70th Street is the western border of the proposed development. There is a posted speed limit of 25 mph.

3.2. STUDY INTERSECTIONS

McDowell Road and 68th Street (1) currently operates as a signalized intersection. The eastbound approach provides one (1) dedicated left turn lane, three (3) through lanes, and one (1) dedicated right turn lane. The westbound approach provides one (1) dedicated left turn lane, two (2) through lanes, and one (1) shared through-right turn lane. The northbound and southbound approaches provide one (1) dedicated left turn lane, and one (1) through lane, and one (1) dedicated right turn lane that is shared with bicyclists.

McDowell Road and 70th Street (2) currently operates as a signalized intersection. The eastbound and westbound approaches provide one (1) dedicated left turn lane, two (2) through lanes, and one

(1) shared though-right turn lane. The northbound and southbound approaches provide one (1) dedicated left turn lane, and one (1) shared through-right turn lane.

McDowell Road and Scottsdale Road (3) currently operates as a signalized intersection. The eastbound and westbound approaches provide two (2) dedicated left turn lanes, three (3) through lanes, and one (1) dedicated right turn lane. The northbound approach provides two (2) dedicated left turn lanes, two (2) through lanes, and one (1) shared through-right turn lane. The southbound approach provides two (2) dedicated left turn lanes, three (3) through lanes, and one (1) dedicated right turn lane.

McDowell Road and Driveway A (4) currently operates as a two-way stop-controlled intersection with stop control on the northbound and southbound approaches. The eastbound and westbound approaches provide two (2) through lanes and one (1) shared through-right turn lane. The northbound and southbound approach provide one (1) dedicated right turn lane.

70th Street and Driveway B (5) currently operates as a stop-controlled T-intersection with stop control on the westbound approach. The westbound approach provides one (1) shared left-right turn lane. The northbound approach provides one (1) shared through-right turn lane. The southbound approach provides one (1) shared left-through turn lane.

3.3. SURROUNDING AREA LAND USE

Located approximately one-half (0.5) mile west of the proposed development in the Arizona Canal. Car dealerships are currently located directly east and west, and multi-family homes are located to the north. Located immediately south of the proposed development, across McDowell Road, is retail and hotel uses.

3.4. SITE ACCESSIBILITY

Pedestrian Facilities, Bicycle Facilities, and Shared-Use Paths

Located in Scottsdale, there are continuous sidewalks provided along McDowell Road and on the east side of 70th Street. Within the vicinity of the study area, bike lanes are currently provided along Scottsdale Road.

Additionally, the Arizona Canal is located approximately one-half mile to the west and provides approximately 70 miles of shared use paths.

Transit Facilities

Valley Metro Route 514 operates along McDowell Road within the study area. This route connects Fountain Hills to Downtown Phoenix. Additionally, Valley Metro Route 17 operates along McDowell Road, which connects the City of Avondale to the City of Scottsdale. Route 514 and Route 17 both operate Monday through Friday.

Valley Metro Route 68CM operates in the area, running along 68th Street. According to the Valley Metro System Map, there are two (2) stops located near the intersection of McDowell Road and 68th Street (1). This route operates Monday through Friday.

Finally, Valley Metro Route 72 operates along Scottsdale Road within the study area. This route connects the City of Chandler to the northern portion of the City of Scottsdale. According to the Valley Metro System Map, there are two (2) stops located near the intersection of McDowell Road and Scottsdale Road (3). This route operates Monday through Friday.

3.5. COLLISION HISTORY

The most recent three-year collision history, from January 2017 to June 2019, was obtained from the City of Scottsdale. See **Appendix B** for collision data. The data included the following intersections and segments:

- McDowell Road and 68th Street (1)
- McDowell Road and 70th Street (2)
- McDowell Road and Scottsdale Road (3)
- 70th Street and Palm Lane

McDowell Road and 68th Street (1)

During the three-year period, there were a total of 20 crashes, of which 3 resulted in a non-incapacitating injuries, 3 possible injuries, and the remaining resulted in unknown or property damage only. There were a total of 8 angle, 5 left turn, 4 rear ends, 1 single vehicle, 1 head on, and 1 sideswipe same direction crash.

McDowell Road and 70th Street (2)

During the three-year period, there were a total of 19 crashes, of which 4 resulted in possible injuries and the remaining resulted in unknown or property damage only. There were a total of 7 angle, 3 left turn, 3 rear end, 3 head on, 2 sideswipe same direction, and 1 single vehicle crash.

McDowell Road and Scottsdale Road (3)

During the three-year period, there were a total of 60 crashes, of which 1 resulted in a fatal injury, 4 incapacitating injuries, 4 non-incapacitating injuries, 5 possible injuries, and the remaining resulted in unknown or property damage only. There were a total of 35 rear ends, 11 angle, 5 sideswipe same direction, 3 single vehicle, 3 left turn, 2 head on, and 1 other crash.

The fatal collision occurred on June 6, 2018, at approximately 2:21 am. A vehicle traveling in the westbound direction struck a pedestrian who was laying down in the roadway at the northeast corner of the intersection, just east of the crosswalk.

70th Street and Palm Lane

During the three-year period, there were a total of two crashes, of which one resulted in an unknown injury and an unknown violation. The second collision resulted in a possible injury, and was caused by a vehicle failing to yield to right of way. There were no collisions reported during the three-year period along the segment of 70th Street between McDowell Road and Palm Lane.

3.6. COLLISION RATES

The City of Scottsdale's *2018 Traffic Volume and Collision Rate Data* report provides collision rate and traffic volume information on major roadway segments and at major intersections within the City. Segment collisions are collisions that occur on a major street more than 100 feet from the major intersections that define the segment, including at minor intersections within the segment. Intersection collisions are collisions that occur at or within 100 feet of a major intersection.

The collision rates and city-wide rankings for the study roadway segments are shown in **Table 1**. The collision rates and city-wide rankings for the study intersections are shown in **Table 2**.

Table 1 – Collision Rates - Study Roadway Segments

Segment	From	To	Collision Rate	Rank
McDowell Road	68th Street	Scottsdale Road	2.48	63
2018 City of Scottsdale Average Segment Collision Rate			1.53	

Table 2 – Collision Rates - Study Intersections

Intersection	Collision Rate	Rank
McDowell Road and Scottsdale Road (3)	1.14	17
McDowell Road and 68th Street (1)	0.65	76
2018 Average Intersection Collision Rate	0.58	

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4. EXISTING CONDITIONS

4.1. EXISTING LAND USE

According to the Maricopa County Assessor's website, the proposed development is located on a 3.83-acre parcel zoned for Highway Commercial C-3 land uses. See **Appendix C** for detailed parcel information.

4.2. EXISTING TRAFFIC COUNTS

A local data collection firm, Field Data Services of Arizona, Inc., was utilized to collect traffic counts. On Tuesday, August 8, 2019, turning movement counts were obtained from 7:00 to 9:00 am and from 4:00 to 6:00 pm at the following intersections:

- McDowell Road and 68th Street (1)
- McDowell Road and 70th Street (2)
- McDowell Road and Scottsdale Road (3)
- McDowell Road and Driveway A (4)
- 70th Street and Driveway B (5)

Additionally, on Tuesday, August 08, 2019, bi-directional tube counts for 24-hours in 15-minute intervals were collected along the following two (2) roadway segments:

- McDowell Road, east of 70th Street
- 70th Street, north of McDowell Road

The turning movement counts were analyzed for the highest 1-hour within each time period. These are the peak hours that were analyzed throughout this study.

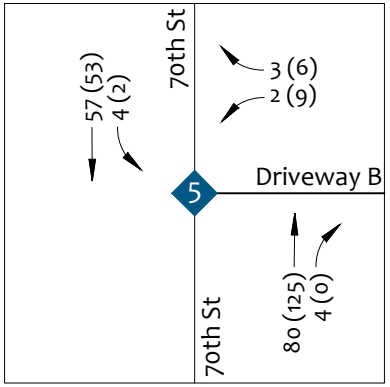
- AM Peak Hour 7:00 am – 8:00 am
- PM Peak Hour 4:30 pm – 5:30 pm

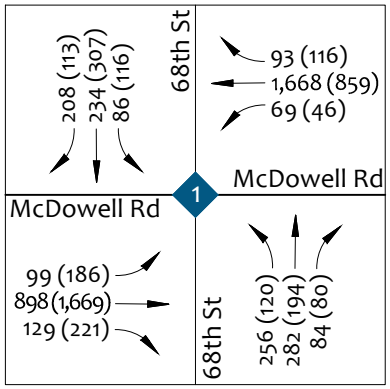
The City of Scottsdale seasonal adjustment factors were used to adjust the traffic counts. The traffic volumes were adjusted based on the month the counts were taken. See **Appendix D** for detailed count data. See **Figure 4** for the existing adjusted AM and PM peak hour weekday traffic volumes.

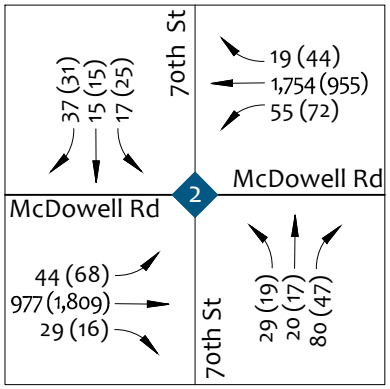


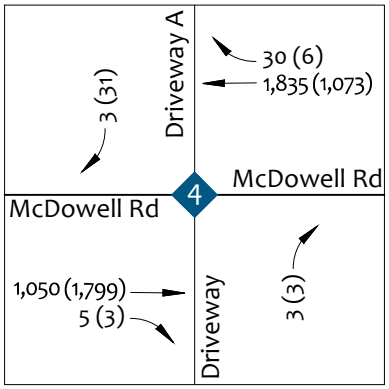
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AM(PM)	Peak Hour Traffic Volumes
X	Intersection
<ADT>	Average Daily Traffic









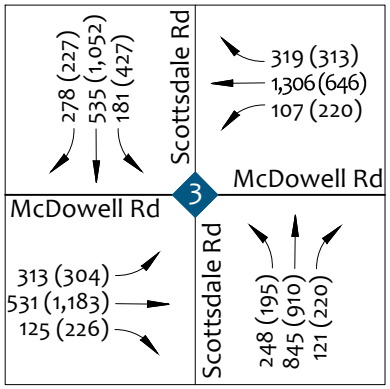


FIGURE 4 | EXISTING TRAFFIC VOLUMES

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4.3. EXISTING CAPACITY ANALYSIS

The existing conditions capacity analysis was completed for the five (5) existing study intersections. The capacity and level of service for the study area intersections were evaluated using the methodology presented in the 6th *Edition of the Highway Capacity Manual*. Traffic analysis software, Synchro Version 10.3, was used to perform the analyses using the existing Peak Hour Factor (PHF) obtained from the traffic counts and the existing signal timing provided by the City of Scottdale. See **Appendix E** for the existing signal timing.

Table 3 is from the 6th *Edition of the Highway Capacity Manual* Exhibit 20-2, which lists the Level of Service (LOS) thresholds for signalized and unsignalized intersections.

Table 3 – Level of Service Criteria

Level of Service (LOS)	Control Delay per Vehicle (s/veh)	
	Signalized Intersection	Unsignalized Intersection
A	≤ 10	0 - 10
B	> 10-20	> 10-15
C	> 20-35	> 15-25
D	> 35-55	> 25-35
E	> 55-80	> 35-50
F	> 80	> 50

The results of the capacity analysis reveal the following locations with an existing level of service (LOS) E or F:

McDowell Road and 68th Street (1) – Signalized

- EB left AM and PM peak hours operate at LOS F and E, respectively
- WB left AM and PM peak hours operate at LOS F and E, respectively
- NB left AM peak hour operates at LOS F
- SB through PM peak hour operates at LOS E

McDowell Road and 70th Street (2) – Signalized

- NB left PM peak hour operates at LOS E
- SB left AM and PM peak hours operate at LOS E

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McDowell Road and Scottsdale Road (3) – Signalized

- Overall intersection PM peak hour operates at LOS E
- EB left AM and PM peak hour operates at LOS F and E, respectively
- EB through PM peak hour operates at LOS E
- WB left AM and PM peak hours operate at LOS E
- WB through AM peak hour operates at LOS E
- WB right PM peak hour operates LOS E
- NB left AM and PM peak hours operate at LOS E
- SB left AM and PM peak hours operate at LOS E and F, respectively

The existing AM and PM peak hour level of service and delay for all studied intersections are shown in **Table 4**.

See **Figure 5** for the existing AM and PM peak hour capacity analysis. The detailed capacity analysis sheets can be found in **Appendix F.**

Table 4 – Existing Level of Service and Delay

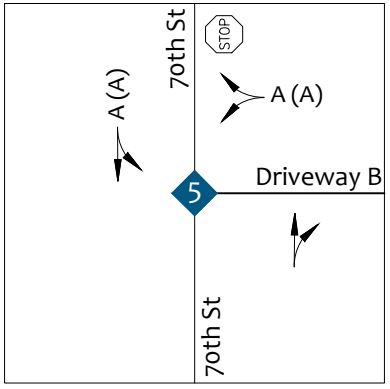
Intersection	Existing Conditions			
	AM PEAK		PM PEAK	
Signalized Intersections	LOS	DELAY	LOS	DELAY
McDowell Road and 68th Street (1)				
Overall Intersection	C	31.2	C	27.1
Eastbound Left	F	103.0	E	74.0
Eastbound Through	B	17.5	C	22.3
Eastbound Right	B	15.6	B	16.7
Westbound Left	F	83.2	E	62.5
Westbound Through	A	2.5	A	6.1
Westbound Shared Through-Right	A	4.6	A	7.1
Northbound Left	F	171.1	D	51.0
Northbound Through	D	51.9	D	44.2
Northbound Right	D	42.6	D	41.2
Southbound Left	D	40.7	D	37.5
Southbound Through	D	51.4	E	59.0
Southbound Right	D	53.4	D	42.3
McDowell Road and 70th Street (2)				
Overall Intersection	A	4.0	A	3.2
Eastbound Left	A	1.8	A	0.5
Eastbound Through	A	0.2	A	0.4
Eastbound Shared Through-Right	A	0.4	A	0.7
Westbound Left	A	0.6	A	3.9
Westbound Through	A	0.6	A	0.2
Westbound Shared Through-Right	A	1.0	A	0.4
Northbound Left	D	53.9	E	55.1
Northbound Shared Through-Right	D	54.3	D	54.4
Southbound Left	E	57.3	E	57.1
Southbound Shared Through-Right	D	51.0	D	53.1
McDowell Road and Scottsdale Road (3)				
Overall Intersection	D	49.5	E	55.4
Eastbound Left	F	84.2	E	61.6
Eastbound Through	D	39.5	E	64.2
Eastbound Right	D	38.1	D	48.6
Westbound Left	E	57.9	E	66.9
Westbound Through	E	56.9	D	39.6
Westbound Right	D	44.3	E	64.4
Northbound Left	E	60.8	E	66.4
Northbound Through	D	38.4	D	45.2
Northbound Shared Through-Right	D	41.3	D	51.4
Southbound Left	E	67.5	F	122.8
Southbound Through	C	34.4	C	34.2
Southbound Right	D	44.4	C	32.2
Unsignalized Intersections				
McDowell Road and Driveway A (4)				
Northbound Right	B	10.4	B	12.2
Southbound Right	B	12.2	B	10.6
McDowell Road and Driveway B (5)				
Westbound Shared Left-Right	A	8.8	A	9.2
Southbound Left	A	7.4	A	7.5

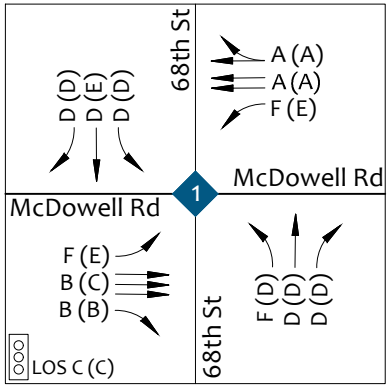
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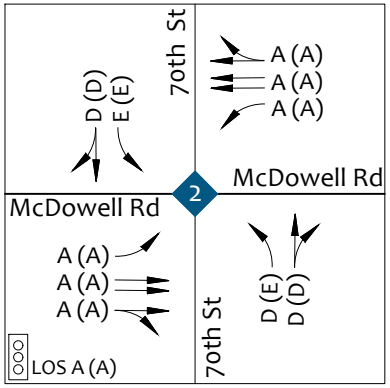


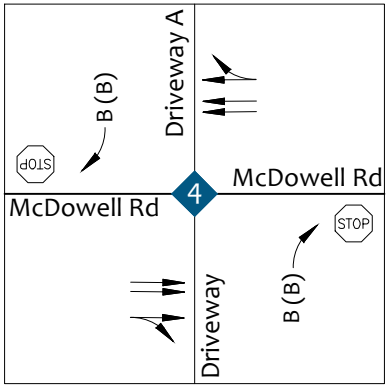
Legend

AM(PM)	Peak Hour Capacity Analysis
X	Intersection
	Lane Configuration









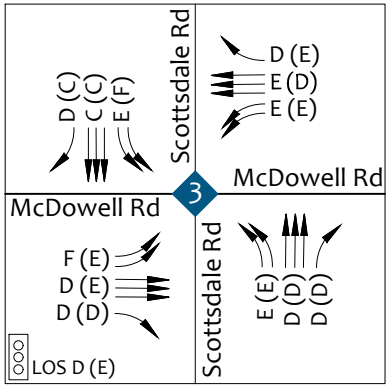


FIGURE 5 | EXISTING CAPACITY ANALYSIS

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5. PROJECTED TRAFFIC

5.1. TRIP GENERATION

The trip generation for the proposed development was calculated utilizing the Institute of Transportation Engineers (ITE) publication entitled *Trip Generation, 10th Edition*. The ITE trip generation rates and fitted curve equations are based on studies that measure trip generation characteristics for various types of land uses. The rates are expressed in terms of trips per unit of lane use type. This publication is the standard for the transportation engineering profession.

Prior Development

According to Maricopa County Assessor's website, the 3.83-acre was occupied by the following land uses:

- Service Repair Garage 18,615 square feet
- Car Wash – Drive Thru 1,760 square feet
- Automobile Showroom 11,194 square feet

The trip generation for the prior land uses was calculated utilizing ITE Land Use 841 – Automobile Sales (Used) for the showroom, and Land Use 941 – Quick Lubrication Vehicle Shop for the service repair garage and car wash. Trip generation calculations are shown in **Table 5** below. Detailed trip generation calculations are provided in **Appendix G**.

Table 5 – Trip Generation – Prior Development

Land Use	ITE Code	Qty	Unit	Weekday	AM Peak Hour			PM Peak Hour		
				Total	Total	In	Out	Total	In	Out
Quick Lubrication Vehicle Shop	941	20.4	1000 SF GFA	1,417	118	89	29	177	74	103
Automobile Sales (Used)	841	11.2	1000 SF GFA	303	24	18	6	42	20	22
			Total	1,720	142	107	35	219	94	125

Existing Development

Currently, BDG Maintenance, a landscape design and maintenance business with over 300 employees along with Scottsdale Christian Church occupies the parcel.

Information was received from BDG Maintenance regarding their current operations. BDG Maintenance generally operates Monday through Friday with their AM peak hour occurring between 4:30 am to 6:00 am, and the PM peak hour occurring between 1:30 pm to 3:00 pm. BDG Maintenance has a fleet of 85 to 90 work trucks. During the AM peak hour, employees arrive in their personal vehicles and depart with their work vehicles. The reverse traffic pattern occurs during the PM peak hour. The existing weekday trip generation was calculated using this operational information along with the ITE Trip Generation ratio between the general office peak

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hour trips and the weekday trips. As a conservative estimate the lower end of the range of work trucks was assumed and is shown in **Table 6**.

Scottsdale Christian Church also occupies this site, it is assumed that there are no trips generated by this use during the peak hour of BDG Maintenance. Information was received that indicated the Church occupies 6,000 square feet of the existing buildings on-site.

Table 6 – Trip Generation – Existing Development (Peak Hour of Landscape Business)

Land Use	ITE Code	Qty	Unit	Weekday	AM Peak Hour			PM Peak Hour		
				Total	Total	In	Out	Total	In	Out
Existing Landscape Design and Maintenance Business	-	-	-	872	170	85	85	170	85	85
Church	560	6.0	1000 SF GFA	42	-	-	-	-	-	-
			Total	914	170	85	85	170	85	85

Utilizing the traffic counts that were collected at the existing site driveways, the trips generated by the existing development during the typical AM and PM peak hour were determined. Similarly, the existing weekday trip generation was calculated using this operational information along with the ITE Trip Generation ratio between the general office peak hour trips and the weekday trips. See **Table 7**.

Table 7 – Trip Generation – Existing Development (Peak Hour of Adjacent Street)

Land Use	Weekday	AM Peak Hour			PM Peak Hour		
	Total	Total	In	Out	Total	In	Out
Existing Landscape Business and Church	280	48	40	8	61	10	51

Potential Development under Existing Zoning

The existing site is currently zoned for Highway Commercial (C-3) land uses. C-3 zoning is intended to permit most type of commercial activities located along major streets, including shopping and service needs. With a total lot area of 166,835 SF (3.83 acres), and a maximum floor-to-area (FAR) of 0.80, allows for 133,468 SF of developable area. However, as a conservative approach, it was assumed a 3,400 SF fast-food restaurant with a drive-thru and a 2,400 SF coffee shop with drive-thru could be developed on this parcel.

Utilizing ITE Land Use 934 Fast-Food Restaurant with Drive-Thru Window and Land Use 937 Coffee Shop with Drive-Thru Window, the trip generation for the existing land uses was calculated as shown in **Table 8** below. Detailed trip generation calculations are provided in **Appendix G**.

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Table 8 - Trip Generation (Existing Zoning)

Land Use	ITE Code	Qty	Unit	Weekday	AM Peak Hour			PM Peak Hour		
				Total	Total	In	Out	Total	In	Out
Fast-Food Restaurant with Drive-Thru Window	934	3.5	1000 SF GFA	1,648	141	72	69	114	59	55
Coffee Shop with Drive-Thru Window	937	2.4	1000 SF GFA	1,969	214	109	105	104	53	51
			Total	3,617	355	181	174	218	112	106

Proposed Development

The proposed Southdale development will include the following land uses:

- Multi-Family Residential — 267 units
  - *52 studio units*
  - *150 one-bedroom units*
  - *65 two-bedroom units*
- Office — 3,300 square feet
- Retail — 1,100 square feet

The 1,100 square feet of retail space provided on-site is anticipated to operate as a neighborhood urban marketplace. This market will be open to the general public and is anticipated to serve the on-site residents as well as nearby adjacent neighbors. Due to the character and items provided at this neighborhood urban market, typically most of the patrons walk or bike.

A similar development to this neighborhood urban marketplace is the URBO (urban bodega), located at 601 W. Fillmore Street within the Pure Fillmore multi-family development, in the City of Phoenix, Arizona. This approximate 500 square foot space is open to public and sells everything from ice cream, hummus, and eggs, to toilet paper, dish detergent, and cold medicine. It provides a convenience for residences of the multi-family development and residents within close proximity.

Data was collected for the URBO on a typical weekday. See **Table 9** for the weekday, AM peak hour, and PM peak hour trips.

Table 9 – URBO (601 W. Fillmore Street)

Land Use	Qty	Unit	Weekday	AM Peak Hour			PM Peak Hour		
			Total	Total	In	Out	Total	In	Out
URBO (601 W. Fillmore Street)	0.5	1000 SF GFA	14	4	2	2	4	2	2

Southdale is a similar neighborhood urban marketplace (operated by the same owner of the Phoenix location) at 1,100 square feet. To account for the larger proposed space, the URBO trip generation data was grown proportionally based on the size. The proposed retail space is

approximately 2.2 times larger than the URBO. Therefore, a factor of 2.2 was applied. See **Table 10** for the trips generated by the proposed retail space.

Table 10 – Trip Generation – Proposed Retail Space

Land Use	Qty	Unit	Weekday	AM Peak Hour			PM Peak Hour		
			Total	Total	In	Out	Total	In	Out
Retail Space	1.1	1000 SF GFA	31	9	5	4	9	5	4

The trip generation for the residential and office components of the proposed development were calculated utilizing ITE Land Use 221 - Multifamily Housing (Mid-Rise) and Land Use 710 – General Office. Trip generation calculations are shown in **Table 11** below. Detailed trip generation calculations are provided in **Appendix G**.

Table 11 – Trip Generation – Proposed Development

Land Use	ITE Code	Qty	Unit	Weekday	AM Peak Hour			PM Peak Hour		
				Total	Total	In	Out	Total	In	Out
Multifamily Housing (Mid-Rise)	221	267	Dwelling Units	1,452	96	25	71	117	71	46
General Office Building	710	3.3	1000 SF GFA	32	4	3	1	4	1	3
Retail Space (Table 9)	-	1.1	1000 SF GFA	31	9	5	4	9	5	4
Southdale - Total				**1,515**	**109**	**33**	**76**	**130**	**77**	**53**

The proposed development is anticipated to generate 1,515 weekday daily trips with 109 and 130 vehicles during the AM and PM peak hours, respectively.

5.2. TRIP GENERATION COMPARISON

Prior Development vs. Proposed Development

A comparison between the trips generated by the prior automobile sales and repair shop development and the proposed Southdale development is shown **Table 12**

Table 12 – Trip Generation Comparison (Prior Development vs. Proposed Development)

Land Use	ITE Code	Qty	Unit	Weekday	AM Peak Hour			PM Peak Hour		
				Total	Total	In	Out	Total	In	Out
Multifamily Housing (Mid-Rise)	221	267	Dwelling Units	1,452	96	25	71	117	71	46
General Office Building	710	3.3	1000 SF GFA	32	4	3	1	4	1	3
Retail Space (Table 9)	-	1.1	1000 SF GFA	31	9	5	4	9	5	4
Southdale - Total				**1,515**	**109**	**33**	**76**	**130**	**77**	**53**
Quick Lubrication Vehicle Shop	941	20.4	1000 SF GFA	1,417	118	89	29	177	74	103
Automobile Sales (Used)	841	11.2	1000 SF GFA	303	24	18	6	42	20	22
Total				**1,720**	**142**	**107**	**35**	**219**	**94**	**125**
Difference				**-205**	**-33**	**-74**	**41**	**-89**	**-17**	**-72**
% Difference				**-12%**	**-23%**	**-69%**	**117%**	**-41%**	**-18%**	**-58%**

Table 12 shows that the proposed mixed-use Southdale development will produce 205 (12%) fewer weekday daily trips, 33 (23%) fewer trips during the AM peak hour, and 89 (41%) fewer trips during the PM peak hour than the prior development.

Existing Development vs. Proposed Development

A comparison between the trips generated by the existing development (BDG Maintenance and Scottsdale Christian Church), during the peak hour of landscape business, and the proposed Southdale development, during AM and PM peak hour of adjacent street, is shown in **Table 13**.

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Table 13 – Trip Generation Comparison (Existing vs. Proposed – Varying Peak Times)

Land Use	ITE Code	Qty	Unit	Weekday	AM Peak Hour			PM Peak Hour		
				Total	Total	In	Out	Total	In	Out
Multifamily Housing (Mid-Rise)	221	267	Dwelling Units	1,452	96	25	71	117	71	46
General Office Building	710	3.3	1000 SF GFA	32	4	3	1	4	1	3
Retail Space (Table 9)	-	1.1	1000 SF GFA	31	9	5	4	9	5	4
Southdale - Total				**1,515**	**109**	**33**	**76**	**130**	**77**	**53**
Existing Landscape Design and Maintenance Business	-	-	-	872	170	85	85	170	85	85
Church	560	6	1000 SF GFA	42	-	-	-	-	-	-
Total				**914**	**170**	**85**	**85**	**170**	**85**	**85**
Difference				**601**	**-61**	**-52**	**-9**	**-40**	**-8**	**-32**
% Difference				**66%**	**-36%**	**-61%**	**-11%**	**-24%**	**-9%**	**-38%**

Table 13 shows that the proposed mixed-use Southdale development will produce 601 (66%) more weekday daily trips, with 61 (36%) fewer trips during the AM peak hour, and 40 (24%) fewer trips during the PM peak hour than the existing development. It should be noted that the peak hour for the existing development occurs between 5:00 am to 6:00 am, and 1:30 pm to 2:30 pm, while the proposed development occurs between 7:00 am to 9:00 am, and 4:00 pm to 6:00 pm.

A comparison between the trips generated by the existing development (BDG Maintenance and Scottsdale Christian Church) and the proposed Southdale development, during AM and PM peak hours of the adjacent street, is shown in **Table 14** below.

Table 14 – Trip Generation Comparison (Existing vs. Proposed – Adjacent Street Peak Hour)

Land Use	ITE Code	Qty	Unit	Weekday	AM Peak Hour			PM Peak Hour		
				Total	Total	In	Out	Total	In	Out
Multifamily Housing (Mid-Rise)	221	267	Dwelling Units	1452	96	25	71	117	71	46
General Office Building	710	3.3	1000 SF GFA	32	4	3	1	4	1	3
Retail Space (Table 9)	-	1.1	1000 SF GFA	31	9	5	4	9	5	4
Southdale - Total				**1,515**	**109**	**33**	**76**	**130**	**77**	**53**
Existing Landscape Business and Church	-	-	-	280	48	40	8	61	10	51
Total				**280**	**48**	**40**	**8**	**61**	**10**	**51**
Difference				**1,235**	**61**	**-7**	**68**	**69**	**67**	**2**
% Difference				**441%**	**127%**	**-18%**	**850%**	**113%**	**670%**	**4%**

Table 14 shows that the proposed mixed-use Southdale development will produce 1,235 (441%) more weekday daily trips, with 61 (127%) more trips during the AM peak hour, and 69 (113%) more trips during the PM peak hour than the existing development.

Existing Zoning vs. Proposed Development

Currently, this parcel is zoned for C-3 (Highway Commercial) development with an allowed floor area ratio of 0.8. This zoning permits most types of commercial activities including shopping and restaurant service needs.

The build out of a fast-food restaurant, paired with a coffee shop is a reasonable build out for this site under the existing zoning, due to its convenient location on an urban major arterial. A 3,500 square foot fast-food restaurant along with a 2,400 square foot coffee shop are considered to be within industry average ranges for sizes for these types of establishment. Combined this represents a floor area ratio of 0.035 which is less than 5% of the allowed maximum of 0.8.

A comparison between the trips generated with the build out under the existing zoning, assuming a fast-food restaurant and a coffee shop, and the proposed Southdale development is shown in **Table 15**.

Table 15 - Trip Generation Comparison (Existing Zoning vs Proposed Development)

Land Use	ITE Code	Qty	Unit	Weekday	AM Peak Hour			PM Peak Hour		
				Total	Total	In	Out	Total	In	Out
Multifamily Housing (Mid-Rise)	221	267	Dwelling Units	1,452	96	25	71	117	71	46
General Office Building	710	3.3	1000 SF GFA	32	4	3	1	4	1	3
Retail Space (Table 9)	-	1.1	1000 SF GFA	31	9	5	4	9	5	4
Southdale - Total				**1,515**	**109**	**33**	**76**	**130**	**77**	**53**
Fast-Food Restaurant with Drive-Thru Window	934	3.5	1000 SF GFA	1,648	141	72	69	114	59	55
Coffee Shop with Drive-Thru Window	937	2.4	1000 SF GFA	1,969	214	109	105	104	53	51
Total				**3,617**	**355**	**181**	**174**	**218**	**112**	**106**
Difference				**-2,102**	**-246**	**-148**	**-98**	**-88**	**-35**	**-53**
% Difference				**-58%**	**-69%**	**-82%**	**-56%**	**-40%**	**-31%**	**-50%**

Table 15 shows that the proposed mixed-use Southdale development will produce 2,102 (58%) fewer weekday daily trips, with 246 (69%) fewer trips during the AM peak hour, and 88 (40%) fewer trips during the PM peak hour than the build-out under existing zoning.

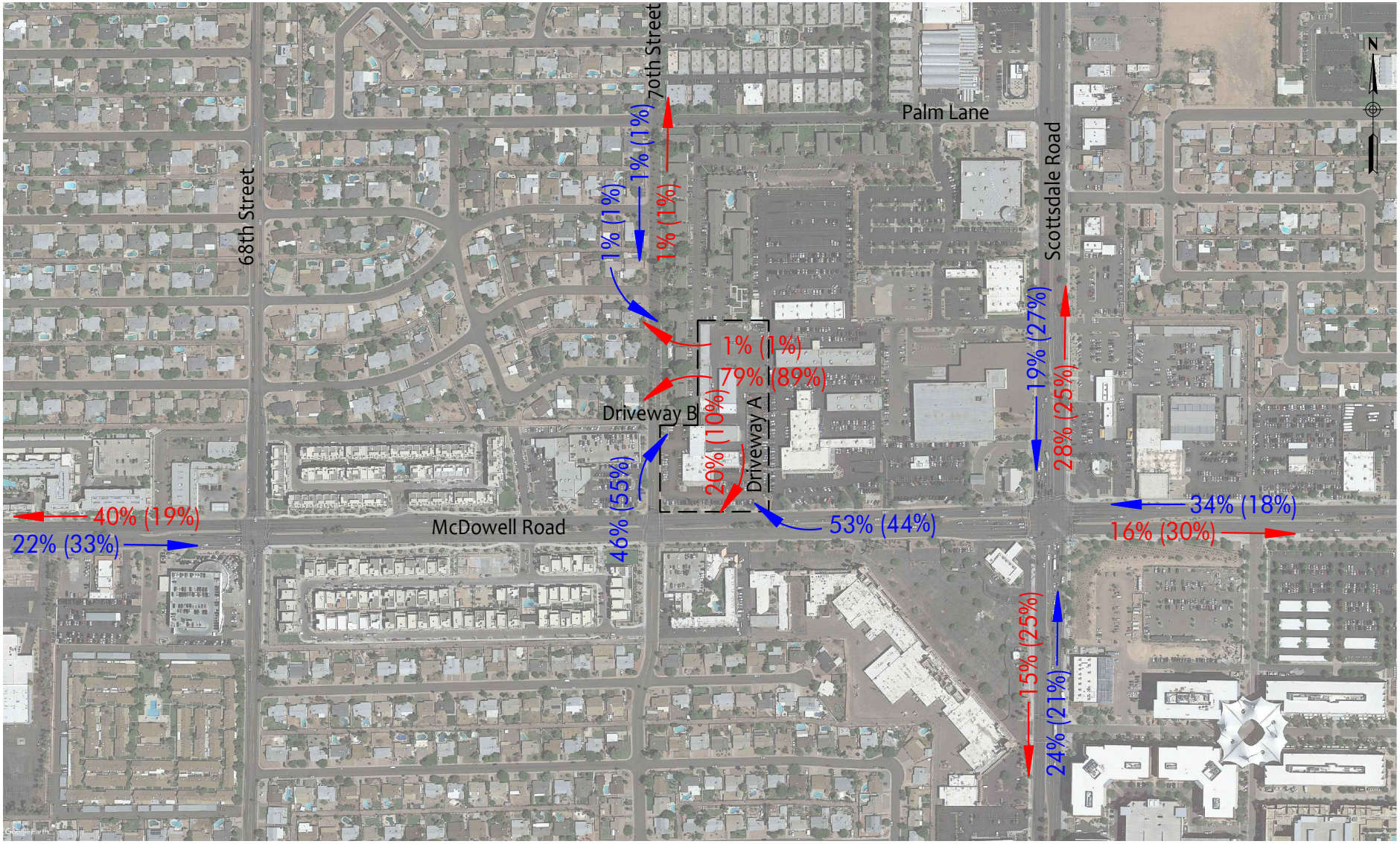
5.3. TRIP DISTRIBUTION AND ASSIGNMENT

The trip distribution procedure determines the general pattern of travel for vehicles entering and leaving the proposed development. The trip distribution for the proposed Southdale development is based on the distribution of the existing traffic. This project is being developed in a primarily developed area, so it can be assumed that the existing trip distribution will remain. The trip distribution is shown in **Figure 6.**

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The trip assignment was generally based on proximity of the driveways, permitted turn movements, as well as ease and probability of use. All site traffic entering and exiting at the 70th Street and Driveway B (5) will be encouraged to enter and exit via McDowell Road to the south and will be discouraged from using 70th Street to the north. The site generated traffic volumes are shown in **Figure 7**.

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Legend

AM(PM) Inbound Trip Distribution Percentages

AM(PM) Outbound Trip Distribution Percentages

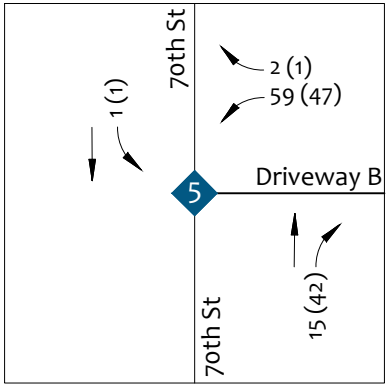
FIGURE 6 | TRIP DISTRIBUTION

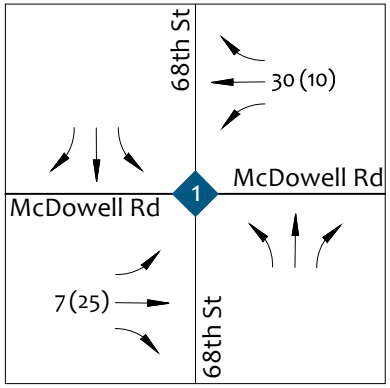
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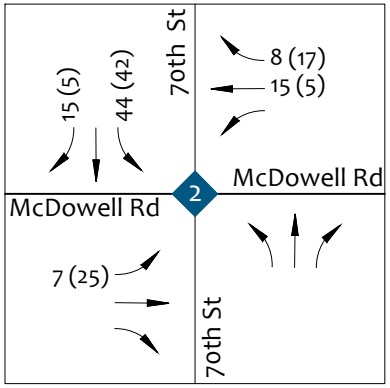


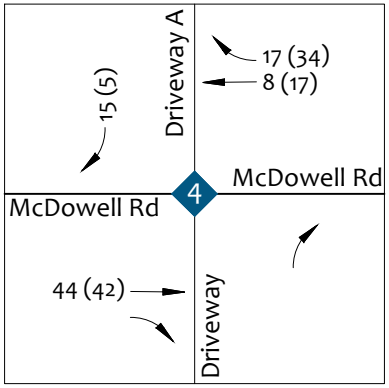
Legend

AM(PM)	Peak Hour Traffic Volumes
X	Intersection
<ADT>	Average Daily Traffic









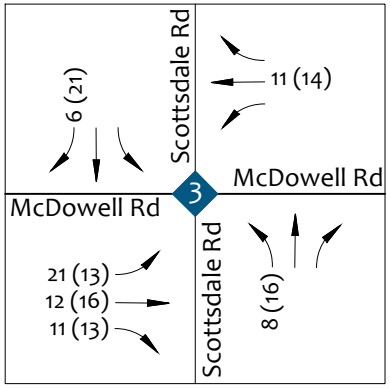


FIGURE 7 | SITE TRAFFIC VOLUMES

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6. FUTURE CONDITIONS (YEAR 2022)

The proposed Southdale development is anticipated to be constructed and ready to open in the year 2022. This section analyzes the effects the proposed development will have on the surrounding roadway network during the opening year of 2022.

6.1. YEAR 2022 BACKGROUND TRAFFIC VOLUMES

According to the 2019 Maricopa Associations of Governments (MAG) socioeconomic projections within the proposed study area, it is estimated that in the year 2030 the population will be approximately 79,910. MAG estimates that the 2018 population of the surrounding area to be 68,987. This results in an approximate annual growth rate of 1.23%.

As a conservative approach, a 2.0% annual growth rate was utilized. See **Appendix H** for the MAG socioeconomic projections. See **Figure 8** for the year 2022 background traffic volumes.

6.2. YEAR 2022 BUILD TRAFFIC VOLUMES

When the site traffic (**Figure 7**) is added to the year 2022 background traffic (**Figure 8**), the result is the 2022 build traffic volumes. This represents the traffic volumes with the build out of the proposed development. The year 2022 build traffic volumes are shown in **Figure 9**.

The trips generated by the existing site were removed from the existing site driveways for the year 2022 build traffic volumes. This includes the intersections of McDowell Road and Driveway A (4) and 70th Street and Driveway B (5).

6.3. YEAR 2022 NO BUILD CAPACITY ANALYSIS

The capacity and level of service for the study area intersection were evaluated for the 2022 no build traffic volumes. A PHF of 0.92 was used.

The results of the year 2022 no build capacity analyses reveal that all study area intersections operate with movements of a LOS D or better, with the exception of the following:

McDowell Road and 68th Street (1) – Signalized

- EB left AM and PM peak hours operate at LOS E
- WB left AM and PM peak hours operate at LOS E

McDowell Road and 70th Street (2) – Signalized

- SB left AM and PM peak hours operate at LOS E

McDowell Road and Scottsdale Road (3) – Signalized

- Overall intersection PM peak hour operates at LOS E
- EB left AM and PM peak hours operates at LOS E
- EB through PM peak hour operates at LOS E
- WB left AM and PM peak hours operate at LOS E
- WB right PM peak hour operates LOS E
- NB left AM peak hour operates at LOS E
- SB left AM and PM peak hours operate at LOS E and F, respectively

The year 2022 AM and PM peak hour level of service and delay for all studied intersections are shown in **Table 16**. The detailed capacity analysis sheets can be found in **Appendix I**.

6.4. YEAR 2022 BUILD IMPROVEMENTS

At the request of the City of Scottsdale, eastbound/westbound left turns at the intersection of McDowell Road and 70th Street (2) were analyzed as permitted plus protected movements.

6.5. YEAR 2022 BUILD CAPACITY ANALYSIS

The capacity and level of service for the study area intersections were evaluated for the year 2022 build traffic volumes. A PHF of 0.92 was used.

The results of the year 2022 capacity analyses reveal that all study area intersections operate with movements at a LOS D or better, or is maintained at the year 2022 no build LOS with the exception of the following:

McDowell Road and Scottsdale Road (3) – Signalized

- NB left AM peak hour operates at LOS E

The need for a westbound right turn deceleration lane at the intersection of McDowell Road and 70th Street (2) was analyzed as part of the year 2022 build analysis. **Figure 9** shows that 28 and 62 westbound right turns occur during the AM and PM hours, respectively. According to the *2018 City of Scottsdale Design Standards and Policies Manual*, a right turn deceleration lane is required along all major arterials. However, the right turn movement operates at a LOS A during both the AM and PM peak hours, therefore the installation of a right turn deceleration lane is not necessary.

The year 2022 AM and PM peak hour level of service and delay for all studied intersections are shown in **Table 16**.

See **Figure 10** year 2022 AM and PM peak hour capacity analysis. The detailed capacity analysis sheets can be found in **Appendix J**.

Table 16 – Year 2022 Level of Service and Delay

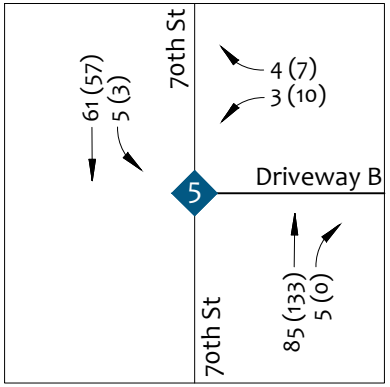
Intersection	Year 2022 No Build				Year 2022 Build			
	AM PEAK		PM PEAK		AM PEAK		PM PEAK	
Signalized Intersections	**LOS**	**DELAY**	**LOS**	**DELAY**	**LOS**	**DELAY**	**LOS**	**DELAY**
McDowell Road and 68th Street (1)								
Overall Intersection	C	31.2	C	29.0	C	31.7	D	35.6
Eastbound Left	E	58.9	E	69.4	E	58.9	E	69.4
Eastbound Through	C	24.2	C	26.7	C	24.3	C	27.0
Eastbound Right	C	21.4	B	19.2	C	21.4	B	19.3
Westbound Left	E	57.2	E	61.8	E	56.9	E	64.5
Westbound Through	B	19.9	A	10.0	C	21.3	D	36.5
Westbound Shared Through-Right	C	27.3	B	11.5	C	29.1	D	38.0
Northbound Left	D	50.7	D	42.5	D	50.7	D	42.5
Northbound Through	D	41.6	D	43.6	D	41.6	D	43.6
Northbound Right	D	35.4	D	40.5	D	35.4	D	40.5
Southbound Left	D	38.3	C	34.9	D	38.3	C	34.9
Southbound Through	D	50.9	D	54.4	D	50.9	D	54.4
Southbound Right	D	52.8	D	41.3	D	52.8	D	41.3
McDowell Road and 70th Street (2)								
Overall Intersection	A	4.1	A	4.0	A	9.5	A	3.9
Eastbound Left	A	2.1	A	0.7	A	4.8	A	3.8
Eastbound Through	A	0.2	A	0.4	B	14.4	A	0.5
Eastbound Shared Through-Right	A	0.4	A	0.6	B	14.6	A	1.0
Westbound Left	A	0.7	A	8.1	A	5.7	A	4.3
Westbound Through	A	0.6	A	2.5	A	1.0	A	0.3
Westbound Shared Through-Right	A	1.1	A	2.7	A	1.8	A	0.6
Northbound Left	D	53.6	D	55.0	D	50.6	D	51.3
Northbound Shared Through-Right	D	53.9	D	54.1	D	48.7	D	49.6
Southbound Left	E	57.2	E	57.0	E	55.4	E	55.3
Southbound Shared Through-Right	D	50.6	D	52.7	D	47.2	D	48.9
McDowell Road and Scottsdale Road (3)								
Overall Intersection	D	46.8	E	62.9	D	49.9	E	60.3
Eastbound Left	E	62.5	E	58.0	E	73.1	D	53.2
Eastbound Through	D	37.6	E	66.0	D	37.7	D	54.8
Eastbound Right	D	36.2	D	48.8	D	36.6	D	38.7
Westbound Left	E	57.6	E	55.2	E	57.8	E	55.2
Westbound Through	D	48.6	D	39.5	D	51.5	D	39.6
Westbound Right	D	40.7	E	63.0	D	41.6	E	62.9
Northbound Left	D	54.7	E	61.6	E	79.7	D	63.4
Northbound Through	D	44.1	D	41.5	D	43.8	D	42.0
Northbound Shared Through-Right	D	48.8	D	46.4	D	48.4	D	47.2
Southbound Left	E	56.2	F	241.7	E	66.1	F	241.7
Southbound Through	D	38.0	D	35.2	D	37.3	D	36.1
Southbound Right	D	53.3	C	33.1	D	52.4	D	35.0
Unsignalized Intersections								
McDowell Road and Driveway A (4)								
Northbound Right	B	10.4	B	12.6	B	10.6	B	12.9
Southbound Right	B	12.9	B	10.8	B	13.1	B	10.6
McDowell Road and Driveway B (5)								
Westbound Shared Left-Right	A	8.9	A	9.2	A	9.5	A	9.8
Southbound Left	A	7.4	A	7.5	A	7.4	A	7.6

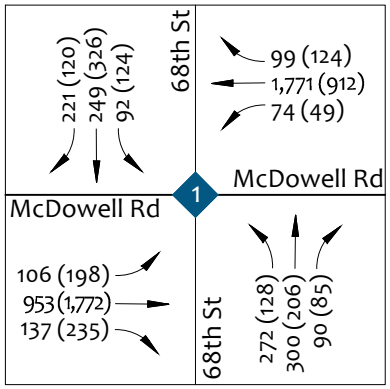
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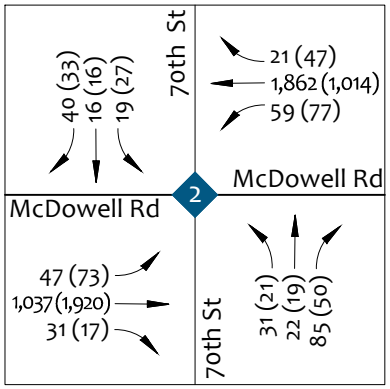


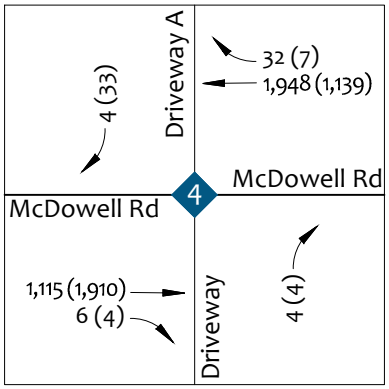
Legend

AM(PM)	Peak Hour Traffic Volumes
X	Intersection
<ADT>	Average Daily Traffic









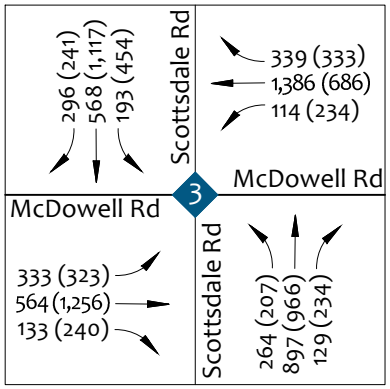


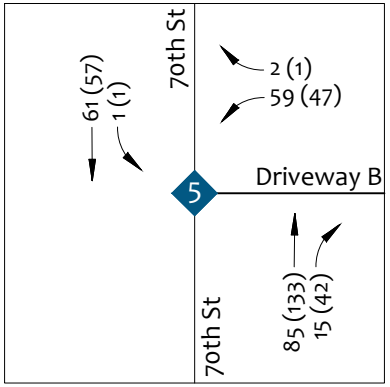
FIGURE 8 | YEAR 2022 BACKGROUND TRAFFIC VOLUMES

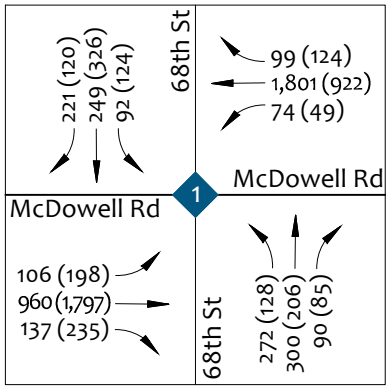
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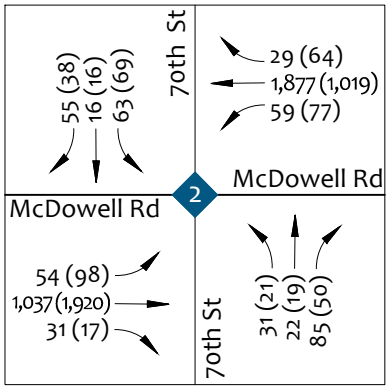


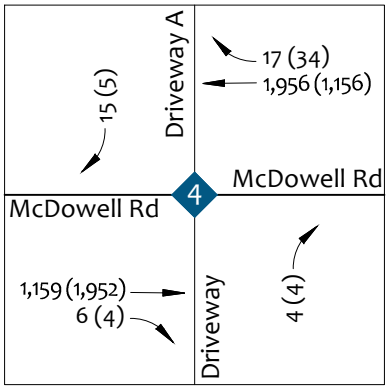
Legend

AM(PM)	Peak Hour Traffic Volumes
X	Intersection
<ADT>	Average Daily Traffic









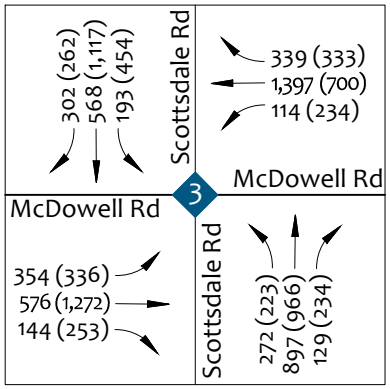


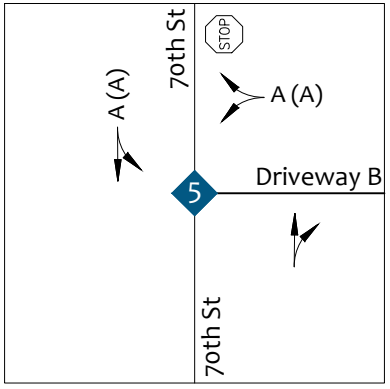
FIGURE 9 | YEAR 2022 BUILD TRAFFIC VOLUMES

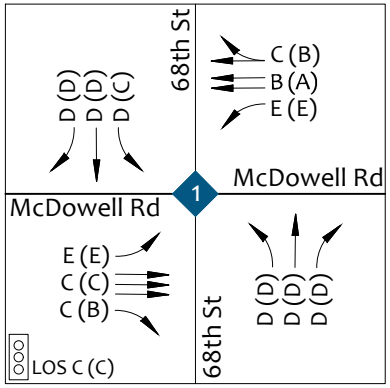
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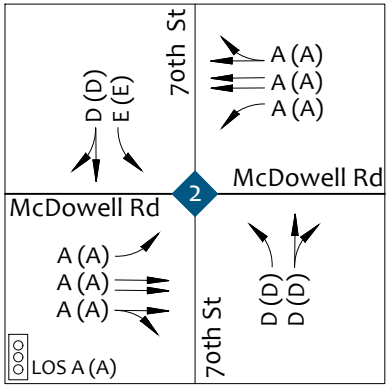


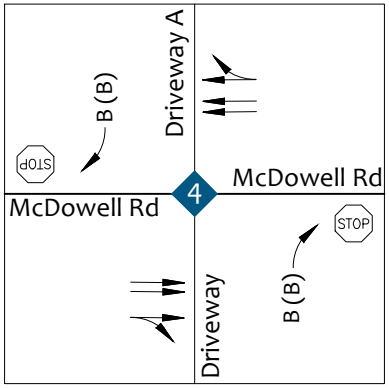
Legend

AM(PM)	Peak Hour Capacity Analysis
X	Intersection
	Lane Configuration









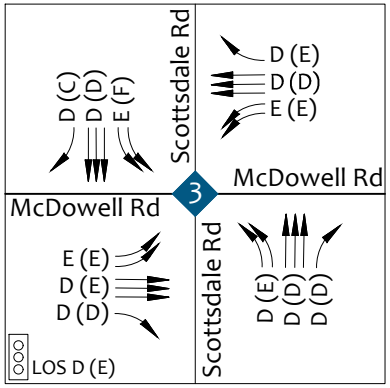


FIGURE 10 | YEAR 2022 NO BUILD CAPACITY ANALYSIS

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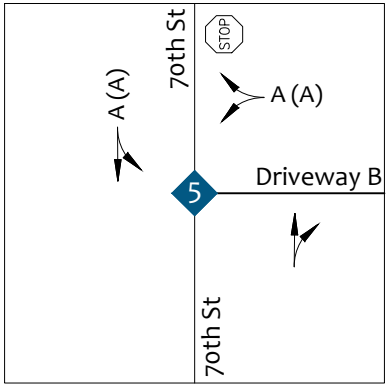


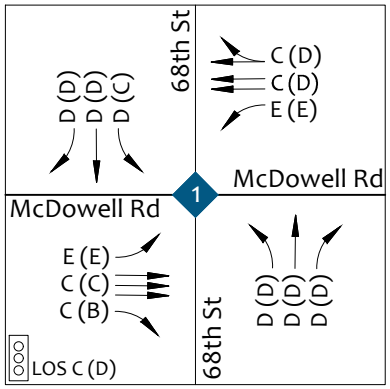
Legend

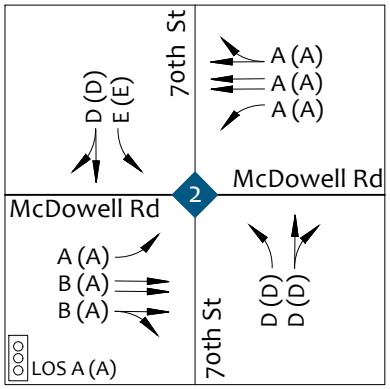
AM(PM) Peak Hour Capacity Analysis

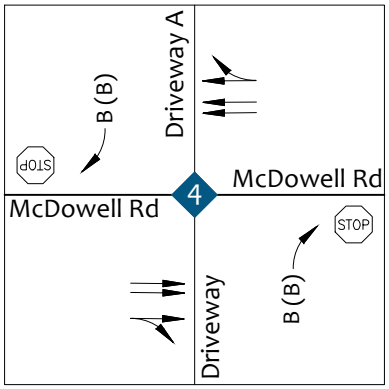
X Intersection

Lane Configuration









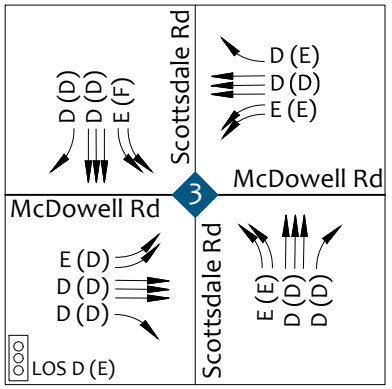


FIGURE 11 | YEAR 2022 BUILD CAPACITY ANALYSIS

5-ZN-2020
8/7/2020

7. RECOMMENDATIONS & CONCLUSIONS

The proposed Southdale development will be located on the northeast corner of McDowell Road and 70th Street, in Scottsdale Arizona.

The proposed development will include the following land uses:

- Multi-Family Residential — 267 units
  - *52 studio units*
  - *150 one-bedroom units*
  - *65 two-bedroom units*
- Office — 3,300 square feet
- Retail — 1,100 square feet

The existing conditions, along with year 2022 (opening year) analyses with and without the build out of the proposed development was completed for the five (5) study intersections.

Existing Capacity Analysis

The AM and PM peak hour existing conditions capacity analysis were completed for the five (5) existing study intersection. The results of the capacity analysis reveal the following location with an existing level of service (LOS) E or F:

McDowell Road and 68th Street (1) – Signalized

- EB left AM and PM peak hours operate at LOS F and E, respectively
- WB left AM and PM peak hours operate at LOS F and E, respectively
- NB left AM peak hour operates at LOS F
- SB through PM peak hour operates at LOS E

McDowell Road and 70th Street (2) – Signalized

- NB left PM peak hour operates at LOS E
- SB left AM and PM peak hours operate at LOS E

McDowell Road and Scottsdale Road (3) – Signalized

- Overall intersection PM peak hour operates at LOS E
- EB left AM and PM peak hour operates at LOS F and E, respectively
- EB through PM peak hour operates at LOS E
- WB left AM and PM peak hours operate at LOS E
- WB through AM peak hour operates at LOS E
- WB right PM peak hour operates LOS E
- NB left AM and PM peak hours operate at LOS E
- SB left AM and PM peak hours operate at LOS E and F, respectively

Trip Generation and Trip Distribution

The proposed development is anticipated to generate 1,515 weekday trips, with 109 trips occurring during the AM peak hour and 130 trips occurring during the PM peak hour. All site traffic entering and exiting 70th Street and Driveway B (5) will be encouraged to enter and exit via McDowell Road to the south and will be discouraged from using 70th Street to the north.

Trip Generation Comparison

Prior Development vs. Proposed Development

A comparison between the trips generated by the prior automobile sales and repair shop development and the proposed Southdale development was calculated.

The proposed mixed-use Southdale development will produce **205 (12%) fewer weekday daily trips** will occur, **33 (23%) fewer trips during the AM peak hour**, and **89 (41%) fewer trips during the PM peak hour** than the prior development.

Existing Development vs. Proposed Development

A comparison between the trips generated by the existing development (BDG Maintenance and Scottsdale Christian Church) and the proposed Southdale development was calculated. The peak hour trips generated by the existing development were calculated based upon operations of the existing site.

The proposed mixed-use Southdale development will produce 601 (66%) more weekday daily trips, with **61 (36%) fewer trips during the AM peak hour**, and **40 (24%) fewer trips during the PM peak hour** than the existing development. It should be noted that the peak hour for the existing development occurs between 5:00 am to 6:00 am, and 1:30 pm to 2:30 pm, while the proposed development occurs between 7:00 am to 9:00 am, and 4:00 pm to 6:00 pm.

Therefore, an additional comparison was completed between the trips generated by the existing development (BDG Maintenance and Scottsdale Christian Church) and the proposed Southdale development was calculated based on the traffic counts that were collected at the existing site driveways

The proposed mixed-use Southdale development will produce 1,235 (441%) more weekday daily trips, with 61 (127%) more trips during the AM peak hour, and 69 (113%) more trips during the PM peak hour than the existing development.

Existing Zoning vs. Proposed Development

Currently, this parcel is zoned for C-3 (Highway Commercial) development with an allowed floor area ratio of 0.8. The build out of a 3,500 square foot fast-food restaurant, paired with a 2,400 square foot coffee shop is a reasonable build out for this site under the existing zoning, due to its

convenient location on an urban major arterial. This translates to a floor area ratio of 0.035 which is less than 5% of the allowed.

A comparison between the trips generated with the build out under the existing zoning, assuming a fast-food restaurant and a coffee shop, and the proposed Southdale development was calculated.

The proposed mixed-use Southdale development will produce **2,102 (58%) fewer weekday daily trips, with 246 (69%) fewer trips during the AM peak hour, and 88 (40%) fewer trips during the PM peak hour** than the build-out under existing zoning.

Future Conditions - Year 2022

Year 2022 analyses was completed with and without the build out of the proposed development. An annual growth rate of 2.0% was applied to the existing traffic volumes.

A capacity analysis was completed for both the AM and PM peak hours for year 2022, with and without the build out of the proposed development. All movements operate at a LOS D or better or are maintained at the year 2022 no build level of service with the exception of the following:

McDowell Road and Scottsdale Road (3) – Signalized

- NB left AM peak hour operates at LOS E

Recommendations

The recommendations with the build out of the proposed Southdale development include:

McDowell Road and 70th Street (2) – Signalized

Modify signal to provide eastbound and westbound permitted plus protected left turn movements

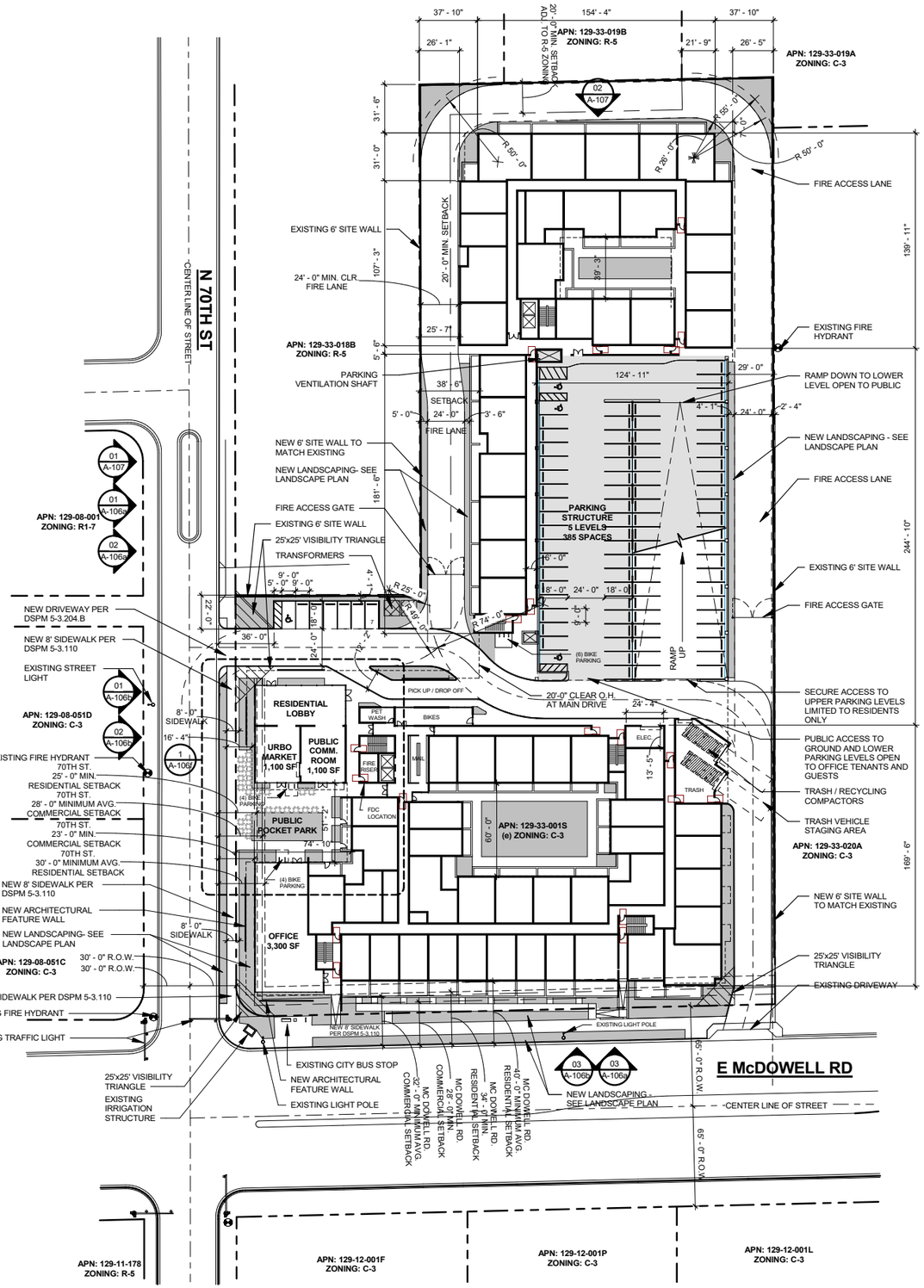
Signal Timing

As with any new development and potential change in traffic patterns, the following is recommended:

- Monitor and Adjust Signal Timing
  Monitor traffic patterns in the area and if necessary, adjust nearby signal timing

Appendix A – Proposed Site Plan

5-ZN-2020
8/7/2020



1 SITE PLAN

SCALE: 1" = 40'-0" REF: 1 / A-102

PROJECT INFORMATION

CURRENT ZONING:	C-3
PROPOSED ZONING:	PUD
GROSS SITE AREA:	4.7 ACRES (204,732 SF)
NET LOT AREA:	3.8 ACRES (165,528 SF)
ALLOWABLE GFAR:	0.8
PROPOSED GFAR:	0.57
ALLOWABLE BUILDING HEIGHT:	48' + 10' MECHANICAL @ 30%
PROPOSED HEIGHT:	48' + 10' MECHANICAL @ 30%
ALLOWABLE DENSITY:	PER DEV. PLAN
PROPOSED DENSITY:	48.8 DU/AC
REQUIRED OPEN SPACE:	20,473 SF (0.10 x GSA)
PROVIDED OPEN SPACE:	36,227 SF (0.33 x GSA)
MCDOWELL RD. SETBACKS	
REQUIRED COMMERCIAL	28' MIN. / 32' MIN. AVG.
PROVIDED COMMERCIAL	28' MIN. / 32' MIN. AVG.
REQUIRED RESIDENTIAL	34' MIN. / 40' MIN. AVG.
PROVIDED RESIDENTIAL	34' MIN. / 40' MIN. AVG.
70TH STREET SETBACKS	
REQUIRED COMMERCIAL	23' MIN. / 28' MIN. AVG.
PROVIDED COMMERCIAL	23' MIN. / 28' MIN. AVG.
REQUIRED RESIDENTIAL	25' MIN. / 30' MIN. AVG.
PROVIDED RESIDENTIAL	25' MIN. / 28' MIN. AVG.
NON-STREET FRONTAGE SETBACKS	
ABUTTING RESIDENTIAL	28' MIN.
PROPOSED	20' MIN.
PROPOSED UNITS:	267

GROSS AREA TABULATIONS

COMMERCIAL OFFICE	3,300 SF
MARKET	1,100 SF
COMMUNITY ROOM	1,100 SF
RESIDENTIAL	279,740 SF
TOTAL GBA	285,240 SF

PARKING TABULATIONS (Table 9.103.A)

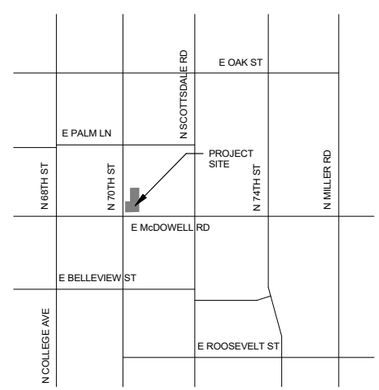
MULTI-FAMILY: 267 UNITS	
1.25 / EFFICIENCY (52 DU @ 1.25)	65.0 SPACES
1.3 / ONE-BEDROOM (147 DU @ 1.3)	191.1 SPACES
1.7 / TWO-BEDROOM (68 DU @ 1.7)	115.6 SPACES
TOTAL REQUIRED	372 SPACES
NON-RESIDENTIAL	
1/300 GSF OFFICE (3,300/300)	11 SPACES
TOTAL REQUIRED	**383 SPACES**

PROVIDED PARKING

LEVEL 04	58	GARAGE
LEVEL 03	89	GARAGE
LEVEL 02	78	GARAGE
LEVEL 01	83	GARAGE
LEVEL 01	7	SURFACE
LEVEL B1	77	GARAGE
TOTAL: 392		

ACCESSIBLE PARKING REQUIRED (4%)	**16 SPACES**
ACCESSIBLE PARKING PROVIDED	**17 SPACES**
REQUIRED BICYCLE PARKING (1/10 CARS)	**40 SPACES**
PROVIDED BICYCLE PARKING	**41 SPACES**

VICINITY MAP



NELSEN PARTNERS
ARCHITECTS & PLANNERS

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Austin | Scottsdale

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Suite #300
Scottsdale, Arizona 85254
t 480.949.6800
nelsenpartners.com

PRELIMINARY:
NOT FOR REGULATORY APPROVAL, PERMITTING, OR CONSTRUCTION

HAWKINS COMPANIES
COMMERCIAL DEVELOPERS

SOUTHDALE
7000 E. McDOWELL ROAD
SCOTTSDALE, AZ 85257

PRE-APP # 225-PA-2020 ZONING # DRB #

OWNER
Hawkins Companies
Commercial Developers
4700 S. McClintock Drive
Ste 160
Tempe, AZ 85282

ARCHITECT
Nelsen Partners
15210 N. Scottsdale Road
Suite 300
Scottsdale, AZ 85254
Attn: Jeff Brand

Date
26 JUNE 2020

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Project No.
319084

A-102
5-ZN-2020
8/7/2020

Appendix B – Crash Data

B

CITY OF SCOTTSDALE '16 - '18 COLLISION SUMMARY

REPORT #	DATE YYMMDD	TIME HHMM	NORTH / SOUTH ST.	TYPE	EAST WEST ST.	TYPE	DIR FROM	DIST FROM	INJ. SEV. #1	INJ. SEV. #2	PHYS. COND. #1	PHYS. COND. #2	VIOLATION #1	VIOLATION #2	ACTION #1	ACTION #2	TRAV. DIR. #1	TRAV. DIR. #2	MANNER OF COLLISION	COMMENTS
16-00597	160108	1231	SCOTTSDALE	RD	PALM	LN	AT		1	1	0	0	2	1	1	2	NB	NB	4	
16-01335	160117	1525	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	4	1	2	3	EB	EB	4	
16-01404	160118	1647	SCOTTSDALE	RD	MCDOWELL	RD	AT		3	1	0	0	16	1	1	2	NB	NB	4	MULTI VEH 3
16-02391	160130	1439	70	ST	MCDOWELL	RD	AT		3		0		1		1		EB		1	
16-02665	160202	1833	SCOTTSDALE	RD	PALM	LN	AT		1	2	0	0	20	1	4	11	WB	SB	3	
16-03058	160206	1925	68	ST	MCDOWELL	RD	AT		1	1	0	0	20	1	4	1	NB	SB	5	
16-03356	160210	1401	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	99	0	2	1	1	3	NB	NB	4	
16-04882	160228	1050	SCOTTSDALE	RD	MCDOWELL	RD	AT		99	2	99	0	2	1	1	3	NB	NB	4	MULTI VEH 3, HIT AND RUN
16-05425	160305	2256	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	5	0		1	1	3	SB	SB	4	HIT AND RUN, DUI
16-06409	160317	1859	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	2	1	1	1	NB	NB	4	
16-06408	160317	1826	70	ST	MCDOWELL	RD	AT		1	1	0	0	6	1	1	1	WB	NB	2	
16-06503	160318	1804	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	12	1	8	1	NB	EB	2	
16-08471	160410	1440	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	2	0	0	2	1	1	3	SB	SB	4	
16-08911	160416	0206	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	4	0	2	1	2	3	EB	EB	4	DUI
16-09160	160419	1035	68	ST	MCDOWELL	RD	AT		99	1	99	0	12	1	8	3	WB	WB	4	MULTI VEH 3, HIT AND RUN
16-10779	160509	0612	SCOTTSDALE	RD	MCDOWELL	RD	AT		2	1	99	0	2	1	1	3	WB	WB	4	MULTI VEH 3
16-11603	160519	1122	68	ST	PALM	LN	AT		1	1	0	0	20	1	1	1	EB	NB	2	
16-12064	160525	1042	SCOTTSDALE	RD	PALM	LN	AT		1	1	0	0	2	1	1	5	NB	NB	4	
16-12063	160525	0958	70	ST	MCDOWELL	RD	AT		1	1	4	0		1	1	3	EB	EB	6	DUI
16-13380	160610	1111	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	99	0	6	1	1	4	WB	NB	2	HIT AND RUN
16-15423	160707	0719	70	ST	MCDOWELL	RD	AT		99	99	99	0	2	1	99	3	SB	SB	6	HIT AND RUN
16-15533	160708	1738	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	3	0	0	7	1	5	4	NB	EB	2	
16-15617	160709	2145	70	ST	PALM	LN	E	75	1		0		97		5		SB		1	
16-15939	160714	1841	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	1	13	1	1	NB	NB	6	
16-16917	160728	1830	68	ST	PALM	LN	AT		1		5		8		1		WB		1	DUI
16-17128	160731	0959	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	13	13	1	1	EB	EB	7	
16-17255	160802	0957	68	ST	MCDOWELL	RD	N	50	1	1	0	0	2	1	1	1	NB	NB	4	
16-17512	160805	1901	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	99	0	12	1	8	5	EB	EB	6	
16-18083	160813	0103	SCOTTSDALE	RD	MCDOWELL	RD	AT		99	1	99	0	2	1	1	3	SB	SB	4	HIT AND RUN
16-18241	160815	0751	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	2	1	2	2	WB	WB	4	
16-18432	160817	1453	68	ST	MCDOWELL	RD	AT		1	1	0	0	2	1	1	1	WB	SB	2	
16-18865	160823	1401	68	ST	MCDOWELL	RD	AT		1	1	0	0	2	1	4	3	EB	NB	4	
16-19136	160826	1822	68	ST	MCDOWELL	RD	AT		1	1	0	0	7	1	5	1	EB	EB	4	
16-19225	160827	1959	SCOTTSDALE	RD	MCDOWELL	RD	N	40	1	1	0	0		1	1	3	SB	SB	4	
16-19535	160831	1453	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	2	0	0	2	1	1	2	NB	NB	4	
16-19779	160903	1402	SCOTTSDALE	RD	MCDOWELL	RD	AT		4	1	0	0	6	1	17	5	NB	EB	2	CAR/BICYCLE

REPORT #	DATE YYMMDD	TIME HHMM	NORTH / SOUTH ST.	TYPE	EAST WEST ST.	TYPE	DIR FROM	DIST FROM	INJ. SEV. #1	#2	PHYS. COND. #1	#2	VIOLATION #1	#2	ACTION #1	#2	TRAV. DIR. #1	#2	MANNER OF COLLISION	COMMENTS
16-20989	160918	1855	SCOTTSDALE	RD	MCDOWELL	RD	S	90	1	1	4	0	2	1	1	3	NB	NB	4	DUI,MUTLI VEH 3
16-21383	160923	1610	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	99	0		1	1	3	EB	EB	4	MULTI VEH 3
16-21791	160928	1553	70	ST	MCDOWELL	RD	AT		1	1	0	0	6	1	1	1	WB	NB	2	
16-22010	161001	1258	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	9	1	97	3	EB	EB	4	
16-22356	161006	1006	68	ST	MCDOWELL	RD	AT		1	1	0	0	2	1	1	3	NB	NB	4	
16-24538	161103	0614	68	ST	MCDOWELL	RD	AT		1	1	97	0	2	1	1	1	WB	WB	2	
16-24584	161103	1808	70	ST	MCDOWELL	RD	AT		99	1	99	0	20	1	4	1	SB	EB	2	HIT AND RUN
16-24626	161104	1142	SCOTTSDALE	RD	MCDOWELL	RD	N	75	1	2	0	0	2	1	1	3	NB	NB	4	
16-24728	161105	2044	70	ST	MCDOWELL	RD	AT		99	1	99	0	12	1	1	1	EB	EB	6	HIT AND RUN
16-24724	161105	1832	SCOTTSDALE	RD	PALM	LN	N	75	3	1	0	0	97	1	97	5	SB	WB	2	CAR/BICYCLE
16-26313	161125	1756	68	ST	MCDOWELL	RD	AT		1	1	0	0	20	1	4	1	WB	SB	3	
16-27933	161214	1539	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	99	0	99	13	1	1	3	NB	NB	6	HIT AND RUN
16-28591	161222	1433	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	2	0	7	1	5	5	SB	NB	2	
16-28779	161225	1017	SCOTTSDALE	RD	MCDOWELL	RD	W	40	1	1	0	0	2	1	1	3	EB	EB	4	
1702781	170203	2051	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	2	1	2	3	SB	SB	4	
1702872	170204	1539	70	ST	MCDOWELL	RD	AT		2	3	0	0	20	1	4	1	SB	EB	3	
1703635	170214	0115	SCOTTSDALE	RD	MCDOWELL	RD	S	50	1	1	4	4		1	1	1	NB	NB	4	DUI
1704076	170218	1154	SCOTTSDALE	RD	MCDOWELL	RD	S	50	1	1	0	0		1	1	3	NB	NB	4	
1704594	170225	1050	70	ST	MCDOWELL	RD	AT		2	3	0	0	99	1	1	1	WB	NB	2	
1704737	170227	0948	70	ST	MCDOWELL	RD	AT		2	2	0	0	20	1	4	1	SB	EB	3	
1706556	170320	1118	70	ST	MCDOWELL	RD	AT		1	1	0	0	6	1	1	1	NB	WB	2	
1708437	170412	1816	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	99	0	2	1	1	14	WB	WB	6	HIT AND RUN
1708428	170412	1646	68	ST	MCDOWELL	RD	N	91	1	1	0	0	20	1	4	1	NB	SB	2	
1709596	170428	1200	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	2	1	3	3	WB	WB	4	
1709620	170428	1518	70	ST	MCDOWELL	RD	W	75	1	1	0	0	2	1	1	3	EB	EB	4	MULTI VEH 3
1709727	170429	1818	SCOTTSDALE	RD	MCDOWELL	RD	AT		4	3	5	0	6	1	1	4	SB	NB	3	
1710019	170503	1022	70	ST	MCDOWELL	RD	AT		1	1	0	0	6	1	1	4	EB	NB	3	
1710029	170503	1225	SCOTTSDALE	RD	PALM	LN	AT		1	1	0	0	2	1	1	3	NB	NB	4	
1710548	170509	2117	68	ST	MCDOWELL	RD	AT		99	99	4	0	2	1	1	3	SB	SB	4	DUI
1710967	170515	1210	68	ST	MCDOWELL	RD	N	80	1	1	0	0	7	1	4	1	NB	SB	2	
1713313	170614	1602	SCOTTSDALE	RD	MCDOWELL	RD	W	25	1	1	0	0	97	1	10	3	EB	EB	6	
1713568	170617	1446	70	ST	MCDOWELL	RD	AT		1	1	0	0	97	1	1	1	NB	WB	2	
1713713	170619	2248	70	ST	PALM	LN	AT		99		99		99		99		NB		5	
1713773	170620	2006	SCOTTSDALE	RD	PALM	LN	AT		1	1	99	0	15	99	5	5	SB	SB	6	HIT AND RUN
1714505	170630	1447	SCOTTSDALE	RD	MCDOWELL	RD	AT		99	1	99	0	12	1	4	4	NB	NB	6	HIT AND RUN
1714982	170706	0537	SCOTTSDALE	RD	MCDOWELL	RD	S	50	99	1	99	0	99	1	2	3	NB	NB	4	HIT AND RUN
1715155	170708	1125	SCOTTSDALE	RD	ROYAL PALM	RD	AT		1	1	0	0	2	1	1	2	NB	NB	4	
1715277	170710	0858	70	ST	PALM	LN	N	58	1	1	0	0	7	1	5	1	NB	SB	5	

REPORT #	DATE YYMMDD	TIME HHMM	NORTH / SOUTH ST.	TYPE	EAST WEST ST.	TYPE	DIR FROM	DIST FROM	INJ. SEV. #1	INJ. SEV. #2	PHYS. COND. #1	PHYS. COND. #2	VIOLATION #1	VIOLATION #2	ACTION #1	ACTION #2	TRAV. DIR. #1	TRAV. DIR. #2	MANNER OF COLLISION	COMMENTS
1715626	170714	1258	68	ST	MCDOWELL	RD	W	75	1	1	0	0	2	1	1	3	EB	EB	4	
1716736	170728	2253	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	4	1	1	1	EB	EB	4	HIT AND RUN
1716851	170730	1229	SCOTTSDALE	RD	MCDOWELL	RD	W	80	1	1	0	0		1	1	3	EB	EB	4	
1716953	170801	0459	68	ST	MCDOWELL	RD	AT		2	1	0	0	2	1	1	1	EB	NB	2	
1718155	170816	2140	SCOTTSDALE	RD	MCDOWELL	RD	AT		99	1	99	0	99	1	99	1	EB	EB	6	HIT AND RUN
1718762	170824	1751	SCOTTSDALE	RD	MCDOWELL	RD	AT		99	1	99	0	20	1	5	1	EB	SB	4	HIT AND RUN
1718841	170825	2120	SCOTTSDALE	RD	MCDOWELL	RD	AT		99	1	99	0	4	1	1	3	NB	NB	4	MULTI VEH 3, HIT AND RUN
1719048	170828	1259	SCOTTSDALE	RD	MCDOWELL	RD	AT		2	2	0	0	6	1	1	4	WB	NB	2	
1720152	170911	2034	68	ST	MCDOWELL	RD	AT		1	1	0	0	20	1	4	1	SB	NB	3	
1720679	170918	1829	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	2	0	0	97	1	1	3	WB	WB	4	
1721350	170926	1817	68	ST	MCDOWELL	RD	AT		1	1	0	0	20	1	4	1	EB	SB	3	
1721507	170928	2030	SCOTTSDALE	RD	PALM	LN	AT		1	1	0	0	12	1	8	1	SB	SB	6	
1722613	171012	1813	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	2	1	1	3	EB	EB	4	
1723011	171017	2010	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	4	0	2	1	2	3	SB	SB	4	DUI
1722982	171017	1326	70	ST	MCDOWELL	RD	AT		1	1	0	0	2	1	2	3	EB	EB	4	
1725088	171111	1823	SCOTTSDALE	RD	MCDOWELL	RD	E	66	3		0		2		4		SB		1	
1725502	171117	1453	70	ST	MCDOWELL	RD	AT		1	2	0	0	6	1	1	1	NB	EB	2	
1726470	171130	0947	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	4	1	1	8	NB	NB	4	
1727196	171208	1723	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	2	1	1	3	EB	EB	4	
1727204	171208	1953	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	2	1	1	3	NB	NB	4	MULTI VEH 3
1727198	171208	1805	SCOTTSDALE	RD	MCDOWELL	RD	N	85	1	1	4	0	2	1	1	3	SB	SB	4	DUI
1728871	171231	1107	SCOTTSDALE	RD	MCDOWELL	RD	S	60	1	1	0	0	2	1	1	3	NB	NB	4	
1721574	171929	1621	68	ST	MCDOWELL	RD	AT		1	1	0	0	13	1	2	1	EB	EB	6	
1800036	180101	0940	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	99	0	0		1	1	1	NB	EB	2	
1800894	180112	1815	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	12	1	8	2	WB	WB	6	
1801236	180117	0908	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	2	1	8	3	EB	EB	4	
1801512	180120	2315	68	ST	MCDOWELL	RD	AT		1	1	0	0	2	1	4	1	NB	WB	2	
1801726	180123	1857	68	ST	MCDOWELL	RD	AT		1	1	0	0	6	1	1	4	WB	NB	5	
1802485	180202	1045	SCOTTSDALE	RD	MCDOWELL	RD	AT		99	1	99	0	2	1	99	3	NB	NB	4	HIT AND RUN
1803420	180212	1125	SCOTTSDALE	RD	MCDOWELL	RD	N	50	1		0		1		4		NB		1	
1803580	180214	1331	70	ST	MCDOWELL	RD	E	68	1	4	0	0	2	1	97	3	WB	WB	4	
1803632	180215	0235	SCOTTSDALE	RD	ROYAL PALM	RD	AT		1		4		2		5		NB		1	DUI, HIT AND RUN
1804173	180222	2258	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	3	0	0	20	1	5	17	SB	SB	2	CAR/PEDESTRIAN
1804531	180227	1306	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	20	1	5	1	EB	SB	2	
1805306	180308	1611	SCOTTSDALE	RD	MCDOWELL	RD	N	60	1	1	0	0	2	1	1	3	SB	SB	4	HIT AND RUN
1806329	180320	2121	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	2		1	2	SB	SB	4	
1807857	180408	0206	SCOTTSDALE	RD	MCDOWELL	RD	AT		99	1	99	0	99	1	1	3	EB	EB	4	HIT AND RUN
1809844	180503	1326	SCOTTSDALE	RD	MCDOWELL	RD	W	45	1	1	0	0	7	1	5	1	WB	WB	3	

REPORT #	DATE YYMMDD	TIME HHMM	NORTH / SOUTH ST.	TYPE	EAST WEST ST.	TYPE	DIR FROM	DIST FROM	INJ. SEV. #1	#2	PHYS. COND. #1	#2	VIOLATION #1	#2	ACTION #1	#2	TRAV. DIR. #1	#2	MANNER OF COLLISION	COMMENTS
1810830	180515	2131	SCOTTSDALE	RD	MCDOWELL	RD	AT		99	1	99	0	2	1	1	1	NB	NB	2	HIT AND RUN
1811049	180518	1251	SCOTTSDALE	RD	MCDOWELL	RD	W	87	1	1	5	0	6	1	1	3	EB	EB	4	DUI
1811122	180519	1227	SCOTTSDALE	RD	MCDOWELL	RD	E	50	1	1	0	0		1	1	3	WB	WB	4	
1811619	180525	1315	70	ST	MCDOWELL	RD	S	15	1		0		7		5		SB		1	
1811803	180527	1155	68	ST	MCDOWELL	RD	AT		1	1	0	0	2	1	1	3	WB	WB	4	
1812248	180602	1041	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	6	1	1	4	EB	SB	2	
1812631	180607	1320	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	6	1	1	1	SB	WB	2	
1812641	180607	1440	SCOTTSDALE	RD	MCDOWELL	RD	E	90	99	1	99	0	99	1	1	3	WB	WB	4	
1813197	180614	1513	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	6	1	2	4	SB	NB	5	
1813278	180615	1336	SCOTTSDALE	RD	MCDOWELL	RD	S	30	1	1	0	0		1	1	3	NB	NB	4	
1813598	180619	1514	SCOTTSDALE	RD	PALM	LN	AT		1	1	0	0	7	1	4	1	EB	SB	2	MULTI VEH 3
1813709	180621	0221	SCOTTSDALE	RD	MCDOWELL	RD	AT		5	99	99	99	97	99	21	1	SB	WB	97	CAR/PEDESTRIAN HIT AND RUN
1814946	180706	1731	70	ST	PALM	LN	E	20	99		99		99		1		EB		5	HIT AND RUN
1815154	180709	1633	68	ST	MCDOWELL	RD	N	75	1	1	0	0	20	1	4	1	NB	SB	3	
1815843	180718	1910	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	5	0	2	1	1	1	EB	EB	4	DUI
1816590	180728	1433	SCOTTSDALE	RD	ROYAL PALM	RD	AT		1	2	0	0	2	1	1	5	NB	NB	4	
1820190	180912	1815	68	ST	MCDOWELL	RD	AT		3	3	0	0	6	1	1	4	WB	NB	3	
1820736	180921	0659	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	1	0	0	6	1	1	1	WB	NB	2	MULTI VEH 3
1821127	180926	1631	SCOTTSDALE	RD	ROYAL PALM	RD	AT		3	1	0	0	20	1	4	4	WB	SB	2	
1821566	181002	1329	68	ST	MCDOWELL	RD	AT		2	1	0	0	6	1	1	1	EB	SB	2	
1821552	181002	1114	68	ST	MCDOWELL	RD	E	67	1		0		2		4		EB		1	
1821789	181005	1439	70	ST	PALM	LN	AT		1	2	0	0	20	1	1	1	EB	SB	2	
1822548	181016	0832	SCOTTSDALE	RD	MCDOWELL	RD	AT		1	3	0	0	6	1	1	1	WB	NB	2	
1825076	181119	1728	68	ST	MCDOWELL	RD	AT		1	2	0	0	6	1	1	1	WB	SB	2	
1825349	181123	2336	SCOTTSDALE	RD	MCDOWELL	RD	AT		2	4	4	0	3	1	1	4	NB	EB	5	DUI
1826080	181203	1613	68	ST	MCDOWELL	RD	AT		1	3	0	0	6	1	4	1	WB	EB	3	
1826217	181205	1209	SCOTTSDALE	RD	MCDOWELL	RD	N	18	1	1	0	0	2	1	1	3	SB	SB	4	
1826597	181210	1115	SCOTTSDALE	RD	MCDOWELL	RD	AT		2	1	0	0	20	1	5	2	NB	EB	2	
1826799	181212	1633	68	ST	MCDOWELL	RD	AT		3	1	0	0	6	1	4	1	EB	WB	2	MULTI VEH 3
1827126	181216	1008	68	ST	MCDOWELL	RD	AT		1	1	0	0		1	3	3	WB	WB	4	
1828062	181230	1126	68	ST	MCDOWELL	RD	AT		1	1	0	0	99	99	5	1	EB	SB	2	

REPORT #	DATE YYMMDD	TIME HHMM	NORTH / SOUTH ST.	TYPE	EAST WEST ST.	TYPE	DIR FROM	DIST FROM	INJ. SEV. #1	INJ. SEV. #2	PHYS. COND. #1	PHYS. COND. #2	VIOLATION #1	VIOLATION #2	ACTION #1	ACTION #2	TRAV. DIR. #1	TRAV. DIR. #2	MANNER OF COLLISION	COMMENTS

KEY

INJURY SEVERITY:
1=NO INJURY, 2=POSSIBLE INJURY, 3=NON-INCAPACITATING INJURY, 4=INCAPACITATING INJURY, 5=FATAL INJURY, 99=NOT REPORTED / UNKNOWN

PHYSICAL CONDITION:
0=NO APPARENT INFLUENCE, 1=ILLNESS, 2=PHYSICAL IMPAIRMENT, 3=FELL ASLEEP / FATIGUED 4=ALCOHOL, 5=DRUGS, 6=MEDICATIONS, A=NO TEST GIVEN, B=TEST GIVEN, C=TEST REFUSED, D=TESTING UNKNOWN, 97=OTHER, 99=UNKNOWN

VIOLATION:
1=NO IMPROPER ACTION, 2=SPEED TOO FAST FOR CONDITIONS, 3=EXCEEDED LAWFUL SPEED 4=FOLLOWED TOO CLOSELY. 5=RAN STOP SIGN, 6=DISREGAREDED TRAFFIC SIGNAL7=MADE IMPROPER TURN, 8=DROVE/RODE IN OPPOSING TRAFFIC LANE, 9=KNOWINGLY OPERATED WITH FAULTY / MISSING EQUIPMENT, 10=REQUIRED MOTORCYCLE SAFETY EQUIPMENT NOT USED, 11=PASSED IN NO PASSING ZONE, 12=UNSAFE LANE CHANGE, 13=FAILED TO KEEP IN PROPER LANE, 14=DISREGARDED PAVEMENT MARKINGS, 15=OTHER UNSAFE PASSING, 16=INATTENTION/DISTRACTION, 17=DID NOT USE CROSSWALK, 18=WALKED ON WRONG SIDE OF ROAD, 19=ELECTRONIC COMMUNICATIONS DEVICE, 20=FAILED TO YIELD RIGHT OF WAY (added August 2014), 97=OTHER, 99 UNKNOWN

ACTION:
1=GOING STRAIGHT AHEAD, 2=SLOWING IN TRAFFICWAY, 3=STOPPED IN TRAFFICWAY, 4=MAKING LEFT TURN, 5=MAKING RIGHT TURN, 6=MAKING U-TURN, 7=OVERTAKING/PASSING, 8=CHANGING LANES, 9=NEGOTIATING A CURVE, 10=BACKING, 11=AVOIDING VEH/OBJ/PED/CYCLIST/ANIMAL, 12=ENTERING PARKING POSITION, 13=LEAVING PARKING POSITION, 14=PROPERLY PARKED, 15=IMPROPERLY PARKED, 16=DRIVERLESS MOVING VEHICLE, 17=CROSING ROAD, 18=WALKING WITH TRAFFIC, 19=WALKING AGAINST TRAFFIC, 20=STANDING, 21=LYING, 22=GETTING ON OR OFF VEHICLE, 23=WORKING ON/PUSHING VEHICLE, 24=WORKING ON ROAD, 97=OTHER, 99=UKNOWN

MANNER OF COLLISION:
1=SINGLE VEHICLE, 2=ANGLE (front to side, other than left turn), 3=LEFT TURN, 4=REAR END (front to rear), 5=HEAD-ON (front to front, other than left turn), 6=SIDESWIPE (same direction), 7=SIDESWIPE (opposite direction), 8=REAR-TO-SIDE, 9=REAR TO REAR, 97=OTHER, 99=UNKNOWN

TOTAL **143**

CITY OF SCOTTSDALE '13 - '18 COLLISION SUMMARY

REPORT #	DATE YYMMDD	TIME HHMM	NORTH / SOUTH ST.	TYPE	EAST WEST ST.	TYPE	DIR FROM	DIST FROM	INJ. SEV. #1	INJ. SEV. #2	PHYS. COND. #1	PHYS. COND. #2	VIOLATION #1	VIOLATION #2	ACTION #1	ACTION #2	TRAV. DIR. #1	TRAV. DIR. #2	MANNER OF COLLISION	COMMENTS
1713713	170619	2248	70	ST	PALM	LN	AT		99		99		99		99		NB		5	
1821789	181005	1439	70	ST	PALM	LN	AT		1	2	0	0	20	1	1	1	EB	SB	2	

KEY

INJURY SEVERITY:
1=NO INJURY, 2=POSSIBLE INJURY, 3=NON-INCAPACITATING INJURY, 4=INCAPACITATING INJURY, 5=FATAL INJURY, 99=NOT REPORTED / UNKNOWN

PHYSICAL CONDITION:
0=NO APPARENT INFLUENCE, 1=ILLNESS, 2=PHYSICAL IMPAIRMENT, 3=FELL ASLEEP / FATIGUED 4=ALCOHOL, 5=DRUGS, 6=MEDICATIONS, A=NO TEST GIVEN, B=TEST GIVEN, C=TEST REFUSED, D=TESTING UNKNOWN, 97=OTHER, 99=UNKNOWN

VIOLATION:
1=NO IMPROPER ACTION, 2=SPEED TOO FAST FOR CONDITIONS, 3=EXCEEDED LAWFUL SPEED 4=FOLLOWED TOO CLOSELY. 5=RAN STOP SIGN, 6=DISREGAREDED TRAFFIC SIGNAL7=MADE IMPROPER TURN, 8=DROVE/RODE IN OPPOSING TRAFFIC LANE, 9=KNOWINGLY OPERATED WITH FAULTY / MISSING EQUIPMENT, 10=REQUIRED MOTORCYCLE SAFETY EQUIPMENT NOT USED, 11=PASSED IN NO PASSING ZONE, 12=UNSAFE LANE CHANGE, 13=FAILED TO KEEP IN PROPER LANE, 14=DISREGARDED PAVEMENT MARKINGS, 15=OTHER UNSAFE PASSING, 16=INATTENTION/DISTRACTION, 17=DID NOT USE CROSSWALK, 18=WALKED ON WRONG SIDE OF ROAD, 19=ELECTRONIC COMMUNICATIONS DEVICE, 20=FAILED TO YIELD RIGHT OF WAY (added August 2014), 97=OTHER, 99 UNKNOWN

ACTION:
1=GOING STRAIGHT AHEAD, 2=SLOWING IN TRAFFICWAY, 3=STOPPED IN TRAFFICWAY, 4=MAKING LEFT TURN, 5=MAKING RIGHT TURN, 6=MAKING U-TURN, 7=OVERTAKING/PASSING, 8=CHANGING LANES, 9=NEGOTIATING A CURVE, 10=BACKING, 11=AVOIDING VEH/OBJ/PED/CYCLIST/ANIMAL, 12=ENTERING PARKING POSITION, 13=LEAVING PARKING POSITION, 14=PROPERLY PARKED, 15=IMPROPERLY PARKED, 16=DRIVERLESS MOVING VEHICLE, 17=CROSING ROAD, 18=WALKING WITH TRAFFIC, 19=WALKING AGAINST TRAFFIC, 20=STANDING, 21=LYING, 22=GETTING ON OR OFF VEHICLE, 23=WORKING ON/PUSHING VEHICLE, 24=WORKING ON ROAD, 97=OTHER, 99=UKNOWN

MANNER OF COLLISION:
1=SINGLE VEHICLE, 2=ANGLE (front to side, other than left turn), 3=LEFT TURN, 4=REAR END (front to rear), 5=HEAD-ON (front to front, other than left turn), 6=SIDESWIPE (same direction), 7=SIDESWIPE (opposite direction), 8=REAR-TO-SIDE, 9=REAR TO REAR, 97=OTHER, 99=UNKNOWN

TOTAL **2**

Appendix C – Parcel Information

C

129-33-001S Commercial Parcel

This is a commercial parcel located at 7000 E MCDOWELL RD SCOTTSDALE 85257. and the current owner is CERCIDIUM HOLDINGS LLC. Its current year full cash value is $3,163,500.

Property Information

7000 E MCDOWELL RD SCOTTSDALE 85257

MCR #	
Description:	PT SE4 SE4 DAF BEG 380' E OF NW COR S2 SE4 SE4 TH W TO A PT ON E R/W LN 20' ALLEY TH S & W ALG SD R/W LN TO A PT ON E R/W LN 70TH ST TH S ALG SD R/W 70TH ST TO INTERSEC OF N R/W LN MCDOWELL TH ELY ALG SD LN TO E LN W 380' OF SE4 SE4 TH N TO POB 3.83 AC
Lat/Long	33.46690500 | -111.92969700
Lot Size	166,835 sq ft.
Zoning	C-3
Lot #	
High School District	SCOTTSDALE UNIFIED #48
Elementary School District	SCOTTSDALE UNIFIED SCHOOL DISTRICT
Local Jurisdiction	SCOTTSDALE
S/T/R	34 2N 4E
Market Area/Neighborhood	19/007
Subdivision (0 Parcels)	

Owner Information

CERCIDIUM HOLDINGS LLC

Mailing Address	7300 E MCDOWELL RD 100, SCOTTSDALE, AZ 85257
Deed Number	100614096
Last Deed Date	07/19/2010
Sale Date	n/a
Sale Price	n/a

Valuation Information

We provide valuation information for the past 5 years. For mobile display, we only show 1 year of valuation information. Should you need more data, please look at our data sales.
The Valuation Information displayed below may not reflect the taxable value used on the tax bill due to any special valuation relief program. **CLICK HERE TO PAY YOUR TAXES OR VIEW YOUR TAX BILL**

Tax Year	2021	2020	2019	2018	2017
Full Cash Value	$3,163,500	$3,155,300	$3,087,900	$3,472,700	$2,625,500
Limited Property Value	$2,728,032	$2,598,126	$2,474,406	$2,356,577	$2,244,359
Legal Class	1.12	1.12	1.12	1.12	1.12
Description	COMMERCIAL / OTHER R/P	COMMERCIAL / OTHER R/P	COMMERCIAL / OTHER R/P	COMMERCIAL / OTHER R/P	COMMERCIAL / OTHER R/P
Assessment Ratio	18%	18%	18%	18%	18%
Assessed LPV	$491,046	$467,663	$445,393	$424,184	$403,985
Property Use Code	1040	1040	1040	1040	1040
PU Description	Miscellaneous Commercial	Miscellaneous Commercial	Miscellaneous Commercial	Miscellaneous Commercial	Miscellaneous Commercial
Tax Area Code	481400	481400	481400	481400	481400
Valuation Source	Notice	Notice	Notice	Notice	Notice

Additional Property Information

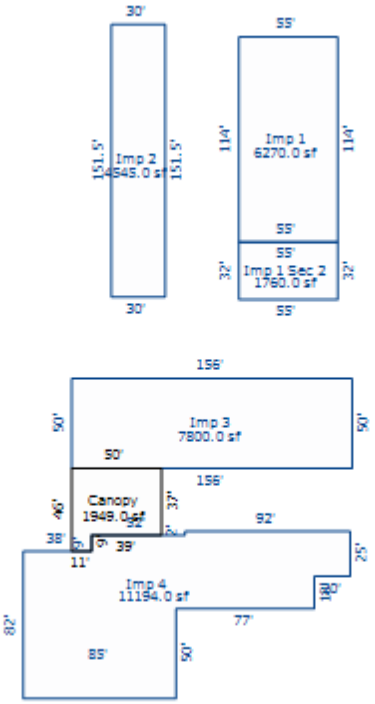
Additional commercial property data.

Description	Imp #	Occupancy	Rank	CCI	Age	Sq Ft.
Service Repair Garage	000101	528	2	S	20	6,270
Car Wash - Drive Thru	000102	435	2	S	23	1,760
Service Repair Garage	000201	528	2	C	53	4,545
Service Repair Garage	000301	528	2	C	45	7,800
Automobile Showroom	000401	303	2	D	30	11,194
Site Improvements	000501	163	2	D	53	1

5-ZN-2020
8/7/2020

Building Sketches

Sketches that illustrate the external dimensions of a property.



5-ZN-2020
8/7/2020

Appendix D – Traffic Count Data

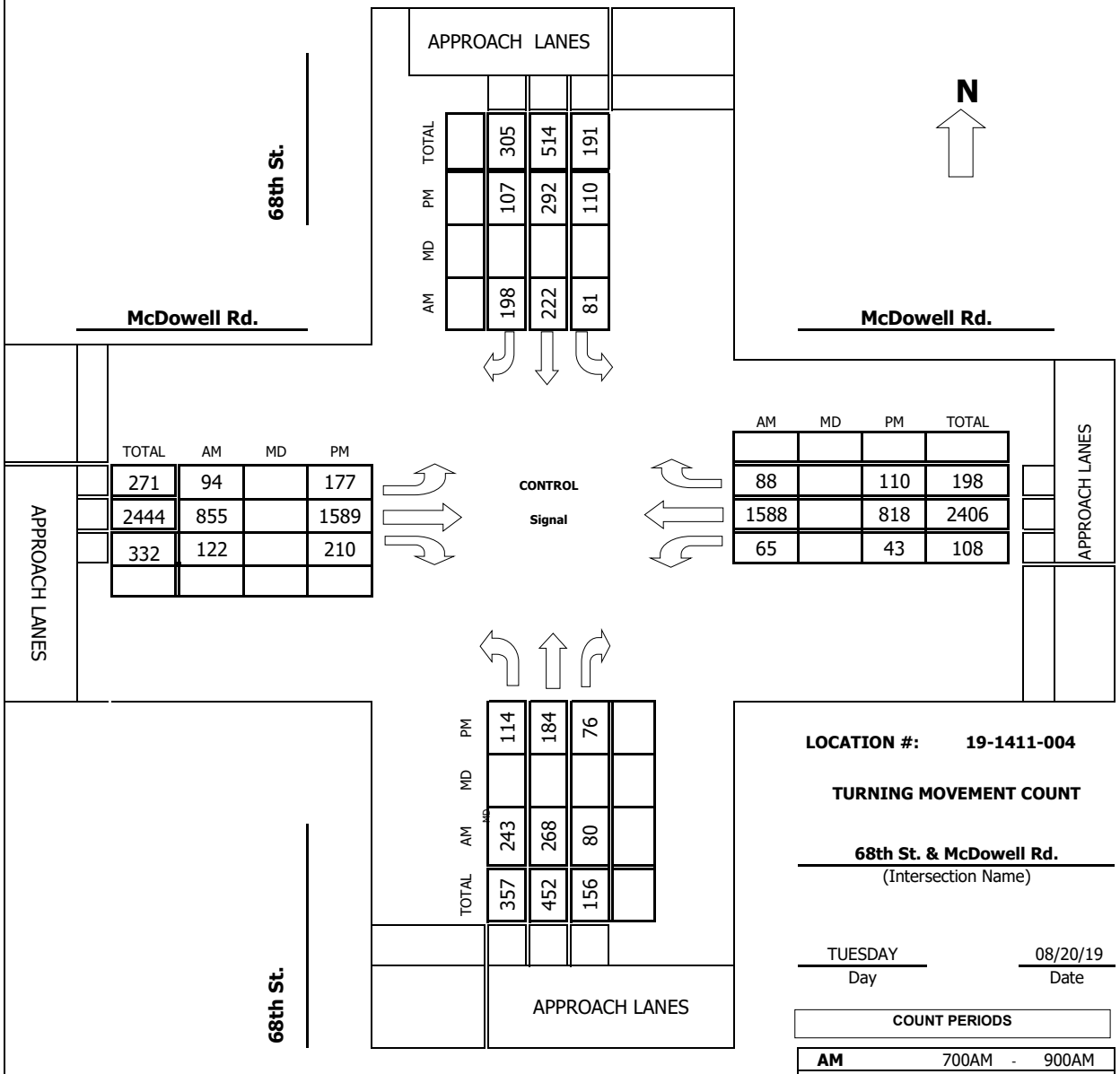
5-ZN-2020
8/7/2020

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

Project #: 19-1411-004

TMC SUMMARY OF 68th St. & McDowell Rd.



LOCATION #: 19-1411-004

TURNING MOVEMENT COUNT

68th St. & McDowell Rd.
(Intersection Name)

TUESDAY (Day) 08/20/19 (Date)

COUNT PERIODS			
AM	700AM	-	900AM
NOON		-	
PM	400PM	-	600PM

AM PEAK HOUR 700 AM

NOON PEAK HOUR

PM PEAK HOUR 430 PM

5-ZN-2020
8/7/2020

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	68th St.	DATE:	08/20/19	LOCATION:	Scottsdale
E-W STREET:	McDowell Rd.	DAY:	TUESDAY	PROJECT#	19-1411-004

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	1	1	1	1	1	3	1	1	3	0	
6:00 AM													
6:15 AM													
6:30 AM													
6:45 AM													
7:00 AM	61	54	24	19	45	39	22	175	31	21	361	15	867
7:15 AM	66	63	26	17	88	55	26	236	45	24	394	25	1065
7:30 AM	71	84	17	22	48	44	26	247	22	12	453	21	1067
7:45 AM	45	67	13	23	41	60	20	197	24	8	380	27	905
8:00 AM	55	53	18	26	48	34	27	192	9	6	350	24	842
8:15 AM	50	46	10	21	36	35	20	187	20	6	297	16	744
8:30 AM	43	41	8	19	40	29	30	203	19	7	279	33	751
8:45 AM	29	34	15	13	32	33	27	196	15	6	226	19	645
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	420	442	131	160	378	329	198	1633	185	90	2740	180	6886
Approach %	42.30	44.51	13.19	18.45	43.60	37.95	9.82	81.00	9.18	2.99	91.03	5.98	
App/Depart	993	/	820	867	/	653	2016	/	1924	3010	/	3489	

AM Peak Hr Begins at: 700 AM

PEAK													
Volumes	243	268	80	81	222	198	94	855	122	65	1588	88	3904
Approach %	41.12	45.35	13.54	16.17	44.31	39.52	8.78	79.83	11.39	3.73	91.21	5.05	
PEAK HR. FACTOR:		0.859			0.783			0.872			0.896		0.915

CONTROL:	Signal
COMMENT 1:	
GPS:	33.465608, -111.934848

5-ZN-2020
8/7/2020

Intersection Turning Movement

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	68th St.		DATE:	08/20/19	LOCATION:	Scottsdale
	0					
E-W STREET:	McDowell Rd.		DAY:	TUESDAY	PROJECT#	19-1411-004

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	1	1	1	1	1	3	1	1	3	0	
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	57	17	28	58	28	38	358	36	16	185	14	860
4:15 PM	22	28	18	24	54	27	28	362	37	7	202	23	832
4:30 PM	34	48	22	22	58	22	40	360	56	10	177	25	874
4:45 PM	16	44	15	23	82	24	28	419	57	5	228	24	965
5:00 PM	37	49	24	38	83	28	50	380	55	17	210	28	999
5:15 PM	27	43	15	27	69	33	59	430	42	11	203	33	992
5:30 PM	23	49	21	32	63	34	43	301	47	12	168	15	808
5:45 PM	28	39	14	24	53	35	45	267	43	17	224	22	811
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	212	357	146	218	520	231	331	2877	373	95	1597	184	7141
Approach %	29.65	49.93	20.42	22.50	53.66	23.84	9.24	80.34	10.42	5.06	85.13	9.81	
App/Depart	715	/	872	969	/	988	3581	/	3241	1876	/	2040	

PM Peak Hr Begins at: 430 PM

PEAK													
Volumes	114	184	76	110	292	107	177	1589	210	43	818	110	3830
Approach %	30.48	49.20	20.32	21.61	57.37	21.02	8.96	80.41	10.63	4.43	84.24	11.33	
PEAK HR. FACTOR:		0.850			0.854			0.930			0.945		0.958

CONTROL:	Signal
COMMENT 1:	0
GPS:	33.465608, -111.934848

5-ZN-2020
8/7/2020

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

Pedestrian & Bicycle Study

N-S STREET: 68th St.
E-W STREET: McDowell Rd.

Date: 08/20/19
Day: TUESDAY

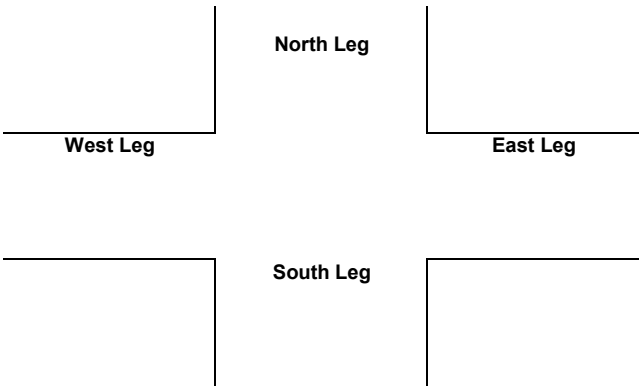
City: Scottsdale
Project #: 19-1411-004

	PEDESTRIANS			
	N-LEG	S-LEG	E-LEG	W-LEG
7:00 AM	0	0	0	2
7:15 AM	2	0	3	0
7:30 AM	0	0	1	0
7:45 AM	0	0	0	0
8:00 AM	0	0	0	0
8:15 AM	1	0	0	1
8:30 AM	0	1	0	3
8:45 AM	2	1	1	3
TOTAL	**5**	**2**	**5**	**9**

	BICYCLES			
	N-LEG	S-LEG	E-LEG	W-LEG
7:00 AM	0	0	0	0
7:15 AM	0	0	0	0
7:30 AM	0	1	0	1
7:45 AM	0	0	0	0
8:00 AM	0	0	0	0
8:15 AM	0	1	0	0
8:30 AM	0	0	0	0
8:45 AM	0	1	0	1
TOTAL	**0**	**3**	**0**	**2**

	PEDESTRIANS			
	N-LEG	S-LEG	E-LEG	W-LEG
4:00 PM	1	0	0	0
4:15 PM	1	0	0	1
4:30 PM	0	0	0	0
4:45 PM	1	0	0	2
5:00 PM	0	0	3	0
5:15 PM	0	1	0	0
5:30 PM	0	0	0	0
5:45 PM	0	0	0	0
TOTAL	**3**	**1**	**3**	**3**

	BICYCLES			
	N-LEG	S-LEG	E-LEG	W-LEG
4:00 PM	0	0	0	0
4:15 PM	0	0	0	0
4:30 PM	0	0	0	0
4:45 PM	0	0	0	0
5:00 PM	0	0	0	0
5:15 PM	0	0	0	0
5:30 PM	0	1	0	0
5:45 PM	0	0	0	0
TOTAL	**0**	**1**	**0**	**0**



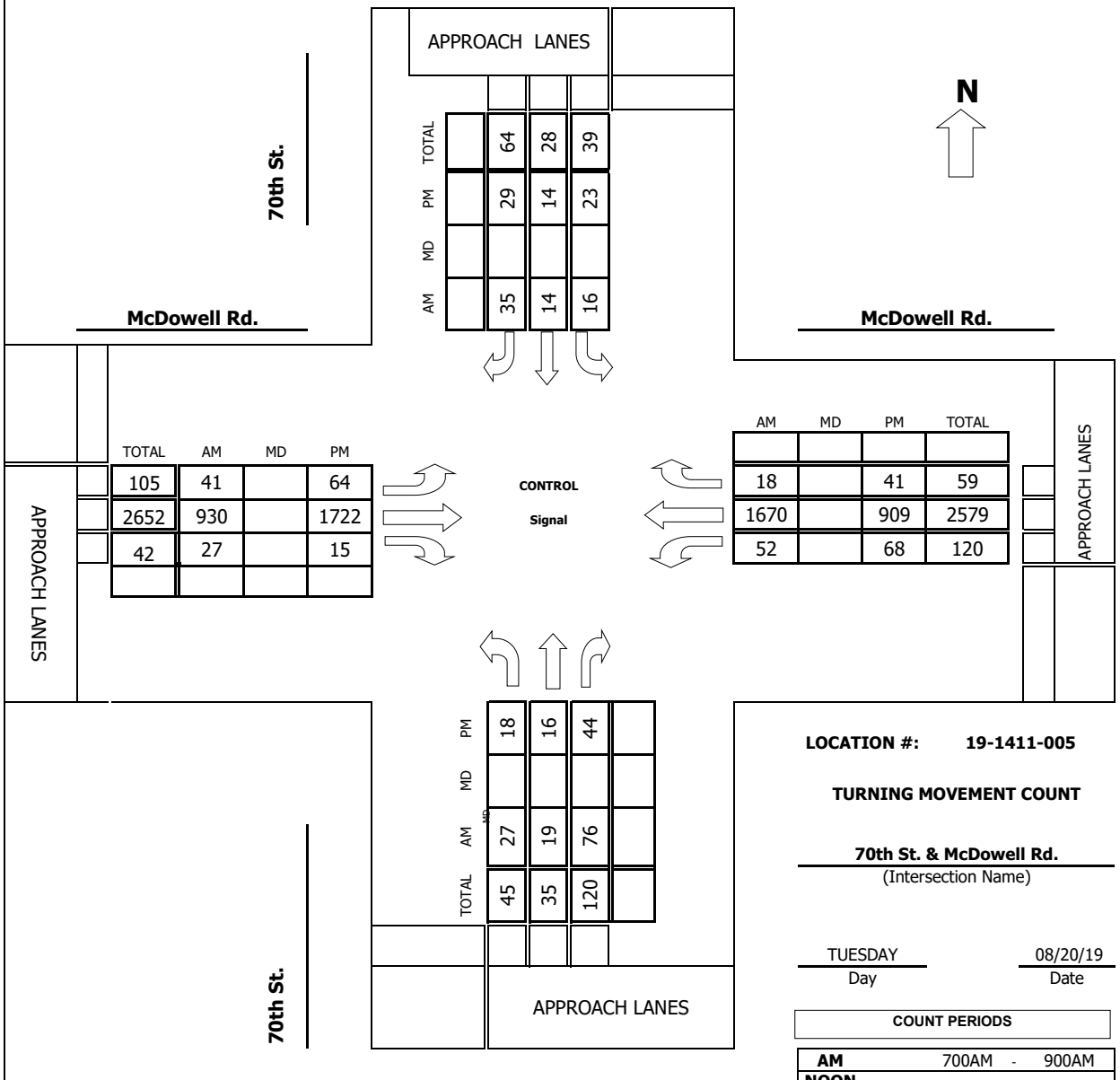
5-ZN-2020
8/7/2020

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

Project #: 19-1411-005

TMC SUMMARY OF 70th St. & McDowell Rd.



LOCATION #: 19-1411-005

TURNING MOVEMENT COUNT

70th St. & McDowell Rd.
(Intersection Name)

TUESDAY (Day) 08/20/19 (Date)

COUNT PERIODS			
AM	700AM	-	900AM
NOON		-	
PM	400PM	-	600PM

AM PEAK HOUR 700 AM

NOON PEAK HOUR

PM PEAK HOUR 430 PM

5-ZN-2020
8/7/2020

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	70th St.	DATE:	08/20/19	LOCATION:	Scottsdale
E-W STREET:	McDowell Rd.	DAY:	TUESDAY	PROJECT#	19-1411-005

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	0	1	1	0	1	3	0	1	3	0	
6:00 AM													
6:15 AM													
6:30 AM													
6:45 AM													
7:00 AM	0	1	21	3	2	13	5	192	3	16	391	2	649
7:15 AM	9	4	20	3	3	9	14	220	8	15	410	1	716
7:30 AM	8	10	22	5	2	8	11	270	7	14	448	8	813
7:45 AM	10	4	13	5	7	5	11	248	9	7	421	7	747
8:00 AM	2	1	8	2	0	12	10	225	4	9	355	3	631
8:15 AM	8	1	17	7	0	4	7	212	2	6	313	9	586
8:30 AM	8	4	16	4	2	6	6	215	2	6	333	8	610
8:45 AM	1	2	10	4	3	5	5	226	0	5	284	8	553
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	46	27	127	33	19	62	69	1808	35	78	2955	46	5305
Approach %	23.00	13.50	63.50	28.95	16.67	54.39	3.61	94.56	1.83	2.53	95.97	1.49	
App/Depart	200	/	142	114	/	132	1912	/	1968	3079	/	3063	

AM Peak Hr Begins at: 700 AM

PEAK													
Volumes	27	19	76	16	14	35	41	930	27	52	1670	18	2925
Approach %	22.13	15.57	62.30	24.62	21.54	53.85	4.11	93.19	2.71	2.99	95.98	1.03	
PEAK HR. FACTOR:		0.763			0.903			0.866			0.926		0.899

CONTROL:	Signal
COMMENT 1:	
GPS:	33.465677, -111.930538

5-ZN-2020
8/7/2020

Intersection Turning Movement

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	70th St.		DATE:	08/20/19	LOCATION:	Scottsdale
	0					
E-W STREET:	McDowell Rd.		DAY:	TUESDAY	PROJECT#	19-1411-005

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	0	1	1	0	1	3	0	1	3	0	
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	4	6	5	8	1	6	11	359	8	12	231	6	657
4:15 PM	4	4	11	4	2	3	17	410	8	14	201	14	692
4:30 PM	6	5	14	2	3	3	21	408	1	20	207	14	704
4:45 PM	6	2	10	6	3	10	13	454	5	17	206	7	739
5:00 PM	5	4	10	9	3	4	15	376	6	13	272	13	730
5:15 PM	1	5	10	6	5	12	15	484	3	18	224	7	790
5:30 PM	8	2	9	5	1	10	20	385	4	14	200	6	664
5:45 PM	7	4	13	7	2	4	13	317	6	12	216	11	612
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	41	32	82	47	20	52	125	3193	41	120	1757	78	5588
Approach %	26.45	20.65	52.90	39.50	16.81	43.70	3.72	95.06	1.22	6.14	89.87	3.99	
App/Depart	155	/	235	119	/	181	3359	/	3322	1955	/	1850	

PM Peak Hr Begins at: 430 PM

PEAK													
Volumes	18	16	44	23	14	29	64	1722	15	68	909	41	2963
Approach %	23.08	20.51	56.41	34.85	21.21	43.94	3.55	95.61	0.83	6.68	89.29	4.03	

PEAK HR. FACTOR:	0.780	0.717	0.897	0.854	0.938

CONTROL:	Signal
COMMENT 1:	0
GPS:	33.465677, -111.930538

5-ZN-2020
8/7/2020

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

Pedestrian & Bicycle Study

N-S STREET: 70th St.
E-W STREET: McDowell Rd.

Date: 08/20/19
Day: TUESDAY

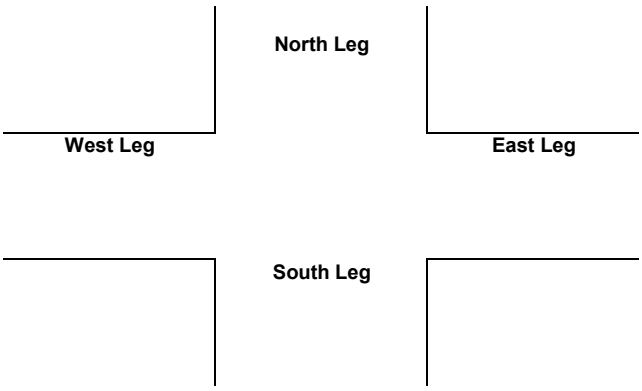
City: Scottsdale
Project #: 19-1411-005

	PEDESTRIANS			
	N-LEG	S-LEG	E-LEG	W-LEG
7:00 AM	1	1	1	0
7:15 AM	0	0	0	0
7:30 AM	0	0	2	0
7:45 AM	0	0	1	0
8:00 AM	1	0	0	0
8:15 AM	0	1	0	0
8:30 AM	0	0	0	1
8:45 AM	1	1	0	0
TOTAL	**3**	**3**	**4**	**1**

	BICYCLES			
	N-LEG	S-LEG	E-LEG	W-LEG
7:00 AM	0	1	1	0
7:15 AM	0	0	0	0
7:30 AM	0	0	0	0
7:45 AM	0	0	0	0
8:00 AM	0	0	0	0
8:15 AM	0	0	0	0
8:30 AM	0	0	0	0
8:45 AM	0	0	0	0
TOTAL	**0**	**1**	**1**	**0**

	PEDESTRIANS			
	N-LEG	S-LEG	E-LEG	W-LEG
4:00 PM	0	0	0	0
4:15 PM	0	0	1	1
4:30 PM	0	0	0	0
4:45 PM	2	0	0	0
5:00 PM	1	0	2	0
5:15 PM	2	0	0	1
5:30 PM	0	0	0	0
5:45 PM	0	0	0	0
TOTAL	**5**	**0**	**3**	**2**

	BICYCLES			
	N-LEG	S-LEG	E-LEG	W-LEG
4:00 PM	0	0	0	0
4:15 PM	0	0	0	0
4:30 PM	0	0	0	1
4:45 PM	0	0	0	0
5:00 PM	0	0	0	0
5:15 PM	0	1	0	0
5:30 PM	0	0	0	0
5:45 PM	0	0	0	0
TOTAL	**0**	**1**	**0**	**1**



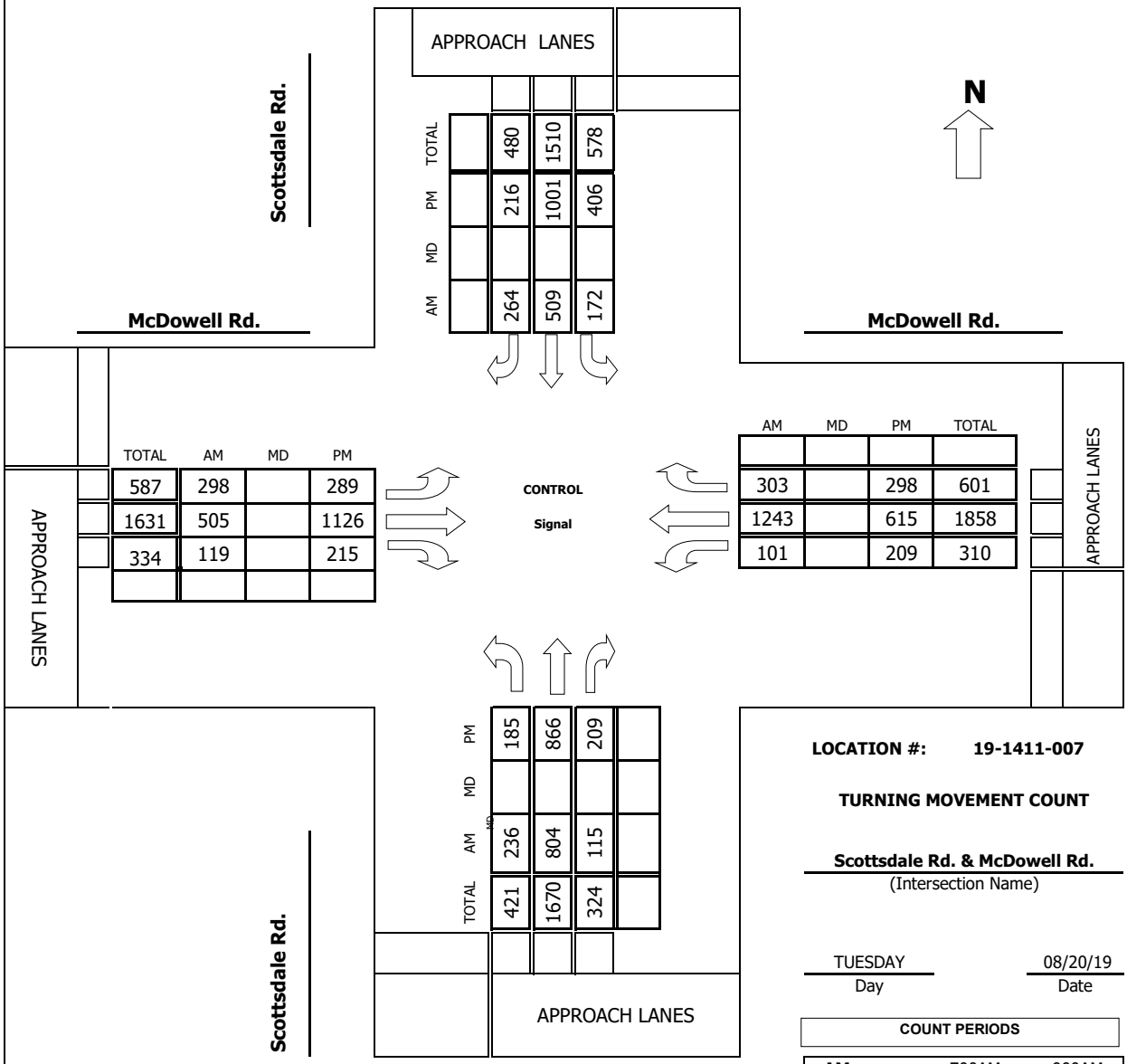
5-ZN-2020
8/7/2020

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

Project #: 19-1411-007

TMC SUMMARY OF Scottsdale Rd. & McDowell Rd.



LOCATION #: 19-1411-007

TURNING MOVEMENT COUNT

Scottsdale Rd. & McDowell Rd.
(Intersection Name)

TUESDAY (Day) 08/20/19 (Date)

COUNT PERIODS

AM	700AM	-	900AM
NOON		-	
PM	400PM	-	600PM

AM PEAK HOUR 700 AM

NOON PEAK HOUR

PM PEAK HOUR 430 PM

5-ZN-2020
8/7/2020

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	Scottsdale Rd.	DATE:	08/20/19	LOCATION:	Scottsdale
E-W STREET:	McDowell Rd.	DAY:	TUESDAY	PROJECT#	19-1411-007

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	2	3	0	2	3	1	2	3	1	2	3	1	
6:00 AM													
6:15 AM													
6:30 AM													
6:45 AM													
7:00 AM	42	135	32	40	92	60	62	100	27	22	290	61	963
7:15 AM	56	180	29	32	102	56	65	129	29	29	285	67	1059
7:30 AM	62	217	21	44	158	93	89	142	26	26	369	77	1324
7:45 AM	76	272	33	56	157	55	82	134	37	24	299	98	1323
8:00 AM	50	221	36	47	133	54	59	122	34	19	291	89	
8:15 AM	62	224	30	47	132	55	77	115	30	25	207	91	1095
8:30 AM	52	224	34	42	116	46	52	141	33	34	264	82	1120
8:45 AM	43	266	48	57	126	49	73	122	38	20	178	83	1103
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	443	1739	263	365	1016	468	559	1005	254	199	2183	648	9142
Approach %	18.12	71.12	10.76	19.74	54.95	25.31	30.75	55.28	13.97	6.57	72.05	21.39	
App/Depart	2445	/	2946	1849	/	1469	1818	/	1633	3030	/	3094	

AM Peak Hr Begins at: 700 AM

PEAK													
Volumes	236	804	115	172	509	264	298	505	119	101	1243	303	4669
Approach %	20.43	69.61	9.96	18.20	53.86	27.94	32.32	54.77	12.91	6.13	75.47	18.40	
PEAK HR. FACTOR:		0.758			0.801			0.897			0.872		0.882

CONTROL:	Signal
COMMENT 1:	
GPS:	33.465744, -111.926228

5-ZN-2020
8/7/2020

Intersection Turning Movement

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	Scottsdale Rd. 0	DATE:	08/20/19	LOCATION:	Scottsdale
E-W STREET:	McDowell Rd.	DAY:	TUESDAY	PROJECT#	19-1411-007

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	2	3	0	2	3	1	2	3	1	2	3	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	64	203	50	68	216	49	83	220	43	46	132	91	1265
4:15 PM	35	235	60	81	266	55	76	238	41	41	147	84	1359
4:30 PM	46	189	49	110	220	62	62	297	53	47	136	75	1346
4:45 PM	43	222	55	105	228	48	56	266	63	64	151	74	1375
5:00 PM	55	225	46	98	246	51	70	295	57	40	176	84	1443
5:15 PM	41	230	59	93	307	55	101	268	42	58	152	65	1471
5:30 PM	43	185	43	94	242	44	82	287	51	44	143	76	1334
5:45 PM	40	198	61	95	263	53	48	191	36	58	135	70	1248
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	367	1687	423	744	1988	417	578	2062	386	398	1172	619	10841
Approach %	14.82	68.11	17.08	23.63	63.13	13.24	19.10	68.14	12.76	18.18	53.54	28.28	
App/Depart	2477	/	2884	3149	/	2772	3026	/	3229	2189	/	1956	

PM Peak Hr Begins at: 430 PM

PEAK													
Volumes	185	866	209	406	1001	216	289	1126	215	209	615	298	5635
Approach %	14.68	68.73	16.59	25.02	61.68	13.31	17.73	69.08	13.19	18.63	54.81	26.56	
PEAK HR. FACTOR:		0.955			0.892			0.966			0.935		0.958

CONTROL:	Signal
COMMENT 1:	0
GPS:	33.465744, -111.926228

5-ZN-2020
8/7/2020

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

Pedestrian & Bicycle Study

N-S STREET: Scottsdale Rd.
E-W STREET: McDowell Rd.

Date: 08/20/19
Day: TUESDAY

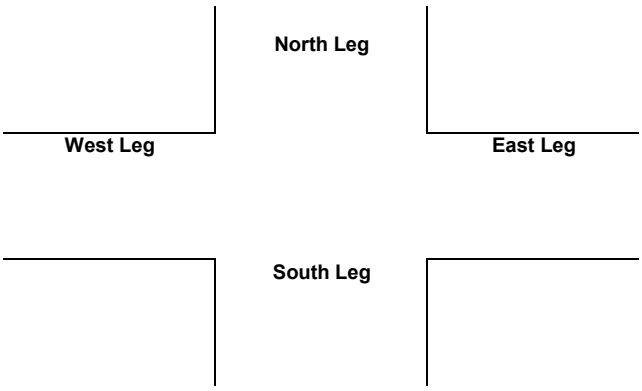
City: Scottsdale
Project #: 19-1411-007

	PEDESTRIANS			
	N-LEG	S-LEG	E-LEG	W-LEG
7:00 AM	2	2	0	0
7:15 AM	1	1	0	1
7:30 AM	1	0	1	0
7:45 AM	0	0	0	0
8:00 AM	0	0	0	0
8:15 AM	0	3	1	0
8:30 AM	1	0	0	0
8:45 AM	2	1	2	0
TOTAL	**7**	**7**	**4**	**1**

	BICYCLES			
	N-LEG	S-LEG	E-LEG	W-LEG
7:00 AM	0	1	0	2
7:15 AM	1	0	0	0
7:30 AM	1	0	0	0
7:45 AM	0	0	1	0
8:00 AM	1	0	0	0
8:15 AM	0	0	0	0
8:30 AM	0	0	0	0
8:45 AM	0	0	0	0
TOTAL	**3**	**1**	**1**	**2**

	PEDESTRIANS			
	N-LEG	S-LEG	E-LEG	W-LEG
4:00 PM	2	2	0	0
4:15 PM	3	0	4	3
4:30 PM	1	1	2	3
4:45 PM	1	2	2	1
5:00 PM	5	1	1	0
5:15 PM	0	0	4	1
5:30 PM	1	0	1	2
5:45 PM	3	1	0	1
TOTAL	**16**	**7**	**14**	**11**

	BICYCLES			
	N-LEG	S-LEG	E-LEG	W-LEG
4:00 PM	1	0	0	0
4:15 PM	1	0	0	1
4:30 PM	0	0	0	1
4:45 PM	1	0	1	0
5:00 PM	0	0	1	0
5:15 PM	0	0	0	0
5:30 PM	0	0	0	0
5:45 PM	0	0	0	0
TOTAL	**3**	**0**	**2**	**2**



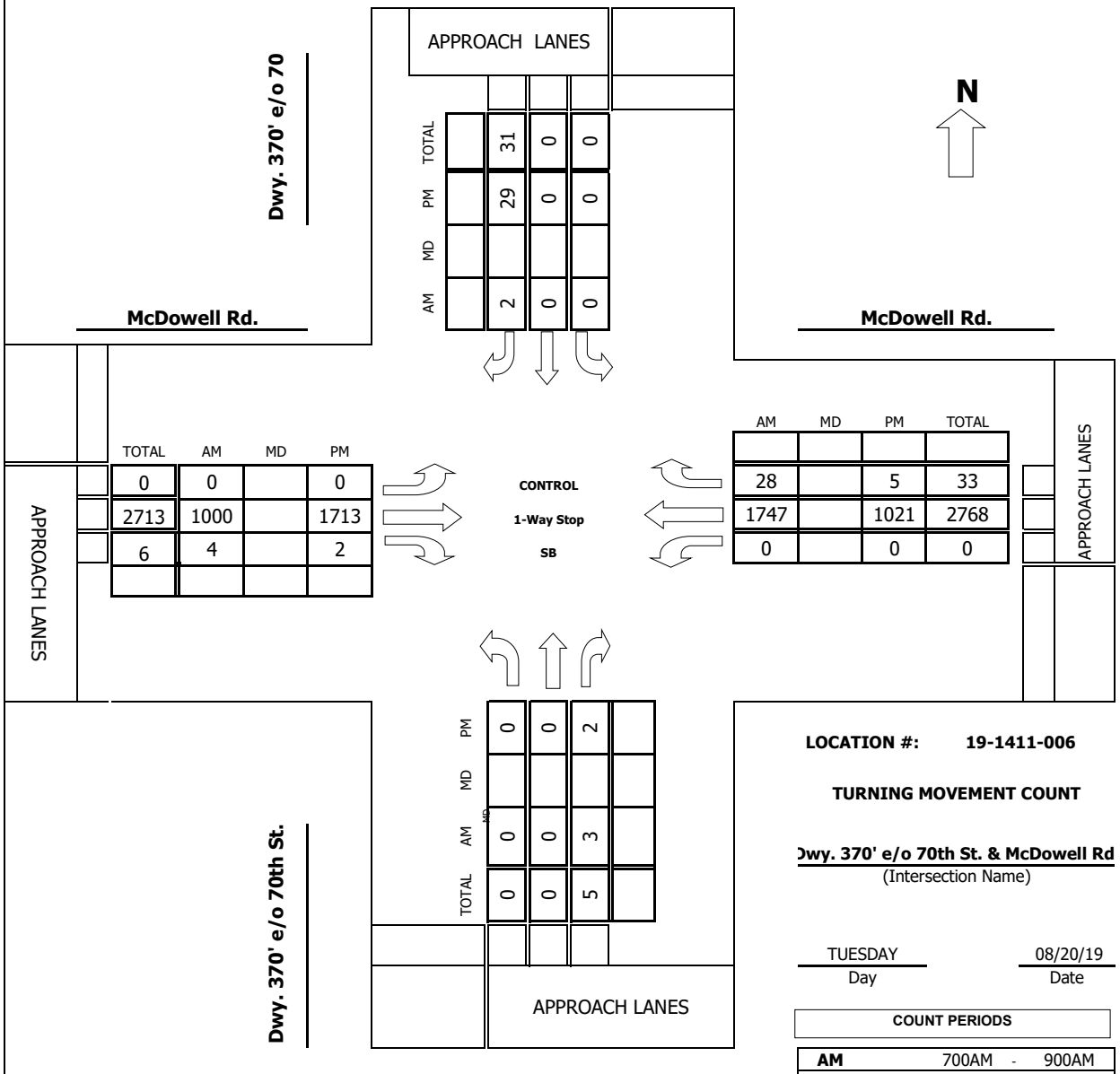
5-ZN-2020
8/7/2020

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

Project #: 19-1411-006

TMC SUMMARY OF Dwy. 370' e/o 70th St. & McDowell Rd.



LOCATION #: 19-1411-006

TURNING MOVEMENT COUNT

Dwy. 370' e/o 70th St. & McDowell Rd
(Intersection Name)

TUESDAY (Day) 08/20/19 (Date)

COUNT PERIODS			
AM	700AM	-	900AM
NOON		-	
PM	400PM	-	600PM

AM PEAK HOUR 700 AM

NOON PEAK HOUR

PM PEAK HOUR 430 PM

5-ZN-2020
8/7/2020

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	Dwy. 370' e/o 70th St.	DATE:	08/20/19	LOCATION:	Scottsdale
E-W STREET:	McDowell Rd.	DAY:	TUESDAY	PROJECT#	19-1411-006

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	0	0	0	0	1	0	3	0	0	3	0	
6:00 AM													
6:15 AM													
6:30 AM													
6:45 AM													
7:00 AM	0	0	1	0	0	1	0	215	1	0	370	5	593
7:15 AM	0	0	1	0	0	1	0	242	0	0	449	4	697
7:30 AM	0	0	1	0	0	0	0	289	2	0	470	12	774
7:45 AM	0	0	0	0	0	0	0	254	1	0	458	7	720
8:00 AM	0	0	0	0	0	0	0	233	0	0	365	3	
8:15 AM	0	0	0	0	0	0	0	232	1	0	355	1	589
8:30 AM	0	0	1	0	0	0	0	234	0	0	325	2	562
8:45 AM	0	0	0	0	0	1	0	228	0	0	292	1	522
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	0	0	4	0	0	3	0	1927	5	0	3084	35	5058
Approach %	0.00	0.00	100.00	0.00	0.00	100.00	0.00	99.74	0.26	0.00	98.88	1.12	
App/Depart	4	/	35	3	/	5	1932	/	1931	3119	/	3087	

AM Peak Hr Begins at: 700 AM

PEAK													
Volumes	0	0	3	0	0	2	0	1000	4	0	1747	28	2784
Approach %	0.00	0.00	100.00	0.00	0.00	100.00	0.00	99.60	0.40	0.00	98.42	1.58	

PEAK HR. FACTOR:	0.750	0.500	0.863	0.921	0.899

CONTROL: 1-Way Stop (SB)
COMMENT 1:
GPS: 33.465751, -111.929363

5-ZN-2020
8/7/2020

Intersection Turning Movement

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	Dwy. 370' e/o 70th St. 0	DATE:	08/20/19	LOCATION:	Scottsdale
E-W STREET:	McDowell Rd.	DAY:	TUESDAY	PROJECT#	19-1411-006

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	0	0	0	0	1	0	3	0	0	3	0	
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	0	0	0	0	0	5	0	380	1	0	240	3	629
4:15 PM	0	0	0	0	0	2	0	400	0	0	232	2	636
4:30 PM	0	0	1	0	0	4	0	401	0	0	243	5	654
4:45 PM	0	0	0	0	0	2	0	453	0	0	237	0	692
5:00 PM	0	0	0	0	0	21	0	388	0	0	284	0	693
5:15 PM	0	0	1	0	0	2	0	471	2	0	257	0	733
5:30 PM	0	0	1	0	0	0	0	384	0	0	224	0	609
5:45 PM	0	0	0	0	0	2	0	409	0	0	239	0	650
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	0	0	3	0	0	38	0	3286	3	0	1956	10	5296
Approach %	0.00	0.00	100.00	0.00	0.00	100.00	0.00	99.91	0.09	0.00	99.49	0.51	
App/Depart	3	/	10	38	/	3	3289	/	3289	1966	/	1994	

PM Peak Hr Begins at: 430 PM

PEAK													
Volumes	0	0	2	0	0	29	0	1713	2	0	1021	5	2772
Approach %	0.00	0.00	100.00	0.00	0.00	100.00	0.00	99.88	0.12	0.00	99.51	0.49	
PEAK HR. FACTOR:	0.500			0.345			0.906			0.903			0.945

CONTROL: 1-Way Stop (SB)
COMMENT 1: 0
GPS: 33.465751, -111.929363

5-ZN-2020
8/7/2020

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

Pedestrian & Bicycle Study

N-S STREET: Dwy. 370' e/o 70th St.
E-W STREET: McDowell Rd.

Date: 08/20/19
Day: TUESDAY

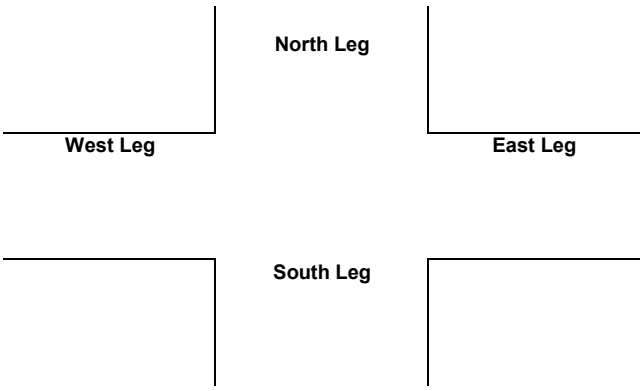
City: Scottsdale
Project #: 19-1411-006

	PEDESTRIANS			
	N-LEG	S-LEG	E-LEG	W-LEG
7:00 AM	1	0	0	0
7:15 AM	0	0	0	0
7:30 AM	0	1	1	0
7:45 AM	0	0	0	0
8:00 AM	1	0	0	0
8:15 AM	0	0	0	0
8:30 AM	1	0	0	0
8:45 AM	1	0	0	0
TOTAL	**4**	**1**	**1**	**0**

	BICYCLES			
	N-LEG	S-LEG	E-LEG	W-LEG
7:00 AM	0	0	0	0
7:15 AM	0	0	0	0
7:30 AM	0	0	0	0
7:45 AM	0	0	0	0
8:00 AM	0	0	0	0
8:15 AM	0	0	0	0
8:30 AM	0	0	0	0
8:45 AM	0	0	0	0
TOTAL	**0**	**0**	**0**	**0**

	PEDESTRIANS			
	N-LEG	S-LEG	E-LEG	W-LEG
4:00 PM	2	0	0	0
4:15 PM	0	0	0	0
4:30 PM	1	0	0	0
4:45 PM	2	0	0	0
5:00 PM	0	0	0	0
5:15 PM	1	0	0	2
5:30 PM	0	0	0	0
5:45 PM	0	1	0	1
TOTAL	**6**	**1**	**0**	**3**

	BICYCLES			
	N-LEG	S-LEG	E-LEG	W-LEG
4:00 PM	0	0	0	0
4:15 PM	1	0	0	0
4:30 PM	0	0	0	0
4:45 PM	0	0	0	0
5:00 PM	0	0	0	0
5:15 PM	0	0	0	0
5:30 PM	0	0	0	0
5:45 PM	0	0	0	0
TOTAL	**1**	**0**	**0**	**0**



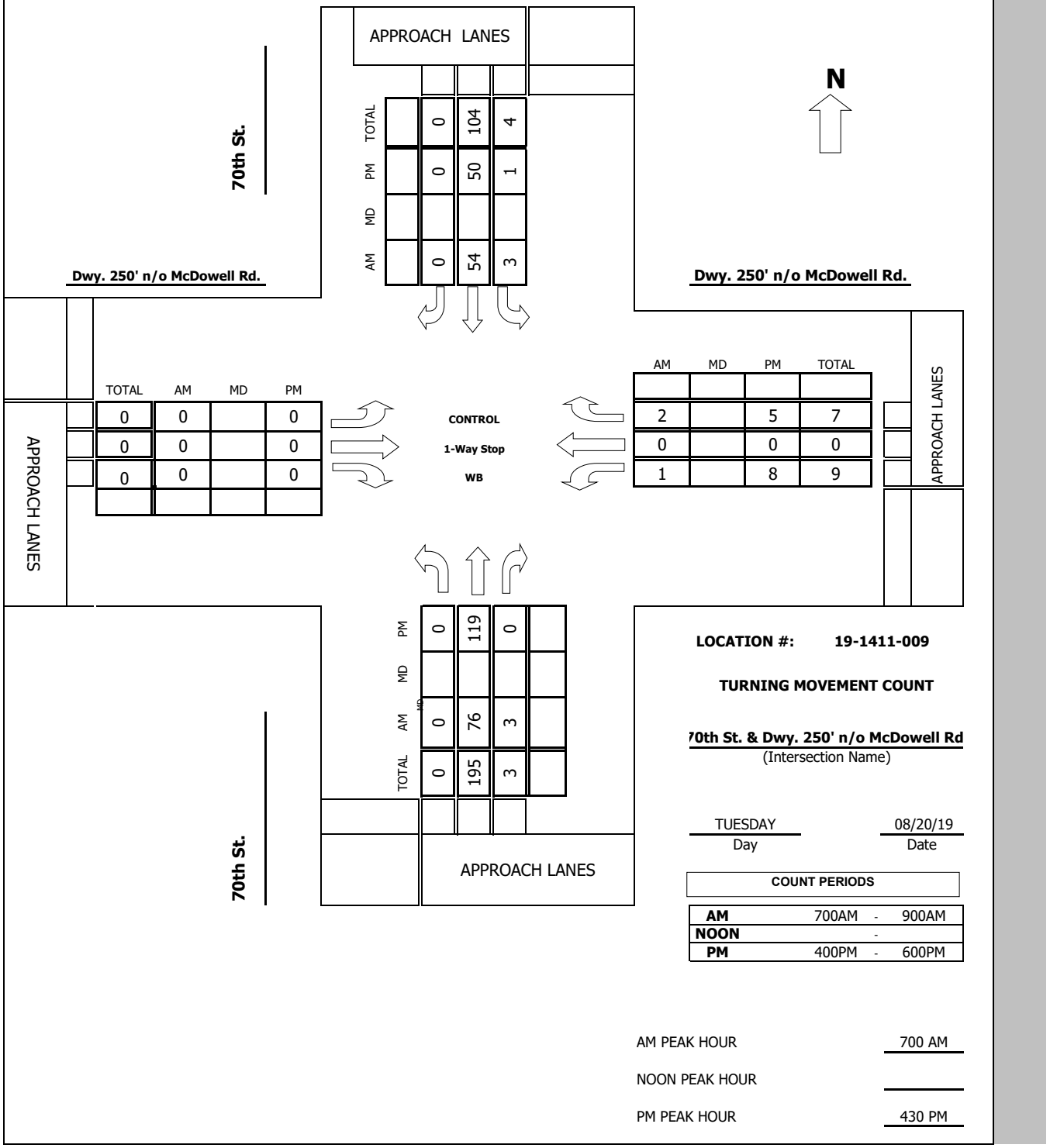
5-ZN-2020
8/7/2020

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

Project #: 19-1411-009

TMC SUMMARY OF 70th St. & Dwy. 250' n/o McDowell Rd.



LOCATION #: 19-1411-009

TURNING MOVEMENT COUNT

70th St. & Dwy. 250' n/o McDowell Rd
(Intersection Name)

TUESDAY (Day) 08/20/19 (Date)

COUNT PERIODS			
AM	700AM	-	900AM
NOON		-	
PM	400PM	-	600PM

AM PEAK HOUR 700 AM

NOON PEAK HOUR

PM PEAK HOUR 430 PM

5-ZN-2020
8/7/2020

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	70th St.	DATE:	08/20/19	LOCATION:	Scottsdale
E-W STREET:	Dwy. 250' n/o McDowell Rd.	DAY:	TUESDAY	PROJECT#	19-1411-009

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	0	0	1	0	0	0	0	0	1	0	
6:00 AM													
6:15 AM													
6:30 AM													
6:45 AM													
7:00 AM	0	18	0	1	8	0	0	0	0	0	0	2	29
7:15 AM	0	17	0	0	14	0	0	0	0	0	0	0	31
7:30 AM	0	23	1	0	16	0	0	0	0	0	0	0	40
7:45 AM	0	18	2	2	16	0	0	0	0	1	0	0	39
8:00 AM	0	6	2	0	13	0	0	0	0	0	0	1	22
8:15 AM	0	14	0	0	11	0	0	0	0	0	0	1	26
8:30 AM	0	16	0	2	12	0	0	0	0	1	0	2	33
8:45 AM	0	10	0	2	10	0	0	0	0	0	0	0	22
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	0	122	5	7	100	0	0	0	0	2	0	6	242
Approach %	0.00	96.06	3.94	6.54	93.46	0.00	####	####	####	25.00	0.00	75.00	
App/Depart	127	/	128	107	/	102	0	/	12	8	/	0	

AM Peak Hr Begins at: 700 AM

PEAK													
Volumes	0	76	3	3	54	0	0	0	0	1	0	2	139
Approach %	0.00	96.20	3.80	5.26	94.74	0.00	####	####	####	33.33	0.00	66.67	
PEAK HR. FACTOR:		0.823			0.792			0.000			0.375		0.869

CONTROL:	1-Way Stop (WB)
COMMENT 1:	
GPS:	33.466410, -111.930513

5-ZN-2020
8/7/2020

Intersection Turning Movement

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET:	70th St.		DATE:	08/20/19	LOCATION:	Scottsdale
	0					
E-W STREET:	Dwy. 250' n/o McDowell Rd.		DAY:	TUESDAY	PROJECT#	19-1411-009

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	0	0	1	0	0	0	0	0	1	0	
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	0	20	0	0	8	0	0	0	0	1	0	2	31
4:15 PM	0	34	0	1	5	0	0	0	0	2	0	0	42
4:30 PM	0	38	0	1	4	0	0	0	0	2	0	0	45
4:45 PM	0	23	0	0	15	0	0	0	0	1	0	2	41
5:00 PM	0	31	0	0	11	0	0	0	0	3	0	2	47
5:15 PM	0	27	0	0	20	0	0	0	0	2	0	1	50
5:30 PM	0	28	0	0	15	0	0	0	0	0	0	0	43
5:45 PM	0	27	0	0	13	0	0	0	0	0	0	0	40
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	0	228	0	2	91	0	0	0	0	11	0	7	339
Approach %	0.00	100.00	0.00	2.15	97.85	0.00	####	####	####	61.11	0.00	38.89	
App/Depart	228	/	235	93	/	102	0	/	2	18	/	0	

PM Peak Hr Begins at: 430 PM

PEAK													
Volumes	0	119	0	1	50	0	0	0	0	8	0	5	183
Approach %	0.00	100.00	0.00	1.96	98.04	0.00	####	####	####	61.54	0.00	38.46	

PEAK HR. FACTOR:	0.783	0.638	0.000	0.650	0.915

CONTROL: 1-Way Stop (WB)
COMMENT 1: 0
GPS: 33.466410, -111.930513

5-ZN-2020
8/7/2020

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

Pedestrian & Bicycle Study

N-S STREET: 70th St.
E-W STREET: Dwy. 250' n/o McDowell Rd.

Date: 08/20/19
Day: TUESDAY

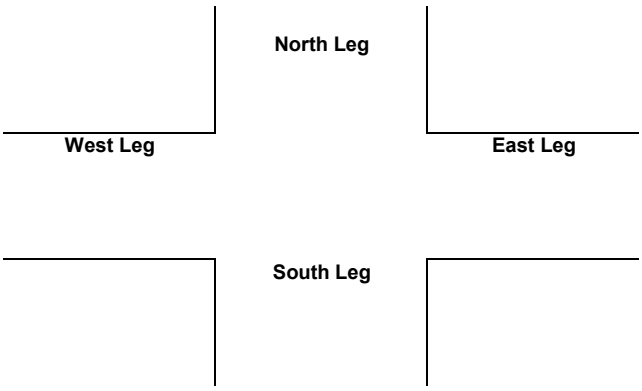
City: Scottsdale
Project #: 19-1411-009

	PEDESTRIANS			
	N-LEG	S-LEG	E-LEG	W-LEG
7:00 AM	0	0	0	0
7:15 AM	0	0	0	0
7:30 AM	0	0	0	0
7:45 AM	0	0	0	0
8:00 AM	0	0	0	0
8:15 AM	0	0	0	0
8:30 AM	0	0	1	0
8:45 AM	0	0	0	0
TOTAL	**0**	**0**	**1**	**0**

	BICYCLES			
	N-LEG	S-LEG	E-LEG	W-LEG
7:00 AM	0	0	0	0
7:15 AM	0	0	0	0
7:30 AM	0	0	0	0
7:45 AM	0	0	0	0
8:00 AM	0	0	0	0
8:15 AM	0	0	0	0
8:30 AM	0	0	0	0
8:45 AM	0	0	0	0
TOTAL	**0**	**0**	**0**	**0**

	PEDESTRIANS			
	N-LEG	S-LEG	E-LEG	W-LEG
4:00 PM	0	0	0	0
4:15 PM	0	0	0	0
4:30 PM	0	0	0	0
4:45 PM	0	0	0	0
5:00 PM	0	0	0	0
5:15 PM	0	0	0	0
5:30 PM	0	0	0	0
5:45 PM	0	0	0	0
TOTAL	**0**	**0**	**0**	**0**

	BICYCLES			
	N-LEG	S-LEG	E-LEG	W-LEG
4:00 PM	0	0	1	0
4:15 PM	0	0	0	0
4:30 PM	0	0	0	0
4:45 PM	0	0	0	0
5:00 PM	0	0	0	0
5:15 PM	0	0	0	0
5:30 PM	0	0	0	0
5:45 PM	0	0	0	0
TOTAL	**0**	**0**	**1**	**0**



5-ZN-2020
8/7/2020

Prepared by: Field Data Services of Arizona/Veracity Traffic Group (520) 316-6745

Volumes for: Tuesday, August 20, 2019 City: Scottsdale Project #: 19-1411-001

Location: McDowell Rd. east of 70th St.

AM Period	NB	SB	EB		WB			PM Period	NB	SB	EB		WB		
00:00			25		25			12:00			258		252		
00:15			15		18			12:15			264		223		
00:30			15		27			12:30			221		232		
00:45			10	65	10	80	145	12:45			222	965	254	961	1926
01:00			9		16			13:00			210		234		
01:15			8		15			13:15			221		239		
01:30			20		7			13:30			221		282		
01:45			9	46	6	44	90	13:45			226	878	278	1033	1911
02:00			15		13			14:00			239		273		
02:15			14		10			14:15			253		239		
02:30			4		15			14:30			280		249		
02:45			10	43	7	45	88	14:45			274	1046	259	1020	2066
03:00			10		10			15:00			299		230		
03:15			20		16			15:15			302		232		
03:30			11		12			15:30			311		212		
03:45			17	58	6	44	102	15:45			317	1229	240	914	2143
04:00			26		24			16:00			369		252		
04:15			26		26			16:15			428		231		
04:30			58		35			16:30			422		243		
04:45			66	176	42	127	303	16:45			467	1686	233	959	2645
05:00			65		40			17:00			401		301		
05:15			64		66			17:15			499		250		
05:30			119		78			17:30			398		223		
05:45			142	390	117	301	691	17:45			329	1627	240	1014	2641
06:00			109		148			18:00			289		232		
06:15			123		187			18:15			266		234		
06:30			131		248			18:30			231		212		
06:45			191	554	316	899	1453	18:45			219	1005	183	861	1866
07:00			219		401			19:00			188		168		
07:15			250		422			19:15			176		189		
07:30			301		469			19:30			197		148		
07:45			265	1035	433	1725	2760	19:45			147	708	162	667	1375
08:00			241		369			20:00			127		153		
08:15			239		322			20:15			124		151		
08:30			233		341			20:30			134		142		
08:45			242	955	298	1330	2285	20:45			109	494	90	536	1030
09:00			210		223			21:00			78		109		
09:15			176		202			21:15			95		117		
09:30			196		202			21:30			95		104		
09:45			216	798	193	820	1618	21:45			79	347	86	416	763
10:00			161		188			22:00			63		82		
10:15			171		171			22:15			63		64		
10:30			175		186			22:30			79		72		
10:45			212	719	169	714	1433	22:45			47	252	70	288	540
11:00			214		200			23:00			40		48		
11:15			254		175			23:15			30		38		
11:30			249		200			23:30			47		35		
11:45			226	943	209	784	1727	23:45			38	155	34	155	310
Total Vol.			5782		6913		**12695**				10392		8824		**19216**

GPS Coordinates: 33.465706, -111.929655

Daily Totals

NB	SB	EB	WB	Combined
		16174	15737	**31911**

	AM			PM		
Split %	45.5%	54.5%	**39.8%**	54.1%	45.9%	**60.2%**
Peak Hour	07:15	07:00	**07:00**	16:30	13:15	**16:30**
Volume	1057	1725	**2760**	1789	1072	**2816**
P.H.F.	0.88	0.92	**0.90**	0.90	0	

5-ZN-2020
8/7/2020

Prepared by: Field Data Services of Arizona/Veracity Traffic Group (520) 316-6745

Volumes for: Tuesday, August 20, 2019 City: Scottsdale Project #: 19-1411-002

Location: 70th St. north of McDowell Rd.

AM Period	NB		SB		EB	WB		PM Period	NB		SB		EB	WB	
00:00	3		1					12:00	23		7				
00:15	1		0					12:15	14		11				
00:30	0		2					12:30	9		17				
00:45	2	6	1	4			10	12:45	16	62	19	54			116
01:00	3		1					13:00	16		14				
01:15	2		2					13:15	20		23				
01:30	0		1					13:30	18		16				
01:45	0	5	1	5			10	13:45	19	73	10	63			136
02:00	2		0					14:00	19		10				
02:15	1		2					14:15	21		4				
02:30	0		1					14:30	19		20				
02:45	2	5	1	4			9	14:45	27	86	17	51			137
03:00	1		1					15:00	20		11				
03:15	0		0					15:15	23		8				
03:30	0		1					15:30	28		8				
03:45	2	3	1	3			6	15:45	20	91	12	39			130
04:00	0		1					16:00	24		9				
04:15	3		1					16:15	33		7				
04:30	6		4					16:30	39		6				
04:45	4	13	5	11			24	16:45	26	122	16	38			160
05:00	5		5					17:00	32		12				
05:15	4		4					17:15	29		19				
05:30	9		7					17:30	28		16				
05:45	7	25	3	19			44	17:45	26	115	12	59			174
06:00	7		2					18:00	17		6				
06:15	8		6					18:15	13		14				
06:30	8		10					18:30	19		10				
06:45	8	31	8	26			57	18:45	21	70	7	37			107
07:00	19		10					19:00	16		8				
07:15	18		16					19:15	12		10				
07:30	22		16					19:30	16		11				
07:45	19	78	17	59			137	19:45	13	57	10	39			96
08:00	9		14					20:00	10		1				
08:15	14		10					20:15	9		4				
08:30	17		15					20:30	6		5				
08:45	11	51	13	52			103	20:45	9	34	4	14			48
09:00	18		7					21:00	2		5				
09:15	12		9					21:15	11		5				
09:30	20		10					21:30	8		2				
09:45	7	57	4	30			87	21:45	6	27	3	15			42
10:00	9		6					22:00	10		4				
10:15	19		7					22:15	3		3				
10:30	5		11					22:30	5		2				
10:45	16	49	8	32			81	22:45	7	25	1	10			35
11:00	18		6					23:00	6		0				
11:15	8		6					23:15	4		7				
11:30	17		6					23:30	5		3				
11:45	14	57	11	29			86	23:45	3	18	5	15			33
Total Vol.		380		274			**654**			780		434			**1214**

GPS Coordinates: 33.466590, -111.930528

Daily Totals

NB	SB	EB	WB	**Combined**
1160	708			**1868**

	AM			**PM**		
Split %	58.1%	41.9%	**35.0%**	64.3%	35.7%	**65.0%**
Peak Hour	07:00	07:15	**07:00**	16:15	12:30	**16:30**
Volume	78	63	**137**	130	73	**179**
P.H.F.	0.89	0.93	**0.90**	0.83	0.79	

5-ZN-2020
8/7/2020

Appendix E – Signal Timing

E

MCDOWELL & 68TH

System # 9

BASIC TIMING PLAN

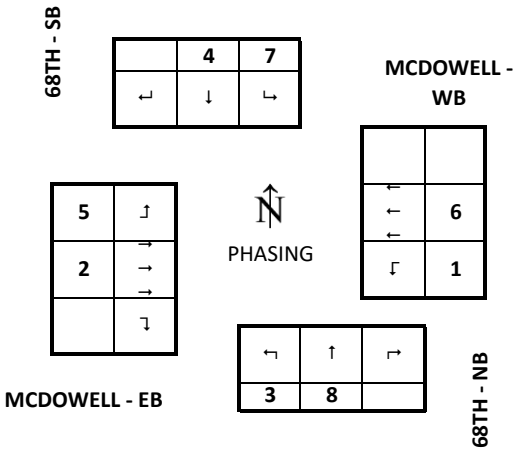
Section #	I.P. Address MM1-5-1	Date Designed
	172.17.10.9	5/23/2017

TIMING PLAN - MM-2-1

Phase	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
NOTES	PROT		p&P		PROT		p&P	
MIN GRN	5	10	5	7	5	10	5	7
BK MGRN				15				15
CS MGRN								
DLY GRN								
WALK		7		10		7		7
WALK2								
WLK MAX								
PED CLR/FDW		15		28		15		24
PD CLR2								
PC MAX								
PED CO								
VEH EXT	1	1	1	1	1	1	1	1
VH EXT2								
MAX 1	15	65	20	55	15	65	20	55
MAX 2	30	75	35	65	30	75	35	65
MAX 3								
DYM MAX								
DYM STP								
YELLOW	3.6	4.7	3.3	4	4	4.7	3.3	4
RED CLR	2	1.0	2	1.7	1.8	1.0	2	1.7
RED MAX								
RED RVT	2	2	2	2	2	2	2	2
ACT B4								
SEC/ACT								
MAX INT								
TIME B4								
CARS WT								
STPTDUC								
TTREDUC								
MIN GAP								

RECALLS - MM-2-8

LOCK DET								
VEH RECALL		X				X		
PED RECALL								
MAX RECALL								
SOFT RECALL								
NO REST								
ADD INIT CAL								



PHASING SEQUENCES					
TOD: MORNING					
R1	2	1	4	3	
R2	6	5	8	7	
		B	B	B	
Use Timing plan: 1					
TOD: MIDDAY					
R1	2	1	4	3	
R2	6	5	8	7	
		B	B	B	
Use Timing plan: 4					
TOD: EVENING					
R1	2	1	4	3	
R2	6	5	8	7	
		B	B	B	
Use Timing plan: 7					
TOD: WEEKEND					
R1	2	1	4	3	
R2	6	5	8	7	
		B	B	B	
Use Timing plan: 10					
FREE					
R1	2	1	4	3	
R2	6	5	8	7	
		B	B	B	
Use Timing plan: 254					

NOTES

EXPIRES XX/XX/XXXX

5-ZN-2020
8/7/2020

MCDOWELL & 68TH

System #	9

COORDINATOR	Section #	Date Updated
	0	5/23/2017

	PHASE	1	2	3	4	5	6	7	8	
	FDW		15		28		15		24	
	YELLOW	3.6	4.7	3.3	4	4	4.7	3.3	4	
	ALL RED	2	1	2	1.7	1.8	1	2	1.7	
	WALK		15		28		15		24	

										COORD PATTERN	OFFSET
PLAN 1 AM PLAN OPERATIVE TIMES 6:30 AM	R1	2	→	1	↓	4	↓	3	←		
	R2	6	←	5	↑	8	↑	7	→	Balanced	86
		RING 1				RING 2					
	PHASE	1	2	3	4	5	6	7	8		
	SPLIT	12	49	15	44	14	47	15	44	Target Cycle Length	
	COORD		X				X			120	
	RECALLS		V				V			Actual Cycle Length	
	GREEN	6.4	43.3	9.7	38.3	8.2	41.3	9.7	38.3	120	

										COORD PATTERN	OFFSET
PLAN 4 MIDDAY PLAN OPERATIVE TIMES 9:00 AM	R1	2	→	1	↓	4	↓	3	←		
	R2	6	←	5	↑	8	↑	7	→	Balanced	86
		RING 1				RING 2					
	PHASE	1	2	3	4	5	6	7	8		
	SPLIT	16	48	12	44	17	47	12	44	Target Cycle Length	
	COORD		X				X			120	
	RECALLS		V				V			Actual Cycle Length	
	GREEN	10.4	42.3	6.7	38.3	11.2	41.3	6.7	38.3	120	

										COORD PATTERN	OFFSET
PLAN 7 PM PLAN OPERATIVE TIMES 3:00 PM	R1	2	→	1	↓	4	↓	3	←		
	R2	6	←	5	↑	8	↑	7	→	Balanced	110
		RING 1				RING 2					
	PHASE	1	2	3	4	5	6	7	8		
	SPLIT	15	53	12	40	24	44	12	40	Target Cycle Length	
	COORD		X				X			120	
	RECALLS		V				V			Actual Cycle Length	
	GREEN	9.4	47.3	6.7	34.3	18.2	38.3	6.7	34.3	120	

										COORD PATTERN	OFFSET
PLAN 10 MIDNIGHT PLAN OPERATIVE TIMES 10:00 PM	R1	2	→	1	↓	4	↓	3	←		
	R2	6	←	5	↑	8	↑	7	→	Balanced	32
		RING 1				RING 2					
	PHASE	1	2	3	4	5	6	7	8		
	SPLIT	11	44	11	24	13	42	11	24	Target Cycle Length	
	COORD		X				X			90	
	RECALLS		V				V			Actual Cycle Length	
	GREEN	5.4	38.3	5.7	18.3	7.2	36.3	5.7	18.3	90	

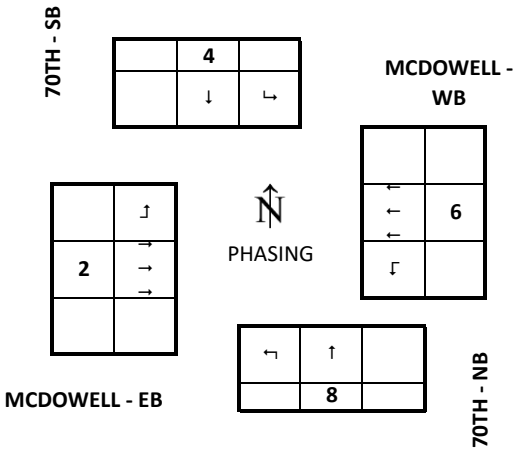
MCDOWELL & 70TH

System # 10

BASIC TIMING PLAN

Section #	I.P. Address	Date Designed
	MM1-5-1	
	172.17.10.10	5/23/2017

	Phase		2		4		6		8
	Movement		EBT		SBT		WBT		NBT
	NOTES								
TIMING PLAN - MM-2-1	MIN GRN		10		7		10		7
	BK MGRN								
	CS MGRN								
	DLY GRN								
	WALK		7		7		7		7
	WALK2								
	WLK MAX								
	PED CLR/FDW		8		23		8		23
	PD CLR2								
	PC MAX								
	PED CO								
	VEH EXT		1		2		1		2
	VH EXT2								
	MAX 1		70		40		70		40
	MAX 2		90		50		90		50
	MAX 3								
	DYM MAX								
	DYM STP								
	YELLOW		4.4		3.3		4.4		3.3
	RED CLR		1.2		1.9		1.2		1.9
	RED MAX								
	RED RVT		2		2		2		2
	ACT B4								
	SEC/ACT								
	MAX INT								
	TIME B4								
	CARS WT								
	STPTDUC								
	TTREDUC								
	MIN GAP								
RECALLS - MM-2-8	LOCK DET								
	VEH RECALL		X				X		
	PED RECALL								
	MAX RECALL								
	SOFT RECALL								
	NO REST								
	ADD INIT CAL								



PHASING SEQUENCES				
TOD: MORNING				
R1	2		4	
R2	6		8	
		B		B
Use Timing plan:				
TOD: MIDDAY				
R1	2		4	
R2	6		8	
		B		B
Use Timing plan:				
TOD: EVENING				
R1	2		4	
R2	6		8	
		B		B
Use Timing plan:				
TOD: WEEKEND				
R1	2		4	
R2	6		8	
		B		B
Use Timing plan:				
FREE				
R1	2		4	
R2	6		8	
		B		B
Use Timing plan: 254				

NOTES

EXPIRES XX/XX/XXXX

5-ZN-2020
8/7/2020

MCDOWELL & 70TH

System #	10

COORDINATOR	Section #	Date Updated
	0	5/23/2017

PHASE	1	2	3	4	5	6	7	8
FDW		8		23		8		23
YELLOW		4.4		3.3		4.4		3.3
ALL RED		1.2		1.9		1.2		1.9
WALK		8		23		8		23

PLAN 1 AM PLAN OPERATIVE TIMES

									COORD PATTERN	OFFSET
R1	2	→			4	↓				
R2	6	←			8	↑			Balanced	62
	RING 1				RING 2					
PHASE		2		4		6		8		
SPLIT		84		36		84		36	Target Cycle Length	
COORD		X				X			120	
RECALLS		V				V			Actual Cycle Length	
GREEN		78.4		30.8		78.4		30.8	120	

PLAN 4 MIDDAY PLAN OPERATIVE TIMES

									COORD PATTERN	OFFSET
R1	2	→			4	↓				
R2	6	←			8	↑			Balanced	98
	RING 1				RING 2					
PHASE		2		4		6		8		
SPLIT		90		30		90		30	Target Cycle Length	
COORD		X				X			120	
RECALLS		V				V			Actual Cycle Length	
GREEN		84.4		24.8		84.4		24.8	120	

PLAN 7 PM PLAN OPERATIVE TIMES

									COORD PATTERN	OFFSET
R1	2	→			4	↓				
R2	6	←			8	↑			Balanced	106
	RING 1				RING 2					
PHASE		2		4		6		8		
SPLIT		84		36		84		36	Target Cycle Length	
COORD		X				X			120	
RECALLS		V				V			Actual Cycle Length	
GREEN		78.4		30.8		78.4		30.8	120	

PLAN 10 MIDNIGHT PLAN OPERATIVE TIMES

									COORD PATTERN	OFFSET
R1	2	→			4	↓				
R2	6	←			8	↑			Balanced	28
	RING 1				RING 2					
PHASE		2		4		6		8		
SPLIT		60		30		60		30	Target Cycle Length	
COORD		X				X			90	
RECALLS		V				V			Actual Cycle Length	
GREEN		54.4		24.8		54.4		24.8	90	

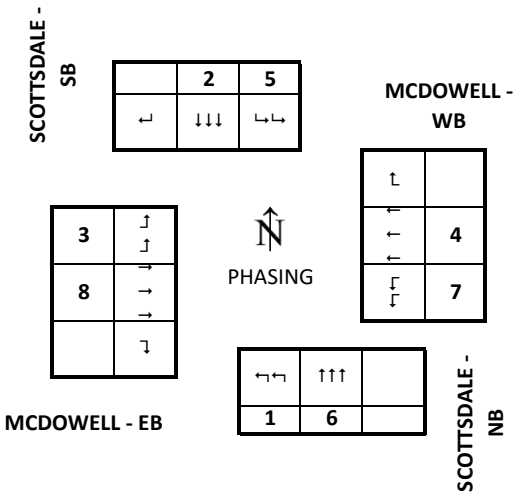
SCOTTSDALE & MCDOWELL

System # 11

BASIC TIMING PLAN

Section #	I.P. Address	Date Designed
	MM1-5-1	
	172.17.10.11	1/5/2017

	Phase	1	2	3	4	5	6	7	8
	Movement	NBL	SBT	EBL	WBT	SBL	NBT	WBL	EBT
	NOTES	PROT		PROT		PROT		PROT	
TIMING PLAN - MM-2-1	MIN GRN	5	10	5	10	5	10	5	10
	BK MGRN								
	CS MGRN								
	DLY GRN								
	WALK		4		4		4		4
	WALK2								
	WLK MAX								
	PED CLR/FDW		27		28		27		25
	PD CLR2								
	PC MAX								
	PED CO								
	VEH EXT	2	2	2	2	2	2	2	2
	VH EXT2								
	MAX 1	15	45	20	45	15	45	20	45
	MAX 2	30	60	30	60	30	60	30	60
	MAX 3								
	DYM MAX								
	DYM STP								
	YELLOW	3.6	4.4	3.6	4.4	3.6	4.4	3.6	4.4
	RED CLR	2	1.5	2	1.5	2	1.5	2	1.5
	RED MAX								
	RED RVT	2	2	2	2	2	2	2	2
	ACT B4								
	SEC/ACT								
	MAX INT								
	TIME B4								
	CARS WT								
	STPTDUC								
	TTREDUC								
	MIN GAP								
RECALLS - MM-2-8	LOCK DET								
	VEH RECALL		X				X		
	PED RECALL								
	MAX RECALL								
	SOFT RECALL								
	NO REST								
	ADD INIT CAL								



PHASING SEQUENCES				
TOD: MORNING				
R1	2	1	3	4
R2	6	5	8	7
		B		B
Use Timing plan: 1				
TOD: MIDDAY				
R1	2	1	3	4
R2	6	5	8	7
		B		B
Use Timing plan: 4				
TOD: EVENING				
R1	2	1	3	4
R2	6	5	8	7
		B		B
Use Timing plan: 7				
TOD: NIGHT				
R1	2	1	4	3
R2	6	5	8	7
		B		B
Use Timing plan: 10				
FREE				
R1	2	1	4	3
R2	6	5	8	7
		B		B
Use Timing plan: 254				

NOTES

EXPIRES XX/XX/XXXX

5-ZN-2020
8/7/2020

SCOTTSDALE & MCDOWELL

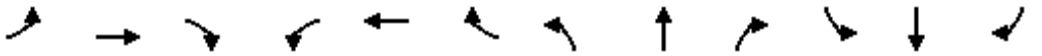
System #	11

COORDINATOR	Section #	Date Updated
	0	1/5/2017

	PHASE	1	2	3	4	5	6	7	8	
	FDW		27		28		27		25	
	YELLOW	3.6	4.4	3.6	4.4	3.6	4.4	3.6	4.4	
	ALL RED	2	1.5	2	1.5	2	1.5	2	1.5	
	WALK		27		28		27		25	
PLAN 1 AM PLAN OPERATIVE TIMES	R1	2	↓	1	↰	3	↥	4	←	COORD PATTERN / OFFSET
	R2	6	↑	5	↳	8	→	7	↧	Balanced / 80
		RING 1				RING 2				
	PHASE	1	2	3	4	5	6	7	8	
	SPLIT	21	38	19	42	15	44	15	46	Target Cycle Length
	COORD		X				X			120
	RECALLS		V				V			Actual Cycle Length
	GREEN	15.4	32.1	13.4	36.1	9.4	38.1	9.4	40.1	120
PLAN 4 MIDDAY PLAN OPERATIVE TIMES	R1	2	↓	1	↰	3	↥	4	←	COORD PATTERN / OFFSET
	R2	6	↑	5	↳	8	→	7	↧	Balanced / 64
		RING 1				RING 2				
	PHASE	1	2	3	4	5	6	7	8	
	SPLIT	13	48	17	42	17	44	20	39	Target Cycle Length
	COORD		X				X			120
	RECALLS		V				V			Actual Cycle Length
	GREEN	7.4	42.1	11.4	36.1	11.4	38.1	14.4	33.1	120
PLAN 7 PM PLAN OPERATIVE TIMES	R1	2	↓	1	↰	3	↥	4	←	COORD PATTERN / OFFSET
	R2	6	↑	5	↳	8	→	7	↧	Balanced / 100
		RING 1				RING 2				
	PHASE	1	2	3	4	5	6	7	8	
	SPLIT	16	47	26	31	21	42	17	40	Target Cycle Length
	COORD		X				X			120
	RECALLS		V				V			Actual Cycle Length
	GREEN	10.4	41.1	20.4	25.1	15.4	36.1	11.4	34.1	120
PLAN 10 MIDNIGHT PLAN OPERATIVE TIMES	R1	2	↓	1	↰	4	←	3	↥	COORD PATTERN / OFFSET
	R2	6	↑	5	↳	8	→	7	↧	Balanced / 44
		RING 1				RING 2				
	PHASE	1	2	3	4	5	6	7	8	
	SPLIT	15	36	14	25	17	34	14	25	Target Cycle Length
	COORD		X				X			90
	RECALLS		V				V			Actual Cycle Length
	GREEN	9.4	30.1	8.4	19.1	11.4	28.1	8.4	19.1	90

Appendix F – Existing Capacity Analysis

F



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	99	898	129	69	1668	93	256	282	84	86	234	208
Future Volume (veh/h)	99	898	129	69	1668	93	256	282	84	86	234	208
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	108	976	140	75	1813	101	278	307	91	93	254	226
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	122	2653	823	94	2487	138	230	345	292	186	301	255
Arrive On Green	0.07	0.52	0.52	0.11	1.00	1.00	0.08	0.18	0.18	0.06	0.16	0.16
Sat Flow, veh/h	1781	5106	1585	1781	4950	275	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	108	976	140	75	1246	668	278	307	91	93	254	226
Grp Sat Flow(s),veh/h/ln	1781	1702	1585	1781	1702	1821	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	7.2	13.6	5.6	4.9	0.0	0.0	9.7	19.2	6.0	5.2	15.8	16.7
Cycle Q Clear(g_c), s	7.2	13.6	5.6	4.9	0.0	0.0	9.7	19.2	6.0	5.2	15.8	16.7
Prop In Lane	1.00		1.00	1.00		0.15	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	122	2653	823	94	1711	915	230	345	292	186	301	255
V/C Ratio(X)	0.89	0.37	0.17	0.79	0.73	0.73	1.21	0.89	0.31	0.50	0.84	0.89
Avail Cap(c_a), veh/h	122	2653	823	95	1711	915	230	597	506	228	597	506
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.89	0.89	0.89	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.4	17.1	15.2	53.0	0.0	0.0	44.7	47.7	42.3	40.0	48.9	49.3
Incr Delay (d2), s/veh	47.6	0.4	0.4	30.2	2.5	4.6	126.4	4.1	0.2	0.8	2.5	4.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.8	5.2	2.1	2.9	0.6	1.2	10.3	9.2	2.3	2.3	7.5	6.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	103.0	17.5	15.6	83.2	2.5	4.6	171.1	51.9	42.6	40.7	51.4	53.4
LnGrp LOS	F	B	B	F	A	A	F	D	D	D	D	D
Approach Vol, veh/h		1224			1989			676			573	
Approach Delay, s/veh		24.9			6.2			99.6			50.4	
Approach LOS		C			A			F			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.0	68.0	15.0	25.0	14.0	66.0	12.2	27.8
Change Period (Y+Rc), s	5.6	5.7	* 5.3	* 5.7	* 5.8	5.7	* 5.3	* 5.7
Max Green Setting (Gmax), s	6.4	43.3	* 9.7	* 38	* 8.2	41.3	* 9.7	* 38
Max Q Clear Time (g_c+I1), s	6.9	15.6	11.7	18.7	9.2	2.0	7.2	21.2
Green Ext Time (p_c), s	0.0	2.6	0.0	0.6	0.0	5.5	0.0	0.6

Intersection Summary	
HCM 6th Ctrl Delay	31.2
HCM 6th LOS	C

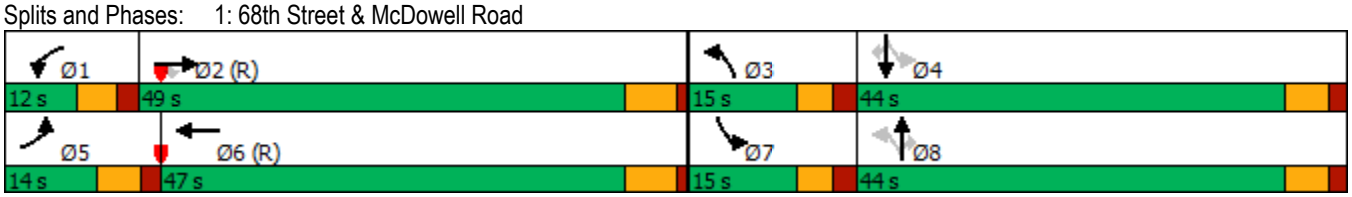
Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	99	898	129	69	1668	256	282	84	86	234	208
Future Volume (vph)	99	898	129	69	1668	256	282	84	86	234	208
Turn Type	Prot	NA	Perm	Prot	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6	3	8		7	4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	3	8	8	7	4	4
Switch Phase											
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	5.0	7.0	7.0	5.0	7.0	7.0
Minimum Split (s)	10.8	27.7	27.7	10.6	27.7	10.3	36.7	36.7	10.3	43.7	43.7
Total Split (s)	14.0	49.0	49.0	12.0	47.0	15.0	44.0	44.0	15.0	44.0	44.0
Total Split (%)	11.7%	40.8%	40.8%	10.0%	39.2%	12.5%	36.7%	36.7%	12.5%	36.7%	36.7%
Yellow Time (s)	4.0	4.7	4.7	3.6	4.7	3.3	4.0	4.0	3.3	4.0	4.0
All-Red Time (s)	1.8	1.0	1.0	2.0	1.0	2.0	1.7	1.7	2.0	1.7	1.7
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.8	5.7	5.7	5.6	5.7	5.3	5.7	5.7	5.3	5.7	5.7
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Min	C-Min	None	C-Min	None	None	None	None	None	None
Act Effct Green (s)	12.0	56.6	56.6	9.3	53.7	34.1	24.0	24.0	30.3	22.1	22.1
Actuated g/C Ratio	0.10	0.47	0.47	0.08	0.45	0.28	0.20	0.20	0.25	0.18	0.18
v/c Ratio	0.61	0.41	0.17	0.55	0.85	1.09	0.83	0.22	0.45	0.74	0.55
Control Delay	66.0	22.9	6.0	85.0	25.5	119.3	64.0	3.7	35.3	58.6	20.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.0	22.9	6.0	85.0	25.5	119.3	64.0	3.7	35.3	58.6	20.2
LOS	E	C	A	F	C	F	E	A	D	E	C
Approach Delay		24.8			27.7		78.6			39.7	
Approach LOS		C			C		E			D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 86 (72%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 125	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.09	
Intersection Signal Delay: 36.2	Intersection LOS: D
Intersection Capacity Utilization 85.0%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 1: 68th Street & McDowell Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	44	977	29	55	1754	19	29	20	80	17	15	37
Future Volume (veh/h)	44	977	29	55	1754	19	29	20	80	17	15	37
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	49	1086	32	61	1949	21	32	22	89	19	17	41
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	240	4138	122	469	4228	46	148	32	129	102	48	115
Arrive On Green	1.00	1.00	1.00	1.00	1.00	1.00	0.10	0.10	0.10	0.10	0.10	0.10
Sat Flow, veh/h	222	5097	150	504	5208	56	1345	324	1311	1282	486	1173
Grp Volume(v), veh/h	49	725	393	61	1274	696	32	0	111	19	0	58
Grp Sat Flow(s),veh/h/ln	222	1702	1843	504	1702	1860	1345	0	1634	1282	0	1659
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	7.9	1.7	0.0	3.9
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	0.0	0.0	6.7	0.0	7.9	9.6	0.0	3.9
Prop In Lane	1.00		0.08	1.00		0.03	1.00		0.80	1.00		0.71
Lane Grp Cap(c), veh/h	240	2763	1496	469	2763	1510	148	0	161	102	0	163
V/C Ratio(X)	0.20	0.26	0.26	0.13	0.46	0.46	0.22	0.00	0.69	0.19	0.00	0.36
Avail Cap(c_a), veh/h	240	2763	1496	469	2763	1510	361	0	420	305	0	426
HCM Platoon Ratio	2.00	2.00	2.00	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.92	0.92	0.92	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	53.7	0.0	52.3	57.0	0.0	50.6
Incr Delay (d2), s/veh	1.8	0.2	0.4	0.6	0.6	1.0	0.3	0.0	2.0	0.3	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.1	0.2	0.1	0.2	0.4	0.9	0.0	3.3	0.6	0.0	1.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	1.8	0.2	0.4	0.6	0.6	1.0	53.9	0.0	54.3	57.3	0.0	51.0
LnGrp LOS	A	A	A	A	A	A	D	A	D	E	A	D
Approach Vol, veh/h		1167			2031			143			77	
Approach Delay, s/veh		0.3			0.7			54.2			52.6	
Approach LOS		A			A			D			D	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		103.0		17.0		103.0		17.0				
Change Period (Y+Rc), s		* 5.6		* 5.2		* 5.6		* 5.2				
Max Green Setting (Gmax), s		* 78		* 31		* 78		* 31				
Max Q Clear Time (g_c+I1), s		2.0		11.6		2.0		9.9				
Green Ext Time (p_c), s		3.8		0.2		6.4		0.4				

Intersection Summary		
HCM 6th Ctrl Delay		4.0
HCM 6th LOS		A

Notes

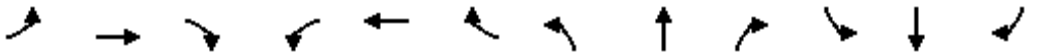
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	44	977	55	1754	29	20	17	15
Future Volume (vph)	44	977	55	1754	29	20	17	15
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	2	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	23.6	23.6	23.6	23.6	35.2	35.2	35.2	35.2
Total Split (s)	84.0	84.0	84.0	84.0	36.0	36.0	36.0	36.0
Total Split (%)	70.0%	70.0%	70.0%	70.0%	30.0%	30.0%	30.0%	30.0%
Yellow Time (s)	4.4	4.4	4.4	4.4	3.3	3.3	3.3	3.3
All-Red Time (s)	1.2	1.2	1.2	1.2	1.9	1.9	1.9	1.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.6	5.6	5.6	5.6	5.2	5.2	5.2	5.2
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	C-Min	C-Min	C-Min	C-Min	None	None	None	None
Act Effct Green (s)	101.4	101.4	101.4	101.4	7.8	7.8	7.8	7.8
Actuated g/C Ratio	0.84	0.84	0.84	0.84	0.06	0.06	0.06	0.06
v/c Ratio	0.34	0.26	0.16	0.46	0.37	0.59	0.31	0.46
Control Delay	23.0	6.1	1.4	2.3	64.7	28.8	65.1	49.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.0	6.1	1.4	2.3	64.7	28.8	65.1	49.9
LOS	C	A	A	A	E	C	E	D
Approach Delay		6.8		2.3		36.8		53.7
Approach LOS		A		A		D		D

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 62 (52%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 70	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.59	
Intersection Signal Delay: 6.4	Intersection LOS: A
Intersection Capacity Utilization 60.4%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 2: 70th Street & McDowell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	313	531	125	107	1306	319	248	845	121	181	535	278
Future Volume (veh/h)	313	531	125	107	1306	319	248	845	121	181	535	278
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	356	603	142	122	1484	362	282	960	138	206	608	316
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	386	1846	573	176	1536	477	340	1446	207	260	1519	471
Arrive On Green	0.04	0.12	0.12	0.05	0.30	0.30	0.10	0.32	0.32	0.08	0.30	0.30
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	3456	4511	647	3456	5106	1585
Grp Volume(v), veh/h	356	603	142	122	1484	362	282	724	374	206	608	316
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1728	1702	1754	1728	1702	1585
Q Serve(g_s), s	12.3	13.0	9.8	4.2	34.4	24.8	9.6	22.0	22.1	7.0	11.4	21.0
Cycle Q Clear(g_c), s	12.3	13.0	9.8	4.2	34.4	24.8	9.6	22.0	22.1	7.0	11.4	21.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.37	1.00		1.00
Lane Grp Cap(c), veh/h	386	1846	573	176	1536	477	340	1091	562	260	1519	471
V/C Ratio(X)	0.92	0.33	0.25	0.69	0.97	0.76	0.83	0.66	0.67	0.79	0.40	0.67
Avail Cap(c_a), veh/h	386	1846	573	271	1536	477	443	1091	562	271	1519	471
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	57.3	39.5	38.0	56.0	41.3	38.0	53.1	35.2	35.2	54.6	33.6	37.0
Incr Delay (d2), s/veh	26.9	0.0	0.1	1.8	15.5	6.3	7.7	3.2	6.1	12.9	0.8	7.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.1	5.9	4.0	1.8	16.1	10.2	4.5	9.3	10.1	3.5	4.7	8.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	84.2	39.5	38.1	57.9	56.9	44.3	60.8	38.4	41.3	67.5	34.4	44.4
LnGrp LOS	F	D	D	E	E	D	E	D	D	E	C	D
Approach Vol, veh/h		1101			1968			1380			1130	
Approach Delay, s/veh		53.8			54.6			43.8			43.2	
Approach LOS		D			D			D			D	

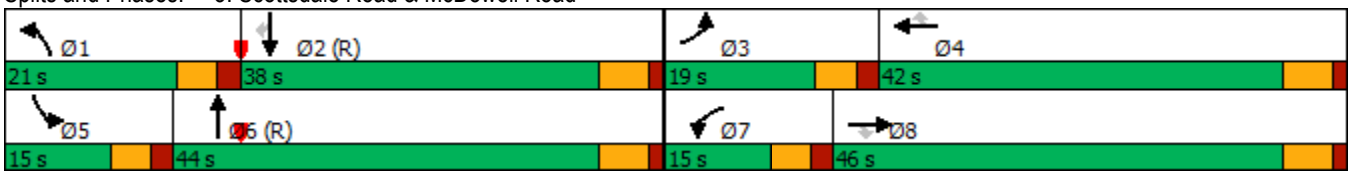
Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	17.4	41.6	19.0	42.0	14.6	44.4	11.7	49.3
Change Period (Y+Rc), s	5.6	5.9	5.6	5.9	5.6	5.9	5.6	5.9
Max Green Setting (Gmax), s	15.4	32.1	13.4	36.1	9.4	38.1	9.4	40.1
Max Q Clear Time (g_c+I1), s	11.6	23.0	14.3	36.4	9.0	24.1	6.2	15.0
Green Ext Time (p_c), s	0.2	2.3	0.0	0.0	0.0	4.1	0.1	2.8

Intersection Summary	
HCM 6th Ctrl Delay	49.5
HCM 6th LOS	D

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	313	531	125	107	1306	319	248	845	181	535	278
Future Volume (vph)	313	531	125	107	1306	319	248	845	181	535	278
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	NA	Perm
Protected Phases	3	8		7	4		1	6	5	2	
Permitted Phases			8			4					2
Detector Phase	3	8	8	7	4	4	1	6	5	2	2
Switch Phase											
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	5.0	10.0	10.0
Minimum Split (s)	10.6	34.9	34.9	10.6	37.9	37.9	10.6	36.9	10.6	36.9	36.9
Total Split (s)	19.0	46.0	46.0	15.0	42.0	42.0	21.0	44.0	15.0	38.0	38.0
Total Split (%)	15.8%	38.3%	38.3%	12.5%	35.0%	35.0%	17.5%	36.7%	12.5%	31.7%	31.7%
Yellow Time (s)	3.6	4.4	4.4	3.6	4.4	4.4	3.6	4.4	3.6	4.4	4.4
All-Red Time (s)	2.0	1.5	1.5	2.0	1.5	1.5	2.0	1.5	2.0	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.6	5.9	5.9	5.6	5.9	5.9	5.6	5.9	5.6	5.9	5.9
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Min	None	C-Min	C-Min
Act Effct Green (s)	15.8	45.3	45.3	8.2	37.8	37.8	13.5	34.3	9.2	29.9	29.9
Actuated g/C Ratio	0.13	0.38	0.38	0.07	0.32	0.32	0.11	0.29	0.08	0.25	0.25
v/c Ratio	0.79	0.31	0.20	0.52	0.93	0.58	0.73	0.76	0.79	0.48	0.58
Control Delay	83.2	11.5	1.2	61.7	51.0	21.4	62.8	42.3	75.3	40.0	19.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	83.2	11.5	1.2	61.7	51.0	21.4	62.8	42.3	75.3	40.0	19.5
LOS	F	B	A	E	D	C	E	D	E	D	B
Approach Delay		33.4			46.2			46.5		40.7	
Approach LOS		C			D			D		D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 80 (67%), Referenced to phase 2:SBT and 6:NBT, Start of Green	
Natural Cycle: 100	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.93	
Intersection Signal Delay: 42.6	Intersection LOS: D
Intersection Capacity Utilization 77.5%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 3: Scottsdale Road & McDowell Road



Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	1050	5	0	1835	30	0	0	3	0	0	3
Future Vol, veh/h	0	1050	5	0	1835	30	0	0	3	0	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	1167	6	0	2039	33	0	0	3	0	0	3

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	-	-	0	-	-	587	-	-	1036
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	-	-	-	7.14	-	-	7.14
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	-	-	-	3.92	-	-	3.92
Pot Cap-1 Maneuver	0	-	-	0	-	-	0	0	*675	0	0	*502
Stage 1	0	-	-	0	-	-	0	0	-	0	0	-
Stage 2	0	-	-	0	-	-	0	0	-	0	0	-
Platoon blocked, %		-	-		-	-			1			1
Mov Cap-1 Maneuver	-	-	-	-	-	-	-	-	*675	-	-	*502
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	10.4	12.2
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT	WBR	SBLn1
Capacity (veh/h)	675	-	-	-	-	502
HCM Lane V/C Ratio	0.005	-	-	-	-	0.007
HCM Control Delay (s)	10.4	-	-	-	-	12.2
HCM Lane LOS	B	-	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	-	0

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

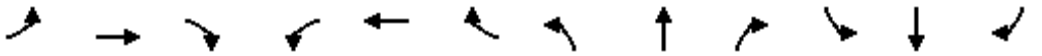
Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	3	80	4	4	57
Future Vol, veh/h	2	3	80	4	4	57
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	87	87	87	87	87	87
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	3	92	5	5	66

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	171	95	0	0	97	0
Stage 1	95	-	-	-	-	-
Stage 2	76	-	-	-	-	-
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	858	1011	-	-	1516	-
Stage 1	956	-	-	-	-	-
Stage 2	947	-	-	-	-	-
Platoon blocked, %	1	1	-	-	1	-
Mov Cap-1 Maneuver	856	1011	-	-	1516	-
Mov Cap-2 Maneuver	856	-	-	-	-	-
Stage 1	956	-	-	-	-	-
Stage 2	944	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.8	0	0.5
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	943	1516	-
HCM Lane V/C Ratio	-	-	0.006	0.003	-
HCM Control Delay (s)	-	-	8.8	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	186	1669	221	46	859	116	120	194	80	116	307	113
Future Volume (veh/h)	186	1669	221	46	859	116	120	194	80	116	307	113
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	202	1814	240	50	934	126	130	211	87	126	334	123
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	228	2687	834	64	1967	265	180	367	311	261	367	311
Arrive On Green	0.13	0.53	0.53	0.07	0.86	0.86	0.06	0.20	0.20	0.06	0.20	0.20
Sat Flow, veh/h	1781	5106	1585	1781	4552	612	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	202	1814	240	50	698	362	130	211	87	126	334	123
Grp Sat Flow(s),veh/h/ln	1781	1702	1585	1781	1702	1760	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	13.4	31.3	10.1	3.3	5.7	5.7	6.7	12.3	5.6	6.7	21.0	8.1
Cycle Q Clear(g_c), s	13.4	31.3	10.1	3.3	5.7	5.7	6.7	12.3	5.6	6.7	21.0	8.1
Prop In Lane	1.00		1.00	1.00		0.35	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	228	2687	834	64	1471	761	180	367	311	261	367	311
V/C Ratio(X)	0.88	0.68	0.29	0.78	0.47	0.48	0.72	0.57	0.28	0.48	0.91	0.40
Avail Cap(c_a), veh/h	270	2687	834	140	1471	761	180	535	453	261	535	453
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.98	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	51.4	20.9	15.9	55.2	5.0	5.0	39.2	43.7	41.0	37.0	47.2	42.0
Incr Delay (d2), s/veh	22.5	1.4	0.9	7.3	1.1	2.1	11.8	0.5	0.2	0.5	11.9	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.3	12.0	3.8	1.6	1.6	1.9	3.6	5.7	2.2	3.0	10.8	3.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	74.0	22.3	16.7	62.5	6.1	7.1	51.0	44.2	41.2	37.5	59.0	42.3
LnGrp LOS	E	C	B	E	A	A	D	D	D	D	E	D
Approach Vol, veh/h		2256			1110			428			583	
Approach Delay, s/veh		26.3			9.0			45.7			50.9	
Approach LOS		C			A			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.9	68.8	12.0	29.3	21.2	57.6	12.0	29.3
Change Period (Y+Rc), s	5.6	5.7	* 5.3	* 5.7	* 5.8	5.7	* 5.3	* 5.7
Max Green Setting (Gmax), s	9.4	47.3	* 6.7	* 34	* 18	38.3	* 6.7	* 34
Max Q Clear Time (g_c+I1), s	5.3	33.3	8.7	23.0	15.4	7.7	8.7	14.3
Green Ext Time (p_c), s	0.0	5.0	0.0	0.6	0.0	2.4	0.0	0.4

Intersection Summary	
HCM 6th Ctrl Delay	27.1
HCM 6th LOS	C

Notes

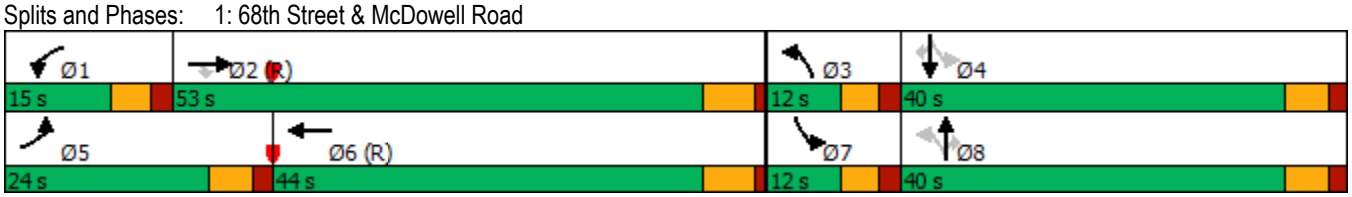
User approved pedestrian interval to be less than phase max green.

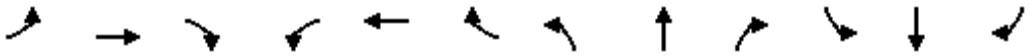
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	186	1669	221	46	859	120	194	80	116	307	113
Future Volume (vph)	186	1669	221	46	859	120	194	80	116	307	113
Turn Type	Prot	NA	Perm	Prot	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6	3	8		7	4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	3	8	8	7	4	4
Switch Phase											
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	5.0	7.0	7.0	5.0	7.0	7.0
Minimum Split (s)	10.8	27.7	27.7	10.6	27.7	10.3	36.7	36.7	10.3	43.7	43.7
Total Split (s)	24.0	53.0	53.0	15.0	44.0	12.0	40.0	40.0	12.0	40.0	40.0
Total Split (%)	20.0%	44.2%	44.2%	12.5%	36.7%	10.0%	33.3%	33.3%	10.0%	33.3%	33.3%
Yellow Time (s)	4.0	4.7	4.7	3.6	4.7	3.3	4.0	4.0	3.3	4.0	4.0
All-Red Time (s)	1.8	1.0	1.0	2.0	1.0	2.0	1.7	1.7	2.0	1.7	1.7
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.8	5.7	5.7	5.6	5.7	5.3	5.7	5.7	5.3	5.7	5.7
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Min	C-Min	None	C-Min	None	None	None	None	None	None
Act Effct Green (s)	16.6	60.1	60.1	7.1	48.3	32.9	25.1	25.1	32.9	25.1	25.1
Actuated g/C Ratio	0.14	0.50	0.50	0.06	0.40	0.27	0.21	0.21	0.27	0.21	0.21
v/c Ratio	0.82	0.71	0.28	0.48	0.52	0.68	0.54	0.19	0.44	0.86	0.26
Control Delay	76.1	27.3	11.1	89.4	7.3	49.1	46.5	0.9	34.3	65.8	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	76.1	27.3	11.1	89.4	7.3	49.1	46.5	0.9	34.3	65.8	2.6
LOS	E	C	B	F	A	D	D	A	C	E	A
Approach Delay		30.0			11.0		38.0			45.7	
Approach LOS		C			B		D			D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 110 (92%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 105	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 28.0	Intersection LOS: C
Intersection Capacity Utilization 77.8%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 1: 68th Street & McDowell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	68	1809	16	72	955	44	19	17	47	25	15	31
Future Volume (veh/h)	68	1809	16	72	955	44	19	17	47	25	15	31
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	76	2010	18	80	1061	49	21	19	52	28	17	34
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	482	4333	39	234	4153	192	129	35	97	111	44	89
Arrive On Green	1.00	1.00	1.00	1.00	1.00	1.00	0.08	0.08	0.08	0.08	0.08	0.08
Sat Flow, veh/h	508	5219	47	209	5002	231	1354	442	1210	1329	557	1113
Grp Volume(v), veh/h	76	1311	717	80	722	388	21	0	71	28	0	51
Grp Sat Flow(s),veh/h/ln	508	1702	1862	209	1702	1829	1354	0	1653	1329	0	1670
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	5.0	2.5	0.0	3.5
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0	5.0	7.4	0.0	3.5
Prop In Lane	1.00		0.03	1.00		0.13	1.00		0.73	1.00		0.67
Lane Grp Cap(c), veh/h	482	2826	1546	234	2826	1518	129	0	132	111	0	133
V/C Ratio(X)	0.16	0.46	0.46	0.34	0.26	0.26	0.16	0.00	0.54	0.25	0.00	0.38
Avail Cap(c_a), veh/h	482	2826	1546	234	2826	1518	368	0	424	346	0	429
HCM Platoon Ratio	2.00	2.00	2.00	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.69	0.69	0.69	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	54.9	0.0	53.1	56.7	0.0	52.4
Incr Delay (d2), s/veh	0.5	0.4	0.7	3.9	0.2	0.4	0.2	0.0	1.3	0.4	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.1	0.3	0.3	0.1	0.2	0.6	0.0	2.1	0.8	0.0	1.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.5	0.4	0.7	3.9	0.2	0.4	55.1	0.0	54.4	57.1	0.0	53.1
LnGrp LOS	A	A	A	A	A	A	E	A	D	E	A	D
Approach Vol, veh/h		2104			1190			92			79	
Approach Delay, s/veh		0.5			0.5			54.5			54.5	
Approach LOS		A			A			D			D	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		105.2		14.8		105.2		14.8				
Change Period (Y+Rc), s		* 5.6		* 5.2		* 5.6		* 5.2				
Max Green Setting (Gmax), s		* 78		* 31		* 78		* 31				
Max Q Clear Time (g_c+I1), s		2.0		9.4		2.0		7.3				
Green Ext Time (p_c), s		6.9		0.2		5.0		0.2				

Intersection Summary	
HCM 6th Ctrl Delay	3.2
HCM 6th LOS	A

Notes

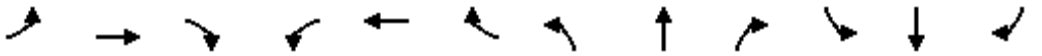
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	68	1809	72	955	19	17	25	15
Future Volume (vph)	68	1809	72	955	19	17	25	15
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	2	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	7.0	7.0	7.0	7.0
Minimum Split (s)	23.6	23.6	23.6	23.6	35.2	35.2	35.2	35.2
Total Split (s)	84.0	84.0	84.0	84.0	36.0	36.0	36.0	36.0
Total Split (%)	70.0%	70.0%	70.0%	70.0%	30.0%	30.0%	30.0%	30.0%
Yellow Time (s)	4.4	4.4	4.4	4.4	3.3	3.3	3.3	3.3
All-Red Time (s)	1.2	1.2	1.2	1.2	1.9	1.9	1.9	1.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.6	5.6	5.6	5.6	5.2	5.2	5.2	5.2
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	C-Min	C-Min	C-Min	C-Min	None	None	None	None
Act Effct Green (s)	103.7	103.7	103.7	103.7	9.1	9.1	9.1	9.1
Actuated g/C Ratio	0.86	0.86	0.86	0.86	0.08	0.08	0.08	0.08
v/c Ratio	0.19	0.46	0.59	0.25	0.21	0.51	0.28	0.32
Control Delay	1.2	0.7	44.8	8.8	55.7	54.1	58.5	29.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.2	0.7	44.8	8.8	55.7	54.1	58.5	29.7
LOS	A	A	D	A	E	D	E	C
Approach Delay		0.8		11.2		54.4		39.9
Approach LOS		A		B		D		D

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 106 (88%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 120	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.59	
Intersection Signal Delay: 6.7	Intersection LOS: A
Intersection Capacity Utilization 65.4%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2: 70th Street & McDowell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	304	1183	226	220	646	313	195	910	220	427	1052	227
Future Volume (veh/h)	304	1183	226	220	646	313	195	910	220	427	1052	227
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	345	1344	257	250	734	356	222	1034	250	485	1195	258
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	411	1442	448	305	1284	399	277	1270	307	443	1826	567
Arrive On Green	0.04	0.09	0.09	0.09	0.25	0.25	0.08	0.31	0.31	0.13	0.36	0.36
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	3456	4105	991	3456	5106	1585
Grp Volume(v), veh/h	345	1344	257	250	734	356	222	857	427	485	1195	258
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1728	1702	1692	1728	1702	1585
Q Serve(g_s), s	11.9	31.4	18.6	8.5	15.1	26.0	7.6	27.9	27.9	15.4	23.6	15.0
Cycle Q Clear(g_c), s	11.9	31.4	18.6	8.5	15.1	26.0	7.6	27.9	27.9	15.4	23.6	15.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.59	1.00		1.00
Lane Grp Cap(c), veh/h	411	1442	448	305	1284	399	277	1053	524	443	1826	567
V/C Ratio(X)	0.84	0.93	0.57	0.82	0.57	0.89	0.80	0.81	0.82	1.09	0.65	0.46
Avail Cap(c_a), veh/h	587	1451	450	328	1284	399	299	1053	524	443	1826	567
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	56.5	53.3	47.5	53.8	39.3	43.3	54.3	38.2	38.3	52.3	32.3	29.6
Incr Delay (d2), s/veh	5.1	10.9	1.1	13.1	0.4	21.0	12.2	6.9	13.1	70.5	1.8	2.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.8	15.8	8.0	4.2	6.2	12.2	3.7	12.3	13.1	10.9	9.7	6.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	61.6	64.2	48.6	66.9	39.6	64.4	66.4	45.2	51.4	122.8	34.2	32.2
LnGrp LOS	E	E	D	E	D	E	E	D	D	F	C	C
Approach Vol, veh/h		1946			1340			1506			1938	
Approach Delay, s/veh		61.7			51.3			50.0			56.1	
Approach LOS		E			D			D			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.2	48.8	19.9	36.1	21.0	43.0	16.2	39.8
Change Period (Y+Rc), s	5.6	5.9	5.6	5.9	5.6	5.9	5.6	5.9
Max Green Setting (Gmax), s	10.4	41.1	20.4	25.1	15.4	36.1	11.4	34.1
Max Q Clear Time (g_c+I1), s	9.6	25.6	13.9	28.0	17.4	29.9	10.5	33.4
Green Ext Time (p_c), s	0.0	5.5	0.4	0.0	0.0	3.0	0.0	0.5

Intersection Summary	
HCM 6th Ctrl Delay	55.4
HCM 6th LOS	E

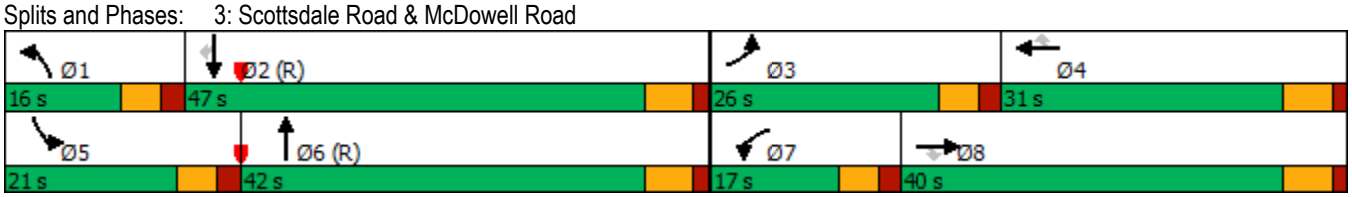
Notes

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

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	304	1183	226	220	646	313	195	910	427	1052	227
Future Volume (vph)	304	1183	226	220	646	313	195	910	427	1052	227
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	NA	Perm
Protected Phases	3	8		7	4		1	6	5	2	
Permitted Phases			8			4					2
Detector Phase	3	8	8	7	4	4	1	6	5	2	2
Switch Phase											
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	5.0	10.0	10.0
Minimum Split (s)	10.6	34.9	34.9	10.6	37.9	37.9	10.6	36.9	10.6	36.9	36.9
Total Split (s)	26.0	40.0	40.0	17.0	31.0	31.0	16.0	42.0	21.0	47.0	47.0
Total Split (%)	21.7%	33.3%	33.3%	14.2%	25.8%	25.8%	13.3%	35.0%	17.5%	39.2%	39.2%
Yellow Time (s)	3.6	4.4	4.4	3.6	4.4	4.4	3.6	4.4	3.6	4.4	4.4
All-Red Time (s)	2.0	1.5	1.5	2.0	1.5	1.5	2.0	1.5	2.0	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.6	5.9	5.9	5.6	5.9	5.9	5.6	5.9	5.6	5.9	5.9
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Min	None	C-Min	C-Min
Act Effct Green (s)	16.3	34.2	34.2	11.1	29.0	29.0	10.1	34.6	17.1	41.6	41.6
Actuated g/C Ratio	0.14	0.28	0.28	0.09	0.24	0.24	0.08	0.29	0.14	0.35	0.35
v/c Ratio	0.74	0.93	0.47	0.79	0.60	0.66	0.77	0.88	0.99	0.68	0.38
Control Delay	57.3	39.2	10.5	71.3	43.1	23.7	72.2	47.1	91.3	36.0	10.4
Queue Delay	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	39.2	10.5	71.3	43.1	23.7	72.2	47.1	91.3	36.0	10.4
LOS	E	D	B	E	D	C	E	D	F	D	B
Approach Delay		38.7			43.2			50.8		46.4	
Approach LOS		D			D			D		D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 100 (83%), Referenced to phase 2:SBT and 6:NBT, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.99	
Intersection Signal Delay: 44.5	Intersection LOS: D
Intersection Capacity Utilization 83.0%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 3: Scottsdale Road & McDowell Road



Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	1799	3	0	1073	6	0	0	3	0	0	31
Future Vol, veh/h	0	1799	3	0	1073	6	0	0	3	0	0	31
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	1999	3	0	1192	7	0	0	3	0	0	34

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	-	-	0	-	-	1001	-	-	600
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	-	-	-	7.14	-	-	7.14
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	-	-	-	3.92	-	-	3.92
Pot Cap-1 Maneuver	0	-	-	0	-	-	0	0	*502	0	0	*675
Stage 1	0	-	-	0	-	-	0	0	-	0	0	-
Stage 2	0	-	-	0	-	-	0	0	-	0	0	-
Platoon blocked, %		-	-		-	-			1			1
Mov Cap-1 Maneuver	-	-	-	-	-	-	-	-	*502	-	-	*675
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	12.2	10.6
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT	WBR	SBLn1
Capacity (veh/h)	502	-	-	-	-	675
HCM Lane V/C Ratio	0.007	-	-	-	-	0.051
HCM Control Delay (s)	12.2	-	-	-	-	10.6
HCM Lane LOS	B	-	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	-	0.2

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	0.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	6	125	0	2	53
Future Vol, veh/h	9	6	125	0	2	53
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	87	87	87	87	87	87
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	10	7	144	0	2	61

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	209	144	0	0	144	0
Stage 1	144	-	-	-	-	-
Stage 2	65	-	-	-	-	-
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	833	969	-	-	1462	-
Stage 1	918	-	-	-	-	-
Stage 2	958	-	-	-	-	-
Platoon blocked, %	1	1	-	-	1	-
Mov Cap-1 Maneuver	832	969	-	-	1462	-
Mov Cap-2 Maneuver	832	-	-	-	-	-
Stage 1	918	-	-	-	-	-
Stage 2	957	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.2	0	0.3
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	882	1462	-
HCM Lane V/C Ratio	-	-	0.02	0.002	-
HCM Control Delay (s)	-	-	9.2	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Appendix G – Trip Generation

G

Southdale
Hawkins

Completed: GT 4/6/2020
Checked: TG 4/6/2020

Trip Generation Calculations

Prior Development

841 Automobile Sales (Used) (Three to Ten Levels)

Land Use	ITE Code	Qty	Unit	Weekday Rate	Weekday % In	Weekday % Out	AM Peak Hour Rate	AM Peak Hour % In	AM Peak Hour % Out	PM Peak Hour Rate	PM Peak Hour % In	PM Peak Hour % Out	Weekday Total	Weekday In	Weekday Out	AM Peak Hour Total	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	
Automobile Sales (Used)	**841**	**11.2**	**1000 SF GFA**	**27.06**	**50%**	**50%**	**2.13**	**76%**	**24%**	**3.75**	**47%**	**53%**	**303**	**152**	**151**	**24**	**18**	**6**	**42**	**20**	**22**	**Average**
Automobile Sales (Used)	841	11.2	1000 SF GFA	4.44	50%	50%	0.38	76%	24%	0.56	47%	53%	50	25	25	4	3	1	6	3	3	Minimum
Automobile Sales (Used)	841	11.194	1000 SF GFA	71.21	50%	50%	7.41	76%	24%	8.15	47%	53%	797	399	398	83	63	20	91	43	48	Maximum
Land Use	ITE Code	Qty	Unit	Weekday Equation	Weekday % In	Weekday % Out	AM Peak Hour Equation	AM Peak Hour % In	AM Peak Hour % Out	PM Peak Hour Equation	PM Peak Hour % In	PM Peak Hour % Out	Weekday Total	Weekday In	Weekday Out	AM Peak Hour Total	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	
Automobile Sales (Used)	841	11.194	1000 SF GFA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Equation

Automobile Sales (Used)	Standard Deviation	17.91		1.98		2.28	
	Number of Studies	14		8		14	
	Average Size	2		3		2	
	R^2	N/A		N/A		N/A	

941 Quick Lubrication Vehicle Shop

Land Use	ITE Code	Qty	Unit	Weekday Rate	Weekday % In	Weekday % Out	AM Peak Hour Rate	AM Peak Hour % In	AM Peak Hour % Out	PM Peak Hour Rate	PM Peak Hour % In	PM Peak Hour % Out	Weekday Total	Weekday In	Weekday Out	AM Peak Hour Total	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	
Quick Lubrication Vehicle Shop	**941**	**20.4**	**1000 SF GFA**	**69.57**	**50%**	**50%**	**5.8**	**75%**	**25%**	**8.7**	**42%**	**58%**	**1,417**	**709**	**708**	**118**	**89**	**29**	**177**	**74**	**103**	**Average**
Quick Lubrication Vehicle Shop	941	20.4	1000 SF GFA	69.57	50%	50%	5.8	75%	25%	8.7	42%	58%	1,417	709	708	118	89	29	177	74	103	Minimum
Quick Lubrication Vehicle Shop	941	20.375	1000 SF GFA	69.57	50%	50%	5.8	75%	25%	8.7	42%	58%	1,417	709	708	118	89	29	177	74	103	Maximum
Land Use	ITE Code	Qty	Unit	Weekday Equation	Weekday % In	Weekday % Out	AM Peak Hour Equation	AM Peak Hour % In	AM Peak Hour % Out	PM Peak Hour Equation	PM Peak Hour % In	PM Peak Hour % Out	Weekday Total	Weekday In	Weekday Out	AM Peak Hour Total	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	
Quick Lubrication Vehicle Shop	941	20.375	1000 SF GFA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Equation

Quick Lubrication Vehicle Shop	Standard Deviation	N/A		N/A			
	Number of Studies	1		1			
	Average Size	1		1			
	R^2	N/A		N/A			

Existing Development

560 Church

Land Use	ITE Code	Qty	Unit	Weekday Rate	Weekday % In	Weekday % Out	AM Peak Hour Rate	AM Peak Hour % In	AM Peak Hour % Out	PM Peak Hour Rate	PM Peak Hour % In	PM Peak Hour % Out	Weekday Total	Weekday In	Weekday Out	AM Peak Hour Total	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	
Church	**560**	**6**	**1000 SF GFA**	**6.95**	**50%**	**50%**	**0.33**	**60%**	**40%**	**0.49**	**48%**	**52%**	**42**	**21**	**21**	**2**	**1**	**1**	**3**	**1**	**2**	**Average**
Church	560	6	1000 SF GFA	3.01	50%	50%	0.08	60%	40%	0.14	48%	52%	18	9	9	0	0	0	1	0	1	Minimum
Church	560	6	1000 SF GFA	13.14	50%	50%	0.94	60%	40%	2.1	48%	52%	79	40	39	6	4	2	13	6	7	Maximum
Land Use	ITE Code	Qty	Unit	Weekday Equation	Weekday % In	Weekday % Out	AM Peak Hour Equation	AM Peak Hour % In	AM Peak Hour % Out	PM Peak Hour Equation	PM Peak Hour % In	PM Peak Hour % Out	Weekday Total	Weekday In	Weekday Out	AM Peak Hour Total	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	
Church	560	6	1000 SF GFA	T=6.14(X)+17.09	50%	50%	T=0.36(X)-0.74	60%	40%	T=0.37(X)+3.90	48%	52%	54	27	27	1	1	0	6	3	3	Equation

Church	Standard Deviation	2.98		0.24		0.4	
	Number of Studies	7		8		13	
	Average Size	21		34		32	
	R^2	0.67		0.79		0.65	

Southdale
Hawkins

Completed: GT 8/5/2019
Checked:

Trip Generation Calculations

934 Fast-Food Restaurant with Drive-Thru Window

Land Use	ITE Code	Qty	Unit	Weekday			AM Peak Hour			PM Peak Hour			Weekday			AM Peak Hour			PM Peak Hour			
				Rate	% In	% Out	Rate	% In	% Out	Rate	% In	% Out	Total	In	Out	Total	In	Out	Total	In	Out	
Fast-Food Restaurant with Drive-Thru Window	**934**	**3.5**	**1000 SF GFA**	**470.95**	**50%**	**50%**	**40.19**	**51%**	**49%**	**32.67**	**52%**	**48%**	**1,648**	**824**	**824**	**141**	**72**	**69**	**114**	**59**	**55**	**Average**
Fast-Food Restaurant with Drive-Thru Window	934	3.5	1000 SF GFA	98.89	50%	50%	0.38	51%	49%	8.17	52%	48%	346	173	173	1	1	0	29	15	14	Minimum
Fast-Food Restaurant with Drive-Thru Window	934	3.5	1000 SF GFA	1137.66	50%	50%	164.25	51%	49%	117.22	52%	48%	3,982	1,991	1,991	575	293	282	410	213	197	Maximum
Land Use	ITE Code	Qty	Unit	Weekday			AM Peak Hour			PM Peak Hour			Weekday			AM Peak Hour			PM Peak Hour			
				Equation	% In	% Out	Equation	% In	% Out	Equation	% In	% Out	Total	In	Out	Total	In	Out	Total	In	Out	
Fast-Food Restaurant with Drive-Thru Window	934	3.5	1000 SF GFA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Equation

Fast-Food Restaurant with Drive-Thru Window	Standard Deviation	244.44		28.78		17.87
	Number of Studies	67		111		185
	Average Size	3		4		3
	R^2	N/A		N/A		N/A

937 Coffee Shop with Drive-Thru Window

Land Use	ITE Code	Qty	Unit	Weekday			AM Peak Hour			PM Peak Hour			Weekday			AM Peak Hour			PM Peak Hour			
				Rate	% In	% Out	Rate	% In	% Out	Rate	% In	% Out	Total	In	Out	Total	In	Out	Total	In	Out	
Coffee Shop with Drive-Thru Window	**937**	**2.4**	**1000 SF GFA**	**820.38**	**50%**	**50%**	**88.99**	**51%**	**49%**	**43.38**	**51%**	**49%**	**1,969**	**985**	**984**	**214**	**109**	**105**	**104**	**53**	**51**	**Average**
Coffee Shop with Drive-Thru Window	937	2.4	1000 SF GFA	738.66	50%	50%	18.32	51%	49%	2.09	51%	49%	1,773	887	886	44	22	22	5	3	2	Minimum
Coffee Shop with Drive-Thru Window	937	2.4	1000 SF GFA	869.00	50%	50%	353.57	51%	49%	92.31	51%	49%	2,086	1,043	1,043	849	433	416	222	113	109	Maximum
Land Use	ITE Code	Qty	Unit	Weekday			AM Peak Hour			PM Peak Hour			Weekday			AM Peak Hour			PM Peak Hour			
				Equation	% In	% Out	Equation	% In	% Out	Equation	% In	% Out	Total	In	Out	Total	In	Out	Total	In	Out	
Coffee Shop with Drive-Thru Window	937	2.4	1000 SF GFA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Equation

Coffee Shop with Drive-Thru Window	Standard Deviation	*		48.19		18.88
	Number of Studies	2		61		26
	Average Size	5		2		2
	R^2	N/A		N/A		N/A

Southdale
Hawkins

Completed: GT 4/6/2020
Checked: TG 4/6/2020

Trip Generation Calculations

Proposed Development

221 Multifamily Housing (Mid-Rise) (Three to Ten Levels)

Land Use	ITE Code	Qty	Unit	Weekday			AM Peak Hour			PM Peak Hour			Weekday			AM Peak Hour			PM Peak Hour			
				Rate	% In	% Out	Rate	% In	% Out	Rate	% In	% Out	Total	In	Out	Total	In	Out	Total	In	Out	
Multifamily Housing (Mid-Rise)	**221**	**267**	**Dwelling Units**	**5.44**	**50%**	**50%**	**0.36**	**26%**	**74%**	**0.44**	**61%**	**39%**	**1,452**	**726**	**726**	**96**	**25**	**71**	**117**	**71**	**46**	**Average**
Multifamily Housing (Mid-Rise)	221	267	Dwelling Units	1.27	50%	50%	0.06	26%	74%	0.15	61%	39%	339	170	169	16	4	12	40	24	16	Minimum
Multifamily Housing (Mid-Rise)	221	267	Dwelling Units	12.50	50%	50%	1.61	26%	74%	1.11	61%	39%	3,338	1,669	1,669	430	112	318	296	181	115	Maximum
Land Use	ITE Code	Qty	Unit	Weekday			AM Peak Hour			PM Peak Hour			Weekday			AM Peak Hour			PM Peak Hour			
				Equation	% In	% Out	Equation	% In	% Out	Equation	% In	% Out	Total	In	Out	Total	In	Out	Total	In	Out	
Multifamily Housing (Mid-Rise)	221	267	Dwelling Units	T=5.45(X)-1.75	50%	50%	Ln(T)=0.98Ln(X)-0.98	26%	74%	Ln(T)=0.96Ln(X)-0.63	61%	39%	1,453	727	726	90	23	67	114	70	44	Equation

Multifamily Housing (Mid-Rise)	Standard Deviation	2.03		0.19	0.19
	Number of Studies	27		53	60
	Average Size	205		207	208
	R^2	0.77		0.67	0.72

710 General Office Building

Land Use	ITE Code	Qty	Unit	Weekday			AM Peak Hour			PM Peak Hour			Weekday			AM Peak Hour			PM Peak Hour			
				Rate	% In	% Out	Rate	% In	% Out	Rate	% In	% Out	Total	In	Out	Total	In	Out	Total	In	Out	
General Office Building	**710**	**3.3**	**1000 SF GFA**	**9.74**	**50%**	**50%**	**1.16**	**86%**	**14%**	**1.15**	**16%**	**84%**	**32**	**16**	**16**	**4**	**3**	**1**	**4**	**1**	**3**	**Average**
General Office Building	710	3.3	1000 SF GFA	2.71	50%	50%	0.37	86%	14%	0.47	16%	84%	9	5	4	1	1	0	2	0	2	Minimum
General Office Building	710	3.3	1000 SF GFA	27.56	50%	50%	4.23	86%	14%	3.23	16%	84%	91	46	45	14	12	2	11	2	9	Maximum
Land Use	ITE Code	Qty	Unit	Weekday			AM Peak Hour			PM Peak Hour			Weekday			AM Peak Hour			PM Peak Hour			
				Equation	% In	% Out	Equation	% In	% Out	Equation	% In	% Out	Total	In	Out	Total	In	Out	Total	In	Out	
General Office Building	710	3.3	1000 SF GFA	Ln(T)=0.97Ln(X)+2.50	50%	50%	T=.94(X)+26.49	86%	14%	Ln(T)=0.95Ln(X)+0.36	16%	84%	39	20	19	30	26	4	4	1	3	Equation

General Office Building	Standard Deviation	5.15		0.47	0.42
	Number of Studies	66		35	32
	Average Size	171		117	114
	R^2	0.83		0.85	0.88

Appendix H – MAG Socioeconomic Projections

H

Socioeconomic Projections

Population and Employment

by Municipal Planning Area, Jurisdiction, and Regional Analysis Zone

June 2019



MARICOPA ASSOCIATION of GOVERNMENTS

302 North 1st Avenue, Suite 300
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5-ZN-2020
8/7/2020

Maricopa Association of Governments
Table 1: Total Population by Municipal Planning Area
July 1, 2018 and Projections July 1, 2020 to July 1, 2055

Municipal Planning Area	Total Population					
	2018	2020	2030	2040	2050	2055
Apache Junction	59,000	60,800	70,000	92,000	117,100	132,600
Avondale	84,200	86,700	101,800	111,900	119,000	122,100
Buckeye	89,000	97,700	186,600	305,400	409,900	459,300
Carefree	3,700	3,800	4,100	4,200	4,200	4,300
Cave Creek	5,900	6,000	6,500	7,000	7,200	7,300
Chandler	270,300	279,500	309,100	321,100	329,000	332,400
El Mirage	34,300	35,100	36,500	36,900	37,200	37,200
Florence	79,400	85,500	120,300	160,500	209,900	231,400
Fort McDowell Yavapai Native Nation	1,000	1,100	1,100	1,100	1,100	1,100
Fountain Hills	24,000	24,700	26,200	26,600	26,900	27,000
Gila Bend	2,500	2,700	3,700	3,700	3,900	4,200
Gila River Indian Native Nation	12,000	12,200	12,300	12,300	12,300	12,300
Gilbert	256,500	265,900	293,500	308,800	318,100	321,400
Glendale	272,200	279,100	306,400	323,400	333,200	338,800
Goodyear	87,300	92,100	140,300	192,200	228,600	247,900
Guadalupe	6,300	6,400	6,700	6,800	6,800	6,800
Litchfield Park	13,300	14,000	15,400	15,700	16,100	16,400
Maricopa	59,800	67,000	90,800	106,400	121,600	128,900
Mesa	533,400	552,800	607,500	649,400	680,000	690,300
Paradise Valley	14,000	14,100	14,700	15,100	15,200	15,300
Peoria	188,500	196,600	232,400	273,700	312,600	329,900
Phoenix	1,653,500	1,697,700	1,881,900	2,019,300	2,117,400	2,155,300
Queen Creek	58,700	65,000	90,900	109,000	120,900	128,500
Salt River Pima-Maricopa Native Nation	6,800	6,100	5,700	5,800	5,800	5,800
Scottsdale	245,500	253,800	281,900	299,400	311,400	316,700
Surprise	144,000	150,300	216,700	307,500	383,300	417,200
Tempe	185,300	190,000	217,100	247,000	272,400	282,200
Tolleson	7,000	7,100	8,600	10,300	11,400	11,800
Unicorporated Pinal County	66,800	68,600	79,100	93,700	110,800	122,700
Unincorporated Maricopa County	97,900	101,200	110,500	116,800	137,000	152,600
Wickenburg	8,200	8,500	9,400	9,500	9,800	10,000
Youngtown	6,600	6,800	7,300	7,700	7,800	7,800

Notes: Numbers rounded to the nearest 100. These projections include both the Maricopa County and Pinal County portions for Apache Junction, Queen Creek, and the Gila River Indian Community. Peoria and Wickenburg include only the Maricopa County portion.

Source: Maricopa Association of Governments (MAG) Socioeconomic Projections of Population and Employment by Municipal Planning Area (MPA) and Regional Analysis Zone (RAZ), June 2019

For explanation of variables and complete notation on this series, please refer to the Notes and Caveats in Appendix A.

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Maricopa Association of Governments
Table 2: Total Employment by Municipal Planning Area
July 1, 2018 and Projections July 1, 2020 to July 1, 2055

	Total Employment					
Municipal Planning Area	2018	2020	2030	2040	2050	2055
Apache Junction	7,800	8,800	13,100	17,800	26,400	30,500
Avondale	22,400	23,200	30,400	36,200	42,800	45,400
Buckeye	21,600	26,900	42,900	64,500	98,000	128,900
Carefree	1,600	1,600	2,100	2,400	2,500	2,600
Cave Creek	2,200	2,400	2,700	2,900	3,000	3,200
Chandler	145,500	154,700	182,300	202,100	215,200	222,000
El Mirage	5,000	5,100	6,500	7,200	8,000	8,900
Florence	11,000	12,100	17,000	26,400	40,900	51,100
Fort McDowell Yavapai Native Nation	2,200	2,400	2,400	2,500	2,600	2,600
Fountain Hills	7,100	7,700	9,100	9,800	10,200	10,300
Gila Bend	900	900	1,200	1,300	1,500	1,700
Gila River Indian Native Nation	10,500	10,700	11,500	13,100	14,800	15,500
Gilbert	92,800	98,600	120,200	135,900	146,600	152,200
Glendale	103,800	111,400	134,000	153,100	168,900	175,900
Goodyear	35,900	37,200	50,600	69,000	92,600	102,500
Guadalupe	1,300	1,300	1,500	1,600	1,600	1,600
Litchfield Park	3,800	4,400	5,200	5,900	6,400	6,700
Maricopa	6,200	7,100	11,400	18,200	28,200	33,500
Mesa	197,200	205,900	249,000	296,000	333,700	351,000
Paradise Valley	6,300	6,300	6,800	7,100	7,500	7,700
Peoria	58,200	62,400	73,100	84,800	91,900	96,300
Phoenix	897,700	937,600	1,084,000	1,189,200	1,264,900	1,298,900
Queen Creek	15,500	16,400	19,900	24,000	28,900	31,100
Salt River Pima-Maricopa Native Nation	21,200	22,900	28,200	33,900	35,900	36,400
Scottsdale	197,200	207,400	235,500	252,000	261,700	267,000
Surprise	33,600	36,400	59,500	86,400	113,400	130,500
Tempe	190,000	200,500	231,200	257,700	280,000	290,900
Tolleson	17,700	18,300	21,200	23,900	26,000	26,700
Unicorporated Pinal County	3,500	3,900	6,000	8,900	13,500	17,800
Unincorporated Maricopa County	28,600	31,500	35,500	41,100	51,200	58,400
Wickenburg	4,400	4,600	5,200	5,600	6,000	6,200
Youngtown	1,500	1,800	2,200	2,700	2,800	3,100

Notes: Numbers rounded to the nearest 100. These projections include both the Maricopa County and Pinal County portions for Apache Junction, Queen Creek, and the Gila River Indian Community. Peoria and Wickenburg include only the Maricopa County portion.

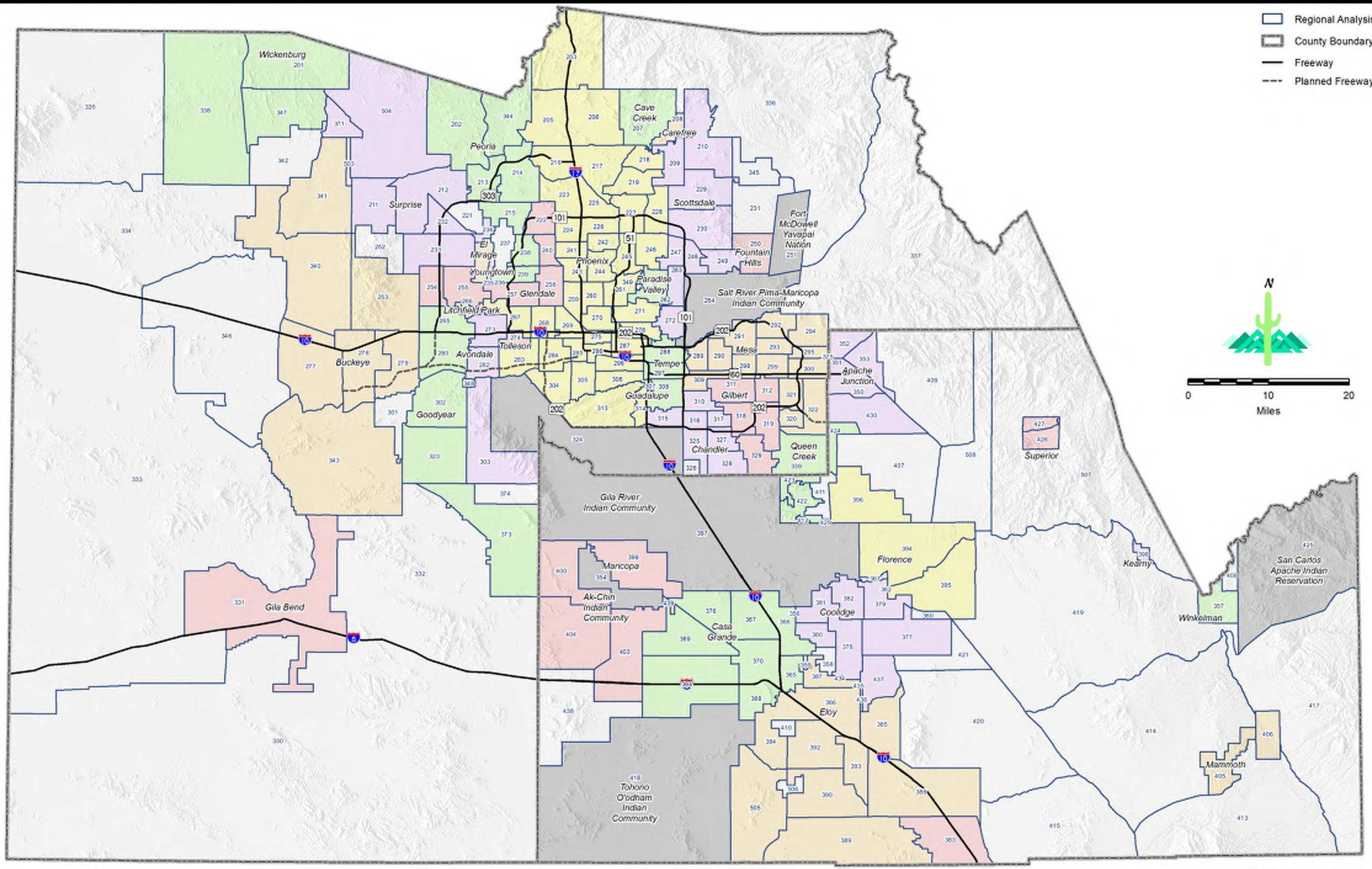
Source: Maricopa Association of Governments (MAG) Socioeconomic Projections of Population and Employment by Municipal Planning Area (MPA) and Regional Analysis Zone (RAZ), June 2019

For explanation of variables and complete notation on this series, please refer to the Notes and Caveats in Appendix A.

5-ZN-2020
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Regional Analysis Zones (RAZ), 2019
Maricopa and Pinal Counties, Arizona

MARICOPA ASSOCIATION of GOVERNMENTS



Source: MAG and the MAG member agencies, CAG and the CAG member agencies

Date: May 2019

While every effort has been made to ensure the accuracy of this information, the Maricopa Association of Governments makes no warranty, expressed or implied, as to its accuracy and exp liability for the accuracy thereof.

5-ZN-2020
8/7/2020

Maricopa Association of Governments
Table 4: Population by Regional Analysis Zone (RAZ) by MPA
July 1, 2018 and Projections July 1, 2020 to July 1, 2055

RAZ	County	Total Population					
		2018	2020	2030	2040	2050	2055
	Total	1,653,469	1,697,722	1,881,876	2,019,269	2,117,427	2,155,333
Queen Creek MPA							
339	Maricopa County	49,781	53,579	72,670	82,172	87,155	89,586
422	Pinal County	13	13	300	437	564	638
423	Pinal County	1,286	1,410	3,714	6,136	7,457	8,686
424	Pinal County	7,642	10,003	14,200	20,287	25,759	29,586
	Total	58,722	65,005	90,884	109,032	120,935	128,496
Salt River Pima-Maricopa Native Nation MPA							
264	Maricopa County	6,798	6,073	5,708	5,820	5,820	5,820
	Total	6,798	6,073	5,708	5,820	5,820	5,820
Scottsdale MPA							
209	Maricopa County	12,188	12,605	13,961	14,512	14,984	15,255
210	Maricopa County	6,013	6,591	10,463	12,339	13,491	13,961
229	Maricopa County	20,542	21,269	25,221	27,864	29,698	30,229
230	Maricopa County	32,232	33,028	38,882	43,580	46,789	48,510
247	Maricopa County	13,549	13,858	15,420	16,342	16,871	17,019
248	Maricopa County	36,178	37,227	38,468	38,807	39,048	39,143
249	Maricopa County	20,903	21,410	22,543	22,768	22,839	22,848
263	Maricopa County	34,908	35,814	37,002	37,252	37,584	37,773
272	Maricopa County	68,987	71,970	79,910	85,942	90,054	91,927
	Total	245,500	253,772	281,870	299,406	311,358	316,665
Surprise MPA							
211	Maricopa County	863	884	4,471	23,112	36,704	40,737
212	Maricopa County	10,265	11,365	37,615	69,296	85,862	93,806
232	Maricopa County	29,296	30,200	34,506	37,144	37,927	38,313
233	Maricopa County	87,834	91,276	111,822	119,384	123,777	126,523
234	Maricopa County	8,969	9,467	10,460	10,878	11,335	11,488
371	Maricopa County	342	344	434	734	2,584	4,316
504	Maricopa County	6,460	6,718	17,425	46,912	85,127	102,004
	Total	144,029	150,254	216,733	307,460	383,316	417,187
Tempe MPA							
288	Maricopa County	73,442	76,444	100,651	129,202	150,094	157,410
297	Maricopa County	53,146	54,092	56,336	57,432	61,780	64,273
308	Maricopa County	58,756	59,473	60,120	60,348	60,476	60,559
	Total	185,344	190,009	217,107	246,982	272,350	282,242

Notes: Numbers rounded to the nearest 100. These projections include both the Maricopa County and Pinal County portions for Apache Junction, Queen Creek, and the Gila River Indian Community. Peoria and Wickenburg include only the Maricopa County portion.

Source: Maricopa Association of Governments (MAG) Socioeconomic Projections of Population and Employment by Municipal Planning Area (MPA) and Regional Analysis Zone (RAZ), May 2019

For explanation of variables and complete notation on this series, please refer to the Notes and Caveats in Appendix A.

5-ZN-2020
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Maricopa Association of Governments
Table 5: Employment by Regional Analysis Zone (RAZ) by MPA
July 1, 2018 and Projections July 1, 2020 to July 1, 2055

RAZ	County	Total Employment					
		2018	2020	2030	2040	2050	2055
	Total	897,713	937,622	1,083,980	1,189,209	1,264,941	1,298,903
Queen Creek MPA							
339	Maricopa County	13,933	14,696	16,482	18,825	20,733	21,151
422	Pinal County	9	8	18	22	31	39
423	Pinal County	89	109	351	620	1,068	1,639
424	Pinal County	1,435	1,576	3,073	4,571	7,020	8,309
	Total	15,466	16,389	19,924	24,038	28,852	31,138
Salt River Pima-Maricopa Native Nation MPA							
264	Maricopa County	21,160	22,869	28,215	33,871	35,903	36,442
	Total	21,160	22,869	28,215	33,871	35,903	36,442
Scottsdale MPA							
209	Maricopa County	4,488	4,659	4,851	5,174	5,161	5,344
210	Maricopa County	2,386	3,018	2,759	3,091	3,139	3,191
229	Maricopa County	9,604	10,005	11,231	11,962	12,193	12,896
230	Maricopa County	23,272	24,919	32,112	36,968	40,834	42,136
247	Maricopa County	44,254	47,089	52,652	54,822	55,679	56,105
248	Maricopa County	29,603	30,901	33,285	34,001	34,234	34,548
249	Maricopa County	7,409	7,692	8,179	8,684	8,906	9,045
263	Maricopa County	26,351	26,961	28,903	30,245	30,919	31,381
272	Maricopa County	49,833	52,185	61,540	67,039	70,676	72,330
	Total	197,200	207,429	235,512	251,986	261,741	266,976
Surprise MPA							
211	Maricopa County	60	53	1,560	3,172	4,766	7,017
212	Maricopa County	2,008	2,338	5,821	9,965	13,362	15,709
232	Maricopa County	8,349	9,228	11,297	12,187	12,875	13,116
233	Maricopa County	19,943	21,079	32,661	44,032	52,007	57,402
234	Maricopa County	2,588	2,711	3,354	3,922	4,239	4,386
371	Maricopa County	18	20	327	423	2,381	2,937
504	Maricopa County	677	1,020	4,460	12,695	23,763	29,886
	Total	33,643	36,449	59,480	86,396	113,393	130,453
Tempe MPA							
288	Maricopa County	88,927	94,229	111,010	128,894	144,714	152,703
297	Maricopa County	44,730	47,069	53,149	57,125	60,725	62,552
308	Maricopa County	56,380	59,208	67,052	71,701	74,542	75,596
	Total	190,037	200,506	231,211	257,720	279,981	290,851

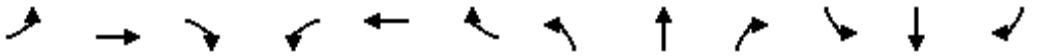
Notes: Numbers rounded to the nearest 100. These projections include both the Maricopa County and Pinal County portions for Apache Junction, Queen Creek, and the Gila River Indian Community. Peoria and Wickenburg include only the Maricopa County portion.

Source: Maricopa Association of Governments (MAG) Socioeconomic Projections of Population and Employment by Municipal Planning Area (MPA) and Regional Analysis Zone (RAZ), May 2019

For explanation of variables and complete notation on this series, please refer to the Notes and Caveats in Appendix A.

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Appendix I – Year 2022 No Build Capacity Analysis



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	106	953	137	74	1771	99	272	300	90	92	249	221
Future Volume (veh/h)	106	953	137	74	1771	99	272	300	90	92	249	221
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	115	1036	149	80	1925	108	296	326	98	100	271	240
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	140	2250	698	100	2061	115	349	480	407	264	317	269
Arrive On Green	0.08	0.44	0.44	0.11	0.83	0.83	0.15	0.26	0.26	0.06	0.17	0.17
Sat Flow, veh/h	1781	5106	1585	1781	4948	277	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	115	1036	149	80	1323	710	296	326	98	100	271	240
Grp Sat Flow(s),veh/h/ln	1781	1702	1585	1781	1702	1821	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	7.6	17.1	7.0	5.3	34.9	35.6	15.9	18.8	5.9	5.5	16.9	17.8
Cycle Q Clear(g_c), s	7.6	17.1	7.0	5.3	34.9	35.6	15.9	18.8	5.9	5.5	16.9	17.8
Prop In Lane	1.00		1.00	1.00		0.15	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	140	2250	698	100	1418	758	349	480	407	264	317	269
V/C Ratio(X)	0.82	0.46	0.21	0.80	0.93	0.94	0.85	0.68	0.24	0.38	0.85	0.89
Avail Cap(c_a), veh/h	315	2250	698	318	1418	758	349	581	493	419	581	493
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.87	0.87	0.87	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.4	23.6	20.7	52.6	8.8	8.8	33.9	40.1	35.3	38.0	48.4	48.7
Incr Delay (d2), s/veh	4.4	0.7	0.7	4.6	11.2	18.5	16.8	1.5	0.1	0.3	2.6	4.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.5	6.8	2.7	2.3	5.6	7.6	8.4	8.7	2.3	2.4	8.0	7.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	58.9	24.2	21.4	57.2	19.9	27.3	50.7	41.6	35.4	38.3	50.9	52.8
LnGrp LOS	E	C	C	E	B	C	D	D	D	D	D	D
Approach Vol, veh/h		1300			2113			720			611	
Approach Delay, s/veh		27.0			23.8			44.5			49.6	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.4	58.6	23.0	26.1	15.2	55.7	12.6	36.5
Change Period (Y+Rc), s	5.6	5.7	* 5.3	* 5.7	* 5.8	5.7	* 5.3	* 5.7
Max Green Setting (Gmax), s	21.4	21.3	* 18	* 37	* 21	21.3	* 18	* 37
Max Q Clear Time (g_c+I1), s	7.3	19.1	17.9	19.8	9.6	37.6	7.5	20.8
Green Ext Time (p_c), s	0.0	0.9	0.0	0.6	0.0	0.0	0.0	0.6

Intersection Summary	
HCM 6th Ctrl Delay	31.2
HCM 6th LOS	C

Notes

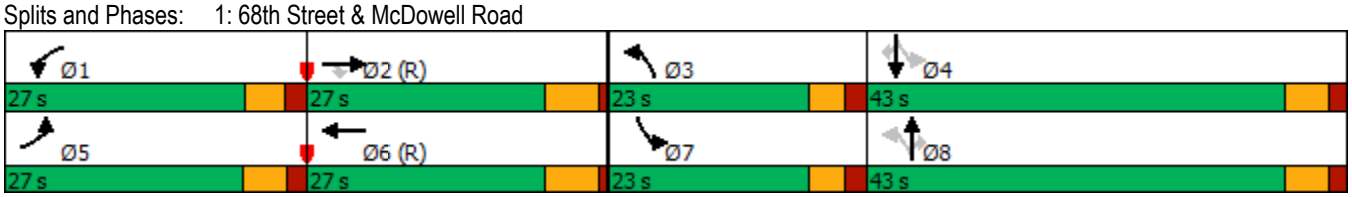
User approved pedestrian interval to be less than phase max green.

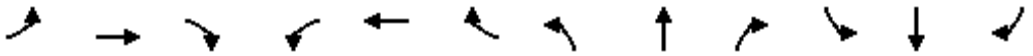
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	106	953	137	74	1771	272	300	90	92	249	221
Future Volume (vph)	106	953	137	74	1771	272	300	90	92	249	221
Turn Type	Prot	NA	Perm	Prot	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6	3	8		7	4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	3	8	8	7	4	4
Switch Phase											
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	5.0	7.0	7.0	5.0	7.0	7.0
Minimum Split (s)	10.8	27.7	27.7	10.6	27.7	10.3	36.7	36.7	10.3	43.7	43.7
Total Split (s)	27.0	27.0	27.0	27.0	27.0	23.0	43.0	43.0	23.0	43.0	43.0
Total Split (%)	22.5%	22.5%	22.5%	22.5%	22.5%	19.2%	35.8%	35.8%	19.2%	35.8%	35.8%
Yellow Time (s)	4.0	4.7	4.7	3.6	4.7	3.3	4.0	4.0	3.3	4.0	4.0
All-Red Time (s)	1.8	1.0	1.0	2.0	1.0	2.0	1.7	1.7	2.0	1.7	1.7
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.8	5.7	5.7	5.6	5.7	5.3	5.7	5.7	5.3	5.7	5.7
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Min	C-Min	None	C-Min	None	None	None	None	None	None
Act Effct Green (s)	11.2	52.8	52.8	8.9	48.3	43.7	30.1	30.1	29.5	21.2	21.2
Actuated g/C Ratio	0.09	0.44	0.44	0.07	0.40	0.36	0.25	0.25	0.25	0.18	0.18
v/c Ratio	0.70	0.46	0.19	0.61	1.00	0.88	0.70	0.20	0.39	0.82	0.52
Control Delay	73.7	26.8	7.6	90.8	41.9	55.9	48.7	3.6	29.3	67.2	10.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	73.7	26.8	7.6	90.8	41.9	55.9	48.7	3.6	29.3	67.2	10.6
LOS	E	C	A	F	D	E	D	A	C	E	B
Approach Delay		28.8			43.7		45.5			38.8	
Approach LOS		C			D		D			D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 92 (77%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 135	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.00	
Intersection Signal Delay: 39.3	Intersection LOS: D
Intersection Capacity Utilization 89.2%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 1: 68th Street & McDowell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	47	1037	31	59	1862	21	31	22	85	19	16	40
Future Volume (veh/h)	47	1037	31	59	1862	21	31	22	85	19	16	40
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	51	1127	34	64	2024	23	34	24	92	21	17	43
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	226	4112	124	451	4202	48	153	35	133	104	48	122
Arrive On Green	1.00	1.00	1.00	1.00	1.00	1.00	0.10	0.10	0.10	0.10	0.10	0.10
Sat Flow, veh/h	206	5093	154	484	5205	59	1343	339	1298	1276	469	1187
Grp Volume(v), veh/h	51	753	408	64	1323	724	34	0	116	21	0	60
Grp Sat Flow(s),veh/h/ln	206	1702	1843	484	1702	1860	1343	0	1637	1276	0	1657
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	8.2	1.9	0.0	4.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	0.0	0.0	6.9	0.0	8.2	10.2	0.0	4.0
Prop In Lane	1.00		0.08	1.00		0.03	1.00		0.79	1.00		0.72
Lane Grp Cap(c), veh/h	226	2748	1488	451	2748	1501	153	0	168	104	0	170
V/C Ratio(X)	0.23	0.27	0.27	0.14	0.48	0.48	0.22	0.00	0.69	0.20	0.00	0.35
Avail Cap(c_a), veh/h	226	2748	1488	451	2748	1501	371	0	434	311	0	439
HCM Platoon Ratio	2.00	2.00	2.00	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.90	0.90	0.90	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	53.4	0.0	52.0	56.9	0.0	50.1
Incr Delay (d2), s/veh	2.1	0.2	0.4	0.7	0.6	1.1	0.3	0.0	1.9	0.4	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.1	0.2	0.1	0.2	0.5	1.0	0.0	3.4	0.6	0.0	1.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	2.1	0.2	0.4	0.7	0.6	1.1	53.6	0.0	53.9	57.2	0.0	50.6
LnGrp LOS	A	A	A	A	A	A	D	A	D	E	A	D
Approach Vol, veh/h		1212			2111			150			81	
Approach Delay, s/veh		0.4			0.8			53.8			52.3	
Approach LOS		A			A			D			D	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		102.5		17.5		102.5		17.5				
Change Period (Y+Rc), s		* 5.6		* 5.2		* 5.6		* 5.2				
Max Green Setting (Gmax), s		* 77		* 32		* 77		* 32				
Max Q Clear Time (g_c+I1), s		2.0		12.2		2.0		10.2				
Green Ext Time (p_c), s		4.2		0.2		6.9		0.4				

Intersection Summary												
HCM 6th Ctrl Delay			4.1									
HCM 6th LOS			A									

Notes

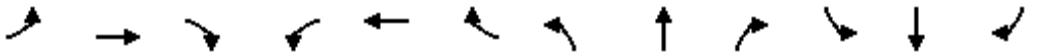
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	47	1037	59	1862	31	22	19	16
Future Volume (vph)	47	1037	59	1862	31	22	19	16
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	2	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	7.0	7.0	7.0	7.0
Minimum Split (s)	23.6	23.6	23.6	23.6	35.2	35.2	35.2	35.2
Total Split (s)	83.0	83.0	83.0	83.0	37.0	37.0	37.0	37.0
Total Split (%)	69.2%	69.2%	69.2%	69.2%	30.8%	30.8%	30.8%	30.8%
Yellow Time (s)	4.4	4.4	4.4	4.4	3.3	3.3	3.3	3.3
All-Red Time (s)	1.2	1.2	1.2	1.2	1.9	1.9	1.9	1.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.6	5.6	5.6	5.6	5.2	5.2	5.2	5.2
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	C-Min	C-Min	C-Min	C-Min	None	None	None	None
Act Effct Green (s)	100.6	100.6	100.6	100.6	8.6	8.6	8.6	8.6
Actuated g/C Ratio	0.84	0.84	0.84	0.84	0.07	0.07	0.07	0.07
v/c Ratio	0.39	0.27	0.18	0.48	0.36	0.57	0.32	0.45
Control Delay	26.3	3.2	2.2	3.1	62.6	27.3	65.3	51.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.3	3.2	2.2	3.1	62.6	27.3	65.3	51.7
LOS	C	A	A	A	E	C	E	D
Approach Delay		4.2		3.0		35.3		55.2
Approach LOS		A		A		D		E

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 62 (52%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 70	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.57	
Intersection Signal Delay: 6.0	Intersection LOS: A
Intersection Capacity Utilization 66.4%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2: 70th Street & McDowell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	333	564	133	114	1386	339	264	897	129	193	568	296
Future Volume (veh/h)	333	564	133	114	1386	339	264	897	129	193	568	296
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	362	613	145	124	1507	368	287	975	140	210	617	322
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	428	1993	619	181	1627	505	349	1298	186	270	1352	420
Arrive On Green	0.04	0.13	0.13	0.05	0.32	0.32	0.10	0.29	0.29	0.08	0.26	0.26
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	3456	4512	646	3456	5106	1585
Grp Volume(v), veh/h	362	613	145	124	1507	368	287	735	380	210	617	322
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1728	1702	1754	1728	1702	1585
Q Serve(g_s), s	12.5	13.1	9.9	4.2	34.2	24.7	9.8	23.5	23.6	7.2	12.1	22.5
Cycle Q Clear(g_c), s	12.5	13.1	9.9	4.2	34.2	24.7	9.8	23.5	23.6	7.2	12.1	22.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.37	1.00		1.00
Lane Grp Cap(c), veh/h	428	1993	619	181	1627	505	349	980	505	270	1352	420
V/C Ratio(X)	0.85	0.31	0.23	0.69	0.93	0.73	0.82	0.75	0.75	0.78	0.46	0.77
Avail Cap(c_a), veh/h	590	1993	619	590	1659	515	587	980	505	472	1352	420
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	56.4	37.6	36.2	55.9	39.5	36.3	52.9	38.8	38.9	54.3	36.9	40.7
Incr Delay (d2), s/veh	6.1	0.0	0.1	1.7	9.1	4.4	1.9	5.3	10.0	1.9	1.1	12.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.2	5.9	4.1	1.9	15.2	9.9	4.3	10.3	11.3	3.1	5.1	10.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	62.5	37.6	36.2	57.6	48.6	40.7	54.7	44.1	48.8	56.2	38.0	53.3
LnGrp LOS	E	D	D	E	D	D	D	D	D	E	D	D
Approach Vol, veh/h		1120			1999			1402			1149	
Approach Delay, s/veh		45.5			47.7			47.6			45.6	
Approach LOS		D			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	17.7	37.7	20.5	44.1	15.0	40.4	11.9	52.7
Change Period (Y+Rc), s	5.6	5.9	5.6	5.9	5.6	5.9	5.6	5.9
Max Green Setting (Gmax), s	20.4	17.1	20.5	39.0	16.4	21.1	20.5	39.0
Max Q Clear Time (g_c+I1), s	11.8	24.5	14.5	36.2	9.2	25.6	6.2	15.1
Green Ext Time (p_c), s	0.4	0.0	0.4	2.0	0.2	0.0	0.2	2.9

Intersection Summary	
HCM 6th Ctrl Delay	46.8
HCM 6th LOS	D

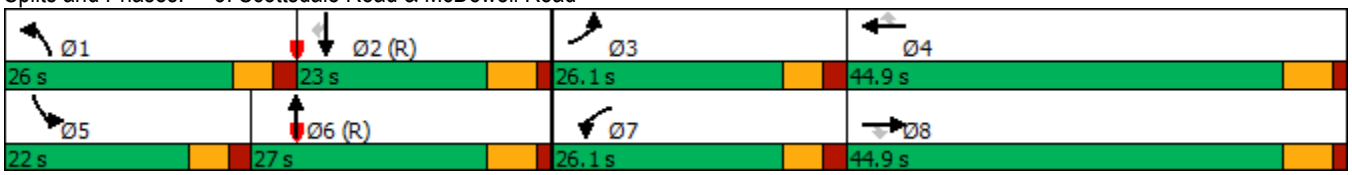
Notes

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

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	333	564	133	114	1386	339	264	897	193	568	296
Future Volume (vph)	333	564	133	114	1386	339	264	897	193	568	296
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	NA	Perm
Protected Phases	3	8		7	4		1	6	5	2	
Permitted Phases			8			4					2
Detector Phase	3	8	8	7	4	4	1	6	5	2	2
Switch Phase											
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	5.0	10.0	10.0
Minimum Split (s)	10.6	34.9	34.9	10.6	37.9	37.9	10.6	36.9	10.6	36.9	36.9
Total Split (s)	26.1	44.9	44.9	26.1	44.9	44.9	26.0	27.0	22.0	23.0	23.0
Total Split (%)	21.8%	37.4%	37.4%	21.8%	37.4%	37.4%	21.7%	22.5%	18.3%	19.2%	19.2%
Yellow Time (s)	3.6	4.4	4.4	3.6	4.4	4.4	3.6	4.4	3.6	4.4	4.4
All-Red Time (s)	2.0	1.5	1.5	2.0	1.5	1.5	2.0	1.5	2.0	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.6	5.9	5.9	5.6	5.9	5.9	5.6	5.9	5.6	5.9	5.9
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Min	None	C-Min	C-Min
Act Effct Green (s)	16.7	48.2	48.2	8.7	40.2	40.2	14.4	28.4	11.7	25.7	25.7
Actuated g/C Ratio	0.14	0.40	0.40	0.07	0.34	0.34	0.12	0.24	0.10	0.21	0.21
v/c Ratio	0.76	0.30	0.20	0.50	0.89	0.57	0.70	0.93	0.63	0.57	0.54
Control Delay	72.3	12.0	1.8	60.1	45.1	20.0	59.7	59.2	60.4	45.9	8.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	72.3	12.0	1.8	60.1	45.1	20.0	59.7	59.2	60.4	45.9	8.7
LOS	E	B	A	E	D	C	E	E	E	D	A
Approach Delay		30.2			41.4			59.3		38.1	
Approach LOS		C			D			E		D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 80 (67%), Referenced to phase 2:SBT and 6:NBT, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.93	
Intersection Signal Delay: 43.0	Intersection LOS: D
Intersection Capacity Utilization 81.2%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 3: Scottsdale Road & McDowell Road



Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	1115	6	0	1948	32	0	0	4	0	0	4
Future Vol, veh/h	0	1115	6	0	1948	32	0	0	4	0	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	1212	7	0	2117	35	0	0	4	0	0	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	-	-	0	-	-	610	-	-	1076
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	-	-	-	7.14	-	-	7.14
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	-	-	-	3.92	-	-	3.92
Pot Cap-1 Maneuver	0	-	-	0	-	-	0	0	*675	0	0	*459
Stage 1	0	-	-	0	-	-	0	0	-	0	0	-
Stage 2	0	-	-	0	-	-	0	0	-	0	0	-
Platoon blocked, %		-	-		-	-			1			1
Mov Cap-1 Maneuver	-	-	-	-	-	-	-	-	*675	-	-	*459
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	10.4	12.9
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT	WBR	SBLn1
Capacity (veh/h)	675	-	-	-	-	459
HCM Lane V/C Ratio	0.006	-	-	-	-	0.009
HCM Control Delay (s)	10.4	-	-	-	-	12.9
HCM Lane LOS	B	-	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	-	0

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

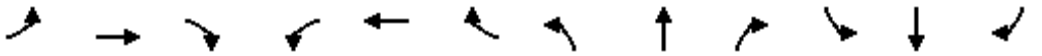
Intersection	
Int Delay, s/veh	0.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	3	4	85	5	5	61
Future Vol, veh/h	3	4	85	5	5	61
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	3	4	92	5	5	66

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	171	95	0	0	97	0
Stage 1	95	-	-	-	-	-
Stage 2	76	-	-	-	-	-
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	858	1011	-	-	1516	-
Stage 1	956	-	-	-	-	-
Stage 2	947	-	-	-	-	-
Platoon blocked, %	1	1	-	-	1	-
Mov Cap-1 Maneuver	856	1011	-	-	1516	-
Mov Cap-2 Maneuver	856	-	-	-	-	-
Stage 1	956	-	-	-	-	-
Stage 2	944	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.9	0	0.6
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	938	1516	-
HCM Lane V/C Ratio	-	-	0.008	0.004	-
HCM Control Delay (s)	-	-	8.9	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	198	1772	235	49	912	124	128	206	85	124	326	120
Future Volume (veh/h)	198	1772	235	49	912	124	128	206	85	124	326	120
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	215	1926	255	53	991	135	139	224	92	135	354	130
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	242	2533	786	68	1805	245	210	383	325	296	388	329
Arrive On Green	0.14	0.50	0.50	0.08	0.79	0.79	0.07	0.20	0.20	0.08	0.21	0.21
Sat Flow, veh/h	1781	5106	1585	1781	4545	618	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	215	1926	255	53	742	384	139	224	92	135	354	130
Grp Sat Flow(s),veh/h/ln	1781	1702	1585	1781	1702	1759	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	14.2	36.6	11.6	3.5	9.5	9.6	7.3	13.0	5.9	7.1	22.2	8.5
Cycle Q Clear(g_c), s	14.2	36.6	11.6	3.5	9.5	9.6	7.3	13.0	5.9	7.1	22.2	8.5
Prop In Lane	1.00		1.00	1.00		0.35	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	242	2533	786	68	1352	698	210	383	325	296	388	329
V/C Ratio(X)	0.89	0.76	0.32	0.78	0.55	0.55	0.66	0.58	0.28	0.46	0.91	0.40
Avail Cap(c_a), veh/h	315	2533	786	318	1352	698	210	546	462	371	628	532
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.97	0.97	0.97	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	51.0	24.5	18.2	54.9	8.4	8.4	36.3	43.1	40.3	34.5	46.5	41.1
Incr Delay (d2), s/veh	18.4	2.2	1.1	6.8	1.6	3.0	6.2	0.5	0.2	0.4	7.9	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.5	14.4	4.4	1.6	2.6	3.0	3.5	6.0	2.3	3.1	11.0	3.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	69.4	26.7	19.2	61.8	10.0	11.5	42.5	43.6	40.5	34.9	54.4	41.3
LnGrp LOS	E	C	B	E	A	B	D	D	D	C	D	D
Approach Vol, veh/h		2396			1179			455			619	
Approach Delay, s/veh		29.7			12.8			42.6			47.4	
Approach LOS		C			B			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.2	65.2	14.0	30.6	22.1	53.3	14.3	30.3
Change Period (Y+Rc), s	5.6	5.7	* 5.3	* 5.7	* 5.8	5.7	* 5.3	* 5.7
Max Green Setting (Gmax), s	21.4	27.3	* 8.7	* 40	* 21	27.3	* 14	* 35
Max Q Clear Time (g_c+I1), s	5.5	38.6	9.3	24.2	16.2	11.6	9.1	15.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.7	0.0	2.5	0.0	0.4

Intersection Summary	
HCM 6th Ctrl Delay	29.0
HCM 6th LOS	C

Notes

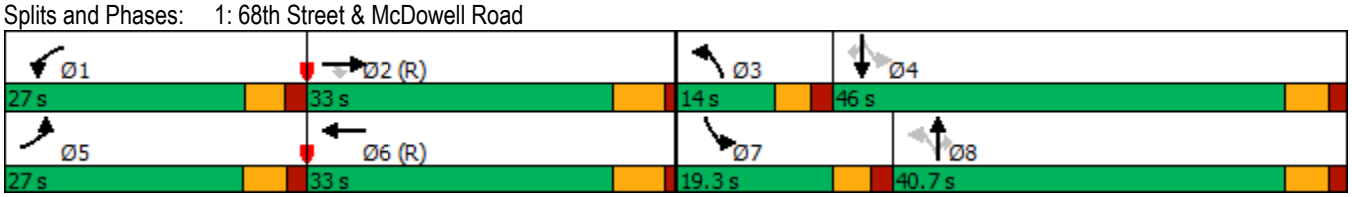
User approved pedestrian interval to be less than phase max green.

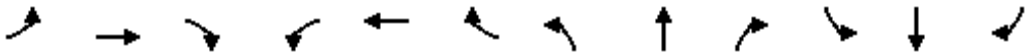
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	198	1772	235	49	912	128	206	85	124	326	120
Future Volume (vph)	198	1772	235	49	912	128	206	85	124	326	120
Turn Type	Prot	NA	Perm	Prot	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6	3	8		7	4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	3	8	8	7	4	4
Switch Phase											
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	5.0	7.0	7.0	5.0	7.0	7.0
Minimum Split (s)	10.8	27.7	27.7	10.6	27.7	10.3	36.7	36.7	10.3	43.7	43.7
Total Split (s)	27.0	33.0	33.0	27.0	33.0	14.0	40.7	40.7	19.3	46.0	46.0
Total Split (%)	22.5%	27.5%	27.5%	22.5%	27.5%	11.7%	33.9%	33.9%	16.1%	38.3%	38.3%
Yellow Time (s)	4.0	4.7	4.7	3.6	4.7	3.3	4.0	4.0	3.3	4.0	4.0
All-Red Time (s)	1.8	1.0	1.0	2.0	1.0	2.0	1.7	1.7	2.0	1.7	1.7
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.8	5.7	5.7	5.6	5.7	5.3	5.7	5.7	5.3	5.7	5.7
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Min	C-Min	None	C-Min	None	None	None	None	None	None
Act Effct Green (s)	18.0	57.5	57.5	7.3	44.5	33.8	25.2	25.2	37.0	26.8	26.8
Actuated g/C Ratio	0.15	0.48	0.48	0.06	0.37	0.28	0.21	0.21	0.31	0.22	0.22
v/c Ratio	0.81	0.79	0.31	0.50	0.60	0.68	0.57	0.21	0.43	0.85	0.29
Control Delay	71.6	31.5	12.9	89.5	16.1	44.9	48.0	3.6	31.1	63.4	8.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.6	31.5	12.9	89.5	16.1	44.9	48.0	3.6	31.1	63.4	8.1
LOS	E	C	B	F	B	D	D	A	C	E	A
Approach Delay		33.1			19.4		38.1			44.8	
Approach LOS		C			B		D			D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 110 (92%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 105	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.85	
Intersection Signal Delay: 31.7	Intersection LOS: C
Intersection Capacity Utilization 81.2%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 1: 68th Street & McDowell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	73	1920	17	77	1014	47	21	19	50	27	16	33
Future Volume (veh/h)	73	1920	17	77	1014	47	21	19	50	27	16	33
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	79	2087	18	84	1102	51	23	21	54	29	17	36
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	439	4317	37	221	4136	191	132	39	99	112	44	94
Arrive On Green	1.00	1.00	1.00	0.83	0.83	0.83	0.08	0.08	0.08	0.08	0.08	0.08
Sat Flow, veh/h	487	5221	45	194	5001	231	1351	464	1192	1325	535	1132
Grp Volume(v), veh/h	79	1360	745	84	750	403	23	0	75	29	0	53
Grp Sat Flow(s),veh/h/ln	487	1702	1862	194	1702	1829	1351	0	1656	1325	0	1667
Q Serve(g_s), s	1.4	0.0	0.0	15.8	5.9	5.9	2.0	0.0	5.2	2.6	0.0	3.6
Cycle Q Clear(g_c), s	7.3	0.0	0.0	15.8	5.9	5.9	5.6	0.0	5.2	7.8	0.0	3.6
Prop In Lane	1.00		0.02	1.00		0.13	1.00		0.72	1.00		0.68
Lane Grp Cap(c), veh/h	439	2815	1540	221	2815	1512	132	0	138	112	0	139
V/C Ratio(X)	0.18	0.48	0.48	0.38	0.27	0.27	0.17	0.00	0.54	0.26	0.00	0.38
Avail Cap(c_a), veh/h	439	2815	1540	221	2815	1512	456	0	535	431	0	539
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.59	0.59	0.59	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	0.2	0.0	0.0	3.2	2.3	2.3	54.7	0.0	52.8	56.6	0.0	52.1
Incr Delay (d2), s/veh	0.5	0.4	0.6	4.9	0.2	0.4	0.2	0.0	1.2	0.4	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.1	0.3	0.7	1.3	1.4	0.7	0.0	2.2	0.9	0.0	1.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.7	0.4	0.6	8.1	2.5	2.7	55.0	0.0	54.1	57.0	0.0	52.7
LnGrp LOS	A	A	A	A	A	A	D	A	D	E	A	D
Approach Vol, veh/h		2184			1237			98			82	
Approach Delay, s/veh		0.5			3.0			54.3			54.3	
Approach LOS		A			A			D			D	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		104.8		15.2		104.8		15.2				
Change Period (Y+Rc), s		* 5.6		* 5.2		* 5.6		* 5.2				
Max Green Setting (Gmax), s		* 70		* 39		* 70		* 39				
Max Q Clear Time (g_c+I1), s		9.3		9.8		17.8		7.6				
Green Ext Time (p_c), s		7.4		0.2		5.6		0.3				

Intersection Summary	
HCM 6th Ctrl Delay	4.0
HCM 6th LOS	A

Notes

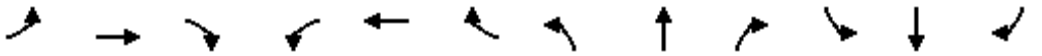
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	73	1920	77	1014	21	19	27	16
Future Volume (vph)	73	1920	77	1014	21	19	27	16
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	2	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	7.0	7.0	7.0	7.0
Minimum Split (s)	23.6	23.6	23.6	23.6	35.2	35.2	35.2	35.2
Total Split (s)	76.0	76.0	76.0	76.0	44.0	44.0	44.0	44.0
Total Split (%)	63.3%	63.3%	63.3%	63.3%	36.7%	36.7%	36.7%	36.7%
Yellow Time (s)	4.4	4.4	4.4	4.4	3.3	3.3	3.3	3.3
All-Red Time (s)	1.2	1.2	1.2	1.2	1.9	1.9	1.9	1.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.6	5.6	5.6	5.6	5.2	5.2	5.2	5.2
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	C-Min	C-Min	C-Min	C-Min	None	None	None	None
Act Effct Green (s)	103.0	103.0	103.0	103.0	9.7	9.7	9.7	9.7
Actuated g/C Ratio	0.86	0.86	0.86	0.86	0.08	0.08	0.08	0.08
v/c Ratio	0.21	0.48	0.69	0.27	0.21	0.53	0.27	0.32
Control Delay	1.1	1.3	56.3	8.6	54.8	60.0	57.0	28.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.1	1.3	56.3	8.6	54.8	60.0	57.0	28.0
LOS	A	A	E	A	D	E	E	C
Approach Delay		1.3		11.9		58.8		38.2
Approach LOS		A		B		E		D

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 106 (88%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 140	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.69	
Intersection Signal Delay: 7.4	Intersection LOS: A
Intersection Capacity Utilization 67.6%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2: 70th Street & McDowell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	323	1256	240	234	686	333	207	966	234	454	1117	241
Future Volume (veh/h)	323	1256	240	234	686	333	207	966	234	454	1117	241
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	351	1365	261	254	746	362	225	1050	254	493	1214	262
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	422	1446	449	318	1292	401	282	1353	327	357	1795	557
Arrive On Green	0.04	0.09	0.09	0.09	0.25	0.25	0.08	0.33	0.33	0.10	0.35	0.35
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	3456	4104	992	3456	5106	1585
Grp Volume(v), veh/h	351	1365	261	254	746	362	225	871	433	493	1214	262
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1728	1702	1692	1728	1702	1585
Q Serve(g_s), s	12.1	31.9	18.9	8.6	15.3	26.5	7.7	27.6	27.7	12.4	24.3	15.4
Cycle Q Clear(g_c), s	12.1	31.9	18.9	8.6	15.3	26.5	7.7	27.6	27.7	12.4	24.3	15.4
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.59	1.00		1.00
Lane Grp Cap(c), veh/h	422	1446	449	318	1292	401	282	1122	558	357	1795	557
V/C Ratio(X)	0.83	0.94	0.58	0.80	0.58	0.90	0.80	0.78	0.78	1.38	0.68	0.47
Avail Cap(c_a), veh/h	818	1446	449	818	1408	437	357	1122	558	357	1795	557
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	56.4	53.4	47.6	53.4	39.2	43.4	54.1	36.2	36.2	53.8	33.1	30.2
Incr Delay (d2), s/veh	1.7	12.6	1.3	1.8	0.3	19.6	7.5	5.3	10.2	187.9	2.1	2.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	16.2	8.2	3.8	6.3	12.3	3.6	11.9	12.6	14.6	10.1	6.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	58.0	66.0	48.8	55.2	39.5	63.0	61.6	41.5	46.4	241.7	35.2	33.1
LnGrp LOS	E	E	D	E	D	E	E	D	D	F	D	C
Approach Vol, veh/h		1977			1362			1529			1969	
Approach Delay, s/veh		62.3			48.6			45.8			86.6	
Approach LOS		E			D			D			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.4	48.1	20.3	36.3	18.0	45.5	16.6	39.9
Change Period (Y+Rc), s	5.6	5.9	5.6	5.9	5.6	5.9	5.6	5.9
Max Green Setting (Gmax), s	12.4	23.1	28.4	33.1	12.4	23.1	28.4	33.1
Max Q Clear Time (g_c+I1), s	9.7	26.3	14.1	28.5	14.4	29.7	10.6	33.9
Green Ext Time (p_c), s	0.1	0.0	0.6	1.8	0.0	0.0	0.4	0.0

Intersection Summary	
HCM 6th Ctrl Delay	62.9
HCM 6th LOS	E

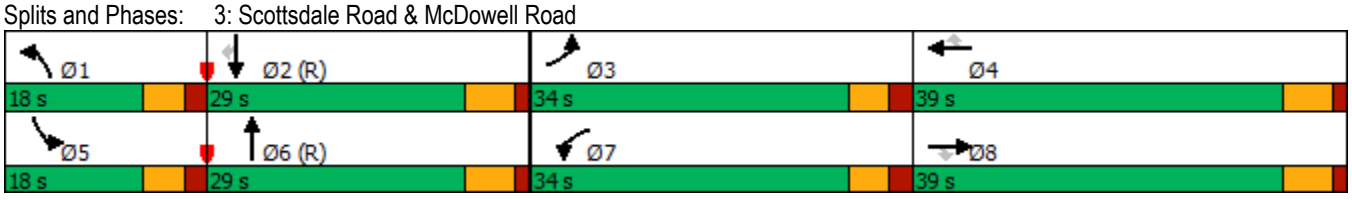
Notes

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

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	323	1256	240	234	686	333	207	966	454	1117	241
Future Volume (vph)	323	1256	240	234	686	333	207	966	454	1117	241
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	NA	Perm
Protected Phases	3	8		7	4		1	6	5	2	
Permitted Phases			8			4					2
Detector Phase	3	8	8	7	4	4	1	6	5	2	2
Switch Phase											
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	5.0	10.0	10.0
Minimum Split (s)	10.6	34.9	34.9	10.6	37.9	37.9	10.6	36.9	10.6	36.9	36.9
Total Split (s)	34.0	39.0	39.0	34.0	39.0	39.0	18.0	29.0	18.0	29.0	29.0
Total Split (%)	28.3%	32.5%	32.5%	28.3%	32.5%	32.5%	15.0%	24.2%	15.0%	24.2%	24.2%
Yellow Time (s)	3.6	4.4	4.4	3.6	4.4	4.4	3.6	4.4	3.6	4.4	4.4
All-Red Time (s)	2.0	1.5	1.5	2.0	1.5	1.5	2.0	1.5	2.0	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.6	5.9	5.9	5.6	5.9	5.9	5.6	5.9	5.6	5.9	5.9
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Min	None	C-Min	C-Min
Act Effct Green (s)	16.7	40.7	40.7	13.3	37.4	37.4	11.5	23.1	19.9	31.4	31.4
Actuated g/C Ratio	0.14	0.34	0.34	0.11	0.31	0.31	0.10	0.19	0.17	0.26	0.26
v/c Ratio	0.74	0.79	0.42	0.67	0.47	0.53	0.68	1.33	0.87	0.91	0.50
Control Delay	65.1	23.2	6.5	59.8	34.1	10.7	63.2	190.9	66.4	55.0	20.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.1	23.2	6.5	59.8	34.1	10.7	63.2	190.9	66.4	55.0	20.8
LOS	E	C	A	E	C	B	E	F	E	E	C
Approach Delay		28.4			32.7			172.2		53.3	
Approach LOS		C			C			F		D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 100 (83%), Referenced to phase 2:SBT and 6:NBT, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.33	
Intersection Signal Delay: 68.6	Intersection LOS: E
Intersection Capacity Utilization 86.9%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 3: Scottsdale Road & McDowell Road



Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	1910	4	0	1139	7	0	0	4	0	0	33
Future Vol, veh/h	0	1910	4	0	1139	7	0	0	4	0	0	33
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	2076	4	0	1238	8	0	0	4	0	0	36

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	-	-	0	-	-	1040	-	-	623
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	-	-	-	7.14	-	-	7.14
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	-	-	-	3.92	-	-	3.92
Pot Cap-1 Maneuver	0	-	-	0	-	-	0	0	*480	0	0	*653
Stage 1	0	-	-	0	-	-	0	0	-	0	0	-
Stage 2	0	-	-	0	-	-	0	0	-	0	0	-
Platoon blocked, %		-	-		-	-			1			1
Mov Cap-1 Maneuver	-	-	-	-	-	-	-	-	*480	-	-	*653
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	12.6	10.8
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT	WBR	SBLn1
Capacity (veh/h)	480	-	-	-	-	653
HCM Lane V/C Ratio	0.009	-	-	-	-	0.055
HCM Control Delay (s)	12.6	-	-	-	-	10.8
HCM Lane LOS	B	-	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	-	0.2

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	0.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	7	133	0	3	57
Future Vol, veh/h	10	7	133	0	3	57
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	11	8	145	0	3	62

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	213	145	0	0	145	0
Stage 1	145	-	-	-	-	-
Stage 2	68	-	-	-	-	-
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	827	967	-	-	1461	-
Stage 1	917	-	-	-	-	-
Stage 2	955	-	-	-	-	-
Platoon blocked, %	1	1	-	-	1	-
Mov Cap-1 Maneuver	826	967	-	-	1461	-
Mov Cap-2 Maneuver	826	-	-	-	-	-
Stage 1	917	-	-	-	-	-
Stage 2	953	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.2	0	0.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	879	1461	-
HCM Lane V/C Ratio	-	-	0.021	0.002	-
HCM Control Delay (s)	-	-	9.2	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Appendix J – Year 2022 Build Capacity Analysis

J

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	106	960	137	74	1801	99	272	300	90	92	249	221
Future Volume (veh/h)	106	960	137	74	1801	99	272	300	90	92	249	221
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	115	1043	149	80	1958	108	296	326	98	100	271	240
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	140	2250	698	100	2063	113	349	480	407	264	317	269
Arrive On Green	0.08	0.44	0.44	0.11	0.83	0.83	0.15	0.26	0.26	0.06	0.17	0.17
Sat Flow, veh/h	1781	5106	1585	1781	4953	272	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	115	1043	149	80	1344	722	296	326	98	100	271	240
Grp Sat Flow(s),veh/h/ln	1781	1702	1585	1781	1702	1821	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	7.6	17.2	7.0	5.3	37.6	38.4	15.9	18.8	5.9	5.5	16.9	17.8
Cycle Q Clear(g_c), s	7.6	17.2	7.0	5.3	37.6	38.4	15.9	18.8	5.9	5.5	16.9	17.8
Prop In Lane	1.00		1.00	1.00		0.15	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	140	2250	698	100	1418	759	349	480	407	264	317	269
V/C Ratio(X)	0.82	0.46	0.21	0.80	0.95	0.95	0.85	0.68	0.24	0.38	0.85	0.89
Avail Cap(c_a), veh/h	315	2250	698	318	1418	759	349	581	493	419	581	493
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.82	0.82	0.82	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.4	23.6	20.7	52.6	9.0	9.0	33.9	40.1	35.3	38.0	48.4	48.7
Incr Delay (d2), s/veh	4.4	0.7	0.7	4.4	12.4	20.0	16.8	1.5	0.1	0.3	2.6	4.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.5	6.8	2.7	2.3	5.9	8.0	8.4	8.7	2.3	2.4	8.0	7.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	58.9	24.3	21.4	56.9	21.3	29.1	50.7	41.6	35.4	38.3	50.9	52.8
LnGrp LOS	E	C	C	E	C	C	D	D	D	D	D	D
Approach Vol, veh/h		1307			2146			720			611	
Approach Delay, s/veh		27.0			25.3			44.5			49.6	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.4	58.6	23.0	26.1	15.2	55.7	12.6	36.5
Change Period (Y+Rc), s	5.6	5.7	* 5.3	* 5.7	* 5.8	5.7	* 5.3	* 5.7
Max Green Setting (Gmax), s	21.4	21.3	* 18	* 37	* 21	21.3	* 18	* 37
Max Q Clear Time (g_c+I1), s	7.3	19.2	17.9	19.8	9.6	40.4	7.5	20.8
Green Ext Time (p_c), s	0.0	0.8	0.0	0.6	0.0	0.0	0.0	0.6

Intersection Summary	
HCM 6th Ctrl Delay	31.7
HCM 6th LOS	C

Notes

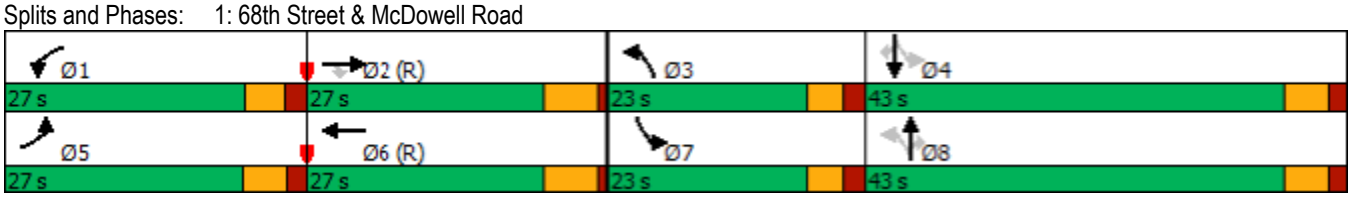
User approved pedestrian interval to be less than phase max green.

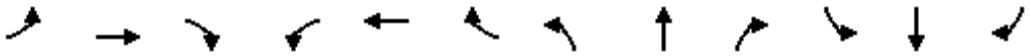
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	106	960	137	74	1801	272	300	90	92	249	221
Future Volume (vph)	106	960	137	74	1801	272	300	90	92	249	221
Turn Type	Prot	NA	Perm	Prot	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6	3	8		7	4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	3	8	8	7	4	4
Switch Phase											
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	5.0	7.0	7.0	5.0	7.0	7.0
Minimum Split (s)	10.8	27.7	27.7	10.6	27.7	10.3	36.7	36.7	10.3	43.7	43.7
Total Split (s)	27.0	27.0	27.0	27.0	27.0	23.0	43.0	43.0	23.0	43.0	43.0
Total Split (%)	22.5%	22.5%	22.5%	22.5%	22.5%	19.2%	35.8%	35.8%	19.2%	35.8%	35.8%
Yellow Time (s)	4.0	4.7	4.7	3.6	4.7	3.3	4.0	4.0	3.3	4.0	4.0
All-Red Time (s)	1.8	1.0	1.0	2.0	1.0	2.0	1.7	1.7	2.0	1.7	1.7
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.8	5.7	5.7	5.6	5.7	5.3	5.7	5.7	5.3	5.7	5.7
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Min	C-Min	None	C-Min	None	None	None	None	None	None
Act Effct Green (s)	11.2	52.8	52.8	8.9	48.3	43.7	30.1	30.1	29.5	21.2	21.2
Actuated g/C Ratio	0.09	0.44	0.44	0.07	0.40	0.36	0.25	0.25	0.25	0.18	0.18
v/c Ratio	0.70	0.47	0.19	0.61	1.02	0.88	0.70	0.20	0.39	0.82	0.52
Control Delay	73.7	26.9	7.6	68.8	62.9	55.9	48.7	3.6	29.3	67.2	10.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	73.7	26.9	7.6	68.8	62.9	55.9	48.7	3.6	29.3	67.2	10.6
LOS	E	C	A	E	E	E	D	A	C	E	B
Approach Delay		28.8			63.1		45.5			38.8	
Approach LOS		C			E		D			D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 92 (77%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 135	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.02	
Intersection Signal Delay: 48.0	Intersection LOS: D
Intersection Capacity Utilization 89.8%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 1: 68th Street & McDowell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	54	1037	31	59	1877	29	31	22	85	63	16	55
Future Volume (veh/h)	54	1037	31	59	1877	29	31	22	85	63	16	55
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	59	1127	34	64	2040	32	34	24	92	68	17	60
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	264	3557	107	396	3621	57	186	47	178	151	50	176
Arrive On Green	0.02	0.47	0.47	0.07	1.00	1.00	0.14	0.14	0.14	0.14	0.14	0.14
Sat Flow, veh/h	1781	5093	154	1781	5179	81	1322	339	1298	1276	362	1278
Grp Volume(v), veh/h	59	753	408	64	1340	732	34	0	116	68	0	77
Grp Sat Flow(s),veh/h/ln	1781	1702	1843	1781	1702	1856	1322	0	1637	1276	0	1640
Q Serve(g_s), s	1.1	16.6	16.6	1.2	0.0	0.0	2.9	0.0	7.9	6.3	0.0	5.1
Cycle Q Clear(g_c), s	1.1	16.6	16.6	1.2	0.0	0.0	8.0	0.0	7.9	14.2	0.0	5.1
Prop In Lane	1.00		0.08	1.00		0.04	1.00		0.79	1.00		0.78
Lane Grp Cap(c), veh/h	264	2377	1287	396	2380	1298	186	0	225	151	0	225
V/C Ratio(X)	0.22	0.32	0.32	0.16	0.56	0.56	0.18	0.00	0.52	0.45	0.00	0.34
Avail Cap(c_a), veh/h	519	2377	1287	650	2380	1298	398	0	488	357	0	489
HCM Platoon Ratio	0.67	0.67	0.67	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.90	0.90	0.90	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	4.4	14.0	14.0	5.5	0.0	0.0	50.4	0.0	48.0	54.6	0.0	46.8
Incr Delay (d2), s/veh	0.4	0.3	0.6	0.2	1.0	1.8	0.2	0.0	0.7	0.8	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	7.0	7.6	0.4	0.3	0.6	1.0	0.0	3.2	2.0	0.0	2.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	4.8	14.4	14.6	5.7	1.0	1.8	50.6	0.0	48.7	55.4	0.0	47.2
LnGrp LOS	A	B	B	A	A	A	D	A	D	E	A	D
Approach Vol, veh/h		1220			2136			150			145	
Approach Delay, s/veh		14.0			1.4			49.2			51.0	
Approach LOS		B			A			D			D	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.9	89.4		21.7	8.8	89.5		21.7				
Change Period (Y+Rc), s	4.5	* 5.6		* 5.2	4.5	* 5.6		* 5.2				
Max Green Setting (Gmax), s	21.5	* 47		* 36	21.5	* 47		* 36				
Max Q Clear Time (g_c+I1), s	3.2	18.6		16.2	3.1	2.0		10.0				
Green Ext Time (p_c), s	0.1	2.7		0.3	0.1	6.2		0.5				

Intersection Summary	
HCM 6th Ctrl Delay	9.5
HCM 6th LOS	A

Notes

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

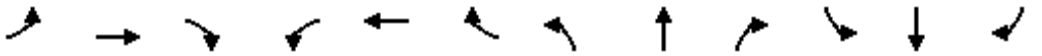
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	54	1037	59	1877	31	22	63	16
Future Volume (vph)	54	1037	59	1877	31	22	63	16
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA	Perm	NA
Protected Phases	5	2	1	6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	1	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	5.0	10.0	7.0	7.0	7.0	7.0
Minimum Split (s)	9.5	23.6	9.5	23.6	35.2	35.2	35.2	35.2
Total Split (s)	26.0	53.0	26.0	53.0	41.0	41.0	41.0	41.0
Total Split (%)	21.7%	44.2%	21.7%	44.2%	34.2%	34.2%	34.2%	34.2%
Yellow Time (s)	3.5	4.4	3.5	4.4	3.3	3.3	3.3	3.3
All-Red Time (s)	1.0	1.2	1.0	1.2	1.9	1.9	1.9	1.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	5.6	4.5	5.6	5.2	5.2	5.2	5.2
Lead/Lag	Lead	Lag	Lead	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes				
Recall Mode	None	C-Min	None	C-Min	None	None	None	None
Act Effct Green (s)	95.3	89.1	95.5	89.1	11.3	11.3	11.3	11.3
Actuated g/C Ratio	0.79	0.74	0.80	0.74	0.09	0.09	0.09	0.09
v/c Ratio	0.31	0.31	0.16	0.55	0.28	0.49	0.72	0.37
Control Delay	23.0	1.1	6.5	26.0	54.5	22.0	89.1	22.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.0	1.1	6.5	26.0	54.5	22.0	89.1	22.1
LOS	C	A	A	C	D	C	F	C
Approach Delay		2.1		25.4		29.3		53.5
Approach LOS		A		C		C		D

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.72	
Intersection Signal Delay: 18.9	Intersection LOS: B
Intersection Capacity Utilization 64.0%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 2: 70th Street & McDowell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	354	576	144	114	1397	339	272	897	129	193	568	302
Future Volume (veh/h)	354	576	144	114	1397	339	272	897	129	193	568	302
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	385	626	157	124	1518	368	296	975	140	210	617	328
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	441	1996	620	178	1608	499	328	1305	187	265	1383	429
Arrive On Green	0.04	0.13	0.13	0.05	0.31	0.31	0.09	0.29	0.29	0.08	0.27	0.27
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	3456	4512	646	3456	5106	1585
Grp Volume(v), veh/h	385	626	157	124	1518	368	296	735	380	210	617	328
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1728	1702	1754	1728	1702	1585
Q Serve(g_s), s	13.3	13.4	10.7	4.2	34.8	24.9	10.2	23.5	23.6	7.2	12.0	22.8
Cycle Q Clear(g_c), s	13.3	13.4	10.7	4.2	34.8	24.9	10.2	23.5	23.6	7.2	12.0	22.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.37	1.00		1.00
Lane Grp Cap(c), veh/h	441	1996	620	178	1608	499	328	985	507	265	1383	429
V/C Ratio(X)	0.87	0.31	0.25	0.70	0.94	0.74	0.90	0.75	0.75	0.79	0.45	0.76
Avail Cap(c_a), veh/h	443	1996	620	251	1621	503	328	985	507	288	1383	429
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	56.5	37.6	36.5	56.0	40.1	36.7	53.7	38.7	38.7	54.5	36.3	40.2
Incr Delay (d2), s/veh	16.5	0.0	0.1	1.8	11.5	4.9	26.0	5.2	9.7	11.6	1.0	12.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.2	6.1	4.4	1.9	15.7	10.0	5.5	10.2	11.2	3.5	5.0	10.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	73.1	37.7	36.6	57.8	51.5	41.6	79.7	43.8	48.4	66.1	37.3	52.4
LnGrp LOS	E	D	D	E	D	D	E	D	D	E	D	D
Approach Vol, veh/h		1168			2010			1411			1155	
Approach Delay, s/veh		49.2			50.1			52.6			46.8	
Approach LOS		D			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	17.0	38.4	20.9	43.7	14.8	40.6	11.8	52.8
Change Period (Y+Rc), s	5.6	5.9	5.6	5.9	5.6	5.9	5.6	5.9
Max Green Setting (Gmax), s	11.4	32.1	15.4	38.1	10.0	33.5	8.7	44.8
Max Q Clear Time (g_c+I1), s	12.2	24.8	15.3	36.8	9.2	25.6	6.2	15.4
Green Ext Time (p_c), s	0.0	2.1	0.0	1.0	0.0	3.1	0.0	3.0

Intersection Summary	
HCM 6th Ctrl Delay	49.9
HCM 6th LOS	D

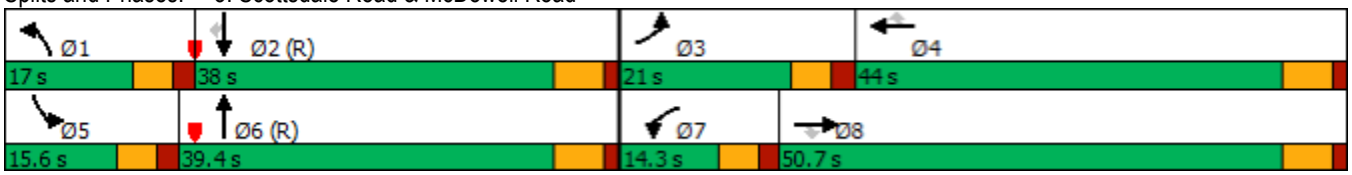
Notes

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

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	354	576	144	114	1397	339	272	897	193	568	302
Future Volume (vph)	354	576	144	114	1397	339	272	897	193	568	302
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	NA	Perm
Protected Phases	3	8		7	4		1	6	5	2	
Permitted Phases			8			4					2
Detector Phase	3	8	8	7	4	4	1	6	5	2	2
Switch Phase											
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	5.0	10.0	10.0
Minimum Split (s)	10.6	34.9	34.9	10.6	37.9	37.9	10.6	36.9	10.6	36.9	36.9
Total Split (s)	21.0	50.7	50.7	14.3	44.0	44.0	17.0	39.4	15.6	38.0	38.0
Total Split (%)	17.5%	42.3%	42.3%	11.9%	36.7%	36.7%	14.2%	32.8%	13.0%	31.7%	31.7%
Yellow Time (s)	3.6	4.4	4.4	3.6	4.4	4.4	3.6	4.4	3.6	4.4	4.4
All-Red Time (s)	2.0	1.5	1.5	2.0	1.5	1.5	2.0	1.5	2.0	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.6	5.9	5.9	5.6	5.9	5.9	5.6	5.9	5.6	5.9	5.9
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Min	None	C-Min	C-Min
Act Effct Green (s)	15.6	46.2	46.2	7.9	38.5	38.5	11.5	33.2	9.7	31.4	31.4
Actuated g/C Ratio	0.13	0.38	0.38	0.07	0.32	0.32	0.10	0.28	0.08	0.26	0.26
v/c Ratio	0.86	0.32	0.22	0.55	0.93	0.59	0.90	0.80	0.76	0.46	0.59
Control Delay	59.7	18.6	5.6	63.5	50.7	21.1	83.7	44.7	71.8	38.6	20.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	59.7	18.6	5.6	63.5	50.7	21.1	83.7	44.7	71.8	38.6	20.9
LOS	E	B	A	E	D	C	F	D	E	D	C
Approach Delay		30.4			46.1			52.9		39.6	
Approach LOS		C			D			D		D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 80 (67%), Referenced to phase 2:SBT and 6:NBT, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.93	
Intersection Signal Delay: 43.3	Intersection LOS: D
Intersection Capacity Utilization 82.0%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 3: Scottsdale Road & McDowell Road



Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	1159	6	0	1956	17	0	0	4	0	0	15
Future Vol, veh/h	0	1159	6	0	1956	17	0	0	4	0	0	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	1260	7	0	2126	18	0	0	4	0	0	16

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	-	-	0	-	-	634	-	-	1072
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	-	-	-	7.14	-	-	7.14
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	-	-	-	3.92	-	-	3.92
Pot Cap-1 Maneuver	0	-	-	0	-	-	0	0	*653	0	0	*459
Stage 1	0	-	-	0	-	-	0	0	-	0	0	-
Stage 2	0	-	-	0	-	-	0	0	-	0	0	-
Platoon blocked, %		-	-		-	-			1			1
Mov Cap-1 Maneuver	-	-	-	-	-	-	-	-	*653	-	-	*459
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	10.6	13.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT	WBR	SBLn1
Capacity (veh/h)	653	-	-	-	-	459
HCM Lane V/C Ratio	0.007	-	-	-	-	0.036
HCM Control Delay (s)	10.6	-	-	-	-	13.1
HCM Lane LOS	B	-	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	-	0.1

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

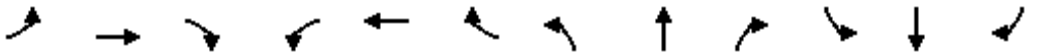
Intersection	
Int Delay, s/veh	2.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	59	2	85	15	1	61
Future Vol, veh/h	59	2	85	15	1	61
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	64	2	92	16	1	66

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	168	100	0	0	108	0
Stage 1	100	-	-	-	-	-
Stage 2	68	-	-	-	-	-
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	862	1004	-	-	1501	-
Stage 1	950	-	-	-	-	-
Stage 2	955	-	-	-	-	-
Platoon blocked, %	1	1	-	-	1	-
Mov Cap-1 Maneuver	861	1004	-	-	1501	-
Mov Cap-2 Maneuver	861	-	-	-	-	-
Stage 1	950	-	-	-	-	-
Stage 2	954	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.5	0	0.1
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	865	1501	-
HCM Lane V/C Ratio	-	-	0.077	0.001	-
HCM Control Delay (s)	-	-	9.5	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0	-



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	198	1797	235	49	922	124	128	206	85	124	326	120
Future Volume (veh/h)	198	1797	235	49	922	124	128	206	85	124	326	120
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	215	1953	255	53	1002	135	139	224	92	135	354	130
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	242	2532	786	68	1807	243	210	383	325	296	388	329
Arrive On Green	0.14	0.50	0.50	0.03	0.27	0.27	0.07	0.20	0.20	0.08	0.21	0.21
Sat Flow, veh/h	1781	5106	1585	1781	4552	612	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	215	1953	255	53	749	388	139	224	92	135	354	130
Grp Sat Flow(s),veh/h/ln	1781	1702	1585	1781	1702	1760	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	14.2	37.5	11.6	3.5	22.7	22.8	7.3	13.0	5.9	7.1	22.2	8.5
Cycle Q Clear(g_c), s	14.2	37.5	11.6	3.5	22.7	22.8	7.3	13.0	5.9	7.1	22.2	8.5
Prop In Lane	1.00		1.00	1.00		0.35	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	242	2532	786	68	1352	699	210	383	325	296	388	329
V/C Ratio(X)	0.89	0.77	0.32	0.77	0.55	0.56	0.66	0.58	0.28	0.46	0.91	0.40
Avail Cap(c_a), veh/h	315	2532	786	318	1352	699	210	546	462	371	628	532
HCM Platoon Ratio	1.00	1.00	1.00	0.67	0.67	0.67	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.96	0.96	0.96	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	51.0	24.7	18.2	57.9	34.9	34.9	36.3	43.1	40.3	34.5	46.5	41.1
Incr Delay (d2), s/veh	18.4	2.3	1.1	6.5	1.6	3.0	6.2	0.5	0.2	0.4	7.9	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.5	14.7	4.4	1.7	10.1	10.7	3.5	6.0	2.3	3.1	11.0	3.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	69.4	27.0	19.3	64.5	36.5	38.0	42.5	43.6	40.5	34.9	54.4	41.3
LnGrp LOS	E	C	B	E	D	D	D	D	D	C	D	D
Approach Vol, veh/h		2423			1190			455			619	
Approach Delay, s/veh		30.0			38.2			42.6			47.4	
Approach LOS		C			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.2	65.2	14.0	30.6	22.1	53.3	14.3	30.3
Change Period (Y+Rc), s	5.6	5.7	* 5.3	* 5.7	* 5.8	5.7	* 5.3	* 5.7
Max Green Setting (Gmax), s	21.4	27.3	* 8.7	* 40	* 21	27.3	* 14	* 35
Max Q Clear Time (g_c+I1), s	5.5	39.5	9.3	24.2	16.2	24.8	9.1	15.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.7	0.0	0.9	0.0	0.4

Intersection Summary	
HCM 6th Ctrl Delay	35.6
HCM 6th LOS	D

Notes

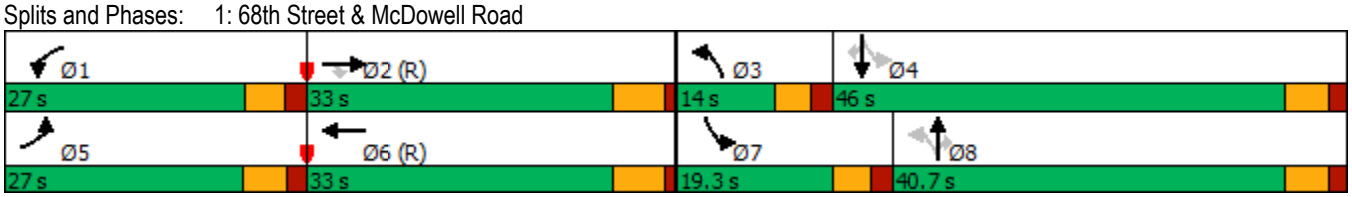
User approved pedestrian interval to be less than phase max green.

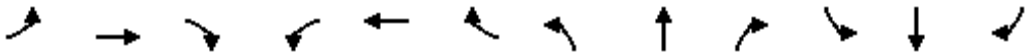
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	198	1797	235	49	922	128	206	85	124	326	120
Future Volume (vph)	198	1797	235	49	922	128	206	85	124	326	120
Turn Type	Prot	NA	Perm	Prot	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6	3	8		7	4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	3	8	8	7	4	4
Switch Phase											
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	5.0	7.0	7.0	5.0	7.0	7.0
Minimum Split (s)	10.8	27.7	27.7	10.6	27.7	10.3	36.7	36.7	10.3	43.7	43.7
Total Split (s)	27.0	33.0	33.0	27.0	33.0	14.0	40.7	40.7	19.3	46.0	46.0
Total Split (%)	22.5%	27.5%	27.5%	22.5%	27.5%	11.7%	33.9%	33.9%	16.1%	38.3%	38.3%
Yellow Time (s)	4.0	4.7	4.7	3.6	4.7	3.3	4.0	4.0	3.3	4.0	4.0
All-Red Time (s)	1.8	1.0	1.0	2.0	1.0	2.0	1.7	1.7	2.0	1.7	1.7
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.8	5.7	5.7	5.6	5.7	5.3	5.7	5.7	5.3	5.7	5.7
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Min	C-Min	None	C-Min	None	None	None	None	None	None
Act Effct Green (s)	18.0	57.5	57.5	7.3	44.5	33.8	25.2	25.2	37.0	26.8	26.8
Actuated g/C Ratio	0.15	0.48	0.48	0.06	0.37	0.28	0.21	0.21	0.31	0.22	0.22
v/c Ratio	0.81	0.80	0.31	0.50	0.61	0.68	0.57	0.21	0.43	0.85	0.29
Control Delay	71.6	31.9	12.9	88.0	17.0	44.9	48.0	3.6	31.1	63.4	8.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.6	31.9	12.9	88.0	17.0	44.9	48.0	3.6	31.1	63.4	8.1
LOS	E	C	B	F	B	D	D	A	C	E	A
Approach Delay		33.4			20.2		38.1			44.8	
Approach LOS		C			C		D			D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 110 (92%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 115	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.85	
Intersection Signal Delay: 32.0	Intersection LOS: C
Intersection Capacity Utilization 81.7%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 1: 68th Street & McDowell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	98	1920	17	77	1019	64	21	19	50	69	16	38
Future Volume (veh/h)	98	1920	17	77	1019	64	21	19	50	69	16	38
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	107	2087	18	84	1108	70	23	21	54	75	17	41
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	473	3745	32	269	3514	222	173	54	138	158	56	136
Arrive On Green	0.08	1.00	1.00	0.08	1.00	1.00	0.12	0.12	0.12	0.12	0.12	0.12
Sat Flow, veh/h	1781	5221	45	1781	4909	310	1345	464	1192	1325	486	1173
Grp Volume(v), veh/h	107	1360	745	84	768	410	23	0	75	75	0	58
Grp Sat Flow(s),veh/h/ln	1781	1702	1862	1781	1702	1815	1345	0	1656	1325	0	1659
Q Serve(g_s), s	1.9	0.0	0.0	1.5	0.0	0.0	1.9	0.0	5.0	6.7	0.0	3.8
Cycle Q Clear(g_c), s	1.9	0.0	0.0	1.5	0.0	0.0	5.8	0.0	5.0	11.7	0.0	3.8
Prop In Lane	1.00		0.02	1.00		0.17	1.00		0.72	1.00		0.71
Lane Grp Cap(c), veh/h	473	2441	1336	269	2437	1299	173	0	192	158	0	193
V/C Ratio(X)	0.23	0.56	0.56	0.31	0.32	0.32	0.13	0.00	0.39	0.47	0.00	0.30
Avail Cap(c_a), veh/h	690	2441	1336	488	2437	1299	362	0	425	344	0	426
HCM Platoon Ratio	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.57	0.57	0.57	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	3.6	0.0	0.0	3.6	0.0	0.0	51.2	0.0	49.1	54.5	0.0	48.6
Incr Delay (d2), s/veh	0.1	0.5	1.0	0.7	0.3	0.6	0.1	0.0	0.5	0.8	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.2	0.4	0.5	0.1	0.2	0.6	0.0	2.1	2.2	0.0	1.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	3.8	0.5	1.0	4.3	0.3	0.6	51.3	0.0	49.6	55.3	0.0	48.9
LnGrp LOS	A	A	A	A	A	A	D	A	D	E	A	D
Approach Vol, veh/h		2212			1262			98			133	
Approach Delay, s/veh		0.8			0.7			50.0			52.5	
Approach LOS		A			A			D			D	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.2	91.7		19.1	9.4	91.5		19.1				
Change Period (Y+Rc), s	4.5	* 5.6		* 5.2	4.5	* 5.6		* 5.2				
Max Green Setting (Gmax), s	19.5	* 54		* 31	19.5	* 54		* 31				
Max Q Clear Time (g_c+I1), s	3.5	2.0		13.7	3.9	2.0		7.8				
Green Ext Time (p_c), s	0.1	6.4		0.2	0.2	2.7		0.3				

Intersection Summary		
HCM 6th Ctrl Delay		3.9
HCM 6th LOS		A

Notes

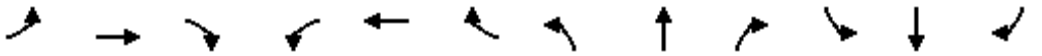
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	98	1920	77	1019	21	19	69	16
Future Volume (vph)	98	1920	77	1019	21	19	69	16
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA	Perm	NA
Protected Phases	5	2	1	6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	1	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	5.0	10.0	7.0	7.0	7.0	7.0
Minimum Split (s)	9.5	23.6	9.5	23.6	35.2	35.2	35.2	35.2
Total Split (s)	24.0	60.0	24.0	60.0	36.0	36.0	36.0	36.0
Total Split (%)	20.0%	50.0%	20.0%	50.0%	30.0%	30.0%	30.0%	30.0%
Yellow Time (s)	3.5	4.4	3.5	4.4	3.3	3.3	3.3	3.3
All-Red Time (s)	1.0	1.2	1.0	1.2	1.9	1.9	1.9	1.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	5.6	4.5	5.6	5.2	5.2	5.2	5.2
Lead/Lag	Lead	Lag	Lead	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes				
Recall Mode	None	C-Min	None	C-Min	None	None	None	None
Act Effct Green (s)	96.1	90.3	98.3	88.7	11.5	11.5	11.5	11.5
Actuated g/C Ratio	0.80	0.75	0.82	0.74	0.10	0.10	0.10	0.10
v/c Ratio	0.27	0.55	0.39	0.32	0.18	0.36	0.60	0.30
Control Delay	2.8	3.6	9.7	9.3	51.1	23.8	70.2	24.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	2.8	3.6	9.7	9.3	51.1	23.8	70.2	24.4
LOS	A	A	A	A	D	C	E	C
Approach Delay		3.5		9.3		30.2		50.3
Approach LOS		A		A		C		D

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.60	
Intersection Signal Delay: 7.9	Intersection LOS: A
Intersection Capacity Utilization 65.0%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2: 70th Street & McDowell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	336	1272	253	234	700	333	223	966	234	454	1117	262
Future Volume (veh/h)	336	1272	253	234	700	333	223	966	234	454	1117	262
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	365	1383	275	254	761	362	242	1050	254	493	1214	285
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	431	1461	453	318	1293	401	298	1341	324	357	1756	545
Arrive On Green	0.12	0.29	0.29	0.09	0.25	0.25	0.09	0.33	0.33	0.10	0.34	0.34
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	3456	4104	992	3456	5106	1585
Grp Volume(v), veh/h	365	1383	275	254	761	362	242	871	433	493	1214	285
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1728	1702	1692	1728	1702	1585
Q Serve(g_s), s	12.4	31.8	18.0	8.6	15.7	26.5	8.3	27.8	27.8	12.4	24.6	17.3
Cycle Q Clear(g_c), s	12.4	31.8	18.0	8.6	15.7	26.5	8.3	27.8	27.8	12.4	24.6	17.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.59	1.00		1.00
Lane Grp Cap(c), veh/h	431	1461	453	318	1293	401	298	1113	553	357	1756	545
V/C Ratio(X)	0.85	0.95	0.61	0.80	0.59	0.90	0.81	0.78	0.78	1.38	0.69	0.52
Avail Cap(c_a), veh/h	818	1461	453	818	1408	437	357	1113	553	357	1756	545
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	51.4	41.9	37.0	53.4	39.3	43.4	53.9	36.5	36.5	53.8	33.9	31.5
Incr Delay (d2), s/veh	1.8	12.9	1.7	1.8	0.3	19.5	9.5	5.5	10.6	187.9	2.3	3.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.4	14.7	7.0	3.8	6.5	12.3	3.9	12.0	12.8	14.6	10.2	7.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	53.2	54.8	38.7	55.2	39.6	62.9	63.4	42.0	47.2	241.7	36.1	35.0
LnGrp LOS	D	D	D	E	D	E	E	D	D	F	D	D
Approach Vol, veh/h		2023			1377			1546			1992	
Approach Delay, s/veh		52.3			48.6			46.8			86.9	
Approach LOS		D			D			D			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	16.0	47.2	20.6	36.3	18.0	45.1	16.6	40.2
Change Period (Y+Rc), s	5.6	5.9	5.6	5.9	5.6	5.9	5.6	5.9
Max Green Setting (Gmax), s	12.4	23.1	28.4	33.1	12.4	23.1	28.4	33.1
Max Q Clear Time (g_c+I1), s	10.3	26.6	14.4	28.5	14.4	29.8	10.6	33.8
Green Ext Time (p_c), s	0.1	0.0	0.6	1.9	0.0	0.0	0.4	0.0

Intersection Summary	
HCM 6th Ctrl Delay	60.3
HCM 6th LOS	E

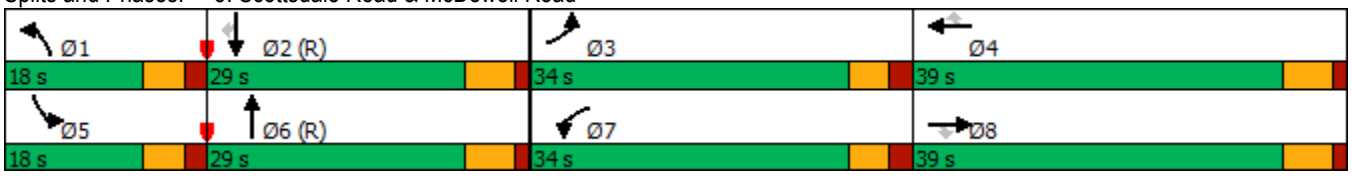
Notes

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

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	336	1272	253	234	700	333	223	966	454	1117	262
Future Volume (vph)	336	1272	253	234	700	333	223	966	454	1117	262
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	NA	Perm
Protected Phases	3	8		7	4		1	6	5	2	
Permitted Phases			8			4					2
Detector Phase	3	8	8	7	4	4	1	6	5	2	2
Switch Phase											
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	5.0	10.0	10.0
Minimum Split (s)	10.6	34.9	34.9	10.6	37.9	37.9	10.6	36.9	10.6	36.9	36.9
Total Split (s)	34.0	39.0	39.0	34.0	39.0	39.0	18.0	29.0	18.0	29.0	29.0
Total Split (%)	28.3%	32.5%	32.5%	28.3%	32.5%	32.5%	15.0%	24.2%	15.0%	24.2%	24.2%
Yellow Time (s)	3.6	4.4	4.4	3.6	4.4	4.4	3.6	4.4	3.6	4.4	4.4
All-Red Time (s)	2.0	1.5	1.5	2.0	1.5	1.5	2.0	1.5	2.0	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.6	5.9	5.9	5.6	5.9	5.9	5.6	5.9	5.6	5.9	5.9
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Min	None	C-Min	C-Min
Act Effct Green (s)	17.2	41.6	41.6	13.3	37.8	37.8	12.0	23.1	19.0	30.1	30.1
Actuated g/C Ratio	0.14	0.35	0.35	0.11	0.32	0.32	0.10	0.19	0.16	0.25	0.25
v/c Ratio	0.74	0.78	0.43	0.67	0.48	0.53	0.71	1.33	0.91	0.95	0.55
Control Delay	62.8	24.1	7.6	59.8	34.0	11.1	63.9	190.9	72.3	61.2	21.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.8	24.1	7.6	59.8	34.0	11.1	63.9	190.9	72.3	61.2	21.8
LOS	E	C	A	E	C	B	E	F	E	E	C
Approach Delay		28.8			32.8			171.1		58.3	
Approach LOS		C			C			F		E	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 100 (83%), Referenced to phase 2:SBT and 6:NBT, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.33	
Intersection Signal Delay: 69.8	Intersection LOS: E
Intersection Capacity Utilization 87.3%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 3: Scottsdale Road & McDowell Road



Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	1952	4	0	1156	34	0	0	4	0	0	5
Future Vol, veh/h	0	1952	4	0	1156	34	0	0	4	0	0	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	2122	4	0	1257	37	0	0	4	0	0	5

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	-	-	0	-	-	1063	-	-	647
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	-	-	-	7.14	-	-	7.14
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	-	-	-	3.92	-	-	3.92
Pot Cap-1 Maneuver	0	-	-	0	-	-	0	0	*459	0	0	*653
Stage 1	0	-	-	0	-	-	0	0	-	0	0	-
Stage 2	0	-	-	0	-	-	0	0	-	0	0	-
Platoon blocked, %		-	-		-	-			1			1
Mov Cap-1 Maneuver	-	-	-	-	-	-	-	-	*459	-	-	*653
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	12.9	10.6
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT	WBR	SBLn1
Capacity (veh/h)	459	-	-	-	-	653
HCM Lane V/C Ratio	0.009	-	-	-	-	0.008
HCM Control Delay (s)	12.9	-	-	-	-	10.6
HCM Lane LOS	B	-	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	-	0

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	47	1	133	42	1	57
Future Vol, veh/h	47	1	133	42	1	57
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	51	1	145	46	1	62

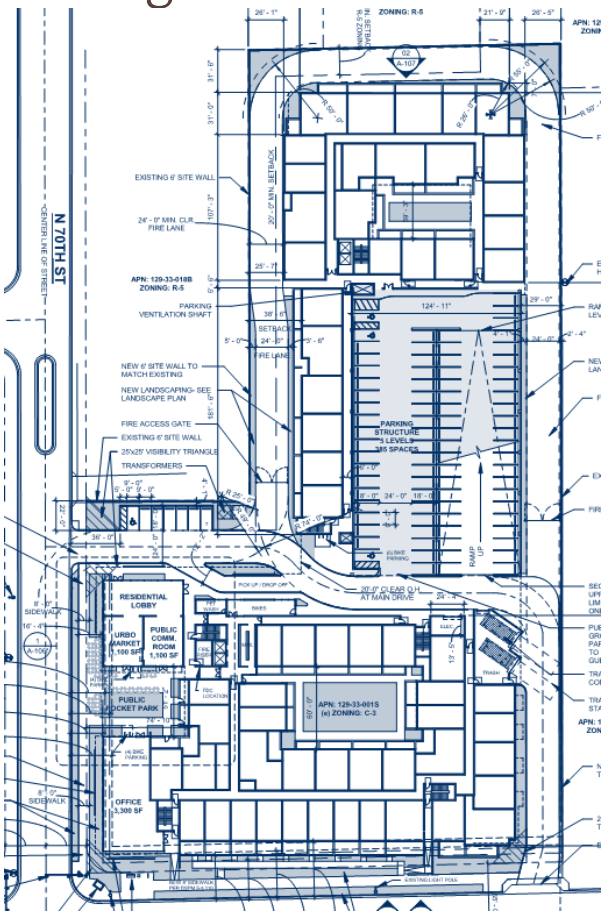
Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	232	168	0	0	191	0
Stage 1	168	-	-	-	-	-
Stage 2	64	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	805	936	-	-	1401	-
Stage 1	894	-	-	-	-	-
Stage 2	959	-	-	-	-	-
Platoon blocked, %	1	1	-	-	1	-
Mov Cap-1 Maneuver	804	936	-	-	1401	-
Mov Cap-2 Maneuver	804	-	-	-	-	-
Stage 1	894	-	-	-	-	-
Stage 2	958	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.8	0	0.1
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	806	1401	-
HCM Lane V/C Ratio	-	-	0.065	0.001	-
HCM Control Delay (s)	-	-	9.8	7.6	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Southdale

Parking Master Plan



Prepared for:

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June 30, 2020

5-ZN-2020
07/1/20

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1. Executive Summary

Lōkahi, LLC (Lōkahi) was retained by Hawkins Companies to complete a Parking Master Plan for the proposed Southdale mixed-use development. The development is located at on the northeast corner of McDowell Road and 70th Street in Scottsdale, Arizona.

The proposed development will include the following land uses:

- Multi-Family Residential — 267 units
  - *52 studio units*
  - *150 one-bedroom units*
  - *65 two-bedroom units*
- Office — 3,300 square feet
- Retail — 1,100 square feet

The objective of this Parking Master Plan is to establish that the **392 total parking stalls provided on site, will provide sufficient parking** for the proposed Southdale mixed-use development.

City of Scottsdale Required Parking

Using the *City of Scottsdale Code of Ordinance's* shared parking requirements, a maximum parking demand of 372 parking spaces are required. Therefore, with 392 parking stalls provided, this represents a surplus of 20 (5.4%) parking stalls for the proposed development. This peak parking demand occurs on weekdays between midnight and 7:00 am.

During the daytime hours, from 7:00 am to 6:00 pm on weekdays, there is a **surplus of 173 parking stalls**. While weekday evenings from 6:00 pm to midnight when residents may anticipate guests and visitors, there is a **surplus of 71 parking stalls**. Additionally, on weekends between the hours of 7:00 am and midnight there are a minimum **surplus of 109 parking stalls** available for guests and visitors, while also providing with a **surplus of 21 parking stalls** between the hours of midnight and 7:00 am.

ITE Parking Generation

The weekday and Saturday parking demand was also calculated for the proposed development using the *Institute of Transportation Engineers (ITE)* publication *Parking Generation, 5th Edition*. The weekday and weekend parking calculations result in a parking **surplus of 31 (8.6%) and 61 (18.4%)** parking stalls for the proposed development.

ULI Shared Parking

Utilizing the *Urban Land Institute (ULI)* publication titled *Shared Parking, 3rd Edition*, the weekday and weekend parking demand was calculated for the proposed Southdale development. The

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weekday and weekend parking calculations result in a parking **surplus of 59 (17.7%) and 55 (16.3%)** parking stalls for the proposed development.

Additional Parking Occupancy Data Collection

Parking occupancy data was collected near and surrounding Broadstone Waterfront on Thursday, April 2, 2020 and Saturday, April 4, 2020 from midnight to 6:00 am every 30 minutes. With an occupancy of 95.4%, and under COVID-19 "stay at home" orders it is logical to assume the majority to all vehicles of Broadstone Waterfront residents would be parked. There was no overflow residential parking observed at the Nordstrom parking garage or along Marshall Way. Therefore, the 1.02 parking stalls per bedroom provided sufficient parking for all residential parking. Applying this parking ratio to the proposed Southdale development, which assumes all parking stalls in the Broadstone Waterfront garage was occupied, and combining this with the City of Scottsdale's parking requirements for the other proposed land uses on-site, results in a total of 353 parking stalls, resulting in a parking **surplus of 39 (11.0%)** parking stalls.

Similarly, parking occupancy data was collected Dwell Apartment Homes, a multi-family residential development immediately north and west of the proposed development. Parking occupancy data was collected on Wednesday, March 4th and Saturday, March 7th, 2020, from midnight to 6:00 am every 30 minutes. The maximum observed parking demand ratio occurred at Dwell Apartment Homes, which resulted in a parking demand of 0.75 parking stalls per bedroom. Applying this maximum observed parking demand ratio to the proposed Southdale Development combined with the City of Scottsdale's parking requirements for the other proposed land uses on-site, results in 264 parking stalls. This represents a parking **surplus of 128 (48.5%)** parking stalls for the proposed development.

Parking Trends – In the News

There is a great deal of information in various publications regarding parking needs of mixed-use multi-family developments. The overriding theme is that there are ongoing changes in land use and transportation that are driving down the demand for parking.

According to "People Over Parking" published by the American Planning Association (October 2018), "tinkering with minimum parking requirements is not new...what's different now is an evolving understanding that urban lifestyles are changing, traditional parking ratios are outdated, and too much supply can be as harmful as too little." Two groups, TransForm and Center for Neighborhood Technology, conducted surveys during the middle of the night at apartments on the West Coast and Chicago and found that consistently "one-quarter to one-third of spaces sat empty."

Additionally, the growing popularity of rideshare services such as Uber and Lyft, and bikeshare services, all contribute to reducing the reliance on personal vehicles, and thereby reducing parking demand.

Parking Summary

	Reference Table	Parking Stalls	Surplus
City of Scottsdale Code			
Shared Parking Requirements	2	372	20
ITE Parking Generation			
Weekday	4	361	31
Saturday	5	331	61
ULI Shared Parking			
Weekday	6	333	59
Weekend	7	337	55
Additional Parking Occupancy Data Collection			
Applying Broadstone Waterfront Parking Demand Ratio	9	353	39
Applying Dwell Apartment Homes Parking Demand Ratio	12	264	128

In conclusion, the request to provide 392 parking stalls for the proposed Southdale mixed-use development meets the requirements of the City of Scottsdale's Shared Parking Requirements, and results in a surplus of parking based the ITE Parking Generation, the ULI Shared Parking, and based on parking demand rates observed at local multi-family residential developments.

Therefore, based upon the detailed analysis in this Parking Master Plan, the 392 proposed parking stalls is anticipated to meet and exceed the parking demand for the Southdale development.

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2. Introduction

Lōkahi, LLC (Lōkahi) was retained by Hawkins Companies to complete a Parking Master Plan for the proposed Southdale mixed-use development. The development is located at on the northeast corner of McDowell Road and 70th Street in Scottsdale, Arizona.

The proposed development will include the following land uses:

- Multi-Family Residential — 267 units
  - *52 studio units*
  - *150 one-bedroom units*
  - *65 two-bedroom units*
- Office — 3,300 square feet
- Retail — 1,100 square feet

Scope of Study

The objective of this Parking Master Plan is to establish that the 392 on-site parking stalls will provide sufficient parking for the proposed multi-family development.

This Parking Master Plan calculates the number of parking spaces required for the proposed development based on the City of Scottsdale Code, the ITE Parking Generation, and the ULI Shared Parking. Additionally, parking occupancy data collected near Broadstone Waterfront is analyzed, and a discussion regarding recent parking trends and findings is provided.

Surrounding Area

The study area is located in the City of Scottsdale, Arizona. The proposed development is bordered by McDowell Road to the south, 70th Street to the west, multi-family residential to the north, and an automotive sales dealership to the east. See **Figure 1** for a vicinity map.

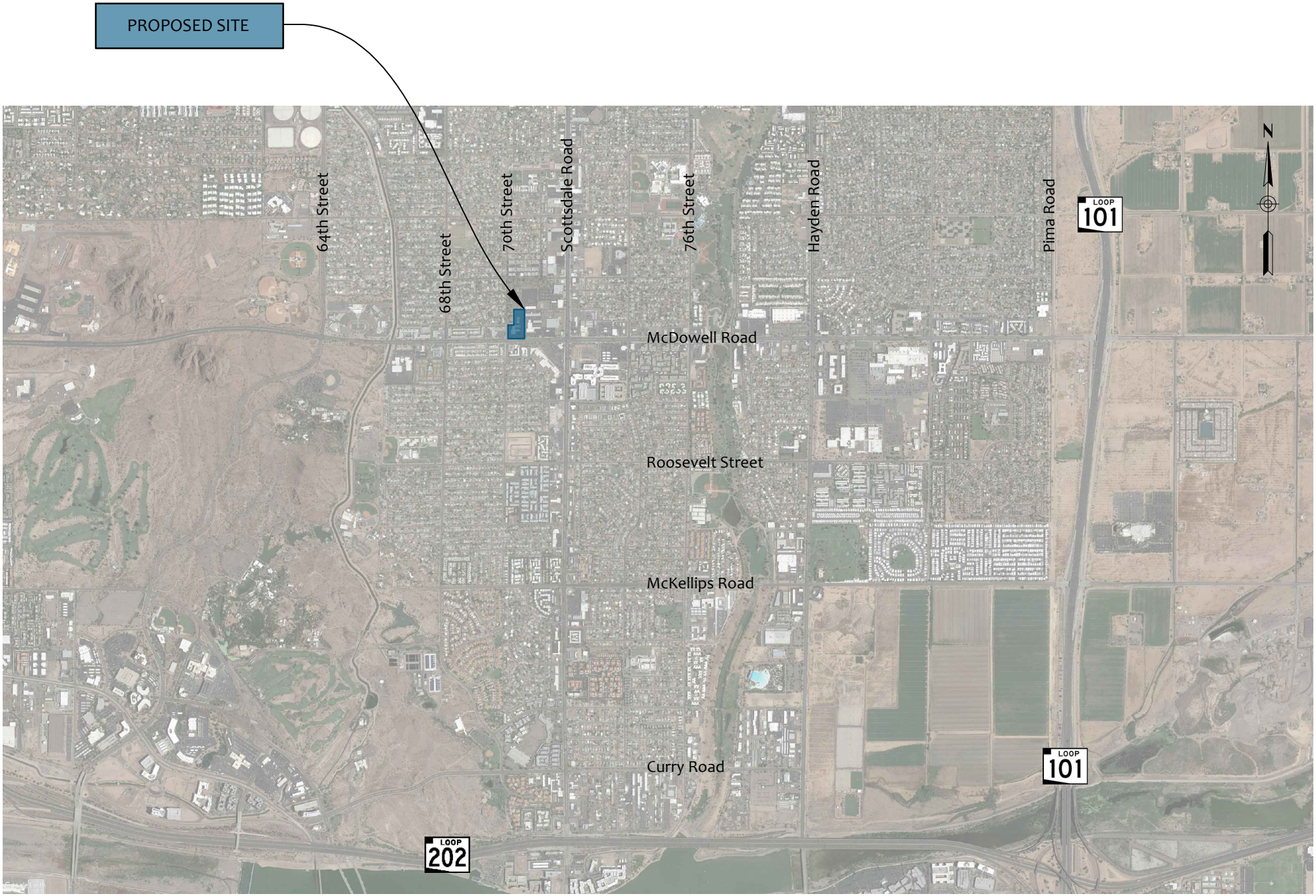


FIGURE 1 | VICINITY MAP

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3. Proposed Development

The study area is located in the City of Scottsdale, Arizona, approximately two and one-half miles west of State Route Loop 101 (SR 101L) and 2 miles north of State Route Loop 202 (SR 202L). The proposed site will be located on the northeast corner of McDowell Road and 70th Street.

The proposed development will include the following land uses:

- Multi-Family Residential — 267 units
  - *52 studio units*
  - *150 one-bedroom units*
  - *65 two-bedroom units*
- Office — 3,300 square feet
- Retail — 1,100 square feet

See **Figure 2** and **Appendix A** for the proposed site plan.

Proposed Parking

The proposed Southdale development will provide a total of 392 parking stalls. The 392 total parking stalls will be provided via a mixture of garage and surface stalls.

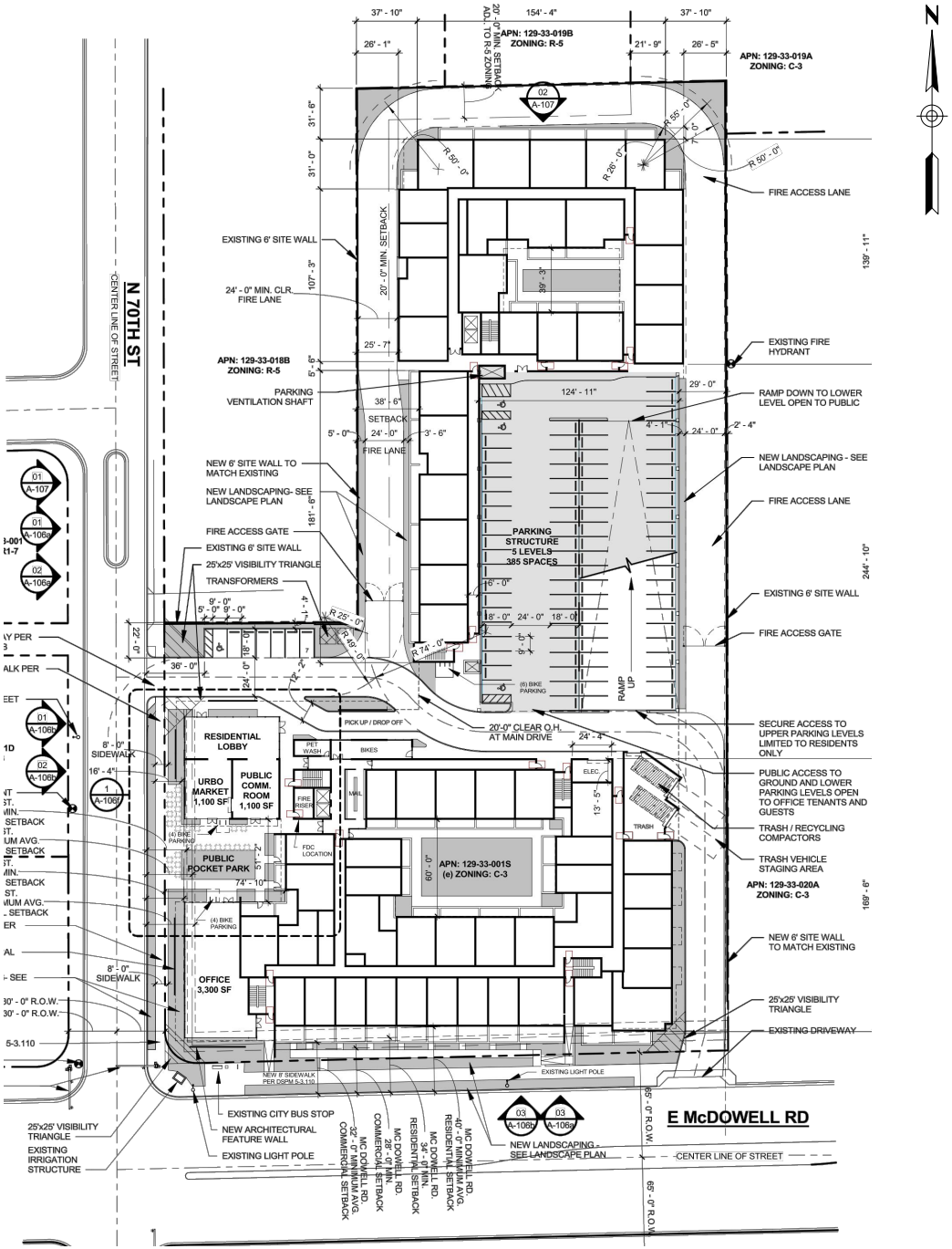


FIGURE 2 | SITE PLAN

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4. City of Scottsdale Required Parking

The proposed Southdale mixed-use development will include the following land uses:

- Multi-Family Residential — 267 units
  - *52 studio units*
  - *150 one-bedroom units*
  - *65 two-bedroom units*
- Office — 3,300 square feet
- Retail — 1,100 square feet

Shared Parking Requirements

Table 9.103.A entitled *Schedule of Parking Requirements* within the *City of Scottsdale Code of Ordinances* provides the general parking requirements. The following categories and vehicle parking ratio minimums are relevant to the proposed Southdale development:

Mixed-Use Developments

- Dwellings, Multiple-Family
  - Efficiency — 1.25 per dwelling unit
  - 1-Bedroom — 1.30 per dwelling unit
  - 2-Bedroom — 1.70 per dwelling unit
- Nonresidential area — 1 per 325 sf of gross floor area (GFA)

Applying these rates to the proposed Southdale development results in the following parking requirement, see **Table 1**.

Table 1 – City of Scottsdale Parking Requirement

Use	Rate	Quantity	Units	Parking Stalls
Dwellings, Multiple-Family	1.25 Per each Efficiency Unit	52	Dwelling Units	65
	1.3 Per each 1 Bedroom	150	Dwelling Units	195
	1.7 Per each 2 Bedroom	65	Dwelling Units	111
Non-Residential Area	1 Per 325 SF GFA	4,400	Square Feet	14
			Total	**385**

Table 9.104.A entitled *Schedule of Shared Parking Calculations* within the *City of Scottsdale Code of Ordinances* provides shared use parking requirements for seven land use categories based upon a time of day. Residential, retail, and office land uses are among these categories. See **Table 2** for the

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parking percentages for the three land uses broken down by weekday and weekend and hours of the day.

Table 2 – Scottsdale Shared Parking Percentages

General Land Use Classification	Weekday			Weekend		
	12 am - 7 am	7 am - 6 pm	6 pm - 12 am	12 am - 7 am	7 am - 6 pm	6 pm - 12 am
Residential	100%	55%	85%	100%	65%	75%
Retail	0%	100%	80%	0%	100%	60%
Office and industrial	5%	100%	5%	0%	60%	10%

Applying the percentages, shown in **Table 2** to the parking requirements shown in **Table 1** results in the shared parking requirement, shown in **Table 3** below:

Table 3 – Scottsdale Shared Parking Calculations

General Land Use Classification	Weekday			Weekend		
	12 am - 7 am	7 am - 6 pm	6 pm to 12 am	12 am - 7 am	7 am - 6 pm	6 pm to 12 am
Residential	371	205	316	371	242	279
Residential Total	**371**	**205**	**316**	**371**	**242**	**279**
Retail	0	4	4	0	4	3
Office	1	10	1	0	6	1
Amenities Total	**1**	**14**	**5**	**0**	**10**	**4**
Total	**372**	219	321	371	252	283
Difference From Provided	20	173	71	21	140	109
% Difference	5.4%	79.0%	22.1%	5.7%	55.6%	38.5%

Based on the *City of Scottsdale Zoning Ordinance's* Shared Parking Calculations, the 392 parking stalls provided, represents a surplus of 20 (5.4%) parking stalls for the proposed development.

Conclusion:

Using the *City of Scottsdale Code of Ordinance's* shared parking requirements, a maximum parking demand of 372 parking spaces are required. Therefore, the proposed Southdale development meets and exceeds the City of Scottsdale shared parking requirements.

The peak parking demand occurs on weekdays between midnight and 7:00 am. During the daytime hours, from 7:00 am to 6:00 pm on weekdays, there is a **surplus of 173 parking stalls**. While weekday evenings from 6:00 pm to midnight when residents may anticipate guests and visitors, there is a **surplus of 71 parking stalls**. Additionally, on weekends between the hours of 7:00 am and

midnight there are a minimum **surplus of 109 parking stalls** available for guests and visitors, while also providing with a **surplus of 21 parking stalls** between the hours of midnight and 7:00 am.

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5. ITE Parking Generation

The Institute of Transportation Engineers (ITE) publication titled *Parking Generation, 5th Edition* is utilized for estimating parking demand based on research and experiences of transportation engineering and planning professionals.

The land use categories that most closely represents the proposed Southdale development are the following:

- Land Use 221 Multifamily Housing (Mid-Rise)
- Land Use 710 General Office Building
- Lane Use 820 Shopping Center

Multi-family Housing (Mid-Rise) (Land Use 221)

The average weekday peak period parking demand for General Urban/Suburban (no nearby rail transit) site is 1.31 parking stalls per dwelling unit, and the average Saturday peak period parking demand is 1.22 parking stalls per dwelling unit.

General Office Building (Land Use 710)

The average weekday peak period parking demand for General Urban/Suburban (no nearby rail transit) site is 2.39 parking stalls per 1,000 square feet of gross floor area, and the average Saturday peak period parking demand is 0.28 parking stalls per 1,000 square feet of gross floor area.

Shopping Center (Land Use 820)

The average weekday peak period parking demand for General Urban/Suburban (no nearby rail transit) site is 1.95 parking stalls per 1,000 square feet of gross floor area, and the average Saturday peak period parking demand is 2.91 parking stalls per 1,000 square feet of gross floor area.

The average weekday and Saturday ITE peak period parking demand calculations for General Urban/Suburban locations are presented below in **Table 4** and **Table 5**, respectively.

Table 4 – ITE Parking Demand (Weekday)

Use	Weekday Rate	Quantity	Units	Parking Stalls
ITE Code 221 - Multifamily Housing (Mid-Rise)	1.31 Per 1 Dwelling Unit	267	Dwelling Units	350
ITE Code 710 - General Office Building	2.39 Per 1000 SF GFA	3,300	Square Feet	8
ITE Code 820 - Shopping Center	1.95 Per 1000 SF GFA	1,100	Square Feet	3
			Total	**361**

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Table 5 – ITE Parking Demand (Saturday)

Use	Saturday Rate	Quantity	Units	Parking Stalls
ITE Code 221 - Multifamily Housing (Mid-Rise)	1.22 Per 1 Dwelling Unit	267	Dwelling Units	326
ITE Code 710 - General Office Building	0.28 Per 1000 SF GFA	3,300	Square Feet	1
ITE Code 820 - Shopping Center	2.91 Per 1000 SF GFA	1,100	Square Feet	4
			Total	**331**

Based upon ITE Parking Generation, 5th Edition, the weekday and Saturday parking demand for the proposed Southdale development is 361 and 331 parking stalls, respectively. With 392 parking stalls provided, this represents a surplus of 31 (8.6%) and 61 (18.4%) parking stalls for the proposed development.

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6. ULI Shared Parking

The *Urban Land Institute (ULI)* publication titled *Shared Parking, 3rd Edition* is an additional source for estimating parking demand based on research and experiences planners, government agencies, consultants, and engineers. Similar to the ITE Parking Generation publication, ULI's Shared Parking publication provides base parking demand ratios based on various land uses.

Weekday

The following categories and base weekday vehicle parking ratio minimums are relevant to the proposed Southdale development:

- Residential
  - Studio efficiency — 0.85 per dwelling unit
  - 1-Bedroom — 0.90 per dwelling unit
  - 2-Bedroom — 1.65 per dwelling unit
  - Visitor — 0.10 per dwelling unit
- Office (<25,000 SF)
  - Employee — 3.50 per 1,000 sf GFA
  - Visitor — 0.30 per 1,000 sf GFA
- Retail (<400,000 SF)
  - Employee — 0.70 per 1,000 sf GFA
  - Visitor — 2.90 per 1,000 sf GFA

Applying these rates to the proposed Southdale development results in the following parking requirement, see **Table 6**.

Table 6 – ULI Shared Parking (Weekday)

Use		Rate	Quantity	Units	Parking Stalls
Residential	Residents	0.85 per each Studio	52	Units	45
		0.90 per each 1 Bedroom	150	Units	135
		1.65 per each 2 Bedroom	65	Units	108
	Visitor	0.10 per each unit	267	Units	27
Office (< 25,000 SF)	Employee	3.50 per 1,000 SF GFA	3,300	SF	12
	Visitor	0.30 per 1,000 SF GFA	3,300	SF	1
Retail (< 400,000 SF)	Employee	0.70 per 1,000 SF GFA	1,100	SF	1
	Visitor	2.90 per 1,000 SF GFA	1,100	SF	4
				Total	**333**

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Based upon the ULI *Shared Parking, 3rd Edition*, the weekday parking demand for the proposed Southdale development is 333 parking stalls. With 392 parking stalls provided, this represents a surplus of 59 (17.7%) parking stalls for the proposed development.

Weekend

The following categories and base weekend vehicle parking ratio minimums are relevant to the proposed Southdale development:

- Residential
  - Studio efficiency — 0.85 per dwelling unit
  - 1-Bedroom — 0.90 per dwelling unit
  - 2-Bedroom — 1.65 per dwelling unit
  - Visitor — 0.15 per dwelling unit
- Office (<25,000 SF)
  - Employee — 0.35 per 1,000 sf GFA
  - Visitor — 0.03 per 1,000 sf GFA
- Retail (<400,000 SF)
  - Employee — 0.80 per 1,000 sf GFA
  - Visitor — 3.20 per 1,000 sf GFA

Applying these rates to the proposed Southdale development results in the following parking requirement, see **Table 7**.

Table 7 – ULI Shared Parking (Weekend)

Use		Rate	Quantity	Units	Parking Stalls
Residential	Residents	0.85 per each Studio	52	Units	45
		0.90 per each 1 Bedroom	150	Units	135
		1.65 per each 2 Bedroom	65	Units	108
	Visitor	0.15 per each unit	267	Units	41
Office (< 25,000 SF)	Employee	0.35 per 1,000 SF GFA	3,300	SF	2
	Visitor	0.03 per 1,000 SF GFA	3,300	SF	1
Retail (< 400,000 SF)	Employee	0.80 per 1,000 SF GFA	1,100	SF	1
	Visitor	3.20 per 1,000 SF GFA	1,100	SF	4
				Total	**337**

Based upon the ULI *Shared Parking, 3rd Edition*, the weekend parking demand for the proposed Southdale development is 337 parking stalls. With 392 parking stalls provided, this represents a surplus of 55 (16.3%) parking stalls for the proposed development.

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7. Additional Parking Occupancy Data Collection

Broadstone Waterfront

Parking occupancy data was collected at the Scottsdale Fashion Square Nordstrom parking garage, which is located directly across the street from the Broadstone Waterfront, as well as along Marshall Way in the vicinity of Broadstone Waterfront. Data was collected on Thursday, April 2, 2020 and Saturday, April 4, 2020 from midnight to 6:00 am every 30 minutes. The results of the data show:

Thursday, April 2, 2020		
Nordstrom Parking Garage	midnight to 6:00 am	0 vehicles parked
Marshall Way	midnight to 2:00 am	2-3 vehicles parked
	2:30 am to 6:00 am	0 vehicles parked
Saturday, April 4, 2020		
Nordstrom Parking Garage	midnight to 6:00 am	0 vehicles parked
Marshall Way	midnight to 6:00 am	0 vehicles parked

Detailed parking occupancy data sheets are provided in **Appendix C**.

Occupancy at the time of data collection of the Broadstone Waterfront was 95.4%. It should also be noted that this parking data was collected during "stay at home" orders during COVID-19 which went into effect on March 31, 2020. This would imply that the majority or all of the vehicles for Broadstone Waterfront residents would be parked.

There has previously been concern expressed in the community that Broadstone Waterfront is under parked and resident parking overflows into the Nordstrom parking garage and along Marshall Way. However, based on the recent data collection, there were not overflow parked vehicles.

Broadstone Waterfront has a total of 259 units (130 studio/1-bedroom, and 126 2-bedroom) with a total of 396 parking stalls dedicated for residential use. Assuming all parking stalls are occupied and calculating the parking per bedroom ratio results in 1.02 stalls per bedroom. Applying this ratio of 1.02 stalls per bedroom to the Southdale development calculates to a total of 339 parking stalls, see **Table 8** below.

Table 8 – Proposed Development – Residential Parking Demand (Broadstone Waterfront)

Use	Rate	Quantity	Units	Parking Stalls
Residential	1.02 Per each Bedroom	332	Dwelling Units	339
			Total	**339**

Combining the residential parking demand with the City of Scottsdale's parking requirements for the other proposed land uses on-site, as shown in **Table 1**, results in 353 parking stalls. See **Table 9**.

Table 9 – Parking Requirements with Residential Parking Demand (Broadstone Waterfront)

Use	Parking Stalls
Residential Parking Demand (Table 8)	339
Nonresidential Parking Requirement (Table 1)	14
Total	**353**

The proposed Southdale development anticipates providing 392 parking stalls, this represents a surplus of 39 (11.0%) parking stalls for the proposed development.

Dwell Apartment Homes

Located immediately north and west of the proposed Southdale development, Dwell Apartment Homes provides 193 multi-family dwelling units. The following is a breakdown of the units available at Dwell Apartment Homes:

- Studio 21 units
- One-Bedroom 92 units
- Two-Bedroom 80 units

On Wednesday, March 4th and Saturday, March 7th, 2020, parking occupancy counts were collected every thirty minutes from 12:00am to 6:00am. At the time of the data collection, Dwell Apartment Homes reported a 96.9%-unit occupancy.

A summary of the parking occupancy data collected at the Dwell Apartment Homes developments is shown in **Table 10** below. Detailed parking occupancy data sheets are provided in **Appendix C**.

Table 10 – Dwell Apartment Homes Parking Occupancy Data Collection

Date:	3/4/2020	3/7/2020
Day of Week:	Thursday	Saturday
Time	Occupied Stalls	Occupied Stalls
12:00AM	198	194
12:30AM	198	195
1:00AM	205	195
1:30AM	201	195
2:00AM	203	199
2:30AM	205	198
3:00AM	203	200
3:30AM	203	199
4:00AM	203	205
4:30AM	193	196
5:00AM	193	197
5:30AM	190	193
6:00AM	184	192
Maximum	205	205
Ratio (occupied stall/bedroom)	0.75	0.75

During the time of the observations, the maximum parking occupancy count was 205 stalls, which occurred during both Wednesday and Saturday. The represents a peak parking demand of 0.75 occupied parking stalls per bedroom.

The proposed Southdale development will provide a total of 267 units, which will be comprised of a total of 332 bedrooms. Applying the maximum observed parking demand ratio of 0.75 parking stalls per bedroom to the proposed Southdale Development results in 250 parking stalls, see **Table 11** below.

Table 11 – Proposed Development – Residential Parking Demand (Dwell Apartment Homes)

Use	Rate	Quantity	Units	Parking Stalls
Residential	0.75 Per each Bedroom	332	Dwelling Units	250
			Total	**250**

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Combining the residential parking demand with the City of Scottsdale's parking requirements for the other proposed land uses on-site, as shown in **Table 1**, results in 264 parking stalls. See **Table 12**.

Table 12 – Parking Requirements with Residential Parking Demand (Dwell Apartment Homes)

Use	Parking Stalls
Residential Parking Demand (Table 11)	250
Nonresidential Parking Requirement (Table 1)	14
Total	**264**

The proposed Southdale development anticipates providing 392 parking stalls, this represents a surplus of 128 (48.5%) parking stalls for the proposed development.

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8. Parking Trends

There is a great deal of information in various publications regarding parking needs. This section examines a small sample of books, articles, and significant points of interest.

The issue of parking needs for residential developments is not a new topic. In his book "The High Cost of Free Parking," published in 2005 by American Planning Association (revised in 2011), UCLA professor Donald Shoup found 129 articles reporting cities that have removed off-street parking requirement in their downtowns since 2005 in order "to promote the creation of downtown apartments (Greenfield, Massachusetts), to see more affordable housing (Miami), to give business owners more flexibility while creating a vibrant downtown (Sandpoint, Idaho), and to prevent ugly auto-oriented townhouses (Seattle)."

An extensive 2015 parking study "Right Size Parking" led by King County Metro gathered data from over 200 multi-family sites in King County, WA to determine that "existing multi-family parking capacity exceeded utilization by an average of 0.4 spaces per housing unit – a 40% oversupply". According to this report the RSP project has attracted national attention. Several regions and cities around the country are currently working to replicate the RSP study and web calculator concept for their own planning purposes, including the San Francisco Bay Area, Washington, D.C., Boston, and Chicago. Many regions are reexamining parking requirements in support of pedestrian-oriented design, transit access, and a compact mix of uses to include transportation choices." Website www.rightsizeparking.org also provides a multi-family residential parking calculator for King County area as well as guidance on unbundled parking prices and resulting rental prices adjustments.

According to "People Over Parking" published by the American Planning Association (October 2018), "tinkering with minimum parking requirements is not new...what's different now is an evolving understanding that urban lifestyles are changing, traditional parking ratios are outdated, and too much supply can be as harmful as too little." Two groups, TransForm and Center for Neighborhood Technology, conducted surveys during the middle of the night at apartments on the West Coast and Chicago and found that consistently "one-quarter to one-third of spaces sat empty."

This new focus on alternative transportation modes can take interesting twists in this new world of more cost-effective ride-hailing services, as evidenced by the Aug 8, 2017 article from the Financial Post: Ontario Town's Experiment Using Uber As Public Transportation Is Working, Officials Say. The following provides excerpts from this article.

The town of Innisfil, Ontario is hailing its two-month old experiment to subsidize Uber as the lone form of public transit as a success, with nearly 5,000 trips taken since the pilot project began in May. Innisfil — … home to about 36,000 people — has paid $26,462.41, or an average of $5.43 per

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trip, for 4,868 Uber rides taken in the two months since launching the unique-to-Canada project on May 15.

Another article entitled, Toward Zero Parking: Challenging Conventional Wisdom for Multi-family, by David Baker and Brad Leibon (July 2nd, 2018), mentions additional benefits with the recent shift in transportation trends:

"With the ubiquity of ride-hailing services, residents can walk out their front door, hop in a vehicle, and get dropped off at their destination rather than risk having to drive themselves, park several blocks from their destination, and walk the remaining distance, or walk through a parking garage getting to and from a car."

The author of this article also notes that, "A future not dominated by privately owned cars may be a long way off, but increasingly the use of a car is becoming detached from the need for parking."

This brief summary of interconnected articles on the topic of parking needs in the news is by no means comprehensive but does serve to point to several important issues when assessing parking needs.

See **Appendix D** for the articles referenced in this section.

9. Recommendations & Conclusions

Through this Parking Master Plan, the Southdale mixed-use development is **requesting the approval to provide a total of 392 parking stalls on-site.**

City of Scottsdale Required Parking

Using the *City of Scottsdale Code of Ordinance's* shared parking requirements, a maximum parking demand of 372 parking spaces are required. Therefore, with 392 parking stalls provided, this represents a surplus of 20 (5.4%) parking stalls for the proposed development. This peak parking demand occurs on weekdays between midnight and 7:00 am.

During the daytime hours, from 7:00 am to 6:00 pm on weekdays, there is a **surplus of 173 parking stalls**. While weekday evenings from 6:00 pm to midnight when residents may anticipate guests and visitors, there is a **surplus of 71 parking stalls**. Additionally, on weekends between the hours of 7:00 am and midnight there are a minimum **surplus of 109 parking stalls** available for guests and visitors, while also providing with a **surplus of 21 parking stalls** between the hours of midnight and 7:00 am.

ITE Parking Generation

The weekday and Saturday parking demand was calculated for the proposed development using the *Institute of Transportation Engineers (ITE)* publication *Parking Generation, 5th Edition*. The weekday and weekend parking calculations result in a parking surplus of 31 (8.6%) and 61 (18.4%) parking stalls for the proposed development.

ULI Shared Parking

Utilizing the *Urban Land Institute (ULI)* publication titled *Shared Parking, 3rd Edition,* the weekday and weekend parking demand was calculated for the proposed Southdale development. The weekday and weekend parking calculations result in a parking surplus of 59 (17.7%) and 55 (16.3%) parking stalls for the proposed development.

Additional Parking Occupancy Data Collection

Parking occupancy data was collected near and surrounding Broadstone Waterfront on Thursday, April 2, 2020 and Saturday, April 4, 2020 from midnight to 6:00 am every 30 minutes. With an occupancy of 95.4%, and under COVID-19 "stay at home" orders it is logical to assume the majority to all vehicles of Broadstone Waterfront residents would be parked. There was no overflow residential parking observed at the Nordstrom parking garage or along Marshall Way. Therefore, the 1.02 parking stalls per bedroom provided sufficient parking for all residential parking. Applying this parking ratio to the proposed Southdale development, which assumes all parking stalls in the Broadstone Waterfront garage was occupied, and combining this with the City of Scottsdale's parking requirements for the other proposed land uses on-site, results in a total of 353 parking stalls, resulting in a parking **surplus of 39 (11.0%)** parking stalls.

Similarly, parking occupancy data was collected Dwell Apartment Homes, a multi-family residential development immediately north and west of the proposed development. Parking occupancy data was collected on Wednesday, March 4th and Saturday, March 7th, 2020, from midnight to 6:00 am every 30 minutes. The maximum observed parking demand ratio occurred at Dwell Apartment Homes, which resulted in a parking demand of 0.75 parking stalls per bedroom. Applying this maximum observed parking demand ratio to the proposed Southdale Development combined with the City of Scottsdale's parking requirements for the other proposed land uses on-site, results in 264 parking stalls. This represents a parking **surplus of 128 (48.5%)** parking stalls for the proposed development.

Parking Trends – In the News

There is a great deal of information in various publications regarding parking needs of mixed-use multi-family developments. The overriding theme is that there are ongoing changes in land use and transportation that are driving down the demand for parking.

According to "People Over Parking" published by the American Planning Association (October 2018), "tinkering with minimum parking requirements is not new...what's different now is an evolving understanding that urban lifestyles are changing, traditional parking ratios are outdated, and too much supply can be as harmful as too little." Two groups, TransForm and Center for Neighborhood Technology, conducted surveys during the middle of the night at apartments on the West Coast and Chicago and found that consistently "one-quarter to one-third of spaces sat empty."

Additionally, the growing popularity of rideshare services such as Uber and Lyft, and bikeshare services, all contribute to reducing the reliance on personal vehicles, and thereby reducing parking demand.

Parking Summary

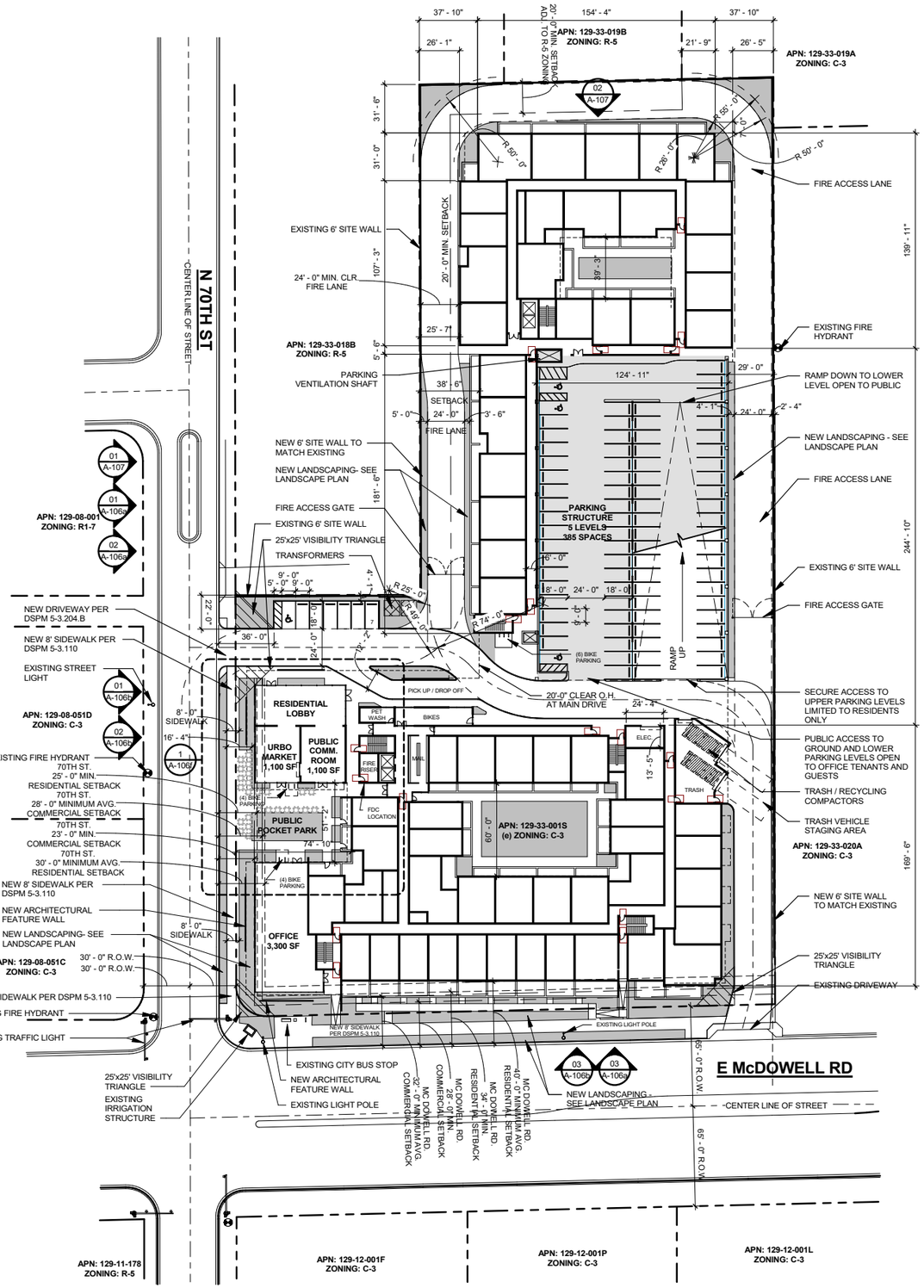
	Reference Table	Parking Stalls	Surplus
City of Scottsdale Code			
Shared Parking Requirements	2	372	20
ITE Parking Generation			
Weekday	4	361	31
Saturday	5	331	61
ULI Shared Parking			
Weekday	6	333	59
Weekend	7	337	55
Additional Parking Occupancy Data Collection			
Applying Broadstone Waterfront Parking Demand Ratio	9	353	39
Applying Dwell Apartment Homes Parking Demand Ratio	12	264	128

In conclusion, the request by the proposed Southdale development to provide 392 on-site parking stalls will provide sufficient parking to meet and exceed the parking demand for this development.

Appendix A – Proposed Site Plan

A

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1 SITE PLAN

SCALE: 1" = 40'-0" REF: 1 / A-102

PROJECT INFORMATION

CURRENT ZONING:	C-3
PROPOSED ZONING:	PUD
GROSS SITE AREA:	4.7 ACRES (204,732 SF)
NET LOT AREA:	3.8 ACRES (165,528 SF)
ALLOWABLE GFAR:	0.8
PROPOSED GFAR:	0.57
ALLOWABLE BUILDING HEIGHT:	48' + 10' MECHANICAL @ 30%
PROPOSED HEIGHT:	48' + 10' MECHANICAL @ 30%
ALLOWABLE DENSITY:	PER DEV. PLAN
PROPOSED DENSITY:	48.8 DU/AC
REQUIRED OPEN SPACE:	20,473 SF (0.10 x GSA)
PROVIDED OPEN SPACE:	36,227 SF (0.33 x GSA)
MCDOWELL RD. SETBACKS	
REQUIRED COMMERCIAL	28' MIN. / 32' MIN. AVG.
PROVIDED COMMERCIAL	28' MIN. / 32' MIN. AVG.
REQUIRED RESIDENTIAL	34' MIN. / 40' MIN. AVG.
PROVIDED RESIDENTIAL	34' MIN. / 40' MIN. AVG.
70TH STREET SETBACKS	
REQUIRED COMMERCIAL	23' MIN. / 28' MIN. AVG.
PROVIDED COMMERCIAL	23' MIN. / 28' MIN. AVG.
REQUIRED RESIDENTIAL	25' MIN. / 30' MIN. AVG.
PROVIDED RESIDENTIAL	25' MIN. / 28' MIN. AVG.
NON-STREET FRONTAGE SETBACKS	
ABUTTING RESIDENTIAL	28' MIN.
PROPOSED	20' MIN.
PROPOSED UNITS:	267

GROSS AREA TABULATIONS

COMMERCIAL OFFICE	3,300 SF
MARKET	1,100 SF
COMMUNITY ROOM	1,100 SF
RESIDENTIAL	279,740 SF
TOTAL GBA	285,240 SF

PARKING TABULATIONS (Table 9.103.A)

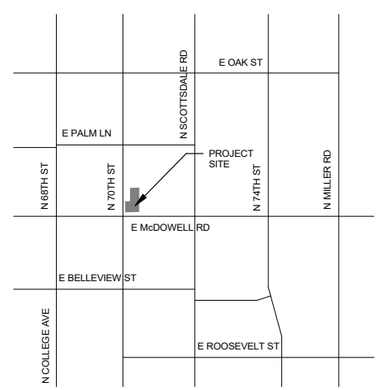
MULTI-FAMILY: 267 UNITS	
1.25 / EFFICIENCY (52 DU @ 1.25)	65.0 SPACES
1.3 / ONE-BEDROOM (147 DU @ 1.3)	191.1 SPACES
1.7 / TWO-BEDROOM (68 DU @ 1.7)	115.6 SPACES
TOTAL REQUIRED	372 SPACES
NON-RESIDENTIAL	
1/300 GSF OFFICE (3,300/300)	11 SPACES
TOTAL REQUIRED	**383 SPACES**

PROVIDED PARKING

LEVEL 04	58	GARAGE
LEVEL 03	89	GARAGE
LEVEL 02	78	GARAGE
LEVEL 01	83	GARAGE
LEVEL 01	7	SURFACE
LEVEL B1	77	GARAGE
TOTAL: 392		

ACCESSIBLE PARKING REQUIRED (4%)	**16 SPACES**
ACCESSIBLE PARKING PROVIDED	**17 SPACES**
REQUIRED BICYCLE PARKING (1/10 CARS)	**40 SPACES**
PROVIDED BICYCLE PARKING	**41 SPACES**

VICINITY MAP



NELSEN PARTNERS
ARCHITECTS & PLANNERS

Nelsen Partners, Inc.
Austin | Scottsdale

15210 North Scottsdale Road
Suite #300
Scottsdale, Arizona 85254
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PRELIMINARY:
NOT FOR REGULATORY APPROVAL, PERMITTING, OR CONSTRUCTION

HAWKINS COMPANIES
COMMERCIAL DEVELOPERS

SOUTHDALE
7000 E. McDOWELL ROAD
SCOTTSDALE, AZ 85257

PRE-APP # 225-PA-2020 ZONING # DRB #

OWNER
Hawkins Companies
Commercial Developers
4700 S. McClintock Drive
Ste 160
Tempe, AZ 85282

ARCHITECT
Nelsen Partners
15210 N. Scottsdale Road
Suite 300
Scottsdale, AZ 85254
Attn: Jeff Brand

Date
26 JUNE 2020

Drawings and written material appearing herein constitute original and unpublished work of the architect and may not be duplicated, used, or disclosed without written consent of the architect.

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Project No.
319084

A-102
SITE PLAN

~~5-ZN-2020~~
07/1/20

Appendix B – City of Scottsdale Code of Ordinance

B

5-ZN-2020
07/1/20

Sec. 9.103. - Parking requirements.

A. *General requirement.* Except as provided in Sections 9.103.B, 9.104, 9.107, and 9.108, and subsections therein, each use of land shall provide the number of parking spaces indicated for that use in Table 9.103.A. and Section 9.105.

B. *Requirement in the Downtown Area.* Except as provided in Sections 9.104, 9.107, and 9.108, and subsections therein each use of land in the Downtown Area shall provide the number of parking spaces indicated for that use in Table 9.103.b. and Section 9.105. Those uses that are not specifically listed in Table 9.103.B. shall provide the number of parking spaces indicated for that use in Table 9.103.A.

C. *Required bicycle parking.* Every principal and accessory use of land which is required to provide at least forty (40) vehicular parking spaces shall be required to provide bicycle parking spaces at a rate of one (1) bicycle parking space per every ten (10) required vehicular parking spaces; and after July 9, 2010, new development shall provide, at a minimum, two (2) bicycle parking spaces. No use shall be required to provide more than one hundred (100) bicycle parking spaces.

1. Subject to the approval of the Zoning Administrator, in the Downtown Area, bicycle parking spaces may be provided within a common location that is obvious and convenient for the bicyclist, does not encroach into adjacent pedestrian pathways or landscape areas, and the location shall be open to view for natural surveillance by pedestrians. Such common bicycle parking areas shall be subject to the approval of the Zoning Administrator.

D. *Bicycle parking facilities design.* Required bicycle parking facilities shall, at a minimum, provide a stationary object to which the bicyclist can lock the bicycle frame and both wheels with a user provided U-shaped lock or cable and lock. The stationary object shall generally conform to the Design Standards & Policies Manual. The Zoning Administrator may approve alternative designs. Bicycle lockers and other high security bicycle parking facilities, if provided, may be granted parking credits pursuant to Section 9.104.C., Credit for bicycle parking facilities.

E. *Calculating required parking for transportation facilities.* Required parking for park and ride lots and major transfer centers shall be determined by the Zoning Administrator. Subject to the Design Standards & Policies Manual and the following criteria:

1. Goals of the City with regard to transit ridership along the route on which the transportation facility is located.
2. Distance from other transportation facilities with parking.

F. *Fractions shall be rounded.*

1. When any calculation for the required parking results in a fraction of a parking space, the fraction shall be rounded up to the next greater whole number.
2. When any calculation for the provided parking results in a fraction of a parking space, the fraction shall be rounded down to the next greater whole number.
3. When any calculation of a Parking P-3 District credit, improvement district credit, or in-lieu parking credit results in a fraction of a credit, the fraction shall not be rounded.

G. *Interpreting requirements for analogous uses.* The Zoning Administrator shall determine the number of spaces required for analogous uses. In making this determination, the Zoning Administrator shall consider the following:

1. The number of parking spaces required for a use listed in Table 9.103.A., or Table 9.103.B., that is similar to the proposed use;

2. An appropriate variable by which to calculate parking for the proposed use; for example, building square fo of employees;
3. Parking data from the same use on a different site or from a similar use on a similar site;
4. Parking data from professional publications such as those published by the Institute of Transportation Engineers (ITE) or the Urban Land Institute (ULI);

H. *Additional requirements for company vehicles.* When parking spaces are used for the storage of vehicles or equipment used for delivery, service and repair, or other such use, such parking spaces shall be provided in addition to those otherwise required by this Zoning Ordinance. Before a building permit is issued the number of spaces to be used for vehicle storage shall be shown on the plans. Unless additional spaces are provided in excess of the required number of spaces, no vehicles in addition to that number shall be stored on the site.

———

Table 9.103.A. Schedule of Parking Requirements	
Amusement parks	Three (3) spaces per hole for any miniature golf course, plus one (1) space per three thousand (3,000) square feet of outdoor active recreation space, plus any additional spaces required for ancillary uses such as but not limited to game centers and pool halls.
Arts festivals, seasonal	A. One (1) space for each two hundred (200) square feet of indoor public floor area, other than public restaurant space. B. Restaurant at seasonal arts festivals shall be provided parking in accordance with table 9.103.a.
Banks/financial institutions	One (1) space per two hundred fifty (250) square feet gross floor area.
Bars, cocktail lounges, taverns, afterhours or micro-brewery/distillery with live entertainment	A. One (1) space per sixty (60) square feet of gross floor area; and B. One (1) space per two hundred (200) gross square feet of outdoor patio area, excluding the first two hundred (200) gross square feet.
Bars, cocktail lounges, taverns, afterhours or micro-brewery/distillery	A. One (1) space per eighty (80) square feet of gross floor area; and B. One (1) space per two hundred (200) gross square feet of outdoor patio area, excluding the first two hundred (200) gross square feet.

Boardinghouses, lodging houses, and other such uses	One (1) parking space for each one (1) guest room or dwelling unit.
Bowling alleys	Four (4) parking spaces for each lane, plus two (2) parking spaces for any pool table, plus one (1) parking space for every five (5) audience seats.
Carwash	Four (4) spaces per bay or stall plus one (1) space per employee plus ten (10) stacking spaces.
Churches and places of worship	A. With fixed seating. One (1) space per four (4) seats in main sanctuary, or auditorium, and c below; or B. Without fixed seating. One (1) space for each thirty (30) square feet of gross floor area in main sanctuary and c below. C. One (1) space per each three hundred (300) square feet gross floor area of classrooms and other meeting areas.
Club/lodge, civic and social organizations	One (1) space per two hundred fifty (250) square feet gross floor area.
College/university	One (1) space per two (2) employees plus one (1) space per four (4) students, based on projected maximum enrollment.
Community or recreation buildings	One (1) parking space for each two hundred (200) square feet of gross floor area.
Conference and meeting facilities, or similar facilities	A. One (1) parking space for every five (5) seats, if seats are fixed, and/or B. One (1) parking space for fifty (50) square feet of gross floor area of conference/meeting area.
Cultural institutions and museums	One (1) space per three hundred (300) square feet gross floor area.
Dance halls, skating rinks, and similar indoor recreational uses	One (1) parking space for each three hundred (300) square feet of gross floor area in the building.

Dance/music/and professional schools	One (1) space per two hundred (200) square feet of gross floor area classroom area.
Day care center	One (1) parking space for each employee; plus one (1) space for every fifteen (15) students, plus one (1) space for each company vehicle as per Section 9.103.H., additional requirements for company vehicles.
Dry cleaners	One (1) space per two hundred fifty (250) square feet gross floor area.
Dwellings, multiple-family	Parking spaces per dwelling unit at the rate of: efficiency units 1.25 one-bedroom 1.3 two-bedrooms 1.7 three (3) or more bedrooms 1.9
Dwellings, single- and two-family and townhouses	Two (2) spaces per unit.
Elementary schools	One (1) parking space for each classroom plus one (1) parking space for each two hundred (200) square feet of gross floor area in office areas.
Funeral homes and funeral services	A. One (1) parking space for every two (2) permanent seats provided in the main auditorium; and B. One (1) parking space for every thirty (30) square feet of gross floor area public assembly area.
Furniture, home improvement, and appliance stores	A. Uses up to fifteen thousand (15,000) square feet of gross floor area. One (1)space per five hundred (500) square feet gross floor area; or B. Uses over fifteen thousand (15,000) square feet of gross floor area. One (1) space per five hundred (500) square feet for the first fifteen thousand (15,000) square feet of gross floor area, and one (1) space per eight hundred (800) square feet area over the first fifteen thousand (15,000) square feet of gross floor area

Galleries	One (1) space per five hundred (500) square feet of gross floor area.
Game centers	One (1) space per one hundred (100) square feet gross floor area.
Gas station	Three (3) spaces per service bay and one (1) space per 250 square feet of accessory retail sales gross floor area. Each service bay counts for one (1) of the required parking spaces.
Golf course	One (1) parking space for each two hundred (200) square feet of gross floor area in any main building plus one (1) space for every two (2) practice tees in the driving range, plus four (4) parking spaces for each green in the playing area.
Grocery or supermarket	One (1) space per three hundred (300) square feet gross floor area.
Health or fitness studio, and indoor recreational uses	A. Building area less than, or equal to, 3,000 square feet of gross floor area: one space per 250 square feet of gross floor area. B. Building area greater than 3,000 square feet of gross floor area, and less than 10,000 square feet of gross floor area: one space per 150 square feet of gross floor area. C. Building areas equal to, or greater than, 10,000 square feet of gross floor area, and less than 20,000 square feet of gross floor area: one space per 200 square feet of gross floor area. D. Building areas equal to, or greater than, 20,000 square feet of gross floor area: one space per 250 square feet of gross floor area.
High schools	One (1) parking space for each employee plus one (1) space for every six (6) students, based on projected maximum enrollment.

Hospitals	One and one half (1.5) parking spaces for each one (1) bed.
Internalized community storage	One (1) parking space for each two thousand five hundred (2,500) square feet of gross floor area.
Library	One (1) space per three hundred (300) square feet gross floor area.
Live entertainment (not including bars, restaurants, and performing arts theaters)	A. With fixed seating. One (1) parking space for two and one-half (2.5) seats. B. Without fixed seating. One (1) parking space for every sixty (60) square feet of gross floor area of an establishment that does not contain fixed seating.
Manufactured home park	One and one-half parking spaces per manufactured home space.
Manufacturing and industrial uses	One (1) parking space for each five hundred (500) square feet of gross floor area.
Mixed-use commercial centers In mixed-use commercial centers with less than 20,000 square feet of gross floor area, land uses (with parking requirements of one space per 250 square feet or fewer spaces) shall occupy at least 60 percent of gross floor area.	One (1) space per three hundred (300) square feet of gross floor area.
Mixed-use developments	A. One (1) space per three hundred twenty-five (325) square feet of gross floor area of nonresidential area; B. Multiple-family residential uses shall be parked at the ratios of the dwellings, multiple-family in other districts requirements, herein.
Office, all other	One (1) space per three hundred (300) square feet gross floor area.
Offices (government, medical/dental and clinics)	One (1) space per two hundred fifty (250) square feet of gross floor area.

Parks	Three (3) parking spaces for each acre of park area.
Personal care services	One (1) space per two hundred fifty (250) square feet gross floor area.
Plant nurseries, building materials yards, equipment rental or sales yards and similar uses	One (1) parking space for each three hundred (300) square feet gross site area of sales and display area.
Pool hall	Two (2) spaces per pool table.
Postal station(s)	One (1) parking space for each two hundred (200) square feet of gross floor area.
Radio/TV/studio	One (1) space per five hundred (500) square feet gross floor area, plus one (1) space per company vehicle, as per Section 9.103.H., additional requirements for company vehicles.
Ranches	One (1) space per every two (2) horse stalls.
Residential health care facilities	A. Specialized care facilities—0.7 parking space for each bed. B. Minimal care facilities—1.25 parking spaces for each dwelling unit.

Restaurants with live entertainment	A. When live entertainment limited to the hours that a full menu is available, and the area of live entertainment is less than fifteen (15) percent of the gross floor area, one (1) parking space per one hundred twenty (120) square feet of gross floor area; and B. One (1) parking space for each three hundred fifty (350) gross square feet of outdoor public floor area, excluding the first three hundred fifty (350) gross square feet of outdoor patio area, unless the space is located next to and oriented toward a publicly owned walkway or street, in which case the first five hundred (500) gross square feet of outdoor patio area is excluded. C. When live entertainment is not limited to the hours that a full menu is available, and/or the area of live entertainment is less than fifteen (15) percent of the gross floor area, one (1) parking space per sixty (60) square feet of gross floor area, plus patio requirements above.
Restaurants	A. One (1) parking space per one hundred twenty (120) square feet of gross floor area; and B. One (1) parking space for each three hundred fifty (350) gross square feet of outdoor patio area, excluding the first three hundred fifty (350) gross square feet of outdoor patio area, unless the space is located next to and oriented toward a publicly owned walkway or street, in which case the first five hundred (500) square gross feet of outdoor patio area is excluded.
Retail	One (1) space per two hundred fifty (250) square feet of gross floor area.
Retail, in a PCoC zoning district without arterial street frontage	One (1) space per three hundred (300) square feet gross floor area.

Stables, commercial	Adequate parking for daily activities shall be provided as determined by the Zoning Administrator.
Swimming pool or natatorium	One (1) space per one thousand (1,000) square feet gross floor area.
Tennis clubs	One (1) parking space per each two hundred (200) square feet of gross floor area, excluding court area, plus three (3) parking spaces per each court. The property owner shall provide additional parking spaces as necessary for tournaments, shows or special events.
Theaters, cinemas, auditoriums, gymnasiums and similar places of public assembly in PNC, PCC, PCP, PRC, or PUD zoning districts	One (1) space per ten (10) seats.
Theaters, cinemas, auditoriums, gymnasiums and similar places of public assembly in other districts	One (1) parking space per four (4) seats.
Trailhead - gateway	Five hundred (500) to six hundred (600) spaces, including those for tour buses and horse trailers.
Trailhead - local	None required.
Trailhead - major community	Two hundred (200) to three hundred (300) spaces, including those for horse trailers.
Trailhead - minor community	Fifty (50) to one hundred (100) spaces.
Transportation facilities	Required parking shall be determined by the Zoning Administrator per Section 9.103.E., Calculating required parking for transportation facilities.
Transportation uses	Parking spaces required shall be determined by the Zoning Administrator.
Travel accommodations	One (1.25) parking spaces for each one (1) guest room or dwelling unit.

Travel accommodations with conference and meeting facilities, or similar facilities	The travel accommodation requirements above. A. Travel accommodations with auxiliary commercial uses (free standing buildings) requirements above. B. One (1) parking space for every five (5) seats, if seats are fixed, and/or C. One (1) parking space for fifty (50) square feet of gross floor area of conference/meeting area.
Travel accommodations, with auxiliary commercial uses (free standing buildings)	A. The travel accommodation requirements above. B. Bar, cocktail lounge, tavern, after hours, restaurants, and live entertainment uses shall provide parking in accordance uses parking requirements herein this table. C. All other free standing commercial uses. One (1) parking space for every four hundred (400) square feet of gross floor area.
Vehicle leasing, rental, or sales (parking plans submitted for vehicle sales shall illustrate the parking spaces allocated for each of A, B, and C.)	A. One employee parking space per 200 square feet of gross floor area, B. One employee parking space per 20 outdoor vehicular display spaces, and C. One patron parking space per 20 outdoor vehicular display spaces.
Veterinary services	One (1) space per three hundred (300) square feet gross floor area.
Warehouses, mini	One (1) space per three hundred (300) square feet of gross floor area of administrative office space, plus one (1) space per each fifty (50) storage spaces.
Warehousing, wholesaling establishments, or separate storage buildings.	One (1) parking space for each eight hundred (800) square feet of gross floor area.
Western theme park	Total of all spaces required for the various uses of the theme park, may apply for a reduction in required parking per Section 9.104, Programs and incentives to reduce parking requirements.

Table 9.103.B. Schedule of Parking Requirements in the Downtown Area	
Bars, cocktail lounges, taverns, afterhours or micro-brewery/distillery with live entertainment	A. One (1) space per eighty (80) square feet of gross floor area; and B. One (1) space per two hundred (200) gross square feet of outdoor patio area, excluding the first two hundred (200) gross square feet.
Bars, cocktail lounges, taverns, afterhours or micro-brewery/distillery	A. One (1) space per one-hundred twenty (120) square feet of gross floor area; and B. One (1) space per two hundred (200) gross square feet of outdoor patio area, excluding the first two hundred (200) gross square feet.
Dwellings, multi-family	A. One parking space per dwelling unit for units with one bedroom or less. B. Two parking spaces per dwelling unit, for units with more than one bedroom.
Financial intuitions	A. In a Type 1 area, one (1) space per five hundred (500) square feet of gross floor area; or B. In a Type 2 area, all other lot widths, one (1) space per three hundred (300) square feet of gross floor area.
Fitness studio (no larger than 3,000 gross square feet)	A. One (1) space per three hundred (300) square feet of gross floor area. B. A fitness studio larger than 3,000 gross square feet shall comply with Table 9.103.a.
Galleries	One (1) space per three hundred (500) square feet of gross floor area.
Live entertainment (not including bars, restaurants, and performing arts theaters)	A. With fixed seating. One (1) parking space for two and one-half (2.5) seats. B. Without fixed seating. One (1) parking space for every eighty (80) square feet of gross floor area of an establishment that does not contain fixed seating.

Medical and diagnostic laboratories	One (1) space per three hundred (300) square feet of gross floor area.
Mixed-use commercial centers In mixed-use commercial centers with less than 20,000 square feet of gross floor area, land uses (with parking requirements of one space per 300 square feet or fewer spaces) shall occupy at least 60 percent of gross floor area.	One (1) space per three hundred fifty (350) square feet of gross floor area.
Mixed-use developments	A. One space per 350 square feet of gross floor area of nonresidential area; plus B. Parking spaces required for multiple-family dwellings as shown in this table, except as provided in Section 9.104.H.3.d.
Office, including government and medical/dental offices and clinics	A. In a Type 1 area, one (1) space per five hundred (500) square feet of gross floor area; or B. In a Type 2 area, all other lot widths, one (1) space per three hundred (300) square feet of gross floor area.
Performing arts theaters	One (1) parking space per ten (10) seats.
Restaurants that serve breakfast and/or lunch only, or the primary business is desserts, bakeries, and/or coffee/tea or non-alcoholic beverage	A. One (1) parking space for each four hundred (400) square feet of gross floor area; and B. One (1) space for each three hundred fifty (350) gross square feet of outdoor public floor area. Excluding the first three hundred fifty (350) gross square feet of outdoor public floor area, unless the space is located next to and oriented toward a publicly owned walkway or street, in which case the first five hundred (500) gross square feet of outdoor public floor area is excluded.

Restaurants, including restaurants with a micro-brewery/distillery as an accessory use.	A. One (1) parking space per three hundred (300) square feet of gross floor area; and B. One (1) parking space for each three hundred fifty (350) gross square feet of outdoor patio area. Excluding the first three hundred fifty (350) gross square feet of outdoor patio area, unless the space is located next to and oriented toward a publicly owned walkway or street, in which case the first five hundred (500) gross square feet of outdoor public floor area is excluded.
Restaurants, including restaurants with a micro-brewery/distillery as an accessory use, and with live entertainment	A. When live entertainment limited to the hours that a full menu is available, and the area of live entertainment is less than fifteen (15) percent of the gross floor area, one (1) parking space per three hundred (300) square feet of gross floor area; and B. One (1) parking space for each three hundred fifty (350) gross square feet of outdoor public floor area. Excluding the first three hundred fifty (350) gross square feet of outdoor patio, unless the space is located next to and oriented toward a publicly owned walkway or street, in which case the first five hundred (500) gross square feet of outdoor patio area is excluded. C. When live entertainment is not limited to the hours that a full menu is available, and/or the area of live entertainment is greater than fifteen (15) percent of the gross floor area, one (1) parking space per one hundred twenty (120) square feet of gross floor area, plus patio requirements above at all times.
Retail, personal care services, dry cleaners, and tattoo parlors	A. In a Type 1 area, one (1) space per five hundred (500) square feet of gross floor area; or B. In a Type 2 area, all other lot widths, one (1) space per three hundred (300) square feet of gross floor area.

Work/live	A. The required parking shall be based on the area of commercial uses, per Table 9.103.B and when applicable, Table 9.103.A. B. In addition to the parking requirement for the commercial area, parking shall be provide in accordance with the dwellings, multi-family and co-housing parking requirement for developments containing more than one (1) dwelling unit, excluding the first unit (except as provided in Section 9.104.H.3.d).
All other uses	As specified Table 9.103.A.

Note: 1. Type 1 and Type 2 Areas are locations of the Downtown Area described by the Downtown Plan.

(Ord. No. 2736, § 1, 3-7-95; Ord. No. 3048, § 2, 10-7-97; Ord. No. 3225, § 1, 5-4-99; Ord. No. 3879, § 1(Exh. § 26), 3-2-10; Ord. No. 3896, § 1(Exh. § 6), 6-8-10; Ord. No. 3899, § 1(Res. No. 8342, Exh. A, §§ 18, 19), 8-30-10; Ord. No. 3920, § 1(Exh. §§ 104—109), 11-9-10; Ord. No. 3926, § 1(Exh. § 13), 2-15-11; Ord. No. 3980, § 1(Res. 8895, § 1, Exh. A, § 46), 12-6-11; Ord. No. 3992, § 1(Res. No. 8922, Exh. A, § 17), 1-24-12; Ord. No. 4099, § 1(Res. No. 9439, Exh. A, §§ 17—23), 6-18-13; Ord. No. 4117, § 1(Res. No. 9563, Exh. A, §§ 96—98), 11-19-13; Ord. No. 4143, § 1(Res. No. 9678, Exh. A, §§ 246—249), 5-6-14; Ord. No. 4265, § 1, 6-21-16)

Sec. 9.104. - Programs and incentives to reduce parking requirements.

The following programs and incentives are provided to permit reduced parking requirements in the locations and situations outlined herein where the basic parking requirements of this Zoning Ordinance would be excessive or detrimental to goals and policies of the city relating to mass transit and other alternative modes of transportation.

A. *Administration of parking reductions.* Programs and incentives which reduce parking requirements may be applied individually or jointly to properties and developments. Where reductions are allowed, the number of required parking spaces which are eliminated shall be accounted for both in total and by the program, incentive or credit which is applied. The record of such reductions shall be kept on the site plan within the project review file. Additionally, the reductions and manner in which they were applied shall be transmitted in writing to the property owner.

B. *Credit for on-street parking.* Wherever on-street angle parking is provided in the improvement of a street, credit toward on-site parking requirements shall be granted at the rate of one (1) on-site space per every twenty-five (25) feet of frontage, excluding the following:

1. Frontage on an arterial, major arterial or expressway as designated in the Transportation Master Plan.
2. Frontage on a street that is planned to be less than fifty-five (55) feet wide curb-to-curb.
3. Frontage within twenty (20) feet of a corner.

4. Frontage within ten (10) feet of each side of a driveway or alley.
5. Frontage within a fire hydrant zone or other emergency access zone.
6. Locations within the Downtown Area.

C. *Credit for bicycle parking facilities.*

1. *Purpose.* The City of Scottsdale, in keeping with the federal and Maricopa County Clean Air Acts, wishes to encourage the use of alternative transportation modes such as the bicycle instead of the private vehicle. Reducing the number of vehicular parking spaces in favor of bicycle parking spaces helps to attain the standards of the Clean Air Act, to reduce impervious surfaces, and to save on land and development costs.
2. *Performance standards.* The Zoning Administrator may authorize credit towards on-site parking requirements for all uses except residential uses, for the provision of bicycle facilities beyond those required by this Zoning Ordinance, subject to the following guidelines:
   a. Wherever bicycle parking is provided beyond the amount required per Section 9.103.C., required bicycle parking, credit toward required on-site vehicular parking may be granted pursuant to the following:
      i. Downtown Area: one (1) vehicular space per eight (8) bicycle spaces.
      ii. All other zoning districts: one (1) vehicular space per ten (10) bicycle spaces.
   b. Wherever bicycle parking facilities exceed the minimum security level required per Section 9.103.D., required bicycle parking, credit towards required onsite vehicular parking may be granted at a rate of one (1) vehicular space per every four (4) high-security bicycle spaces.

      High-security bicycle spaces shall include those which protect against the theft of the entire bicycle and of its components and accessories by enclosure through the use of bicycle lockers, check-in facilities, monitored parking areas, or other means which provide the above level of security as approved by the Zoning Administrator.
   c. Wherever shower and changing facilities for bicyclists are provided, credit towards required on-site vehicular parking may be granted at the rate of two (2) vehicular spaces per one (1) shower.
   d. The number of vehicular spaces required Table 9.103.A., or when applicable Table 9.103.B., shall not be reduced by more than five (5) percent or ten (10) spaces, whichever is less.

D. *Credit for participation in a joint parking improvement project.* After April 7, 1995, no new joint parking improvement projects shall be designated in the City of Scottsdale. Existing joint parking improvement projects may continue to exist, subject to the standards under which they were established.

The joint parking improvement project was a program through which a group of property owners with mixed land uses including an area of more than three (3) blocks and at least six (6) separate ownerships could join together on a voluntary basis to form a parking improvement district, providing parking spaces equal to a minimum of thirty (30) percent of their combined requirements according to the ordinance under which they were established. Each participant property could have received credit for one and one-half (1½) times his proportioned share of the parking spaces provided. The project required that a statement be filed with the superintendent of buildings stating the number of spaces assigned to each participating property. No adjustments were to be permitted subsequent to the filing of this statement.

E. *Mixed-use shared parking programs.*

1. Purpose. A mixed-use shared parking program is an option to reduce the total required parking in larg commercial centers and mixed-use developments in which the uses operate at different times throug recognizes that strict application of the required parking ratios may result in excessive parking spaces. excessive pavement and impermeable surfaces and discourages the use of alternate transportation m
2. Applicability. A mixed-use shared parking program is an alternative to a parking master plan.
3. Procedure.
    a. A mixed-use shared parking program may be proposed at the time a parking plan is required.
    b. The mixed-use shared parking program may also be requested exclusive of any other site plan review or permitting procedure.
    c. Mixed-use shared parking plans shall be reviewed by, and are subject to the approval of, the Zoning Administrator.
    d. Alternatively, the applicant may elect to have the shared parking plan reviewed by, and subject to the approval of, the City Council in a public hearing.
    e. For changes of use in mixed-use projects, the parking necessary for the new mix of uses shall not exceed the parking required by the previous mix of uses.
4. Limitations on mixed-use shared parking.
    a. The total number parking spaces required by Table 9.103.B. and the total number of parking spaces required for a mixed-use commercial center and mixed-use development indicated in Table 9.103.A. shall not be used to reduce the required parking in the Downtown Area or a development that is defined as mixed-use development or mixed- use commercial center not in the Downtown Area.
    b. The total number of parking spaces required by Table 9.103.A. shall not be reduced by more than twenty (20) percent.
5. Performance standards. The Zoning Administrator may authorize a reduction in the total number of required parking spaces for two (2) or more uses jointly providing on-site parking subject to the following criteria:
    a. The respective hours of operation of the uses do not overlap, as demonstrated by the application on Table 9.104.A., Schedule of Shared Parking Calculations. If one (1) or all of the land uses proposing to use joint parking facilities do not conform to one (1) of the general land use classifications in Table 9.104.A., Schedule of Shared Parking Calculations, data shall indicate there is not substantial conflict in the principal operating hours of the uses. Such data may include information from a professional publication such as those published by the Institute of Transportation Engineers (ITE) or the Urban Land Institute (ULI), or by a professionally prepared parking study.
    b. A parking plan shall be submitted for approval which shall show the layout of proposed parking.
    c. The property owners involved in the joint use of on-site parking facilities shall submit a written agreement subject to City approval requiring that the parking spaces shall be maintained as long as the uses requiring parking exist or unless the required parking is provided elsewhere in accordance with the provisions of this Article. Such written agreement shall be recorded by the property owner with the Maricopa County Recorder's Office prior to the issuance of a building permit, and a copy filed in the project review file.

Table 9.104.A Schedule of Shared Parking Calculations

General Land Use Classification	Weekdays			Weekends		
	12:00 a.m.— 7:00 a.m.	7:00 a.m.— 6:00 p.m.	6:00 p.m.— 12:00 a.m.	12:00 a.m.— 7:00 a.m.	7:00 a.m.— 6:00 p.m.	6:00 p.m.— 12:00 a.m.
Office and industrial	5%	100%	5%	0%	60%	10%
Retail	0%	100%	80%	0%	100%	60%
Residential	100%	55%	85%	100%	65%	75%
Restaurant and bars	50%	70%	100%	45%	70%	100%
Hotel	100%	65%	90%	100%	65%	80%
Churches and places of worship	0%	10%	30%	0%	100%	30%
Cinema/theater, and live entertainment	0%	70%	100%	5%	70%	100%

How to use the schedule of shared parking. Calculate the number of parking spaces required by Table 9.103.A. for each use as if that use were free-standing (the total number of parking spaces required by Table 9.103.B. and the total number of parking spaces required for a mixed-use commercial center and mixed-use development indicated in Table 9.103.A. shall not be used to reduce the required parking in the Downtown Area, or a development that is defined as mixed-use development or mixed-use commercial center not in Downtown Area.)

Applying the applicable general land use category to each proposed use, use the percentages to calculate the number of spaces required for each time period, (six (6) time periods per use). Add the number of spaces required for all applicable land uses to obtain a total parking requirement for each time period. Select the time period with the highest total parking requirement and use that total as your shared parking requirement.

F. *Parking master plan.*

1. *Purpose.* A parking master plan is presented as an option to promote the safe and efficient design

of parking facilities for sites larger than two (2) acres or those sites in the Downtown Type 1 Area as designated by the Downtown Plan larger than sixty thousand (60,000) square feet. The city recognizes that strict application of the required parking standards or ratios may result in the provision of parking facilities of excessive size or numbers of parking spaces. This results in excessive pavement and impermeable surfaces and may discourage the use of alternate transportation modes. A parking master plan provides more efficient parking through the following requirements.

2. *Applicability.* The parking master plan is appropriate to alleviate problems of reuse and is also applicable as an alternative to the above mixed-use shared parking programs.
3. *Procedure.*
    a. A parking master plan may be proposed at the time a parking plan is required.
    b. The parking master plan may also be requested exclusive of any other site plan review or permitting procedure.
    c. Parking master plans shall be reviewed by, and are subject to the approval of, the Zoning Administrator.
    d. For changes of use in mixed-use projects, the parking necessary for the new mix of uses shall not exceed the parking required by the previous mix of uses.
4. Limitations on parking master plans.
    a. The total number parking spaces required by Table 9.103.B. and the total number of parking spaces required for a mixed-use commercial center and mixed-use development indicated in Table 9.103.A. shall not be used to reduce the required parking in the Downtown Area or a development that is defined as mixed-use development or mixed-use commercial center not in the Downtown Area.
    b. The Zoning Administrator shall only permit reductions of up to twenty (20) percent of the total parking required per Table 9.103.A.
    c. Reductions of more than twenty (20) percent of required parking shall be subject to approval by the City Council.
5. Elements of a parking master plan. The contents of the parking master plan shall include:
    a. A plan, which graphically depicts where the spaces and parking structures are to be located.
    b. A report, which demonstrates how everything shown on the plan complies with or varies from applicable standards and procedures of the City.
    c. The plan shall show all entrances and exits for any structured parking and the relationship between parking lots or structures and the circulation master plan.
    d. The plan, supported by the report, shall show the use, number, location, and typical dimensions of parking for various vehicle types including passenger vehicles, trucks, vehicles for mobility impaired persons, buses, other transit vehicles and bicycles.
    e. The plan, supported by the report, shall include phasing plans for the construction of parking facilities and any interim facilities planned.
    f. Whenever a reduction in the number of required parking spaces is requested, the required report shall be prepared by a registered civil engineer licensed to practice in the State of Arizona and shall document how any reductions were calculated and upon what assumptions such calculations were based.

g. Parking ratios used within the report shall be based upon uses or categories of uses already liste Schedule Of Parking Requirements (the total number of parking spaces required by Table 9.103.E parking spaces required for a mixed-use commercial center and mixed-use development indicate not be used to reduce the required parking in the Downtown Area or a development that is defin development or mixed-use commercial center not in the Downtown Area.)

h. Such other information as is determined by the reviewing authority to be necessary to process the parking master plan.

6. *Performance standards.* Parking shall comply with the requirements of the Zoning Ordinance as amended except where application of the following criteria can show that a modification of the standards is warranted. This shall be determined by the Zoning Administrator pending review of the materials described in Subsection 5. above.

a. The parking master plan shall provide sufficient number and types of spaces to serve the uses identified on the site.

b. Adequate provisions shall be made for the safety of all parking facility users, including motorists, bicyclists and pedestrians.

c. Parking master plans shall be designed to minimize or alleviate traffic problems.

d. Parking spaces shall be located near the uses they are intended to serve.

e. Adequate on-site parking shall be provided during each phase of development of the district.

f. The plan shall provide opportunities for shared parking or for other reductions in trip generation through the adoption of Transportation Demand Management (TDM) techniques to reduce trip generation, such as car pools, van pools, bicycles, employer transit subsidies, compressed work hours, and High Occupancy Vehicle (HOV) parking preference.

g. Surfacing of the lot shall be dust-proof, as provided by Section 9.106.C.1.

h. The parking master plan shall attempt to reduce environmental problems and to further the City's compliance with the federal Clean Air Act amendments of 1990 through appropriate site planning techniques, such as but not limited to reduced impervious surfaces and pedestrian connections.

i. Compliance with the federal Clean Air Act amendments of 1990 shall be considered.

j. Reductions in the number of parking spaces should be related to significant factors such as, but not limited to:

i. Shared parking opportunities;

ii. Hours of operation;

iii. The availability and incorporation of transit services and facilities;

iv. Opportunities for reduced trip generation through pedestrian circulation between mixed-uses;

v. Off-site traffic mitigation measures;

vi. Recognized variations in standards due to the scale of the facilities;

vii. Parking demand for a specified use; and

viii. The provisions of accessible parking spaces beyond those required per Section 9.105.

k. Reductions in the number of parking spaces for neighborhood-oriented uses may be granted at a rate of one (1) space for every existing or planned residential unit located within two (2)

blocks of the proposed use, and one-half (0.5) space for every existing or planned residential unit located within four (4) blocks of the proposed use.

7. *Approval.* The property owner involved in the parking master plan shall submit a written agreement, subject to City approval, requiring that the parking facility and any associated Transportation Demand Management (TDM) techniques shall be maintained without alteration unless such alteration is authorized by the Zoning Administrator. Such written agreement shall be recorded by the property owner with the Maricopa County Recorder's Office prior to the issuance of a building permit, and a copy filed in the project review file.

G. *Reserved.*

H. *Downtown Overlay District Program.*

1. *Purpose.* This parking program will ease the process of calculating parking supply for new buildings, remodels, or for buildings with new tenants or new building area.

   This parking program consists of two (2) elements: Parking required and parking waiver.

2. *Parking required.* The amount of parking required shall be:

   a. *If there is no change of parking intensity.*

      i. If there is no change of parking intensity of the land use on any lot that has a legal land use existing as of July 31, 2003, no additional parking shall be required.

   b. *Parking credits.*

      i. Parking credits under this program shall be only for: parking improvement districts, permanent parking in-lieu credits, approved zoning variances for on-site parking requirements - unless the Zoning Administrator finds that the justification for the parking variance no-longer exists, and Parking P-3 District, except as provided in Section 9.104.H.2.b.i.(1). Only these parking credits shall carry forward with any lot that has parking credits as of July 31, 2003.

         (1) Parking credits associated with the Parking P-3 District shall continue to apply, unless the Parking P-3 District is removed from the property.

      ii. The Downtown Overlay District does not void public agreements for parking payments of any type of parking program.

      iii. Any parking improvement district credit(s) or permanent parking in-lieu credit(s) that the lot has that are in excess of the current parking demand shall remain with the lot.

      iv. Property owners are still required to pay for any program that allowed them to meet the parking requirements.

   c. *Increase in parking.*

      i. When a property's parking requirements increase above the parking requirements on July 31, 2003, the new parking requirement is calculated as follows:

         (N - O) + T = number of parking spaces required

         N = new (increased) parking requirement

         O = old parking requirement (on July 31, 2003)

T = total of on-site and any remote parking spaces, plus any parking credits required on July 31, 2003 to meet the old parking requirement (excluding excess on-site and remote parking spaces and any excess parking credits).

ii. As applicable, Table 9.103.A. Table 9.103.B. shall be used to calculate N and O.

iii. A waiver to this requirement is in Section 9.104.H.3.

3. *Parking waiver within the Downtown Overlay District.*

a. *Purpose.* This parking waiver is designed to act as an incentive for new buildings, and for building area expansions of downtown businesses, which the expansion will have a minimal impact on parking demand.

b. *Applicability.* Upon application, property owners may have parking requirements waived if they meet both the following criteria:

i. Are within the Downtown Overlay District, and/or the Downtown District; and

ii. The new building or the new area of a building expansion is used for retail, office, restaurant or personal care services uses allowed in the underlying district.

c. *Limitations on this parking waiver.*

i. Can be used only once per lot existing as of July 31, 2003.

ii. Can be used for retail, office, restaurant or personal care services uses allowed in the underlying district at a ratio of one (1) space per three hundred (300) gross square feet.

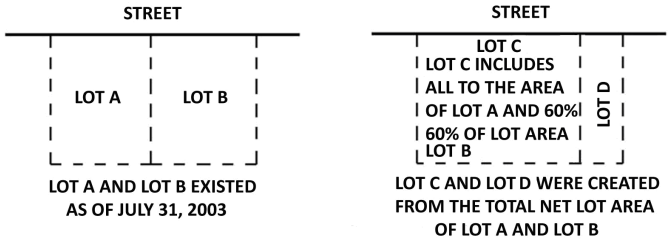
iii. Is limited to a maximum of two thousand (2,000) gross square feet of new building, or building area expansion. The two thousand (2,000) gross square feet per lot of new building, or building area expansion may be used incrementally, but shall not exceed two thousand (2,000) gross square feet of the building size of each lot existing as of July 31, 2003.

(1) Except as provided in Section 9.104.H.3.c.iii.(1)., a lot that is created after July 31, 2003 from more than one (1) lot that existed as of July 31, 2003 shall be allowed to utilize parking waiver as cumulative total of all lots that were incorporated into one (1) lot.

(2) A lot(s) that is created after July 31, 2003 from a portion of a lot(s) that existed as of July 31, 2003 shall be entitled to a waiver of area, as described in section 9.104.H.3.c.iii., based on the pro-rata portion of the net lot that was split from the existing lot(s) and incorporated into the new lot(s). For example:

As shown in Figure 9.104.A., Lot A and Lot B are reconfigured into two (2) new lot configurations, Lot C and Lot D. Lot C now includes all of the net lot area of Lot A and sixty (60) percent of the net lot area of Lot B. Lot C is entitled to the all of the waiver of Lot A and sixty (60) percent of the waiver of Lot B. Lot D is entitled only to forty (40) percent of the waiver of Lot B.

FIGURE 9.104.A.

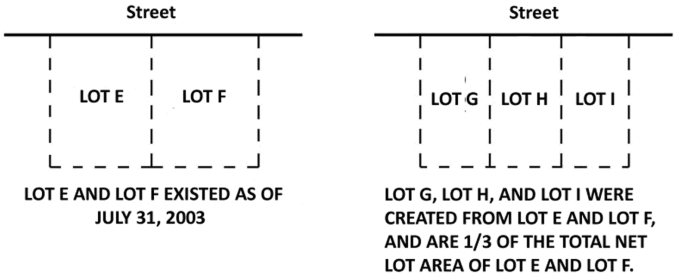


Therefore, Lot C's wavier would be three thousand two hundred (3,200) square feet of new building, or building area expansion; and Lot D's wavier would be eight hundred (800) square feet of new building, or building area expansion.

Another example may be:

As shown in Figure 9.104.B., Lot E and Lot F are reconfigured into three (3) new lots, Lot G, Lot H, and Lots I. Lot G, Lot H, and Lots I are each equal to one-third (1/3) of the total net lot area of Lot E and Lot F. therefore, Lot G, Lot H, AND Lots I each are entitled to one-third (1/3) of the total wavier that is allowed for Lot E and Lot F.

FIGURE 9.104.B.



Therefore, Lot G's, Lot H's, and Lot I's waiver each would be one thousand three hundred thirty-three and one-third (1,333.33) square feet of new building, or building area expansion.

iv. Cannot be used on land that issued to meet a property's current parking requirement unless the same number of physical parking spaces are replaced elsewhere on site, or through the purchase of permanent in-lieu parking credits.

d. *Residential addition parking waiver.* No additional parking is required for up to four new dwelling units that are added to a development as part of a 2,000 square foot (or smaller) nonresidential gross floor area expansion.

(Ord. No. 2736, § 1, 3-7-95; Ord. No. 3520, § 1, 7-1-03; Ord. No. 3543, § 1(Exh. 1), 12-9-03; Ord. No. 3774, § 2, 3-18-08; Ord. No. 3896, § 1(Exh. § 6), 6-8-10; Ord. No. 3920, § 1(Exh. §§ 110—114), 11-9-10; Ord. No. 3980, § 1(Res. 8895, § 1, Exh. A, § 47), 12-6-11; Ord. No. 4005, § 1(Res. No. 8947, Exh. A, § 199, 200), 4-3-12; Ord. No. 4099, § 1(Res. No. 9439, Exh. A, §§ 24, 25), 6-18-13; Ord. No. 4143, § 1(Res. No. 9678, Exh. A, §§ 250—261), 5-6-14)

Appendix C – Additional Parking Occupancy Data Collection

C

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Nordstrom Parking Garage (Scottsdale) Parking Study

April 2, 2020

Parking Usage Data Collection

Date	Time	Stalls Occupied
4/2/2020	12:00 AM	0
	12:30 AM	0
	1:00 AM	0
	1:30 AM	0
	2:00 AM	0
	2:30 AM	0
	3:00 AM	0
	3:30 AM	0
	4:00 AM	0
	4:30 AM	0
	5:00 AM	0
	5:30 AM	0
	6:00 AM	0

Nordstrom Parking Garage (Scottsdale) Parking Study

April 4, 2020

Parking Usage Data Collection

Date	Time	Stalls Occupied
4/4/2020	12:00 AM	0
	12:30 AM	0
	1:00 AM	0
	1:30 AM	0
	2:00 AM	0
	2:30 AM	0
	3:00 AM	0
	3:30 AM	0
	4:00 AM	0
	4:30 AM	0
	5:00 AM	0
	5:30 AM	0
	6:00 AM	0

Nordstrom Parking Marshall Way (Scottsdale) Parking Study

April 2, 2020

Parking Usage Data Collection

Date	Time	Stalls Occupied
4/2/2020	12:00 AM	3
	12:30 AM	2
	1:00 AM	2
	1:30 AM	2
	2:00 AM	2
	2:30 AM	0
	3:00 AM	0
	3:30 AM	0
	4:00 AM	0
	4:30 AM	0
	5:00 AM	0
	5:30 AM	0
	6:00 AM	0

Nordstrom Parking Marshall Way (Scottsdale) Parking Study

April 4, 2020

Parking Usage Data Collection

Date	Time	Stalls Occupied
4/4/2020	12:00 AM	0
	12:30 AM	0
	1:00 AM	0
	1:30 AM	0
	2:00 AM	0
	2:30 AM	0
	3:00 AM	0
	3:30 AM	0
	4:00 AM	0
	4:30 AM	0
	5:00 AM	0
	5:30 AM	0
	6:00 AM	0

Dwell Apartment Homes Parking Study

March 4, 2020

Parking Usage Data Collection

Date	Time	Stalls Occupied
3/4/2020	12:00 AM	198
	12:30 AM	198
	1:00 AM	205
	1:30 AM	201
	2:00 AM	203
	2:30 AM	205
	3:00 AM	203
	3:30 AM	203
	4:00 AM	203
	4:30 AM	193
	5:00 AM	193
	5:30 AM	190
	6:00 AM	184

Dwell Apartment Homes Parking Study

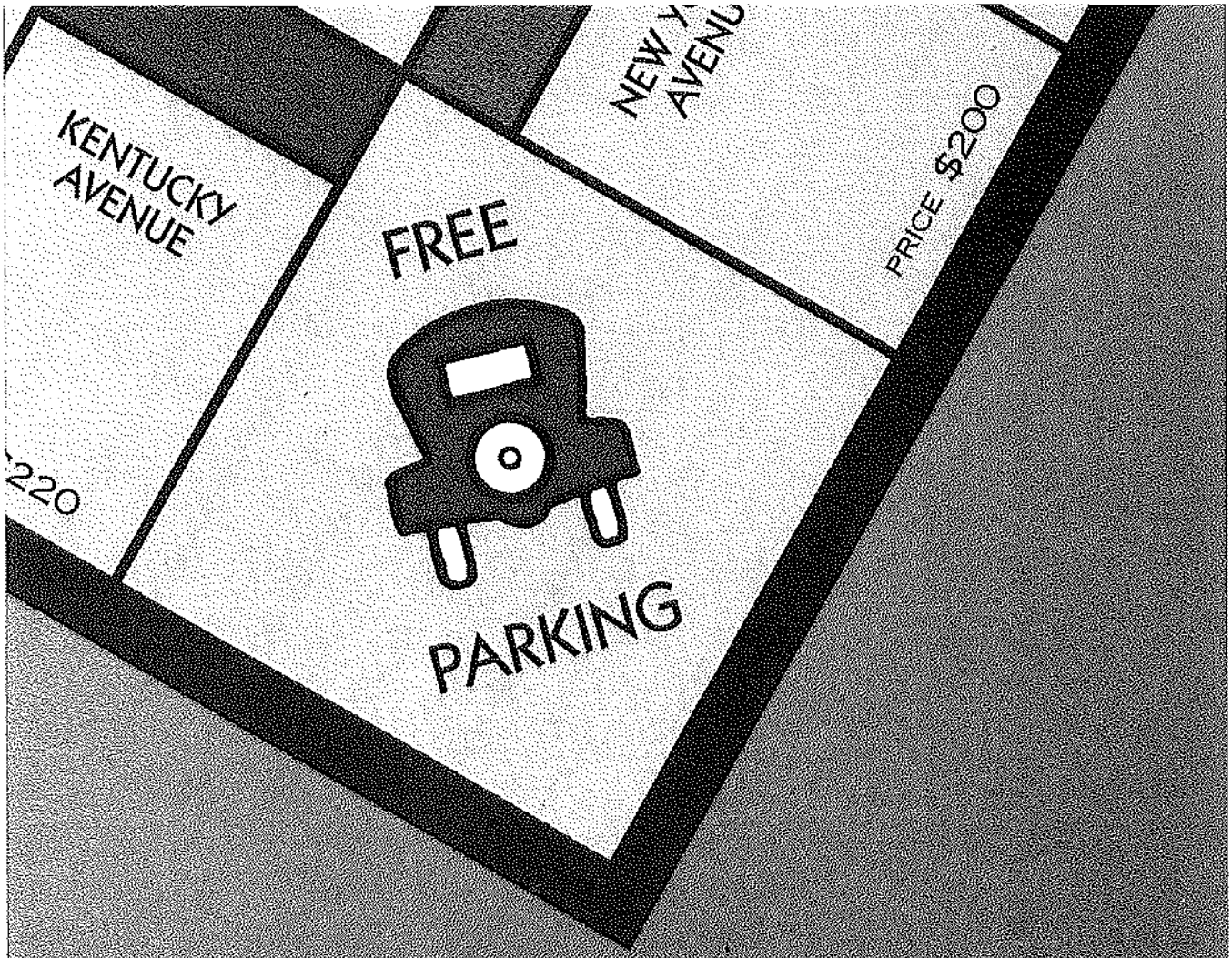
March 7, 2020

Parking Usage Data Collection

Date	Time	Stalls Occupied
3/7/2020	12:00 AM	194
	12:30 AM	195
	1:00 AM	195
	1:30 AM	195
	2:00 AM	199
	2:30 AM	198
	3:00 AM	200
	3:30 AM	199
	4:00 AM	205
	4:30 AM	196
	5:00 AM	197
	5:30 AM	193
	6:00 AM	192

Appendix D – Parking Trends in the News

D



The High Cost of Free Parking

DONALD SHOUP

Updated by the author

5-ZN-2020

Preface

A Progress Report on Parking Reforms

All of us, if we are reasonably comfortable, healthy and safe, owe immense debts to the past. There is no way, of course, to repay the past. We can only repay those debts by making gifts to the future.

—JANE JACOBS

Who would have predicted that a 750-page book on parking could be popular enough to reprint as a paperback? One sign that *The High Cost of Free Parking* has attracted a following is a Facebook group for the book with about a thousand members, called the Shoupistas. Although the group sounds radical, the members support market-rate prices for parking, which sounds conservative. Because of this widespread interest across the political spectrum, the American Planning Association is publishing this paperback edition to make the book more affordable, especially for students who are the next generation of city planners.

When the hardback edition was published in 2005, the reviews were, with one unimportant exception, very good.[1] More important than good reviews, several cities have adopted the policies proposed in the book, and the paperback edition offers an opportunity to report on progress made in parking reforms during the past six years. In this preface I will discuss reforms that have taken place in relation to the three basic policies recommended in the book: (1) set the right price for curb parking, (2) return the parking revenue to pay for local public services, and (3) remove minimum parking requirements. (The Afterword on pages 683–709 presents more information about these reforms.)

I hope the progress reported here will convince readers that my policy proposals are not theoretical and idealistic but are instead practical and realistic. The good news about our decades of bad planning for parking is that the damage we have done will be far cheaper to repair than to ignore.

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1. SET THE RIGHT PRICE FOR CURB PARKING

Cities should set the right price for curb parking because the wrong prices produce such bad results. Where curb parking is underpriced and overcrowded, a surprising share of traffic can be cruising in search of a place to park. Sixteen studies conducted between 1927 and 2001 found that, on average, 30 percent of the cars in congested traffic were cruising for parking (see Chapter 11). New studies continue to find that many drivers cruise for curb parking like hawks looking for prey. For example, when researchers interviewed drivers who were stopped at traffic signals in New York City, they found that 28 percent of the drivers on one street in Manhattan and 45 percent on a street in Brooklyn were cruising for curb parking.[2]

In another study, observers found the average time to find a curb space on 15 blocks in the Upper West Side of Manhattan was 3.1 minutes and the average cruising distance was 0.37 miles. These findings were used to estimate that cruising for underpriced parking on these 15 blocks alone creates about 366,000 excess vehicle miles of travel and produces 325 tons of CO_2 per year.[3]

Performance Parking Prices

Free curb parking in a congested city gives a small, temporary benefit to a few drivers who happen to be lucky on a particular day, but it creates large social costs for everyone else every day. To manage curb parking and avoid the problems caused by cruising, some cities have begun to adjust their curb parking prices by location and time of day to produce an 85 percent occupancy rate for curb parking, which corresponds to one vacant space on a block with eight curb spaces. The price is too high if many spaces are vacant and too low if no spaces are vacant. But if one or two spaces are vacant on a block and drivers can reliably find open curb spaces at their destinations, the price is just right. We can call this the Goldilocks principle of parking prices.

Although cruising may seem to be an inevitable consequence of living in a crowded city, some drivers believe they have good "parking karma," an uncanny ability to find a curb space when they arrive at a destination. Given the laws of probability, some drivers will be luckier than others in finding a parking spot, and they may interpret this luck as a rare gift rather than pure chance. Setting the right parking prices can give all drivers the gift of good parking karma.

Some cities refer to the policy of setting prices to produce one or two open curb spaces on every block as *performance pricing*. It can

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improve performance in three ways. First, curb parking will perform more efficiently. If all but one or two curb spaces are occupied on every block, parking will be well used but also remain readily available for drivers who want to park. Second, the transportation system will perform more efficiently because cruising for curb parking will not congest traffic, waste fuel, pollute the air, and waste drivers' time. Third, the economy will perform more efficiently. In business districts, drivers will park, buy something, and leave promptly, allowing other customers to use the spaces.

SFpark. With a grant from the U.S. Department of Transportation, San Francisco has embarked on an ambitious program, called SF*park*, to get the prices of curb parking right. The city is installing meters that can charge variable prices and sensors that can report the occupancy of each space in real time. The city will thus have information on curb occupancy rates and the ability to adjust curb parking prices in response to the occupancy rates. The city intends to adjust prices once a month, by not more than 50¢ an hour. By nudging prices up or down in a trial-and-error process, the city will seek a structure of prices that vary by time and location throughout the city, yielding one or two open spaces on every block.[4]

The central idea of SF*park* is that you cannot set the right price for curb parking without observing the occupancy. The goal is to set the lowest price that will yield one or two open spaces on every block. Figure P-1 shows that nudging up the price on crowded Block A by enough to shift only one car to less crowded Block B can significantly improve the performance of the transportation system. This shift will eliminate cruising on Block A and take advantage of the empty spaces on Block B. Even if all the curb spaces are occupied on all the nearby blocks, shifting only one car per block from a curb space to nearby off-street parking can also eliminate cruising. Small changes in parking prices and location choices can lead to big improvements in transportation efficiency.

Beyond managing the curb parking supply, SF*park* can depoliticize parking by stating a clear principle for setting the prices for curb spaces: the

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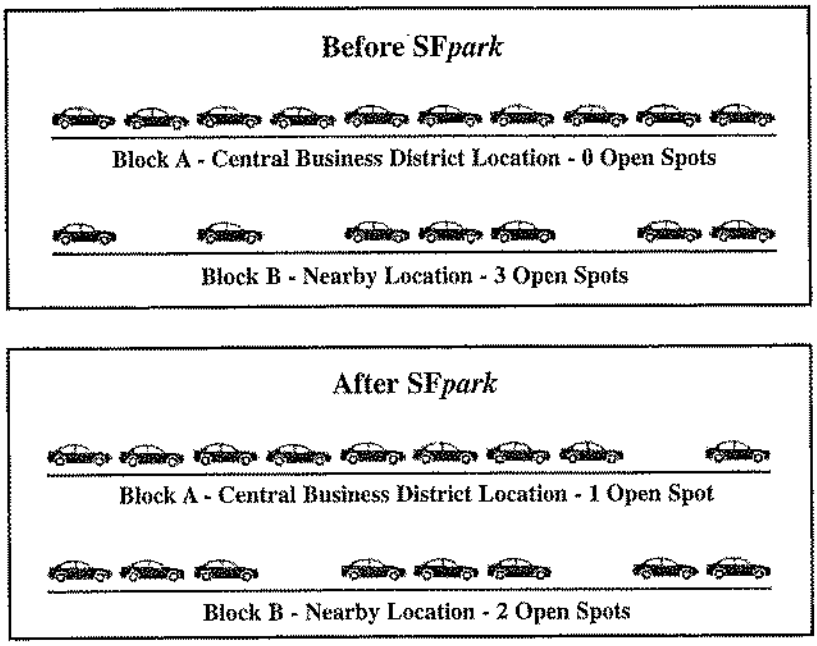


Figure P-1. Performance prices create open spaces on every block.

lowest prices the city can charge without creating a parking shortage. Because San Francisco has set a policy goal for how curb parking should perform, the demand for parking will set the prices.

Performance parking programs do not rely on complex models to set prices; they rely only on paying attention to the results. After shifting from a revenue goal to an outcome goal for the parking system and choosing the occupancy rate to indicate the desired outcome, the city council will no longer have to vote on parking prices. If too many curb spaces are vacant, the price will go down, and if no curb spaces are vacant, the price will go up. Wanting more money will no longer justify raising prices. Relying on the power of an impersonal rule to set prices makes an end run around the politics of parking.

In preparing for SF*park*, San Francisco conducted a census of its parking spaces and found 281,000 on-street spaces, which make up 58 percent of all publicly available parking in the city. San Francisco has one on-street parking space for every three people in the city, but only 9 percent of those spaces are metered.[5] Expanding SF*park* into areas that have a shortage of curb parking can greatly improve management of this valuable asset and also yield substantial revenue for local public investments.

Several other cities—including Los Angeles, New York, Seattle, and Washington, D.C.—have adopted similar performance parking policies. The Afterword explains their programs.

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Opposition to SFpark. Drivers who cruise in search of free curb parking pay with time instead of money, and their cruising congests traffic, pollutes the air, and wastes fuel. In contrast, drivers who pay money for performance-priced curb parking provide funds to improve public services. Nevertheless, some people oppose charging anything for curb parking. One group in San Francisco, the Act Now to Stop War and End Racism (ANSWER) Coalition, has strongly but unsuccessfully tried to block SF*park*. One flyer proclaimed:

> Stop the parking meter hike! Make the rich pay, not the workers! Don't squeeze workers and small business. This is a tax on the people! It's time to organize and defeat the parking meter robbery![6]

The ANSWER Coalition opposes foreign wars for oil but supports free parking at home, and this sort of confusion is common in debates about parking policy. Thinking about parking seems to take place in the reptilian cortex, the most primitive part of the brain responsible for making snap decisions about urgent fight-or-flight choices, such as how to avoid being eaten.[7] The brain's reptilian cortex is said to govern instinctive behavior involved in aggression, dominance, territoriality, and ritual display—all important factors in cruising for parking and debating about parking policies.

The ANSWER Coalition's criticism of SF*park* is misguided. Thirty percent of households in San Francisco don't own a car, and the city uses all the parking meter revenue to subsidize public transit. Many poor people ride buses that are mired in traffic congested by richer drivers who are cruising for underpriced curb parking.[8]

Drivers who don't want to pay for parking often push poor people out in front of them like human shields, claiming that charging for parking will hurt the poor. Free curb parking limits the revenue available to pay for public services, and poor people are less able to replace public services with private purchases the way richer people can. The poorest people cannot afford cars, but they can benefit from public services—such as public transportation—that are financed by parking revenues. Using curb parking revenue to pay for local public services is much fairer than keeping curb parking free and requiring ample off-street parking (see pp. 530–539).

Some opposition to performance parking prices may be due to unfamiliarity, and only experience will change minds. Once drivers have become accustomed to performance prices and see that prices can decline as well as increase, they may come to value the ready availability of curb parking. What seems indefensible for a current generation

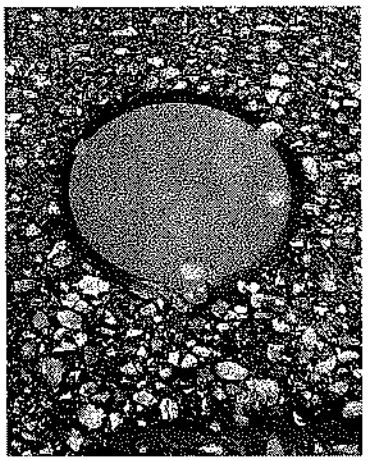
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may become indispensable for future generations. Familiarity breeds acceptability and, as Thomas Paine wrote, "Time makes more converts than reason."

New Technology for Performance Pricing

Setting an occupancy goal is easier than achieving it. How can a city adjust parking prices to yield one or two open curb spaces on every block? Fortunately, the technology used to charge for parking and measure occupancy has advanced rapidly in recent years. This new technology enables cities not only to set different prices at different times of day but also to measure the resulting occupancy of curb spaces.

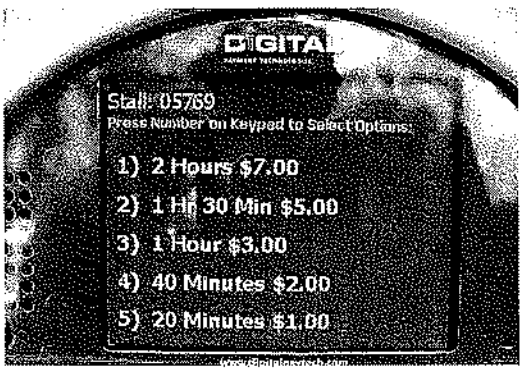
Occupancy sensors are one promising new technology (see Figure P-2).[9] These sensors are about the size of a hockey puck and are placed in every curb space, either on the surface of the street or a few inches beneath it. They sense changes in the earth's magnetic field when a ton of metal is parked above and send this information to a central database. San Francisco will use the data from sensors to adjust parking prices once a month to reach the occupancy goal.[10]



www.streetlinenetworks.com

Figure P-2. Occupancy sensor

The technology for charging variable prices has also advanced. Most multispace meters can charge variable prices through the day, and these prices can be remotely updated without touching the meters. Multispace parking meters on the UCLA campus charge four different prices during a day, and the price of parking is not printed anywhere on the meter. When drivers touch a button on the meter, the digital display shows the price of parking at that time (see Figure P-3). For example, during peak hours the price of parking at the center of campus is $3 for the first hour and $4 for the second hour. Is this too much to charge for parking at a university? You cannot answer this question without looking at the results. The right price of curb parking is like Supreme Court Justice Potter Stewart's definition of pornography: "I know it when I see it."



Donald C. Shoup

Figure P-3. Variable parking prices

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UCLA has not installed occupancy sensors, but I took photographs of eight parking spaces governed by the meter in Figure P-3 every four minutes for an hour and calculated the occupancy rate. In effect, I was the occupancy sensor. The goal of having one or two vacant spaces was met 87 percent of the time, and the average occupancy rate was 83 percent (see Figure P-4). I am *not* saying that $3 an hour is the right price for curb parking. I am saying that $3 an hour was the right price *at that time, at that place*. The combination of high-tech meters and occupancy sensors will allow cities to charge the right prices for curb parking everywhere.

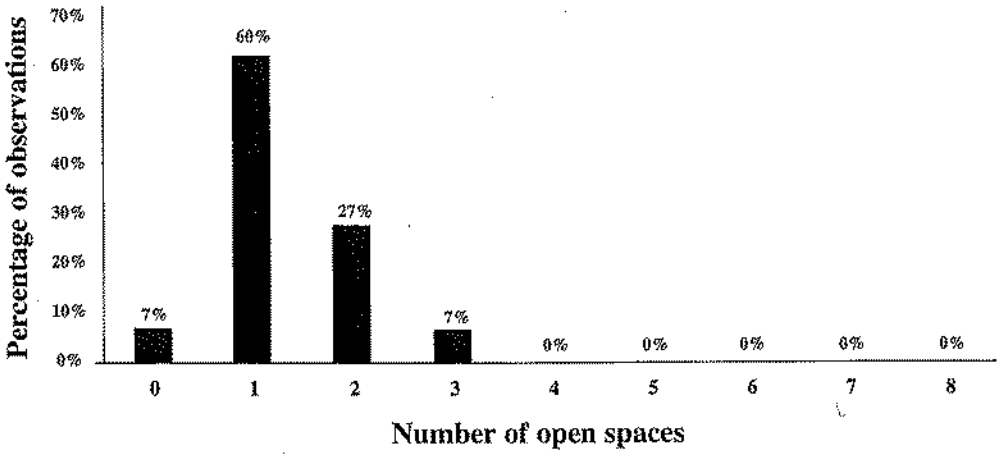


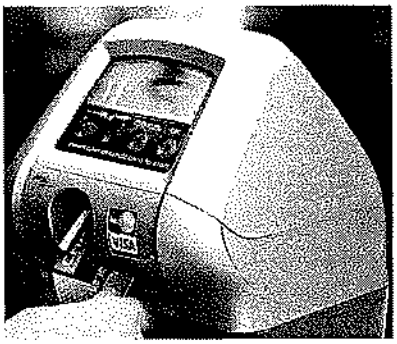
Figure P-4. Parking is well used but readily available.

Should the price of parking be lower? Then all the spaces will often be full and drivers will have to cruise for parking. This cruising will waste fuel, pollute the air, congest traffic, and increase carbon emissions. Should the price of parking be higher? Then more spaces will remain vacant because fewer drivers will pay to park in them. In business districts the stores will lose customers, the city will lose sales tax revenue, employees will lose jobs, and the economy will suffer. So other than aiming for one or two open spaces on every block, can anyone recommend a better principle for setting the price of curb parking?

Miniaturization is another technology that allows even single-space meters to offer sophisticated features such as variable prices, remote updates, payment by credit card, and solar power (see Figure P-5).[11] Drivers who pay by credit card can pay for more time than they expect to use, and, upon returning, reinsert the credit card to deduct the unused time before the card is charged.[12] This arrangement has two advantages. First, it reduces uncertainty. Drivers no longer have to guess how much to pay, worry that they have guessed wrong, or rush

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back to the meter to avoid getting a ticket. Second, drivers pay only for the time they use.



IPS Group Inc., San Diego

Figure P-5. Smart meter

The increasingly common option of paying for parking by mobile phone also offers drivers the ability to pay only for the time parked, with no worry about returning before a meter has expired (see pp. 389–390). Paying for curb parking can thus be as convenient and worry free as paying for other services where the charge depends on the time used, such as long-distance telephone calls. If cities remove time limits at meters and give drivers the option to use credit cards at meters or pay by mobile phone, performance prices may become more acceptable, because they give drivers greater convenience.

Because occupancy sensors and parking meters provide real-time information for every parking space, the city has real-time information about the number of occupied but unpaid-for spaces on every block, enabling enforcement officers to focus on areas with high violation rates. Paying at a parking meter is like taking out an insurance policy against getting a parking ticket. It is a gamble, and a higher probability of being ticketed for overtime parking will encourage drivers to pay the meter rather than risk a ticket.

These two new technologies—occupancy sensors and remotely configured, variably priced parking meters—may change parking and transportation as profoundly as the invention of the cash register in the 19th century changed retail commerce. They can unlock the immense value of land now devoted to free parking and bring transportation into the market economy.

If the Price Is Right, Customers Will Come

Often when I present a proposal for performance parking prices in a city, someone in the audience vehemently says something like "If this city operates the parking meters in the evening, I will never drive downtown to eat in a restaurant again." This threat to boycott downtown restaurants would be a convincing argument if many curb spaces remained empty after the meters began operating in the evening. But this threat ignores the key argument for performance prices: *If the meters are priced right, cars will fill most of the curb spaces, leaving only one or two vacant spaces on each block.* If most curb spaces are filled, parking meters can't be chasing all the customers away.

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Meters *will* chase away some drivers, but the curb spaces these drivers would have occupied will then become available to customers who are willing to pay for parking if they can easily find a convenient curb space on the block they want to visit. Because the curb spaces will remain almost fully occupied, merchants shouldn't be alarmed that performance prices will harm their businesses. And who is likely to leave a bigger tip in a restaurant? Drivers who are willing to pay for parking if they can always find open curb spaces at their destinations? Or drivers who will come only if they can park free after they circle the block a few times to find free parking?

The benefits do not stop with bigger tips. Whenever I am in a restaurant, I usually ask the waiters where they park. If the meters cease operating at 6 p.m. in the area, waiters often tell me they try to arrive shortly before 6 p.m. so they can find a meter and park free for the whole evening. But the curb spaces these waiters use are then not available for potential restaurant customers. If cities instead charge performance prices for curb parking and run the meters as late as needed to manage demand, waiters can park off-street or farther away in cheaper curb spots, making the most convenient spots available for more restaurant customers, who can leave more tips for the waiters.

Both common sense and empirical research suggest that performance-priced curb parking will motivate more people to carpool, because carpoolers can share the cost of parking while a solo driver pays the full cost (see p. 362). Waiters who park free at the curb will probably be solo drivers, but diners who pay to park may arrive with two, three, or four customers in a car. Further, performance prices will promote faster turnover because drivers will pay as long as they park. If a curb space turns over twice during the evening, each space can deliver two groups of diners to a restaurant rather than one waiter (see pp. 363–366). For both reasons—higher-occupancy vehicles and faster turnover—performance prices for curb parking will attract more customers to a business district. With more customers, the restaurants can expand and hire more waiters and pay more in sales taxes. Charging performance prices to manage curb parking can thus benefit many people, including even those who don't live in the metered areas.

A further advantage of performance prices is that they will decline when demand declines during a recession. The price of curb parking will automatically fall to keep the customers coming. The cheaper curb parking will help businesses survive and prevent job losses. But if curb parking prices remain high during a recession, curb spaces will be underoccupied, stores will lose customers, and more people will lose jobs.

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If cities eliminate cruising by charging performance prices for curb parking, where will the cruising cars go? Because drivers will no longer have to arrive at their destinations 5 to 10 minutes early to search for a curb space, their vehicle trips will be 5 to 10 minutes shorter. The reduction in traffic will come not from fewer vehicle trips but from shorter vehicle trips.

Everybody wants something for nothing, but we should not promote free parking as a principle for transportation pricing and public finance. Using performance prices to manage curb parking can produce a host of benefits for businesses, neighborhoods, cities, transportation, and the environment. Parking wants to be paid for.

2. RETURN PARKING REVENUE TO PAY FOR LOCAL PUBLIC SERVICES

Drivers want to park free, and that will never change. What can change, however, is that people can want to *charge* for curb parking. The simplest way to convince people to charge for curb parking in their neighborhood is to dedicate the resulting revenue to paying for added public services in the neighborhood, such as repairing sidewalks, planting street trees, and putting utility wires underground. That is, the city can offer each neighborhood a *package* that includes both performance-priced curb parking *and* the added public services financed by the meters. Performance pricing will improve the parking and the revenue will improve the neighborhood. The people who live and work and own property in the neighborhood will see the meter money at work, and the package will be much more popular than meters alone.

Local Politics

Old Pasadena, a historic business district in Pasadena, California, is the leading example of a battered area that dramatically improved after the city used parking meter revenue to finance added public services (see Chapter 16). Spending more than $1 million a year of meter money on new public services helped convert what had been a commercial skid row into one of the most popular tourist destinations in Southern California. The success has even accelerated in recent years. In 2010, Marilyn Buchanan, a prominent business leader in Old Pasadena, said about the use of meter revenue:

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> Our public-private parking management situation works because of the knowledge we [the Old Pasadena business community] bring to it. . . . We have the passion for Old Pasadena and the business sense to recognize long-term good. Money is still a very personal issue and you can't just take our money and throw it into the general fund. Our money belongs here in Old Pasadena and we know how to put it to good use. Not selfish use but use for the good of the community which in the end of course helps us, the business people.[13]

If all parking revenue disappears into a city's general fund, business leaders and residents probably won't campaign for meters, even with all the sophisticated hardware now available to charge performance prices. Dedicating the revenue to paying for local public services can be the political software necessary to create local support for performance prices. If meter money stays in the neighborhood, it will probably be spent on things the residents value highly. And if new public spending in a neighborhood is financed by new revenue generated in that neighborhood, residents in the rest of the city will probably find this spending more acceptable.

Some people seem to think that parking meter revenue should go neither into the general fund nor back to the neighborhood but instead into a trust fund for motorists—for example, to build off-street parking garages. But if each neighborhood's parking meter revenue goes into a trust fund for the neighborhood and the money can be spent for the neighborhood's highest priorities, such as cleaner and safer sidewalks, residents may soon realize that subsidizing cars is not the best use of their trust fund.

Redwood City

In 2005, Redwood City, California, south of San Francisco, adopted legislation establishing a performance parking policy and returning the meter revenue to the metered district. The city council set a performance goal for curb parking—a target occupancy rate of 85 percent—and gave city staff the responsibility for adjusting prices to achieve the target occupancy. The council thus set parking *policy*, not parking *prices*. The council also dedicated the meter revenue to pay for public improvements in the metered zone. Once the merchants understood that the revenue would remain in the metered district, they strongly backed the proposal, and the members of the city council voted for it unanimously.

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REDWOOD CITY'S PERFORMANCE PARKING ORDINANCE

To accomplish the goal of managing the supply of parking and to make it reasonably available when and where needed, a target occupancy rate of eighty-five percent (85%) is hereby established.

The Parking Manager shall survey the average occupancy for each parking area in the Downtown Meter Zone that has parking meters. Based on the survey results, the Parking Manager shall adjust the rates up or down in twenty-five cent ($0.25) intervals to seek to achieve the target occupancy rate.

Revenues generated from on-street and off-street parking within the Downtown Meter Zone boundaries shall be accounted for separately from other City funds and may be used only . . . within or for the benefit of the Downtown Core Meter Zone.

Sections 20.120 and 20.121 of the Redwood City Municipal Code

When Redwood City began to charge performance prices for curb parking, it also removed the time restrictions at meters, and this has been the program's most popular feature.[14] Because curb parking prices are higher than the adjacent off-street prices, most drivers who want to park for a long time naturally choose the off-street spaces.

Removing time limits for curb parking is especially important if meters operate in the evening. Having a one-hour time limit can make the curb spaces almost useless for people who want to dine in a restaurant or go to a movie. In 2009, desperate for new revenue, Los Angeles extended the hours of meter operation to 8 p.m. in business districts but left many of the one-hour time limits in place. As a result, many spaces remain empty in the evening and most revenue is from tickets for overtime parking. The time limits harm the adjacent businesses by making it difficult for restaurant or theater patrons to park and by irritating customers who get tickets. If customers have convenient curb parking, businesses will prosper and the city will receive more sales tax revenue, so removing time limits and pricing curb spaces to yield one or two vacancies in each block can help everyone.

The Afterword reports on the programs in several other cities—including Austin, Texas; St. Louis, Missouri; Ventura, California; and Washington, D.C.—that earmark the revenue from curb parking to pay for public services in the metered districts.

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3. REMOVE MINIMUM PARKING REQUIREMENTS

Reform is not only adopting good policies but also repealing bad policies. Charging performance prices for curb parking and dedicating the revenue to pay for local public services are two good policies that cities can adopt. In contrast, requiring all buildings to provide ample parking is a bad policy that cities can repeal.

In Greek mythology, a cornucopia always overflowed with whatever its owner wanted. Chapters 1 to 10 show how the prohibition against buildings without ample parking does give us all the free parking we want, but that this cornucopian parking distorts transportation choices, debases urban design, damages the economy, and degrades the environment. Like alcohol prohibition in the 1920s, minimum parking requirements do more harm than good and should be repealed.

Some cities have begun to remove minimum parking requirements, at least in their downtowns, for two reasons. First, parking requirements prevent infill redevelopment on small lots, where fitting both a new building and the required parking is difficult and expensive. Second, parking requirements prevent new uses for many older buildings that lack the parking spaces required for the new uses (see pp. 97–101 and 153–156).

A search of newspaper articles about minimum parking requirements found 129 reports of cities that have removed off-street parking requirements in their downtowns since 2005. Although newspaper articles do not represent what all cities are doing, the articles include many comments on *why* cities are beginning to change their policies. At least in downtown business districts, some elected officials have been convinced that parking requirements put the brakes on what they want to happen and accelerate what they want to prevent. Some of the reasons given for removing parking requirements are "to promote the creation of downtown apartments" (Greenfield, Massachusetts), "to see more affordable housing" (Miami), "to meet the needs of smaller businesses" (Muskegon, Michigan), "to give business owners more flexibility while creating a vibrant downtown" (Sandpoint, Idaho), and "to prevent ugly, auto-oriented townhouses" (Seattle).

According to these quotes, cities remove parking requirements to prevent bad results and to produce good ones. The logical corollary is that parking requirements produce bad results and prevent good ones.[15] Removing a minimum parking requirement is not the same, however, as restricting parking or putting the city on a parking diet. Rather, minimum parking requirements force-feed the city with parking spaces, and removing a parking requirement simply stops this force-feeding. Businesses will be free to provide as much parking as they like.

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An Example from Downtown Los Angeles

Many older downtowns have some wonderful buildings in terrible condition. Minimum parking requirements make restoring these historic buildings difficult or impossible, because they rarely have all the parking spaces cities require for new uses. Spring Street in Los Angeles, once known as the Wall Street of the West, is a prime example. It has the nation's largest collection of intact office buildings built between 1900 and 1930. Starting in the 1960s, the city's urban renewal program moved most office uses a few blocks west to Bunker Hill and left many splendid Art Deco and Beaux Arts buildings on Spring Street vacant except for retail uses on the ground floor.

In 1999, Los Angeles adopted its Adaptive Reuse Ordinance (ARO), which allows the conversion of economically distressed or historically significant office buildings into new residential units—with no new parking spaces (Figure P-6). Before 1999, the city required two parking spaces per condominium unit in downtown Los Angeles; in effect, the city had determined that no housing was better than any housing without all the required parking spaces.[16] Michael Manville studied the results of the ARO and found that many good things can happen when a city removes its parking requirements.[17]

Developers used the ARO to convert 56 historic office buildings into at least 7,300 new housing units between 1999 and 2008. All the office buildings had been vacant for at least five years, and many had been vacant much longer. By contrast, only 4,300 housing units were added in downtown between 1970 and 2000.[18]

Skeptics doubted that banks would finance developers who wanted to convert office buildings into residential condominiums without two parking spaces each, but the skeptics were proved wrong. Developers provided, on average, only 1.3 spaces per unit, with 0.9 spaces on-site and 0.4 off-site in nearby lots or garages. Had the ARO not been adopted, the city would have required two *on-site* spaces for every unit, or more than twice as many as developers did provide. Manville noted, "The ability to supply parking off-site helped developers simultaneously satisfy lenders, minimize development costs, and maximize the potential of an old building."[19] Deregulating both the *quantity* and the *location* of parking for the new housing was a key factor in restoring and converting the 56 office buildings Manville studied. Manville concluded that removing the parking requirements "led to both *more* housing and a greater *variety* of housing. Not only were more units built, but these units were constructed in buildings and neighborhoods that had long been stagnant and underused. Further, almost half of these buildings

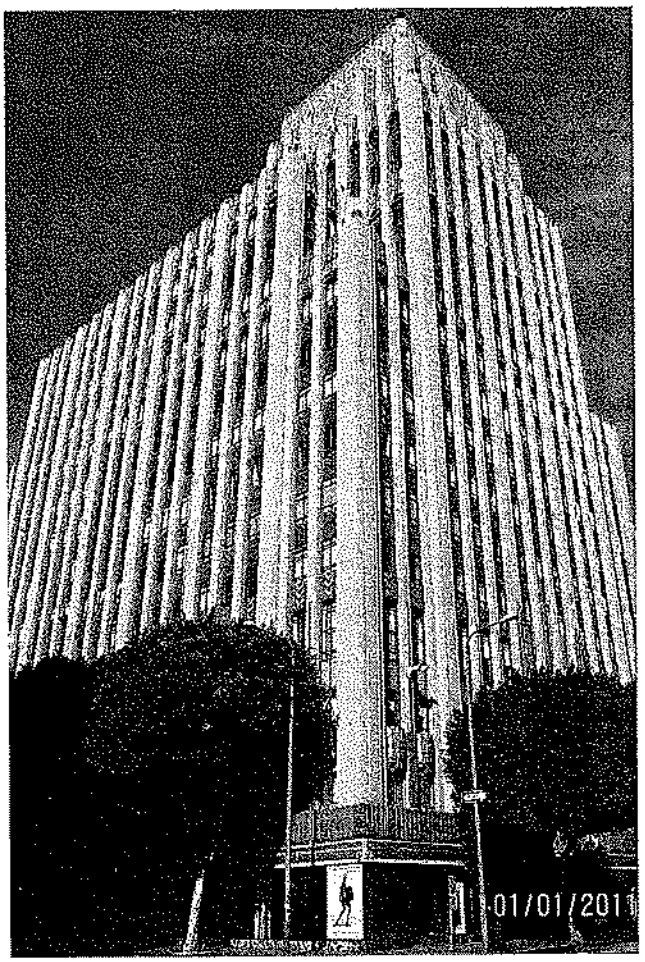
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unbundled some or all of the parking from rent, allowing them to target an underserved demographic—people without cars."[20]

The ARO also exempts the converted office buildings from other planning requirements, such as density and height limits for residential uses, so the exemption from parking requirements isn't the sole reason for the conversions. Nevertheless, if the city hadn't removed the parking requirements these conversions couldn't have occurred, and the conversion boom shows that there is a residential market for people who don't own two cars. These results strongly suggest that until the ARO was adopted, minimum parking requirements had been preventing the restoration and conversion of many obsolete office buildings into housing.

The ARO also produced other benefits. It allowed the preservation of many historic buildings that had been vacant for years and might have been demolished if minimum parking requirements had remained in place. Historic buildings are a scarce resource in any city, and the evidence shows that parking requirements stood in the way of preserving these buildings. The ARO applied only to downtown when it was adopted in 1999, but the benefits were so quickly apparent that it was extended citywide in 2003.

The ARO preserved not only individual historic buildings but also a historic neighborhood. The Spring Street Financial District was listed in the National Register of Historic Places in 1979, but by then, the *Los Angeles Times* reported, it had become "a neighborhood of hoodlums, derelicts



Donald C. Shoup

Figure P-6. Office building in Los Angeles converted to residential use without adding on-site parking spaces.

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and winos—a neighborhood of echoing buildings full of absolutely nothing above the ground floor."[21] If empty office buildings blight a neighborhood, preserving and converting them to residential use can help restore a neighborhood. The benefits of removing off-street parking requirements do not stop with historic preservation. The conversion projects created many jobs, and the government receives higher property tax revenue on the converted buildings.

Los Angeles's ARO shows the good results of removing off-street parking requirements. We usually can't see things that don't happen or count things that don't occur, but the beautifully restored buildings on Spring Street show us some wonderful things that parking requirements had been preventing in Los Angeles and are now preventing in many other cities.

An Example from Silicon Valley

Cities are removing or reducing off-street parking requirements in their downtowns, but most people live and work outside downtown. In the suburbs, cities often require more space for cars than for people. Figure P-7 shows the relationship between buildings and the required parking at a few land uses in San Jose, California.[22] The area required for parking at a restaurant, for example, is more than eight times larger than the dining area in the restaurant itself. Even if the required parking is used only intermittently, as at an auction house, the city requires the parking lots to be big enough to meet the peak demand for free parking.[23]

High parking requirements help to explain the parking-dominated landscape in many parts of San Jose and the rest of Silicon Valley. The top picture in Figure P-8 shows an example of the parking-disoriented development. Developers rarely provide more parking than cities require (see pp. 89–92), so the buildings in the picture are probably as big as they can be, given the number of parking spaces surrounding them. Many of the spaces, especially the ones at the periphery of the parking lots and adjacent to the streets, remain vacant almost all the time. So what would happen if

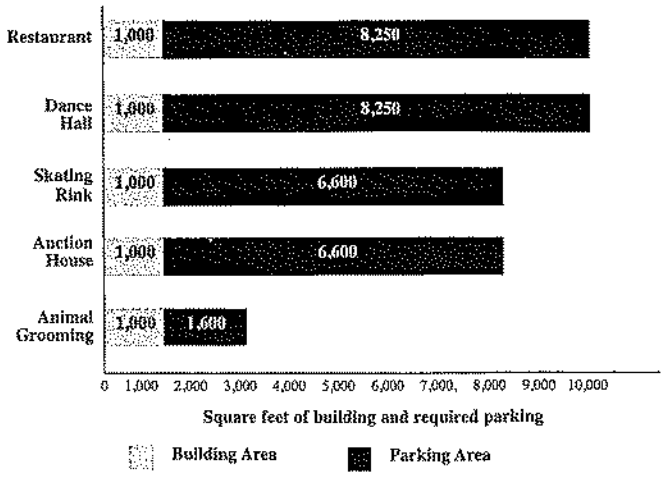
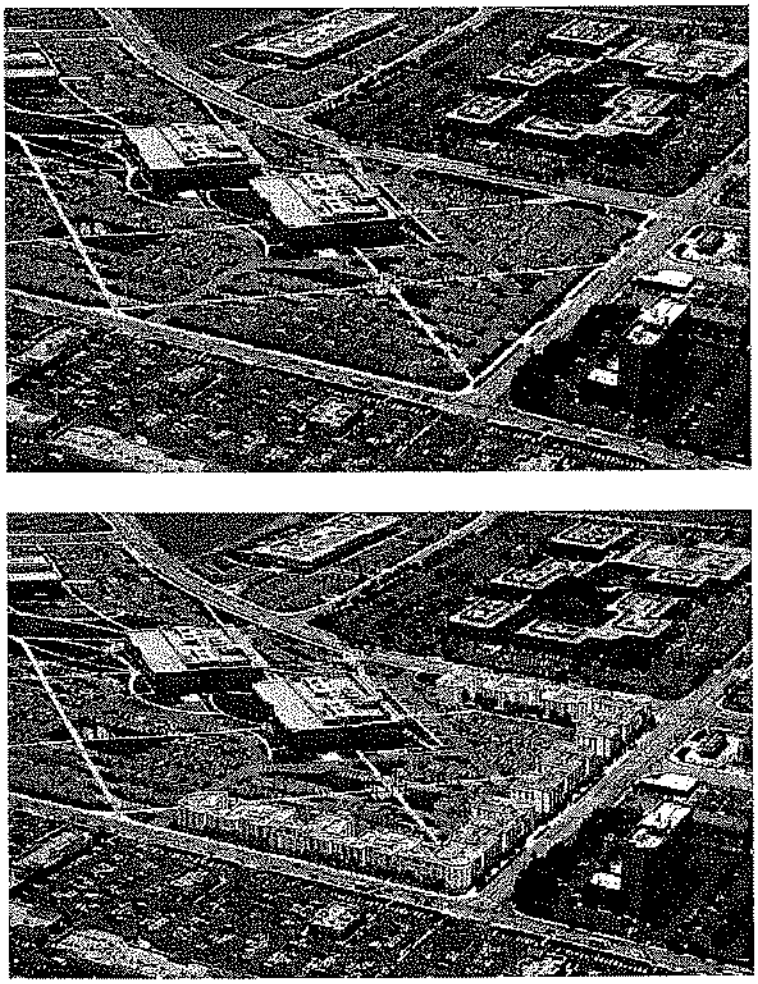


Figure P-7. San Jose's minimum parking requirements

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San Jose removed off-street parking requirements, charged performance prices for on-street parking, and returned the resulting revenue to the metered neighborhoods? Property owners might decide their land was more valuable for housing than for vacant parking spaces.

Everyone in Silicon Valley complains about high housing prices, long commutes, traffic jams, air pollution, and the difficulty of attracting employees. Building housing on the periphery of parking lots would help to solve all these problems. The bottom picture in Figure P-8 suggests what might happen without minimum parking requirements. If apartment buildings were built next to the sidewalks, anyone walking, biking, or driving by would see what looks like a real city. The smartest way to travel is to be near your destination already, and this job-adjacent housing would give commuters out-of-car experiences while walking to work.

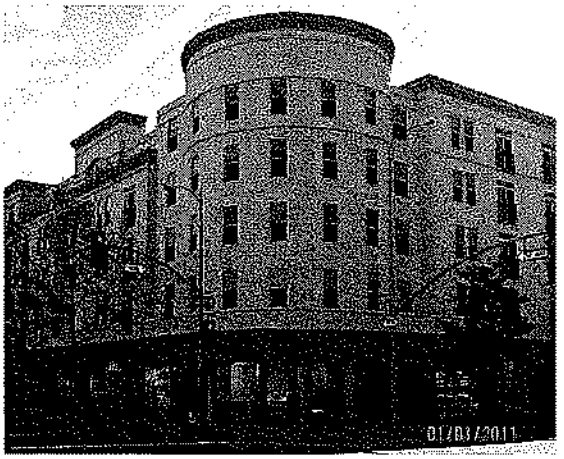


Stuart Cohen, Transportation and Land Use Coalition

Figure P-8. Parking lots in Silicon Valley before and after liner buildings

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Liner Buildings



Donald C. Shoup

Figure P-9. Liner building

New urbanists refer to buildings that mask a parking lot or garage from the street as *liner buildings*. Figure P-9 shows one of the liner buildings inserted in the bottom picture in Figure P-8.[24] The term *liner* suggests that the wrapping is a superficial way to hide what is inside, but in this case the wrapping would probably be far more valuable than the parking spaces it would replace. Parking is probably the least profitable use of this peripheral land since almost any other use would yield far more revenue. In parking, as in everything else, there are opportunity costs.

The land is already assembled, and the housing could be built without new parking because the existing spaces could be shared between office buildings and apartments. To avoid a parking shortage, the owner would probably have to unbundle the cost of parking from the rent for both apartments and offices, so car owners would pay only for the parking spaces they use (see Chapter 20). Some residents who work in a nearby office building may find they could easily live with only one car, and they would appreciate the freedom to rent an apartment without paying for two parking spaces.

If cities remove off-street parking requirements, they will have to charge performance prices for the curb spaces to prevent spillover, but this will produce another great benefit: All the money paid for curb parking will become a new revenue stream to pay for local public services. Curb parking will become too valuable not to meter.

Removing the parking requirements for both housing and offices can produce a cascade of benefits: shorter commutes, less traffic, a healthier economy, a cleaner environment, and more affordable housing. And the benefits don't stop there. If we reform our misguided planning for parking, the money now spent on cars and fuel will become available for other things. Cars and fuel are often imported, but we cannot import apartment buildings. Shifting spending from cars, fuel, and parking to housing construction will increase the demand for labor in a host of professions, such as architects, carpenters, electricians, engineers, gardeners, glaziers, laborers, lawyers, locksmiths, painters, plumbers, real estate agents, roofers, surveyors, and even urban planners. Importing

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less oil and hiring all these people to build infill development will boost the whole economy.

The five-story apartment buildings shown in Figure P-8 are not the only option for liner buildings. Courtyard apartments, row houses, office buildings, stores, restaurants, or even single-family houses might be the best use for the land on the periphery of a parking lot. Liner buildings can create the atmosphere of a city, not a parking lot. If cities stop requiring off-street parking, vast suburban parking lots can evolve into real communities.

It is easy to see the bad results caused by parking requirements—asphalt everywhere and a lack of life on the streets. But it is hard to see the good results that parking requirements *prevent*. Photoshop can suggest, however, what cities might look like without parking requirements. The upside of the mess we have made is that we have an accidental land bank readily available for job-adjacent housing. This land is now locked up in required parking, but if cities remove their unwise parking requirements we can reclaim land on a scale that will rival the Netherlands.

A QUIET REVOLUTION IN PARKING POLICIES

Academic research has repeatedly shown that minimum parking requirements inflict widespread damage on cities, the economy, and the environment. But this research has had little influence on planning practice. Most city planners continue to set minimum parking requirements as though nothing has happened. The profession's commitment to minimum parking requirements seems to be a classic example of *groupthink*, which Yale professor of psychology Irving Janis defined as "a mode of thinking that people engage in when they are deeply involved in a cohesive in-group, when the members' striving for unanimity overrides their motivation to realistically appraise alternative courses of action."[25] The process of setting minimum parking requirements displays most of the symptoms of defective decision making that Janis identified with groupthink: incomplete survey of alternatives; incomplete survey of objectives; failure to examine risks of preferred choice; poor information search; and selective bias in processing information at hand.[26] Unfortunately, academic research on parking has had little effect on practitioners' groupthinking, even though the research shows that a central part of the practice does so much harm.

Requiring Peter to pay for Paul's parking, and Paul to pay for Peter's parking, was a bad idea. People should pay for their own parking, just as they pay for their own cars and their own gasoline. The planning profession has given cities bad advice about parking requirements, which

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have misshaped our cities to fit the car—almost without planners' noticing.[27] Parking requirements hide the cost of parking, but they cannot make it go away, and free parking usually means fully subsidized parking. At the very least, parking requirements should carry strong warning labels about all the dangerous side effects.

Suppose cities required all fast-food restaurants to include french fries with every hamburger. The fries would appear free, but they would have a high cost in money and health. Those who don't eat the fries pay higher prices for their hamburgers but receive no benefit. Those who do eat the fries they wouldn't have ordered separately are also worse off, because they eat unhealthy food they wouldn't otherwise buy. Even those who would order the fries if they weren't included free are no better off, because the price of a hamburger would increase to cover the cost of the fries. How are minimum parking requirements different? Minimum parking requirements force people who are too poor to own cars to pay for parking spaces they don't use, and they encourage others to buy more cars and drive them more than they would if they had to pay separately for parking. I am not saying that there should be no parking. I am saying that parking should be supplied in a fair market.

Despite institutional inertia in the practice of planning for parking, reforms are sprouting. Paradigm shifts in urban planning are often barely noticeable while they are happening, and after they have happened it is hard to tell that anything has changed. But shifts happen. Planners simply begin to understand cities in a new way and can scarcely remember a time when they understood cities differently. The incremental reforms now under way suggest that off-street parking requirements will not quickly disappear but will gradually erode. Cities may slowly shift from minimum parking requirements to performance parking prices without explicitly acknowledging that planning for parking had ever gone wrong. Eventually, however, planners may recognize that minimum parking requirements were a poisoned chalice, providing ample free parking while hiding the many costs. Our ample free parking comes at the expense of our cities' future.

All parking is political, and the prospects for parking reform depend on what the political context allows. Diverse interests from across the political spectrum can for different reasons support a shift from minimum parking requirements to performance parking prices. Liberals will see that it increases public spending. Conservatives will see that it reduces government regulation. Environmentalists will see that it reduces energy consumption, air pollution, and carbon emissions. Business leaders will see that it unburdens enterprise. New urbanists will see that it enables people to live at high density without being over-

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run by cars. Libertarians will see that it increases the opportunities for individual choice. Developers will see that it reduces building costs. Neighborhood activists will see that it devolves public decisions to the local level. Local elected officials will see that it reduces traffic congestion, encourages infill redevelopment, and pays for local public services without raising taxes. The current system of planning for parking does such widespread harm that the right reforms can benefit almost everyone.

But all these people also want to park free. They may not have an ideological or professional interest in free parking, but they do have a *personal* interest in it. This personal interest in free parking helps explain the popularity of minimum parking requirements. But the right use of parking meter revenue can also create a countervailing personal interest in *charging* for curb parking. Cities can create the necessary political support for performance parking prices by dedicating the meter revenue to pay for enhanced public services on the metered streets (see Chapters 16 and 17).

Both Jane Jacobs and Robert Moses might have agreed that charging performance prices for curb parking and using the revenue to improve the metered neighborhoods are good public policy. Jane Jacobs loved lively neighborhoods, and Robert Moses mastered the art of using tolls to finance public investments. Combining the best of both Jacobs and Moses can guide cities off the hard path of minimum parking requirements onto the soft path of performance parking prices.

In this book I focus on how performance parking policies can repair the damage minimum parking requirements have done to American cities, but the same policies are also appropriate for developing countries that do not yet have high levels of automobile ownership. Even countries with low automobile ownership have chaotic parking problems, as suggested by this description of Mexico City:

> Cars dominate nearly every square inch of Mexico City's public space. Vehicle owners double- and triple-park on the streets, to say nothing of curbs, sidewalks, gardens, alleys, boulevards and bike paths.[28]

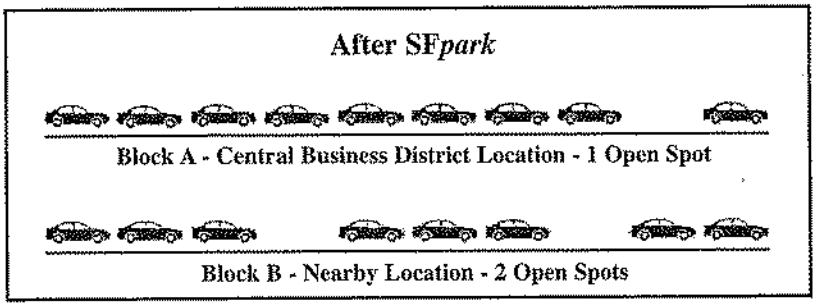
Crowded cities in India also have problems with sacred cars, although only 14 percent of households in India own a car, and ownership is concentrated among the relatively rich.[29]

Many big cities in poor countries have such a high density of people that even a low rate of car ownership per household leads to a high density of cars. If these cities adopt performance prices for curb parking and use the revenue to pay for local public services, never before will so

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many poor people receive so much public benefit paid for by so few rich people. Even drivers will benefit because performance prices will help solve the two most difficult problems of owning a car in these cities: traffic congestion and parking shortages.

Market prices can manage the demand for parking spaces. If cities continue to offer free curb parking and require ample off-street parking, it won't be because performance prices don't work but because planners and politicians choose not to change course. There is a way, but we need the will. We can make great gifts to the future by reforming our misguided planning for free parking. In both sprawling rich cities and crowded poor cities, charging performance prices for curb parking, spending the revenue on local public services, and removing off-street parking requirements can do a world of good.



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PREFACE NOTES

1. Twenty-four reviews of the book are available at http://its.ucla.edu/shoup/BookReviews.pdf.

2. Schaller (2006, 1, 15) and Transportation Alternatives (2007, 1).

3. Transportation Alternatives (2008, 10). Another way to learn about cruising is to ask drivers how much time they spend hunting for parking spaces. A survey of 9,000 drivers in the United Kingdom in 2010 found that British drivers reported spending an average of 25 minutes per day, or 152 hours per year, cruising for parking (Macrae 2010). That adds up to 11 months for someone who drives over the course of 50 years. Londoners lost the most time cruising, an average of 182 hours a year, or 54 weeks in 50 years.

4. Also with a grant from the U.S. DOT, Los Angeles will establish a similar program, called ExpressPark (Groves 2010). Berkeley, California, is establishing a program of "dynamic parking pricing" in two neighborhoods. In Los Angeles, occupancy sensors send information on curb vacancies to an iPhone app, Parker, which provides a real-time map showing nearby city blocks with more than four, more than two, or less than two vacant curb spaces, as well as blocks with "rock star" parking—the closest blocks with the most open spaces. The app also shows information about meter time limits, meter prices, and whether meters take credit cards or coins.

5. The census did not include off-street residential parking spaces. The data are available at http://sfpark.org/2010/04/05/parkingcensus.

6. The ANSWER Coalition's website is www.answercoalition.org/national/index.html.

7. See, for example, Raskin (2007).

8. Even rich people who complain about paying for parking may shift to public transit. Consider this instance in Beverly Hills: "Glen Rosten, 60, a retired real estate investor in Beverly Hills, took the bus to shop at Cartier on Rodeo Drive on Friday. 'You hate to get ripped off for parking, especially if you're going to spend the money you generally spend in Beverly Hills,' said Rosten after buying new sunglasses for about $1,000. 'The parking wouldn't break me,' he said. 'It's just the principle. If I'm going to spend $1,000 for sunglasses, I shouldn't have to pay for parking'" (Hennessy-Fisk and Abdollah 2007).

9. Barry (2010).

10. SF*park* has an excellent website that describes the program, including a short video that shows how the program works: http://sfpark.org.

11. Pierce (2010). Multispace meters also offer a new twist: pay by license plate number. Drivers enter their license plate numbers at the pay station when paying for parking. They do not need to remember their space numbers or return to their cars to display receipts. Parking enforcement officers use vehicle-mounted license-plate-recognition cameras that communicate with the payment database to check whether drivers have paid or whether they have permits for residential parking districts.

12. The payment system has two forms: (1) start–duration, in which the driver inserts the credit card to pay for a fixed time in advance and reinserts the card when leaving to receive a rebate for unused time, or (2) start–stop, in which the driver inserts the credit card to start paying and reinserts the card when leaving to stop paying. Payment by cell phone can have the same start–duration and start–stop options.

13. Salzman (2010, 27).

14. In a *Wall Street Journal* article about Redwood City's program, Conor Dougherty (2007) wrote, "In the past, Cheryl Angeles has had to jump up in the middle of a coloring treatment, foil in her hair and a black-plastic cape around her neck, to pop more

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quarters in the meter. Twice the self-storage company regional manager got $25 parking tickets when she didn't make it in time. Now that the time limits have been removed, she can pay once and return when the appointment is over."

15. Many other newspaper articles illustrate how off-street parking requirements affect the layout and restrict the use of buildings. Consider, for example, this report about the design of the $25 million Holocaust Memorial Museum in Illinois: "The number of seats in the main lecture hall of the museum, originally set at 293, has been reduced to 270 to meet parking requirements" ("Holocaust Museum makes modifications to site plan," *Pioneer Press*, December 1, 2005). Consider also this report about a restaurant in Florida: "Town planning staffers have recommended approval of the site plan changes, but tagged several conditions onto their recommendations. Chief among them are the requirements to reduce the restaurant area by 1,500 square feet to match the parking available during the day" ("Guanabanas seeks Jupiter's permission to become full-fledged restaurant," *Jupiter Courier*, December 4, 2005).

16. Behdad (2006) explains the history of the ARO. For conversion of an office building to residential use under the ARO, Section 12.222-A, 26(h)(3) of the Los Angeles Municipal Code requires that "the number of parking spaces shall be the same as the number of parking spaces that existed on the site on June 3, 1999."

17. Manville (2010).

18. Manville (2010, 12).

19. Manville (2010, 17).

20. Manville (2010, 26).

21. Dreyfuss (1982).

22. The average size of an off-street parking space is assumed to be 330 square feet, including the access aisles needed for circulation in the parking lot or structure. San Jose requires 25 parking spaces per 1,000 square feet of dining area in a restaurant, so the parking lot is 8,250 square feet for every 1,000 square feet of dining area (25 spaces x 330 square feet).

23. See Table 20-190 in the San Jose Municipal Code.

24. The apartment buildings inserted on the periphery of the parking lot are copied from downtown Los Angeles.

25. Janis (1982, 9). Other definitions of groupthink emphasize conformity and uncritical acceptance of a perceived majority point of view; the lack of creativity or individual responsibility in making decisions; the search for consensus without critically testing, analyzing, and evaluating ideas; the desire to minimize conflict; and making decisions without weighing all the facts, especially those contradicting the majority opinion.

26. Janis (1982, 175).

27. A survey of land-use plans in 30 cities and counties in North Carolina found that only two included any discussion of off-street parking requirements. Rodriguez et al. (2004, 7) explain that minimum parking requirements "lie at the intersection between land use and transportation planning, and as such are rarely included explicitly in either type of plan."

28. Dickerson (2004).

29. The Centre for Science and Environment (2009) explains how parking reforms in New Delhi can reduce traffic congestion, air pollution, and energy consumption; save drivers' time and fuel; and improve both neighborhood businesses and the environment. Barter (2010) studied parking policies in 14 Asian cities and recommends many promising policy reforms. The Institute for Transportation and Development Policy has also recently published two excellent reports on parking reforms in the United States (Weinberger, Kaehny, and Rufo 2010) and in Europe (Kodransky and Hermann 2011).

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RIGHT SIZE PARKING

Final Report

AUGUST 2015

Right Size Parking
Tools to balance supply

King County METRO

Fehr & Peers
Transportation Consultants

VIA

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Project partners

U.S. Department of Transportation
Federal Highway Administration

Washington State Department of Transportation

CNT
Sustainable Communities. Attainable Results.

ULI Urban Land Institute
Northwest

Consultant team

Rick Williams Consulting

FEHR & PEERS

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Report prepared by VIA Architecture

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What is the "right size" for parking?

Right-sizing parking means striking a balance between parking supply and demand.

Why does Right Size Parking matter?

Parking is expensive to build. Construction of parking in multi-family projects costs between $20,000 - $40,000 per stall, which has an impact on rent charged to tenants.

King County is over-parked. The Right Size Parking study found that on average, multi-family buildings in King County supply 40% more parking than is actually utilized.

Excess parking has negative effects on communities. Oversupply of parking leads to increased automobile ownership, vehicle miles traveled, congestion and housing costs.

The **Right Size Parking** project was designed to address the issues surrounding multi-family residential parking supply in King County, assembling local information on parking demand to guide parking supply and management decisions in the future.

King County
Right Size Parking
Tools to balance supply.

www.rightsizeparking.org

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Introduction

Project overview

The Right Size Parking (RSP) project is an innovative, data-driven research and outreach effort focused on helping local jurisdictions and developers to balance parking supply and demand for multi-family buildings. Led by King County Metro, the public transit authority for King County, WA, the project advances the state of parking demand and pricing research by presenting up-to-date parking data in context.

Research has shown that multi-family parking is oversupplied. Based on parking utilization and pricing data gathered from over 200 multi-family properties in King County, WA, the RSP project determined that existing multi-family parking capacity exceeded utilization by an average of 0.4 spaces per housing unit — a 40% oversupply.

The RSP project determined that existing multi-family parking capacity exceeded utilization by an average of 0.4 spaces per housing unit — a 40% oversupply.

Excess parking presents significant barriers to smart growth and efficient transit service operations. Too much parking at residential properties is associated with more automobile ownership, vehicle miles traveled, and congestion as well as higher housing costs. On the other hand, too little parking can have negative impacts on the real estate marketability of multi-family housing projects in addition to on-street parking spillover impacts when on-street parking is not sufficiently managed and priced. Finding the balance of parking supply and demand supports transportation choice and walkable, more affordable neighborhoods.

The RSP project provides locally credible and context-sensitive data on parking demand, providing stakeholders with the information they need to make decisions that:

- Support economic development by reducing barriers to building mixed-use multi-family residential developments in urban centers near transit infrastructure
- Reduce housing costs as well as household monthly expenditures, allowing a larger demographic to participate in the urban and suburban infill housing markets
- Encourage transit use, ridesharing, biking and walking
- Reduce traffic congestion, vehicle miles traveled, and the amount of greenhouse gases (GHG) produced

Who benefits from RSP?

Developers, public decision makers, and communities all have the potential to benefit from the outcomes of this project. With updated context-sensitive information on parking demand, cities can regulate development in ways that meet local and regional goals. Developers can build more housing near transit and sell it for less.

This information is relevant to a wide variety of potential user groups, including jurisdictions, developers, and communities.

Sharing the research

A key goal of the RSP project is making the research available to and usable by the public. The data resources and tools created by the RSP project support a wide range of community and policy goals, such as providing a range of transportation choices (including transit), affordable housing, smart growth, and economic development. RSP tools have been designed for ease of use and adaptability.

Project background

The RSP project was funded through a grant from the Federal Highway Administration's (FHWA's) Value Pricing Pilot Program to address the issues around multi-family residential parking supply in King County. Initial data collection began in 2011, and the final RSP pilot projects were completed in 2015. The project directly addresses FHWA's call to action to develop policy that builds more livable communities. The project assembled local information on multi-family residential parking demand to guide future decisions regarding parking supply and management, therefore enabling the reduction of excess parking supply at multi-family housing developments in urban and suburban infill environments.

Why does right-sizing parking matter to affordability?

The high cost of parking construction and maintenance drives up the cost of housing and reduces the supply of affordable housing. Unless parking costs are separated from the cost of housing – "unbundled" - households are forced to pay for parking regardless of their needs. Even when parking costs are unbundled, developers often cannot

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charge the full cost-recovery price for parking due to the required oversupply typical in zoning codes and 'sticker shock' concerns of their customers.

In King County, WA, parking makes up 10-20% of the cost to construct multi-family buildings, but only 6% is recovered through parking charges, meaning that the remainder must be accounted for through rent prices. This cross-subsidization, or recovering part of the parking investment through higher rental rates, causes a distorted market for parking and reduces the opportunity to use pricing as a tool to manage parking demand. Lower-income households are especially burdened by this distortion as they typically have lower rates of auto ownership and spend a larger percentage of their income on housing.

However, providing too little parking also can pose risks for real estate marketability and cause on-street parking impacts nearby, such as parking spillover, especially when on-street parking is not sufficiently managed and priced. These problems suggest that there is a "right size" to providing parking that strikes a delicate supply-to-demand balance, ensuring real estate marketability while meeting community goals.

Why King County Metro?

The RSP project is aligned with the mission of King County Metro Transit. King County Metro's Strategic Plan calls for supporting the integration of transit and land use to create compact, healthy communities. Communities that are compact and friendly to pedestrians and bicycles are most easily served by transit. Such communities foster healthier, more active lifestyles while reducing auto-dependency and associated road investments. By the same token, transit service can support and encourage development that is more compact.

Public transit is often most successful in markets in which parking is priced and supplied to reflect actual demand. As a transit agency, King County Metro has an interest in encouraging land uses and policies that prevent over-building of parking supply. Too much parking leads to increased automobile ownership, vehicle miles traveled, congestion and housing costs. In addition, it presents barriers to smart growth and efficient transit service. Right-sizing parking in locations where an oversupply of parking exists can be expected to help promote transit ridership and service efficiency.

RSP Project Approach

1. Get the Data
   - Scientific approach
   - Field counts collect local, up-to-date data
   - Statistical analysis
2. Provide New Tools
   - Web tools, model code, best practices
3. Check the Code
   - Find gaps and make changes
4. Engage Partners
   - Implement public and private demonstration projects

Project scope

In order to address the project need for up-to-date, context-sensitive data and user-friendly tools for understanding parking supply and demand, the RSP team engaged a diverse set of stakeholders, including developers, financiers and public-sector decision makers. In collaboration with this assemblage of multidisciplinary advisors, the team worked to develop technical policy best practices aimed at overcoming barriers to right-sizing parking supply.

The RSP project was structured around an interdisciplinary approach to developing innovative research and tools, as well as providing best practices on policy reform and parking management. These tools were implemented and tested through demonstration pilot projects with local partners.

Through the coordinated work efforts of the project team, the RSP project was able to achieve the following objectives:

- Provide context-sensitive multi-family residential parking demand information on a dynamic website to guide stakeholder decisions about building new parking and managing existing parking
- Offer tools and incentives to jurisdictions and developers to test pricing and right-sizing of parking supply in residential and commercial developments
- Engage the development community through professional forums to utilize new parking demand information and implement pricing and management techniques

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At the project outset, the RSP team conducted an audit of principal technical policy issues pertinent to achieving right-sized parking in multi-family residential buildings. From this assessment, the team compiled a Technical Policy Memorandum summarizing the known barriers and potential solutions for RSP in addition to a set of policy and action recommendations that set the stage for the project research. The Technical Policy Memorandum can be found at:

http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/rsp-technical-policy-memo-final-09-17-12.pdf

RSP research and modeling

The primary goals of the project research were to bring clarity to the existing lack of consensus on the factors that influence parking demand and to make the findings easily accessible to a broad audience. Despite a recent surge in research, a lack of consensus still exists on the factors that drive demand for parking in multi-family buildings across a variety of urban and suburban contexts. While socio-demographic, housing, and built environment variables have all been shown to have an impact on residential parking and vehicle availability, their relative influence is a source of debate.

The RSP research identified independent variables to be tested in a regression analysis of parking utilization within 208 multi-family housing developments in King County, WA, which was conducted in 2012. Parking utilization was correlated to building characteristics as well as to neighborhood characteristics where the building resides. The final model derived from this regression analysis incorporated seven variables – five pertaining to the property or development characteristics and two to the built environment – and has a high R-square value of 0.81, meaning that the model has very substantial explanatory power.

Web calculator

The King County Multi-Family Residential Parking Calculator is a map-based web tool that enables users to estimate parking use for multi-family developments in the context of specific building and site/neighborhood characteristics. The website tool condenses the research findings and RSP model into a simple interactive calculator format accessible to a wide variety of stakeholders. The web calculator can help analysts, planners, developers, and community members weigh factors that will affect parking use at multi-family housing sites, including consideration of how much parking is "just enough" when making economic, regulatory, and community decisions about development.

Users are able to create custom multi-family parking scenarios and adjust them using variables related to the building and its location, including proximity to transit, unit and parking pricing, jobs and population. Understanding the influence of these variables helps determine how much parking is "just enough" for a particular site.

More detailed information about the web calculator can be found in Chapter 3. Try out the calculator online at:

www.rightsizeparking.org

Project partners and potential users

King County Metro applied for the FHWA grant in partnership with the Center for Neighborhood Technology (CNT) and the Urban Land Institute (ULI). As the leader of the RSP effort, King County Metro provided project administration and management as well as technical support for the project team. Recognizing that the issues addressed in the RSP project span multiple disciplines, Metro assembled a multidisciplinary team in order to ensure that the appropriate resources and expertise would be available to support the wide-ranging needs of the project.

What's in this document?



This document describes the RSP project goals, research methodology, and the results of the RSP pilot projects; provides an overview of stakeholder outreach efforts; and outlines next steps for RSP applications and research. In addition, this report introduces the tools and strategies created by the project for those interested in implementing RSP practices in other jurisdictions or communities. These tools can help analysts, planners, developers, and community members weigh factors that will affect parking use at multi-family housing sites.

Throughout this document, look for the RSP toolkit icon (above) to learn more about RSP tools and products. Links to additional project resources can be found in the Appendix.

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Research 2

Research scope and context

Today, multi-family residential buildings often provide too much automobile parking, which can be an impediment to achieving a wide range of community goals. An oversupply of parking can have deleterious effects on economic development, consumers, the community at large and the environment.

Excess parking consumes valuable urban real estate, which contributes to sprawl, lower-density development, and greater distances between buildings. Those outcomes can deter walking, transit use and efficient transit service operations. An oversupply of parking can also damage natural landscapes through urban sprawl, increase impervious surfaces and add to greenhouse gas emissions. These considerations pose challenges for communities that want to encourage multi-modal transportation options and promote smart growth land use planning strategies.

In auto-dominated suburban developments with little transit service, parking decisions are relatively straightforward; planners or developers can apply findings from parking generation studies conducted in similar communities across the country found in the Institute of Transportation Engineers (ITE) Parking Generation Manual. However, parking supply decisions become more complicated as suburban communities introduce more compact development, mixed uses, and new multimodal transportation options in addition to welcoming a more diverse demographic of multi-family housing users. Current suburban parking generation studies do not meet the objectives of these settings, nor do they account for factors that may influence parking demand. They also do not serve as an adequate model to guide parking provision in urban areas.

Despite a recent surge in research, a lack of consensus still exists on the factors that drive demand for parking and account for the variation in auto ownership in multi-family buildings across a variety of urban and suburban contexts. While socio-demographic, housing, and built environment variables have all been shown to have an impact on residential parking and vehicle availability, their relative influence is a source of debate.

Academics and practitioners have responded to this gap in research through a growing body of studies showing how the oversupply of parking can lead to increased auto ownership, vehicle miles traveled, congestion and housing costs. In addition, studies have shown that misaligned parking policies present barriers to smart growth and efficient transit service. There is some agreement that parking supply and pricing have a significant impact on parking demand and auto ownership, but these variables have been understudied.

The Right Size Parking research applies extensive data collection and analysis to provide clarity on the factors that influence parking demand in multi-family developments. Specifically, the objective of this research was to identify independent variables to be tested in regression analysis of parking utilization within 208 multi-family housing developments which were surveyed in King County, Washington in 2012.

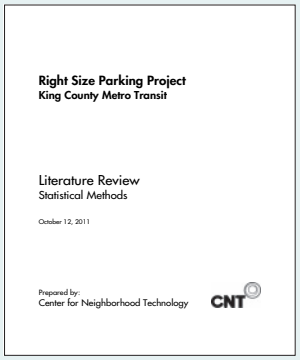
The RSP research question: What are the contextual factors that influence parking demand for multi-family buildings?

Drawing upon an extensive literature review of existing parking standards and studies, the RSP team used regression analysis to develop a model of parking utilization. Where other studies have stopped at modeling parking demand based upon the utilization of existing parking supply, the RSP project went further to develop a robust statistical model that describes parking demand as a complex equation composed of strongly correlated independent and context-sensitive variables.

It is the goal of the RSP team that the new data, research, and tools developed by the project provide the information needed to help developers, financiers, jurisdictions, and neighborhood groups better estimate the optimum amount of parking for new multi-family developments across a wide variety of development contexts. The results are intended for use by practitioners and are made easily accessible through an interactive website tool.

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Literature Review of Statistical Methods



The project team worked with the Center for Neighborhood Technology (CNT) to conduct a thorough literature review of parking supply standards and studies in order to determine the current state of knowledge and inquiry surrounding the balance of parking supply and demand. This initial survey of accepted standards most often used to guide parking supply indicates that they are typically based on a single independent variable — unit count — and do not account for independent variables such as building type, transit and land use factors.

The incorrect application of existing parking data has been criticized both locally and nationally and has been identified as a major barrier to successful transit-oriented development. As a case in point, the ITE manual continues to be used as a standard for determining parking supply. However, these guidelines consider only the number of units in a building in its parking supply calculation and draw from mainly suburban data gathered in the 1980s.

The RSP team compiled an overview of current statistical methods for estimating parking demand and studied new models aimed at linking contextual factors, such as sociodemographic characteristics, to parking demand. The literature review included many studies that begin to address and model the relationships between parking demand and contextual variables such as household characteristics, housing type, qualities of the built environment, and parking price. Additionally, data sources that assess auto ownership or vehicle availability were reviewed to ascertain the extent to which vehicle ownership could serve as a proxy measure for estimating parking demand.

The RSP Literature Review can be found at:

http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/rsp-litreview_11-2011.pdf

Background research findings

The RSP team laid the foundation for the development of the research methodology by conducting a thorough literature review (see sidebar) to determine the current state of the industry methods for estimating parking demand. The findings of the literature review indicated that parking supply requirements and guidelines are typically not tied to demand and that there is currently no clear understanding of the factors contributing to parking demand.

The team reviewed multiple studies indicating that there is often a measurable oversupply of parking in multi-family buildings. This phenomenon is often caused by a combination of factors: developer overestimation, financier requirements, and/or jurisdictional parking requirements. The review of these studies clarified that the importance of considering parking demand is widely recognized while the impacts of contextual factors, although documented in many cases, are still debated. The two largest identified gaps were 1) a lack of consensus on factors that influence demand for parking; and 2) omission of data on parking availability, cost and pricing.

It was clear to the team that the tools and methods that have informed parking supply regulations in the past are often not appropriate for guiding parking supply decisions for new development in King County today. The literature review included several studies that have begun to establish a meaningful link between parking demand and a range of building and site characteristics. These initial findings served as the basis for the development of the RSP model.

RSP Research Guiding Principles

- Scientific approach
- Based on data and statistical analysis
- Local data with hyper-local applicability
- Relevant to community goals
- Actionable
- Support policy change, informed participation in project review and investment/development decisions
- Designed to support creation of interactive web tool

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Methodology development

The RSP team set out to design the research to address the gaps in understanding regarding parking demand and vehicle availability uncovered during the literature review. A primary goal of the RSP study is to provide clarity on these issues in the form of practical tools for use in development and policy discussions. The literature review served as the basis for drafting the research methodology, which was vetted by a Methods Review Committee.

Methods Review Committee

The RSP team assembled a Methods Review Committee to assist with developing and vetting the research methodology. The committee consisted of a panel of parking experts, including national and local academics, practicing professionals, leaders of the urban planning and engineering fields, and ITE members.

Methods Review Committee

Cynthia Chen, University of Washington

Donald Shoup, University of California Los Angeles

John Holtzclaw, Sierra Club

John McIlwain, Urban Land Institute

Jeffrey Tumlin, Nelson\Nygaard

Robert Cervero, University of California Berkeley

Ransford McCourt, DKS Associates

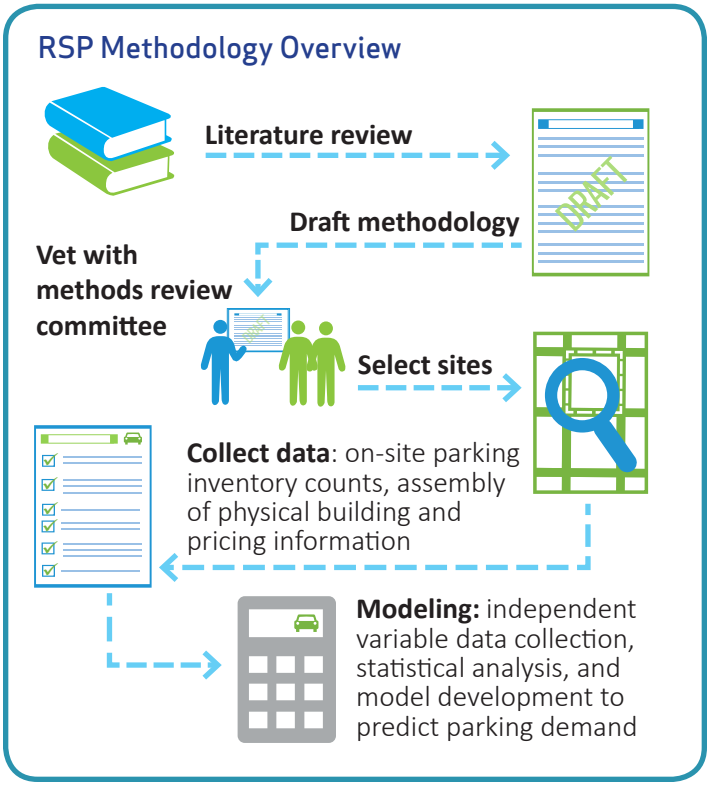
Rachel Weinberger, University of Pennsylvania

Richard Willson, California State Polytechnic University

Steffen Turoff, Walker Parking Consultants

The Methods Committee worked to ensure that the RSP research methodology met the highest academic and industry standards, honored the budget allocation, and provided statistically significant and replicable results.

Comments and input from the Methods Review Committee were integrated into the final research methodology documents, which documented background research, outlined the research objectives, and provided a road map for project development.



Site selection and data collection

Site selection process

Convenience and quota sampling techniques were used to assemble a total of 223 multi-family sites representing various types of multi-family development around King County, Washington. Study sites were chosen to provide a well-distributed sample of the dependent variable and many of the site-specific independent variables used to generate the RSP model.

The geographic location of eligible properties was defined to ensure that the sample was focused in areas where future multi-family residential development could potentially occur. Within the defined boundary, eligible sites included multi-family residential properties with a minimum of ten units either leased as apartments or sold as condominiums. For properties that contained a mix of uses, only the residential portion of the parking supply was studied.

Numerous developers, property owners, and property management companies were asked to participate in the data collection effort. Targets to ensure a representative sample were established based on transit connectivity, employment access, average medium gross rent, and average median household income.

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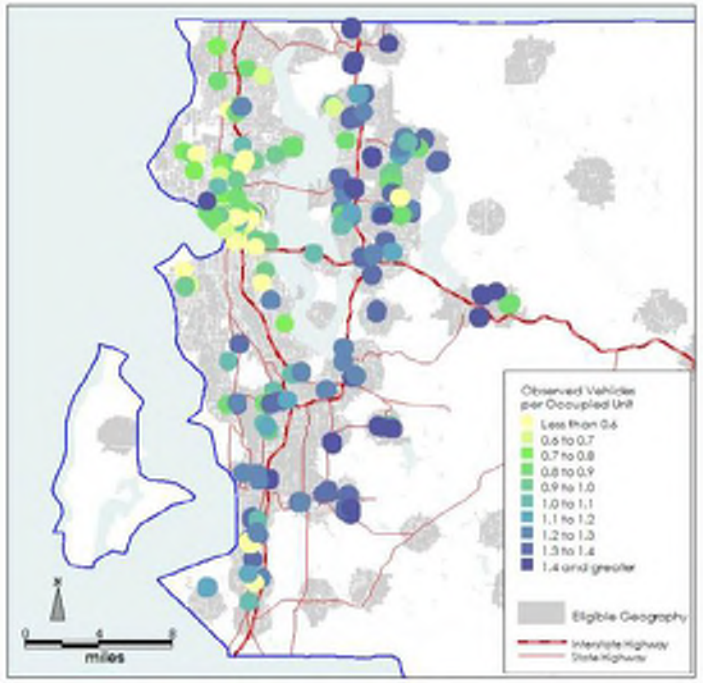


Fig. 1: Observed Vehicles per Occupied Unit.

Field counts

The RSP team collected data for 33,166 occupied apartment units throughout King County accompanied by 46,420 residential parking stalls (32,608 of which were observed to be occupied with vehicles). The field counts required at least two visits to the site: an initial visit to meet with the property manager and discuss data needs, and a second to perform the parking utilization count. The parking utilization count followed the Institute of Transportation Engineer's Parking Generation Manual method of counting between the parking peak hours of 12:00 a.m. and 5:00 a.m. on weekdays only for multi-family land uses.

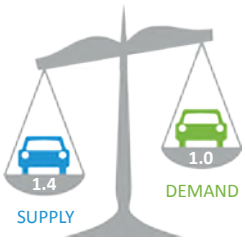
The sample represented a range of parking types but included all residential parking, including visitor parking, identified by the property manager at each multi-family development. Parking was generally provided in off-street garages or lots located on the multi-family parcel, but some parking was located in dedicated on-street stalls or satellite garages.

Sites selected for the study were screened for building age and available parking supply to control for potential under-supplied parking where constrained supply made actual demand unknowable. The end result was the identification of 223 sites for which parking utilization could be measured via parking counts, and the exclusion of sites for which undefined off-site, on-street parking may have resulted in underrepresentation of parking use. The initial 223 sites were cut to 208 sites, as explained later in this document, in order to eliminate statistical outliers.

RSP data collection summary

What did we find?

The RSP team found that, on average, parking is supplied at 1.4 spaces per dwelling unit but is only used at about 1 space/unit.



What does this imbalance mean?

When these average supply and utilization findings are applied to a typical suburban project with 150 units, roughly $800,000 would be wasted on unused parking. This estimate assumes a conservative construction cost of $15,000/stall .

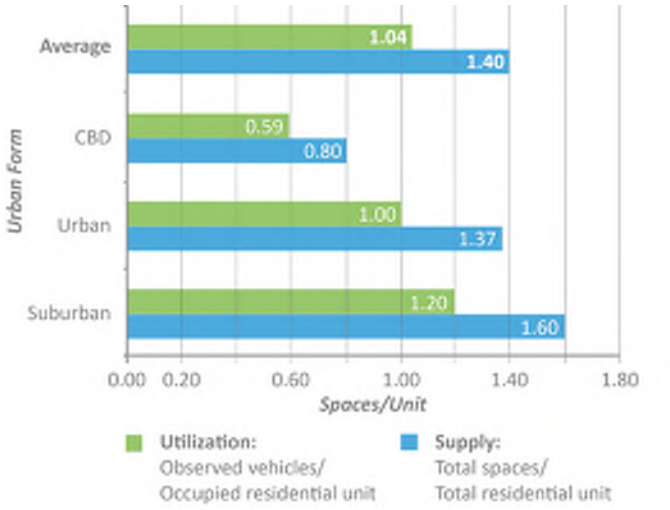


Fig. 2: Observed Vehicles per Occupied Unit as a function of urban form. Both parking utilization and the gap between parking supply and demand tend to be greater in suburban areas on average.

Parking oversupply by the numbers:

Oversupply of parking adds unnecessary cost to project development and inefficient use of land:

- Excess surface parking can add $2 per foot to annual unit leasing cost (@ $8,000 per stall)
- Excess garage parking can add $6.00- $7.00 per foot to annual unit leasing cost (@ $30,000 per stall)
- For a typical affordable housing development, adding one space per unit increases leasing costs by about 12.5%; adding two parking spaces increases leasing costs by about 25%

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Data modeling

Modeling parking utilization, dependent variable

The dependent variable used in the model estimating parking utilization was "observed vehicles per occupied residential unit" collected from the field data. This dependent variable analysis was comparable to the approach of some of the studies included in the literature review. However, the RSP study sought to determine the effect of contextual factors on parking demand in addition to the much more basic number of housing units.

Modeling parking utilization, independent variables

The RSP project went beyond modeling parking demand based on the utilization of existing supply per each unit of housing by also considering the effects of a host of other potential independent variables. The collection of the primary parking utilization data enabled a unique statistical analysis and the development of a model for predicting parking utilization at multi-family residential developments. Based on the field data, the Center for Neighborhood Technology used regression analysis to test a set of independent variables and to create a statistical model that would identify the building and environmental characteristics that best described the relationship between parking utilization and demand.

During the regression analysis and model development process, over 100 distinct potential independent variables grouped into five categories—parking supply and price, property/development characteristics, neighborhood household characteristics, accessibility, and built form characteristics — were analyzed, enabling the consideration of the greatest number of possible variables to create a complete picture of the primary factors contributing to parking demand. These external data were collected from a variety of sources, including the American Community Survey, the King County GIS Center, Zipcar, and Walkscore.

Because one variable can be represented in many different formats using different metrics, an extensive list of potential explanatory variables was analyzed. For example, while it was expected that transit access would correlate with parking utilization rates, the best measure of transit access to explain utilization rates was unknown, so several different kinds of transit access measurements were included in the study.

Parking supply as a variable

Parking supply is often cited as one of the most important variables in determining demand, and many past studies have found a high correlation between the two factors. A similarly high correlation was found in the RSP research data, indicating that it should be included in the model.

However, estimating parking utilization for the purposes of informing supply decisions should not be a function of supply. Parking supply was ultimately excluded from the model because its inclusion addresses a different research goal. The RSP research objective was to estimate the full quantity of parking that would be demanded at a given property in order to help inform a decision on the amount of parking that should be supplied at that location. Therefore, it was not desirable for the model to take into account situations for which parking utilization was low because of inadequate supply rather than low demand.

If supply were to be included in the regression model, its coefficient would indicate the effect of parking supply on usage, conditional on the other observable characteristics included in the model. Therefore, parking supply was excluded as an independent variable from the model.

Regression analysis

Because the regression analysis began with the presumption that the ordinary least squares (OLS) transformation would provide the optimal approach, a simple linear regression model was used at the outset of the modeling effort. However, because relationships between the dependent and independent variables were not all assumed to be linear, all variables were tested using various transformations (e.g. natural log, inverse, square root, etc.). Variables were tested for their correlation with the dependent variable as well as for the form that provided the best and most logical fit.

To construct the regression analysis, many approaches were tested to find the best method of including, removing, and ultimately assembling the best set of variables. In the end, the goal was to find the set of variables that provided the most robust theoretical framework while remaining relevant from a practical development and planning standpoint, keeping in mind that the resulting formula must ultimately be applied and made accessible via an online tool.

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RSP Technical Research Memo



The RSP Technical Research Memo outlines the RSP research objectives and explains the project research methodology and model development in detail. The report identifies the key variables that describe parking demand in King County according to the RSP research. It also discusses the connection between characteristics of multi-family buildings and the parking and transportation needs of residents. The RSP Technical Research Memo can be found at:

http://www.rightsizeparking.org/Right_Size_Parking_Technical_Memo.pdf

Maintaining the criteria that all variables be significant (the probability that the coefficient is non-zero, or $p < 0.05$) and all multicollinearity be low (as assessed through variance inflation factors, or VIF values, less than 5) was considered throughout the modeling process. Because each factor or characteristic was represented using many independent variables (as well as multiple transformations of each), multicollinearity, or a high level of correlation between independent variables, was an important consideration.

The most effective modeling approach identified, which served as the basis for the parking utilization model, began with a set of variables that appeared in the highest-scoring results of multiple approaches. A stepwise method was used, with an entry criterion of 0.05 and a removal criterion of 0.10.

Variables were then considered based on their logical candidacy from a planning or development context. For example, for a case in which a variable representing the count of three-bedroom units was included in the final set of variables in the absence of any other count or average number of bedrooms, the three-bedroom unit count was removed and variables pertaining to average bedroom counts were added and tested in a stepwise method. Or, if two variables had high collinearity, such as block size and the transit connectivity index, one was removed and various variables were tested to replace the other.

Throughout the modeling process, outlying cases were tested to ensure that no single property was significantly influencing the fit. Sample properties, or cases, with high leverage values (approximately > 0.5) or outlying residuals (as identified through separated tails in a residual histogram) were removed from the sample. In the end, 15 cases were removed based on these criteria, resulting in a final sample size of 208 properties.

Further details on the regression analysis can be found in the RSP Technical Memo (see sidebar to left).

Results and summary of findings

The final model derived from the regression analysis incorporated seven variables – five pertaining to the property or development characteristics and two describing the built environment (these variables are described in further detail on p. 12). The final equation for the model is:

$$P_u = b + \sum_{i=1}^{7} C_i X_i$$

where P_u is the modeled value of the parking utilization, b is a constant term, C_i is the coefficient for the "ith" variable (derived from the regression equation), and X_i is the value of the "ith" variable representing a location or building characteristic.

Parking utilization was found to be correlated to individual building characteristics as well as to the neighborhood in which the building resides. In other words, parking utilization cannot be determined from the characteristics of the building alone, nor from the setting alone. To understand and accurately assess parking needs, both building type and location must be considered in tandem.

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RSP independent variables

CNT identified seven variables that produce a combined R-square value of 81.0%, an adjusted R-square of 80.3%, and a standard error of 0.16: Table 1 identifies the seven independent variables as well as their individual R-square and stepwise R-square values. Individual R-square values represent the correlations between the given variable and the dependent variable. The stepwise R-square values represent the improved R-square value as each variable is added to the final model.

Independent variable	Individual R Square	Stepwise R Square
Gravity measure of transit frequency	55.5%	55.5%
Percent of units designated affordable	27.6%	67.1%
Average occupied bedroom count	34.3%	73.7%
Gravity measure of intensity (population + jobs)	53.3%	76.2%
Units per residential square feet	17.1%	78.7%
Average rent	6.7%	80.0%
Parking price as a fraction of average rent	18.1%	81.0%

Table 1: Independent Variables and Summary of Regression Results.

Figure 3 illustrates the final fit of the observed or measured data as compared to the predicted model results.

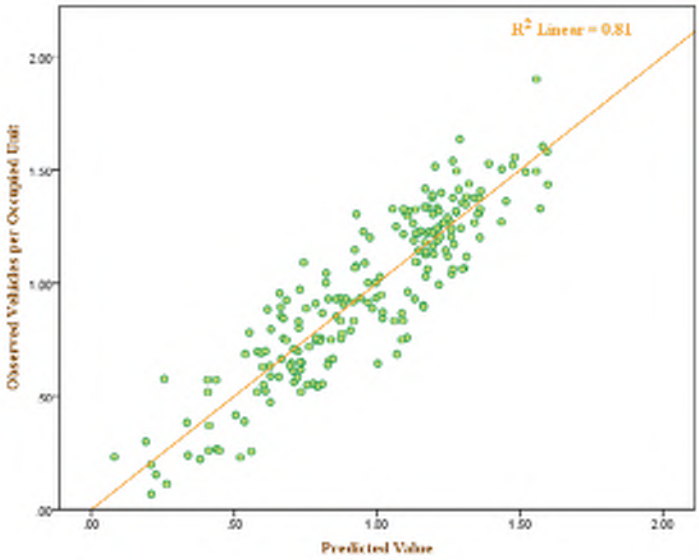


Fig. 3: Observed vehicles per occupied unit versus modeled value.

Limitations

The final model resulting from the RSP regression analysis can help to support and guide decisions about parking supply and management. However, it cannot provide definitive answers about specific future policies or developments. Rather, the model is intended to serve as a resource to inform discussions as users weigh the factors affecting parking use and consider how much parking is needed.

Model estimates and data collection

Although the final model is statistically very strong, it is important to keep in mind that it represents an estimate, which by definition has inherent limitations. Real-world parking use can and will vary from RSP estimates for many reasons. For example, some property managers provide transit passes to building residents as a transit demand management (TDM) strategy, which is likely to reduce the demand for parking in those buildings beyond what the RSP model estimates.

Limitations on data collection also affect the model's accuracy. For the most part, observed parking included supply that was on-site and off- street, unless additional resident parking was noted by property managers. The sites selected for the study were screened based on building age and available parking supply to control for potential under-supplied parking that could result in spillover and unmet on-site parking demand. The result was that the sites studied were those for which parking could be measured through parking counts rather than those for which undefined off-site parking would have resulted in an underrepresentation of parking demand.

Due to a lack of on-street parking data and limitations on scope, this research was not able to fully account for on-street parking supply, occupancy, and pricing in the modeling of off-street multi-family parking. Using neighborhood on-street parking counts and resident surveys, future research opportunities exist to establish a more comprehensive understanding of multi-family parking demand.

Additionally, the data collected and utilized in the model represents a single point in time. As factors related to both the built environment and parking usage change (e.g. expanded transit service), the independent variables may need to be updated and their relationships to the dependent variable (parking utilization) reassessed.

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RSP Independent Variables

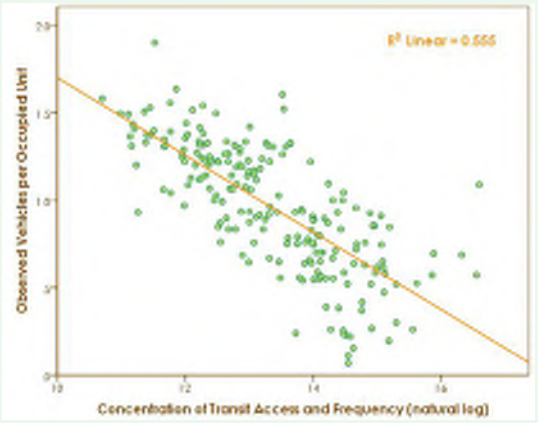


Fig. 4: Gravity measure of transit frequency.

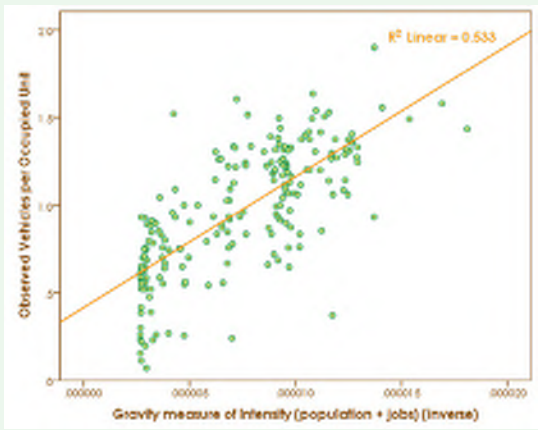


Fig. 5: Gravity measure of intensity (jobs + population).

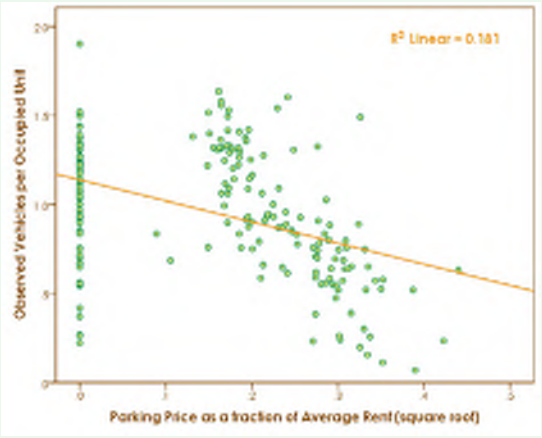


Fig. 6: Parking price as a fraction of average rent.

1. Gravity measure of Transit Frequency

Gravity measures take into account both the quantity and proximity of the factor being measured. RSP data indicated a strong correlation between concentration of transit frequency and observed vehicles per occupied unit. Transit concentration was able to serve as a proxy for many other built environment factors.

2. Percent of Units Designated Affordable

This variable includes all units identified as affordable by any designation as a percent of all units (regardless of occupancy). RSP data indicated that as the percent of affordable units increases, parking utilization decreases.

3. Average Occupied Bedroom Count

Average occupied bedroom count is the average number of bedrooms in all occupied units. To calculate this average, studio units were assumed to have a bedroom count of one. RSP data indicates that the average count of bedrooms has a positive correlation with parking utilization: as average bedroom count increases, parking utilization increases.

4. Gravity measure of Intensity (Population + Jobs)

Previous research often found a strong correlation between both residential density and job access with auto ownership. The strong correlation of the gravity measure of intensity and observed vehicles per occupied unit observed in the RSP data supports these findings.

5. Units per Residential Square Feet

Obtained from the property managers, units per residential square feet is calculated as total residential units divided by the residential square feet of the development. RSP data indicates that as units per residential square feet increase, or as average unit size decreases, parking utilization decreases.

6. Average Rent

Average rent (measured in dollars) represents the average monthly cost of all residential units in the building. RSP data indicates that observed parking utilization increases as average rent increases.

7. Parking Price as a Fraction of Average Rent

Parking price as a fraction of average rent is calculated as the monthly price of parking per stall divided by the average monthly rent. RSP data indicates a negative trend, revealing that as parking price increases, parking utilization decreases.

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Model coverage

To ensure confidence in the model estimates, limits were established for the coverage area. The sample utilized for data collection covered a wide range of built environment characteristics and land uses, but it did not cover the full spectrum found throughout the county. Therefore, the coverage for which model estimates were calculated was limited to the range of built environment characteristics found in the data collection sample. In other words, areas of the county that had lower transit service, population, or job concentrations than those found within the RSP research sample were removed from the coverage area.

Applications

A principal goal of the RSP project is to provide stakeholder access to the research. The King County Multi-family Residential Parking Calculator, which is described in detail in the following chapter, condenses the project's complex research findings into a simple map-based format accessible to a wide variety of stakeholders. Using the RSP model to estimate parking utilization, resulting outputs for most developable parcels in King County, Washington are clearly illustrated on this interactive, mapping website.

Conclusions

The RSP project provides analysts with new tools to consider the proper provision of parking, given several land use, transit and walk factors. Block size, population and job density, and walk and transit access to trip destinations influence parking utilization, in some cases by as much as 50 percent. They provide clear indication of where parking for low auto ownership characteristics can be applied. CBD multi-family parking utilization of 0.51 vehicles per occupied dwelling unit in the sites studied, compared with suburban 1.18 vehicles per occupied dwelling unit, indicates that accommodations and environments conducive to low- and zero-auto-ownership households correlate with reduced need for parking. Economic and pricing considerations were also found to matter, including average rent units, the share of units that are affordable, and the price charged for parking.

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Web Tool

Background and goals

A principal goal of the RSP project is to provide stakeholder access to the project research. To achieve this goal, the RSP team used the project data and conclusions to design and build an easy-to-use web calculator tool that can provide useful information and guidance for the broad spectrum of RSP stakeholders and potential users. The web calculator is a map-based tool that provides place-specific estimates of parking demand at the parcel level. The web tool has been designed to demonstrate RSP research findings, illustrate the influence of the identified predictive factors, and present data that multiple stakeholders will find valuable in their efforts to right-size parking supply.

Design and function

In order to achieve the project outreach goals, King County Metro partnered with the Center for Neighborhood Technology (CNT) to create a dynamic website with the ability to estimate multi-family residential parking demand across King County. The multi-family residential parking demand information provided by the calculator can be used for both policy guidance and market research.

Data-based

The calculator is based on the RSP model developed during the research phase of the project, which was created using local data of actual parking use collected in 2012 at over 200 developments in urban and suburban localities across King County, Washington. The interactive calculator tool uses the RSP statistical model to estimate parking use for multi-family developments throughout King County in the context of specific sites. The parking use data is correlated with factors related to the observed building, its occupants, and its surroundings - particularly concentrations of transit, residents and jobs, as well as the price charged directly to the users of parking. Using best available research findings and industry-accepted rule of thumb assumptions, additional impacts were estimated to highlight the associated 'costs' of parking, which are displayed as part of the web calculator interface.

King County Multi-Family Residential Parking Calculator

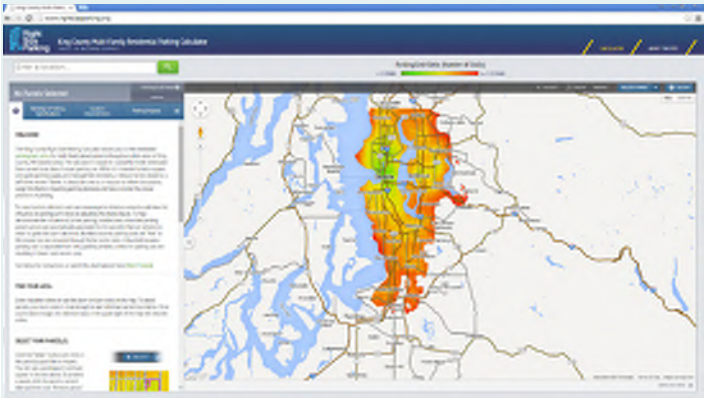


Figure 7. Screenshot of the King County Multi-Family Residential Parking Calculator.

To highlight the importance of parking price and presence of affordable units on parking utilization, the calculator automatically calculates and displays the different parking utilization estimates for two scenarios: a given parcel and building with 1) parking pricing bundled with or unbundled from rent, and 2) 100% affordable units or no affordable units. Additional calculator functions include:

- Viewing estimated parking/unit ratios for multi-family developments in urban King County, WA
- Creating scenarios for a specific parcel or custom area by inputting variables particular to a proposed development (instead of relying on default values representing development averages), such as number of units, unit type and size, and average rent
- Adjusting scenarios for contextual factors such as concentration of population, jobs and transit service to estimate parking use if neighborhood characteristics were to change in the future
- Comparing the impacts of alternative parking scenarios, including information about cost, greenhouse gas (GHG) emissions and estimated vehicle miles traveled (VMT) of building users

See the following pages for step-by-step instructions on how to use the web calculator tool. The King County Multi-family Residential Parking Calculator is online at:

http://www.rightsizeparking.org/

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Web Calculator Overview

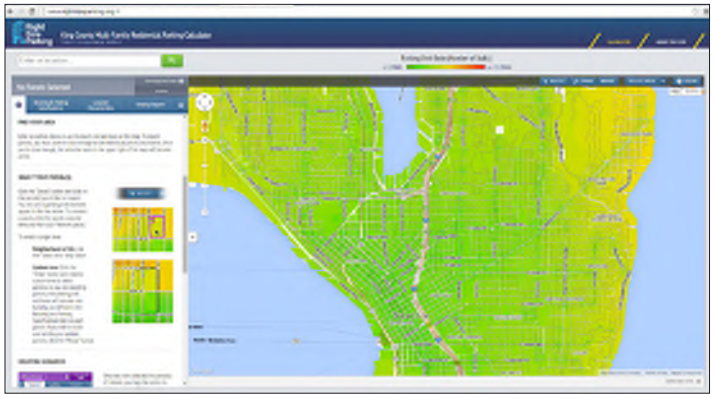
Calculator basics

The King County Multi-Family Residential Parking Calculator is a map-based web tool that helps users estimate parking demand for multi-family developments at specific sites. The calculator can help analysts, planners, developers, and community members weigh factors that will affect parking use at multi-family housing sites and determine how much parking is "just enough" when making economic, regulatory, and community decisions about development.

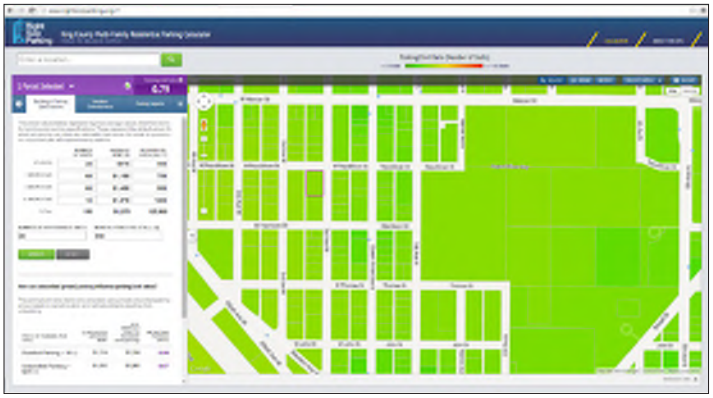


The RSP web calculator can be accessed online at: www.rightsizeparking.org

How to use the King County Multi-Family Residential Parking Calculator:



Enter an address or use the zoom tool to find an area of interest.



Select an individual parcel using the "Select" arrow tool.

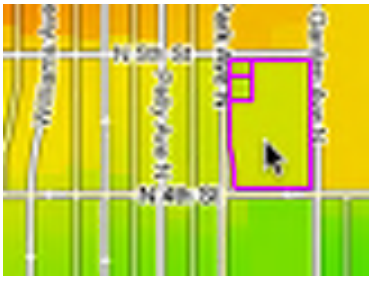
1 Find your area

Enter a location or use the zoom and pan tools on the map to zoom in to the area of interest. When zoomed in close enough, individual parcels boundaries will become visible and the selection tools in the upper right of the map will become active.

2 Select your parcels

Click the "Select" button and then click on the parcel(s) of interest. A parking/unit estimate will appear in the calculator box. Parcels can be added to or subtracted from a selection using the "Select" tool. A larger area, such as an entire neighborhood or city, can be selected using the "Select Area" drop down menu.

Parking demand can be estimated for a custom area by using the "Draw" tool to select multiple parcels. In a custom calculation, the parking/unit estimates assume that one building will be assigned to each parcel. The "Merge" tool allows users to assign one building to multiple parcels.

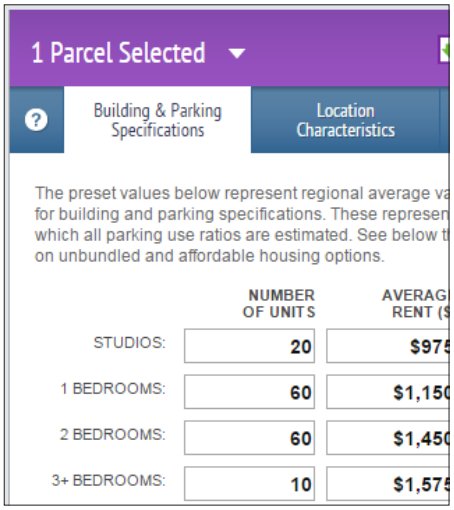


Select multiple parcels or draw a custom area if desired.

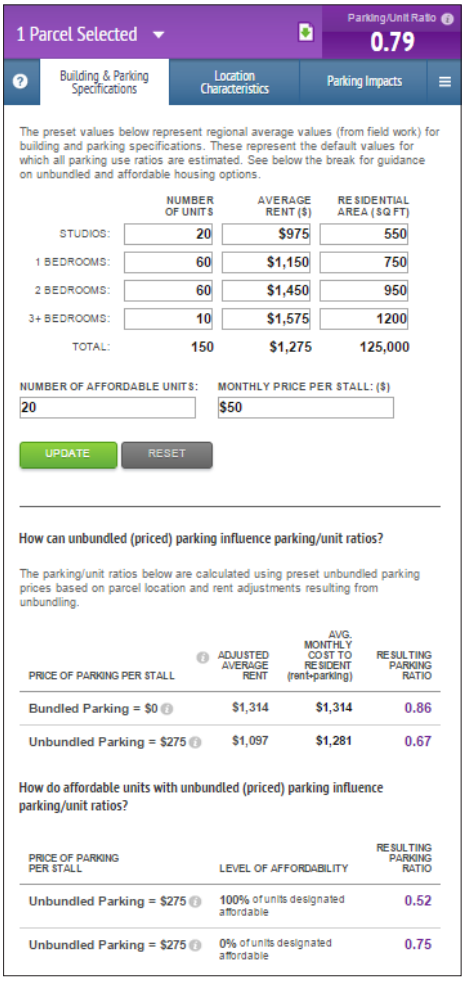
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3 Create scenarios

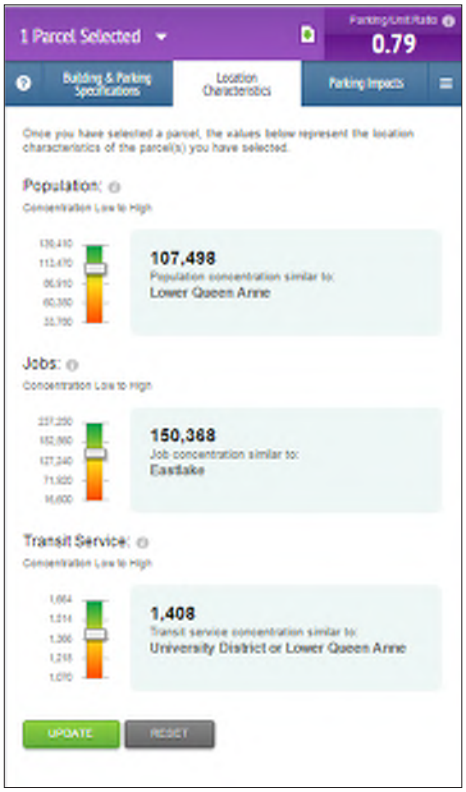
Once the parcel(s) of interest have been selected, the default inputs are shown and can be adjusted using the "Building and Parking Specifications" and "Location Characteristics" tabs. Two preset scenario options (unbundled parking and affordable housing) are provided on the "Building and Parking Specifications" tab to provide a starting point for developing custom scenarios.



Adjust default inputs under the first two tabs.



Enter building and parking specifications.



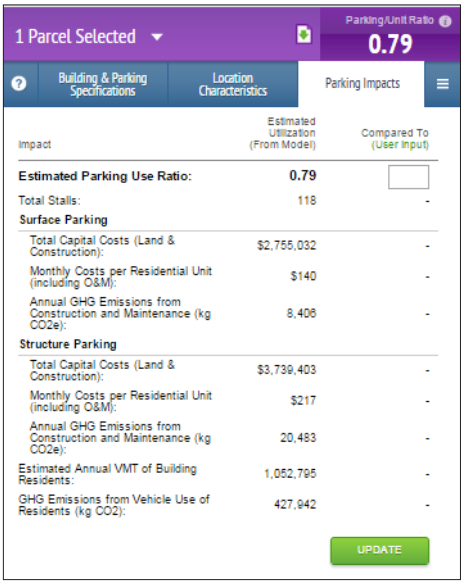
Make adjustments for location characteristics.

4 View results

Parking/Unit Ratio: The calculator tool displays the estimated parking spaces per residential unit for the selected building(s), or the parking/unit ratio. When multiple parcels are selected, an average is displayed. The calculator also provides additional information about the selection, such as parcel data and the estimated parking use ratio for the selected parcel(s).

Parking Impacts: This tab provides average parking construction costs and estimated vehicle miles traveled (VMT) as well as greenhouse gas (GHG) emissions based on the amount of parking supplied.

Selection Info: Click the up arrow in the bottom right of the map screen for trip generation reduction estimates and Census data on average commute distance and journey to work mode split.



View parking use estimates and impacts.

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User interface

The RSP web calculator condenses complex research findings into a user-friendly, map-based format accessible to a wide variety of stakeholders. The tool allows users to apply the RSP statistical model to real-world scenarios, whether it be planning at the neighborhood level or designing and financing a building at the parcel level.

Outputs for most developable parcels in King County, Washington are illustrated on this interactive website calculator. Users have the ability to select a parcel, input details specific to a proposed development (replacing the default values that represent development averages), adjust factors of the built environment, and view the resultant parking utilization estimate. Users can also adjust scenarios using variables related to a specific site and its location, including proximity to transit, jobs and/or population.

This ability to adjust variables enables users to compare the impacts of alternative scenarios in order to weigh factors that will affect parking use at multi-family housing sites when making economic, regulatory, and community decisions about development.

When variables are entered, the calculator displays the impacts of creating the stated amount of parking, including: total capital costs of parking, monthly costs per residential unit, annual vehicle miles traveled (VMT) of building residents, and greenhouse gas (GHG) emissions from building construction and maintenance as well as from the vehicle use of residents. Understanding the variables influencing parking supply and demand helps users to determine how much parking is "just enough" for a particular site.

Built-in scenarios

RSP research found that parking pricing and the presence of affordable units are two factors that have a pronounced effect on parking utilization. In order to highlight these findings, the website includes two "built-in" scenarios that automatically calculate and display the different parking utilization estimates for a given parcel and building with:

- Parking pricing bundled with or unbundled from rent, and
- 100% affordable units or no affordable units

Who benefits and how?

Developers, public decision makers, and communities will all benefit from the King County Multi-family Residential Parking Calculator.

Developers and financiers: Decreased costs of housing development, ownership, rental and operation

Action: Right-size new developments; build more housing near transit and sell it for less

Jurisdictions: Improved pedestrian environment, walkable neighborhoods, and transportation choices

Action: Adjust code to reflect findings

Neighborhoods: Improved pedestrian environment, transit operations and efficiency; decreased housing costs

Action: Community participation in the development process

Users and intended applications

Calculating parking use at multi-family developments can help provide information to users that can guide and inform decisions on building and managing parking. The calculator can help analysts, planners, developers, and community members weigh factors that will affect parking use.

The calculator can also be used as a resource to inform discussions and help consider the proper provision of parking. With updated context-sensitive information on parking demand, the calculator allows communities to regulate development in a way that meets both local and regional goals.

This new approach provides public and private sector practitioners with information and tools to better align parking supply with demand, preserving resources and supporting a range of community goals including transit-oriented development and housing affordability. The tool also facilitates developers in building more housing, especially affordable housing, in areas well-served by transit.

While the web calculator tool is intended to help support and guide parking supply and management decisions, it should not be viewed as providing a definitive answer on parking provision. Rather, it should be seen as a resource for informing discussions and weighing the factors impacting parking demand.

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USER TESTIMONIALS RSP WEB CALCULATOR

Web calculator users representing both municipal and developer stakeholder groups provided the RSP team with feedback on the utility of the interactive RSP tool:

City of Kirkland

"The City of Kirkland used the King County Multi-Family Residential Parking Calculator to help draft new parking requirements for multi-family zoning districts within the City. The parking calculator was fundamental in establishing a baseline parking requirement, which we then modified based on additional parking information and policy direction from City officials."

- Jon Regala, Senior Planner, City of Kirkland Department of Planning and Community Development

William Popp Associates

"The tool has been very helpful in our parking demand studies for predicting demands for multi-family apartments in urban settings with abundant public transportation and nearby shop, restaurant, and socio-recreational opportunities. We have found the tool very useful in that we can narrow down our study area to a parcel specific condition or expand out to a larger block area or neighborhood community when predicting demand. Previous data sources for parking demand are often all-encompassing, and they are often only stratified into urban and suburban areas. In general, the tool has been very useful in our recent parking analysis endeavors, particularly in urban settings."

- William Popp Jr., Transportation Engineer

Beacon Development Group

"As a development consultant to non-profits building affordable housing, Beacon used the Right Size Parking calculator to help one of our clients plan for the amount of parking needed by their new mixed-use project. The tool is very easy to use, and it gave us a firm number to start from so that our client could formulate a parking plan during project development rather than simply react to parking needs after the project was completed."

- Boting Zhang, Housing Developer

Capitol Hill Housing

"The King County Multi-Family Residential Parking Calculator web tool has been a great resource for advocacy about parking in our neighborhood of Capitol Hill. Capitol Hill is a dense urban neighborhood in which many residents do not own a car and large households only own one car. Many developers, new to the neighborhood, are skeptical of the low parking demand or need hard evidence to show during their financing negotiations.

King County's parking calculator, and the research behind it, has provided that evidence. We can sit down with developers and pull up recommendations for their specific site, mix of unit sizes, levels of affordability, and the price they are planning to charge. Working with the parking calculator results in lower, more realistic parking ratios in new buildings. Increasingly, new developers have already consulted the parking calculator before we meet with them.

The calculator is also helpful for assuaging neighborhood fears about parking spillover. The tool allows everyone to easily access accurate information about parking demand and make informed decisions."

- Alex Brennan, Senior Planner

City of Renton

"The ability to compare the City's regulations with RSP findings allowed City staff to verify that the adopted City parking regulations were appropriate. The ability to compare our regulations to such an extensive study instead of simply comparing to neighboring jurisdictions gave City staff the confidence that our parking numbers were appropriate for the development patterns in Renton. "

- Vanessa Dolbee, Current Planning Manager, Community & Economic Development Department

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Usage cases and stakeholder input

During its initial two years of use, the calculator website has seen constant use, with visits originating from across the country. The most frequently performed actions by visitors to the RSP web calculator include running the model and viewing the information tabs that allow for user scenario adjustments and display information about parking impacts. Of these tabs, the Building and Parking Specifications tab has been most highly utilized.

King County Multi-Family Residential Parking Calculator usage statistics (Feb 1, 2013 - Feb 1, 2015)

Total Events & Unique Events by Event Category		
Run Model	40,017	2,834
View Tab	27,856	10,104
Update	5,667	1,412
Location Search	2,233	926
Total & Unique Events by Event Action		
Building/Parking Specs	4,152	1,174
Location Specs	758	331
Parking Impacts	757	383

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Demonstration Projects 4

Introduction

The final stage of the RSP project consisted of the development and implementation of pilot demonstration projects with local partners. The project team engaged seven demonstration pilot project partners, including both local jurisdictions and property owners, to put RSP research into practice through policy and management pilots. Pilot project partners were selected through a competitive bid process.

The **policy-based pilots** were designed to align jurisdiction parking regulations with regional goals for vehicle miles traveled (VMT), housing affordability, and greenhouse gas (GHG) emissions. Four King County cities - Kent, Kirkland, Seattle, and Tukwila - were selected as partners and worked with the RSP team to analyze potential policy changes.

The **management-based pilots** utilized innovative Transportation Demand Management (TDM) strategies, including parking pricing and incentive strategies, to test parking management scenarios. The partners for the management pilots included Capitol Hill Housing, an affordable housing provider; El Centro de la Raza, a community-based civil rights organization and housing provider; and Hopelink, an emergency services center.

In order to best support and empower these pilot projects, the RSP team developed a set of tools to assist policy makers and developers in understanding the market demand for parking based on location-specific characteristics. These tools, which include the Right Size Parking Model Code, a Parking Requirements and Utilization Gap Analysis, and a Multi-Family Parking Strategies Toolkit, are described in more detail in the following sections of this chapter.

Policy pilots

Pilot funding and technical support to test innovative parking policy approaches were awarded to four partner King County cities: Seattle, Kent, Kirkland, and Tukwila. These pilot projects began in 2014.

The intent of the policy pilot projects was to apply the RSP research findings in order to achieve better alignment between jurisdiction parking regulations and regional goals, such as increased transit ridership and provision of affordable housing.

Policy changes considered by the partner municipalities ranged from reductions in parking minimums for development to parking management strategies, including shared parking and residential parking program reform.

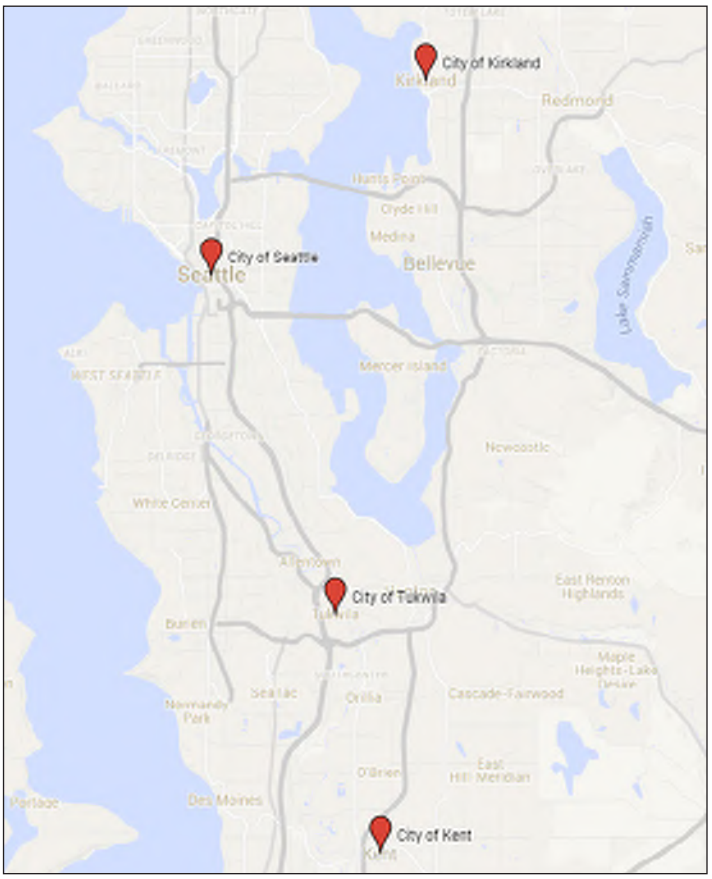


Fig. 8: A map of the Right Size Parking Policy Pilot Project partner locations.

Policy pilot partners

The selected pilot partners worked with RSP staff and consultants to analyze potential policy changes using the RSP web calculator. Both the RSP Model Code and the Parking Requirements and Utilization Gap Analysis were used to provide guidance for the recommendations for each partner city.

Each pilot project had a unique focus based on local issues and context:

- **Kent:** Identify best code and management strategies for mixed-use areas in a suburban context
- **Kirkland:** Establish parking requirements that reflect market demand and prevent spillover
- **Seattle:** Evaluate existing parking policies and programs and explore private shared parking opportunities
- **Tukwila:** Identify parking strategies for the Tukwila International Boulevard Station area; explore the potential for implementing private shared parking

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Parking Requirements & Utilization Gap Analysis

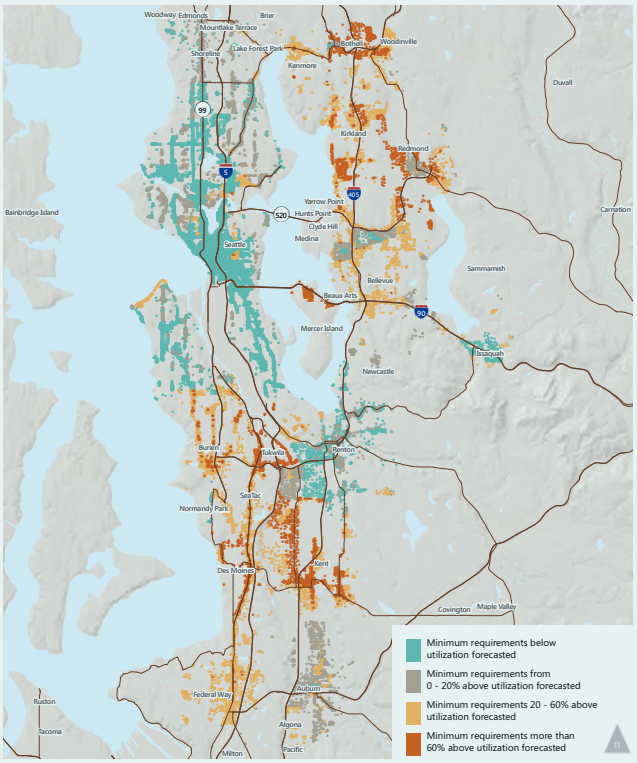


Fig. 9: Data map illustrating the gap between minimum parking requirements and observed parking utilization in King County.

The **Parking Requirements and Utilization Gap Analysis** provides a comparison of local municipal code minimum parking requirements with multi-family off-street parking utilization forecast by the RSP web calculator. The motivation behind this research is that misaligned parking requirements may spur new development to supply more parking than necessary, leading to oversupply and increased housing costs. They can also make it difficult to unbundle the price of parking from rent as it would only lead to a higher parking vacancy rate, but no cost savings.

The analysis indicates that in most King County locations, parking requirements are higher than forecast parking utilization, often by around 50%. More than 82% of King County parcels outside the City of Seattle have minimum parking requirements that are greater than the RSP model utilization. For more information, see:

http://metro.kingcounty.gov/up/projects/right-size-parking/pdf/gap-analysis-7-12-13.pdf

Right Size Parking Model Code



The RSP study found that many parts of King County have established minimum parking requirements that exceed modeled utilization. In many King County municipalities, parking codes may not be up to date with changes in land use, demographics and consumer preferences that have already reduced – and could potentially further reduce – the demand for parking. In some municipalities, parking minimums do not take into account the fact that demand for parking varies based on unit type, occupant income, proximity to transit, or other contextual factors.

In order to address this gap, the RSP team developed the **Right Size Parking Model Code** to help local jurisdictions implement policies that more accurately reflect their stated goals, such as housing affordability and neighborhood walkability. The model code document provides policy options and model code for cities looking to better match their local parking supply with demand using an adaptable, customizable menu of options with an explanation of each policy choice.

The purpose of the model code is to provide a resource for municipalities that are interested in implementing code changes to help right-size local parking supply. The model code draws from several other components of the RSP project, including best practices research, the RSP Technical Policy Memo, multi-family utilization surveys, parking code gap analysis, the RSP calculator, and stakeholder input.

The primary recommendation of the model code is for a market-based approach to parking supply in multi-family buildings and for spillover to be controlled by on-street parking pricing in lieu of parking minimums. The document also provides, as a second best alternative, recommendations for a context-based regulatory approach in which minimums are set based on a comprehensive assessment of neighborhood and project-specific conditions.

http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/140110-rsp-model-code.pdf

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CITY OF KENT POLICY PILOT

PILOT FOCUS

Parking code adjustments and parking management strategies

CONTEXT

The Kent Downtown area is experiencing tensions as it urbanizes from a suburban retail center to a mixed-use transit node. Large surface parking lots provide public parking free of charge throughout the Downtown, and several arterials traversing the area do not currently accommodate on-street parking.

As new multi-family development integrates with the existing urban fabric, the City of Kent desires to ensure that parking is managed as a valuable resource for livability and economic development within the Downtown area. In order to provide the City with tools for achieving this goal and addressing the transitional tensions affecting Downtown Kent, the RSP team worked to identify parking code and parking management strategies appropriate for this urbanizing, mixed-use area located within a broader suburban region.

RSP FINDINGS

A multi-family parking utilization survey conducted by the RSP team indicated that in Kent actual parking demand is less than what is required by the City's parking codes. When presented with this information, both the City and other project stakeholders expressed interest in exploring strategies for right-sizing the parking supply in Downtown Kent.

RSP RECOMMENDATIONS

The pilot project consisted of the creation of a parking code and parking management strategy that recognize the economic value and cost of parking stalls and support the appropriate prioritization of parking users within a mixed-use context. In general, the project team found the need for consistent and user-friendly communication of parking expectations and regulations to different user types as well as a need for focused enforcement and management of surface parking, including dedicated employee parking.

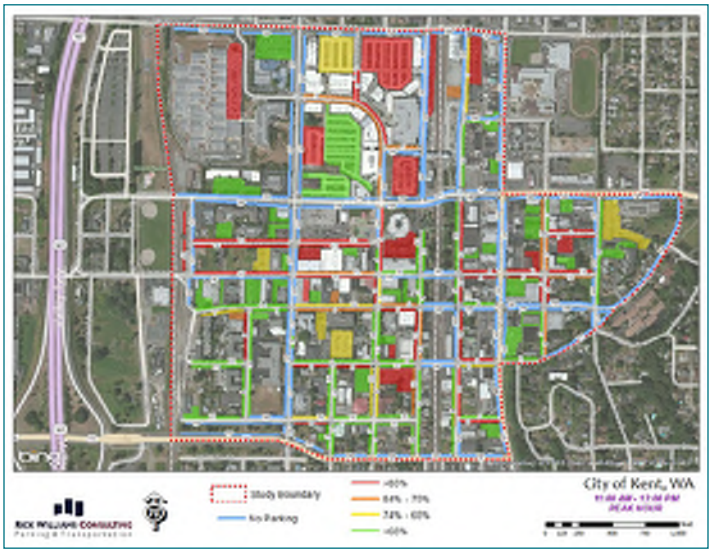


Fig. 10: Combined On and Off-Street Peak Hour Occupancies.

Project deliverables included:

- Documentation of existing parking conditions and identification of parking challenges and barriers
- A policy technical memo with code alternatives that are right-sized for Kent's development context
- Prioritized recommendations for parking code adjustments
- A context-specific parking management strategy that supports RSP standards while directly addressing and responding to stakeholder concerns

EXHIBIT 2
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CITY OF KIRKLAND POLICY PILOT

PILOT FOCUS

Establish parking requirements based on actual parking demand

CONTEXT

The Kirkland Planning Commission and Houghton Community Council expressed interest in gaining a better understanding of how the RSP calculator tool results compared with observed multi-family parking utilization in Kirkland. To address this issue, the RSP team compared the results obtained by using the web calculator to observed parking utilization rates collected at 24 multi-family developments across the City of Kirkland.

RSP FINDINGS

The team found that the RSP web calculator generally predicts parking utilization in the City of Kirkland accurately, with most sites within +/-15 percent of the observed value. Using the results of this analysis, the team compiled a technical memo that included recommendations for adjustments in parking requirements that reflect documented parking demand and prevent parking spillover.

The team also found that in certain transit-rich environments, the calculator may overestimate parking utilization due to the sensitivity of the transit score to relatively small differences in walking distances to transit. They determined that it was reasonable to manually adjust the RSP web model accordingly to more accurately consider the availability of high quality transit service in portions of Kirkland.

RSP RECOMMENDATIONS

- Use a unit-based approach to developing parking standards

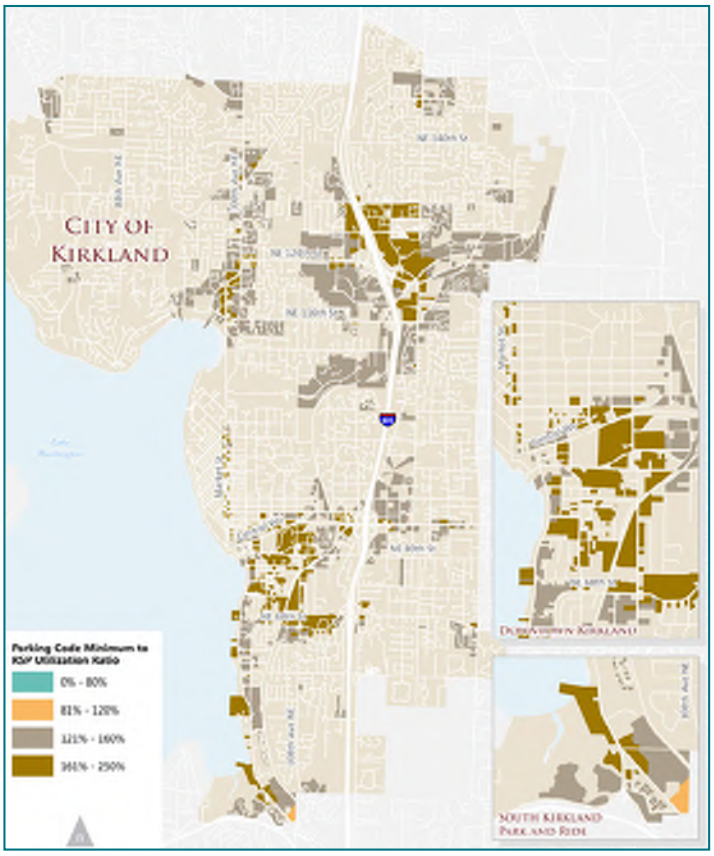


Fig. 11: RSP comparison of Kirkland parking code minimum requirements to RSP utilization ratio.

- Set minimum requirements at or just below utilization rates (may warrant additional on-street parking management)
- Supplement adjustments for parking requirements that respond to transit service with additional on-street parking management strategies

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CITY OF SEATTLE POLICY PILOT

PILOT FOCUS

Parking Code Review, Shared Parking Strategies, and Residential Parking Zone (RPZ) Review

CONTEXT

The City of Seattle participated in the RSP pilot to identify methods, including code and policy changes, for better balancing on and off-street parking supply and pricing. This pilot included an evaluation of existing parking codes and policies, an assessment of the existing Restricted Parking Zone (RPZ) program, and identification of opportunities to expand the feasibility of private shared parking. The goal of the project was to develop key revisions to the parking management process, tying together RSP goals of off-street requirements with effective on-street management.

RSP FINDINGS

Parking Code Review: Seattle parking standards are extremely varied, with distinct separations by use types, making it difficult to "right size" parking requirements.

Shared Parking Strategies: Building design can facilitate shared use parking by bringing the parker to a plaza connected to both the street and the building's private space. Signage and wayfinding systems are also important to supporting successful shared use parking.

Residential Parking Zone Review: The number of parking permits issued exceeds the actual supply of parking. The relationship between the cost of on-street and off-street parking is skewed to favor on-street parking, particularly where off-street parking is unbundled from rent.

RSP RECOMMENDATIONS

The RSP team researched each of these issues and produced reports focused on each of the three analytical tasks. It is hoped that these preliminary recommendations will spur discussion around clarifying issues and strategies for making adjustments to the City of Seattle's parking management practices:



Fig. 12: Signage regulating Seattle's Restricted Parking Zones (RPZs).



Fig. 13: RPZ locations in Seattle.

Minimum and Maximum Requirements Recommendations

- Consider the context of vision goals for unique areas of the City and develop an encompassing policy foundation to "right size" parking everywhere for consistency
- Simplify the parking code by creating broader land use categories

Shared Parking Recommendations

- Research and understand the range of shared use options that could be met within existing parking surpluses
- Establish consensus on those types of shared parking that are acceptable to the City
- Develop communication and facilitation strategies that bring potential shared use partners together

Residential Parking Zone Review Recommendations

- Increase the base price of residential parking permits and shift to monthly permit billing
- Graduate the price of residential parking permits in high-demand neighborhoods
- Modify institutional agreements
- Tie permit eligibility to off-street parking availability

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CITY OF TUKWILA POLICY PILOT

PILOT FOCUS

Private shared parking strategies and on-street parking user prioritization

CONTEXT

The RSP team partnered with the City of Tukwila to perform an "audit" of the RSP web calculator tool to determine how accurately it reflected parking utilization and demand in the Tukwila International Boulevard (TIB) light rail station area. The City also sought parking policy recommendations that would support a walkable, affordable, transit-oriented neighborhood around the TIB station.

RSP FINDINGS

The team found that the RSP model estimates parking utilization accurately for the majority of the selected sites: 15 of 18 sites fell within a 20 percent level of error. On average, apartments in the study area do not share as strong a link between good transit service and lower parking utilization as elsewhere in the County. This relationship is not very strong because current levels of transit service in Tukwila do not vary enough to make a meaningful impact on parking use.

The team found that many businesses actively take measures to prevent non-patron parking in their lots to eliminate spillover. They also found that Tukwila enforces more regulations for non-residential parking than other cities, making shared parking difficult to implement.

RSP RECOMMENDATIONS

Based on the data gathered through the RSP audit, the team worked to identify parking strategies for the TIB station area, including an exploration of private shared parking. The RSP team proposed recommendations and strategies that would enable the City of Tukwila to achieve its vision of creating a welcoming place, supporting equity, and preserving affordabilty. RSP recommendations included:

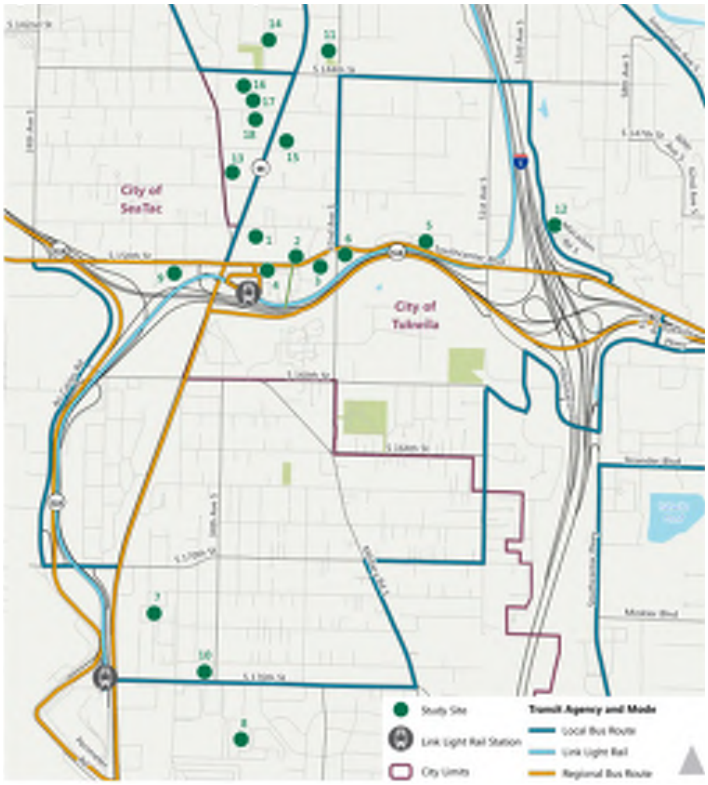


Fig. 14: Tukwila and SeaTac Study Site Locations

- Reduce multi-family parking minimums
- Develop clear policy language about the purpose and intent of on-street parking
- More directly facilitate the use of shared parking agreements between commercial and/or residential lots for off-street parking
- Create design standards that include on-street parking for new and improved streets
- Continue to monitor occupancy levels at the TIB station and transition the area to transit-oriented development

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Management pilots

Pilots to test innovations in parking management, pricing, and transportation demand management to reduce parking demand were awarded to three non-profit partners at multi-family properties in King County: Capitol Hill Housing, Hopelink, and El Centro de la Raza.

The intent of the management pilots is to generate data and case studies that reflect the impact of implementing innovative parking pricing and TDM strategies. In some cases, the RSP team took various approaches to address financial incentives that would support future pricing initiatives. Strategies explored by the partner municipalities included developing shared parking strategies at multiple scales, identifying TDM strategies for affordable housing projects, and applying RSP strategies at multi-family properties with unique federal constraints and requirements. Additional support and funding for the management pilot projects was provided by the Federal Transit Administration.

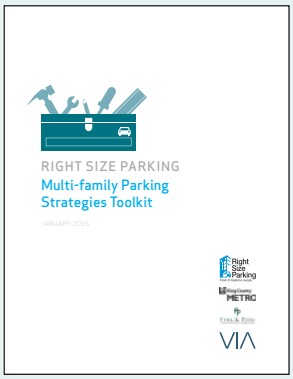
In response to stakeholder input received during the course of the pilot projects, the RSP team developed both a Multi-family Parking Toolkit and a Multi-family Development Passport transit product for use by multi-family property owners and managers. More information on these tools can be found on the following pages.

Management pilot partners

The management pilots were selected to test RSP concepts aimed at supporting regional smart growth goals of dense, compact development that leads to non-auto mode share growth, thereby promoting affordable housing, transit and other travel alternatives. Three partners were selected through a competitive bid process:

- **Capitol Hill Housing:** Test district shared parking strategies; identify a business model to coordinate shared parking at the neighborhood level
- **El Centro de la Raza:** Identify TDM and parking management tools for a planned affordable housing project using the RSP web calculator
- **Hopelink:** Implement TDM and parking management strategies at senior and low-income properties with unique needs and constraints, including federal restrictions on pricing parking

Multi-family Parking Strategies Toolkit



The **RSP Multi-family Parking Strategies Toolkit** is a guide that presents a set of tools for developers and property managers to use for managing parking supply in multi-family buildings. The toolkit addresses pricing, transportation demand management (TDM) strategies, design, and parking management as well as providing a case study and additional RSP resources.

Some of the tools presented can reduce the amount of parking needed to serve residential demand, resulting in a significant positive impact on project bottom line in terms of both construction costs and rent. Others can increase parking utilization and create new revenue streams.

By encouraging alternatives to driving, these parking strategies can help facilitate transit-oriented development, protect the environment, reduce congestion, and support local businesses. Reduced parking can also earn points in green building ratings systems such as LEED.

The tools in this guide address pricing, transportation demand management, design, and parking management. They can be applied to new developments or existing buildings, and many work best when combined in a multi-pronged approach. A case study that employed some of the recommended tools is included at the end of the document.

The “toolkit” is intended only as an overview of the best tools. Further details on implementation can be obtained from widely available publications or from a parking or transportation demand management expert.

The Multi-Family Parking Strategies Toolkit can be found online:

http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/multifamily-parking-toolkit.pdf

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CAPITOL HILL HOUSING MANAGEMENT PILOT

PILOT FOCUS

District shared parking strategies and business model

CONTEXT

Capitol Hill Housing (CHH), an affordable housing provider, engaged the RSP team to develop district shared parking strategies in the Pike/Pine corridor of Seattle's Capitol Hill neighborhood as a means of managing oversupply. Shared parking fits strongly within Capitol Hill's EcoDistrict program and supports neighborhood goals of developing neighborhood-scale strategies that benefit the environment while increasing housing affordability. The RSP team analyzed current Pike/Pine parking practices and economics, reviewed best practices case studies, and provided next steps toward the creation of a district parking system. The team identified a business model that could be used to coordinate shared parking at the neighborhood level.

RSP FINDINGS

CHH carried out the bulk of the data collection and research, drawing upon its long-standing neighborhood relationships to identify and recruit initial participants for pilot leases. The team conducted focus groups with residents as well as with owners and property managers to help develop and test the pilot lease agreements. The team generally found that neighborhood stakeholders strongly support transitioning to a shared parking system. Stakeholder interviews revealed the following findings:

- Developers supply excess parking to reduce risk of a shortage; if that risk could be mitigated through shared parking strategies, parking ratios could be reduced
- Employers are concerned about the cost of employee time spent searching for parking
- Residents parking on the street tend to base parking decisions on price rather than on time spent looking for or walking to and from a more distant location

RSP RECOMMENDATIONS

The RSP team developed a four-step approach toward creating a district parking system in the Pike/Pine corridor. The progressive process, which describes an evolution from a relatively simple "Broker" model to a more complex and dynamic "Internet of Parking" model, would allow CHH to make adjustments gradually and minimize risk (see Fig. 15). Specific recommendations were made at each step regarding operations, responsibilities, and technologies.

The final report for this pilot can be accessed online:

https://capitolhillecodistrict.org/projects/pike-pine-shared-parking/

DISTRICT SHARED PARKING BUSINESS MODEL PROGRESSION

	Broker	Smart Broker	Intranet of Parking	Internet of Parking
Buyers	Residents, Buildings	*Broker* Plus Businesses	Same as *Smart Broker*	*Smart Broker* Plus Visitors
Data Collection Method	N/A	Automated	Same as *Smart Broker*	Same as *Smart Broker*
Data Collection Times	N/A	Real Time	Same as *Smart Broker*	Same as *Smart Broker*
Space Assignment	Assigned	Unassigned	Same as *Smart Broker*	Same as *Smart Broker*
Garage Assignment	Assigned	Same as *Broker*	Unassigned	Same as *Intranet*
Notification Incentives	No	Yes	Yes	Yes
Peak Demand Incentives	No	Yes	Yes	Yes
Valet Service	No	Yes	Yes	Yes
Equipment Changes	None	Occupancy Tracking	*Smart Broker* Plus Card Readers	Same as *Intranet*
Garage Communication	None	One-Way	Two-Way	Same as *Intranet*
Rental Period Length	Monthly	Same as *Broker*	Same as *Broker*	*Broker* Plus Daily, Hourly
Time Restrictions For	Businesses	Same as *Broker*	Same as *Broker*	*Broker* Plus Individuals
Target Occupancy	Low	Medium	Medium-High	High
Cost	Low	Low-Medium	Medium-High	High
Revenue	Low-Medium	Medium	Medium-High	High

Fig. 15: The recommended business model for progression toward shared parking in Pike/Pine. Table from final report, ***District Shared Parking: Program, Policy and Technology - Strategies for a More Resilient Parking System in Pike Pine***. Link to complete report provided above.

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HOPELINK MANAGEMENT PILOT

PILOT FOCUS

Assistance with parking demand management and improving affordable housing resident mobility

CONTEXT

Hopelink is a non-profit community action agency that provides mobility management services in King County. Hopelink proposed implementing TDM and parking management strategies at senior and low-income properties in King County, including an exploration of parking pricing options.

In partnership with Senior Housing Assistance Group (SHAG) and Catholic Housing Services (CHS), Hopelink's Mobility Management team created Existing Conditions Reports for three SHAG properties and two CHS properties. Parking management plans were created for four of the five properties. The plans incorporated TDM best practices with site-specific factors to prioritize implementation strategies.

During the second half of 2014, prioritized strategies determined by project partners to be most feasible within the constraints of each property were implemented. Strategies specific to each study site were selected, which included shared and/or remote parking, nonmotorized infrastructure improvements, mobility management strategies, financial incentives, and parking regulation and enforcement, among others. A parking utilization assessment was conducted to gauge the relative success of the implemented strategies, and the team followed up with household surveys and staff interviews.

RSP FINDINGS

One of the primary pilot implementation strategies was the facilitation of a Transit Incentive Program (TIP) to encourage use of public transit by residents. The program, implemented across all of the study properties, was designed to reduce dependence on private automobiles, allowing residents to consider giving up vehicles or ensuring that additional vehicles are not purchased. The TIP gave participants a fully-loaded ORCA card for four months during 2014. As a result, an overall increase in resident mobility and comfort with use of transit was observed. A majority of participant survey respondents reported an increase in weekly transit use (see Fig. 16). Data collected on parking utilization showed a slight decrease in parking utilization at all properties.

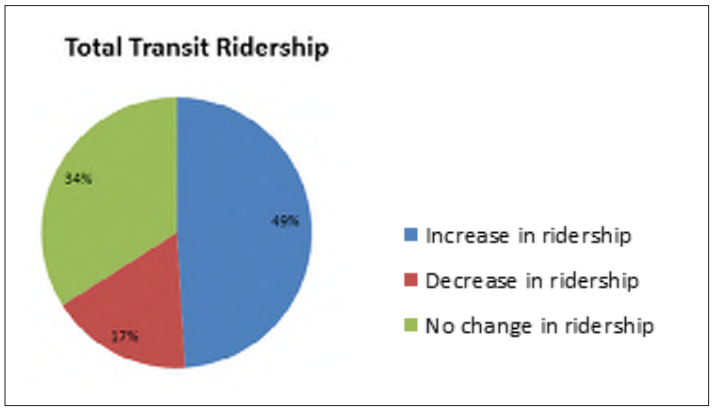


Fig. 16 A Transit Incentive Program implemented during the pilot project resulted in increased total transit ridership.

Additional implementation strategies included pedestrian safety enhancements, a Car2Go waiver for SHAG residents, and clarification of existing parking policies and operations practices.

RSP RECOMMENDATIONS

Due to the regulatory framework governing facilities built using low income tax credits, the team recognized that unbundling parking, a potential strategy explored during the course of the project, would require a policy change at the federal level.

As an outcome of the pilot project, SHAG staff expressed interest in self-funding a parking utilization assessment of a nearby park-and-ride lot as well as implementing a community rideshare program for group trips.

Hopelink is currently exploring opportunities to help partner agencies develop mobility plans for residents, develop tools to explain cost differentials between gas and transit for certain trips, and facilitate financial workshops for CHS residents who are burdened by high-interest car loans.

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EL CENTRO DE LA RAZA MANAGEMENT PILOT

PILOT FOCUS

Traffic study and TDM plan

CONTEXT

El Centro de la Raza (ECDLR), a social services organization and housing provider, sought to explore and select TDM and parking management tools for application at a planned affordable housing project, Plaza Roberto Maestas. The mixed-use project and auxiliary garage would replace existing parking lots, keeping total parking in the campus context at approximately 150 stalls while bringing new residents and businesses to the site. The team was charged with determining the parking and traffic needs on the campus after completion of the project.

The RSP team worked together with ECDLR, Beacon Development Group, the project developer, and the City of Seattle's Department of Transportation to balance parking supply and demand for the entire campus. The project began with a community meeting to gather feedback about the design of the proposed parking garage. Needed parking supply was determined using the RSP web calculator. The team conducted a parking and traffic study, which included consideration of construction parking and staging as well as recommended project-related outreach efforts.

RSP FINDINGS

During the course of the project, the team learned that the Columbia City Station Apartments (CCSA), a 52-unit low-income 1- and 2-bedroom apartment building adjacent to the Columbia City Light Rail Station, has nearly filled its 23 rentable stalls while being situated in a similar restricted parking zone. Recognizing that paid parking could help the project and ECDLR in a number of ways, including inducing and underwriting transit ridership, ECDLR is exploring the possibility of charging households for parking with pricing scaled to reflect a percentage of tenant rent.

Though not an initial focus of the project, it became clear during the study that office-related parking demand will also influence parking demand in the completed ECDLR campus. To address ECDLR's office parking uses, the RSP team explored a TDM strategy that included layered parking uses throughout the day, establishing an organizational account with ZipCar for ECDLR staff members, and providing 50% subsidies for employee ORCA passes.

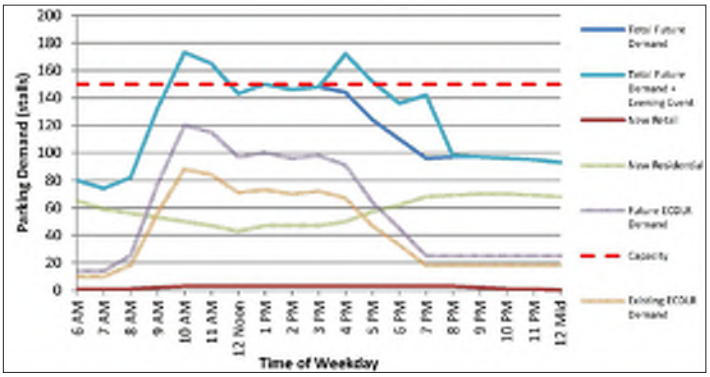


Fig. 18: Future on-site parking demand compiled for the Plaza Roberto Maestas Traffic Study.

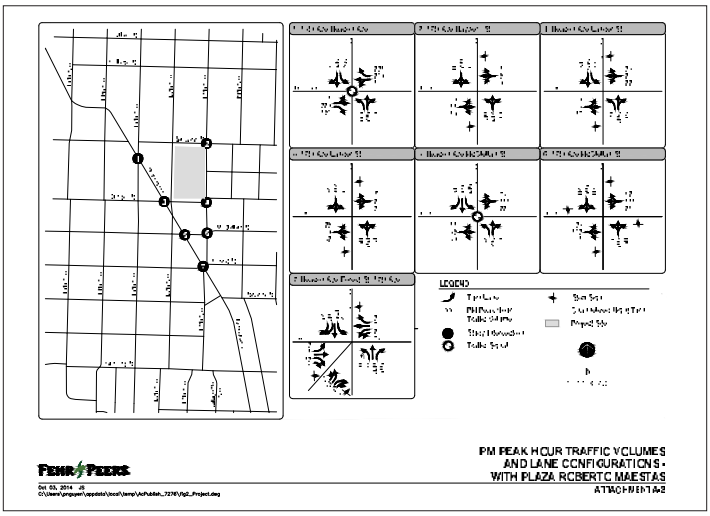


Fig. 19: Projected future peak hour traffic volumes and lane configurations from the Plaza Roberto Maestas Traffic Study.

RSP RECOMMENDATIONS

The calculator projections were used to identify TDM strategies for the completed project. The final RSP deliverable was an operating plan for TDM at the completed project that outlined guiding principles for implementing TDM and provided detailed recommendations regarding residential parking, alternative transportation, office and shared daytime parking, and event parking.

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ORCA Multi-family Development Passport Pilot Program



The **ORCA Multi-family Development Passport** pilot program provides an ORCA card that is an annual transportation pass for multi-family property owners or managers to offer to residents. Participating multi-family property owners and managers purchase the ORCA cards to offer to their residents. In exchange for a substantial discount, the program requires that the ORCA card be offered to every residential unit in the building; however, participation by residents is not mandatory.

The program benefits multi-family property owners and managers by providing an amenity for residents that encourages transit use, in turn reducing traffic congestion around buildings, lessening neighborhood parking impacts, and facilitating easier building parking management. Offering this product to residents can also give building owners and managers a competitive edge in a crowded rental and real estate market and contribute to more sustainable building and transportation management practices.

Residents benefit from receiving a single card to access comprehensive transit services throughout Seattle and beyond, ensuring a convenient, flexible, and affordable transportation option for choosing how to get to work, run errands, or visit family and friends.

The cost of the passport varies depending on property location and existing transit use. After the first year of the program, the cost is adjusted based on resident participation and use from the previous year. Property owners and managers may elect for residents to co-pay up to 50% of the cost of the product.

More information on the ORCA Multi-family Development Passport program and other transportation programs available to multi-family property owners and managers can be found here:

http://www.seattle.gov/waytogo/navSeattle.htm

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Stakeholder Involvement & Project Outreach 5

Telling the RSP story

Though rooted in academically-rigorous statistical analysis, it was Metro's intention that the RSP story not be solely an academic exercise. RSP's goal is to put data in the hands of those who make parking decisions in order to have a direct impact on communities, both within King County and beyond.

It was critical for the RSP project to create a call-to-action among stakeholders in order to spread the word about RSP research and to affect meaningful change in parking pricing behavior. The RSP findings tell a compelling story about the dynamics surrounding parking supply and the necessity for taking action to implement change in order to support community and regional goals.

RSP tools and education

RSP interfaces and products have been designed with ease of use and flexibility of application in mind. The primary means by which RSP research and data have been made easily accessible to stakeholders — including policymakers, project planners and developers, and the general public — is via the RSP web calculator. In order to best leverage the research and web tool products, the RSP project also developed guidelines for parking best practices that address both regulatory and property development topics.

These products, which include the RSP Model Code, the Parking Requirements and Utilization Gap Analysis, and the Multi-family Parking Strategies Toolkit, provide hands-on guidance for decision-makers and practitioners seeking to meet organizational goals through parking reform.

Stakeholder involvement

The RSP team recognized at the outset of the project that stakeholder outreach and involvement would be an essential component of sharing the RSP message and research. To that end, the RSP project sought an interdisciplinary approach, soliciting input from a wide array of parking stakeholders, developing innovative research and tools, providing best practices on policy reform and parking management, and implementing demonstration pilot projects with local partners. Stakeholder input came from a variety of forums, including focus groups as well as a methods committee of national academics and practicing professionals that guided the development of the research.

The RSP team has made a concerted and comprehensive effort to spread the word about RSP findings and tools via outreach through publications, conference presentations, and meetings with interested stakeholder groups.

The project team presented the RSP research and findings at conferences focused on issues of transportation, parking management, smart growth, real estate, land use, and urban planning. The team also presented to municipal, agency, and organizational audiences that were interested in potential applications of the RSP tools and research. RSP presentations were a feature of multiple FHWA-sponsored parking pricing and management workshops throughout the country. In addition, the RSP project was shared with student audiences at the University of Washington and the University of Oregon.

The realization and implementation of the pilot projects are also a testament to the success of the RSP outreach efforts. The project team partnered with seven developer and jurisdictional partners to successfully complete pilot projects focused on parking management and policy reform.

RSP project outreach goals and audiences

Primary RSP outreach goals included the following:

- Educate a broad range of stakeholders regarding the availability and utility of RSP tools and products
- Increase stakeholder understanding of the impacts of building too much or little parking
- Raise awareness of individual stakeholder perspectives and concerns between and among the broader stakeholder group
- Promote the website tool and other RSP products; Explain how to use the tool
- Create momentum around RSP concepts and actions within relevant industries and professions (for example, use of the web calculator by developers or policy changes on the part of jurisdictions)
- Identify new partners for RSP implementation and continued research

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"Supply & Demand: A Balanced Approach to Parking" Presentation and Panel



Fig. 20: Professor Donald Shoup presents on parking supply and demand at a Right Size Parking event. Photo courtesy ULI.

In February 2013, the Urban Land Institute Northwest partnered with King County Metro to present a lunch event entitled **'Supply & Demand: A Balanced Approach to Parking'**. The event featured opening remarks from King County Executive Dow Constantine, a keynote presentation by Donald Shoup, Professor of Urban Planning at UCLA, and a panel of local industry experts. The discussion focused on issues surrounding the art and science of parking and the presentation of groundbreaking data from the Right Size Parking Project.

Key points presented by Shoup, a highly-regarded expert in balancing parking supply and demand, included the observation that municipal land use codes have a tendency to require the provision of quantities of parking that exceed actual demand. In Shoup's experience, city codes that keep street parking free or cheap and that seek to prevent spillover parking effects actually have the effect of distorting the parking market.

Shoup presented three potential solutions: implementing variable pricing for street parking that targets 85% parking space occupancy, returning parking meter revenue directly to the district in which it is generated, and removing off-street parking requirements for buildings in coordination with changes in land use.

A video of the full presentation can be found at:

https://vimeo.com/65086043

Audiences include:

- Developers of multi-family and mixed-use projects
- Financiers of multi-family and mixed-use developments
- Local government staff and decision-makers (transportation, land use/permitting, neighborhoods, economic development)
- Local, regional, national levels of public sector, industry/professional organizations
- Urban planning and architecture consultants
- Neighborhood groups with an interest in parking supply issues
- Advocacy groups with interest in the environment, smart growth, transit, health, and active transportation
- Chambers of commerce and business groups
- Academics
- Media

Project team partners

The RSP team, which included agency, private and non-profit sector partners, worked to balance issues of parking supply with competing interests while creating tools that support economic development and community goals alike. Project outreach included the range of user types and multidisciplinary experts necessary to assure a relevant and accurate product.

Within the RSP project team, several committees were organized that helped to provide guidance for the various initiatives of the RSP project, including a **Jurisdictional/ Technical Committee,** a **ULI Development Committee,** a **Methods Committee,** and an **Education Outreach Committee**. The following is a list of the key partners in the RSP project:

Federal Highway Administration (FHWA)

The FHWA provided project funding, grant oversight, and technical review of deliverables.

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Washington State Department of Transportation (WSDOT)

WSDOT provided project management, grant oversight and progress review.

Center for Neighborhood Technology

Metro engaged the Center for Neighborhood Technology (CNT), a non-profit organization and leader in the promotion of livable and sustainable urban communities, to assist in the development of the project research methodology. CNT worked with Metro staff and project partners to design the research to meet RSP project goals. CNT also supported the analysis and reporting of the RSP data and produced statistical models to enable the development of data-driven tools for informing and influencing development and parking supply decisions. In addition, CNT supported the production of the website calculator tool to help disseminate project information to a broad audience of potential users.

Urban Land Institute

Metro collaborated with the Urban Land Institute (ULI) to structure the community engagement and outreach component of the RSP project. ULI reviewed the project research, explored concepts and strategies, and helped to develop and recommend guidelines and incentives to be advanced by the RSP project.

In addition, ULI established a committee to engage multi-family development professionals to support the overall program development and implementation of the RSP project. ULI was also charged with marketing and communicating the RSP work products and concepts to existing and potential project stakeholders as well as to the broader public.

Consultant team

In addition to the project partners listed above, Metro enlisted a consultant team to provide technical expertise in the various disciplines engaged by the RSP project:

- **VIA Architecture:** Urban design and planning consultants
- **Rick Williams Consulting:** Parking and Transportation Demand Management consultants
- **Fehr & Peers:** Transportation consultants
- **Kidder Mathews:** Commercial real estate consultants

The consultant team conducted local parking demand research and data collection. The team used this information to develop guidelines for best practices and strategies for addressing parking issues in complex, mixed-use urban environments. In addition, the consultant team facilitated the stakeholder committee meetings and gathered feedback from participants.

The consultant team identified potential barriers and challenges to achieving RSP goals and collaborated to provide solutions. They also developed guidelines for implementing incentive program pilot projects.

Pilot partners

The RSP project engaged several municipal and developer partners to participate in seven policy and management pilot projects to test the RSP model and findings. See Chapter 4 for more information on the RSP pilot projects.

Stakeholder committees

The RSP project organized two stakeholder committees to provide valuable input and feedback to project deliverables: the **ULI Development Committee** and a **Jurisdiction Technical Committee**. These two committees were developed to provide unique skills and experience that are necessary for effectively addressing residential multi-family parking issues in King County. The two groups met together several times throughout the course of the project to ensure efficient review and input on project concepts and deliverables, including:

- Developing a common understanding of project parameters, assumptions, and outcomes
- Discussion of public/private conflicts, finding common ground, and identifying project opportunities
- Developing ideas about function, content and target audience for the RSP website and web calculator

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ULI Development Committee

The ULI Development Committee comprised a broadly representational stakeholder group consisting of ULI members representing the multi-family development community, financiers, property managers, engineers, and city planning managers.

This committee was convened to serve as a sounding board to the larger RSP project team by supporting the overall program development and implementation. The ULI Development Committee was tasked with advocating for the outcomes and solutions developed through the project and serving as a liaison to the real estate community during project implementation. In addition, the committee provided targeted support to the following RSP project efforts:

- Identification of barriers and solutions to RSP development in multi-family and mixed-use properties within King County
- Development of a list of monitoring and measurement metrics, including identification of gaps in information
- Creation of technical program guidelines, model code language and development of incentives
- Oversight of RSP community engagement and outreach, including development of a project implementation plan

Jurisdiction Technical Committee

The Jurisdiction Technical Committee was composed of members familiar with the technical issues surrounding parking demand and its implications for urban development and transportation. Committee members included jurisdiction technical staff members from cities throughout King County, with a representative mix of expertise in permit review, long range planning, code writing, traffic demand management, and traffic engineering.

The Jurisdiction Technical Committee provided public sector stakeholder review and input on technical aspects of the RSP project, such as new methods to assess multi-family residential parking demand, and suggested policy and zoning regulations to allow a reduction in parking supply when appropriate. The committee provided additional support to the RSP project in the following ways:

- Identification of barriers to RSP and the corresponding development of innovative but practical solutions that could be implemented locally
- Contribution to the creation of products that help jurisdictions and developers build successful transit-oriented communities
- Review, revision, and testing of RSP products
- Provision of advice and feedback for the development of technical program guidelines and incentives necessary for the implementation of a new approach to parking

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Recommendations & Next Steps 6

The RSP project has attracted national attention. Several regions and cities around the country are currently working to replicate the RSP study and web calculator concept for their own planning purposes, including the San Francisco Bay Area, Washington, D.C., Boston, and Chicago. Many regions are reexamining parking requirements in support of pedestrian-oriented design, transit access, and a compact mix of uses to increase transportation choices. Such priorities demonstrate a long-term commitment to RSP principles such as lowering reliance on cars, and they provide justification for reductions in or elimination of requirements for off-street parking in multi-family developments.

The strategies and tools created by the RSP project offer a model to jurisdictions aiming to base parking decisions on local data and sound scientific methods, as well as to developers seeking to determine how much parking to supply in a multi-family building. In particular, the web calculator tool advanced the parking industry by developing a context-sensitive approach to predicting multi-family residential parking utilization.

Overall challenges and successes

Challenges

The primary challenges faced by the RSP team during the course of the project involved questioning and challenging institutionally-entrenched "status quo" assumptions about parking utilization and demand. These assumptions influence public perception of parking supply and demand dynamics. They provide the foundation for developer and financier decisions regarding the building of new parking in multi-family projects and are not necessarily aligned with the realities of current conditions in many urban contexts, as the RSP research revealed.

Another challenge faced by the team was ensuring property manager follow-through with research assistance during the data collection stage of the project.

Successes

RSP has significantly advanced the industry's understanding of residential parking dynamics through its high-quality, comprehensive research, originality, and transferability to other regions. RSP presentations were a feature of multiple FHWA-sponsored parking pricing and management workshops throughout the country. The RSP study was also recently featured by both ITE and the Transportation Research Board, and it has received national attention for its innovative data-driven process, strategies of public engagement, and best practice policy development.

The pilot projects have demonstrated that the results of the RSP research can help to successfully support and guide decisions about parking supply and management. RSP tools and strategies can serve as resources to inform discussions as users weigh the factors affecting parking use and consider how much parking to provide or how much to reduce parking requirements.



Top Tips for Implementing RSP

Following are the top recommendations from the project team to other cities looking to implement RSP:

- **Good communication is important.** Maintain good relationships between real estate and jurisdictional communities.
- **Data collection takes time.** Develop strong methods that can be implemented efficiently and consistently.
- **Consider your audience.** Create tools and products that are audience-specific, context-relevant and user-friendly.
- **Improve upon the research.** The RSP project is one approach to understanding the relationship between parking supply and demand, and it lays the groundwork for future research efforts. The RSP team would like to see future efforts continue to develop and improve the research methodology. This might include conducting resident surveys, analyzing vehicle licensing information, and including on-street parking counts in the project data.

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Next steps for RSP

RSP data and methodologies are currently being shared with ITE and other interested parties beyond King County, leading to subsequent projects in other regions and potential inclusion in the next edition of the ***ITE Parking Generation Manual***. RSP has garnered national attention, spurring initiatives in other regions, and many communities are examining the project to identify how RSP concepts can be implemented in their area.

One of the most important aspects of the RSP project is its up-to-date and context-specific data. Because many of the areas included in the RSP data collection sample continue to experience rapid development that results in an ever-changing context, it is important that data collection and database updates remain an ongoing piece of the RSP effort. The RSP team is analyzing options for regularly updating RSP data and the website calculator to ensure the continued accuracy of the model estimates.

Current RSP goals include continuing to gather momentum on data-driven parking allocations and securing additional partnerships for pilot projects. The RSP team also plans to develop a monitoring evaluation program to measure the effectiveness of the incentive program pilot projects.

See the project website for more information on the Right Size Parking Project: http://metro.kingcounty.gov/programs-projects/right-size-parking/

GREENTRIP PARKING DATABASE CASE STUDY

The GreenTRIP Parking Database provides data from more than 65 multi-family residential sites around the San Francisco Bay Area, a region that has shown a trend in decreased car ownership in recent years.

The GreenTRIP Parking Database project built upon the research methods developed by the King County Multi-family Residential Parking Calculator. Although not a predictive model like the RSP calculator, the GreenTRIP Parking Database takes into account many similar factors, such as income and access to transit.

Working together with CNT, the GreenTRIP team used lessons learned from RSP to optimize data collection, resulting in a wider range of data for each site. The database also incorporated more about depth of affordability than the RSP data set.

The parking database can be used to search for specific sites and to view actual total parking used at a particular location or for a particular building type. Reports can be printed and shared freely with developers and decision-makers.

The Metropolitan Transportation Commission (MTC) partially funded the research that served as the basis for the GreenTRIP database, with additional support from a U.S. Department of Housing and Urban Development grant.

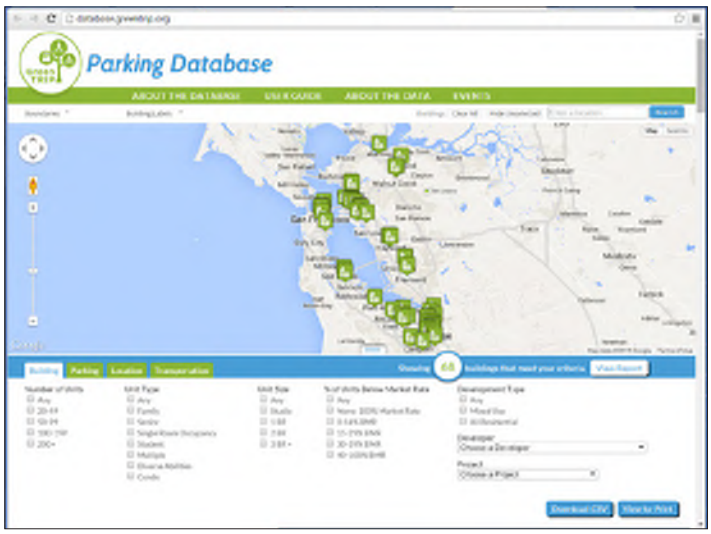


Fig. 21: The GreenTRIP user interface.

The GreenTRIP Parking Database can be found at:

http://database.greentrip.org/

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Appendix 7

Right Size Parking products and tools

In an effort to ensure that the project data and findings continue to be easily accessible and usable by the full spectrum of stakeholders, the team created a set of technical memoranda, RSP "toolkit" documents, and a multifaceted web calculator tool to aid users in determining how much parking is "just enough" for a specific site. These tools, listed below, are described in further detail throughout this report (look for the RSP tool icon below) and can also be accessed online:



- **Right Size Parking Literature Review**
  Review of existing parking supply standards and studies
  http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/rsp-litreview_11-2011.pdf
- **King County Multi-family Residential Parking Calculator**
  Interactive map-based RSP web calculator
  http://www.rightsizeparking.org/
- **Right Size Parking Technical Research Memo**
  A summary of the RSP research findings
  http://www.rightsizeparking.org/Right_Size_Parking_Technical_Memo.pdf
- **Right Size Parking Technical Policy Memo**
  Provides policy-based solutions to identified RSP barriers
  http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/rsp-technical-policy-memo-final-09-17-12.pdf
- **Right Size Parking Model Code**
  A menu of RSP model code language for jurisdictions
  http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/140110-rsp-model-code.pdf
- **Parking Requirements and Utilization Gap Analysis**
  Comparison of code requirements and actual utilization
  http://metro.kingcounty.gov/up/projects/right-size-parking/pdf/gap-analysis-7-12-13.pdf
- **Multi-family Parking Strategies Toolkit**
  RSP parking management toolkit for property owners
  http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/multifamily-parking-toolkit.pdf

King County Metro web resources

King County Metro Right Size Parking website

The **King County Metro Right Size Parking website** includes an introduction to the RSP project and web tool, an overview of the project objectives, and links to project deliverables and additional resources.

http://metro.kingcounty.gov/programs-projects/right-size-parking/

King County Multi-family Residential Parking Calculator

The **King County Multi-family Residential Parking Calculator** is the interactive web tool that enables a wide variety of audiences to interact with the RSP data and apply the project research and findings to specific projects or areas.

http://www.rightsizeparking.org/

Right Size Parking Glossary

The **Right Size Parking Glossary** provides definitions for project-related terminology and further describes key project concepts and variables.

http://www.rightsizeparking.org/glossary.php

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Additional resources & related research:

- Minimum Efforts: How a City Successfully Addressed Minimum Parking Requirements for Multi-family Properties, Daniel Rowe, ***Parking Professional Magazine***, November 2013. http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/parking-professional-article-nov-2013-drowe.pdf
- Do Land Use, Transit, and Walk Access Affect Residential Parking Demand?, Daniel Rowe, Ransford S. McCourt, P.E., PTOE, Stephanie Morse, and Peter Haas, Ph.D., ***ITE Journal***, February 2013. http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/ite-journal-feb-2013-drowe.pdf
- Contemporary Approaches to Parking Pricing: A Primer, U.S. Department of Transportation, Federal Highway Administration, May 2012. http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/fhwa-parking-pricing-primer.pdf
- Getting the Parking Right for Transit-Oriented Development, Ming Zhang, Katie Mulholland, Jane Zhang, and Ana J. Gomez-Sanchez, Center for Transportation Research, University of Texas at Austin, March 2012. http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/getting-the-parking-right-transit-oriented-development.pdf
- Searching for the Right Spot: Minimum Parking Requirements and Housing Affordability in New York City, Furman Center for Real Estate & Urban Policy, New York University, March 2012. http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/furman-parking-requirements-policy-brief_3-21-12-final.pdf
- Evaluating the Impact of Transit Service on Parking Demand and Requirements, Daniel H. Rowe, C.-H. Christine Bae, and Qing Shen, ***Transportation Research Record 2245***, December 2011. http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/trb-rowe-transit-service-impacts-parking.pdf
- San Diego Affordable Housing Parking Study, Wilbur Smith Associates, December 2011. http://www.sandiego.gov/planning/programs/transportation/mobility/pdf/111231sdafhfinal.pdf
- Parking Evaluation: Evaluating Parking Problems, Solutions, Costs, and Benefits, Victoria Transport Policy Institute, October 2011. http://www.vtpi.org/tdm/tdm73.htm
- Parking Pricing Implementation Guidelines, Todd Litman, Victoria Transport Policy Institute, March 2011. http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/park-pricing.pdf
- Parking Demand and Zoning Requirements for Suburban multi-family Housing, Richard Willson and Michael Roberts, 90th Annual Meeting of the Transportation Research Board, January 2011. http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/willson-parking-demand-suburban.pdf
- A Parking Utilization Survey of Transit-Oriented Development Residential Properties in Santa Clara County, San Jose State University and Santa Clara Valley Transportation Authority, December 2010. http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/vta-tod-parking-survey-report-vol2.pdf
- The Trouble With Minimum Parking Requirements, Donald Shoup, December 1999. http://www.vtpi.org/shoup.pdf
- Smart Growth Alternatives to Minimum Parking Requirements, Christopher V. Forinash, Adam Millard-Ball, Charlotte Dougherty and Jeffrey Tumlin. http://www.urbanstreet.info/2nd_sym_proceedings/Volume%202/Forinash_session_7.pdf

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People Over Parking

People Over Parking

Planners are reevaluating parking requirements for affordable housing.

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Carless in Seattle: Plymouth on First Hill's apartments are now home to some of the city's formerly homeless disabled population. Photo courtesy SMR Architects and Plymouth Housing Group.

By Jeffrey Spivak

Like a lot of cities, Minneapolis has experienced the dual trends of rising multifamily rents and dwindling housing affordability. For years it offered the usual carrots of tax incentives and development subsidies for residential projects with affordable units. But three years ago, it tried a different strategy: The city slashed its multifamily parking requirements in certain parts of town.

The usual ratio of one parking space for every one unit was cut in half for larger apartment projects and was eliminated entirely for projects with 50 or fewer units located near high-frequency transit. Lo and behold, the market mostly responded in the exact ways planners had predicted.

Apartment developers proposed projects with fewer parking spaces. That lowered the cost of construction. So, such projects began offering rents below the market's established levels. New studio apartments, which typically went for $1,200 per month, were being offered for less than $1,000 per month.

"There's definitely a new type of residential unit in the market that we haven't seen much before," says Nick Magrino, a Minneapolis planning commissioner who has researched apartment development trends since the parking code change. "Outside of downtown, there's

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been a lot of infill development with cheaper, more affordable units."

Tinkering with minimum parking requirements is not new. Cities have been fiddling with regulations for decades, sometimes raising them, sometimes lowering them, and sometimes giving variances for specific projects. What's different now is an evolving understanding that urban lifestyles are changing, traditional parking ratios are outdated, and too much supply can be as harmful as too little.

So there's a burgeoning movement of municipalities across the U.S. reducing or eliminating parking requirements for certain locales or certain types of development or even citywide.

"This would have seemed inconceivable just a few years ago," says Donald Shoup, FAICP, a Distinguished Research Professor in UCLA's Department of Urban Planning who has studied and written about parking policies for years and is considered the godfather of the current reform movement. (See an article based on his new book, *Parking and the City:* www.planning.org/planning/2018/oct/parkingpricetherapy/ (/planning/2018/oct/parkingpricetherapy/).)



Carless in Seattle: The mixed use transit-oriented development Artspace Mt. Baker Lofts is located on the Central Link light-rail line. It has bicycle storage and a reserved car-share space, but no parking garage. Photo courtesy SMR Architects and Artspace.

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Over the past three years, a Minnesota-based smart-growth advocacy organization called Strong Towns has compiled, through crowdsourcing, more than 130 examples of communities across the country addressing or discussing parking minimum reforms. And that list hasn't captured all the cities taking actions.

Communities are reforming these regulations in a variety of ways.

Some have ditched parking minimums entirely. Buffalo, New York, in early 2017 became the first U.S. city to completely remove minimum parking requirements citywide, applied to developments of less than 5,000 square feet. Late last year Hartford, Connecticut, went a step further and eliminated parking minimums citywide for all residential developments.

Some have targeted their reforms to certain areas or development districts. Lexington, Kentucky, earlier this year scrapped parking requirements in a shopping center corridor to allow the development of new multifamily housing. Spokane, Washington, this past summer eliminated parking requirements for four-plus-unit housing projects in denser parts of the city.

Some have tied new policies specifically to spur affordable housing. Seattle this past spring eliminated parking requirements for all nonprofit affordable housing developments in the city, among other provisions. A couple of years ago, Portland, Oregon, waived parking requirements for new developments containing affordable housing near transit. Also in 2016, New York eliminated parking requirements for subsidized and senior housing in large swathes of the city well served by the subway.

Even some suburbs are doing it. Santa Monica, California, removed parking requirements entirely last year for new downtown developments as part of a new *Downtown Community Plan*. And this year, the Washington, D.C., suburban county Prince George's, Maryland, revised its zoning code to significantly reduce parking minimums.

"We're trying to create a new model of mobility and not emphasize the car as much as we've done in the past," says David Martin, Santa Monica's director of planning and community development.

Building Parking Raises Rent

Parking costs a lot to build, and that cost usually ends up raising tenant rents.

$5,000: Cost per surface space

$25,000: Cost per above-ground garage space

$35,000: Cost per below-ground garage space

$142: The typical cost renters pay per month for parking

+17%: Additional cost of a unit's rent attributed to parking

Source: Housing Policy Debate, 2016

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Catalysts for change

Three primary factors are driving this new reform:

1. CITIES ALREADY HAVE MORE THAN ENOUGH PARKING.

The Research Institute for Housing America, part of the Washington, D.C.-based Mortgage Bankers Association, used satellite imagery and tax records this year to tally parking space totals in different- sized U.S. cities, and determined that outside of New York City, the parking densities per acre far exceeded the population densities.

Meanwhile, two different groups — TransForm, which promotes walkable communities in California, and the Chicago-based Center for Neighborhood Technology, a nonprofit sustainable development advocacy group — have both conducted middle-of-the-night surveys of parking usage at apartment projects on the West Coast and in Chicago, respectively. They consistently found one-quarter to one-third of spaces sat empty. The Chicago center concluded "it is critical to 'right size' parking at a level below current public standards."

2. TRANSPORTATION PREFERENCES ARE SHIFTING.

A variety of converging trends point to the possibility of fewer cars in the future. Fixed-rail transit lines continue to be developed in more urban centers, and millennials are not driving as much as previous generations. Meanwhile, transportation alternatives are proliferating, from passenger services such as Uber to car-sharing services such as Zipcar. Then there's the potential of driverless cars and the expansion of retail delivery services.

3. BOTTOM LINE: WE'RE GOING TO NEED MUCH LESS SPACE TO STORE CARS.

In fact, Green Street Advisors, a commercial real estate advisory firm, analyzed what it calls the "transportation revolution" — encompassing ride-hailing services, driverless cars, etc. — and estimated that U.S. parking needs could decline by 50 percent or more in the next 30 years. (See "Future-Proof Parking," March: www.planning.org/planning/2018/mar/futureproofparking (/planning/2018/mar/futureproofparking/).)

"In the old days, you built an apartment and you expected it needed two cars," says Doug Bibby, president of the National Multifamily Housing Council, an apartment trade association in Washington D.C. "Those parking ratios are outdated and no longer valid in any jurisdiction."

Concerns about housing affordability

With the U.S. economy reasonably strong and most urban crime rates on a long-terms decline, housing costs have increasingly emerged as a hot-button issue. In Boston University's nationwide Menino Survey of Mayors last year, housing costs were cited as the number one reason residents move away, and more affordable housing was the top-ranked improvement mayors most wanted to see.

"It's on the minds of mayors now more than it has been in the past," says Kimble Ratliff , the National Multifamily Housing Council's vice president of government affairs.

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They're concerned because there's ample evidence of a continued national shortage of affordable housing. The latest "State of the Nation's Housing" report from Harvard University's Joint Center for Housing Studies noted that a decade-long multifamily construction boom has increased total occupied rental units by 21 percent, but mainly at the top end of the market. Total units deemed "affordable" — costing less than 33 percent of median income — have remained basically static during the last decade, while the number of extremely low-income renter households has grown by more than 10 percent. The 2018 report concluded that there is a "tremendous pent-up demand for affordable rental housing."

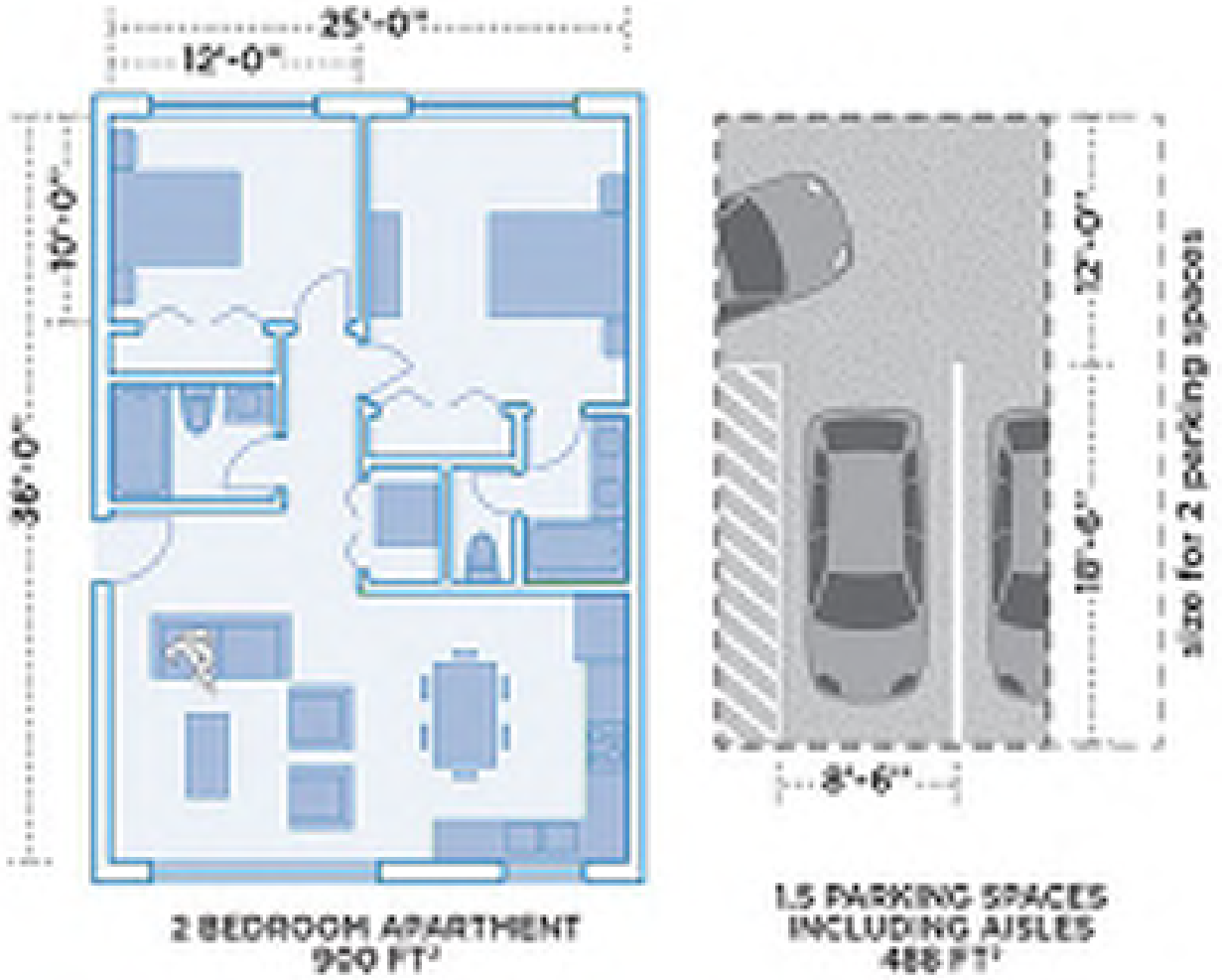
So as cities have searched for ways to generate more affordable housing, parking has emerged as an easy target. Parking ratios are simple to change, and the process doesn't lead to future cost obligations like subsidies do.

That was the approach taken by Seattle this year. "The number one issue facing our city is the lack of housing options and affordability. We're looking to remove any barriers to the supply of housing, and parking is one of them," says Samuel Assefa, the director of Seattle's Office of Planning and Community Development.

Living Space versus Parking Space

The typical median parking required for a two-bedroom apartment in many large North American cities is more than half the size of the apartment itself.

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Source: Seth Goodman, graphicparking.com.

Impacts on housing costs

Planners' shifting strategies toward parking are now supported by a growing body of evidence that parking requirements negatively impact multifamily housing, especially affordable projects.

In a nutshell, building parking costs a lot, and that cost usually ends up raising tenant rents.

Various studies indicate that surface parking lot spaces cost upwards of $5,000 each, while above-ground parking garages average around $25,000 per space and below-ground garages average around $35,000 per space. That can translate into higher rent, particularly in big cities. Two UCLA urban planning professors studied U.S. rental data and reported in the journal *Housing Policy Debate* in 2016 that garage parking typically costs renter households approximately $142 per month, or an additional 17 percent of a housing unit's rent. Other studies have found even larger impacts on rents.

"That can be a significant burden on lower-income households," says David Garcia, policy director of the Terner Center for Housing Innovation at the University of California–Berkeley.

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Changing that equation can help produce additional affordable housing. That's a scenario actually playing out in Portland, Oregon.

In 2016 the Portland Community Reinvestment Initiatives, a nonprofit developer and manager of low-income housing, began planning a 35-unit senior housing project called Kafoury Court. At the time, Portland's code required providing five parking spaces for the project, and the developer was struggling to find financing. But late that year, the city changed its parking requirements, and Kafoury now only needs to provide two spaces.

While that change doesn't seem like much, it allowed the development to be totally redesigned. A first-floor parking garage was no longer needed, so the building has been scaled back from five stories to four stories, which led to cost-saving ripple effects. "This has made the project financially feasible," says PCRI's Julia Metz.

She adds: "We prefer to build houses for people, not cars. When it comes down to choosing space for people or parking, we're going to choose people."

Affordable housing projects, with their lower rent revenue streams, are already challenging to finance. So parking is an increasingly key factor in whether or not a project works financially. But to developers, reducing or removing parking requirements does not mean eliminating parking supply. It simply allows developers to decide how many spaces to build based on market and locational demand.

"I've had developers say to me, 'Hey, I could make this deal work if I only had to build a garage that's one-third smaller,'" says Greg Willett, chief economist of RealPage, a provider of property management software and services. "Any way you can take costs out of the deal is meaningful."

APA Housing Initiative: Planning Home

By Emily Pasi

Planners know better than anyone the critical role that housing plays in our communities, and the severity of the U.S.'s housing affordability and availability crisis. Lack of housing choice and affordability hurts people and limits communities' prosperity. To this end, APA is actively working to develop new tools and better planning practices to encourage and deliver more and better housing options for all.

Earlier this year, APA's board of directors greenlit Planning Home, an organization-wide, multiyear housing initiative that aims to reshape the way planners, elected officials, decision makers, advocates, and the public use planning to address the nation's housing challenges.

Grounded in the philosophy that better tools can get communities the housing people need, APA's Planning Home action agenda is driven by six board-approved principles, which call on policy makers at all levels of government to:

- Modernize state planning laws

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- Reform local codes
- Promote inclusive growth strategies
- Remove barriers to multifamily housing
- Turn NIMBY into YIMBY
- Rethink finance

Learn what you can do now to advance APA's Planning Home action agenda at PlanningHome.com (/home/).

Emily Pasi is the public affairs manager at APA.

'The debate is now won'

When it comes to utilizing parking to augment planning and development policies, U.S. cities still have a long way to go to catch up to some European counterparts. Zurich, Switzerland; Copenhagen, Denmark; and Hamburg, Germany, have all capped the total number of allowable parking spaces in their cities. Oslo, Norway — where a majority of center-city residents don't own cars — is pursuing plans to remove all parking spaces from that district, to be replaced by installations such as pocket parks and phone-charging street furniture.

And last year the largest city in North America, Mexico City, eliminated parking requirements for new developments citywide and instead imposed limits on the number of new spaces allowed, depending on the type and size of building.

In the U.S., however, parking is still sacred in many places. Sometimes when parking reductions are proposed for a certain urban district or a specific new development, nearby residents complain it will force new renters to park on their residential streets. Because so many people still own cars, the National Multifamily Housing Council's *2017 Kingsley Renter Preferences Report* ranked parking as renters' second-most desired community amenity, behind only cell-phone reception.

Not surprisingly, then, some places are still demanding more parking, not less. In Boston, for instance, an influx of new residents clamoring for parking in the booming South Boston neighborhood led to zoning code changes in 2016 that require developers to build two-thirds more off-street parking than before.

Nevertheless, the movement to reduce parking is now widespread, involving big cities and small towns, urban districts and suburban locales, affordable housing and market-rate units. "It's pretty well accepted now that reforming parking minimums is a good way to manage cities," says Tony Jordan, founder of Portlanders for Parking Reform, which has advocated for better parking policies. "The debate is now won."

The lessons for planners are, first, to be open to adjusting parking policies in zoning codes and comprehensive plans and, second, to be flexible in crafting new parking limits depending on the location or desired outcome, such as spurring affordable housing development.

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"As we update our policies, we as planners need to learn from the past and adjust," says Seattle planning director Assefa. "We constantly need to tweak our policies and face the challenges of what's not necessarily working. More often than not, there's significant space dedicated to the car that is not utilized."

Jeffrey Spivak, a market research director in suburban Kansas City, Missouri, is an award-winning writer specializing in real estate planning, development, and demographic trends.

RESOURCES

APA Knowledgebase Collection, "Rethinking Off-Street Parking Requirements": www.planning.org/knowledgebase/parkingrequirements (/knowledgebase/parkingrequirements).

Harvard University Joint Center for Housing Studies' *The State of the Nation's Housing 2018*: hjchs.harvard.edu/state-nations-housing-2018 (http://hjchs.harvard.edu/state-nations-housing-2018).

Center for Neighborhood Technology, "Stalled Out: How Empty Parking Spaces Diminish Neighborhood Affordability:" http://bit.ly/2Mr0bES (http://bit.ly/2Mr0bES).

Strong Towns keeps track of progress on parking minimum removals across the U.S. http://bit.ly/2C1t86k665600 (http://bit.ly/2C1t86k665600).

(https://www.facebook.com/AmericanPlanningAssociation)

(https://www.youtube.com/user/AmericanPlanningAssn) (https://twitter.com/APA_Planning)

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Ontario town's experiment using Uber as public transportation is working, officials say

Innisfil – located just south of Barrie and home to about 36,000 people — has paid $26,462.41, or an average of $5.43 per trip, for 4,868 Uber rides taken in the two months since launching the unique-to-Canada project on May 15





Alicja Siekierska

August 8, 2017
5:18 PM EDT

Filed under
Transportation

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The town of Innisfil, Ont. is hailing its two-mo
subsidize Uber as the lone form of public trar
nearly 5,000 trips taken since the pilot projec

Innisfil — located just south of Barrie and hor
people — has paid $26,462.41, or an averag
4,868 Uber rides taken in the two months sin
unique-to-Canada project on May 15.

“We are really pleased we did go this route,”
a senior policy advisor with the town.

“This partnership with Uber had definitely pro
cost effective for us, being able to provide thi
residents. You don’t need to be within walkin
or a bus route, so it’s something that works fo

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More

Last summer, Innisfil's city council was at a c
additional transportation options across the s
declared a key priority in the community's str
found that a fixed-route bus service would be
tag of $270,000 per year for one bus, and $6

Instead, the town decided to partner with glob
Uber to launch a partnership to provide on-de
Innisfil residents that is partially subsidized by
Passengers pay between $3 and $5 for set ro
such as to Town Hall and the GO train statior
for all other rides within town.

Pentikainen and Tim Cane, Innisfil's manage
will provide city council with a two-month upd
on Wednesday.

So far, demand is keeping pace with the budg
Innisfil's council committed $100,000 for the f
and an additional $125,000 next year.

There are certain times where meeting dema
but according to Uber people have been able
time," Pentikainen said.

"As a 24/7 service, we're quite pleased," Pen
that using Uber as an on-demand public tran
the best option for the town for the foreseeab

"With our large geography, the distance betw
bus routes to provide the same level of servic
expensive," he said. "Maybe decades into the
much higher population we may look at other
right now this is working for us."

Pentikainen added that, in the short term, the
to tweak the service to make it more efficient
users, as well as surveying residents about th

Uber spokesperson Susie Heath said the ride
pleased with the results of the report that was
will be presented on Wednesday.

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“Since we launched this exciting public transi
has been great to see Innisfil residents acces
demand rides to get around their community
transit hubs,” Heath said in an emailed stater

“We look forward to continued dialogue with
transit authorities across Canada to explore s

The past several months have proven to be a
ride sharing company. In June, chief executiv
resigned after a lengthy investigation that wa
former engineer publicly accused the compar
and discrimination. The report, conducted by
General Eric Holder, had many recommenda
Kalanick’s authority should be reduced.

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Toward Zero Parking: Challenging Conventional Wisdom for Multifamily

By David Baker and Brad Leibin
July 2, 2018

Text Size: A A A



The 69 condos in 388 Fulton (left center) in San Francisco's Hayes Valley sold easily in 2017 without any structured parking being provided. (Bruce Damonte)

This article appeared in the spring issue of Urban Land *on page 146.*

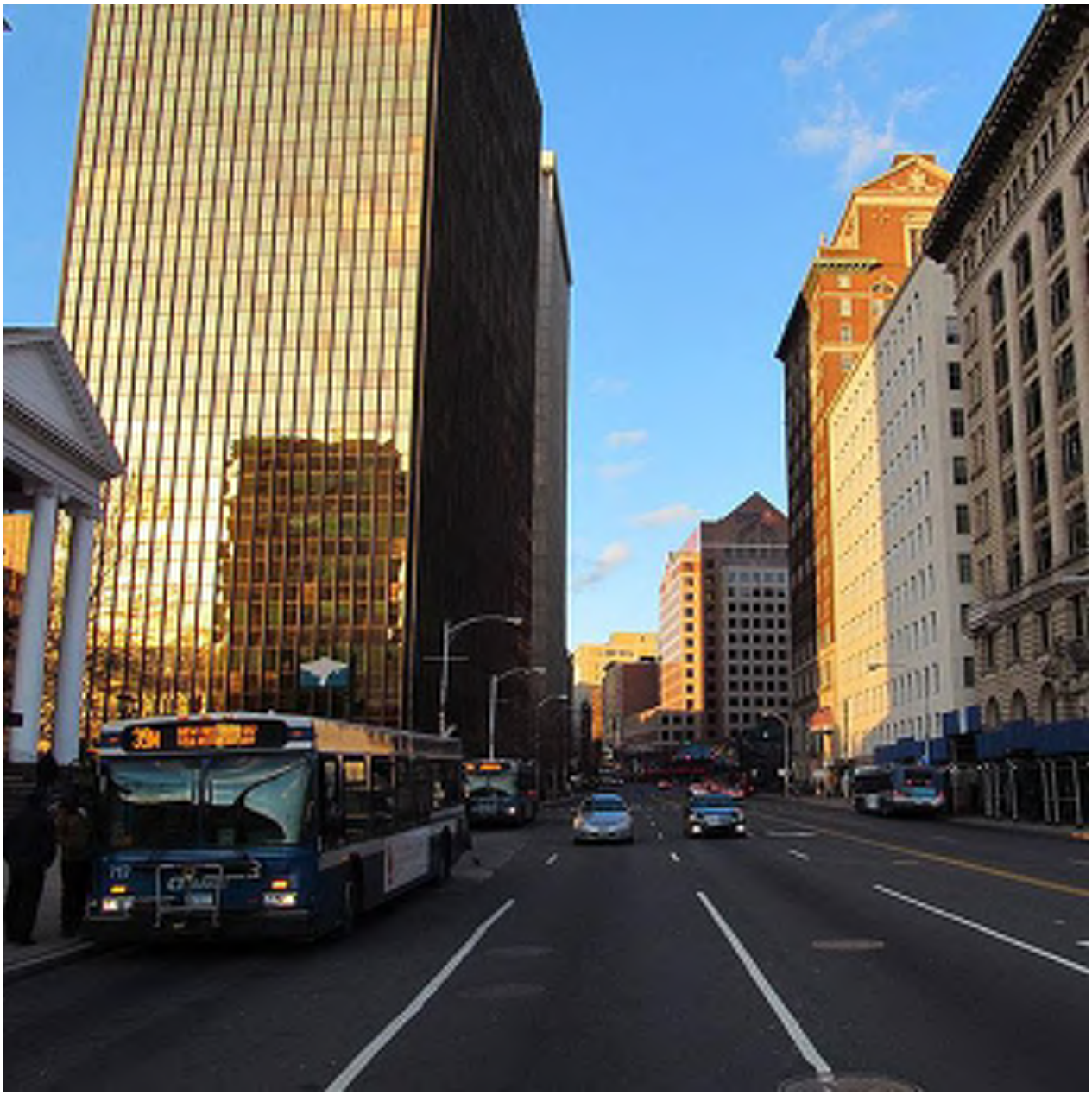
The rising popularity of human-powered transportation, walking and bicycling, and widespread availability of ride-hailing services like Lyft and Uber plus car-sharing services like Zipcar and Getaround, and the introduction of same-day delivery services have all reduced the need for individuals to own—and park—cars.

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At the same time, costs of construction are at historic highs in dense urban areas, creating a challenge for developers to meet housing demand. Individual unit sizes are shrinking in response, allowing greater density. However, with smaller units, the number of parking spaces goes up, too, if traditional parking ratios hold. High construction expenses result in a very high per-space cost for parking spaces, especially for structured parking, which can run $50,000 or more for a single space.

In response to these factors, municipalities are changing the way they handle parking. Cities around the United States are eliminating minimum parking requirements for new developments.

Last year, officials in Buffalo, New York, removed parking minimums citywide for commercial and residential projects of less than 5,000 square feet (465 sq m). Also last year, Hartford, Connecticut, scratched parking minimums across the city for commercial and residential developments, regardless of size. Many other municipalities have removed parking minimums for at least one part of the city or have lowered or removed minimums for certain uses. San Francisco has gone a step further, establishing parking maximums for downtown and nearby areas well served by public transit, capping the amount of parking that developers are allowed to build for multifamily housing.



In 2017, Hartford, Connecticut, scrapped parking minimums across the city for commercial and residential developments, regardless of size. (John Phelan/Wikimedia Commons)

Nevertheless, even multifamily housing developers who support creating walkable neighborhoods and prioritizing alternative forms of transit still think they need to follow traditional parking ratios or the units will not rent or sell. What

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follows are common concerns we have heard in our architecture practice, as well as the experiences and counterarguments we have come across that make us optimistic about reaching a future in which parking plays a much-diminished role in the urban environment.

1. Will planning commissions embrace attempts to reduce or eliminate parking?

About 20 years ago, a development proposal came before the San Francisco Planning Commission: a new restaurant with two residential units above and no parking spaces for the residents. Even though the project was small, dozens of neighbors showed up at the commission hearing to share their fears about the loss of street parking. The commission chairman responded by saying, "I moved from Manhattan to San Francisco so I could park." The commission voted down the no-parking proposal. Back then, the primary concerns of neighbors of proposed projects were increased traffic and competition for street parking.

In the intervening years, as voter attitudes toward automobiles have changed, the San Francisco Planning Commission has reversed its approach.

In 2005, the commission established caps specifically addressing the amount of parking developers can build for multifamily housing downtown and nearby areas well served by public transit. The commission encourages projects with active uses on ground floors, and not requiring parking makes this easier by freeing space for commercial or residential use and obviating the need for a wide parking garage door on the street. Limiting driving also reduces infrastructural maintenance costs. Last year, San Francisco's Transportation Demand Management Ordinance acknowledged that parking generates auto traffic (rather than the converse—that traffic is mainly caused by cars circling in the hunt for scarce parking, which is often the pro-parking argument).

2. What about irate neighbors?

Although some community groups still push developers to add parking, many neighborhood associations are now recognizing that car ownership is dropping. We recently designed a project in central San Francisco, the Brady Block, which will have about 600 new units of housing, a new office building, and new public realm and streetscape improvements on Market Street. The parking ratio is about 0.5 spaces per apartment. The local neighborhood group, the Hayes Valley Neighborhood Association, would have preferred that the ratio be 0:1, and, in fact, we were concerned members would come to the Planning Commission hearing to demand less than the 0.5 ratio. In the past, we would face local resident groups who would oppose projects for the opposite reason.

Urban advocacy groups have played a key role in changing public opinion. Locally, these include SPUR (San Francisco Bay Area Planning and Urban Research Association), Livable City, the San Francisco Bicycle Coalition, TransForm, and the San Francisco Housing Action Coalition, among others. They have been highly active in encouraging reliance on—and infrastructure support for—walking, bicycling, and transit, and they endorse developments that deemphasize reliance on the automobile.



In place of parking in San Francisco, Curran House's ground floor includes community spaces, a peaceful courtyard, office space for the building developer, and additional affordable family-sized units. (Brian Rose)

3. Even if residents say they drive less, don't they really want to own a car?

We have not found this to be the case.

An example is one of our recently completed projects, Potrero 1010, a 453-unit mixed-use, mixed-income development in San Francisco's Potrero neighborhood. Developed by Chicago-based Equity Residential, Potrero 1010 has 0.65 parking spaces per unit, which was the city's allowed parking maximum, and the parking spaces are not bundled with the units but available for rent separately.

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About half of the parking spaces are rented, while the others remain empty, indicating that the development could have succeeded with half the parking. The building promotes walkability and alternative forms of transit: it has extensive bike storage with bike repair stands, and it is organized around a new city-owned one-acre (0.4 ha) park accessible to the public via a midblock passage lined with active uses.

4. Renters may be willing to forgo cars, but what about condominium buyers?

We designed a no-parking condo building, 388 Fulton, in Hayes Valley, San Francisco, for local developer 7×7 Development, with 69 studio and two-bedroom market-rate units. Even with zero parking, the units sold out easily in 2016 and early 2017.

5. Don't residents prefer the security of driving in their own cars?

At 388 Fulton, most of the 35 325-square-foot (30 sq m) micro-unit studios were purchased by single women in their 20s and 30s. This challenges the idea that car ownership is perceived as safer even though parking garages are high-crime areas. With the ubiquity of ride-hailing services, residents can walk out their front door, hop in a vehicle, and get dropped off at their destination rather than risk having to drive themselves, park several blocks from their destination, and walk the remaining distance, or walk through a parking garage getting to and from a car.



The Brady Block, in design in San Francisco, will have 600 new units of housing, a new office building, a new public realm, and streetscape improvements on Market Street—plus a 0.5:1 parking ratio. (David Baker Architects)

6. How can affordable-housing developers and operators help residents travel to jobs and schools without providing parking?

"While our priority is to provide housing, we do not want simply to pass the cost of parking on to our residents," says Jerry Jai, senior project manager at East Bay Asian Local Development Corporation (EBALDC), an Oakland-based nonprofit provider of affordable housing. "If we don't offer parking, does that limit job opportunities? What about costs due to towing, break-ins, and parking tickets?"

Jai notes that car ownership is not just about quality of life; it can also help parents transport their kids to school. "We don't want to be in a patronizing position where we say to residents, 'You should be able to get by without parking.'" However, Jai points to new sources of funding like California's Affordable Housing and Sustainable Communities Program (AHSC) as a promising opportunity. "Sources like AHSC are exciting because they encourage affordable-housing developers to build in transit-rich areas and to increase transportation connections—bus, light rail, etc."

Not paying to build parking can also free up money to provide other supportive resources to residents in need. In San Francisco's Tenderloin neighborhood, Curran House, completed in 2005, has 67 affordable family apartments and no

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parking spaces. Most of the low-income residents cannot afford a car, and the central site has excellent public transit connections. Providing parking would have added several million dollars to the construction cost.

By not spending money—or dedicating space—for structured parking, the nonprofit housing developer, Tenderloin Neighborhood Development Corporation (TNDC), was able to provide additional units, a courtyard, space for supportive services, neighborhood-serving retail space, and office space for itself.

Our firm is working on another project with TNDC, 222 Taylor Street, just a block from Curran House on the site of a former parking lot. The design includes 113 affordable family apartments and no parking, reserving the ground level for a much-needed community grocery.

Now that Congress's overhaul of the federal tax code has lowered the tax rate for corporations and federal affordable housing tax credit programs have less value to corporations, developers of affordable housing will be even more strapped for funds, and eliminating parking will become even more essential as a strategy for meeting housing demand.

7. Will lenders be willing to finance low- and no-parking developments?

Developers who plan to build multifamily housing and then sell it have to convince equity investors and loan committees to accept lower parking ratios. The investment community is often reluctant to embrace lower amounts of parking, fearing that renters and especially buyers will be turned off, particularly in places outside highly dense urban areas like San Francisco.

However, this is changing, says Will Goodman, vice president of San Francisco–based Strada Investment Group. "There is an evolution happening with the investment community to accept no parking or low parking," he says. "We are seeing parking utilization rates go down in new buildings and technologies like ride share expanding. So, investors are increasingly buying into the story that most people don't need parking day to day, especially if they are in an area that is near to transit and where traffic is bad. In these locations, people are typically not driving to work. They may want a car for weekend excursions, but it does not need to be on site."

Particularly in super-hot markets like San Francisco, there are many precedents that investors can look at to understand that renters are willing to forgo on-site parking. But even in slightly cooler markets like downtown Oakland, Goodman says he is finding that investors are willing to take the risk.

Strada is about to break ground on a new luxury high-rise rental development in downtown Oakland, where there has not been a luxury high-rise completed since 2009. "All the comps are based on 2009 or pre-2009 parking-to-dwelling-unit ratios, which are 1:1," Goodman says. "There were some members of the investment community who were not comfortable with not providing parking. We were ultimately able to find the right investors who saw the project as representing the future of Oakland development. They understood that this is a project in an extremely transit-rich part of the city. Additionally, there are a number of garages nearby so that our residents could have a secure parking space off site."

The simplest solution is for municipalities to put parking maximums in place for transit-rich areas, as San Francisco has done. These maximums change the culture, providing successful examples of developments with limited parking, which consequently makes it much easier for developers to persuade investors to get behind low- and no-parking developments.

Even in more car-oriented markets, some developers are seeing an opening for reducing parking. In Minneapolis, we are working with local developer Lander Group on a mixed-use residential project on a 1.5-acre (0.6 ha) site in the Lyn Lake neighborhood. It is in the conceptual design phase, and the developer aims to balance density and parking requirements with a desire to create a vibrant streetscape and public realm.

"The larger projects with institutional investors are going to be very cautious about reducing parking ratios," says Michael Lander, founder and president of Lander Group. "But lenders are starting to understand that in some of the denser, more transit-rich markets there is not as much need for parking. And they know the enormous cost of parking. So there is beginning to be a changing of the status quo."

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In San Francisco's Tenderloin neighborhood, 222 Taylor (left) is replacing a little-used parking lot with 113 homes for low-income residents and a neighborhood-serving grocery store. (David Baker Architects)

8. Millennials may be forgoing car ownership, but are baby boomers still attached to owning their own cars?

Even many baby boomers are beginning to question the need for cars and parking, Lander says. "The baby boomer generation in the Midwest is often still saying the same thing when it comes to proposed new developments: 'not enough parking, too much traffic.' It is a relearning process for baby boomers," says Lander. "When empty-nesters move downtown, they often bring two cars. But once they try the alternatives, like ride share, many of them reconsider the practicality of owning more than one vehicle."

9. Does this idea have traction beyond San Francisco?

Last year, San Francisco developer Panoramic Interests proposed building 1,031 market-rate apartments near the West Oakland station on the Bay Area Rapid Transit (BART) system and providing no parking for residents. The project is going through the approval process. Also in Oakland, EBALDC is looking for creative ways for projects to make economic sense despite rapid construction-cost escalation. One of these ways is reducing or eliminating parking. "The elimination of parking in one of our recent projects resulted in major savings, which made the difference between a feasible project versus one that was not," says Jai.

Even outside coastal markets, possibilities exist to minimize parking. "Midwestern cities like Minneapolis are different from denser, more transit-rich cities," Lander says. "There is more need for a car. So, I think there will still be a lot of auto mobility in the future, but many more alternatives to private ownership like Uber and car-sharing services. This will significantly reduce the need for parking."

10. Is the preference for not owning a car just a short-term trend?

A future not dominated by privately owned cars may be a long way off, but increasingly the use of a car is becoming detached from the need for parking. In urban areas, driverless taxis are likely to hit the streets much sooner than anticipated. Waymo, Google's self-driving car project, has teamed with Fiat Chrysler Automobiles to announce plans to

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start offering driverless ride-hailing service in Phoenix by the end of this year. General Motors plans to launch a fleet of driverless taxis in multiple cities in 2019. At the same time, municipalities that once focused on providing ample street parking are now prioritizing bus stops, loading zones, bicycle lanes, and ride-hailing stops.

The days when multifamily housing developers must provide individual parking spaces are numbered. "Who knows? Perhaps in 20 years, no one will be having this debate because of autonomous vehicles, ride sharing, and improvements in public transportation," says Jai. "We need to remember that we are building housing that is supposed to last 50 years."

David Baker *is a principal and* ***Brad Leibin*** *is an associate at David Baker Architects in San Francisco.*

SHOW COMMENTS

Juergen Fenk Appointed Chairman of ULI Europe

By Trisha Riggs
July 6, 2018

Text Size: A A A

Juergen Fenk, member of the Group Executive Board of SIGNA Group, has been named the new chair of ULI Europe. Fenk, who succeeds Jon Zehner, global head of the client capital group for LaSalle Investment Management, will serve on a voluntary basis for a two-year term.

Fenk brings extensive ULI leadership experience to his new role. A member of ULI for over a decade, Fenk has just completed a four-year term as chair of ULI Germany, ULI's second largest national council in Europe. He is also a Global Governing Trustee, a member of ULI Europe's Executive Committee, and serves on ULI's Global Board of Directors.

"On behalf of all of the ULI members in Europe, I would like to thank Jon Zehner for his visionary leadership over the past two years," said Fenk. "During Jon's term as chair, ULI Europe has grown rapidly to nearly 3,500 members, and expanded the opportunities for members to engage by increasing the number of National Council events, creating new Product Councils, and advancing programmes such as UrbanPlan. Undoubtedly one of Jon's greatest achievements as chair is the creation of our new Strategic Plan that will act as ULI Europe's roadmap for the next four years."

Fenk will lead the implementation of the ULI Europe Strategic Plan, which is part of ULI's Global Strategic Plan, recently approved by the Institute's Global Board of Directors. The four-year plan strives to strengthen member engagement and expand its impact around the world. The Europe Strategic Plan will focus on five key areas: growing individual and corporate membership in the region; strengthening ULI's position in Europe as a multi-disciplinary real estate and land use knowledge network, which leads in applying big ideas and emerging trends to business practices; further developing National Councils and Product Councils to increase member engagement; focusing on mission-driven activities, such as UrbanPlan and Advisory Services to distinguish ULI from other organizations; and establishing a financially resilient platform for sustainable growth.

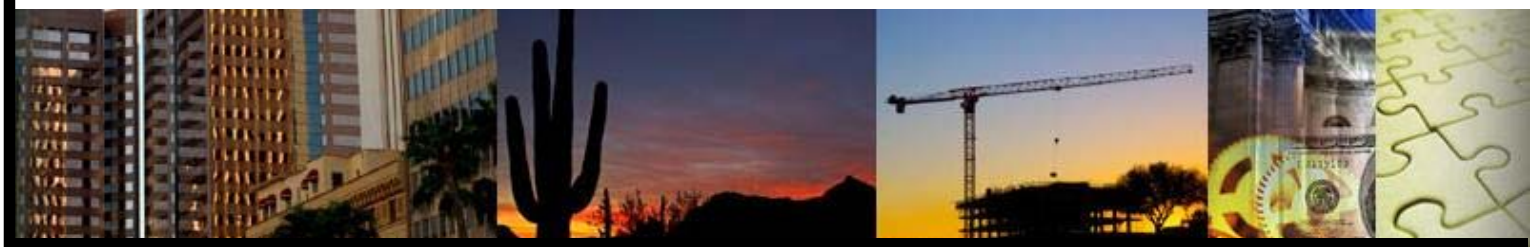
"ULI in Europe is in an exciting phase of its development," said Fenk. "The approval of the new Strategic Plan will provide us with the focus and investment needed to grow our membership, develop our networks, and expand our reach across Europe. Our approach will be to continue building each National Council by developing its local programme and growing its membership, while at the same time increasing the knowledge sharing and collaboration between councils to ensure we build a truly European network."

"ULI's global and genuinely multi-disciplinary membership is something that makes us unique among real estate organisations. ULI's origins in Europe have always made it more historically focused on capital markets and finance, and while we want to maintain our strong presence in this area, we also want to continue our growth in other sectors and disciplines to ensure we are truly reflective of the whole real estate market," continued Fenk. "Advisory Services is one programme that can really help us broaden our engagement with the public sector. During my term as chair for ULI Germany, we undertook an Advisory Services panel in Frankfurt / Offenbach. The panel not only tackled an important real estate challenge for the city, but really helped drive engagement between members and facilitated a much richer dialogue

5-ZN-2020
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70th & McDowell Multi-Family Community

Analysis of the South Scottsdale Multi-Family Market and Economic & Fiscal Impact Analysis Scottsdale, Arizona



Prepared for:

Hawkins Companies Commercial Developers

March 2020

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4/16/2020

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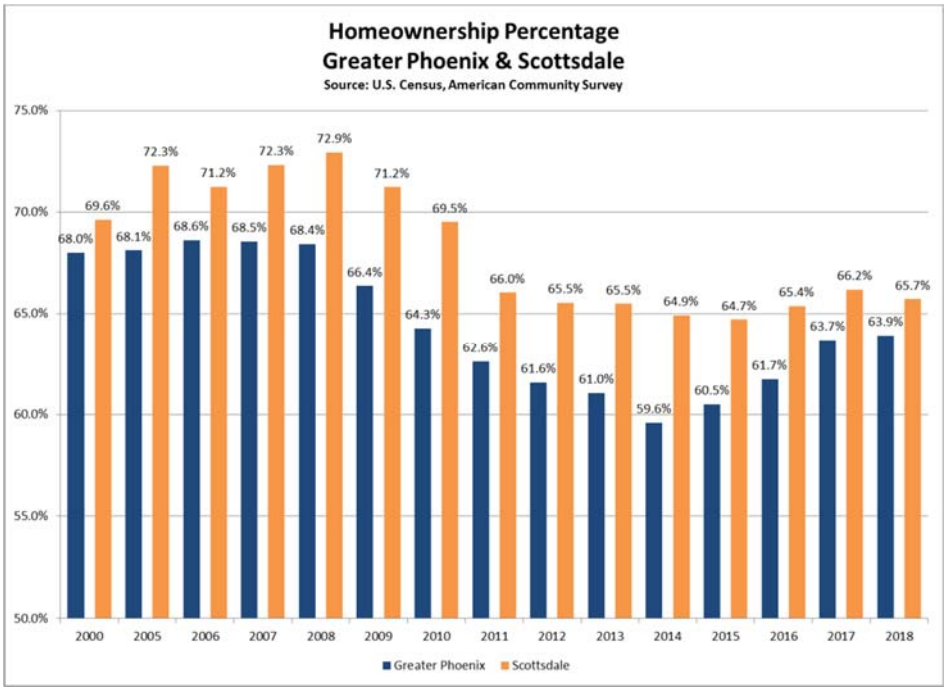
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Executive Summary

Elliott D. Pollack & Company has been retained by Hawkins Companies Commercial Developers to provide a limited analysis of the multi-family housing market in South Scottsdale as well as an economic and fiscal impact of the proposed multi-family mixed-use community at 70th Street & McDowell Road. The market analysis will focus on the demand for multi-family housing relative to job growth and overall economic development of the community. The market area that is the subject of this study is defined as the Scottsdale city limits from Indian Bend Road south to the Tempe border. The economic and fiscal impact analysis will focus on the impacts generated during construction as well as the long-term impacts of operations, including resident spending.

Multi-Family Market Trends

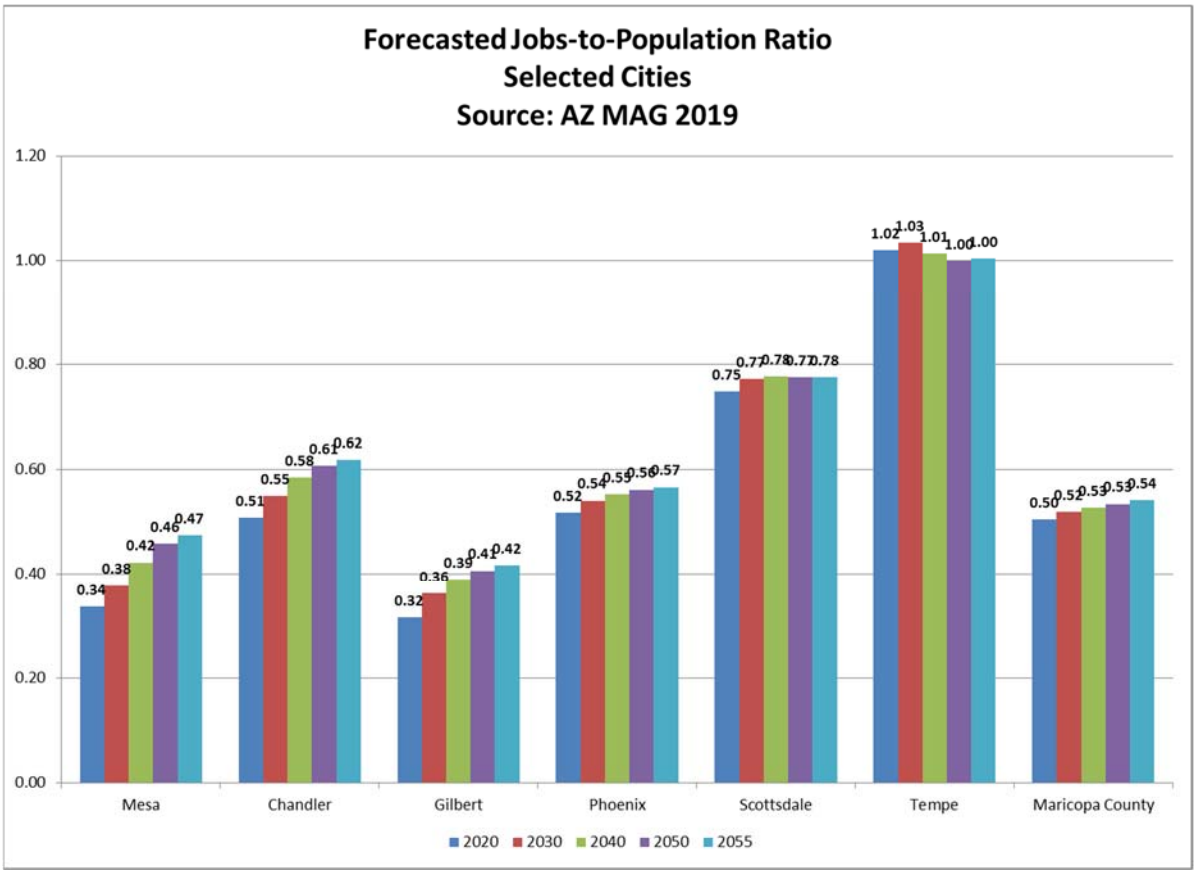
- The Greater Phoenix multi-family market made a significant recovery after the end of the Great Recession in 2009 and through 2019 experienced historic levels of construction activity.
- Following the 2009 recession, the demand for multi-family communities increased significantly as homeowners were forced from their homes due to foreclosure.
- In comparison, however, Scottsdale's homeownership rate has historically always exceeded the rate for Greater Phoenix. During the housing boom of 2005 to 2007, homeownership in Scottsdale exceeded 70%. After the recession, homeownership declined to 65%, but was significantly above the Greater Phoenix average. The rate in Scottsdale started increasing in 2015, reaching above 66% in 2017 with a slight decline in 2018.



- Vacancy rates are at historic lows across the Valley ranging from 5% to 7% depending on the source. Scottsdale's stabilized vacancy rate stands at 4.4% today, among the lowest in the County.
- Employment and population growth forecasted for the Greater Phoenix area will continue to create demand for new multi-family units in the long run (although we now expect some short-term slowdown due to the impacts of Covid-19). Through 2029, the population of Greater Phoenix is expected to be more than 850,000 persons according to the University of Arizona. Similarly, the long-term outlook for job growth in Greater Phoenix is positive. The University of Arizona forecasts an increase of 499,000 jobs through 2029.
- In order to accommodate the influx of new residents to Greater Phoenix, approximately 35,000 housing units will need to be built each year over the next ten years (on average). Of those units, 25% are expected to be multifamily units.

Scottsdale Population and Employment Forecasts

- Scottsdale is expected increase in population to 68,700 persons by 2055 from its 2020 population estimate of 247,944. It is also expected to add nearly 64,800 new jobs to its employment base between 2018 and 2055.
- Scottsdale's jobs to population ratio is much higher than the county, standing at 0.73 in 2018 and expected to be within a range of 0.74 to 0.77 for the future. In comparison to other major cities in the Valley, Scottsdale is among the leaders in job growth and the jobs-to-population ratio.



Drivers of Multi-Family Demand

- According to RentCafe.com, the fastest growing segment of the multi-family rental market is persons over the age of 60. Studies show that a portion of the older population is no longer enthusiastic about homeownership and is starting to downsize and move into rentals.
- This trend is on display in Scottsdale. Scottsdale (19.1%) has historically had a high percentage of 60+ year old renter households - above the County (18.8%) average.
- In the case of both Maricopa County and Scottsdale, the percentage of the multi-family market occupied by households under the age of 34 grew by 51.4%, 35-59 by 66.2%, and the 60 plus age group increased 24.9%.

Percentage of Total Renters by Age 2008 & 2018
Maricopa County & Scottsdale

	Maricopa County			Scottsdale		
Age Group	2008	2018	% Growth	2008	2018	% Growth
34 and Under	176,650	220,598	24.9%	9,497	14,381	51.4%
35-59	190,701	260,408	36.6%	10,870	18,070	66.2%
60+	62,472	111,275	78.1%	6,153	7,685	24.9%
Total	429,823	592,281	37.8%	26,520	40,136	51.3%

Source: U.S. Census, American Community Survey

- Not surprisingly, the second source of demand for the multi-family market is the Millennial generation of 76.2 million persons which became the largest generation in 2018 surpassing the 74.5 million Baby Boomers. The Millennial generation views their jobs and lives in ways much different than other generations. They have delayed marriage and family formations, lived with relatives or roommates, and delayed purchasing a home. The multi-family market has benefited from the choices made by Millennials.
- For at least the next decade, the multi-family market will be driven by both Baby Boomers and Millennials. Younger households will continue to seek shelter and life experiences. Older households are expected to continue downsizing as a lifestyle choice, a portion of whom will choose to rent in a multi-family community.

Summary of South Scottsdale Sub-Market Conditions

- Scottsdale and the Southeast Valley have captured a large share of the multi-family market because of their employment base which includes high tech, aerospace, healthcare, and other high wage occupations. Scottsdale's target industries and top local firms as outlined by the City's Economic Development Department are:
    - Advanced Business Services: Vanguard, Nationwide Insurance and APL Logistics
    - Bio-Life Sciences: Mayo Clinic, Orion Health, Honor Health
    - Hospitality: Troon Golf, Fairmount Scottsdale Princess, Westworld
    - Technology: GoDaddy, JDA Software, PayPal, Yelp

- The current pipeline of multi-family communities in South Scottsdale is modest with only one community to be completed in 2020 and two more in the planning stages. Multi-family development activity in Scottsdale generally is expected to slow as developers seek out other cities for new projects, particularly in the West Valley which has had limited development activity until the last three years.

Overall, the South Scottsdale multi-family market is extremely healthy. Continued development of new units is anticipated to provide for the housing needs of new residents and employees as well as to further promote the desires of well-heeled Baby Boomers and successful Millennials for an urban, walkable lifestyle.

Economic and Fiscal Impact of 70th & McDowell Multi-Family Community

The Hawkins-unit multi-family mixed-use community that includes approximately 7,000 square feet of non-residential uses proposed for Scottsdale. Rents are expected to average $2.00 per square foot with average household income for community residents of about $68,900. Based on information from similar density projects, a typical household size of 1.4 persons per unit was used. All calculations assume a vacancy rate for the project of 5.5%.

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Economic Impacts

- The proposed multi-family community is a 260-unit multi-family community with approximately 5,000 square feet of office space, 1,000 square feet of retail space and a 1,000 square-foot community room that will provide an immediate $86.9 million economic impact from construction activity. This investment will create 449 construction jobs and $25.9 million in wages.

- Upon completion of construction, the proposed mixed-use community will support 149 jobs, $6.8 million in wages, and $16.9 million in annual economic activity (includes combined direct operations of the community and resident spending in the local economy).

Economic Impact Summary
70th & McDowell Multi-Family Community
(2020 Dollars)

Construction Impact				Annual Operations/Spending Impact			
Impact Type	Person Years of Employment	Wages	Economic Output	Impact Type	Jobs	Wages	Economic Output
Direct	215	$13,000,000	$45,860,000	Direct	98	$3,996,200	$8,374,900
Indirect	115	$6,800,000	$21,790,000	Indirect	21	$1,165,000	$3,468,000
Induced	120	$6,100,000	$19,290,000	Induced	31	$1,600,000	$5,025,000
Total	**449**	**$25,900,000**	**$86,940,000**	**Total**	**149**	**$6,761,200**	**$16,867,900**

Sources: Hawkins Companies Commercial Developers; Elliott D. Pollack & Company; IMPLAN

Fiscal Impacts

- The construction of the proposed community would generate $617,900 in revenues for the City of Scottsdale, including construction sales tax, and the spending of onsite construction workers.

- After the project is completed, commercial operations and residents living in the complex would create an estimated $347,200 in ongoing tax revenue that would be collected by the City of Scottsdale each year at stabilized occupancy (in 2020 dollars).



Fiscal Impact Summary
70th & McDowell Multi-Family Community
City of Scottsdale
(2020 Dollars)

Construction Impact				Annual Operations Impact			
Impact Type	Primary	Secondary	**Total**	Impact Type	Primary	Secondary	**Total**
Direct	$559,000	$29,800	**$588,800**	Direct	$328,300	$12,100	**$340,400**
Indirect	N/A	$14,500	**$14,500**	Indirect	N/A	$2,730	**$2,730**
Induced	N/A	$14,600	**$14,600**	Induced	N/A	$4,050	**$4,050**
Total	**$559,000**	**$58,900**	**$617,900**	**Total**	**$328,300**	**$18,880**	**$347,200**

Sources: Hawkins Companies Commercial Developers; Elliott D. Pollack & Company

1.0 Introduction

1.1 Background

The purpose of this study is to prepare both an analysis of the multi-family housing market in South Scottsdale as well as to conduct an economic and fiscal impact analysis of the proposed multi-family mixed-use community at 70th Street & McDowell Road. The project will have 260 residential units and approximately 7,000 square feet of non-residential uses. The market analysis will focus on the demand for such housing relative to job growth and overall economic development of the community. The market area that is the subject of this study is defined as the Scottsdale city limits from Indian Bend Road south to the Tempe border. The economic and fiscal impact analysis will focus on the impacts generated during construction as well as ongoing operations and resident spending. The contents of this study include:

- An overview of the Greater Phoenix economy and multi-family market trends.
- A historical analysis of multi-family construction in the market area including rents, and occupancy.
- The capture of metro-wide multi-family construction activity by the market area.
- Analysis of the relationship between job growth and multi-family construction.
- An opinion on the near-term demand for multi-family units in the market area given current demographic considerations, the Millennial population, and other factors that will continue to drive demand.
- Economic and Fiscal impact of the construction and operations of Phase 1 development for the 1,241-unit Gentry on the Green multi-family community.

1.2 Limiting Conditions

This study prepared by Elliott D. Pollack & Company is subject to the following considerations and limiting conditions.

- It is our understanding that this study is for the client's due diligence and other planning purposes.

- The reported recommendation(s) represent the considered judgment of Elliott D. Pollack & Company based on the facts, analyses and methodologies described in the report.

- This study is intended to be read and used as a whole and not in parts.

- Our analysis is based on currently available information and estimates and assumptions about long-term future development trends. Such estimates and assumptions are subject to uncertainty and variation. Accordingly, we do not represent them as results that will be achieved. Some assumptions inevitably will not materialize and



unanticipated events and circumstances may occur; therefore, the actual results achieved may vary materially from the forecasted results. The assumptions disclosed in this analysis are those that are believed to be significant to the projections of future results.

- This economic and fiscal impact study evaluates the potential "gross impacts" of the project on various governmental jurisdictions. The term "gross impacts" as used in this study refers to the total revenue, jobs and economic output that will be generated by the project.

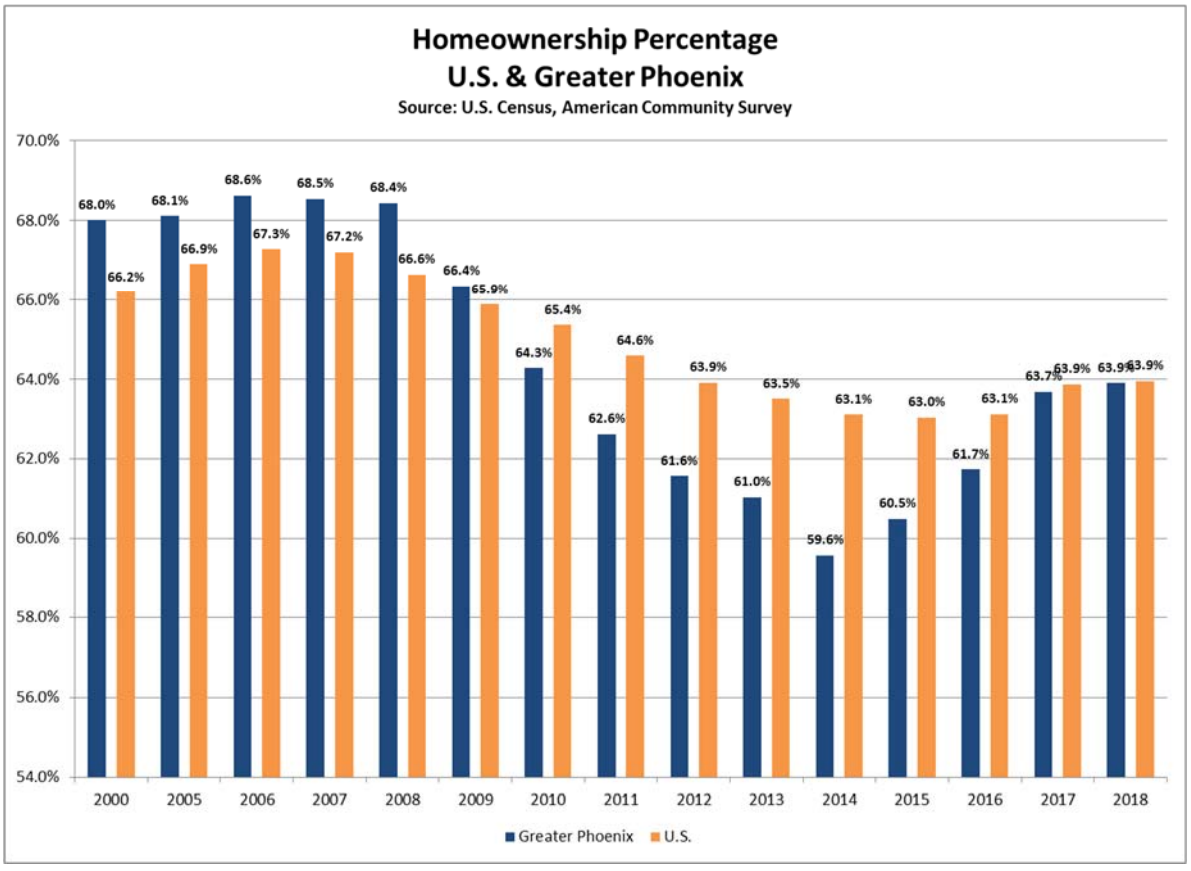
- This analysis does not consider the costs associated with providing services to the project. Such analysis is beyond the scope of this study. In addition, the analysis is based on the current tax structure and rates imposed by the affected municipalities. Changes in those rates would alter the findings of this study. All dollar amounts are stated in 2020 dollars and, unless indicated, do not take into account the effects of inflation.



2.0 Multi-Family Market Trends

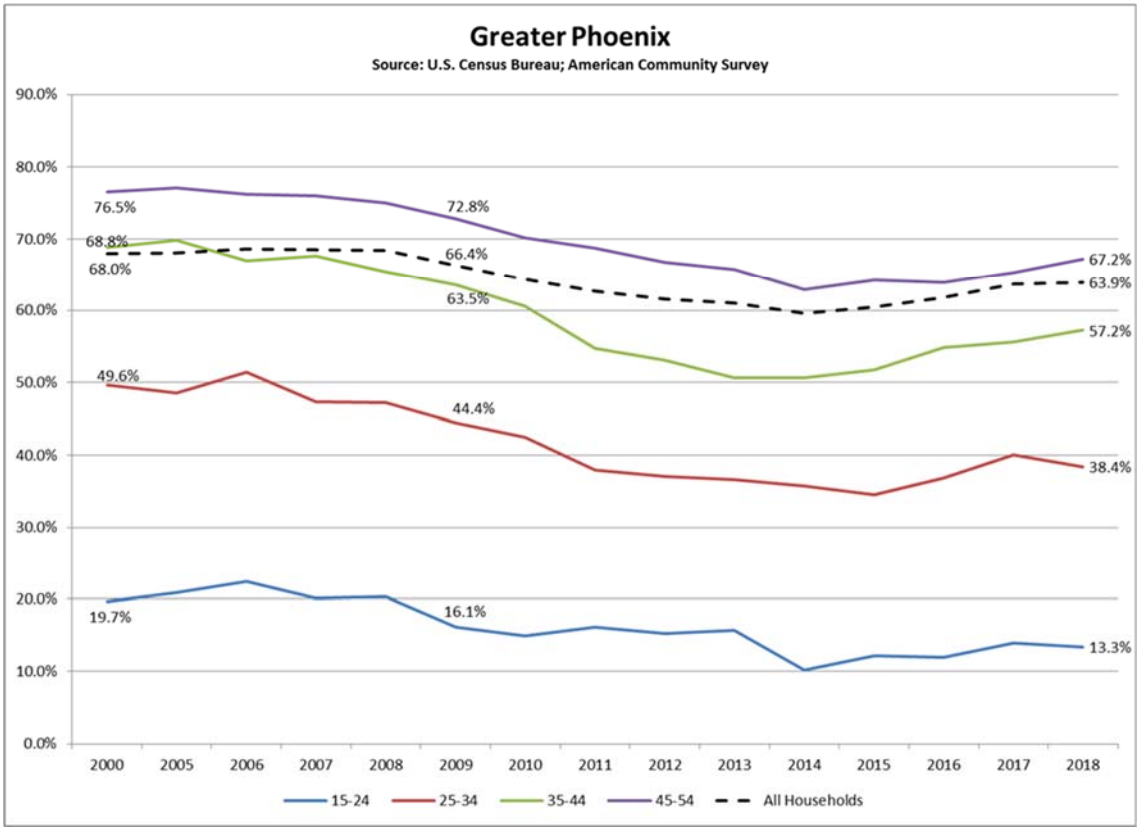
2.1 Greater Phoenix Multi-Family Market Conditions

The Greater Phoenix multi-family market made a significant recovery after the end of the Great Recession in 2009. Following the recession, the multi-family market experienced rising vacancies and declining rents. Throughout the country, multi-family vacancies rose sharply in 2008 and 2009 but then started to decline in 2010 and 2011. Much of this decline was due to the bursting of the housing bubble and resulting housing foreclosures which forced many homeowners into the rental market. Homeownership rates in Greater Phoenix fell to historic lows between 2006 and 2014, declining to 59.6%. Comparatively, the homeownership rate for the U.S. only decline approximately five percentage points between 2005 and 2016. While homeownership in Greater Phoenix and the country is improving, it still has not recovered to pre-recession levels.



One factor driving the demand for the multi-family market is the Millennial population. Millennials have delayed purchasing homes and forming families as they struggle with student debt and the psychological effects of the Great Recession. The homeownership rate for the 25 to 34-year old age group, which includes most Millennials, declined from near 50% in 2000 (before the housing bubble) to 35% in 2015. The homeownership rate for all age groups is now

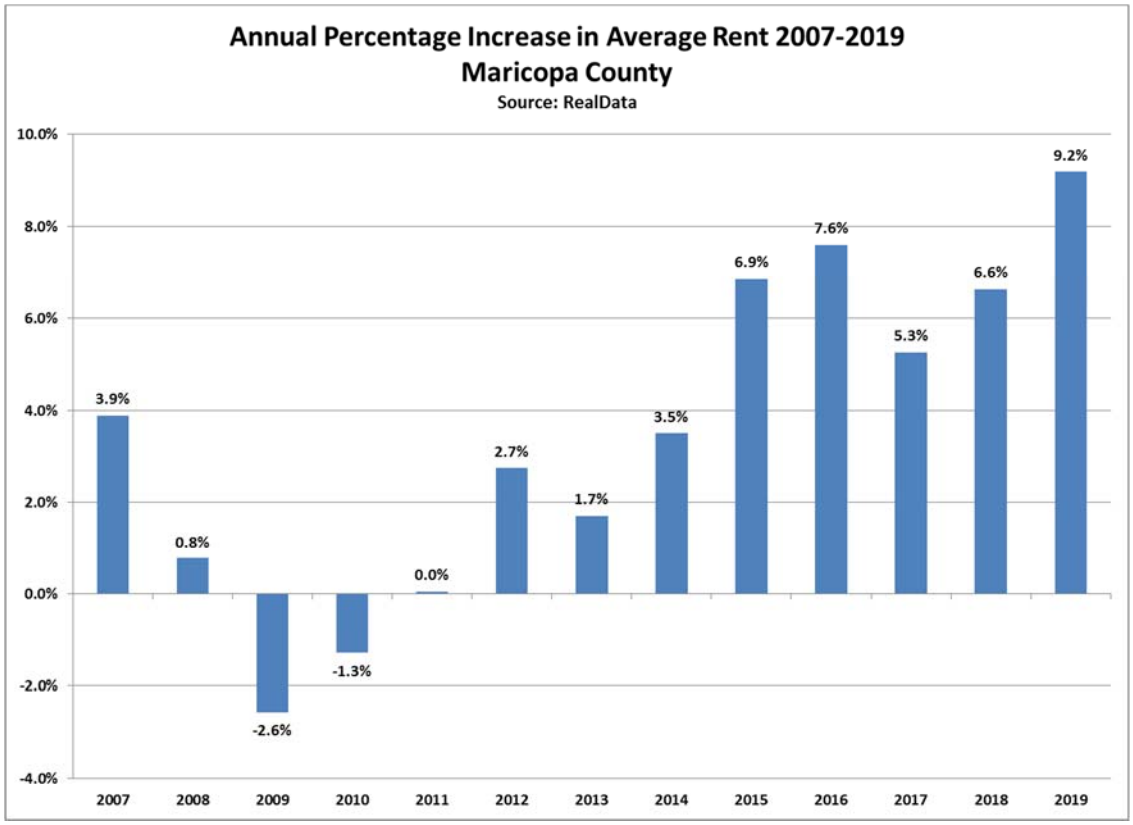
rising but is still below pre-recession levels. As a result, the construction of multi-family units has increased significantly over the past five years to accommodate this demand for housing.



Rent and vacancy data for Maricopa County was obtained from RealData, a multi-family data vendor that compiles information on all multi-family communities with at least 50 units. According to RealData, as of the end of 2020, there were approximately 312,400 conventional multi-family units in the county in 1,494 communities. Since the end of the recession in 2009, 56,233 units have been built representing a 21.9% increase in the inventory.

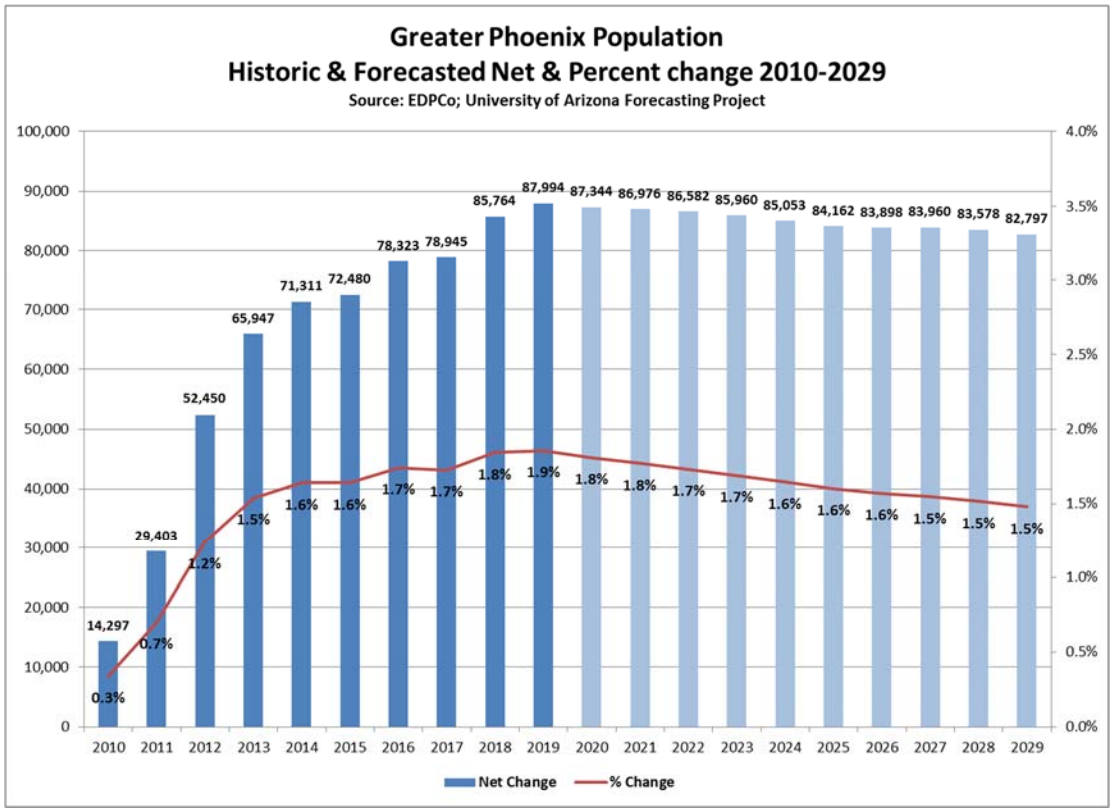
Between 2004 and 2006, the inventory of multi-family units in Maricopa County declined by nearly 8,000 units as multi-family communities were converted to condominiums. Even with this reduction in inventory, the vacancy rate for multi-family units increased as renters vacated their units in favor of purchasing single family homes. Many renters also purchased their units during the condo conversion process. In 2008, the inventory of multi-family units began to increase again, consisting of newly-constructed units as well as condo communities that were reverted from ownership back to rentals. Vacancy rates peaked in 2009 at 14.3% as more units were brought to the market during a time of weak absorption. That trend ended in 2010 with reported absorption of nearly 11,000 units, lowering the average county vacancy rate to 12.7%. Very weak construction activity followed from 2010 to 2013, but in 2014 the supply of multi-family units began to increase rising to more than 10,000 newly constructed units in 2017.

In Maricopa County, monthly rents have risen by $343 since 2013 or an average of 6.5% each year. The average rent today is nearly $1,100 per month or $1.31 per square foot of livable area.



2.2 Greater Phoenix Multi-Family Construction Forecast

Employment and population growth forecasted for the Greater Phoenix area will continue to create demand for new multi-family units in the long run (although the short-term forecast will now be impacted by Covid-19). Prior to the recession, Greater Phoenix historically grew at an average rate of 3.5% per year. Since that time, the percentage growth in population has only exceeded 2.0% in one year – 2017. The forecast for population growth is positive but moderate compared with earlier years, expected to average 1.7% over the next ten years. But even this moderate level of growth will still produce a population increase through 2028 of more than 80,000 persons per year and a total of more than 872,000 persons according to the University of Arizona.



While mobility across the U.S. has decreased since the Great Recession, Greater Phoenix started to attract a significant number of new residents over the last few years. While this inflow of population may change due to the impact of Covid-19 and the impending recession, the region is still considered one of the leaders in population growth in the nation. According to the U.S. Census, in 2018 Greater Phoenix was the second fastest growing metro area in terms of absolute population increase with nearly 96,200 new residents (the U.S. Census estimates vary from estimates from the University of Arizona that are cited in the above chart). Because of its overall size at more than 4.7 million persons, Greater Phoenix ranks fifth in percentage growth behind several much smaller metro areas such as Austin and Las Vegas.

Fastest Growing Metro Areas 2018
By Numeric Growth

Rank	Metro Area	Net Change 2017-2018
1	Dallas-Fort Worth-Arlington, TX	131,767
2	Phoenix-Mesa-Scottsdale, AZ	96,268
3	Houston-The Woodlands-Sugar Land, TX	91,689
4	Atlanta-Sandy Springs-Roswell, GA	75,702
5	Orlando-Kissimmee-Sanford, FL	60,045
6	Seattle-Tacoma-Bellevue, WA	54,894
7	Austin-Round Rock, TX	53,086
8	Riverside-San Bernardino-Ontario, CA	51,934
9	Tampa-St. Petersburg-Clearwater, FL	51,438
10	Washington-Arlington-Alexandria, DC-VA-MD-WV	49,949

Source: U.S. Census

Fastest Growing Metro Areas 2018
By Numeric Growth

Rank	Metro Area	Net Change 2017-2018
1	Austin-Round Rock, TX	2.5%
2	Orlando-Kissimmee-Sanford, FL	2.4%
3	Las Vegas-Henderson-Paradise, NV	2.2%
4	Raleigh, NC	2.1%
5	Phoenix-Mesa-Scottsdale, AZ	2.0%
6	Jacksonville, FL	2.0%
7	Dallas-Fort Worth-Arlington, TX	1.8%
8	San Antonio-New Braunfels, TX	1.8%
9	Charlotte-Concord-Gastonia, NC-SC	1.8%
10	Tampa-St. Petersburg-Clearwater, FL	1.7%

Source: U.S. Census

Greater Phoenix is also a top 10 metro area in employment growth. In 2019, 61,800 jobs were created, fifth in the country. On a percentage basis, Greater Phoenix ended with a job increase of 2.93% ranking third behind Orlando and Dallas in 2019.

Fastest Growing Employment Centers 2019
By Numberic Growth

Rank	Metro Area	Net Change 2018-2019
1	New York	116,300
2	Dallas	113,800
3	Houston	82,700
4	Los Angeles	74,000
5	Phoenix	61,800
6	San Francisco	61,800
7	Atlanta	57,700
8	Seattle	56,900
9	Chicago	56,500
10	Miami	54,200

Source: U.S. Bureau of Labor Statistics

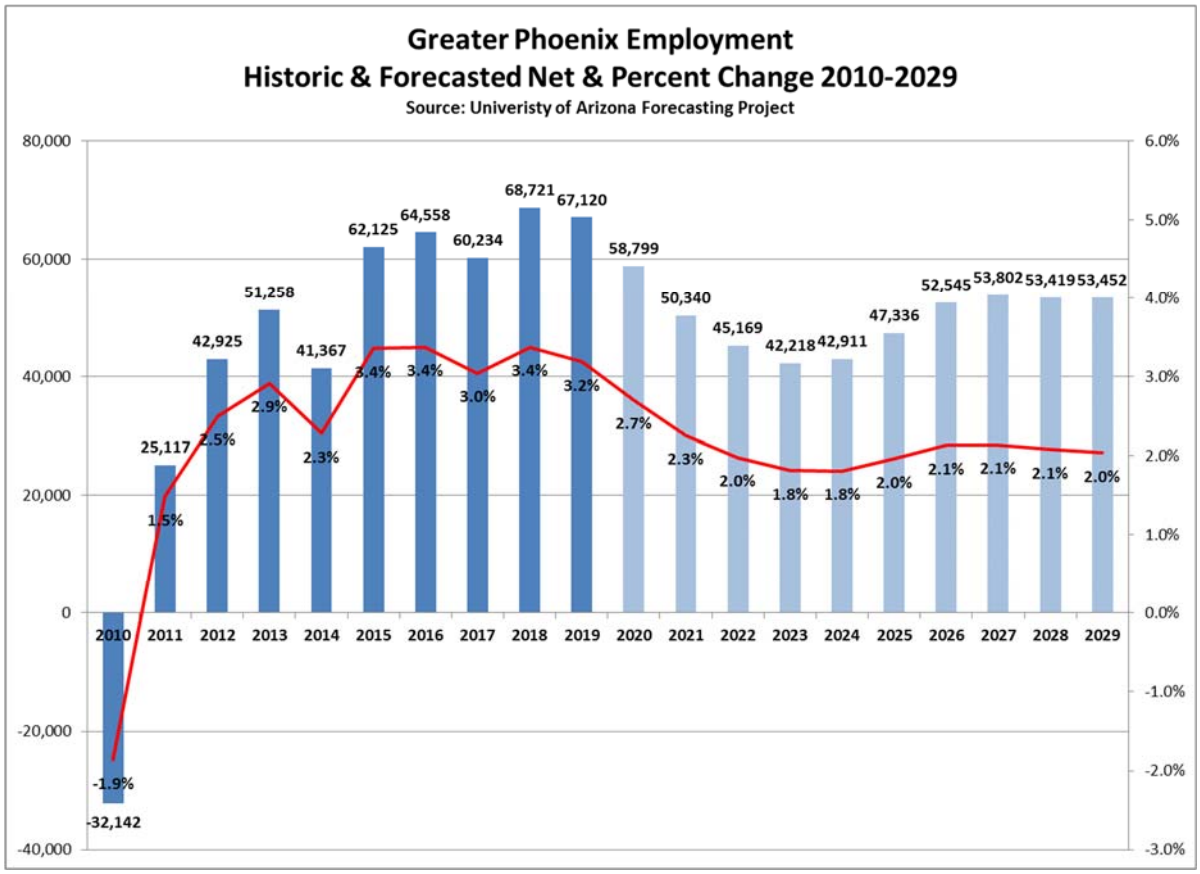
Fastest Growing Employment Centers 2019
By Percentage Growth

Rank	Metro Area	% Change 2018-2019
1	Orlando	3.59%
2	Dallas	3.09%
3	Phoenix	2.93%
4	Seattle	2.78%
5	Houston	2.68%
6	San Jose	2.64%
7	San Francisco	2.53%
8	Charlotte	2.46%
9	Las Vegas	2.41%
10	Austin	2.40%

Source: U.S. Bureau of Labor Statistics

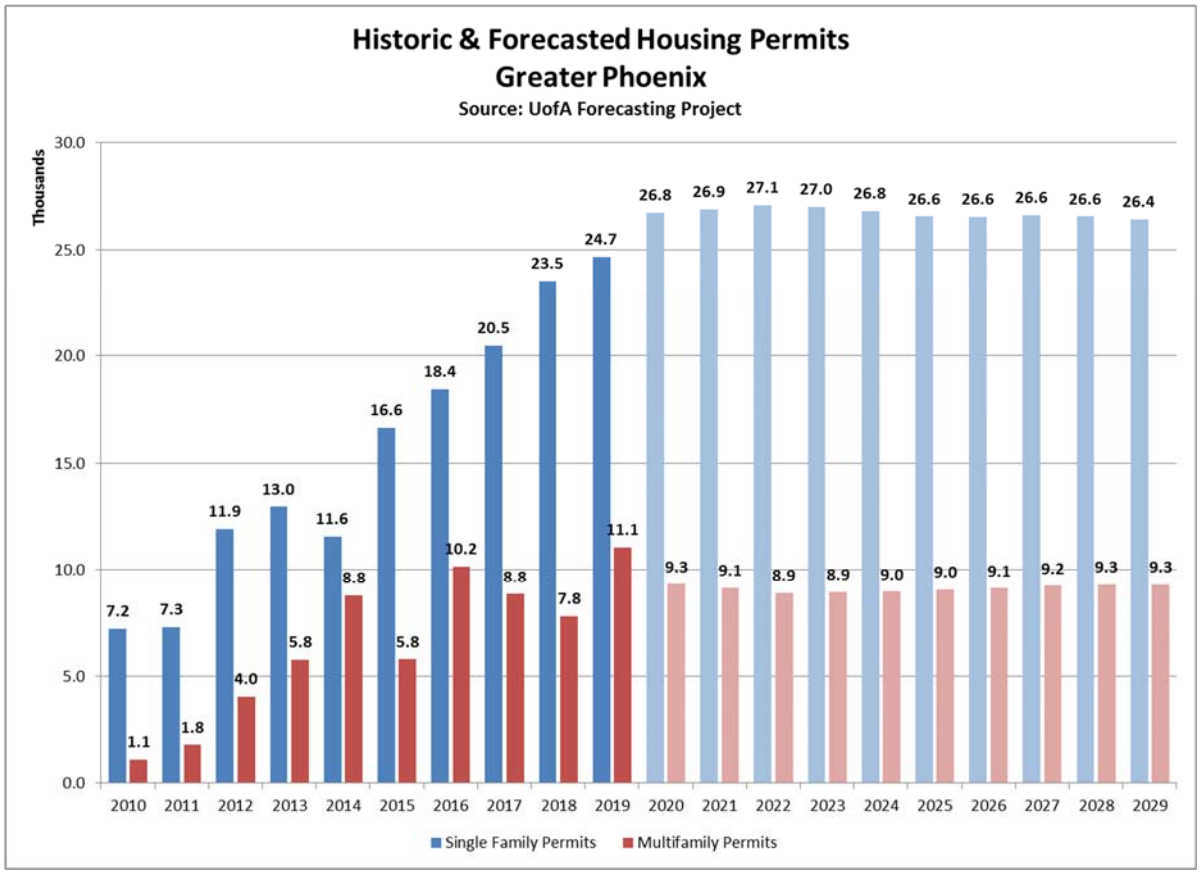
For Greater Phoenix, after losing 243,000 jobs in the recession, it regained another 524,900 jobs (207% of jobs lost) from the bottom of the job market in September 2010. While a recession is now imminent due to Covid-19, the length, depth and shape of the recovery is currently unknown. As for the short term, the expectation is for a decrease in growth for employment and population whilst the long-term outlook for job growth in Greater Phoenix remains positive over the next ten years. The University of Arizona forecasts an increase of 497,900 jobs through 2029. The forecast now calls for a slowdown in job growth in 2020 in response to the Corona virus impact and the recession. It is notable that since 2009, 87% of all job growth in the State has occurred in Greater Phoenix.





Overall, the Greater Phoenix and Arizona economies experienced a long and healthy recovery since the last recession. While we will now experience some impacts to growth rates, the long-term outlook remains positive. Median household incomes in Arizona rose 4.7% in 2018, nearly double the national rate, to a high of $59,246. The state is ranked fourth nationally for GDP growth; Forbes magazine ranks Arizona in the top five for growth prospects.

In order to accommodate the influx of new residents to Greater Phoenix, approximately 35,000 housing units will need to be built each year over the next ten years. Of those units, 25% are expected to be multifamily units.



2.3 Drivers of Multi-Family Development

There are two significant demand generators of the multi-family market: Baby Boomers and Millennials. Each will be described in this section.

Baby Boomers

A growing source of demand for multi-family units is the age group over 60 years old which includes most Baby Boomers. While this may be surprising given the focus on the Millennial generation, several observers have recognized the trend of an increasing percentage of older Americans who make up the rental market. According to RentCafe.com, the fastest growing segment of the multi-family rental market is persons over the age of 60. Studies show that a portion of the older population is no longer enthusiastic about homeownership and is starting to downsize and move into rentals. The cost to maintain a home is now being replaced with more lifestyle choices – less monthly cost, lock-and-leave, no maintenance obligations.

This trend is on display in Scottsdale. The number of renter households over the age of 60 in the County has increased 24.9% in 2018. Scottsdale (19.1%) has historically had a higher percentage of 60+ year old renter households - above the County (18.8%) average. In 2008, 23.2% of all Scottsdale renter households were older than 60 years. In 2018, that percentage decreased to 19.1%. In fact, the number of renter households in Scottsdale over the age of 60

increased by 24.9% between 2008 and 2018. By comparison, the number of renter households under the age of 34, which traditionally makes up the majority of renters, grew by 51.4%.

In the case of Maricopa County, the number of multi-family market occupied by households under the age of 35 increased 24.9% while the 60 plus age group grew rapidly 78.1%. In Scottsdale the number of households under 35 grew by 51.4% and the number of 60 plus had a increased to 7,685.

Percentage of Total Renters by Age 2008 & 2018
Maricopa County & Scottsdale

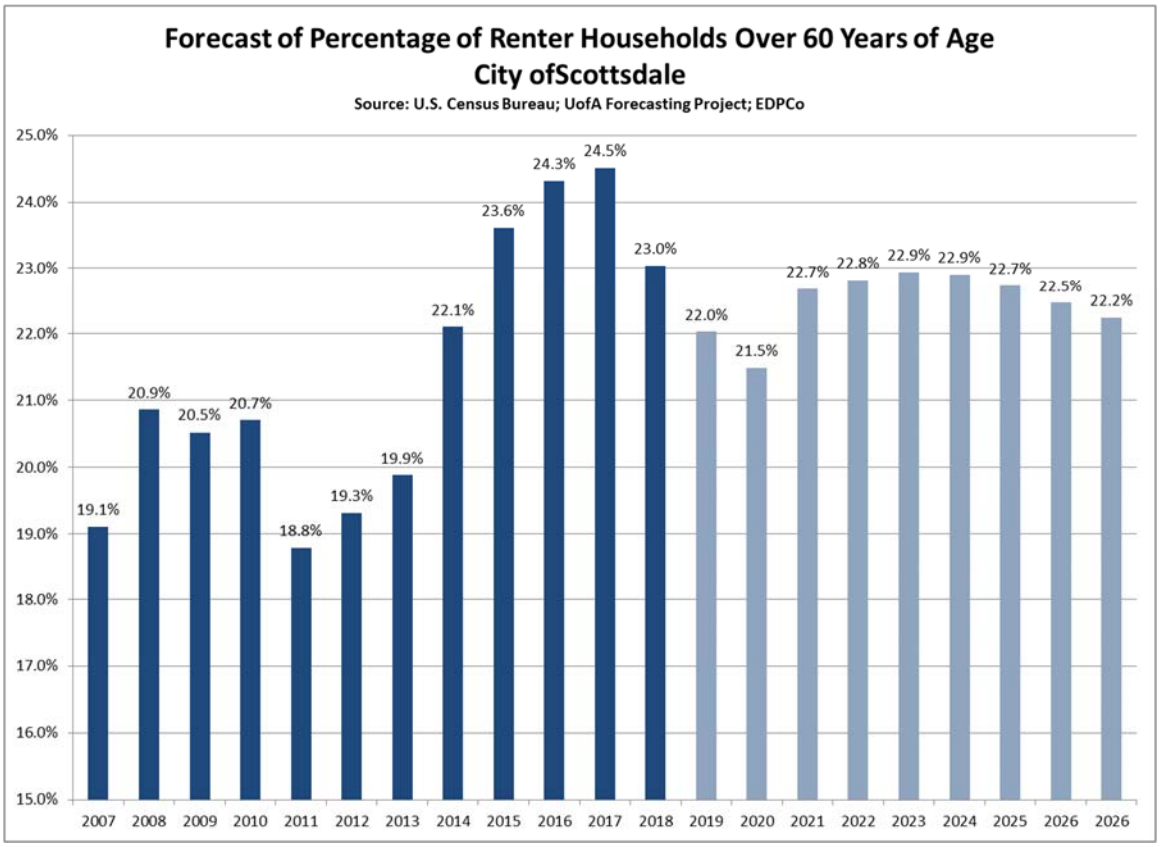
	Maricopa County			Scottsdale		
Age Group	2008	2018	% Growth	2008	2018	% Growth
34 and Under	176,650	220,598	24.9%	9,497	14,381	51.4%
35-59	190,701	260,408	36.6%	10,870	18,070	66.2%
60+	62,472	111,275	78.1%	6,153	7,685	24.9%
Total	429,823	592,281	37.8%	26,520	40,136	51.3%

Source: U.S. Census, American Community Survey

Scottsdale's population with a median age of 47.0 is quite different than its neighbors. For instance, the median age of a Mesa resident is 35.8 while Tempe's median age is 29.8. As a result, the percentage of residents over the age of 60 who are renters in these adjacent cities is much lower. In Mesa, only 16.7% of all renters are over the age of 60; in Tempe an even smaller percentage at 11.1% are over 60. In Scottsdale, 19.1% of all renters are over age 60, 46% higher than in Mesa and 89% higher than in Tempe. The Scottsdale multi-family rental market is expected to continue to be driven by the Baby Boomer generation by virtue of the city's older age cohort.

Baby Boomers are making a lifestyle choice to rent instead of owning a home. Most have the incomes to comfortably own but are now downsizing and choosing to enjoy more flexibility in their lives. This may include traveling abroad more or living in another state for part of the year. The ability to lock and leave a unit is a conscious choice for this generation. A forecast through 2025 shows the continued growth in the Baby Boomer rental trend.





Millennials

Not surprisingly, the Millennial population has been one of the major drivers of the multi-family market since the Greater Recession. The definition of a Millennial varies from source to source. The narrowest definition is persons born between 1981 and 1996 which places their ages between 23 and 38 years old in 2020.

According to the U.S. Census Bureau data from 2018, the Millennial generation of 76.2 million persons surpass the 74.5 million Baby Boomers (ages 54 to 74 today) in 2018 becoming the largest generation. The Millennial generation will continue to grow in the future due to the influx of young immigrants. Boomers, on the other hand, are reaching retirement age and their numbers are shrinking as the number of deaths among them exceeds the number of older immigrants arriving in the country. The Millennial population is expected to grow to 81 million persons by 2036 before leveling off.

The Millennial generation grew up one of the worst recessions in U.S. history at a time when they were just entering adulthood. As they graduated from high school and college, many could not find permanent work and wage levels were depressed. In addition, those graduating from college were often burdened with student debt. As a result, the Millennial generation views their jobs and lives in ways much different than other generations. They have delayed marriage and family formations, lived with relatives or roommates, and delayed purchasing a home. The multi-family rental market has benefited from the choices made by Millennials.

Baby Boomers Versus Millennials Ages 25 - 34		
	Baby Boomer In 1980	Millennials in 2015
Married	68%	40%
Separated/Divorced	12%	7%
Never Married	20%	53%
Live in Independent Households	84%	59%
Lived with Parents/Grandparents	9%	22%
Home Ownership	60%	43%

Source: Bowling Green State University; 1980 Decennial Census; 2015 American Community Survey

Some of the findings of various studies of the Millennial psyche are:

- Job flexibility – buying a home locks one into not changing jobs or relocating.
- Millennials are more frugal than other generations and want to get a good deal. The newest and the best is not always the favored purchase.
- They will live with parents to save money.
- They have a desire to own a home but worry about buying one that is overpriced. A recession is still a lingering worry and the potential impact on housing values.
- They would rather spend money on "experiences" rather than housing.
- Affordability and having a suitable down payment are holding some back from buying.

There are many reasons for the decline in homeownership among Millennials, much of which has been divulged in the media. Student debt, tight credit, high down payment requirements, lack of income, and a general distrust in the housing market are all cited as reasons for Millennials not purchasing homes.

In a number of surveys, nearly all Millennials indicate they want to own a home. However, the actual purchase of a home is expected in the future, with a majority saying it will be more than five years away. Once again, the impact of the Great Recession and housing bust is echoed in the survey findings. The delay in home buying is a function of:

- Completing education
- Achieving a steady income
- Increasing confidence in future home price growth
- An improving job market and economic outlook.

A recent Bankrate survey also illustrates some of the various life milestones that have been postponed due to individual financial situations, including the purchase of a home which is highest among those aged 18-29.



Milestones Postponed By Age Group			
Milestone	**18-29**	**30-49**	**50-64**
Buying a House	30%	27%	16%
Saving for Retirement	18%	21%	24%
Buying a Car	29%	24%	12%
Getting Married	19%	11%	7%
Having Children	14%	12%	9%
Not Delaying Anything	44%	47%	67%
Source: Bankrate Money Pulse Survey			

Consistent with other surveys, the National Association of Realtors reports that student loans and other debts such as credit cards and car loans are causing a delay in saving for a down payment on a home. This is especially true for the Millennial generation. Credit availability and lending standards have also contributed to the declines in homeownership. There was a severe decline in available mortgage credit following the housing crash that has been slow to recover.

Expenses that Delayed Saving for a Down Payment or Home Purchase by Age							
	All Buyers	**28 and Younger**	**29 to 38**	**39 to 53**	**54 to 63**	**64 to 72**	**73 to 93**
Saving for Downpayment was the Most Difficult Task in Buying Process:	13%	26%	24%	13%	4%	1%	1%
Debt that Delayed Saving:							
Student Loans	50%	61%	59%	36%	22%	8%	*
Credit Card Debt	37%	27%	27%	46%	53%	67%	20%
Car Loan	35%	43%	43%	32%	28%	*	*
Child Care Expenses	17%	7%	7%	21%	15%	*	*
Health Care Costs	13%	7%	7%	14%	23%	36%	20%
Other	17%	18%	18%	15%	27%	17%	80%
Median Year Delayed	**2**	**2**	**4**	**5**	**5**	**3**	**4**

Source: National Associatio of Realtors 2019

Overall, due to the size of the Millennial population that is still aging into the multi-family rental market, fundamentals appear strong for continued multi-family project development for the next decade.

For the near term, the next five to ten years, the multi-family market will be driven by both the under 34 age group and the over 60 age group. Younger households will continue to seek shelter and life experiences. They will likely choose their place of living depending on their income. Older households are expected to continue downsizing as a lifestyle choice, a portion of whom will decide to rent in a multi-family community.



3.0 Scottsdale Population and Employment Forecasts

The official population estimate from the Arizona Office of Economic Opportunity (OEO) for Scottsdale is 247,944 persons as of July 2020. Forecasts of population and employment growth for Scottsdale were prepared in 2020 by the Maricopa Association of Governments and are the latest available estimates of population and employment.

Scottsdale's population is expected to grow more slowly on a percentage basis over the next 30+ years than Maricopa County. This is partly due to a dwindling land supply as well as the cost of housing which is well above average in Scottsdale. Overall, Scottsdale is expected increase in population 62,800 persons total by 2055 from its 2020 population forecast. It is also expected to add nearly 55,600 new jobs to its employment base between 2020 and 2055. This equates to a capture rate by Scottsdale of 3.1% of County's forecasted population and 4.5% of the County's future jobs. By comparison, Maricopa County is expected in grow by 2.0 million persons and 1.2 million jobs by 2055.

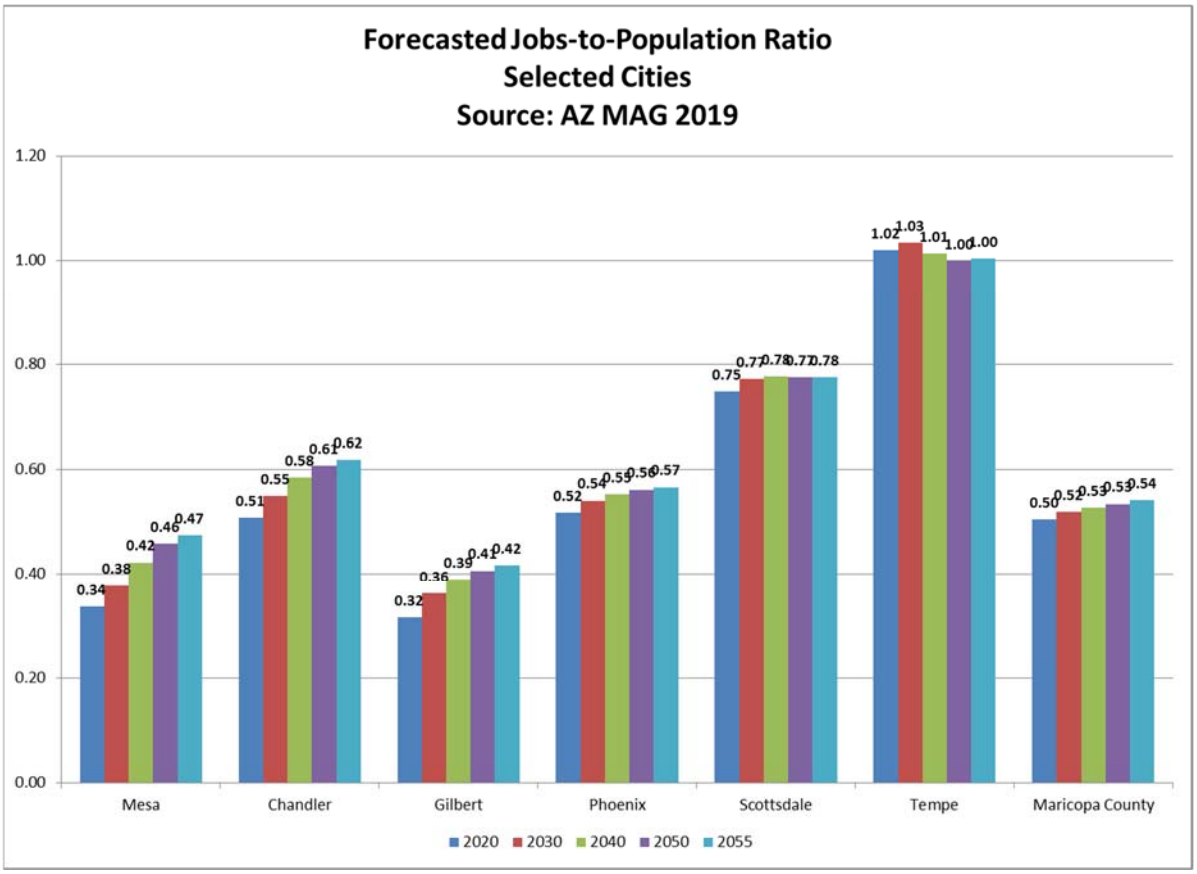
Population & Employment Forecasts
City of Scottsdale & Maricopa County

	2020	2030	2040	2050	2055	Change
Scottsdale						
Population	253,772	281,870	299,406	311,358	316,665	62,893
Average Annual Growth Rate		1.1%	0.6%	0.4%	0.3%	
Jobs	189,798	217,430	232,294	241,132	245,458	55,660
Average Annual Growth Rate		1.4%	0.7%	0.4%	0.4%	
Jobs/Population Ratio	0.75	0.77	0.78	0.77	0.78	
Maricopa County						
Population	4,436,900	5,107,700	5,712,000	6,196,000	6,414,100	1,977,200
Average Annual Growth Rate		1.4%	1.1%	0.8%	0.7%	
Jobs	2,236,400	2,648,000	3,004,300	3,307,900	3,467,700	1,231,300
Average Annual Growth Rate		1.7%	1.3%	1.0%	0.9%	
Jobs/Population Ratio	0.50	0.52	0.53	0.53	0.54	

Source: AZ MAG

An important consideration in analyzing forecasts is the jobs-to-population ratio for a municipality. A jobs-to-population ratio that is higher than the county average indicates that the community is a center of employment. Scottsdale's ratio is much higher than the county, standing at 0.73 in 2018 and expected to be within a range of 0.74 to 0.77 for the future. In comparison to other major cities in the Valley, Scottsdale is among the leaders in job growth and the jobs-to-population ratio.





As a result of its employment base, Scottsdale experiences an influx of workers each day commuting to the city. Employee commuting data prepared by the U.S. Census suggests that Scottsdale attracts workers from across the metro area. More than a third of Scottsdale workers commute from Phoenix with the remainder spread across the East and West Valleys.

Scottsdale Worker Commuting Patterns		
Community	**Workers**	**% of Total**
Scottsdale city, AZ	31,117	16.7%
Where Persons Live Who Work in Scottsdale		
Phoenix city, AZ	65,218	35.0%
Mesa city, AZ	15,881	8.5%
Chandler city, AZ	7,952	4.3%
Tempe city, AZ	7,388	4.0%
Gilbert town, AZ	7,331	3.9%
Glendale city, AZ	5,597	3.0%
Peoria city, AZ	5,042	2.7%
Surprise city, AZ	2,782	1.5%
Tucson city, AZ	2,628	1.4%
All Other Locations	35,329	19.0%
Totals	**186,265**	**100.0%**

Source: U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics

The following table outlines the strengths of the Scottsdale job market compared to Maricopa County averages. Highlighted are the employment clusters that make Scottsdale standout from other communities. Overall, Scottsdale's strengths are in Business Services, Consumer Services, Finance, Insurance & Real Estate, Health Care, Hospitality, and Media. Most of these clusters generate above average wages.

Employment Cluster Summary

Cluster	City of Scottsdale Employees	City of Scottsdale % of Total	Maricopa County Employees	Maricopa County % of Total
Business Services	25,640	16.8%	194,340	11.9%
Construction	9,050	5.9%	117,030	7.2%
Consumer Goods Manufacturing	1,400	0.9%	20,940	1.3%
Consumer Services	17,930	11.7%	182,780	11.2%
Education	5,730	3.7%	121,840	7.5%
Finance, Insurance, & Real Estate (FIRE)	21,680	14.2%	167,760	10.3%
Government, Social, & Advocacy Services	5,910	3.9%	129,290	7.9%
Health Care	20,300	13.3%	176,190	10.8%
High Tech Manufacturing & Development	6,560	4.3%	72,360	4.4%
Hospitality, Tourism, & Recreation	10,900	7.1%	65,090	4.0%
Media, Publishing, & Entertainment	1,560	1.0%	12,330	0.8%
Metal Inputs & Transportation-Related Manufacturing	790	0.5%	20,860	1.3%
Non-Metallic Manufacturing	1,440	0.9%	19,090	1.2%
Resource-Dependent Activities	760	0.5%	17,870	1.1%
Retail	16,720	10.9%	190,330	11.7%
Telecommunications	1,430	0.9%	20,540	1.3%
Transportation & Distribution	5,240	3.4%	104,280	6.4%
Totals	153,040	100.0%	1,632,920	100.0%

Source: MAG

A listing of the major private employers in Scottsdale illustrate the industry clusters of health care services, business services, and finance, insurance and real estate services.

Major Private Employers
City of Scottsdale

Business	Employees	Industry Cluster
HonorHealth	4,320	Health Care
Vanguard	4,070	Finance, Insurance, & Real Estate (FIRE)
General Dynamics C4 Systems Inc	3,000	Business Services
CVS Pharmacy Inc	2,280	Business Services
Nationwide Insurance	1,710	Finance, Insurance, & Real Estate (FIRE)
Mayo Clinic	1,700	Health Care
Yelp	1,300	Business Services
Favorite Healthcare Staffing Inc	910	Business Services
Go Daddy Software Inc	880	High Tech Manufacturing & Development
The Fairmont Scottsdale Princess	700	Hospitality, Tourism, & Recreation
The Hartford	700	Finance, Insurance, & Real Estate (FIRE)

Source: MAG

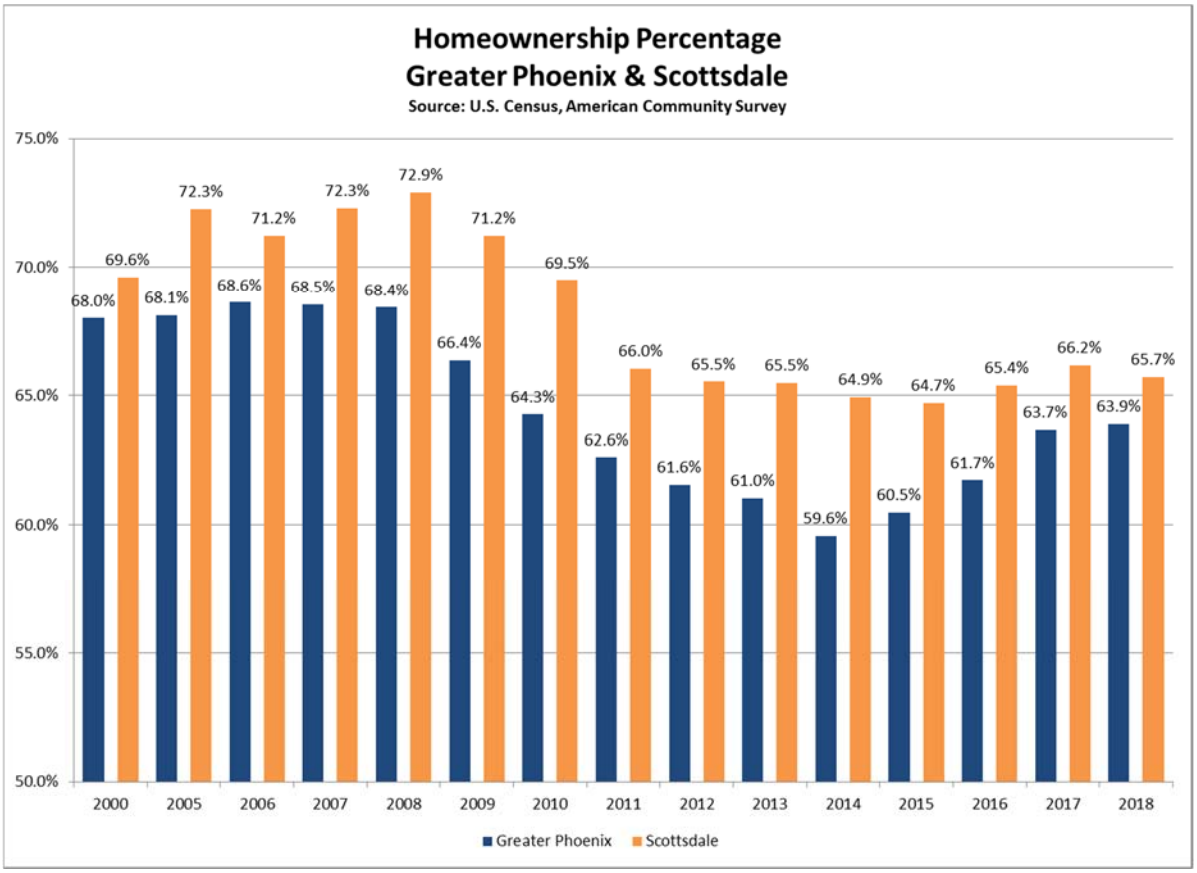
In summary, as an important hub of employment in the Greater Phoenix area, the demand for housing will continue to grow in Scottsdale. Based on the population forecasts from MAG, the demand for housing in Scottsdale will total more than 31,100 units over the next 30+ years. Most of that demand will occur in the next decade totaling 16,300 units. With a limited land resource, much of the development will likely take place:

- In southern Scottsdale where obsolete properties are being redeveloped and
- Along and near the Loop 101 where mixed-use employment and residential uses are planned.



4.0 Scottsdale Multi-family Market

Scottsdale's homeownership rate has historically always exceeded the rate for Greater Phoenix. During the housing boom of 2005 to 2007, homeownership in Scottsdale exceeded 70%. After the recession, homeownership declined to 65%, but was significantly above the Greater Phoenix average. The rate in Scottsdale remains above the 2015 level, reaching above 66% in 2017 and decreasing to 65.7%.



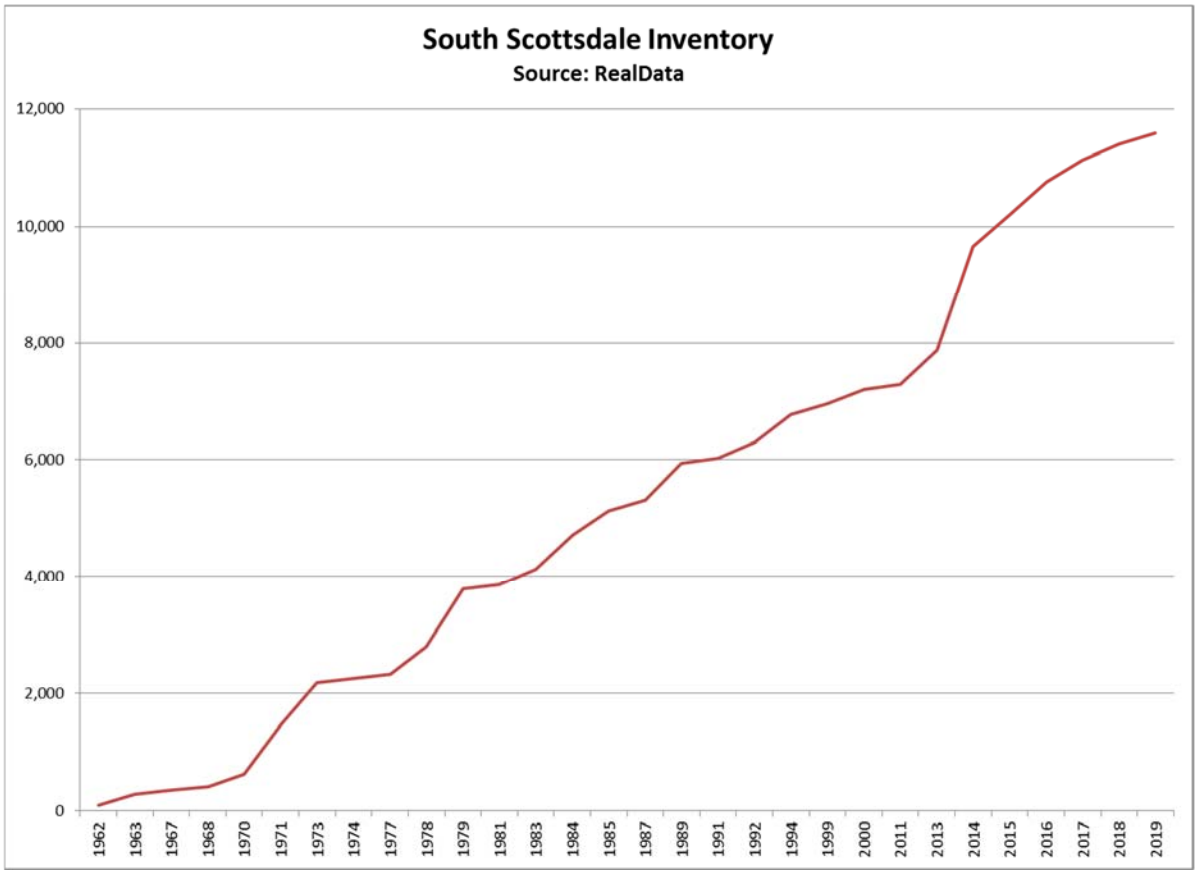
Scottsdale currently has 107 multi-family communities with approximately 26,137 units. During the real estate boom, Scottsdale experienced a significant number of condominium conversions. Scottsdale had the second highest number of conversions in the county, exceeded only by Phoenix. Between 2002 and 2007, the inventory of multi-family communities in Scottsdale declined by 6,400 units, primarily the result of condominium conversions. When the housing boom ended, some communities did revert to rentals, either in whole or in part, due to the decline in demand.

In comparison to the typical Maricopa County multi-family community, Scottsdale enjoys a lower vacancy rate and higher average rents. The current vacancy rate in Scottsdale stands at 5.0%, excluding communities that are in the lease-up stage. The average rent in Scottsdale is 33% higher than the average county rent.

Scottsdale & Maricopa County Apartment Markets 4th Quarter 2018					
	Units	Rent	Unit SF	Rent/SF	Vacancy Rate
Scottsdale					
Total Inventory	25,737	$1,395	940	$1.49	8.0%
Stablized Inventory	24,049	$1,355	939	$1.45	5.0%
Maricopa County	303,967	$1,037	839	$1.24	7.3%
Source: RealData					

4.1 South Scottsdale Sub-Market

The South Scottsdale multi-family sub-market is generally defined as south of Indian Bend Road. Within the South Scottsdale area are 52 multi-family communities with 11,583 units. The following chart plots the increase in the multi-family unit count from the 1960s to 2020 Much of the development in South Scottsdale occurred in the 1970s and 1980s, then leveled off through the 1990s. Multi-family development in the sub-market started again in 2014 along with construction activity throughout the entire City.





The current pipeline of planned and under construction multi-family communities shows that only one community in the South sub-market will be completed in 2020 with an additional three projects under construction. There are five communities under construction in the North sub-market near the Loop 101. Overall, Scottsdale's share of the county's under-construction projects is 21%.

The pipeline for planned multi-family communities in Scottsdale represents 24% of the county's planned 14,035 units. Two of the communities are in the North sub-market and two in the South, both on McDowell Road. The timing of development of these planned projects is not known at this time.

4.2 Scottsdale Housing Forecast

Scottsdale is forecasted to grow from a population of 247,944 persons in 2020 to 281,800 persons by 2030 or an increase of 33,800. This growth will require the addition of 16,900 new housing units between 2020 and 202030. Based on this historical homebuilding activity and the dwindling available land supply in the City, the multi-family market will likely continue to account for a portion of all units built in the future. The South Scottsdale sub-market will continue to capture its share of the City's future multi-family construction activity. To be sure, this is not an unusual phenomenon in the growth of a community. Most mature cities in the Valley are experiencing a similar mix of housing construction as available residential land becomes scarce.

While southern Scottsdale has captured a fair share of the county-wide multi-family market since 2010, construction activity has now expanded across the Valley, reducing the number of projects that are planned or under construction in Scottsdale and the Southeast Valley. The multi-family forecast for South Scottsdale is modest; forecasted construction activity is down significantly from the early part of this decade.

4.3 Summary of South Scottsdale Sub-Market Conditions

Scottsdale has one of the strongest multi-family markets in Maricopa County. Historically, the vacancy rate in Scottsdale has averaged two to three percentage points lower than the county vacancy rate and the average rent in Scottsdale is typically 25% higher than the average county rent. Today the difference in rents is 33%.

Scottsdale and the Southeast Valley have captured a large share of the multi-family market because of their employment base which includes high tech, aerospace, healthcare, and other high wage occupations. Scottsdale's target industries and top local firms as outlined by the City's Economic Development Department are:

- Advanced Business Services: Vanguard, Nationwide Insurance and APL Logistics
- Bio-Life Sciences: Mayo Clinic, Orion Health, Honor Health
- Hospitality: Troon Golf, Fairmount Scottsdale Princess, Westworld



- Technology: GoDaddy, JDA Software, PayPal, Yelp

The Scottsdale employment base has made the city an attractive destination for residents and visitors alike. A wide mix of housing is an important element of the City's economic development strategy. Between 2020 and 2030, approximately 16,900 housing units will need to be constructed in Scottsdale to provide housing for the forecasted population. A portion of those units will need to be multi-family units to provide housing for well-heeled Baby Boomers. Additionally, the successful younger generation will need transitional housing between starting a career and entering the homeownership market. The South Scottsdale sub-market is attractive to new startup companies that desire an urban, walkable environment. Many Baby Boomer and Millennial residents also desire a similar walkable environment that makes South Scottsdale unique from other Valley cities and a destination for tourists.

The current pipeline of multi-family communities in South Scottsdale is modest with only one community to be completed in 2020 and three more in the planning stages. The timing of those planned projects is unknown. Multi-family development activity in Scottsdale generally is expected to slow as developers seek out other locations for new projects, particularly in the West Valley which has had limited development activity until the last three years.

Overall, the South Scottsdale multi-family market is extremely healthy. Continued development of new units is anticipated to provide for the housing needs of new residents and employees as well as to further promote the desires of well-heeled Baby Boomers and successful Millennials for an urban, walkable lifestyle.



5.0 Economic and Fiscal Impact of Phase I of Gentry on the Green

This section of the report provides the economic and fiscal impacts of the construction and ongoing operations of the proposed multi-family mixed-use community proposed for 70th Street & McDowell Road in Scottsdale, Arizona. The project will have 260 residential units and approximately 7,000 square feet of non-residential uses.

The impact analysis focuses on the economic and fiscal impacts of the following:

1. Construction of the project.
2. Impact from community operations once construction is completed.
3. Impact from employees and residents once construction is completed.

Economic impact analysis examines the regional implications of an activity in terms of three basic measures: output, earnings, and job creation. Fiscal impact analysis evaluates the public revenues and costs created by a particular activity. In a fiscal impact analysis, the primary revenue sources of a city, county, or state government are analyzed to determine how the activity may financially affect them.

5.1 Project Assumptions & Methodology

The assumptions used to estimate the economic and fiscal impacts of the construction and operations of the proposed multi-family mixed-use community have been developed from a variety of sources. The development plan for the property was provided by Hawkins Companies Commercial Developers, which outlined the initial number of units, average size per unit, expected rents and occupancy.

As initially conceived, the community would contain 260 multi-family units averaging 861 square feet with rents of $2.00 per square foot. The estimated annual taxable spending of residents was calculated based on the U.S. Consumer Expenditure Survey using an average household income for complex residents of $68,900. Based on information from similar high-density projects, a typical household size of 1.4 persons per unit was used. All calculations assume a vacancy rate for the project of 5.5%.



Project Assumptions 70th & McDowell Multi-Family Community			
Construction		**Operations**	
Development Plan			
Units	260	Projected rents per square foot	$2.00
Average size (SF)	861	Stabilized vacancy	5.5%
Multi-family net square feet	220,000		
Total gross square feet	254,000	Limited property value / sf	$136
Office commercial square feet	5,000	Median Household Income	$68,900
Retail commercial square feet	1,000	Persons per household	1.4
Community room square feet	1,000	Per capita state shared revenue	$291
Construction Cost			
Total	$57,300,000		

Source: Hawkins Companies Commercial Developers; Elliott D. Pollack & Company

Economic Impact Methodology

Economic impact analysis examines the economic implications of an activity in terms of output, earnings, and employment. For this study, the analysis focuses on the jobs and corresponding output and wages that are created during construction as well as the jobs and output that are created through the operations of the complex and residential activity within the project.

The different types of economic impacts are known as direct, indirect, and induced, according to the manner in which the impacts are generated. For instance, direct employment consists of permanent jobs held by the project employees. Indirect employment is those jobs created by businesses that provide goods and services essential to the operation or construction of the project. These businesses range from manufacturers (who make goods) to wholesalers (who deliver goods) to janitorial firms (who clean the buildings). Finally, the spending of the wages and salaries of the direct and indirect employees on items such as food, housing, transportation and medical services creates induced employment in all sectors of the economy, throughout the local region. These secondary effects were captured in the analysis conducted in this study.

Multipliers have been developed to estimate the indirect and induced impacts of various direct economic activities. The Implan Group developed the multipliers used in this study. The economic impact is categorized into three types of impacts:

(1) Employment Impact – the total wage, salary and self-employed jobs in a region. Jobs include both part time and full-time workers, though the figure is expressed in full time equivalents.

(2) Earnings Impact – the personal income, earnings or wages, of the direct, indirect and induced employees. Earnings include total wage and salary payments as well as benefits of health and life insurance, retirement payments and any other non-cash compensation.



(3) Economic Output – the economic output relates to the gross receipts for goods or services generated by the project's operations.

Economic impacts are by their nature regional in character. The direct impact of job creation will be on-site in the City of Scottsdale while the ripple effects will be felt throughout the local region. All dollar figures, unless otherwise stated, are expressed in 2020 dollars.

Fiscal Impact Methodology

Fiscal impact analysis quantifies the public revenues associated with a particular economic activity. The primary revenue sources of local, county, and state governments (i.e. taxes) are analyzed to determine how an activity may affect the various jurisdictions. This report will evaluate the impact of the project on the City of Scottsdale.

Fiscal impact figures cited in this report have been generated from information provided by a variety of sources including the U.S. Bureau of the Census, the U.S. Department of Labor, the Internal Revenue Service, the City of Scottsdale, Maricopa County, the state of Arizona, the Arizona Tax Research Association, and the U.S. Consumer Expenditure Survey. Elliott D. Pollack and Company has relied upon Hawkins Companies Commercial Development for estimates of construction cost. Unless otherwise stated, all dollar values are expressed in 2020 dollars.

Fiscal impacts are categorized by type in this study, similar to the economic impact analysis. The major sources of revenue generation for governmental entities are related to construction of the project and ongoing impact from the operations and resident spending.

Construction impacts relate to the revenues generated from development of the project and include the state and local sales taxes levied on construction materials. In addition, the City of Scottsdale will benefit from the spending of construction workers within City limits.

Once the project is completed, the ongoing fiscal impacts of community will create revenue for the City. Revenues will be generated through sales tax, lease tax, property tax, and State shared revenue.

The following is a description of the applicable revenue sources that will be considered for this analysis.

- Construction Sales Tax
  The state, counties and cities in Arizona levy a sales tax on materials used in the construction of buildings and development of land improvements. That tax is calculated by state law under the assumption that 65% of the construction cost of the facility and its land improvements are related to construction materials with the remaining 35% devoted to labor. The sales tax rate is then applied to the 65% materials figure.



The sales tax on construction materials is a one-time collection by the governmental entity. Construction sales tax is generated during any new building construction. Scottsdale has a construction sales tax rate of 1.75%.

- Sales Tax on Fixtures, Furniture and Equipment (FF&E)
  The State and local cities charge a sales tax on FF&E purchased as part of the complex. The sales tax rate for the City of Scottsdale is 1.75%. This report has excluded an estimate for FF&E, so can be considered conservative.

- Sales Tax
  The state, counties, and incorporated cities and towns charge sales tax on retail goods and services. The sales tax rate for the City of Scottsdale is 1.75%. These tax rates are applied to the estimated taxable spending of the residents of the project. A 25% leakage rate was used for sales that will take place outside of the City limits.

- Residential Rental Tax
  Residential rents are also subject to tax at the local level. The City of Scottsdale levies a tax of 1.75% on monthly rent collections.

- Property Taxes
  Property taxes will be collected on each of the dwelling units. The taxable value for the complex was based on its construction cost and available comps for new apartments in the area. A limited property value of $136 per square foot is used for the property tax calculation. Dwelling units are considered residential property and assessed at a 10% rate. The City of Scottsdale property tax rate is currently $1.129 per $100 of assessed value. Special districts and school district tax collections are not included in the results of this study.

- State Shared Revenues
  Each county in Arizona receives a portion of State revenues from three different sources - state sales tax (described above), state income tax, vehicle license tax (VLT) and highway user revenue fund (HURF) tax. The formulas for allocating these revenues are primarily based on population.

  State Income Tax
  The State of Arizona collects taxes on personal income. The tax rate used in the analysis averages about 1.6% for earnings. These percentages are based on the most recently available income tax data from the State and the projected wage levels of jobs created by the construction and operations impact. This tax is applied to the wages and earnings of direct, indirect and induced employment. Portions of this tax are redistributed through revenue sharing to cities and towns throughout Arizona based on population.



HURF Taxes

The State of Arizona collects specific taxes for the Highway User Revenue Fund (HURF). Both the registration fees and the motor vehicle fuel tax (gas tax) are considered in this analysis. The motor vehicle fuel tax is $0.18 per gallon and is calculated based on a vehicle traveling 12,000 miles per year at 20 miles per gallon. Registration fees average $66 per employee in the State of Arizona. These factors are applied to the projected direct, indirect and induced employee count. Portions of these taxes are distributed to counties and cities throughout Arizona based on a formula that includes population and the origin of gasoline sales.

Vehicle License Tax

The vehicle license tax is a personal property tax placed on vehicles at the time of annual registration. This factor is applied to the projected direct, indirect and induced employee count. The average tax used in this analysis is $325 and portions of the total collections are distributed through the Highway User Revenue Fund. The remaining funds are shared between counties and cities in accordance with population-based formulas.

The above tax categories represent the largest sources of revenues that will be generated for the City of Scottsdale. This analysis considers gross tax collections and does not differentiate among dedicated purposes or uses of such gross tax collections.

5.2 Impact of Construction

This section of the report outlines the economic and fiscal impact of the construction of the proposed community. Construction phase impacts are generally short-term effects related to onsite and offsite construction employment and other supporting industries. The long-term consequences of a project are the operational phase impacts that are described in Section 5.3.

The total construction value of the project is estimated at $57.3 million. The economic impacts are expressed over the entire duration of the construction.

Economic Impact of Construction

The project would generate 215 direct person years of employment during the construction phase. Person years of employment are the aggregate of each construction job that is recreated year after year throughout the construction time period. To derive the respective annual averages, employment, wages, and economic output can be divided by the expected number of years it may take to complete the development. An estimated $65.2 million in direct wages would be generated based on the total construction activity.

Another 235 indirect and induced person years of employment would be created in the local economy. Wages for these indirect and induced employees would total about $12.9 million.



Altogether, the project would create approximately 449 jobs during the construction timeframe, $133.8 million in wages and nearly $395.8 million in economic activity.

Economic Impact of Construction
70th & McDowell Multi-Family Community
(2020 Dollars)

Impact Type	Person Years of Employment	Wages	Economic Output
Direct	215	$13,000,000	$45,860,000
Indirect	115	$6,800,000	$21,790,000
Induced	120	$6,100,000	$19,290,000
Total	**449**	**$25,900,000**	**$86,940,000**

1/ The total may not equal the sum of the impacts due to rounding. All dollar figures are in constant dollars. Inflation has not been included in these figures.

Source: Hawkins Companies Commercial Developers; Elliott D. Pollack & Company; IMPLAN

Fiscal Impact of Construction

The construction of the proposed community would create significant tax revenues for the City of Scottsdale as shown on the following table. Revenues have been defined in this analysis as either primary or secondary, depending on their source and how the dollars flow through the economy into city tax accounts. For instance, some revenues, such as construction sales taxes, are straightforward calculations based on the cost of construction. These revenues are described in this study as primary revenues.

Secondary revenues, on the other hand, flow from the wages of those direct, indirect and induced employees who are supported by the project. Revenue projections are based on typical wages of the employees working on the project, their spending patterns, and projections of where they might live.

Primary revenues generated to the city from the construction sales tax total $559,000. Other fees and taxes would also be collected such as building permit fees and impact fees, but are not included in this report. In addition, the city would benefit from the spending of construction workers within city limits. Sales tax collections for the city were estimated at an additional $26,300 for the entire construction period. Other secondary revenues include property taxes and State shared revenues. In total, the City of Scottsdale would expect to collect more nearly $617,900 in tax revenue from construction and construction-related activity.

Fiscal Impact of Construction
70th & McDowell Multi-Family Community
City of Scottsdale
(2020 Dollars)

Impact Type	Primary Revenues: Construction Sales Tax	Primary Revenues: FF&E Sales Tax	Secondary Revenues: Employee Spending Sales Tax	Secondary Revenues: Employee Property Tax	Secondary Revenues: State Shared Revenues	**Total Revenues**
Direct	$522,000	$37,000	$12,800	$11,500	$5,500	**$588,800**
Indirect	N/A	N/A	$6,800	$6,100	$1,600	**$14,500**
Induced	N/A	N/A	$6,700	$6,400	$1,500	**$14,600**
Total	**$522,000**	**$37,000**	**$26,300**	**$24,000**	**$8,600**	**$617,900**

1/ The figures are intended only as a general guideline as to how the City could be impacted by the project. The above figures are based on the current economic structure and tax rates of the State and City .

Source: Hawkins Companies Commercial Developers; Elliott D. Pollack & Co.; IMPLAN; ADOR; ATRA

5.3 Impact at Stabilized Operations

Once construction is completed, the impact of the operations and residents living at the proposed multi-family community would begin to produce jobs and tax revenue. The project would generate property taxes to the City of Scottsdale. The residents occupying the 260 dwelling units would also spend their disposable income within the local economy as well as increase the city's proportion of state shared revenue. Additionally, this spending will support a significant number of jobs locally.

Economic Impact of Operations & Resident Spending

- Community Operations Impact
  An estimated 6 direct employees would be employed at the 260-unit community. Taking into account the ripple effect of the regional multipliers, approximately 2 permanent direct, indirect, and induced jobs would be supported throughout the area as a result of the project. The majority of these jobs would be related to resident services, building services and maintenance. A total of $283,200 in annual wages would be created and $614,100 in annual economic output would be added to the regional economy.

- Office Operations Impact
  The 5,000 square feet of office space would accommodate 20 direct jobs with $1.2 million in wages. Including the ripple effect, the total impact would be 35 jobs, equating to $2.1 million in wages and $4.6 million in annual economic output.



- Retail Operations Impact
  The 1,000 square feet of office space would support 3 direct, indirect, and induced jobs, $125,300 in wages, and $298,600 in annual economic output.

- Resident Spending Impact
  Resident spending on retail goods, services, and entertainment would support 103 direct, indirect, and induced jobs, nearly $4.3 million in wages, and nearly $11.3 million in annual economic activity.

- TOTAL Impact
  In total, new residents are projected to spend $8.4 million annually on goods and services in the local economy. This, combined with direct multi-family and commercial operations, is enough to support 149 jobs, $6.8 million in wages, and $16.9 million in annual economic activity. The table below details the economic impact of operations as well as resident spending by category that is expected to occur on an annual basis.



Annual Economic Impact of Operations (at Buildout) 70th & McDowell Multi-Family Community Greater Phoenix (2020 Dollars)				
	Impact Type	**Jobs**	**Wages**	**Economic Output**
Multi-Family Operations	Direct	6	$179,200	$299,100
	Indirect	1	$37,000	$104,000
	Induced	1	$67,000	$211,000
	Total	**8**	**$283,200**	**$614,100**
Office Operations	Direct	20	$1,233,200	$2,134,300
	Indirect	6	$338,000	$945,000
	Induced	9	$488,000	$1,530,000
	Total	**35**	**$2,059,200**	**$4,609,300**
Retail Operations	Direct	3	$76,300	$140,600
	Indirect	0	$19,000	$65,000
	Induced	1	$30,000	$93,000
	Total	**3**	**$125,300**	**$298,600**
Employment Supported by SF Resident Spending	Direct	69	$2,507,500	$5,800,900
	Indirect	14	$771,000	$2,354,000
	Induced	20	$1,015,000	$3,191,000
	Total	**103**	**$4,293,500**	**$11,345,900**
GRAND TOTAL	Direct	98	$3,996,200	$8,374,900
	Indirect	21	$1,165,000	$3,468,000
	Induced	31	$1,600,000	$5,025,000
	Total Impact[1/]	**149**	**$6,761,200**	**$16,867,900**

1/ The total may not equal the sum of the impacts due to rounding. All dollar figures are in constant dollars. Inflation has not been included in these figures.

Source: Elliott D. Pollack & Company; IMPLAN

Fiscal Impact of Operations & Resident Spending

Once the project is completed and occupied to a stabilized level, the operations of the community and residents living onsite would produce tax revenue for the City of Scottsdale.

The following table shows the ongoing tax revenue that the City of Scottsdale would expect to collect from the complex as well as the spending of residents in the city. Sales tax collections on resident incomes are based on the estimated average household income of $68,900 and spending patterns outlined in the U.S. Consumer Expenditure Survey. While residents will likely spend the majority of their disposable incomes in the City of Scottsdale, they will also shop in neighboring cities. For this analysis, a 25% leakage rate was used for the capture of city sales tax revenue (i.e. 75% of spending will occur in Scottsdale).

In total, an estimated $328,300 would be collected each year by the City of Scottsdale. State shared revenues, residential rental tax and resident spending tax (including sales tax generated on-site) would be the largest revenue sources. Revenue would be collected through utility tax and property taxes.

Annual Primary Fiscal Impact of Operations (at Buildout)
70th & McDowell Multi-Family Community
City of Scottsdale
(2020 Dollars)

Residential Rental Tax	Resident Spending Sales Tax	Utility Tax	Property Tax	State Shared Revenues	**Total Annual Revenues**
$88,900	$88,800	$5,400	$45,000	$100,200	**$328,300**

1/ The total may not equal the sum of the impacts due to rounding. All dollar figures are in constant dollars. Inflation has not been included in these figures. All of the above figures are representative of the major revenue sources for the City. The figures are intended only as a general guideline as to how the City could be impacted by the project. The above figures are based on the current economic structure and tax rates of the City.

Source: Hawkins Companies Commercial Developers; Elliott D. Pollack & Co.; IMPLAN; ADOR; Arizona Tax Research Association

Secondary impacts from employee spending and other taxes would be an estimated $18,880 each year. This figure takes into account that only about 17% of employees will live and spend their disposable income within the City of Scottsdale.

Annual Secondary Revenues from Employment (at Buildout)
70th & McDowell Multi-Family Community
City of Scottsdale
(2020 Dollars)

	Employees Sales Tax	Residential Property Tax	State Shared Revenues	**Total Annual Revenues**
Direct	$5,040	$5,970	$1,090	**$12,100**
Indirect	$1,190	$1,260	$280	**$2,730**
Induced	$1,740	$1,910	$400	**$4,050**
Total Impact[1/]	**$7,970**	**$9,140**	**$1,770**	**$18,880**

1/ The total may not equal the sum of the impacts due to rounding. All dollar figures are in constant dollars. Inflation has not been included in these figures. All of the above figures are representative of the major revenue sources for the City. The figures are intended only as a general guideline as to how the City could be impacted by the project. The above figures are based on the current economic structure and tax rates of the City.

Source: Elliott D. Pollack & Company; IMPLAN; Arizona Department of Revenue; Arizona Tax Research Association

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