APPENDIX K
TRANSPORTATION ANALYSIS

Transportation Analysis
Retail at Northgate and Rosin Court
Prepared for
City of Sacramento

August 28, 2018

DKS

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INTRODUCTION

This transportation analysis addresses transportation and circulation conditions associated with the proposed retail development on the west side of Northgate Boulevard both north and south of Rosin Court. The analysis focuses on the project's relationship to the City street system, including nearby intersections, the proposed access points, and on-site circulation. The analysis includes consideration of motorized vehicle traffic impacts on roadway capacity, vehicle-miles travelled (VMT), construction impacts, and potential impacts to transit service, bicyclists, and pedestrians. Quantitative transportation analyses have been conducted for the following scenarios:

- Existing (2018)
- Existing Plus Project

PROJECT DESCRIPTION

As illustrated in Figure 1, the retail development is proposed for the west side of Northgate Boulevard, both north and south of Rosin Court. There is an existing McDonalds Restaurant on the southwest corner of Northgate Boulevard and Rosin Court. Figure 2 illustrates the conceptual site plan. Table 1 summarizes the characteristics of the proposed development on each parcel / lot for purposes of this transportation analysis.

The project proposes access to Northgate Boulevard and Rosin Court, as well as a new street system parallel to Northgate Boulevard.

- Access to / from Northgate Boulevard is proposed via a right-in / right-out driveway to Parcel 3, based upon information from the applicant.

- Access to from Northgate Boulevard is also proposed via A Street, to be located at the southern edge of the development. Access to Northgate Boulevard from A Street was assumed to be right-in / right-out in this analysis, as the current Northgate Boulevard cross-section at that location does not provide adequate room for a northbound left turn lane to A Street.

- Access from Rosin Court is proposed via a right-in driveway from westbound Rosin Court into Lot 6. No other movements were assumed at this location.

- A Street and B Street provide full access to each parcel / lot via several driveways shown in a conceptual manner.

ENVIRONMENTAL SETTING

The roadway, transit, bicycle, and pedestrian transportation systems within the study area are described below. Figure 1 illustrates the roadway system near the project site.

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Figure 1
Project Location

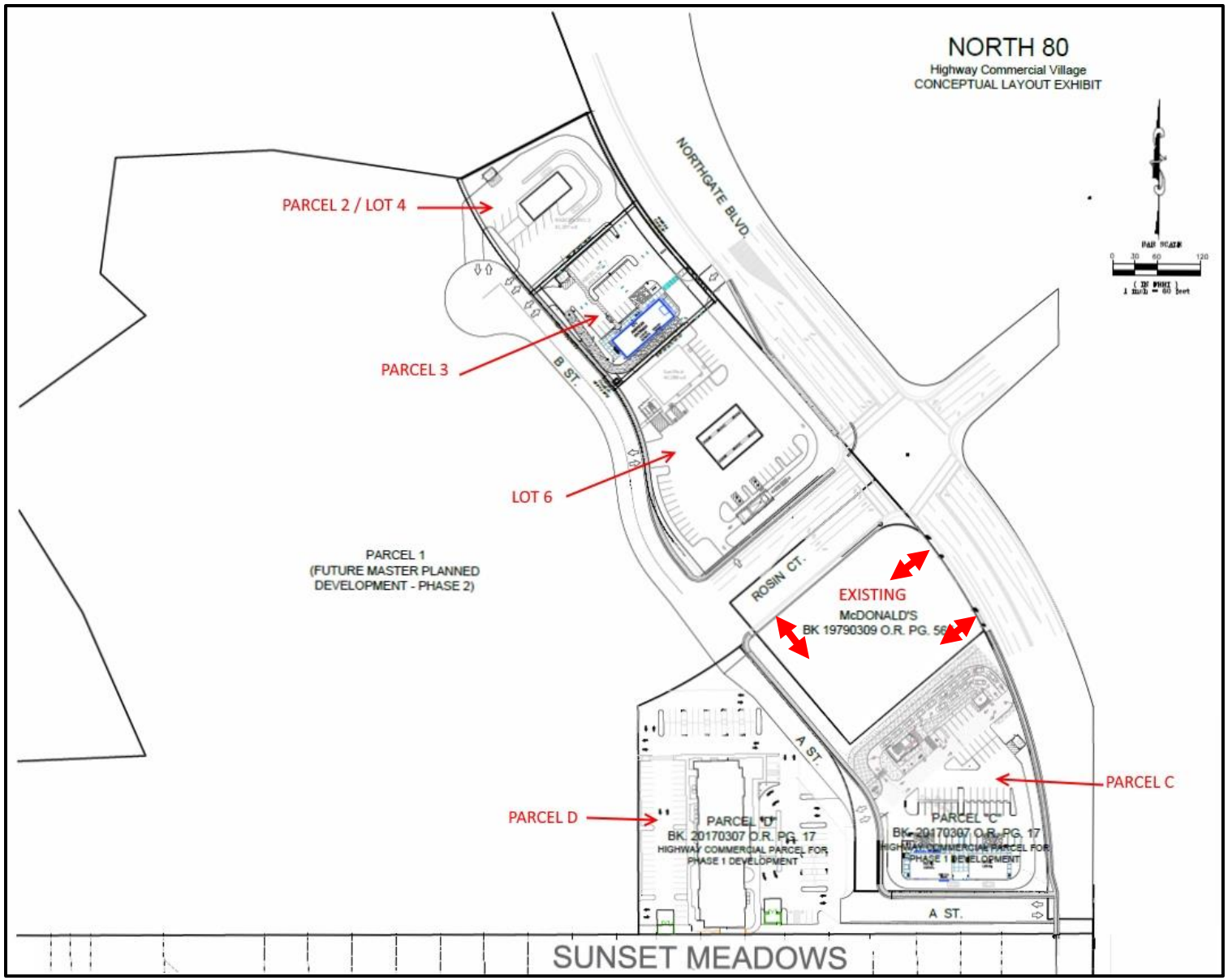


Figure 2
Conceptual Site Plan

TABLE 1 PROPOSED PROJECT			
Parcel / Lot	**Use**	**ITE Category**	**Size**
Parcel 2 / Lot 4	Starbucks	937 - Coffee/Donut Shop with Drive-Through Window	2,200 s.f.
	Retail	820 - Shopping Center	1,800 s.f.
Parcel 3	KFC	934 - Fast Food Restaurant with Drive-Through Window	3,133 s.f.
Lot 6	Chevron	945 - Gasoline/Service Station with Convenience Market	12 fueling positions
Parcel D	Hotel	310 - Hotel	135 rooms (assumed based upon building footprint)
Parcel C	Southwest Corner	934 - Fast Food Restaurant with Drive-Through Window	2,000 s.f.
	Southeast Corner	820 - Shopping Center	1,800 s.f.
	North	935 - Fast Food Restaurant with Drive-Through Window and No Indoor Seating	817 s.f.
***Source**: DKS Associates, 2018, based upon "Conceptual Layout Exhibit", Peabody Engineering, April 13, 2018.*			

ROADWAY SYSTEM

Interstate Route 80 (**I-80**) is an east-west freeway located immediately north of the site. To the west, I-80 provides access to I-5, West Sacramento, the City of Davis, and the San Francisco Bay Area. To the east, I-80 provides access to northern portions of Sacramento County, and extends to Placer County and the state of Nevada.

Primary access to the site is provided via **Northgate Boulevard**. Northgate Boulevard is designated as a four-lane arterial in the City's General Plan. Near the site, Northgate Boulevard has two through travel lanes in each direction. The four-lane segment extends from Arden Garden Connector to the south to Del Paso Road to the north. To the south, Northgate Boulevard extends to SR 160, providing access to the Central City. Northgate Boulevard has a full interchange with I-80.

Rosin Court is a local street providing access to adjacent commercial uses. It has one through travel lane in each direction, with additional widening at the signalized intersection with Northgate Boulevard. To the east of Northgate Boulevard, it extends about 0.3 miles to a cul-de-sac at I-80. To the west of Northgate Boulevard, it extends less than one-tenth of a mile to a dead end. It is

anticipated that the roadway will be extended to the west upon development beyond that considered in this analysis.

Turnstone Drive is a local residential two-lane street that extends west from Northgate Boulevard. At its intersection with Northgate Boulevard, the east leg is a driveway that serves local office and commercial uses. Turnstone Drive has an unsignalized intersection with Northgate Boulevard, with stop sign control on the east and west legs.

PEDESTRIAN SYSTEM

Near the project site, the pedestrian infrastructure is incomplete.

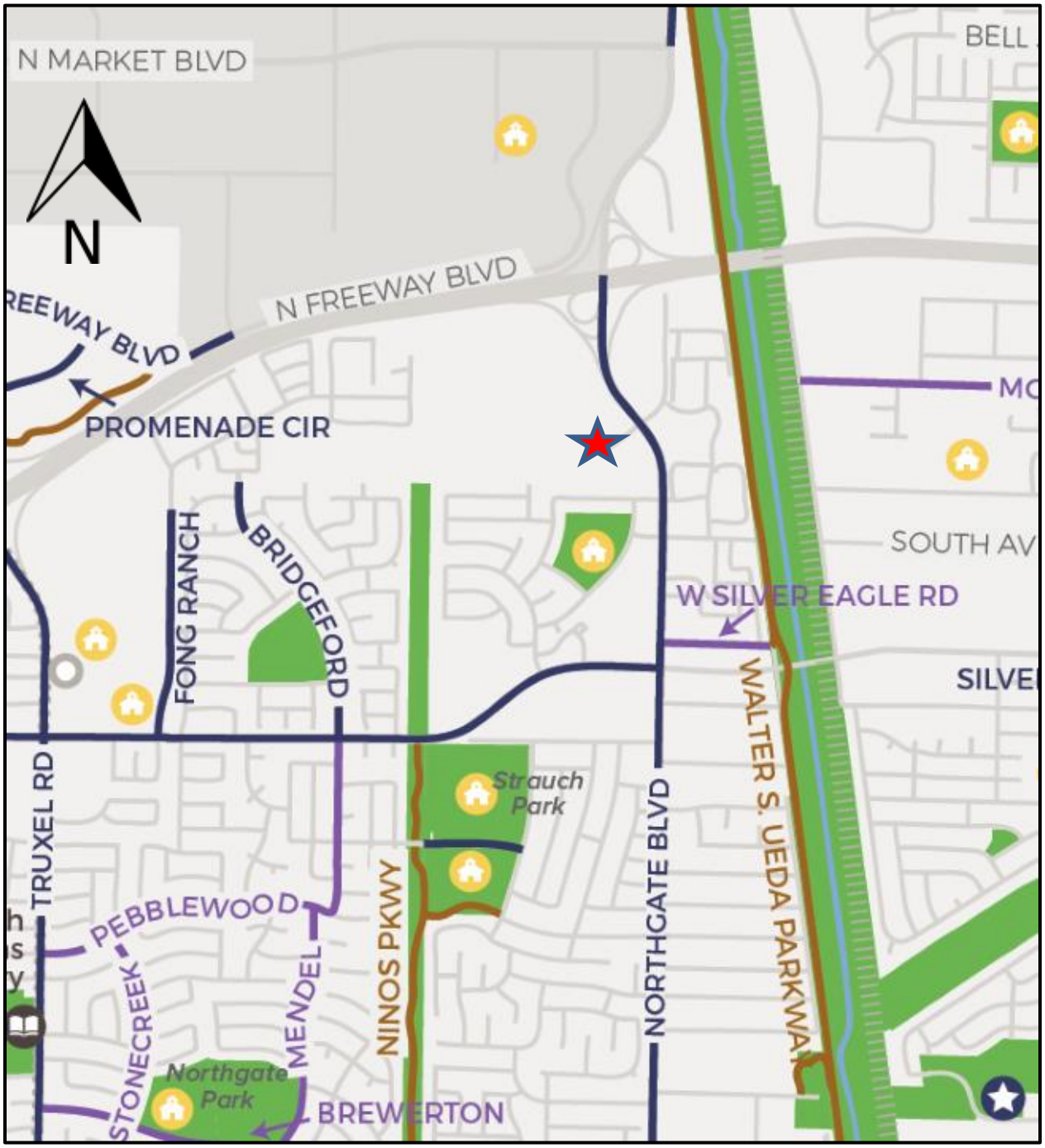
- On Rosin Court east of Northgate Boulevard, there are continuous sidewalks on both sides of the street.
- On Rosin Court west of Northgate Boulevard, there are sidewalks on the south side adjacent to the McDonalds restaurant.
- On the east side of Northgate Boulevard north of Rosin Court, sidewalks extend from Rosin Court for about 400 feet, terminating before I-80.
- On the west side of Northgate Boulevard north of Rosin Court, sidewalks begin about 150 feet north of Rosin Court and extend for about 475 feet, terminating at the I-80 eastbound slip ramp.
- On Northgate Boulevard south of Rosin Court, sidewalks exist along both sides of the arterial, providing access to commercial and residential areas.
- Crosswalks with pedestrian signal heads are provided on all four legs of the Northgate Boulevard intersection with Rosin Court.

EXISTING BICYCLE SYSTEM

Figure 3 illustrates the existing bicycle system in the site vicinity.

Existing on-street bikeways near the site exist on Northgate Boulevard from Rosin Court south to Arden Garden Connector. Bikeways on Northgate Boulevard are incomplete from Rosin Court north to North Market Boulevard. North of North Market Boulevard, on-street bikeways are provided north to Del Paso Road.

An existing off-street bikeway is located just east of the project site. The Natomas East Main Drain Bikeway is a north-south off-street facility that extends from the American River Parkway to the south to Sotnip Road to the north. Local site access is provided via an access point at the northeast end of Rosin Court.



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Source: City of Sacramento Bikeway User Map, Released 2016.

Figure 3
Bikeways

TRANSIT SYSTEM

Regional Transit (RT) service in the site vicinity is illustrated in Figure 4.

Route 13 (Northgate) operates on Northgate Boulevard adjacent to the project site. This route extends from the Arden / Del Paso Light Rail Station to the south to North Natomas to the northwest. This route operates at one-hour headways from approximately 6:00 a.m. to 9:00 p.m., Monday through Friday. There is no weekend or holiday service. Bus stops are located along both sides of Northgate Boulevard just south of Rosin Court.

STUDY AREA

The following intersections (existing and proposed) are included in the study area (see Figure 5):

1. Northgate Boulevard & Rosin Court
2. Northgate Boulevard & McDonalds North Driveway
3. Northgate Boulevard & McDonalds South Driveway
4. Northgate Boulevard & Turnstone Drive
5. McDonalds West Driveway & Rosin Court
6. Northgate Boulevard & I-80 Eastbound Ramps
7. Northgate Boulevard & I-80 Westbound Ramps
8. Northgate Boulevard & Parcel 3 Driveway (proposed)
9. Northgate Boulevard & A Street (proposed)
10. Lot 6 Driveway & Rosin Court (proposed)
11. A Street / B Street & Rosin Court (proposed)

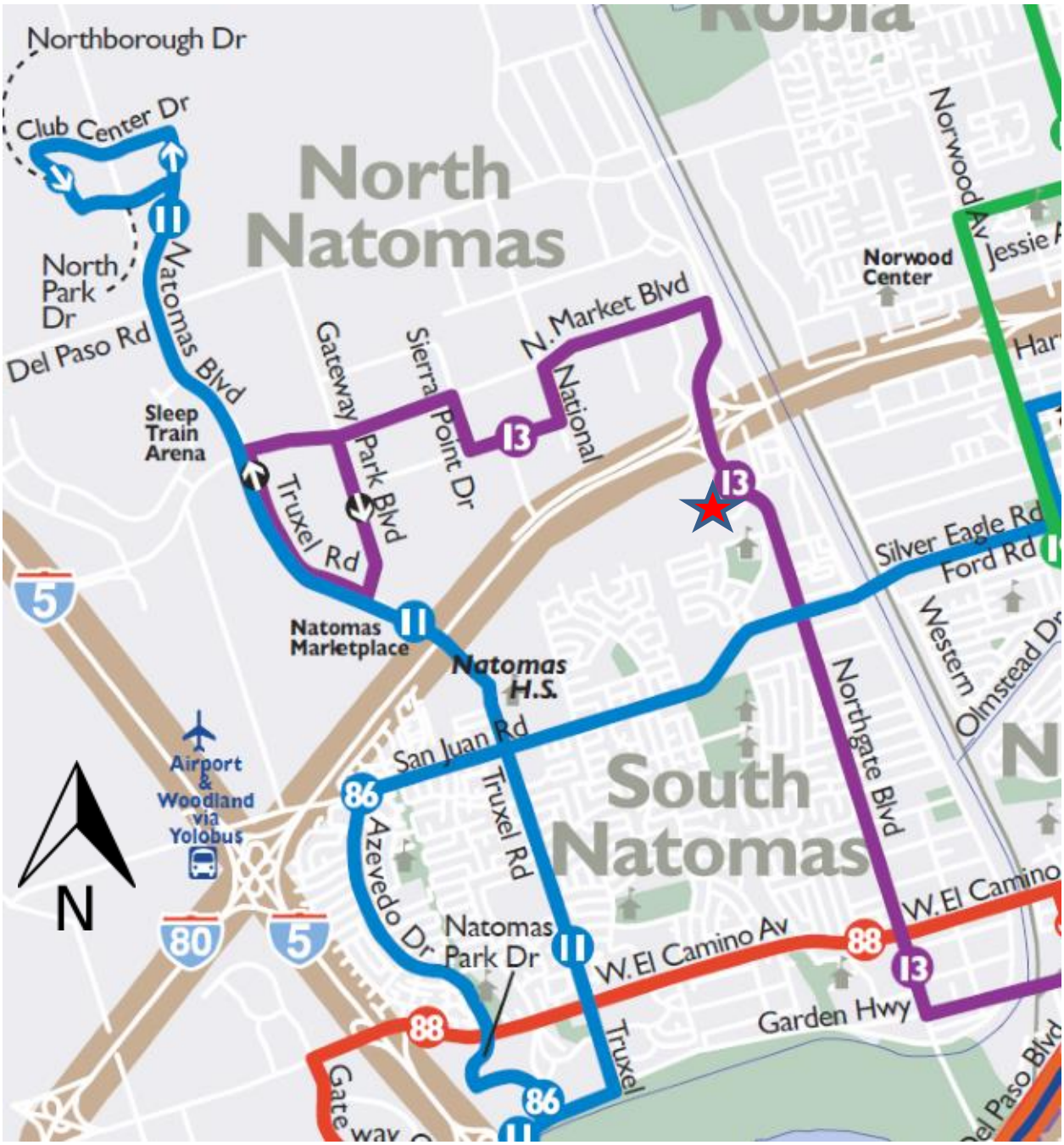
EXISTING INTERSECTION GEOMETRY

Existing intersection geometry (number of approach lanes and traffic control) is illustrated in Figure 6.

EXISTING TRAFFIC VOLUMES

Peak period intersection turning movement counts were conducted for the a.m. weekday peak period (7:00 to 9:00 a.m.) and the p.m. weekday peak period (4:00 to 6:00 p.m.) on Thursday, May 17, 2018 for intersections 1 through 5. Intersections 6 and 7 were counted on Thursday, February 8, 2018.

Figure 6 illustrates the peak hour traffic volumes. Detailed traffic count data is included in the technical appendix.



Source: Sacramento Regional Transit System Map, accessed August 28, 2018.

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Figure 4
Regional Transit Services

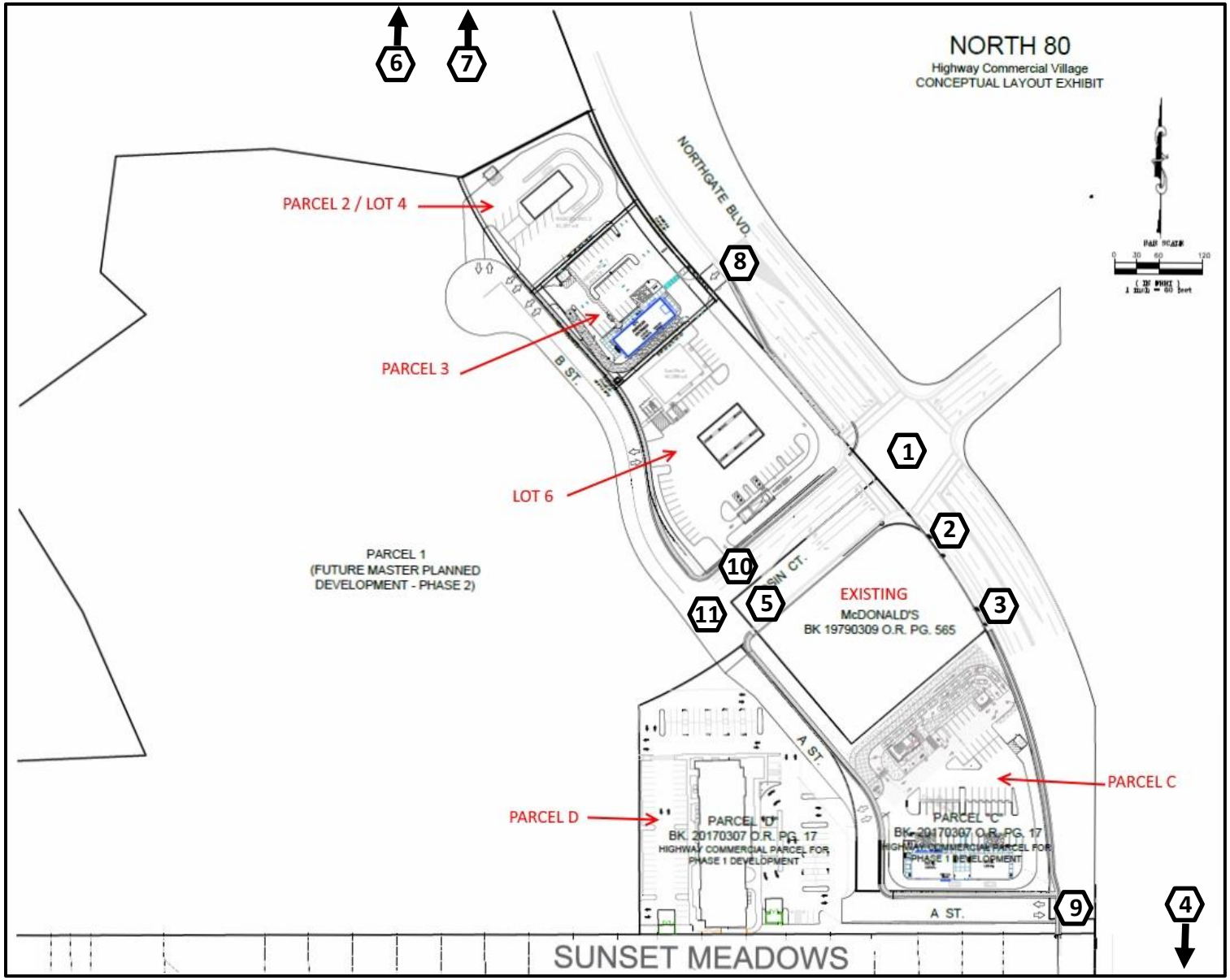

Figure 5
Study Area Intersections

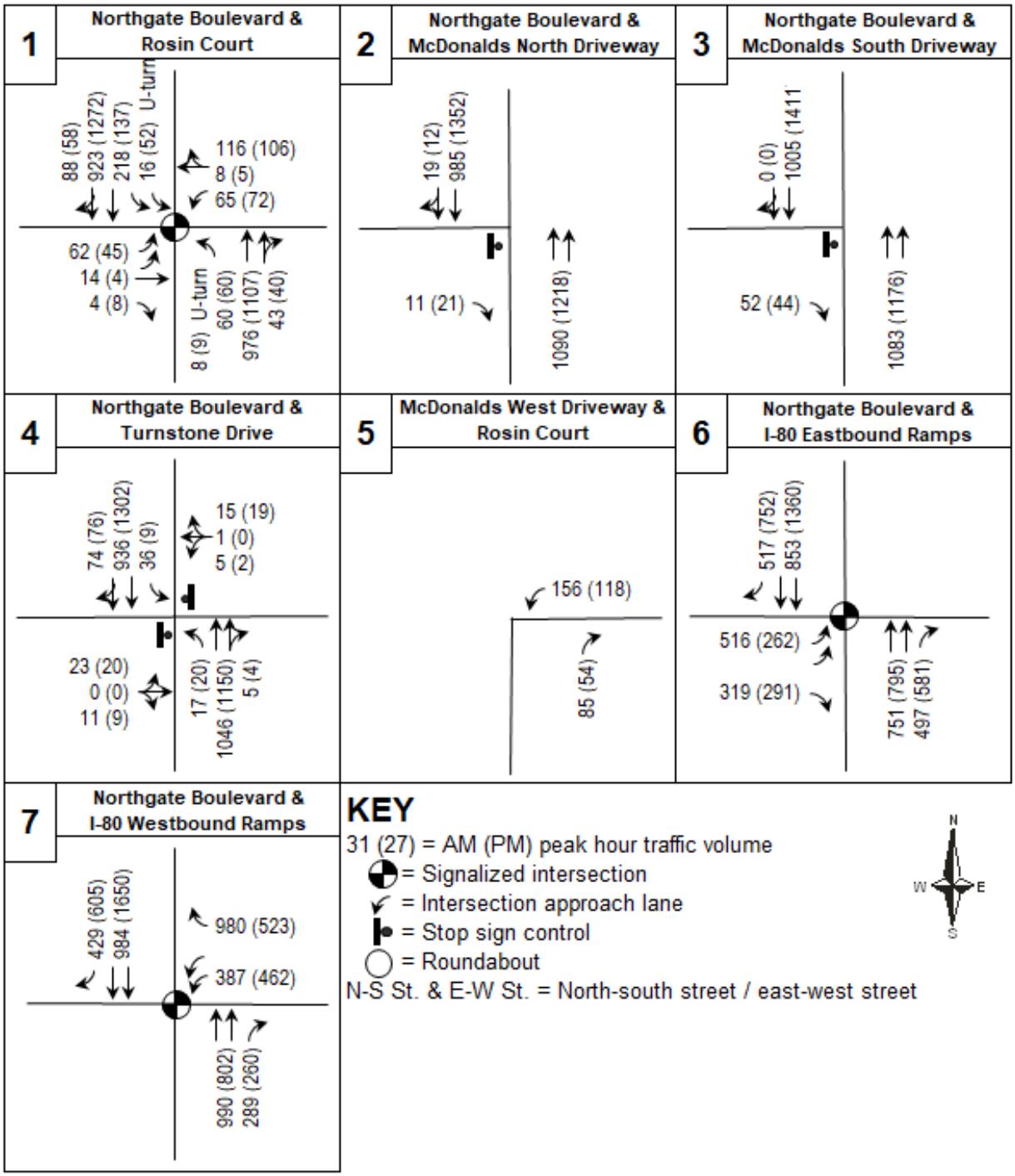

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Figure 6
Existing Peak Hour Traffic Volumes and Geometry

EXISTING TRAVEL SPEEDS

On Thursday, May 17, 2018, radar speed studies were conducted between 1:00 and 2:00 p.m. on Northgate Boulevard at the I-80 eastbound ramp merge. The purpose of the data collection was to determine the free-flow travel speed on Northgate Boulevard at the northern edge of the site. Table 2 summarizes the data. Detailed data is included in the technical appendix.

TABLE 2
SPEED SURVEY
NORTHGATE BOULEVARD AT I-80 EASTBOUND RAMP MERGE

Item	Northbound	Southbound
Number of Vehicles	101	100
Range of Speeds (mph)	31 to 47 mph	25 to 50 mph
50th percentile (mph)	39 mph	38 mph
85th percentile (mph)	42 mph	41 mph
10 mph pace	34 to 43 mph	33 to 42 mph
Number / percent in pace	90 / 89 percent	78 / 78 percent
Number / percent below pace	4 / 3 percent	11 / 11 percent
Number / percent above pace	7 / 7 percent	11 / 11 percent
***Source**: NDS, May 17, 2018.*		

EXISTING INTERSECTION QUEUING

Queuing studies were undertaken on the southbound Northgate Boulevard approach to Rosin Court to determine the extent of queuing. Queues were recorded separately for the left turn lanes and the through / right turn lanes. This data was collected during the a.m. weekday peak period (7:00 to 9:00 a.m.) and the p.m. weekday peak period (4:00 to 6:00 p.m.) on Thursday, May 17, 2018. Table 3 summarizes the data. Detailed data is included in the technical appendix.

TABLE 3
MAXIMUM OBSERVED QUEUE LENGTHS (FEET)
NORTHGATE BOULEVARD SOUTHBOUND APPROACH TO ROSIN COURT

Lanes	AM Peak Period	PM Peak Period
Through / Right Turn Lanes	536 feet (7:45 to 8:00 a.m.)	707 feet (5:00 to 5:15 p.m.)
Left Turn Lanes	233 feet (8:00 to 8:15 a.m.)	165 feet (4:15 to 4:30 p.m.)
***Source**: NDS, May 17, 2018.*		

REGULATORY SETTING

City of Sacramento

The Mobility Element of the *Sacramento 2035 General Plan* outlines goals and policies that coordinate the transportation and circulation system with planned land uses. The following level of service policy has been used in this study, as amended on January 23, 2018:

> **Policy M 1.2.2 Level of Service (LOS) Standard.** The City shall implement a flexible context sensitive Level of Service (LOS) standard, and will measure traffic operations against the vehicle LOS thresholds established in this policy. The City will measure Vehicle LOS based on the methodology contained in the latest version of the Highway Capacity Manual (HCM) published by the Transportation Research Board. The City's specific vehicle LOS thresholds have been defined based on community values with respect to modal priorities, land use context, economic development, and environmental resources and constraints. As such, the City has established variable LOS thresholds appropriate for the unique characteristics of the City's diverse neighborhoods and communities. The City will strive to operate the roadway network at LOS D or better for vehicles during typical weekday conditions, including AM and PM peak hour with the following exceptions described below and mapped on Figure M-1:
>
> A. Core Area (Central City Community Plan Area) - LOS F allowed
> B. Priority Investment Areas – LOS F allowed
> C. LOS E Roadways - LOS E is allowed for the following roadways because expansion of the roadways would cause undesirable impacts or conflict with other community values.
>
> - 65th Street: Elvas Avenue to 14th Avenue
> - Arden Way: Royal Oaks Drive to I-80 Business
> - Broadway: Stockton Boulevard to 65th Street
> - College Town Drive: Hornet Drive to La Rivera Drive
> - El Camino Avenue: I-80 Business to Howe Avenue
> - Elder Creek Road: Stockton Boulevard to Florin Perkins Road
> - Elder Creek Road: South Watt Avenue to Hedge Avenue
> - Fruitridge Road: Franklin Boulevard to SR 99
> - Fruitridge Road: SR 99 to 44th Street
> - Howe Avenue: El Camino Avenue to Auburn Boulevard
> - Sutterville Road: Riverside Boulevard to Freeport Boulevard
>
> LOS E is also allowed on all roadway segments and associated intersections located within 1/2 mile walking distance of light rail stations.
>
> D. Other LOS F Roadways - LOS F is allowed for the following roadways because expansion of the roadways would cause undesirable impacts or conflict with other community values.

- 47th Avenue: State Route 99 to Stockton Boulevard
- Arcade Boulevard: Marysville Boulevard to Roseville Road
- Carlson Drive: Moddison Avenue to H Street
- Duckhorn Drive: Arena Boulevard to San Juan Road
- El Camino Avenue: Grove Avenue to Del Paso Boulevard
- Elvas Avenue: J Street to Folsom Boulevard
- Elvas Avenue/56th Street: 52nd Street to H Street
- Florin Road: Havenside Drive to Interstate 5
- Florin Road: Freeport Boulevard to Franklin Boulevard
- Florin Road: Interstate 5 to Freeport Boulevard
- Folsom Boulevard: 47th Street to 65th Street
- Folsom Boulevard: Howe Avenue to Jackson Highway
- Folsom Boulevard: US 50 to Howe Avenue
- Freeport Boulevard: Sutterville Road (North) to Sutterville Road (South)
- Freeport Boulevard: 21st Street to Sutterville Road (North)
- Freeport Boulevard: Broadway to 21st Street
- Garden Highway: Truxel Road to Northgate Boulevard
- H Street: Alhambra Boulevard to 45th Street
- H Street 45th: Street to Carlson Drive
- Hornet Drive: US 50 Westbound On-ramp to Folsom Boulevard
- Howe Avenue: US 50 to Fair Oaks Boulevard
- Howe Avenue: US 50 to 14th Avenue
- Raley Boulevard: Bell Avenue to Interstate 80
- San Juan Road: Duckhorn Drive to Truxel Road
- South Watt Avenue: US 50 to Kiefer Boulevard
- West El Camino Avenue: Northgate Boulevard to Grove Avenue

E. If maintaining the above LOS standards would, in the City's judgment be infeasible and/or conflict with the achievement of other goals, LOS E or F conditions may be accepted provided that provisions are made to improve the overall system, promote non-vehicular transportation, and/or implement vehicle trip reduction measures as part of a development project or a city-initiated project. Additionally, the City shall not expand the physical capacity of the planned roadway network to accommodate a project beyond that identified in Figure M4 and M4a (2035 General Plan Roadway Classification and Lanes).

LEVEL OF SERVICE ANALYSIS AND METHODOLOGY

Field reconnaissance was undertaken to ascertain the traffic control characteristics of each of the study area intersections and roadway segments. Determination of roadway operating conditions is based upon comparison of known or projected traffic volumes during peak hours to roadway capacity. In an urban setting, roadway capacity is generally governed by intersection characteristics, and intersection delay is used to determine "levels of service." Levels of service (LOS) describe roadway operating conditions. LOS is a qualitative measure of the effect of several factors, including speed and travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience, delay, and operating costs. LOS are designated A through F from best to worst, which cover the entire range of traffic operations that might occur. LOS A through E generally represent traffic volumes at less than roadway capacity, while LOS F represents over capacity and/or forced flow conditions.

Based upon the City's level of service policy, LOS D was utilized as the appropriate criteria in all study analyses.

Intersection Analysis

Intersection analyses were conducted using a methodology outlined in the Transportation Research Board's Special Report 209, Highway Capacity Manual 2010 (HCM 2010) (TRB 2010). The methodology utilized is known as "operational analysis." This procedure calculates an average control delay per vehicle at an intersection and assigns a level of service designation based upon the delay. Table 4 presents the level of service criteria for intersections in accordance with the HCM 2010 methodology. In accordance with City of Sacramento policy, at unsignalized intersection, the intersection average delay / LOS is used to determine conformity with City policies.

TABLE 4
INTERSECTION LEVEL OF SERVICE CRITERIA

Level of Service (LOS)	Total Delay Per Vehicle (seconds)	
	Signalized	Unsignalized
A	$\leq$ 10	$\leq$ 10
B	> 10 and $\leq$ 20	> 10 and $\leq$ 15
C	> 20 and $\leq$ 35	> 15 and $\leq$ 25
D	> 35 and $\leq$ 55	> 25 and $\leq$ 35
E	> 55 and $\leq$ 80	> 35 and $\leq$ 50
F	> 80	> 50

Source: *Highway Capacity Manual 2010, Transportation Research Board.*

RESULTS OF EXISTING CONDITIONS ANALYSIS

Table 5 summarizes the existing a.m. and p.m. peak hour operating conditions at the study area intersections. All but one of the intersections operate at an acceptable LOS D or better. At intersection 1, the intersection operates at LOS E during the p.m. peak hour.

TABLE 5
EXISTING INTERSECTION OPERATING CONDITIONS

Intersection	A.M. Peak Hour		P.M. Peak Hour	
	Delay (Seconds)	LOS	Delay (Seconds)	LOS
1. Northgate Boulevard & Rosin Court	48.3	D	55.8	E
2. Northgate Boulevard & McDonalds North Driveway	0.1	A	0.1	A
- Eastbound Right	*10.3*	*B*	*14.7*	*B*
3. Northgate Boulevard & McDonalds South Driveway	0.3	A	0.3	A
- Eastbound Right	12.8	B	15.8	C
4. Northgate Boulevard & Turnstone Drive	1.6	A	2.1	A
- Northbound Left Turn	*10.4*	*B*	*12.6*	*B*
- Southbound Left Turn	*10.9*	*B*	*11.8*	*B*
- Eastbound	*65.5*	*F*	*164.8*	*F*
- Westbound	*30.3*	*D*	*21.5*	*C*
5. McDonalds West Driveway & Rosin Court	No control delay			
6. Northgate Boulevard & I-80 Eastbound Ramps	8.8	A	6.4	A
7. Northgate Boulevard & I-80 Westbound Ramps	8.3	A	10.8	B

Source: *DKS Associates, 2018.*

PROJECT TRAVEL CHARACTERISTICS

TRIP GENERATION

Vehicular trip generation estimates of the project are based upon data collected at the site as well as information published by the Institute of Transportation Engineers (ITE). Specifically, the following ITE sources have been utilized:

- Trip Generation, Tenth Edition.

- Trip Generation Handbook, Second Edition.
- Trip Generation Handbook, Third Edition.

Project Trip Generation Estimation Methodology

The methodology to estimate vehicular trip generation is based on the following process:

1. For each project component, identify the appropriate ITE land use category and estimate the number of trips.

2. Calculate the internal trip capture between land uses associated with the project. Internal trip capture is the portion of trips generated by a mixed-use development that both begin and end within the development. For example, a trip that stops at both a retail use and a restaurant on the site. Note that internal trip capture is calculated separately for projects north and south of Rosin Court. Trips between project components that access either Northgate Boulevard or Rosin Court are not considered to be internal trips. Similarly, there are no internal trips to or from the existing McDonalds Restaurant because all access to McDonalds utilizes Northgate Boulevard and / or Rosin Court. These "non-internal" trips between adjacent parcels will be addressed with the trip distribution estimates in the traffic analysis.

3. Calculate the number pass-by-trips. Pass-by trips are trips already on the adjacent roadway network that stop at a project land use as an intermediate destination. Pass-by trips are primarily associated with retail / service land use categories. Examples of pass-by trips are a home to restaurant to work linked trip, or a work to gas station to home linked trip.

Vehicular trips have been estimated for the a.m. peak weekday commuter hour, p.m. peak weekday commuter hour, and weekday (daily) time periods. For conservatism in the analysis, no adjustments have been made for walk, bicycle, and / or transit access.

Individual Component Trip Generation

Table 6 summarizes the daily, a.m. peak hour, and p.m. peak hour trip generation of each project component.

Internal Trip Calculations

Internal trips were calculated in a two-step process:

1. In the first step, the number of internal trips between adjacent retail uses was estimated (Parcel 2 / Lot 4 Retail and Chevron). The reduced number of external retail trips was then used in step 2.

2. In the second step, the number of internal trips were estimated between the retail uses, restaurant uses, and hotel separately for the parcels north and south of Rosin Court.

TABLE 6
INDIVIDUAL PROJECT COMPONENT VEHICULAR TRIP GENERATION ESTIMATES

Parcel / Lot	Use	ITE Category	Size	Gross[1] Vehicle Trips Generated (Trip-Ends)						
				Weekday	AM Peak Hour			PM Peak Hour		
					Enter	Exit	Total	Enter	Exit	Total
North of Rosin Court										
Parcel 2 / Lot 4	Starbucks	937 - Coffee/Donut Shop with Drive-Through Window	2,200 s.f.	1,805	100	96	196	47	48	95
	Retail	820 – Shopping Center	1,800 s.f.	391	95	58	153	13	15	28
Parcel 3	KFC	934 - Fast Food Restaurant with Drive-Through Window	3,133 s.f.	1,474	64	62	126	53	49	102
Lot 6	Chevron	945 - Gasoline/Service Station with Convenience Market	12 fueling positions	2,061	67	64	131	86	82	168
Subtotal – North of Rosin Court				*5,731*	*326*	*280*	*606*	*199*	*194*	*393*

TABLE 6
INDIVIDUAL PROJECT COMPONENT VEHICULAR TRIP GENERATION ESTIMATES

Parcel / Lot	Use	ITE Category	Size	Gross[1] Vehicle Trips Generated (Trip-Ends)						
				Weekday	AM Peak Hour			PM Peak Hour		
					Enter	Exit	Total	Enter	Exit	Total
Parcel D	Hotel	310 – Hotel	135 rooms	1,097	37	25	62	38	37	75
Parcel C	Southwest Corner	934 - Fast Food Restaurant with Drive-Through Window	2,000 s.f.	942	41	39	80	34	31	65
	Southeast Corner	820 - Shopping Center	1,800 s.f.	391	95	58	153	13	15	28
	North	935 - Fast Food Restaurant with Drive-Through Window and No Indoor Seating	817 s.f.	377	13	15	28	18	17	35
Subtotal – South of Rosin Court				*2,807*	*186*	*137*	*323*	*103*	*100*	*203*
Total (Gross Trips)				8,538	512	417	929	302	294	596

1. Gross Trips are the total number of vehicle trips before adjustment for internal trips and pass-by trips.

***Source**: DKS Associates, 2018, ITE Trip Generation, Tenth Edition, 2017.*

No internal trips were assumed between the restaurant uses.

Table 7 summarizes the unconstrained internal trip percentages that were applied to the uses. Because of incomplete ITE data, percentages for some time periods were estimated from available data. Each unconstrained internal trip percentage is applied at the origin and destination of the trip. The resultant constrained number of internal trips is the lesser of the origin and destination estimates.

TABLE 7
UNCONSTRAINED INTERNAL TRIP PERCENTAGES

		Daily	AM Peak Hour	PM Peak Hour
Applied to Trip Origins				
From Retail	To Retail	30%	20%	20%
	To Restaurant	21%	13%	29%
	To Hotel	3%	0%	5%
From Restaurant	To Retail	28%	14%	41%
	To Hotel	5%	3%	7%
From Hotel	To Retail	15%	14%	16%
	To Restaurant	39%	9%	68%
Applied to Trip Destinations				
To Retail	From Retail	28%	20%	20%
	From Restaurant	14%	17%	10%
	From Hotel	3%	4%	2%
To Restaurant	From Retail	40%	50%	29%
	From Hotel	6%	6%	5%
To Hotel	From Retail	9%	0%	17%
	From Restaurant	38%	4%	71%

***Source**: DKS Associates, 2018, ITE Trip Generation Handbook, Second Edition, 2004, and ITE Trip Generation Handbook, Third Edition, 2014.*

Pass-By Trip Calculations

Pass-by trips were calculated based upon data in the ITE sources. Table 8 summarizes the percentages. Because of incomplete data, some percentages were taken from similar uses, or from other time periods.

TABLE 8 PASS-BY TRIP PERCENTAGES				
Project Land Uses	**ITE Code**	**Daily**	**AM Peak Hour**	**PM Peak Hour**
Hotel	none	0%	0%	0%
Parcel 2 / Lot 4 Retail	820 – Shopping Center	34%	34%	34%
Parcel C Retail				
Parcel 2 / Lot 4 Starbucks	934 – Fast-Food Restaurant with Drive-Thru	50%	49%	50%
Parcel 3 KFC				
Parcel C Fast Food Restaurant with Drive-Through Window				
Parcel C Fast Food Restaurant with Drive-Through Window and No Indoor Seating				
Lot 6 Chevron	945 – Gasoline / Service Station with Convenience Mart	59%	62%	56%
***Source**: DKS Associates, 2018, ITE Trip Generation Handbook, Second Edition, 2004, and ITE Trip Generation Handbook, Third Edition, 2014.*				

Vehicular Trip Generation Estimates

Table 9 summarizes the project trip generation estimates. The technical appendix to this memorandum includes a summary of the calculations.

TRIP DISTRIBUTION

The distribution of trips associated with the proposed project was derived from the turning movements recorded at the existing McDonalds restaurant and turning movement counts collected at the study area intersections. The trip distribution also reflects trips between the project components that utilize Northgate Boulevard and Rosin Court. Figure 7 illustrates the trip distribution.

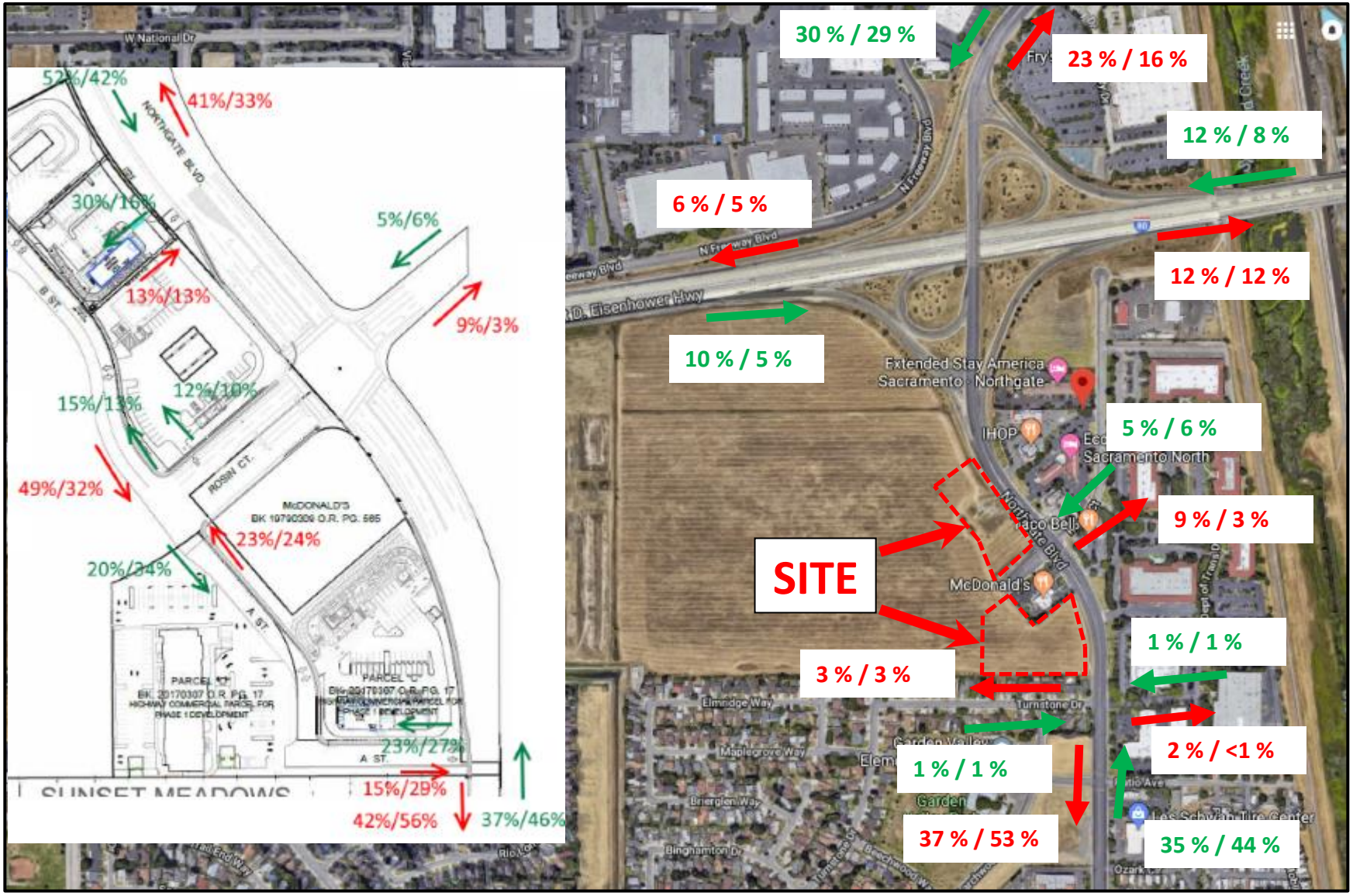
TABLE 9
VEHICULAR TRIP GENERATION ESTIMATES

Parcel / Lot	Use	ITE Category	Size	Vehicle Trips Generated (Trip-Ends)						
				Weekday	AM Peak Hour			PM Peak Hour		
					Enter	Exit	Total	Enter	Exit	Total
1. Parcel 2 / Lot 4	Starbucks	937 - Coffee/Donut Shop with Drive-Through Window	2,200 s.f.	1,805	100	96	196	47	48	95
2. Parcel 2 / Lot 4	Retail	820 – Shopping Center	1,800 s.f.	391	95	58	153	13	15	28
3. Parcel 3	KFC	934 - Fast Food Restaurant with Drive-Through Window	3,133 s.f.	1,474	64	62	126	53	49	102
4. Lot 6	Chevron	945 - Gasoline/Service Station with Convenience Market	12 fueling positions	2,061	67	64	131	86	82	168
5. Parcel D	Hotel	310 – Hotel	135 rooms	1,097	37	25	62	38	37	75
6. Parcel C	Southwest Corner	934 - Fast Food Restaurant with Drive-Through Window	2,000 s.f.	942	41	39	80	34	31	65
7. Parcel C	Southeast Corner	820 - Shopping Center	1,800 s.f.	391	95	58	153	13	15	28
8. Parcel C	North	935 - Fast Food Restaurant with Drive-Through Window and No Indoor Seating	817 s.f.	377	13	15	28	18	17	35
9. Total Project Trips (Sum Lines 1 through 8)				8,538	512	417	929	302	294	596

TABLE 9
VEHICULAR TRIP GENERATION ESTIMATES

Parcel / Lot	Use	ITE Category	Size	Vehicle Trips Generated (Trip-Ends)						
				Weekday	AM Peak Hour			PM Peak Hour		
					Enter	Exit	Total	Enter	Exit	Total
10. Internal Trips (Line 9 times constrained Table 4 values – see appendix)				-1,813	-82	-82	-163	-90	-90	-179
11. Trips at the Driveway (Line 9 minus Line 10)				6,725	430	335	766	212	204	417
12. Pass-By Trips (Line 11 times Table 5 values)				-2,872	-177	-147	-324	-90	-85	-175
13. New External Trips (Line 11 minus Line 12)				3,853	253	188	422	122	119	242

***Source**: DKS Associates, 2018, ITE Trip Generation, Tenth Edition, 2017, ITE Trip Generation Handbook, Second Edition, 2004, and ITE Trip Generation Handbook, Third Edition, 2014.*



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Entering - AM % / PM %

Exiting - AM % / PM %

Figure 7
Trip Distribution

THRESHOLDS OF SIGNIFICANCE

Consistent with Appendix G of the CEQA Guidelines, thresholds of significance adopted by the governing jurisdictions in applicable general plans and previous environmental documents, and professional judgement, a significant impact would occur if the proposed project would:

INTERSECTIONS – CITY OF SACRAMENTO

- The traffic generated by the project degrades LOS from an acceptable LOS (without the project) to an unacceptable LOS (with the project),

- The LOS (without project) is unacceptable and project generated traffic increases the average vehicle delay by 5 seconds or more.

Note: General Plan Mobility Element Policy M 1.2.2 sets forth definitions for what is considered an acceptable LOS. As previously discussed, Policy M 1.2.2 applies to the study area roadway facilities as follows:

- LOS A-D is to be maintained at all times; provided, LOS E or F may be acceptable if improvements are made to the overall transportation system and/or non-vehicular transportation and transit are promoted as part of the project or a City-initiated project.

TRANSIT

- Adversely affect public transit operations,
- Fail to adequately provide access to transit.

BICYCLE FACILITIES

- Adversely affect existing or planned bicycle facilities,
- Fail to adequately provide for access by bicycle.

PEDESTRIAN CIRCULATION

- Adversely affect existing or planned pedestrian facilities,
- Fail to adequately provide for access by pedestrians.

CONSTRUCTION-RELATED TRAFFIC IMPACTS

- Degrade an intersection or roadway to an unacceptable level,
- Cause inconveniences to motorists due to prolonged road closures, or
- Result in increased frequency of potential conflicts between vehicles, pedestrians, and bicyclists.

EXISTING PLUS PROJECT TRAFFIC CONDITIONS

Figure 8 illustrates AM peak hour and PM peak hour traffic volumes associated with the existing plus project scenario. The figure also illustrates the intersection geometry of the existing plus project scenario. Table 10 summarizes the results of the existing plus project peak hour intersection analysis.

IMPACTS AND MITIGATION MEASURES

Impact 1: The proposed project could cause potentially significant impacts to study area intersections under the existing plus project scenario. Based on the analysis below, the impact is less than significant.

As summarized in Table 10, the project would increase traffic volumes and average delay at the study area intersections. Study area intersection 1 would operate at LOS D during the a.m. peak hour. During the p.m. peak hour, the intersection would operate at LOS E, but with less than a 5 second delay above the existing LOS E operating conditions. Study area intersections 2 through 11 would operate at LOS D or better.

Mitigation Measure 1

None required.

Impact 2: The proposed project could cause potentially significant impacts to transit. Based on the analysis below and with the implementation of mitigation, the impact is less than significant.

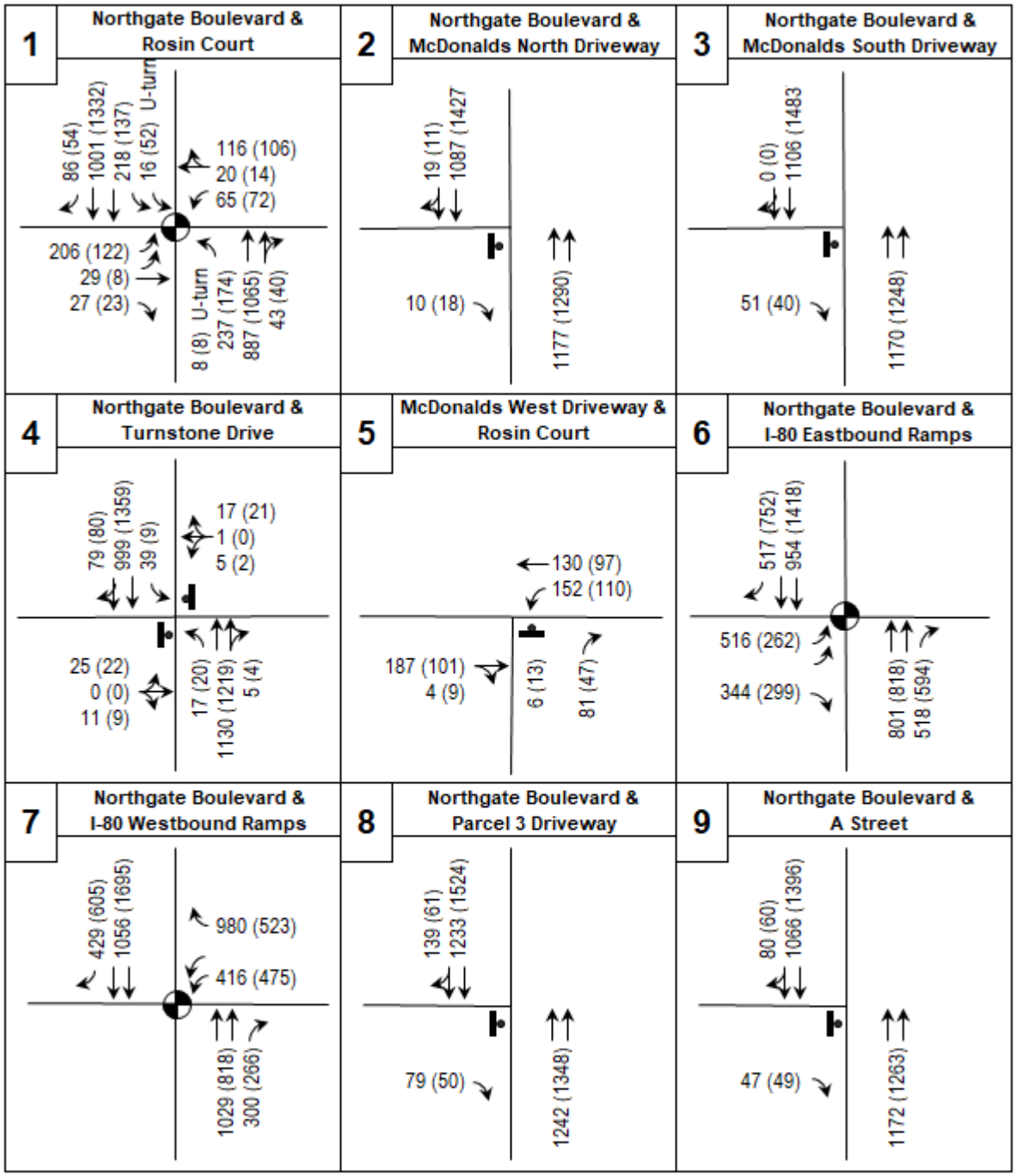
The proposed project would not interfere with transit operations.

Mitigation Measure 2

None required.

Impact 3: The proposed project could cause potentially significant impacts to pedestrian facilities. Based on the analysis below and with the implementation of mitigation measures, the impact is less than significant.

The proposed project would not interfere with existing pedestrian circulation. It is not clear from the conceptual plan what pedestrian improvements would be provided.



KEY

31 (27) = AM (PM) peak hour traffic volume

= Signalized intersection

= Intersection approach lane

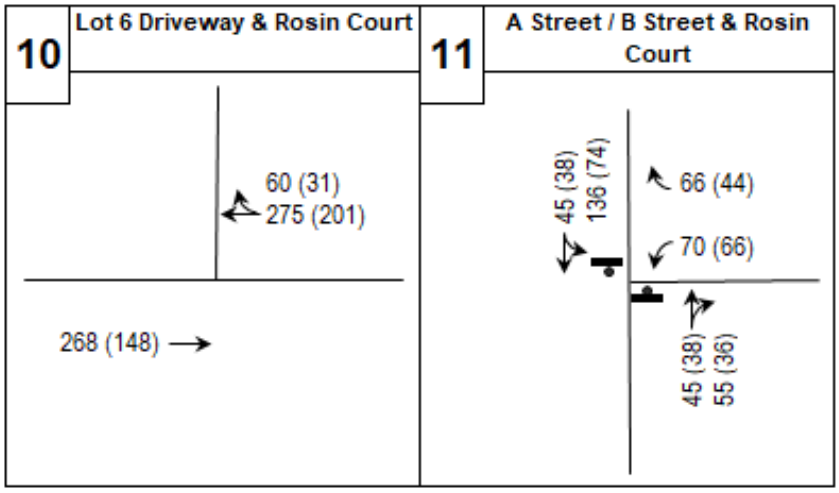
= Stop sign control

= Roundabout

N-S St. & E-W St. = North-south street / east-west street

DKS

Figure 8
Existing Plus Project Peak Hour Traffic Volumes and Geometry (Sheet 1 of 2)



KEY

31 (27) = AM (PM) peak hour traffic volume

= Signalized intersection

= Intersection approach lane

= Stop sign control

= Roundabout

N St. & E St. = North-south street / east-west street

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Figure 8
Existing Plus Project Peak Hour Traffic Volumes and Geometry (Sheet 2 of 2)

TABLE 10
EXISTING PLUS PROJECT INTERSECTION OPERATING CONDITIONS

Intersection	Existing				Existing Plus Project			
	A.M. Peak Hour		P.M. Peak Hour		A.M. Peak Hour		P.M. Peak Hour	
	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS
1. Northgate Boulevard & Rosin Court	48.3	D	55.8	E	54.5	D	57.9	E
2. Northgate Boulevard & McDonalds North Driveway	0.1	A	0.1	A	0.1	A	0.1	A
- Eastbound Right	*10.3*	*B*	*14.7*	*B*	*12.7*	*B*	*15.2*	*C*
3. Northgate Boulevard & McDonalds South Driveway	0.3	A	0.3	A	0.3	A	0.2	A
- Eastbound Right	12.8	B	15.8	C	13.4	B	16.3	C
4. Northgate Boulevard & Turnstone Drive	1.6	A	2.1	A	2.1	A	2.9	A
- Northbound Left Turn	*10.4*	*B*	*12.6*	*B*	*10.8*	*B*	*13.0*	*B*
- Southbound Left Turn	*10.9*	*B*	*11.8*	*B*	*11.4*	*B*	*12.2*	*B*
- Eastbound	*65.5*	*F*	*164.8*	*F*	*93.0*	*F*	*228.6*	*F*
- Westbound	*30.3*	*D*	*21.5*	*C*	*34.5*	*D*	*23.1*	*C*
5. McDonalds West Driveway & Rosin Court	No control delay				3.7	A	3.7	A
- Northbound					*10.1*	*B*	*9.7*	*A*
- Westbound Left					*7.9*	*A*	*7.6*	*A*
6. Northgate Boulevard & I-80 Eastbound Ramps	8.8	A	6.4	A	8.9	A	6.4	A

TABLE 10
EXISTING PLUS PROJECT INTERSECTION OPERATING CONDITIONS

Intersection	Existing				Existing Plus Project			
	A.M. Peak Hour		P.M. Peak Hour		A.M. Peak Hour		P.M. Peak Hour	
	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS
7. Northgate Boulevard & I-80 Westbound Ramps	8.3	A	10.8	B	9.1	A	11.2	B
8. Northgate Boulevard & Parcel 3 Driveway					0.5	A	0.3	A
- Eastbound					*16.6*	*C*	*17.8*	*C*
9. Northgate Boulevard & A Street					0.3	A	0.3	A
- Eastbound					*13.7*	*B*	*16.4*	*C*
10. Lot 6 Driveway & Rosin Court					No control delay			
11. A Street / B Street & Rosin Court					9.1	A	8.3	A
- Northbound					*9.9*	*A*	*9.7*	*A*
- Southbound					*12.7*	*B*	*11.2*	*B*

Source: *DKS Associates, 2018.*

Mitigation Measure 3

The applicant shall provide sidewalks along all site frontage along Northgate Boulevard and Rosin Court, including filling the gap on the west side of Northgate Boulevard north of Rosin Court. Sidewalks shall be installed on both sides of all internal streets, such as A Street and B Street. Pedestrian paths shall be provided to provide circulation between all adjacent project uses.

Impact 4: The proposed project could cause potentially significant impacts to bicycle facilities. Based on the analysis below and with the implementation of mitigation, the impact is less than significant.

The proposed project would not interfere with existing bicycle circulation or bike lanes. It is not clear from the conceptual plan what bicycle improvements would be provided.

Mitigation Measure 4

The applicant shall provide a continuous southbound bike lane, to current City standards, along the Northgate Boulevard frontage. The applicant shall provide bike lanes along Rosin Court west of Northgate Boulevard in anticipation of further development beyond this project. The applicant shall provide onsite bicycle parking to serve each business.

Impact 5: The proposed project could cause potentially significant impacts due to construction-related activities. Based on the analysis below, the impact is less than significant.

The applicant will be required to provide a construction traffic control plan per City Code 12.20.030 to the satisfaction of the City Traffic Engineer.

Mitigation Measure 5

None required.

VEHICLE MILES TRAVELED (VMT)

Travel forecasting for the project VMT analysis was conducted with the use of SACOG's SACSIM travel model. The model was used to calculate regional VMT for the existing and existing plus project scenarios. As shown in Table 11, the project is estimated to increase daily VMT by 11,627 compared to the existing scenario.

TABLE 11 ESTIMATED PROJECT VMT			
Roadway Type	**Regional Daily Vehicle Miles Travelled**		
	Existing	**Existing Plus Project**	**Project Difference**
Freeways and Rural Roads	33,559,682	33,568,991	9,310
Urban Streets	24,630,633	24,632,950	2.318
Total	58,190,315	58,201,942	11,627
Source: *DKS Associates, 2018.*			

SITE ACCESS REVIEW

The conceptual site plan was reviewed for conformity with accepted traffic engineering principles and City Design Guidelines. Figure 9 illustrates the conceptual site plan access points. A list of study references is included at the end of this report.

INTERSECTION AND DRIVEWAY SPACING

The review of intersection and driveway spacing is based upon traffic engineering principles to maintain efficient movement for motorized vehicles, pedestrians, and bicyclists, and minimize conflicts and crashes. Research has shown that proper spacing of intersections and driveways reduces crash frequency, as motorists have ample time between decision points to react to other vehicles that may affect their movement.

Northgate Boulevard is a four-lane arterial roadway. Rosin Court is currently a local commercial street, although its future designation is unknown. Based upon the City Design and Procedures Manual Section 15 – Street Design Standards, minimum intersection spacing is 250 feet for a 4-lane arterial, and 120 feet for a local commercial street (Table 15-7.3). The distance is measured between the nearest curb returns. The curb return is defined as the beginning of the curb radius connecting to the intersecting street. Driveway spacing for a 4-lane arterial is 250 feet, also measured between the inside edges of the driveways.

The AASHTO "Green Book" states that "Driveways should not be situated within the functional boundary of at-grade intersections. This boundary would include the longitudinal limits of auxiliary lanes." In this context, auxiliary lanes refer to exclusive turning lanes at the intersections including taper lengths.

In the Transportation Research Board (TRB) Access Management Manual, Second Edition, and Transportation Research Circular (TRC) 456, Driveway and Street Intersection Spacing, the minimum upstream functional intersection area is calculated for various design speeds. These distances exclude storage, which adds to the total functional boundary.

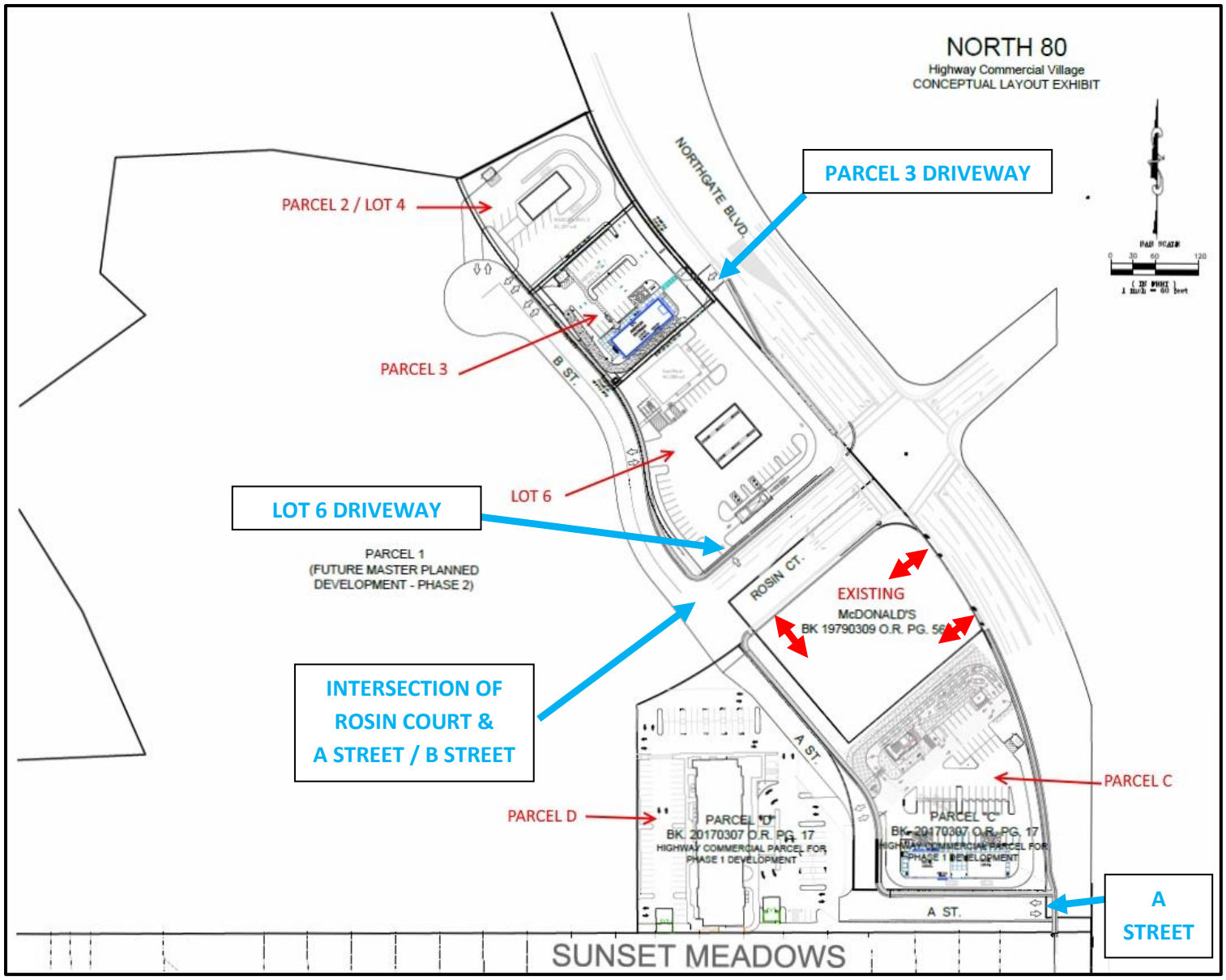

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Figure 9
Proposed Access

Northgate Boulevard & Parcel 3 Driveway

As depicted on the conceptual site plan, this intersection does not meet minimum standards for driveway spacing.

- The driveway is located less than 50 feet from the end of the merge area for the ramp movement from I-80 eastbound to Northgate Boulevard southbound. This distance does not meet City driveway spacing requirements, as measured from "nearest curb return" to the inside of the driveway.

- The driveway is within the upstream functional area of the intersection of Northgate Boulevard and Rosin Court. The driveway is located 250 feet from the Rosin Court curb return. At a 40-mph design speed, TRC 456 specifies a minimum functional area of 335 feet, with a desirable area of 525 feet. This 40-mph design speed is based upon the posted speed limit, and the results of the free-flow speed radar study which indicated an 85th percentile speed of 41 to 42 mph. The City standard design speed for a 4-lane arterial is 50 mph, which would result in a longer minimum functional area.

- As shown in Table 3, the driveway is within the observed existing queuing area. Queues currently extend into the ramp merge during peak hours. Project traffic will extend these queues. Thus, the upstream functional boundary of the intersection extends beyond the ramp merge.

- In the TRB Access Management Manual, the recommended minimum distance from the end of an interchange ramp merge to the first approach (driveway) is 750 feet (Exhibit 18-6).

It is recommended that this driveway be eliminated, primarily because of the adjacent merge from the I-80 ramp. Motorists merging will not have ample time / space to complete that maneuver before the need to react to vehicles slowing to enter the driveway. Peak hour intersection analysis was conducted assuming the elimination of this driveway. Results are shown in Table 12. There is no change in intersection impacts.

An alternate approach which may allow the driveway to be maintained is to eliminate the free-flow ramp. Caltrans has retrofitted several interchanges to eliminate such ramps and bring the right-turn movement to a T-intersection. This would allow greater distance (about 600 feet) between the intersection and the driveway. This approach would also provide ample distance to provide a recommended right-turn deceleration lane to the driveway.

Northgate Boulevard & A Street

As depicted on the conceptual site plan, this intersection does not meet minimum standards for street / driveway spacing.

- The street is located less than 100 feet from the curb return of Turnstone Drive.

TABLE 12
EXISTING PLUS PROJECT INTERSECTION OPERATING CONDITIONS
WITHOUT PARCEL 3 DRIVEWAY TO NORTHGATE BOULEVARD

Intersection	With Driveway				Without Driveway			
	A.M. Peak Hour		P.M. Peak Hour		A.M. Peak Hour		P.M. Peak Hour	
	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS
1. Northgate Boulevard & Rosin Court	54.5	D	57.9	E	50.7	D	54.9	D
2. Northgate Boulevard & McDonalds North Driveway	0.1	A	0.1	A	0.1	A	0.1	A
- Eastbound Right	*12.7*	*B*	*15.2*	*C*	*12.7*	*B*	*15.2*	*C*
3. Northgate Boulevard & McDonalds South Driveway	0.3	A	0.2	A	0.3	A	0.2	A
- Eastbound Right	13.4	B	16.3	C	13.4	B	16.3	C
4. Northgate Boulevard & Turnstone Drive	2.1	A	2.9	A	2.1	A	2.9	A
- Northbound Left Turn	*10.8*	*B*	*13.0*	*B*	*10.8*	*B*	*13.0*	*B*
- Southbound Left Turn	*11.4*	*B*	*12.2*	*B*	*11.4*	*B*	*12.2*	*B*
- Eastbound	*93.0*	*F*	*228.6*	*F*	*93.0*	*F*	*228.6*	*F*
- Westbound	*34.5*	*D*	*23.1*	*C*	*34.5*	*D*	*23.1*	*C*
5. McDonalds West Driveway & Rosin Court	3.7	A	3.7	A	3.4	A	3.4	A
- Northbound	*10.1*	*B*	*9.7*	*A*	*10.5*	*B*	*10.1*	*B*
- Westbound Left	*7.9*	*A*	*7.6*	*A*	*8.0*	*A*	*7.7*	*A*

TABLE 12
EXISTING PLUS PROJECT INTERSECTION OPERATING CONDITIONS
WITHOUT PARCEL 3 DRIVEWAY TO NORTHGATE BOULEVARD

Intersection	With Driveway				Without Driveway			
	A.M. Peak Hour		P.M. Peak Hour		A.M. Peak Hour		P.M. Peak Hour	
	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS	Delay (Seconds)	LOS
6. Northgate Boulevard & I-80 Eastbound Ramps	8.9	A	6.4	A	8.9	A	6.4	A
7. Northgate Boulevard & I-80 Westbound Ramps	9.1	A	11.2	B	9.1	A	11.2	B
8. Northgate Boulevard & Parcel 3 Driveway	0.5	A	0.3	A	-	-	-	-
- Eastbound	*16.6*	*C*	*17.8*	*C*	-	-	-	-
9. Northgate Boulevard & A Street	0.3	A	0.3	A	0.3	A	0.3	A
- Eastbound	*13.7*	*B*	*16.4*	*C*	*13.7*	*B*	*16.4*	*C*
10. Lot 6 Driveway & Rosin Court	No control delay				No control delay			
11. A Street / B Street & Rosin Court	9.1	A	8.3	A	9.0	A	8.3	A
- Northbound	*9.9*	*A*	*9.7*	*A*	*10.1*	*B*	*9.8*	*A*
- Southbound	*12.7*	*B*	*11.2*	*B*	*14.4*	*B*	*12.0*	*B*

Source: *DKS Associates, 2018.*

It is recommended that this street be moved to the north, to provide 250 feet spacing from Turnstone Drive. The intersection should be located at least 250 feet south of the existing McDonalds south driveway.

At this location, it may be possible to provide all turning movements, utilizing a two-way-left-turn-lane (TWLTL) on Northgate Boulevard. However, due to the curvature of Northgate Boulevard, sight distance should be analyzed if this option is pursued. Also, existing driveways on the opposite side of Northgate Boulevard should be considered.

A Street / B Street & Rosin Court

As depicted on the conceptual site plan, this intersection does not meet traffic engineering standards.

- The proposed intersection is located within 25 feet of the existing McDonalds west driveway. For westbound traffic on Rosin Court, there is insufficient distance between the adjacent left turn movements (to McDonalds and to A Street).

It is recommended that this intersection be shifted to the west to provide at least 120 feet between A Street and the McDonalds west driveway.

Lot 6 Driveway & Rosin Court

As depicted on the site plan, this intersection does not meet traffic engineering standards.

- The proposed driveway is located less than 50 feet from the adjacent intersection of A Street / B Street & Rosin Court.

The recommended relocation of the intersection of A Street / B Street & Rosin Court will remedy this issue, providing over 120 feet of space between the driveway and intersection.

Driveway Access to A Street / B Street

As the plan is conceptual, access to each parcel is not fully detailed. The following are recommended:

- Provide 120-foot spacing between intersections.
- Combine intersections where possible, such as those shown at the B Street cul-de-sac.
- Provide a minimum throat length of 50 feet.

References

- City of Sacramento, Design and Procedures Manual, Section 15 – Street Design Standards

- Caltrans Highway Design Manual, 2018.
- A Policy on Geometric Design of Highways and Streets, 6th Edition, AASHTO, 2011.
- Access Management Manual, Second Edition, Transportation Research Board, 2014.
- Access Management Guidelines for Activity Centers, NCHRP Report 348, 1992.
- Impacts of Access Management Techniques, NCHRP Report 420, 1999.
- Guide for the Geometric Design of Driveways, NCHRP Report 659, 2010.
- Design Guidance for Intersection Auxiliary Lanes, NCHRP Report 780, 2014.
- Driveway Regulation Practices, NCHRP Synthesis 304, 2002.
- Access Management on Crossroads in the Vicinity of Interchanges, NCHRP Synthesis 332, 2004.
- State of the Practice in Highway Access Management, NCHRP Synthesis 404, 2010.
- Driveway and Street Intersection Spacing, TRC 456, 1996.

DRIVE-THROUGH LANES

Coffee Shops

Research published by Institute of Transportation Engineers (ITE) indicates that for full service coffee shops, a 220-foot long drive-thru lane, providing eleven cars of total storage, should be adequate to handle the vast majority of the drive-thru lane volumes that might be encountered (New Drive-Through Stacking Information for Banks and Coffee Shops, Mark Stuecheli, PTP, ITE Annual Meeting August 12, 2009).

The location of the menu board relative to the pick-up window also impacts the efficiency of a drive-thru lane operation. If the spacing is too short, stacking behind the pick-up window will extend into the menu board area, delaying ordering for those farther back in line. For the most efficient operation, the distance between the pick-up window and menu board should be at least 80 feet to accommodate four vehicles. Additionally, it is recommended that the window/ordering point be located at a minimum distance of 120-feet from the start of the drive-thru lane to accommodate about six vehicles.

Fast-food Restaurants and Car Washes

Recent literature on vehicular queuing at fast-food restaurants was reviewed to ascertain typical queue lengths. It should be noted that queue lengths can vary greatly based upon the specific restaurant that would occupy the site. ITE Technical Council Committee 5D-10 published an article entitled "*Queuing Area for Drive-Thru Facilities*" in May 1995. This publication indicated

that, with 95 percent probability, the maximum queue at a fast-food restaurant would be no more than ten vehicles.

Mike Spack, PE, collected data in 2011 and 2012 at various facilities with drive-through services. His article, entitled "*Drive-Through Queue Generation*" (February 2012) recommends the following storage lengths based upon 85th percentile observed queues:

- Car washes – 7 vehicles (140 feet)
- Fast food restaurants – 12 vehicles (240 feet)

ON-SITE CIRCULATION

Regarding on-site circulation, the following recommendation is made:

- Anticipated truck turning movements should be illustrated on the site plan, as well as staging areas for deliveries. Large vehicles, including fuel delivery trucks, trash trucks and other delivery trucks, should not unload / load in primary parking aisles / on-site roadways during peak hours of operation. No vehicle loading / unloading should occur within driveway throat areas.

LONG TERM PLANNING CONSIDERATIONS

The proposed project develops commercial units along the west side of Northgate Boulevard. To the west of the project, there is a large amount of vacant land. Rosin Court currently terminates about 250 feet west of Northgate Boulevard. In the future, it will extend to provide access to the remainder of the undeveloped land. In addition, it may connect to other development to the west and / or to residential neighborhoods to the south.

There are too many unknowns to definitively forecast the transportation conditions associated with this future development. However, Rosin Court will be an important element of access to this area. At this time, it is recommended that adequate right-of-way for future access be considered.

- The future classification / number of lanes of Rosin Court is unknown. However, it is recommended that right-of-way be reserved from Northgate Boulevard west to provide accommodate a 4-lane arterial, including expanded intersections.

- The necessary queuing space for eastbound Rosin Court at the Northgate Boulevard intersection with long-term development is unknown. However, it should be recognized that the queue space may extend beyond the proposed intersection with A Street / B Street. Therefore, it may be necessary at a future date to limit turning movements at this intersection to right-in / right-out only. To minimize this possibility, it is recommended that A Street / B Street be located 500 feet west of Northgate Boulevard.

- It is recommended that A Street be designed as a secondary access point to the entire development area. With the recommended street relocation, all turning movements at

Northgate Boulevard may be permissible. The current project should be designed to not preclude future extension of A Street to the west from Northgate Boulevard into the area of future development.