

**From:** [Zenk, Jessica](#)  
**To:** [Downtown West Project](#)  
**Subject:** FW: Access Analysis  
**Date:** Saturday, May 15, 2021 7:20:07 AM  
**Attachments:** [20210513\\_SAP\\_Access\\_Analysis\\_FinalAdminDraft.pdf](#)

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**From:** Franziska Church <[f.church@fehrandpeers.com](mailto:f.church@fehrandpeers.com)>  
**Sent:** Thursday, May 13, 2021 7:32 PM  
**To:** Lapustea, Florin <[Florin.Lapustea@sanjoseca.gov](mailto:Florin.Lapustea@sanjoseca.gov)>  
**Cc:** Zenk, Jessica <[Jessica.Zenk@sanjoseca.gov](mailto:Jessica.Zenk@sanjoseca.gov)>; Banwait, Manjit <[Manjit.Banwait@sanjoseca.gov](mailto:Manjit.Banwait@sanjoseca.gov)>  
**Subject:** RE: Access Analysis

[External Email]

Admin Draft – For internal discussion

Hi Florin,

Attached please find the revised Admin Draft for your review and comment.

Let me know if there are any last edits/revisions.

Franziska Church, AICP  
Principal  
Fehr & Peers Transportation Consultants  
408.645.7014

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**From:** Lapustea, Florin <[Florin.Lapustea@sanjoseca.gov](mailto:Florin.Lapustea@sanjoseca.gov)>  
**Sent:** Thursday, May 13, 2021 11:38 AM  
**To:** Franziska Church <[f.church@fehrandpeers.com](mailto:f.church@fehrandpeers.com)>  
**Cc:** Zenk, Jessica <[Jessica.Zenk@sanjoseca.gov](mailto:Jessica.Zenk@sanjoseca.gov)>; Banwait, Manjit <[Manjit.Banwait@sanjoseca.gov](mailto:Manjit.Banwait@sanjoseca.gov)>  
**Subject:** Re: Access Analysis

Hi Franziska,

Please see attached for draft DOT/DPW comments on the draft access analysis memo.

Let us know if you have any questions.

Thanks!

*Florin Lapustea, P.E.*

Senior Engineer - DOT Development Review  
City of San Jose ~ City Hall  
200 E. Santa Clara St., 8th Floor  
San Jose, CA 95113  
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**From:** Franziska Church <[f.church@fehrandpeers.com](mailto:f.church@fehrandpeers.com)>

**Sent:** Wednesday, May 12, 2021 12:32 PM

**To:** Banwait, Manjit <[Manjit.Banwait@sanjoseca.gov](mailto:Manjit.Banwait@sanjoseca.gov)>; Lapustea, Florin  
<[Florin.Lapustea@sanjoseca.gov](mailto:Florin.Lapustea@sanjoseca.gov)>

**Cc:** Zenk, Jessica <[Jessica.Zenk@sanjoseca.gov](mailto:Jessica.Zenk@sanjoseca.gov)>

**Subject:** RE: Access Analysis

[External Email]

Admin Draft – For internal discussion

Hi All,

Attached please find a Word version of the document, to support ease of review.

Thank you,

**Franziska Church, AICP**

Principal

Fehr & Peers Transportation Consultants

408.645.7014

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**From:** Franziska Church

**Sent:** Tuesday, May 11, 2021 11:37 AM

**To:** Banwait, Manjit <[Manjit.Banwait@sanjoseca.gov](mailto:Manjit.Banwait@sanjoseca.gov)>; Lapustea, Florin  
<[Florin.Lapustea@sanjoseca.gov](mailto:Florin.Lapustea@sanjoseca.gov)>

**Cc:** Zenk, Jessica <[Jessica.Zenk@sanjoseca.gov](mailto:Jessica.Zenk@sanjoseca.gov)>

**Subject:** Access Analysis

Admin Draft – For internal discussion

Hi Manjit and Florin,

Attached please find our memo addressing the access analysis. Please let me know if you have any questions or would like to set up a time to discuss.

Thank you,

**Franziska Church, AICP**

Principal

Fehr & Peers Transportation Consultants

408.645.7014

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# Admin Draft

# Memorandum

Date: May 13, 2021

To: Jessica Zenk and Manjit Banwait, City of San José

From: Franziska Church, Carmen Kwan, and Eric Womeldorff, Fehr & Peers

Subject: **Supplemental Analysis for the Downtown West Mixed-Use Project – SAP Center Access Analyses**

*SJ19-1951*

## Introduction

This memo provides supplemental information about the potential experience of SAP Center event attendees who travel in vehicles after completion of the Downtown West Mixed-Use (“Downtown West”) project. This memo provides evidence in response to the central question: “Can the future roadway network accommodate activity from Downtown West and typical vehicle traffic associated with pre- and post-events at the SAP Center?” This question has been the focus of several meetings among parties invested in the continued success of the SAP Center in the context of the proposed Downtown West project: the City of San José, Sharks Sports & Entertainment (SSE) group, and the Downtown West project sponsor. To address the central question of whether the future roadway network could accommodate activity from Downtown West and SAP events, this memo includes three sections:

- **Ingress Analysis:** Simulation analyses of conditions: 1) before an event (“ingress”) at the SAP Center; and 2) the same time without an event. These analyses were developed by Fehr & Peers in March/April 2021. Comparisons of model results shows that travel times along primary routes from freeway exits to SAP Center parking locations could increase by approximately one to seven minutes in the hour before an event as compared to when





- there are no events, depending on the route. The methodology and model inputs and outputs of the analyses are described herein.
- **Peer-Review of SSE Ingress Analysis:** Fehr & Peers' peer review of an ingress analysis focused along Autumn Parkway developed by Krupka Consulting for Sharks Sports & Entertainment (SSE) group in February 2021. The analysis uses different methods, inputs, analysis software, and interpretations of industry practices than the Fehr & Peers analysis.
  - **Egress Analysis:** A simulation analysis of conditions following an event ("egress") at SAP Center. This analysis was developed by Nelson Nygaard in 2020. The analysis shows that approximately 90 percent of post-event egress traffic could exit parking locations within 1/3-mile of the SAP Center containing 5,733 parking spaces in 45 minutes following the end of an event at the SAP Center. Approximately 70 percent of post-event egress traffic could exit in 30 minutes following the end of an event at SAP Center. Fehr & Peers undertook a peer review of this analysis in December 2020 and has confirmed the findings.

For the purposes of all analyses described above, all SAP Center attendees are assumed to be for a San José Sharks hockey game.

This memo was developed for informational purposes and presents vehicle circulation and parking analysis not required by CEQA.

## Analysis Context

The area in the core of Downtown West, especially around Diridon Station and the SAP Center, is surrounded by surface parking lots that would be redeveloped by the project. The City of San José, through their long-range vision identified in Envision 2040 and the Diridon Station Area Plan ("DSAP"), seek to transform the area around Diridon Station and SAP Center into a dense, vibrant area with access that is balanced for all users, including pedestrians, bicyclists, transit riders, and cars. With this vision comes increased activity, including increased levels of foot, bike, transit, and car traffic, that are representative of a vibrant downtown. SSE is an essential partner in creating the City's vision and the City seeks to work with SSE to embrace the change in character around Downtown West, while balancing the needs for visitors and residents of San José alike.

With the added development proposed by Downtown West, there will be more people working and living in close proximity to SAP Center that can take advantage of transit, bicycle, and pedestrian investments to easily access SAP Center without the need to drive. However, the City does recognize that vehicular access is an important aspect of attending events at SAP Center, and through its commitments in the Arena Management Agreement (AMA) will continue to provide access to a minimum of 5,125 parking spaces within a 1/3-mile of the arena. While the analyses presented in this memo focus on analysis of vehicular access, access by foot, bike, and transit will play a key role to the area's future success.



## Parking Context

The location of parking spaces for SAP Center event attendees will change with the development of Downtown West. As noted in the Analysis Context section, the City has committed to SSE through an Arena Management Agreement (AMA) to maintain 5,125 parking spaces for SAP Center event attendees (and employees) within 1/3-mile of the arena; these consist of 1,650 “on-site” parking spaces located in Lots A-D, 300 employee parking spaces, and 3,175 “off-site” parking spaces. An additional 3,175 “off-site” parking spaces must be available outside of the 1/3-mile but within 1/2-mile of the arena. The City currently meets the AMA parking agreement through a distribution of parking across approximately 30 lots, including Lots A,B,C, as well as on-street parking. As described in the Diridon Station Area Plan Update (October 2020) the City is committed to “ensure the continued vitality of the SAP Center, recognizing that it is a major anchor for both Downtown San José and the Diridon Station area, and pursue best efforts to maintain a sufficient supply of parking and efficient vehicular and pedestrian access for SAP Center customers, compliant with the standards set forth in the Arena Management Agreement.” To date, and moving forward, the City will continue to take a district approach to meeting the requirements outlined in the AMA which includes prioritizing shared and dispersed parking through a right-sized parking approach.

With the buildout of the Downtown West Project, the SAP Center will have access to more parking spaces than it does today as outlined by the AMA. Downtown West’s parking requirements as described in Exhibit K of the Development Agreement are intended to ensure sufficient parking is publicly accessible within the project site and available for SAP Center use. The Downtown West Project is committed to maintenance or replacement of approximately 2,850 available spaces that currently exist on the project site, exclusive of on-street parking; to 4,000 publicly-accessible spaces at full buildout of the commercial development; and may provide up to 4,800 publicly-accessible spaces at its discretion.

**Inset 1** below shows a potential parking distribution at full build-out of the Downtown West project and illustrates how a combination of parking within the Downtown West Project, coupled with parking from existing sites, new parking lots<sup>1</sup>, and on-street parking within 1/3-mile continues to meet, and exceed, AMA requirements.

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<sup>1</sup> This analysis analyzed parking across the 1/3 of a mile in addition to parking located within the Downtown West project. The parking scenario analyzed included an option currently under discussion with the City to develop a group of parcels just north of the SAP Center as a parking lot known as “Lot E.” The completion and timing of Lot E has not been established and is not guaranteed but was assumed to provide approximately 1,020 spaces for the purposes of this analysis.



*Inset 1. Proposed spaces available for SAP Center within 1/3-mile: Illustrative diagram showing potential parking distribution option*

Source: Google, 2021

Together, this parking distribution shows how the AMA parking requirement can be met and exceeded, allowing for an additional 350 spaces above the 5,125 required to be available for SAP Center use. Additionally, at the specific request of SSE, this scenario excludes any parking for SAP Center events at the 1,000 space Adobe parking structure at the north-west corner of the Almaden Boulevard/San Fernando Boulevard intersection. This lot is within the 1/3-mile radius and meets AMA requirements and could therefore add an additional approximate 850 to 1,000 spaces, well above the AMA requirement<sup>2</sup>.

In total, approximately 8,000 parking spaces are available within ½ mile of the SAP Center, which has a standard seating capacity of 17,500. While every comparable arena operates in a distinct environment, the result of the AMA and proposed parking is that the SAP Center will continue to be provided with approximately one parking space within a half-mile per every two venue seats, which is more parking spaces than other arenas in the Bay Area as shown in **Inset 2**, despite the

<sup>2</sup> Parking spaces total assumes 85 percent availability for parking within Downtown West and Lot E and does not assume any parking within the Adobe property; however, the addition of parking within the Adobe property would add approximately 850 parking spaces based on an assumption of 85 percent availability of the 1,000+ spaces provided in the Adobe parking structure. The supply of existing parking locations were based on a 2017 survey of parking occupancy within 1/3 mile of the arena.



changing nature of the area and addition of options to access it by foot, bike, and transit in the future.

## Parking Comparison to Bay Area Venues

\*Parking ratios are based on parking definitions that vary in geographic boundaries  
\*# of attendees based on full seating capacity

Team	Stadium	Standard Seating Capacity	Parking within 1/2 Mile	Parking Space per Seat
San Jose Sharks	SAP Center	17,500	8000	0.5
San Francisco 49ers	Levi's Stadium	68,500	30000	0.4
San Jose Earthquakes	PayPal Park	18,000	5000	0.3
Oakland Athletics	RingCentral Coliseum	46,800	10000	0.2
Golden State Warriors	Chase Center	18,000	3600	0.2
San Francisco Giants	Oracle Park	42,000	3500	0.1

The SAP Center offers approx. 1 parking space for every 2 seats

### *Inset 2. Bay Area Arena Parking Comparison*

Source: Levi Stadium, PayPal Park, RingCentral Coliseum, Oracle Park, 2020.

Since the amount and location of parking for SAP Center event attendees has been a part of negotiations between City of San José staff, SSE and the Downtown West project sponsor with conversations starting in 2019, the number of parking spaces included in the Ingress (5,450) and Egress (5,700) analyses (as described in forthcoming sections) are slightly different than the final proposal included in Exhibit K. In particular, the Egress analysis assumes approximately 250 more vehicles parking than in the Ingress analysis. Given that this exceeds the existing and proposed parking counts, and represents more vehicles trying to leave the SAP Center area following an event, the egress analysis is conservative; as the increased parking assumption equates to more people leaving and longer travel times.



# Fehr & Peers Ingress Analysis

Fehr & Peers participated in meetings with City of San José staff, SSE, Krupka Consulting, and the Downtown West project sponsor to discuss potential approaches in response to the central question: “Can the future roadway network accommodate activity from Downtown West and typical vehicle traffic associated with pre-and post-events at the SAP Center?” During those meetings SSE’s top concern was stated as maintaining convenient vehicular access for attendees, as measured by effects on vehicular delay and increases in travel time, with a specific focus on Autumn Street (now Barack Obama Boulevard) between Santa Clara Street and Park Avenue. SSE expressed their desire for the attendee experience for those traveling in vehicles to be the same as historical norms following the of the Downtown West project, with buildout assumed to occur approximately by the year 2031. City staff expressed a desire for the approach to create access for more people, as conveniently as possible, as travel expectations evolve during development of the Downtown West project. The goals could be summed up as trying to achieve a balance in access (to SAP Center and the adjacent area), travel modes, and travel times for event attendees.

Following the meetings described above and in further consultation with City staff, Fehr & Peers proposed to develop a SimTraffic<sup>3</sup> model to forecast the Background plus Downtown West plus SAP Center Event attendee arrival scenario (as defined in the following section) to address the central question as well as SSE concerns about potential changes to the experience of SAP Center event attendees who travel in vehicles. The ingress model would allow analysis of the future network’s ability to accommodate traffic and report/assess vehicle travel times, which can also be used as a proxy for vehicular delay, particularly at intersections of concern<sup>4</sup>. City staff concurred with this approach, with the stipulation that the results be shared with all parties where the central question was discussed.

Concurrently, Fehr & Peers also developed a scenario in which the same time of day is modeled, but no event occurs at SAP Center; a “typical weekday”. The purpose of this additional model was to compare the travel time results of each scenario to determine the magnitude of route travel time differences between the two. SimTraffic is an appropriate model platform for an exercise centered on vehicle travel times because it simulates all the vehicles on a roadway individually, and accounts for the interactions between vehicles that could cause queuing or have an effect on

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<sup>3</sup> SimTraffic is not used by the City to identify LOS adverse effects per Council Policy 5-1; when LOS analysis is required for adverse effects determination, the City applies TRAFFIX software, which is a macro simulation tool that uses HCM methodology.

<sup>4</sup> SSE requested that LOS analysis occur, but since the study area is within the Downtown Core there are no established LOS thresholds per Council Policy 5-3



vehicle speeds and traffic control, like stop signs and traffic signals. Its main inputs are traffic volumes, roadway / intersection geometries, and intersection control.

The ingress and typical weekday models build upon the traffic volume and roadway network prepared for Downtown West's Local Transportation Analysis (LTA).

## Methodology

The following sections describe the main model inputs, data sources, and key assumptions made during development.

### Traffic Volumes

The ingress model traffic volumes are composed of the following, which are described in more detail below:

1. Background Plus Project traffic volumes (that account for Downtown West-generated vehicles; taken from Downtown West's LTA),
2. Adjustments to account for the weekday 6:30 to 7:30 PM analysis time period,
3. Adjustments to account for background traveler behavior leading up to an arena event,
4. Accounting for Arena attendees arriving in personal vehicles, and
5. Adding vehicles to account for Uber/Lyft.

Figures showing detailed intersection traffic volumes are included in **Appendix A**.

#### *(1) LTA Background Plus Project Traffic Volumes*

The starting point for both the ingress traffic volumes are the PM peak hour traffic volumes from the Background Plus Project Buildout scenario (LTA Scenario 2c),<sup>5</sup> modified to account for the full Transportation Demand Management (TDM) commitment required by mitigation measure AQ-2h, *Enhanced Transportation Demand Management Program*.

The "Background No Project" volumes (to which Downtown West-generated vehicles are added) represent "existing" volumes plus vehicles generated by "approved but not yet built" and "not occupied" developments in the area per the City's Approved Trip Inventory (ATI). The existing volumes and trips from the City's ATI do not account for any shifts from non-single occupancy vehicles (non-SOV) that would occur in the project area with the planned investments in pedestrian, bicycle, and transit infrastructure and services by Downtown West, the City, Caltrain, and BART. Ultimately, the City aims to achieve a 75 percent non-SOV mode split to reach goals identified in the City's *Envision San José*. Since the "approved but not yet built" developments

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<sup>5</sup> The PM peak hour intersection analysis presented in the LTA accounts for an approximately 18 percent trip reduction due to a basic TDM program and does not include the additional nine percentage points required by the EIR TDM mitigation measure.



volumes do not include shifts to non-SOV anticipated in the area, it stands that the Background No Project traffic volumes used in this analysis could be comparatively higher than is expected by the City, leading to a conservative analysis input.

### *(2) Time shift from PM Peak Hour to 6:30–7:30 PM*

The traffic volumes were then adjusted to account for the time period shift from the PM peak hour (an hour between 4:00 – 6:00 PM) to the 6:30 – 7:30 PM time period. This time period was chosen because SSE indicated that historically, most event attendees arrive about one hour prior to a typical game start time, which currently typically start at 7:30 PM. The adjustment factor was developed based on a comparison of freeway ramp traffic volume reports—those collected as part of the project and those from the Caltrans Performance Measurement System (PeMS) traffic count database. The comparison resulted in an estimate that traffic volumes during the typical weekday 6:30–7:30 PM period are approximately 80 percent of typical weekday PM peak hour traffic volumes. A similar time period shift was done as part of the DSAP Traffic Impact Analysis in 2013. As included in that report on page 68, “a comparison of existing traffic volumes at study intersections indicated that on average traffic volumes in the 6:00–7:00 PM period are 70 percent of those during the standard PM peak hour.” Since 70 percent leads lower traffic volumes than the 80 percent assumed, the traffic volumes used in this analysis could be comparatively higher than was projected by an earlier City-led report, leading to a conservative analysis input.

### *(3) Traveler Behavior Adjustments to Traffic Volumes*

An additional adjustment was made to traffic volumes to reflect our observations in other urban locations (e.g., Sacramento, San Francisco, Seattle, and Los Angeles) where Fehr & Peers have engaged in the planning and arrival experiences of arenas.<sup>6</sup> In these locations, “background” traffic during the pre-event arrival time is typically altered on days with an event as 1) some people that work near arenas proactively alter their commute routines on event days, leaving work early and/or working from home on those days to avoid additional commute travel time, and 2) people that would have typically traveled through the area surrounding the arena but choose to alter their route, change their time or mode of travel, or choose not to travel due to awareness of an event.

In general, one can think of the “value” of vehicle trips along a spectrum from low to high. As traffic conditions become more congested, “higher” value trips will displace some of the “lower” value trips, who may choose a different route, mode, time, or even whether to travel. More specific to the “pre-event” ingress scenario, event attendees represent some of the highest value trips on the transportation network; not only have they chosen to travel but the success of their

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<sup>6</sup> Fehr & Peers has engaged in several recent transportation studies where the planning of NBA/NHL arenas and the arrival experience have been the focus: the Golden One Center in Sacramento, CA, the Chase Center in San Francisco, CA, the Climate Pledge Arena in Seattle, WA, and the proposed LA Clippers Arena in Inglewood, CA.

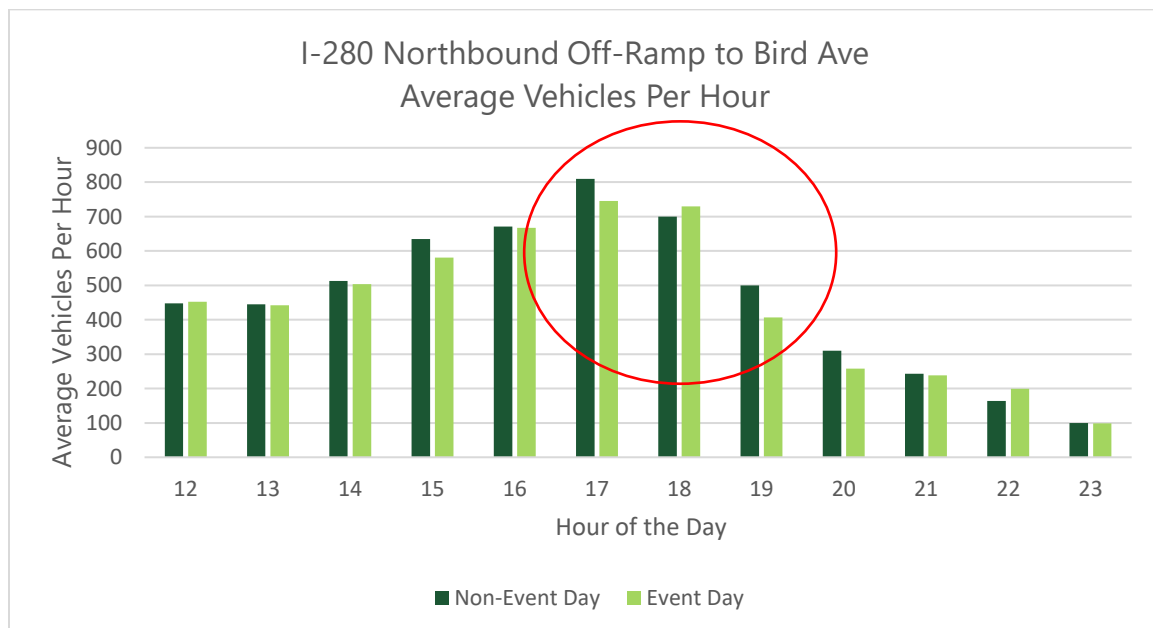




trip (and their investment in the evening as represented by purchasing tickets and attending an event at SAP Center) hinges on their arrival during a certain period (i.e., before the event begins). These people must travel during a certain time and to a certain location, whereas others can alter their route, time, or mode of travel, or choose not to travel. In the case of commuters that typically travel in their vehicles, changing the start time of their commute back home on days where there is an event can lead to a more predictable and consistent commute experience.

In order to approximate the current size of the effect in which background traffic is altered on days in which there are events, available freeway ramp data was collected from the PeMS traffic count database on 6 weekday evenings with a San José Sharks game at SAP Center and 15 days without a home game at the SAP Center in the October to December 2019 timeframe. Data was only available for the I-280 on and off-ramps at Bird Avenue – no ramp data was available for SR 87 off-ramps at Santa Clara or Julian Street.

As shown in the red circle in **Inset 3**, the I-280 northbound off-ramp to Bird Avenue shows that during the 5:00 – 6:00 PM hour before an event, the off-ramp volumes decreased by 8 percent compared to a typical weekday. This could illustrate the phenomenon in which drivers who are aware of the event take steps to avoid the Downtown West area. In the 6:00 – 7:00 PM hour there is a 4 percent increase in off-ramp volumes on a game day compared to a typical weekday representing people arriving to the downtown event, less than the expected increase if one were to assume SAP ingress traffic were added to background traffic with no changes. In the 7:00 – 8:00 PM hour, there is an 18 percent decrease in off-ramp volumes during an event day, which again could show that some drivers take steps to avoid the Downtown West area during the window of events at SAP Center.



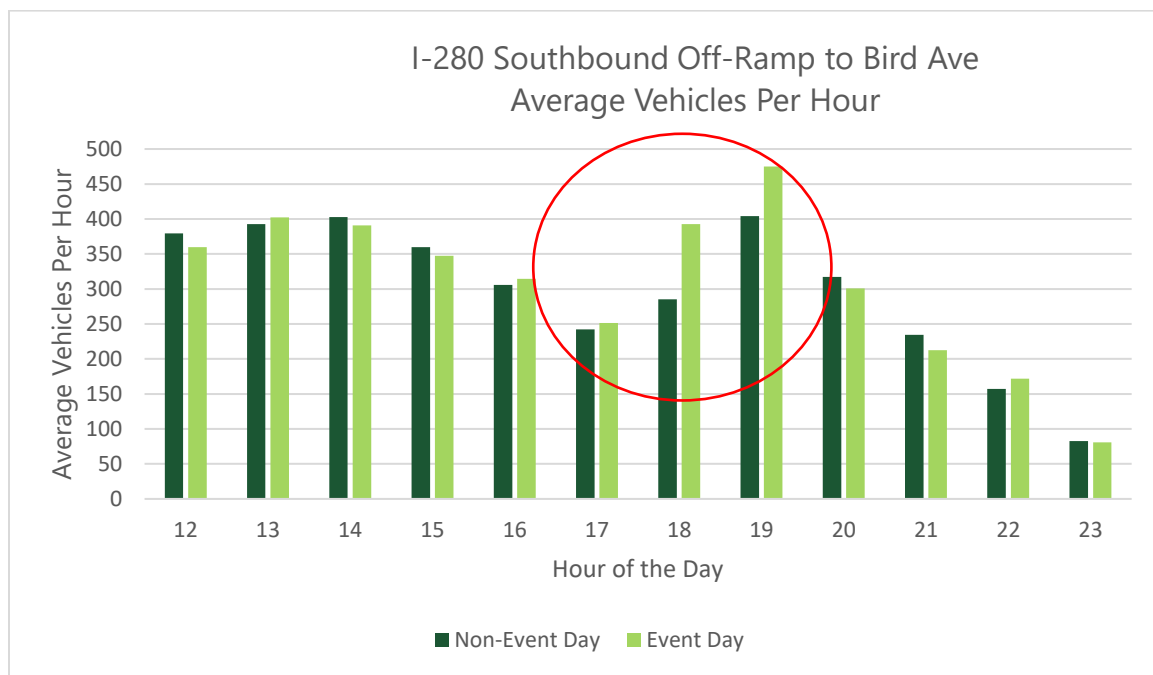




### *Inset 3. I-280 Northbound Off-Ramp to Bird Ave Average Vehicles Per Hour*

Source: Caltrans PeMS traffic count database, Fehr & Peers, 2021

As shown in **Inset 4**, the I-280 southbound off-ramp to Bird Avenue generally shows an increase in ramp volumes on days with an event at SAP Center in the hours preceding it. Further, the red circle indicates that from 5:00 – 6:00 PM, there is an approximate four percent increase in ramp volumes. From 6:00 – 7:00 PM there is a 38 percent increase (from 285 to 393 vehicles) in ramp volumes, and from 7:00 – 8:00 PM there is an 18 percent increase (from 404 to 475 vehicles) in volumes on a game day compared to a typical weekday. However, like the northbound off-ramp to Bird Avenue, we would expect the increase in vehicles to be much larger if arena ingress traffic were simply added to “non-event” traffic with no underlying changes in traveler behavior. In the case of the northbound off-ramp, based on arena ingress information provided by SSE (number of attendees arriving by vehicle prior to an event and by which routes, as described in the Ingress Trip Assignment section) we would expect the increase to be in the range of 500 – 1,000 vehicles. Not only was the typical increase of approximately 110 vehicles between 5:00 – 6:00 PM and 70 vehicles between 6:00 – 7:00 PM comparatively less than this range, the average vehicles per hour inclusive of background traffic and arena attendees arriving by vehicle at this location (approximately 390 vehicles between 5:00 – 6:00 PM and 480 vehicles between 6:00 – 7:00 PM) were themselves less than the potential range of increase in vehicles. Due to these gaps between projections and measured data, it is a reasonable takeaway that some drivers take steps to avoid the Downtown West area during the window of events at SAP Center.





***Inset 4. I-280 Southbound Off-Ramp to Bird Ave Average Vehicles Per Hour***

Source: Caltrans PeMS traffic count database, Fehr & Peers, 2021

Another piece of evidence as to how people alter their travel behavior on days in which there are events comes from comparing the distribution of observed vehicle travel times between major origins (i.e., freeway off ramps) and parking locations on days in which events are held at the SAP Center to days in which there are no events. Fehr & Peers calculated travel times<sup>7</sup> using GPS data obtained from WeJo for four key travel routes from SR 87 and or I-280, identified by SSE for their importance for SAP Center event attendees<sup>8</sup>. This representative sample of vehicle travel times can then be used to speak to the travel time experience of all vehicles along the same route. WeJo provides GPS and driving events data from connected vehicles and is currently one of the only available data sources of vehicle travel time data pre-COVID.

Each colored dot shown in **Inset 5** represents the observed time a vehicle takes to get from the freeway off ramp to the indicated parking location during the ingress 6:30 – 7:30 PM hour for both the non-event (orange dot) and event day (green dot) scenarios. The event day travel times are based on GPS observations collected one hour before the start of two San Jose Sharks home games in October 2019<sup>9</sup>. The non-event day estimates are based on data collected during the same days of the week and hour as the event days during October 2019. Excluding visual outliers, the differences in the non-event and event ranges appears to be minimal – proceeding from left to right across **Inset 5**, the observed travel times for both non-event and event days occur within:

- Delmas Parking via Santa Clara Street (0.1 miles) – less than 2 minutes
- Lot C2 via Julian Street/Montgomery Street (0.6 miles) – one minute and approximately 13 minutes, with a slightly higher skewed distribution on non-event days

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<sup>7</sup> WeJo collects driving-related events (ignition on and off, hard braking, harsh acceleration, excessive speeds, and seatbelt on and off) and GPS data from connected vehicles. The GPS data is collected every three seconds while the vehicle is in motion and is used to identify unique vehicle trips that travel through specific study corridors. Travel time, travel distance, and speed estimates are then calculated using GPS observations along select corridors. Only GPS from trips observed traveling completely throughout the corridor are used. Complete trips are defined as when the ratio of the observed travel distance to the length of the corridor is at least 0.95.

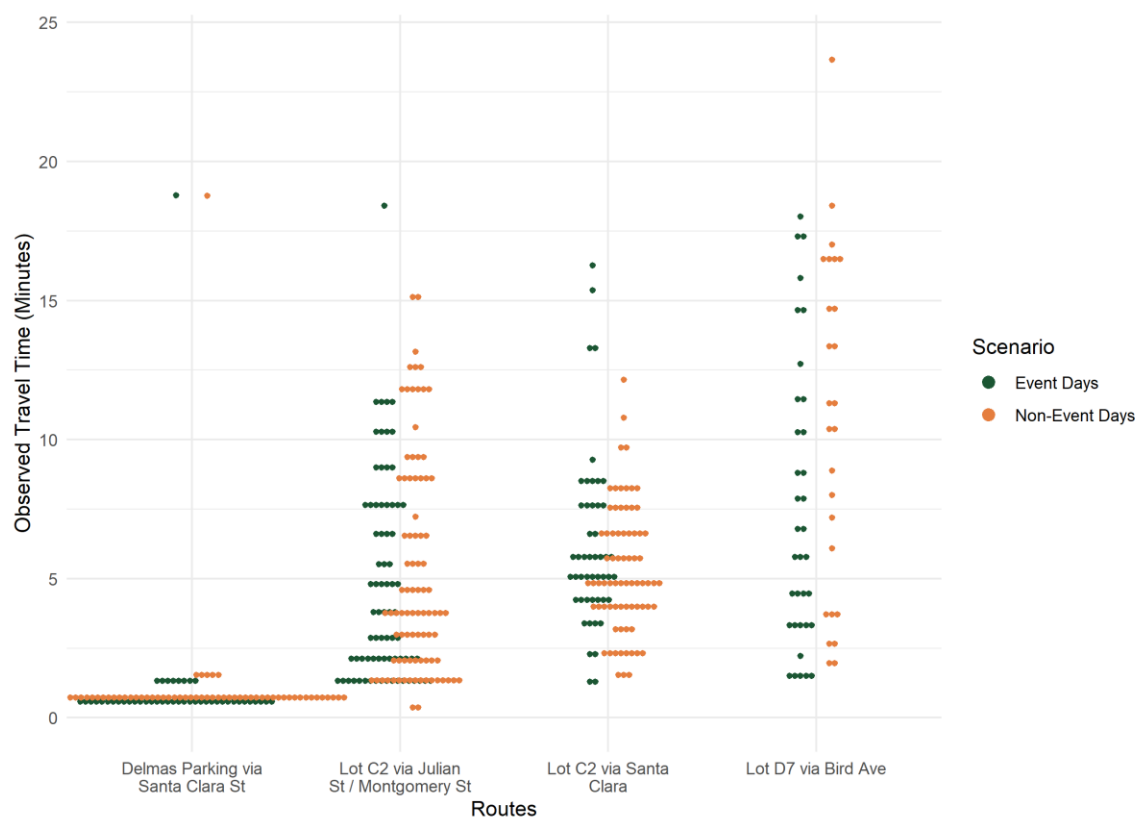
<sup>8</sup> SSE has not provided any vehicle travel time data for those attending events at SAP Center.

<sup>9</sup> Event day travel times were collected on 10.4.19 and 10.16.19 and non-Event day travel times were collected on 10.11.19 and 10.23.19.



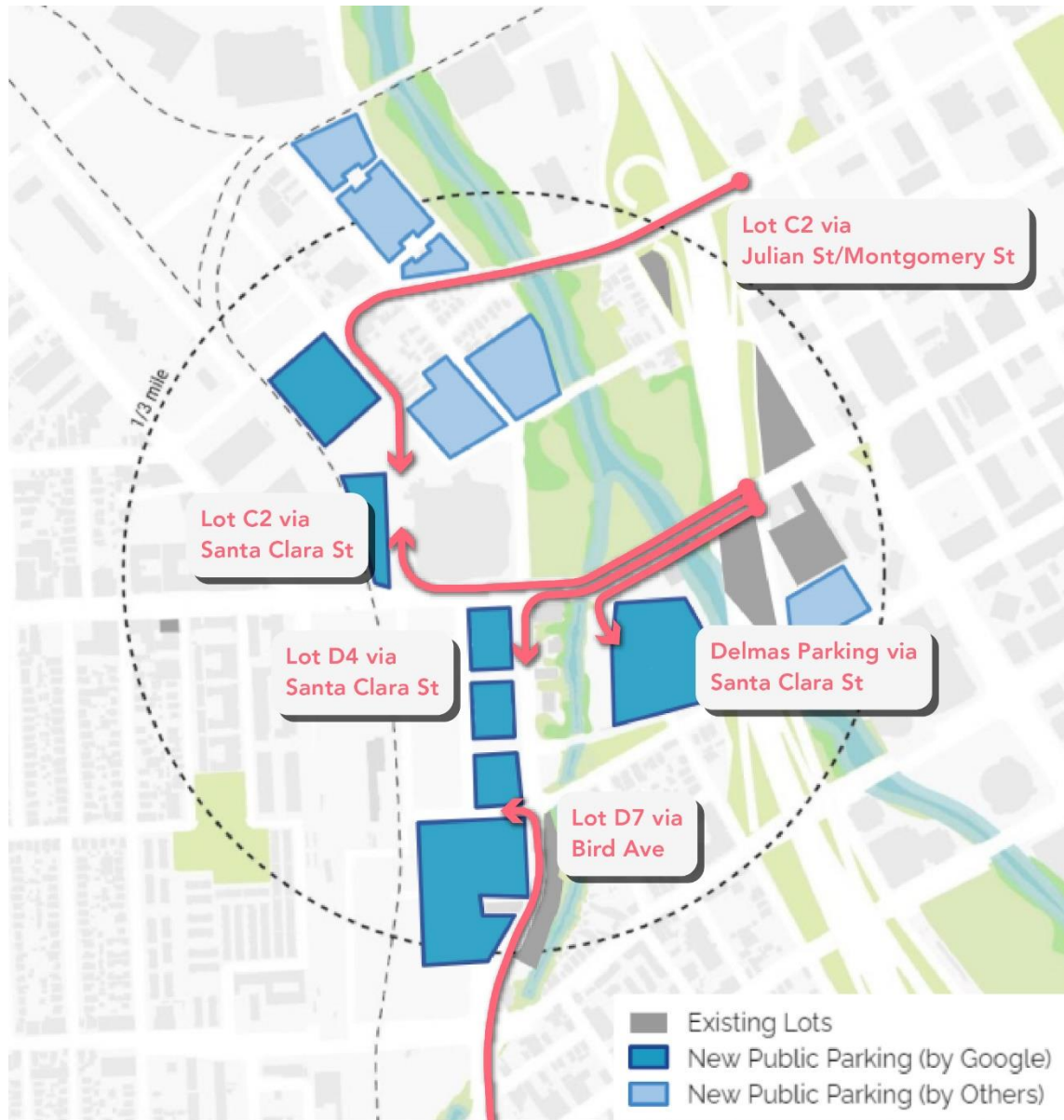
- Lot C2 via Santa Clara Street (0.4 miles) – a couple of minutes and approximately 12 minutes, with similar distributions, but more outliers on event days
- Lot D7 via Bird Avenue (0.5 miles) – a couple of minutes and approximately 17 minutes, with similar uniformity and distributions between event and non-event days

The representative travel routes that correspond to the observed travel time distributions are shown in Error! Reference source not found..



***Inset 5. Representative SAP Center Event Attendee Observed Vehicle Travel Time Distributions by Route (2019)***

Source: Fehr & Peers, 2021.



*Inset 6. Representative SAP Center Event Attendee Vehicle Travel Routes to Select Parking Locations*

Note: The Lot D4 via Santa Clara Street route was added after the other four routes. There was enough time to determine modeled travel time results for this route (as shown in the Model Travel Time Results section), but not enough time before deadline to determine observed (2019) vehicle travel times (as shown in the Traveler Behavior Adjustments to Traffic Volumes section).

Source: Fehr & Peers, 2021.



It is a reasonable conclusion that the fact that the distribution of observed travel times from freeway off-ramps to parking locations are functionally the same when there is and when there is not an event at SAP Center is evidence that some drivers take steps to avoid the Downtown West area during the window of events at SAP Center. If there was no change in travel behavior, and SAP Center attendees were simply added to the “normal” amount of traffic on Downtown West area roadways, the distribution of travel times would not be in alignment as indicated in **Inset 5**.

It is challenging to predict how large the future effect of the following could be: 1) people that work near arenas who would proactively alter their commute routines on event days (i.e., leaving work early and/or working from home) to avoid additional commute travel time, and 2) people that would have typically traveled through the area surrounding the arena but choose to alter their route, change their time or mode of travel, or choose not to travel due to awareness of an event. Through our examination of the Bird Avenue off-ramps, one of several off-ramps used by arena attendees arriving in vehicles, we have shown that there likely have been measured effects from these factors as recently as 2019. Further, our comparison of travel times along key routes provides further evidence of these effects. It is reasonable to presume that as the Downtown West project is built out over time, this effect could become more pronounced as we have observed in other urban locations with arenas. Thus, for the purposes of the ingress analysis we selected a reduction of 25 percent of background traffic, even though we believe the effect may be greater.

#### *(4) Arena Attendee Volumes*

The arena attendee traffic volumes assumed 60 percent of all attendees would arrive in the hour prior to an event start time. This assumption comes from using the average of survey-reported percentages of typical attendee arrivals in the hour before NBA game start times in arenas located in Sacramento (55 percent, reported in 2017), San Francisco (50 percent, reported in 2019), and Los Angeles (70 percent, reported in 2018). The remainder of attendees could arrive before the hour prior to start to participate in pre-game activities and/or patronize restaurant/bars; the type of behavior seen today in San Jose prior to games including in the San Pedro Square area. Further, although the three arenas reported lower percentages of attendees arriving by personal or Uber/Lyft rideshare vehicles (reported between 50 and 85 percent) than SSE did for those attending San Jose Sharks games (90 percent), we retained the higher vehicle arrival percentage for our analysis, despite the potential for increased non-vehicle arrival modes due to the increase in residents and commercial opportunities within a five-minute walk of SAP Center.



#### *(5) Uber/Lyft Rideshare Volumes*

Additionally, the ingress model includes 200 Uber/Lyft rideshare vehicles containing approximately 500 arena event attendees; these attendees are dropped off at the existing Autumn Street Drop Off Area.<sup>10</sup>

### **Ingress Trip Assignment**

The arena attendee vehicle trips were assigned to the roadway network consistent with the “Approach Routes to SAP Center Based on Zip Codes for Sharks Season Ticket Holders,” December 30, 2017 and “Ingress Routes Diridon Area Plan,” June 2020 provided by SSE in March 2021 (included in **Appendix B**). Lacking detailed information about where individual attendees typically park, attendees were assigned to the 16 parking locations within 1/3-mile of the SAP Center, comprising approximately 5,450 available parking spaces (as shown in **Inset 1**) proportional to their available capacity. The 5,450 available parking spaces represent an 85 percent availability target for SAP Center attendee use at 6:30 PM. Thus, in a conservative assumption (i.e., could lead to higher estimated vehicle travel times) each parking location was assumed to have a similar proportion of vehicle trips from each major attendee origin point (e.g., from north on Highway 101, from south on Highway 87, etc.) rather than attendees favoring parking locations closest to their origin point.

### **Roadway Network**

The typical weekday roadway network is the same as that used for the LTA weekday PM peak hour scenario and includes future planned projects such as closing Montgomery Street south of San Fernando Street and converting Autumn Street from one-way today to two-way in the future. The ingress model network was further modified for two assumed event traffic management strategies: (1) the closure of Autumn Street in front of the SAP Center between Santa Clara Street and St. John Street, and (2) the use of dynamic lanes on Autumn Street such that there are two southbound lanes between Santa Clara Street and Post Street, and two northbound lanes between the light rail crossing north of San Fernando Street and Post Street to accommodate ingress and egress operations.

## **Ingress Model Travel Time Analysis Results**

The primary output of the models are average vehicle travel times between freeway off-ramps and parking locations. As previously noted, vehicle travel times are helpful for understanding the projected typical arrival experience for an event attendee traveling in a vehicle. As described in the Traveler Behavior Adjustments to Traffic Volumes section (and shown in **Inset 6**), key travel times/routes from SR 87 and or I-280, identified by SSE for their importance, were selected for analysis and comparison. The travel times shown in **Table 1** represent the modeled average time

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<sup>10</sup> <http://www.sapcenter.com/guest-services/guestpickupdropoff>



a vehicle takes to travel from the freeway exit to the indicated parking location during the ingress 6:30 – 7:30 PM hour for both scenarios<sup>11</sup>. The increases in average travel times range from a couple of minutes to an up to approximately seven-minute increase to travel from the SR 87 off-ramp at Julian Street to parking lot C2.

**Table 1: Representative SAP Center Event Attendee Vehicle Travel Times/Routes**

Route (Approx. Distance)	Non-Event Day	Event Day	Delta
Lot C2 via Julian Street/Montgomery Street (0.6 miles)	8 – 9 minutes	12 – 13 minutes	+3 – 5 minutes
Lot C2 via Santa Clara Street (0.4 miles)	1 – 2 minutes	3 – 4 minutes	+1 – 2 minutes
Delmas Parking via Santa Clara Street (0.1 miles)	< 1 minute	< 1 minute	0 minutes
Lot D7 via Bird Avenue (0.5 miles)	3 – 4 minutes	9 – 10 minutes	+5 – 7 minutes
Lot D4 via Santa Clara Street (0.3 miles)	1 – 2 minutes	3 – 4 minutes	+1 – 2 minutes

Source: Fehr & Peers, May 2021

## Fehr & Peers Ingress Analysis Assessment

The travel time results presented in **Table 1** are based on a series of informed, but often conservative assumptions with respect to 1) how attendees of SAP Center events will travel in the future following the evolution of the Downtown West area, with buildout assumed to occur in approximately the year 2031 and 2) how other travelers will alter their behavior in the future. They offer evidence that under this set of conditions the answer to the central question of whether the future roadway network could accommodate activity from Downtown West and SAP events is “yes” – the increases in average travel times for key routes between non-event and event days, using a set of frequently conservative assumptions and without the benefit of additional transportation management strategies are within the range of a couple of minutes per attendee. Further, not only is the increase between non-event and event days within the range of a couple of minutes per route, the ingress scenarios travel times, representing at minimum 10 years in the future, are within the distribution of travel times observed in 2019, meaning that the land use and roadway network changes associated with Downtown West project are not expected to materially

<sup>11</sup> Unlike the observed (2019) vehicle travel distributions shown in Inset 5, the traffic model does not output travel times for each vehicle during the hour, which could be used to show the travel time distributions; rather, it calculates and outputs average travel times.



change the travel experience of SAP Center attendees as measured by vehicle travel times. In summary:

- The average travel time of vehicles traveling to the SAP Center after Downtown West's buildout are expected to be within the range of travel times observed in 2019.
- After Downtown West buildout, vehicles traveling to the SAP Center on event days may experience an additional 0 to 7 minutes of travel time as compared to non-event days.
- The Downtown West project does not reduce the overall capacity of the street network to access or exit from SAP center events
- This analysis is based on informed, but conservative assumptions:
  - Assumes a 25% reduction of background traffic to account for individuals who shift or adjust their travel behavior during event times, which is conservative as compared to the existing travel patterns seen today
  - Assumes event attendees will travel by similar modes and times as they currently do following the buildout of the Diridon Station Area. With over 300k of active uses, over half the Downtown West residential, and multiple transit options within a 5-minute walk of the SAP Center, attendees will be able to walk, bike, and take transit to the SAP Center, as well as arrive early and stay after SAP events to enjoy the surrounding area.





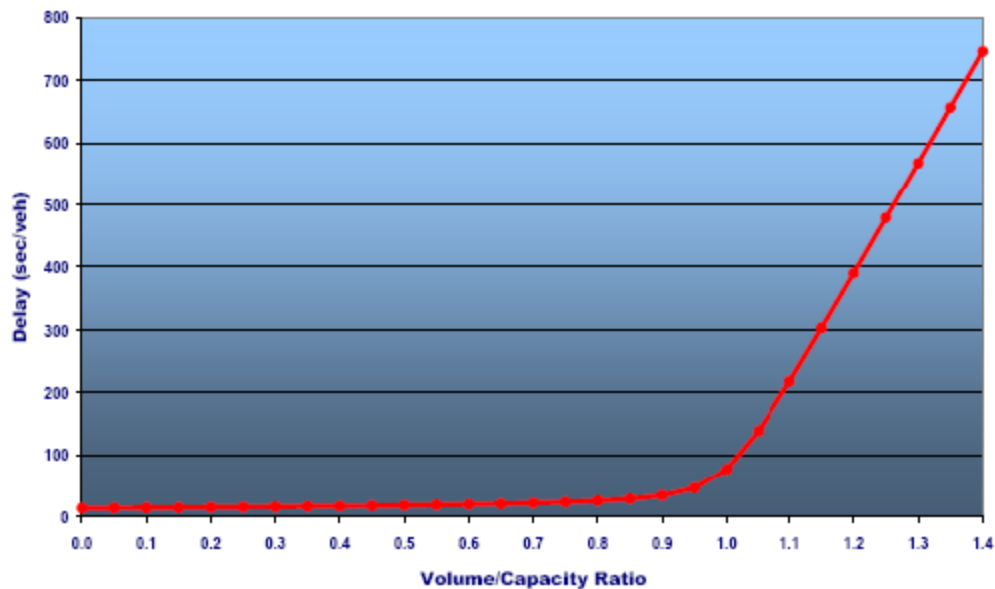
# SSE Ingress Model Peer Review

Krupka Consulting performed an ingress analysis, “Autumn Corridor Intersection Assessment,” February 2021 (included in **Appendix C**) for SSE decision makers. The analysis focused on the four Autumn Street intersections between Santa Clara Street and the Bird Avenue/ Park Avenue intersection to determine whether the Downtown West proposed three-lane cross-section of Autumn Street can accommodate SAP event traffic. The ingress analysis differed from the Fehr & Peers ingress analysis, both methodologically and in terms of output, in several ways:

- The ingress analysis performed for SSE (“SSE ingress model”) focuses exclusively on intersection delay and level of service (LOS) of four intersections along Autumn Street as opposed to the comprehensive network developed to evaluate travel times of attendees arriving via vehicles to the main parking locations.
- The scenarios included in the SSE ingress model and those conducted by Fehr & Peers are different. The SSE ingress analysis compares three scenarios:
  - Existing (year 2013) volumes with SAP Center traffic: These intersection traffic volumes were taken from San José Ballpark Supplemental Traffic Analysis, February 2010. Presumably the earliest these traffic counts could have been collected was during the 2009 NHL hockey season between January and June of 2009; meaning the “existing” traffic counts are at minimum 12 years old; potentially older than that. The intersection LOS results from this “existing” scenario are being compared to results from a scenario meant to approximate year 2040 conditions: a 30 plus year difference. As discussed below, the future year conditions are not meant to be taken as a given either.
  - Cumulative Year 2040 Conditions including SAP Center traffic: As described in the Krupka memo, the intersection traffic volumes are meant to approximate a scenario in which the full buildout of the DSAP occurred. The DSAP is a long-range plan that identifies the amount of development that could occur in the Diridon Station area; besides Downtown West, no major development applications have come forward. As noted in the DSAP Traffic Impact Analysis in 2013 on page 69, *“The DSAP Master Plan envisions buildout of the DSAP to take as long as 35 years. The projected intersection levels of service and identified improvements are based on traffic projections some 35 years into the future. It is likely that traffic conditions will change over a timeframe of that length”*. Further, the intersection volumes are an approximation based on available information, which was included in the Downtown West LTA (Scenario 3b) and the 2013 DSAP TIA, since only one of the four intersections included in the memo was included in the Downtown West LTA.



- Cumulative 2040 with SSE recommended geometry: A scenario in which SSE's preferred intersection geometry for Autumn Street is modeled, with accompanying intersection LOS results using the same Cumulative Year 2040 operations with an event at SAP Center described above.
- The intersection geometries of the four Autumn Street intersections are the same in both analyses, however the SSE ingress model does not include the temporary closure of Autumn Street between Santa Clara and St. John streets prior to events—which has been in place for many years—to facilitate pedestrian access to the arena and ticket booth.
- The modeling software used for the SSE and Fehr & Peers analyses are different, and these models are typically employed to understand different types of traffic conditions. The SSE ingress model is based on Highway Capacity Software (HCS) intersection analysis software, which is more typically employed to model conditions at isolated intersections operating below capacity. The Fehr & Peers ingress model is built using SimTraffic software, which is more typically employed to model congested travel conditions, where it is essential to capture the interactions between vehicles and intersection control in order to accurately model travel conditions, including vehicle travel times and intersection delay.
- The SSE ingress model traffic volumes do not account for how the amount and location of parking locations would change in the future (as described in the Fehr & Peers Ingress Analysis section) for SAP Center event attendees, the typical closure of Autumn Street for Sharks Alley, or the dynamic lanes proposed for Autumn Street as part of the Downtown West project.
- The SSE analysis/memo, by both reporting and comparing intersection delay projected to operate above a 1.0 intersection volume to capacity (v/c) ratio, provides information that is not realistic or accurate. The relationship between intersection delays and v/c ratio is shown in **Inset 7**; specifically, how the deterministic HCM intersection delay methodology results in intersection delay that transfers from a steady increase in delay to a parabolic shift in delay around the point at which intersection capacity is reached. This shift in the delay curve is why it is typical in traffic reports to see intersection delay results for intersections operating at LOS F to report "> 80 seconds of delay" accompanied by intersection v/c ratio (as vehicle travelers do not actually experience these types of delays, except in rare circumstances). In these scenarios the intersection v/c ratio is a better assessment tool as the delay calculation is not meant to operate as a theoretical, in the way that v/c ratios are able to. Further, linear comparison of intersection delay results beyond the capacity point to intersection delay results operating below the capacity point (i.e., Table 2 of the SSS memo) are not accurate as they do not consider the deflection of the vehicle delay curve.



*Inset 7. Figure V.A.3-3 Sensitivity of Vehicle Delay to Volume/Capacity Ratio*

Source: 2000 *Highway Capacity Manual*, Chapter 16, Exhibit 16-14

## Peer Review Assessment

Based on our assessment, the analysis employed by Krupka Consulting took a narrow and conservative approach in trying to provide evidence in response to the central question: “Can the future roadway network accommodate activity from Downtown West and typical vehicle traffic associated with pre- and post-events at the SAP Center?” It looks at the theoretical, projected performance of a subset of intersections rather than taking a holistic view of mobility in the area. Further, it does not take into account the changing nature of the transportation system around Diridon Station, including major aspects like roadway configurations and the fact that parking locations used by SAP Center attendees will change in the future. Further, it does not take into account how people alter their travel behavior on days in which there are events at urban arenas. A narrow and/or conservative approach is not itself an issue, however the analysis relies on incomplete data and assumptions, partially due to necessity due to data limitations, which combined with departures from industry practices and standards does not present a realistic analysis with respect to addressing the central question.



# Egress Analysis

A SimTraffic model was developed by Nelson/Nygaard, a transportation consultant to the Downtown West project sponsor. The purpose of the analysis/model was to determine the percentage of vehicles that could exit the 16 parking locations where SAP event attendees would typically park within 30 minutes following the event, following the development of Downtown West. The 30-minute egress time is not an established threshold or requirement, but a general benchmark to evaluate ease of egress. The methodology and model inputs and outputs are described in *"SAP Egress Traffic Simulation Results under High and Low Traffic Management Scenarios,"* November 2020 (included in **Appendix D**).

The egress model included 16 parking locations containing 5,733<sup>12</sup> parking spaces that are accessible within 1/3-mile. The model extents are approximately within a 1/2-mile radius of the SAP Center, where all the parking locations can be reached with an approximate 5-15 minute walk from the SAP Center. The egress model simulated the time immediately following the end of a typical weekday event at SAP Center (i.e., 9:45–10:45 PM).

## Egress Model Review

Fehr & Peers reviewed the egress model and methodology of its development in December 2020 and made the following observations:

- The model includes the Downtown West proposed changes to the existing roadway network, including converting Autumn Street to two-way circulation and extending Cahill Street to the north and south of its current terminus at Santa Clara Street (north) and San Fernando Street (south).<sup>13</sup>
- The model includes traffic counts collected following a San José Sharks hockey game on Thursday, December 27<sup>th</sup>, 2018, which is during the winter holidays period. Traffic counts collected during this time account for the parking locations as they currently are, but not as they necessarily will be following development of the Downtown West project. Driveways associated with parking lot parcels that would be developed are not included in the model. However, the vehicle trips associated with these driveways were not removed from the network. Thus, the egress model serves as an approximation of the future condition since it includes vehicles associated with parking locations that would be developed. The effect of this is more "background" vehicle trips represented in the egress model, which could translate into higher vehicle travel times and a lower vehicle exiting rate for some parking locations. The fact that the traffic counts were collected

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<sup>12</sup> 5,733 parking stalls for game-day usage across 16 facilities within an approximately 13-minute walk of the SAP Center (from the NN memo)

<sup>13</sup> The full details of proposed roadway changes can be found in the Downtown West project application materials.

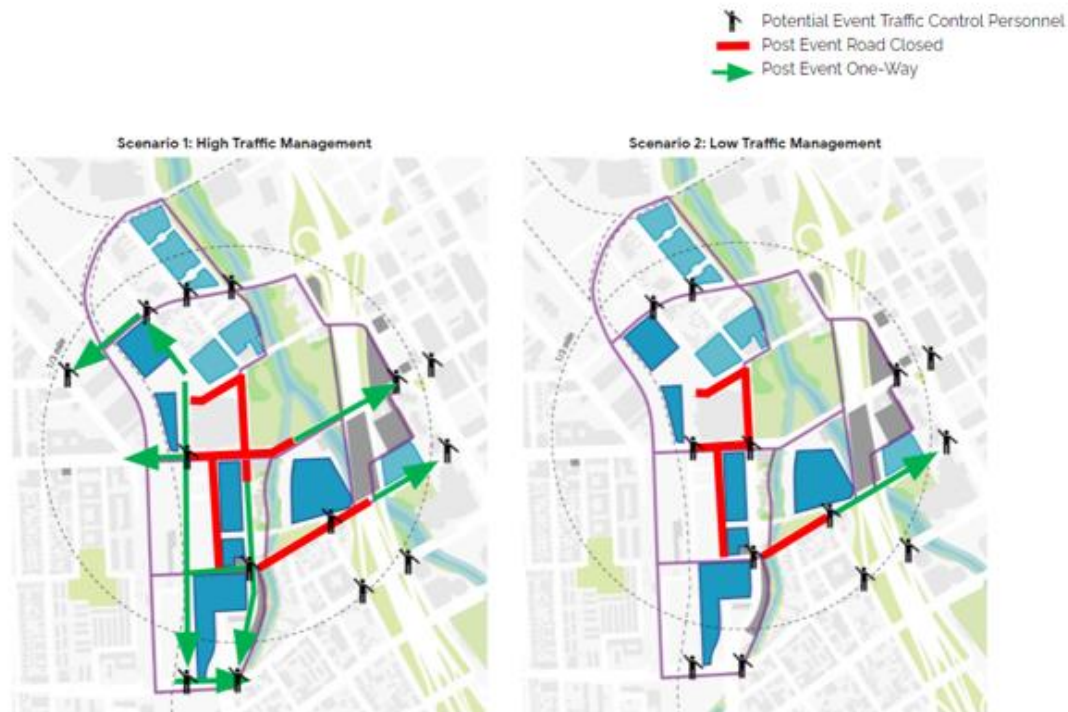


during the winter holidays could also affect whether the background traffic volumes represent “typical” conditions, though the magnitude and direction of the effect is unknown.

- The model accounts for existing background vehicle trips, but does not account for Downtown West project-generated traffic volumes. Given the analysis hour the project-generated traffic volumes could represent approximately 20-25 percent of the PM peak hour vehicle trips<sup>14</sup>. The effect of this decision is to reduce background vehicle trips, which could translate into lower vehicle travel times and a higher vehicle exiting rate for some parking locations.
- Vehicles begin exiting from the parking locations at 9:45 PM and exit at uniform rates over the course of the modeled hour. This does not consider that walk times from the SAP Center to parking locations are different for each parking location, which are roughly 5-15 minutes. It also assumes that some event attendees will not patronize local businesses (i.e., bars, restaurants following) events at SAP Center. The effect of this is that parking locations further away from SAP Center begin generating exiting vehicles at the same time as those closer to SAP Center; however, it is unclear the extent to which this would affect reported vehicle travel times.
- Parking locations were not programmed to stop generating exiting vehicles following the departure of what would be the last remaining vehicle (i.e., vehicles kept exiting an “empty” parking garage). The effect of this is to produce more vehicles on the modeled roadway network, which could translate into higher vehicle travel times and a lower vehicle exiting rate for some parking locations.
- Two “traffic management” scenarios were modeled for “low” and “high” traffic management. Traffic management refers to the combination of city traffic control personnel directing traffic and/or manually controlling the phasing of traffic signals to prioritize the egress of attendee vehicles exiting the area. It also includes post-event road closures and direction changes (i.e., one-way roadways). The difference between low and high is degrees—the high scenario had comparatively more traffic control personnel, road closures, and directional changes (as shown in **Inset 7**). These traffic management scenarios are not intended to reflect the full range of potential traffic management options that could be implemented under the flexible Transportation and Parking Management Plan for the SAP Center, but appear to be representative of a likely range of management options for modeling purposes.

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<sup>14</sup> Based on a comparison of the 5 pm to 9 pm (10 pm is not included) vehicle trip by hour for multi-family residential, office, and retail as found in the ITE Guide handbook.



*Inset 7. “High” and “Low” Traffic Management Scenarios modeled as part of Egress Analysis*

Source: Nelson / Nygaard, 2020

- The effect of traffic control personnel’s ability to prioritize post-event traffic was not fully accounted for in the egress model. This would have been done by using traffic signals to approximate the way traffic control personnel assign right of way at intersections. Further, the lane utilization rates of the roadway network could have been modeled differently to account for more efficient use of the roadway by vehicles. The effect of these decisions is for modeled traffic operations to be less efficient than actual operations, which could translate into higher vehicle travel times and a lower vehicle exiting rate for some parking locations.

## Egress Model Outputs

The egress model analysis outputs were reported in terms of percent of parking location capacity that could exit the parking facility within 30 minutes and 45 minutes. For the low traffic management scenario, assuming 5,733 parking spaces, approximately 68 and 88 percent of the post-event traffic could exit the parking locations at 30 and 40 minutes, respectively. For the high traffic management scenario approximately 70 and 86 percent of the post-event traffic could exit



the parking locations at 30 and 40 minutes, respectively. Fehr & Peers was able to produce the same egress results from the models using the same software.

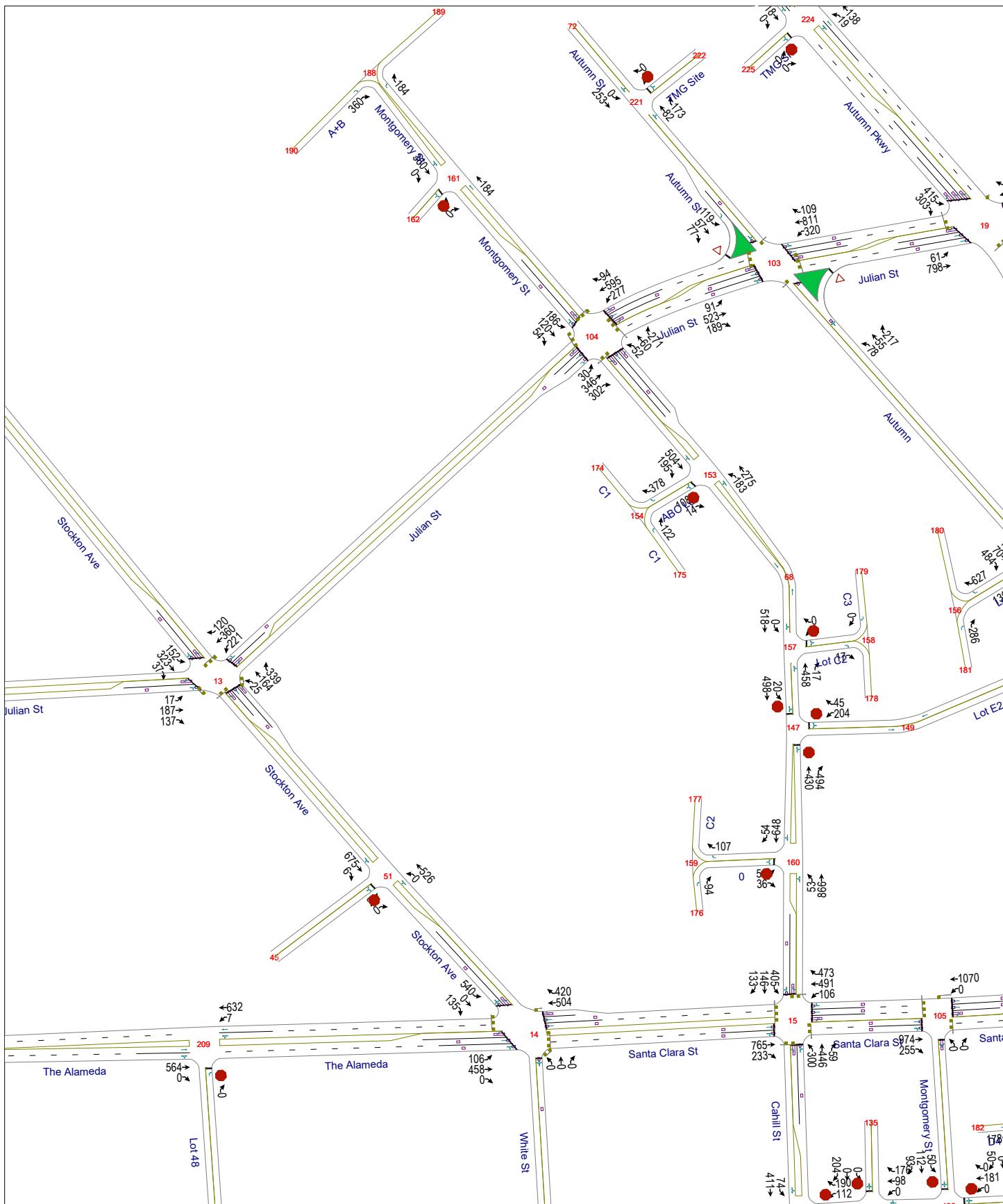
## **Fehr & Peers Egress Analysis Assessment**

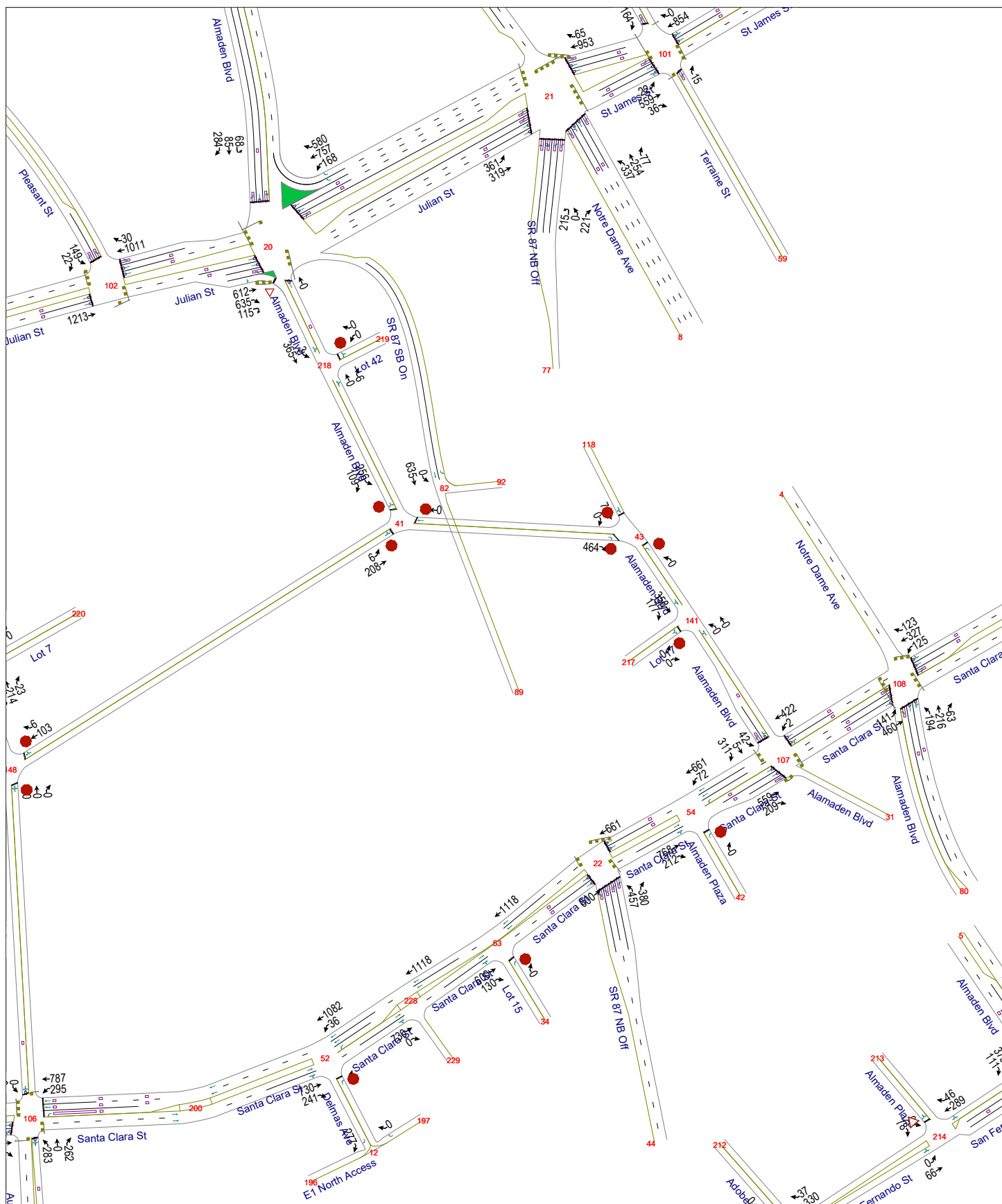
In summary, the decision to not remove vehicles from the network from parking lots that would be developed, stop vehicle generation once parking locations are empty, and inability to fully account for the efficiency improvements of traffic control personnel and lane utilization rates could have led to comparatively higher vehicle travel times and a lower vehicle exiting rate for some parking locations. At the same time, the decision to not include Downtown West-generated vehicle trips could have led to comparatively lower vehicle travel times and a higher vehicle exiting rate for some parking locations. The decision to have parking locations begin exiting at the same time could influence reported travel times, but the direction and magnitude is unclear. However, following review and on balance, we think the egress model and methodology used to approximate the “high” and “low” traffic management scenarios were appropriate for the egress travel time analysis, with the results likely shaded to the conservative side due to methodology decisions made. In summary:

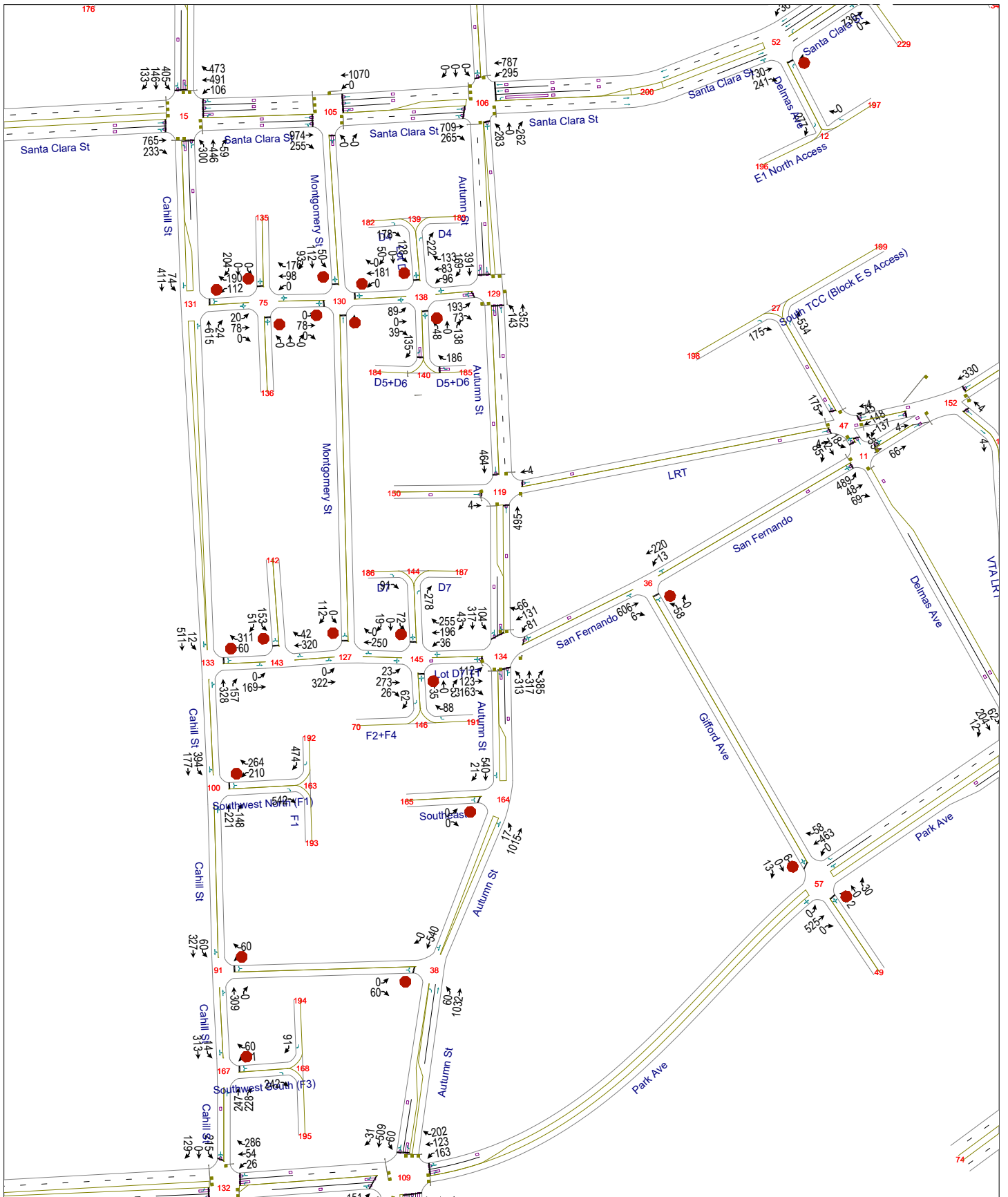
- Approximately 4,000 vehicles (78% of the 5,125 required within 1/3-mile in the AMA) can exit their respective parking facilities within 30 minutes following the end of an SAP Center event
- The analysis included a range of assumptions and methodologies that overall could lead to faster modeled travel times or higher vehicle exiting rates for certain parking locations
- This analysis assumed a range of scenarios, but recognizes the importance of post-game traffic and parking management

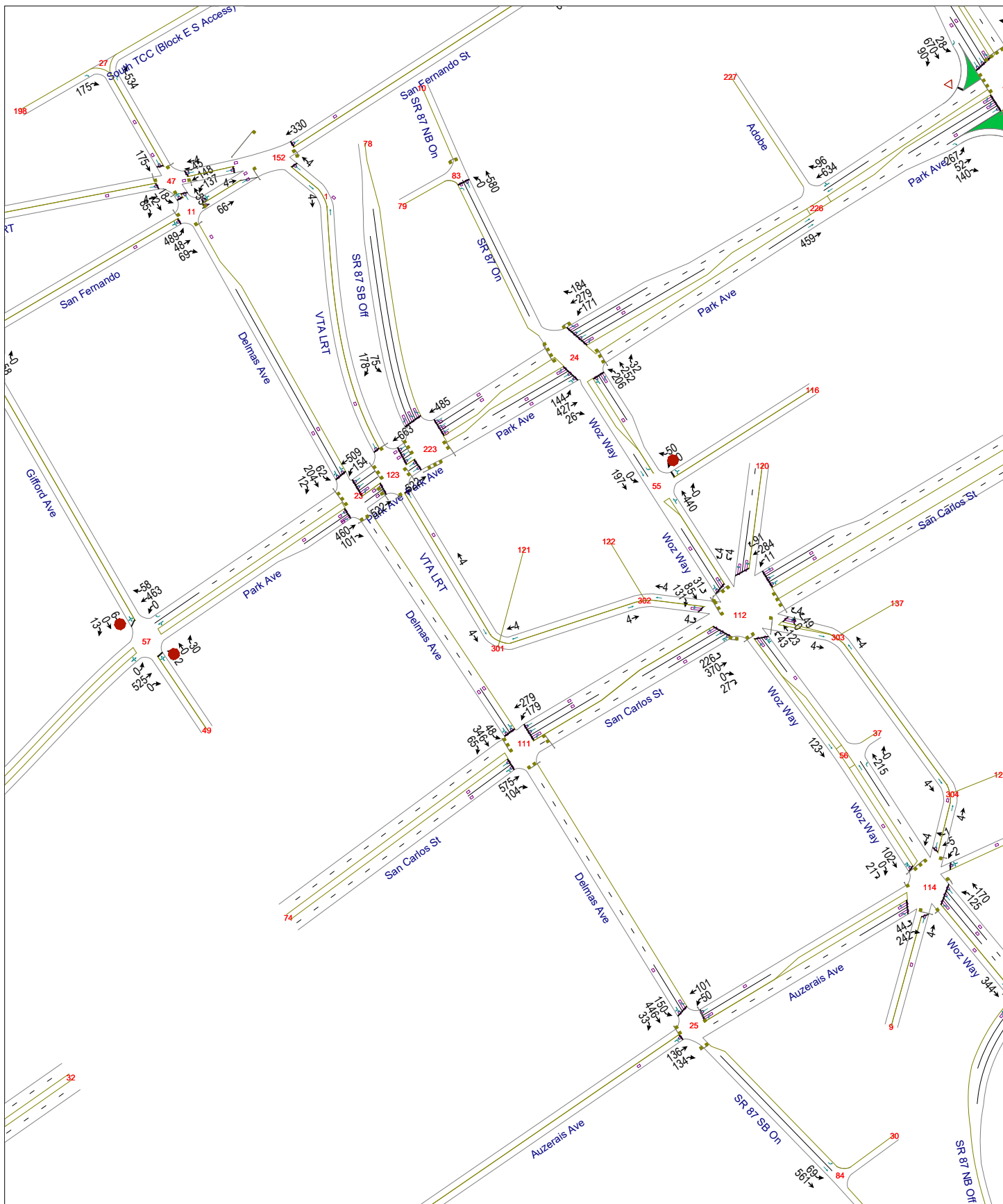
# Appendix A

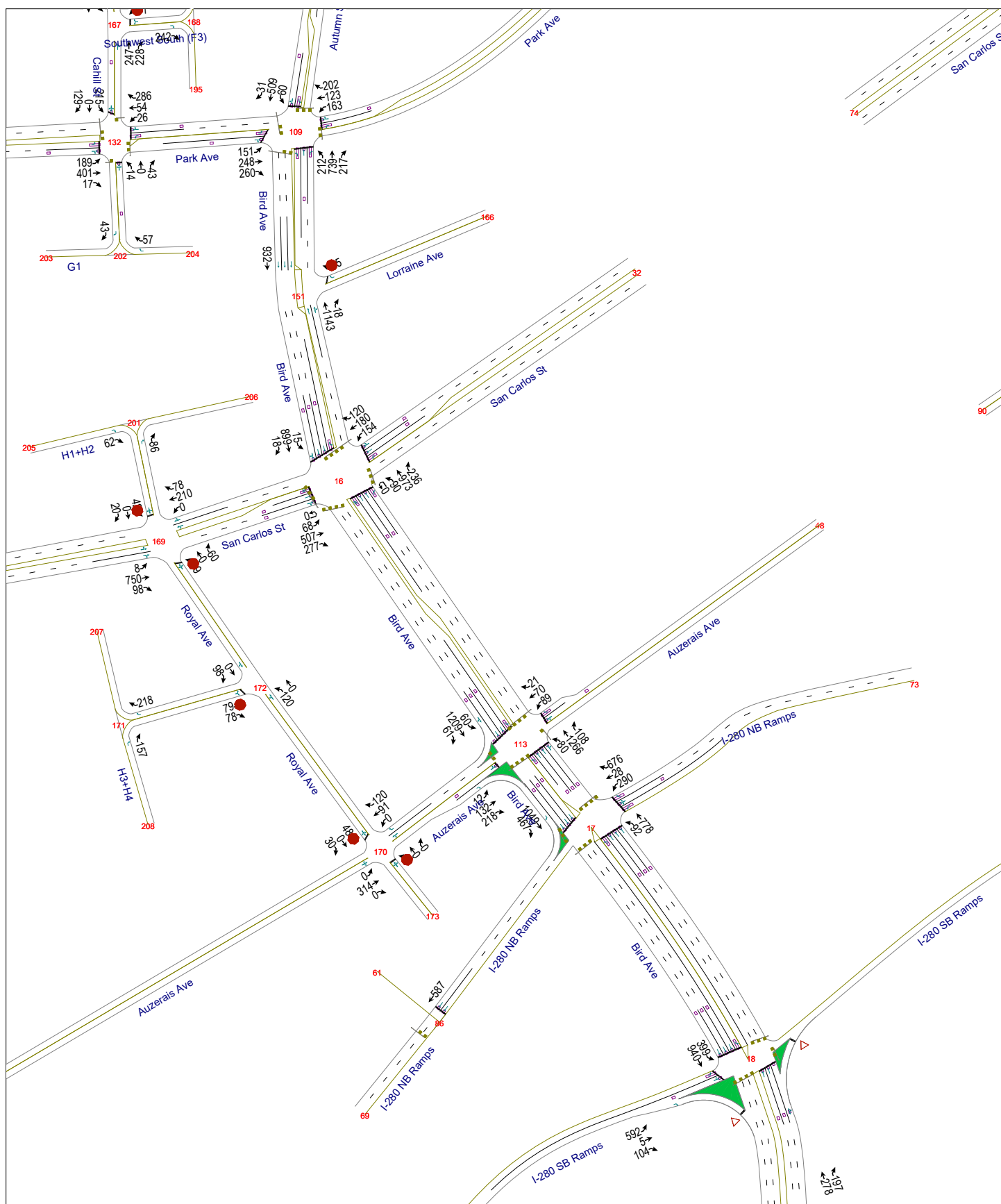












# Appendix B

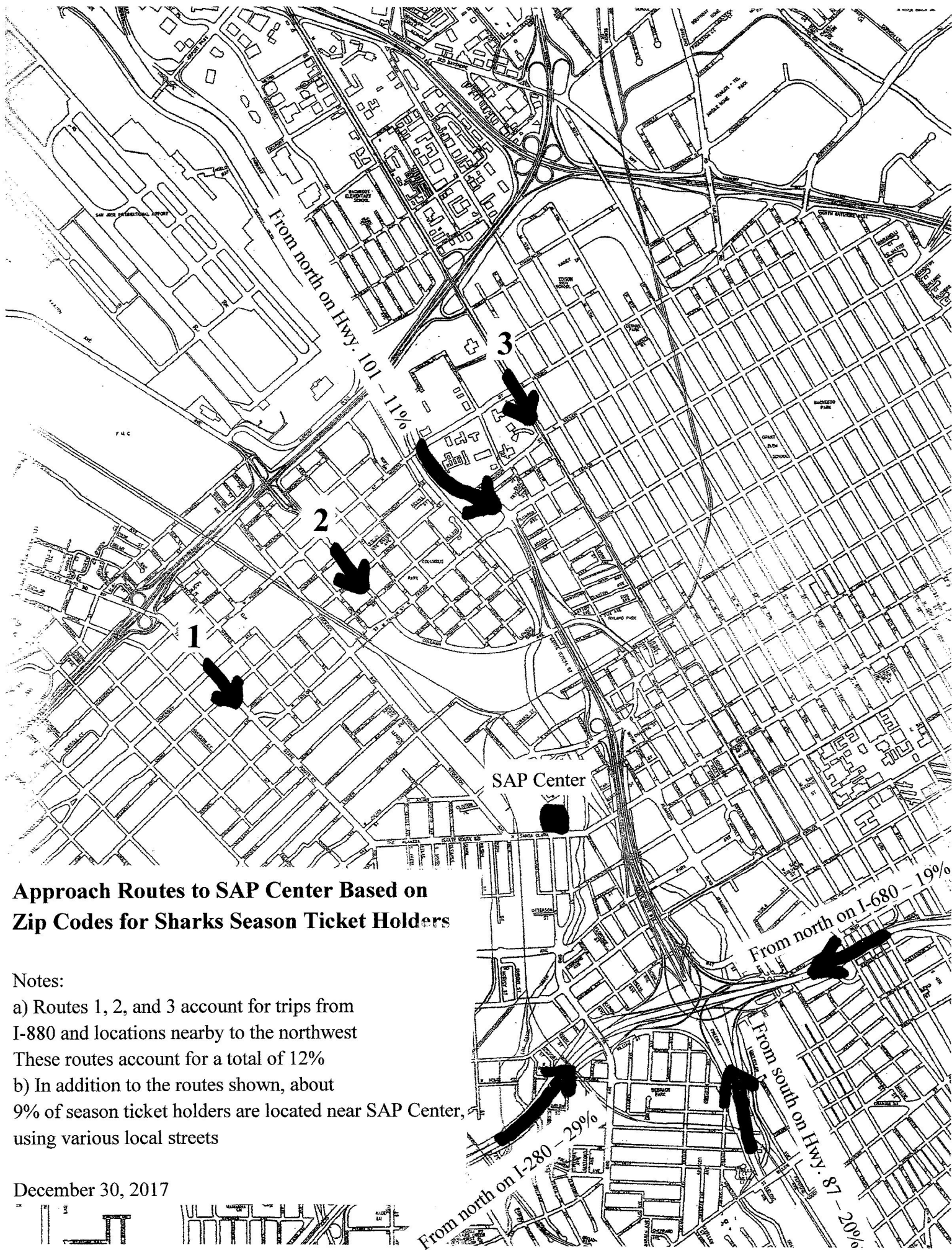




**Ingress Routes**  
**Diridon Area Plan**  
**06/10/20**







## Approach Routes to SAP Center Based on Zip Codes for Sharks Season Ticket Holders

### Notes:

- a) Routes 1, 2, and 3 account for trips from I-880 and locations nearby to the northwest. These routes account for a total of 12%.
- b) In addition to the routes shown, about 9% of season ticket holders are located near SAP Center, using various local streets.

December 30, 2017



# Appendix C

## MEMORANDUM

February 26, 2021

*by email*

TO: Jim Goddard, Sharks Sports & Entertainment LLC (SSE)  
CC: Jim Benshoof  
FROM: Paul Krupka  
Subject: Autumn Corridor Intersection Assessment

This memorandum documents the assessment of cumulative traffic conditions on the Autumn Street corridor during the 6:00 to 7:00 p.m. hour. The assessment was done for SSE by Krupka Consulting in close collaboration with Jim Benshoof, former Traffic Engineer for SSE, who provided advice, guidance and reviews to Krupka Consulting in all aspects of the work.

### Background

The proposed Downtown West (Google) Project (Project) was defined and evaluated in the Downtown West Mixed-Use Plan Draft Environmental Impact Report (Project DEIR) (ESA, October 2020). However, the intersection Level of Service (LOS) analysis for the Project DEIR did not include the segment of Autumn Street between San Carlos Street and Santa Clara Street, which is of utmost importance to SSE for SAP Center access.

Fundamentally, this meant the results of the Project DEIR could not be compared with findings of the most recent traffic evaluation of this key street, the 2014 Diridon Station Area Plan (DSAP) Traffic Impact Analysis (TIA), which is considered by SSE to be an important benchmark regarding traffic conditions.<sup>1</sup> Another important distinction of the DSAP TIA was it addressed the critical 6:00 to 7:00 p.m. hour, when substantial inbound SAP Center event traffic occurs.

Evaluation of intersection LOS during this critical period is essential to this assessment of implications of potential changes to streets and circulation patterns of particular concern to SSE and, in turn, the City of San Jose staff and City Council, who are obligated to coordinate with SSE on such matters. This stimulated SSE to engage Krupka Consulting to develop and undertake an independent assessment to provide relevant comparable information for the corridor intersections during the 6:00 to 7:00 p.m. hour.

### Purpose

The purpose of the assessment was to approximate intersection operations along the critical Autumn Street corridor during the typical access hour for Sharks events, 6:00 to 7:00 p.m., under cumulative conditions evaluated in the Project DEIR. An important element of the assessment was the inclusion of SAP Center (Sharks game) traffic.

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<sup>1</sup> Diridon Station Area Plan (DSAP) Traffic Impact Analysis (TIA) (City of San Jose, Diridon Station Area Plan Integrated Final Program Environmental Impact Report, Appendix B, August 2014)

The following intersections were studied.

- Autumn Street and Santa Clara Street
- Autumn Street and San Fernando Street
- Autumn Street/Montgomery Street and Park Avenue
- Bird Avenue and San Carlos Street

The assessment was based on Year 2040 Cumulative Plus Goal Based Project Conditions defined in the Draft Local Transportation Analysis Report (Draft LTA) for the Project (Fehr & Peers, September 2020, Scenario 3b). The Draft LTA is Appendix J2 of the Project DEIR.

The assessment was necessarily an approximation of intersection LOS during the 6:00 to 7:00 p.m. hour at the above intersections, given the Draft LTA addressed neither this time period nor three of the four intersections. The assessment provided estimates of intersection turning movement volumes and LOS based on average delay, which formed the foundation for credible planning level findings regarding traffic operations during the 6:00 to 7:00 p.m. hour under Project cumulative conditions with Sharks game traffic.

## Procedures

The following points summarize the assessment procedures.

- Intersection Volumes
  - Project intersection turning movement volumes at Bird Avenue and San Carlos Street, for the p.m. peak hour (5:00 p.m. to 6:00 p.m. ) Project cumulative condition (Scenario 3b), were extracted from the Draft LTA. Intersection turning movement volumes at the other intersections *were not included* in the Draft LTA, so referenced data were extracted from the DSAP TIA.
  - Intersection data for the p.m. peak hour and the 6:00 to 7:00 p.m. hour were extracted from the DSAP TIA for the cumulative condition scenario (Scenario 5). Given the p.m. peak hour forecasts included trips generated by the proposed ballpark, which is no longer planned, the data were adjusted to subtract ballpark trips. It is also important to note that the 6:00 to 7:00 p.m. data included SAP Center (Sharks game) traffic. By inspection, it was determined that 6:00 to 7:00 p.m. traffic volumes were in aggregate approximately 80% of the p.m. peak hour volumes. This factor was applied to the total intersection volume at Bird Avenue and San Carlos Street to approximate 6:00 to 7:00 p.m. traffic for the Project condition.
  - Intersection turning movement volumes at the other intersections were derived for the Project case based on the assumption that the relative traffic conditions presented in the DSAP TIA were similar and transferable to the Project condition. Project turning movement volumes were derived as follows.
    - Calculate Project total intersection volumes for three intersections based on relative shares of DSAP TIA volumes at these junctions compared to total intersection volumes at Bird Avenue and San Carlos Street.
    - Calculate Project turning movement volumes by approach and turn (right, through, left) based on relative DSAP TIA volumes.

- Intersection Layouts
  - Two intersection layout cases were defined, one for the Project and one reflecting the SSE recommendation.
  - The Project intends to reduce auto dependence. It follows that, with exception of the segment of Autumn Street between Park Avenue and San Carlos Street, the layout has one through lane in each direction, and left turn lanes at intersections. The noted southern block segment has additional through lanes. All Project layouts were based upon information and data contained in the Draft LTA and the Downtown West Design Standards and Guidelines (Appendix M in the Project DEIR).
  - In view of this obvious reduction in street capacity, SSE engaged Jim Benshoof, Traffic Engineer, to recommend street layouts to serve peak traffic conditions based on past experience. The resulting recommendations developed by Jim Benshoof were documented in a memorandum and used to define specific lane layouts for the intersections under study (“SAP Center Recommendations for Diridon Area Street Network,” Wenck, May 21, 2020). Finally, Krupka Consulting conferred with Jim Benshoof to review the layout assumptions for this assessment.
- LOS
  - LOS is a quantitative measure that represents quality of service, measured on an A-F scale, with LOS A representing the best operating conditions from the traveler’s perspective and LOS F the worst. The chart below provides general descriptions for the letter designations.

#### Level of Service Criteria for Signalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)	General Description
A	≤10	Free Flow
B	>10 – 20	Stable Flow (slight delays)
C	>20 – 35	Stable flow (acceptable delays)
D	>35 – 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 – 80	Unstable flow (intolerable delay)
F <sup>1</sup>	>80	Forced flow (congested and queues fail to clear)

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

1. If the volume-to-capacity (v/c) ratio for a lane group exceeds 1.0 LOS F is assigned to the individual lane group. LOS for overall approach or intersection is determined solely by the control delay.

- Intersection LOS conditions were calculated for Project and SSE Recommended layout cases and, for reference, the DSAP TIA existing case, using Highway Capacity Manual procedures.
- Results were interpreted and summarized.
- This memorandum was prepared to document the assessment.

## Assessment

### Intersection Volumes

Table 1 summarizes intersection traffic data developed. The top two lines at each intersection show 6:00 to 7:00 p.m. volumes for DSAP TIA and Project conditions. The bottom two lines show respective p.m. peak hour volumes. Columns show turning movement volumes by approach, turn and total.

Generally, Project volumes are higher than DSAP TIA volumes. This makes sense given the Project cumulative condition includes substantially higher planned development than the DSAP TIA cumulative condition.

### LOS

Table 2 summarizes LOS results for the Project and SSE Recommended layout cases. Results for the DSAP TIA existing case are shown for reference and were extracted directly from Table 14 in the DSAP TIA (op. cit., pp. 70-71). The table illustrates intersection layouts in white on black diagrams, and analysis results. Intersection delay is shown in seconds per vehicle. The Attachment contains intersection LOS reports developed using Highway Capacity Manual procedures implemented using Highway Capacity Software (HCS) (University of Florida, HCS Streets Version 7.9).

Cumulative intersection LOS conditions were found to be consistently poor - LOS E and F - at all locations under both layout cases. This compares to LOS D or better in the DSAP TIA Existing case.

Cumulative conditions under the Project case were found to be substantially worse than under the SSE Recommended case at the intersections of Autumn Street with Santa Clara Street and San Fernando Street, as indicated by much higher delay values. For reference, the values under "Change Compared to Project" on Table 2 are calculated decreases in delay in absolute and percentage terms.

These results are not surprising, given that the Project layout would provide just one through lane in each direction along Autumn Street through these two intersections. Also, the Project layout at Santa Clara Street includes one left turn lane eastbound and westbound, whereas the SSE Recommended layout includes two left turn lanes in both directions to complement two receiving through lanes on Autumn Street and thereby better serve the respective high left turn volumes.

These findings provide compelling evidence supporting two through lanes and a left turn lane in each direction along Autumn Street between Santa Clara Street and Park Avenue.

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In summary, this assessment provided reasonable data and results related to potential intersection LOS conditions during the 6:00 to 7:00 p.m. hour under Project cumulative conditions with Sharks game traffic, which gives SSE meaningful additional information to supplement the Draft LTA.

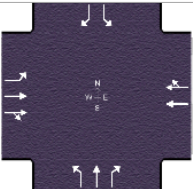
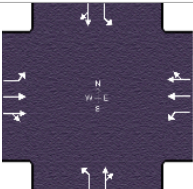
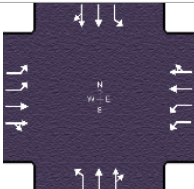
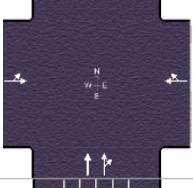
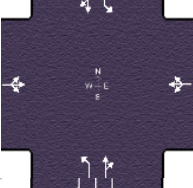
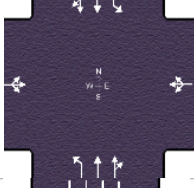
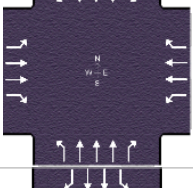
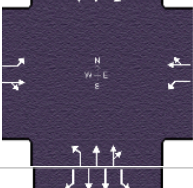
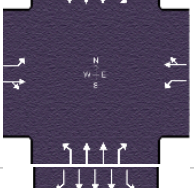
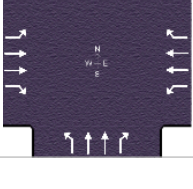
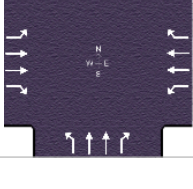
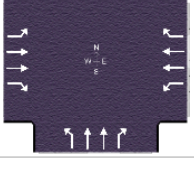
Attachment - Intersection LOS Reports

Table 1

Autumn Street Intersection Assessment > 6:00 - 7:00 PM																	
Prepared for:		SSE		SCENARIO		DEFINITION		NOTES:		2/3/21 Project volumes adjusted to remove ballpark trips.							
Prepared by:		Krupka Consulting		DSAP		DSAP Cumulative											
February 16, 2021						Scenario: 5 Cumulative Conditions											
				Project		Downtown West Cumulative Plus Goal-Based Project											
						Scenario: 3b Year 2040 Cumulative Plus Goal-Based Project Conditions											
INTERSECTIONS/CONDITIONS	North Approach				East Approach				South Approach				West Approach				Total
	RT	TH	LT	Total	RT	TH	LT	Total	RT	TH	LT	Total	RT	TH	LT	Total	
Autumn/Santa Clara																	
6:00 to 7:00 PM DSAP	222	442	310	974	242	629	810	1681	184	117	187	488	698	719	291	1708	4851
6:00 to 7:00 PM Project (estimated)	292	330	287	1283	319	828	747	2214	231	136	246	643	771	799	381	2249	6388
PM Peak Hour DSAP	380	384	343	1107	365	1352	870	2587	247	160	390	797	837	877	420	2134	6625
PM Peak Hour Project (estimated)	458	463	413	1334	440	1630	1049	3118	298	193	470	961	1009	1057	506	2572	7985
Autumn/San Fernando																	
6:00 to 7:00 PM DSAP	92	1067	467	1626	109	20	52	181	176	630	220	1026	452	71	79	602	3435
6:00 to 7:00 PM Project (estimated)	124	1347	316	2197	56	27	70	245	238	578	297	1386	611	96	107	813	4640
PM Peak Hour DSAP	132	1402	315	1849	272	100	272	644	335	755	345	1435	646	101	113	860	4788
PM Peak Hour Project (estimated)	160	1698	382	2240	330	121	330	780	406	915	418	1738	783	122	137	1042	5800
Autumn-Montgomery/Park																	
6:00 to 7:00 PM DSAP	170	1495	46	1711	107	114	238	459	70	1405	168	1643	250	383	120	753	4566
6:00 to 7:00 PM Project (estimated)	182	1547	50	1874	100	125	261	503	77	1300	184	1800	274	272	114	825	5002
PM Peak Hour DSAP	222	2048	45	2315	76	251	376	703	89	1262	208	1559	296	216	99	611	5188
PM Peak Hour Project (estimated)	268	2468	54	2790	92	302	453	847	107	1521	251	1879	357	260	119	736	6252
Bird/San Carlos																	
6:00 to 7:00 PM DSAP	278	1182	139	1599	71	347	218	636	241	1245	211	1697	295	976	255	1526	5458
6:00 to 7:00 PM Project (estimated)	300	1221	153	1766	78	383	241	702	207	1170	233	1874	326	781	248	1685	6026
PM Peak Hour DSAP	379	1785	167	2331	44	613	346	1003	244	888	216	1348	454	885	225	1564	6246
PM Peak Hour Project	289	1090	121	1500	42	1020	788	1850	326	890	540	1756	423	1635	369	2427	7533



### Table 2


INTERSECTION LAYOUTS AND LEVELS OF SERVICE Autumn Corridor Intersection Assessment							
INTERSECTION	2013 DSAP EXISTING - INCLUDING SAP CENTER TRAFFIC 6:00 - 7:00 PM		DOWNTOWN WEST SCENARIO 3b INCLUDING SAP CENTER TRAFFIC 6:00 - 7:00 PM				
	2013 DSAP Existing		Project		SSE Recommended		
	Layout	Delay/LOS	Layout	Delay/LOS	Layout	Delay/LOS	Change Compared to Project (seconds, %)
Autumn/Santa Clara		25.2/C		410.4/F		237.2/F	-173, -42%
Autumn/San Fernando		8.5/A		275.3/F		118.1/F	-157, -57%
Autumn-Montgomery/Park		34.7/C		71.1/E		65.9/E	-5, -7%
Bird/San Carlos		35.5/D		58.9/E		58.0/E	-1, -2%

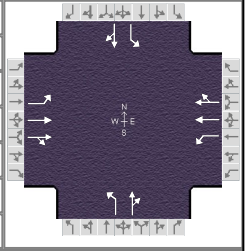
Source: Krupka Consulting, February 26, 2021

**Attachment**

**INTERSECTION LOS RESULTS**

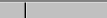



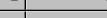



# HCS7 Signalized Intersection Results Summary

General Information				Intersection Information		
Agency	Krupka Consulting			Duration, h	0.250	
Analyst	PK	Analysis Date	Feb 23, 2021	Area Type	Other	
Jurisdiction	San Jose	Time Period	6:00 - 7:00 PM	PHF	0.92	
Urban Street	Autumn Street	Analysis Year	2020	Analysis Period	1> 6:00	
Intersection	Santa Clara	File Name	DW C 1 mod 1 022321.xus			
Project Description	DW C+G-B P 6-7 for Autumn Assessment					



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand ( $v$ ), veh/h	381	799	771	747	828	319	246	136	231	287	330	292

Signal Information														
Cycle, s	120.2	Reference Phase	2											
Offset, s	0	Reference Point	End											
Uncoordinated	Yes	Simult. Gap E/W	On	Green	9.0	7.0	37.2	17.0	30.0	0.0				
				Yellow	4.0	4.0	4.0	4.0	4.0	0.0				
Force Mode	Fixed	Simult. Gap N/S	On	Red	0.0	0.0	0.0	0.0	0.0	0.0				

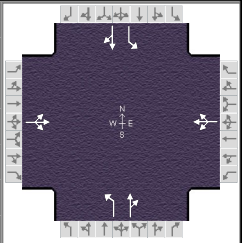
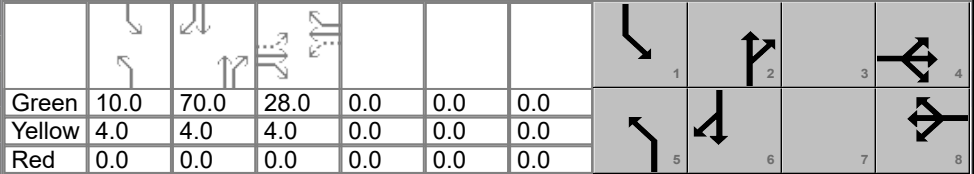
			
1	2	3	4
			
5	6	7	8

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	3	8	7	4	1	6	5	2
Case Number	2.0	4.0	2.0	4.0	2.0	4.0	2.0	4.0
Phase Duration, s	21.0	34.0	21.0	34.0	13.0	41.2	24.0	52.2
Change Period, ( $Y+R_c$ ), s	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Max Allow Headway ( $MAH$ ), s	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2
Queue Clearance Time ( $g_s$ ), s	19.0	32.0	19.0	32.0	11.0	39.2	22.0	47.2
Green Extension Time ( $g_e$ ), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

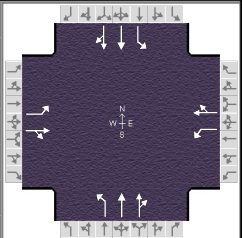
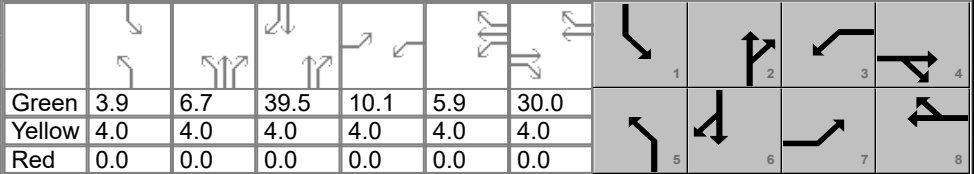
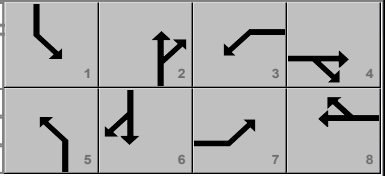
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18	7	4	14	1	6	16	5	2	12
Adjusted Flow Rate ( $v$ ), veh/h	414	868	838	812	652	595	357	532		312	676	
Adjusted Saturation Flow Rate ( $s$ ), veh/h/ln	1810	1900	1610	1810	1900	1720	1810	1707		1810	1752	
Queue Service Time ( $g_s$ ), s	17.0	30.0	30.0	17.0	30.0	30.0	9.0	37.2		20.0	45.2	
Cycle Queue Clearance Time ( $g_c$ ), s	17.0	30.0	30.0	17.0	30.0	30.0	9.0	37.2		20.0	45.2	
Green Ratio ( $g/C$ )	0.39	0.25	0.25	0.39	0.25	0.25	0.41	0.31		0.17	0.40	
Capacity ( $c$ ), veh/h	256	474	402	256	474	429	136	528		301	702	
Volume-to-Capacity Ratio ( $X$ )	1.618	1.831	2.085	3.172	1.375	1.385	2.632	1.008		1.036	0.963	
Back of Queue ( $Q$ ), ft/ln ( 50 th percentile)	715.5	1605.3	1680.1	1945.9	944.8	872	794.7	431.9		351.7	580.5	
Back of Queue ( $Q$ ), veh/ln ( 50 th percentile)	28.6	64.2	67.2	77.8	37.8	34.9	31.8	17.3		14.1	23.2	
Queue Storage Ratio ( $RQ$ ) ( 50 th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	
Uniform Delay ( $d_1$ ), s/veh	51.6	45.1	45.1	51.6	45.1	45.1	55.6	41.5		50.1	35.1	
Incremental Delay ( $d_2$ ), s/veh	295.4	382.2	496.7	987.6	181.6	187.3	736.5	13.7		61.5	23.7	
Initial Queue Delay ( $d_3$ ), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay ( $d$ ), s/veh	347.0	427.3	541.8	1039.2	226.7	232.4	792.1	55.2		111.6	58.8	
Level of Service (LOS)	F	F	F	F	F	F	F	F		F	E	
Approach Delay, s/veh / LOS	456.9	F		548.8	F		350.9	F		75.5	E	
Intersection Delay, s/veh / LOS	410.4						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.94	B	1.94	B	2.29	B	2.28	B
Bicycle LOS Score / LOS	2.24	B	2.19	B	1.59	B	2.12	B

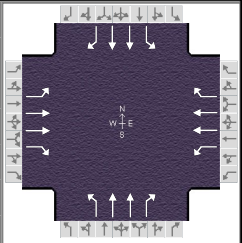
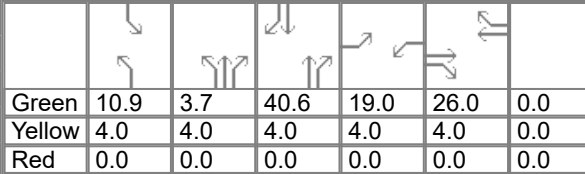
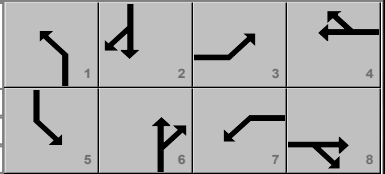
# HCS7 Signalized Intersection Results Summary

General Information						Intersection Information													
Agency		Krupka Consulting				Duration, h		0.250											
Analyst		PK		Analysis Date		Feb 23, 2021		Area Type		Other									
Jurisdiction		San Jose		Time Period		6:00 - 7:00 PM		PHF		0.92									
Urban Street		Autumn Street		Analysis Year		2020		Analysis Period		1> 6:00									
Intersection		San Fernando		File Name		DW C 1 mod 1 022321.xus													
Project Description		DW C+G-B P 6-7 for Autumn Assessment																	
Demand Information				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Demand ( v ), veh/h				107	96	611	70	27	56	297	578	238	316	1347	124				
Signal Information																			
Cycle, s	120.0	Reference Phase	2																
Offset, s	0	Reference Point	End																
Uncoordinated	Yes	Simult. Gap E/W	On																
Force Mode	Fixed	Simult. Gap N/S	On																
				Green	10.0	70.0	28.0	0.0	0.0	0.0									
				Yellow	4.0	4.0	4.0	0.0	0.0	0.0									
				Red	0.0	0.0	0.0	0.0	0.0	0.0									
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase						4				8		5		2		1		6	
Case Number						8.0				8.0		2.0		4.0		2.0		4.0	
Phase Duration, s						32.0				32.0		14.0		74.0		14.0		74.0	
Change Period, ( Y+R c ), s						4.0				4.0		4.0		4.0		4.0		4.0	
Max Allow Headway ( MAH ), s						3.4				3.4		3.1		3.1		3.1		3.1	
Queue Clearance Time ( g s ), s						30.0				26.2		12.0		72.0		12.0		42.4	
Green Extension Time ( g e ), s						0.0				0.0		0.0		0.0		0.0		6.7	
Phase Call Probability						1.00				1.00		1.00		1.00		1.00		1.00	
Max Out Probability						1.00				1.00		1.00		1.00		1.00		0.01	
Movement Group Results				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement				7	4	14	3	8	18	5	2	12	1	6	16				
Adjusted Flow Rate ( v ), veh/h					885			166		423	1163		180	836					
Adjusted Saturation Flow Rate ( s ), veh/h/ln					1646			784		1810	1805		1810	1872					
Queue Service Time ( g s ), s					3.8			0.0		10.0	70.0		10.0	40.4					
Cycle Queue Clearance Time ( g c ), s					28.0			24.2		10.0	70.0		10.0	40.4					
Green Ratio ( g/C )					0.23			0.23		0.08	0.58		0.08	0.58					
Capacity ( c ), veh/h					418			227		151	1053		151	1092					
Volume-to-Capacity Ratio ( X )					2.117			0.734		2.808	1.105		1.191	0.766					
Back of Queue ( Q ), ft/ln ( 50 th percentile)					1796.6			133.7		971.8	1069.4		209.6	408.1					
Back of Queue ( Q ), veh/ln ( 50 th percentile)					71.9			5.3		38.9	42.8		8.4	16.3					
Queue Storage Ratio ( RQ ) ( 50 th percentile)					0.00			0.00		0.00	0.00		0.00	0.00					
Uniform Delay ( d 1 ), s/veh					47.1			43.1		55.0	25.0		55.0	18.8					
Incremental Delay ( d 2 ), s/veh					510.5			10.3		820.3	52.9		92.4	0.1					
Initial Queue Delay ( d 3 ), s/veh					0.0			0.0		0.0	0.0		0.0	0.0					
Control Delay ( d ), s/veh					557.5			53.4		875.3	77.9		147.4	19.0					
Level of Service (LOS)					F			D		F	F		F	B					
Approach Delay, s/veh / LOS				557.5	F		53.4	D		290.7	F		41.7	D					
Intersection Delay, s/veh / LOS				275.3						F									
Multimodal Results				EB			WB			NB			SB						
Pedestrian LOS Score / LOS				1.94	B		1.94	B		1.67	B		1.67	B					
Bicycle LOS Score / LOS				1.95	B		0.76	A		2.48	B		3.69	D					

# HCS7 Signalized Intersection Results Summary

General Information						Intersection Information															
Agency		Krupka Consulting				Duration, h		0.250													
Analyst		PK		Analysis Date		Feb 23, 2021		Area Type		Other											
Jurisdiction		San Jose		Time Period		6:00 - 7:00 PM		PHF		0.92											
Urban Street		Autumn Street		Analysis Year		2020		Analysis Period		1> 6:00											
Intersection		Park		File Name		DW C 1 mod 1 022321.xus															
Project Description		DW C+G-B P 6-7 for Autumn Assessment																			
Demand Information				EB			WB			NB			SB								
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R						
Demand ( v ), veh/h				114	272	274	261	125	100	184	1300	77	50	1547	182						
Signal Information																					
Cycle, s	120.1	Reference Phase	2																		
Offset, s	0	Reference Point	End																		
Uncoordinated	Yes	Simult. Gap E/W	On																		
Force Mode	Fixed	Simult. Gap N/S	On																		
				Green	3.9	6.7	39.5	10.1	5.9	30.0											
				Yellow	4.0	4.0	4.0	4.0	4.0	4.0											
				Red	0.0	0.0	0.0	0.0	0.0	0.0											
Timer Results				EBL		EBT		WBL		WBT		NBL				NBT		SBL		SBT	
Assigned Phase				7		4		3		8		5				2		1		6	
Case Number				2.0		4.0		2.0		4.0		2.0				4.0		2.0		4.0	
Phase Duration, s				14.1		34.0		24.0		43.9		18.6				54.2		7.9		43.5	
Change Period, ( Y+R c ), s				4.0		4.0		4.0		4.0		4.0				4.0		4.0		4.0	
Max Allow Headway ( MAH ), s				3.1		3.2		3.1		3.2		3.1				3.1		3.1		3.1	
Queue Clearance Time ( g s ), s				10.1		32.0		20.6		14.9		14.5				45.2		4.1		35.7	
Green Extension Time ( g e ), s				0.1		0.0		0.0		1.7		0.2				2.4		0.0		3.8	
Phase Call Probability				0.98		1.00		1.00		1.00		1.00				1.00		0.65		1.00	
Max Out Probability				0.00		1.00		1.00		0.01		0.09		0.94		0.00		0.39			
Movement Group Results				EB			WB			NB			SB								
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R						
Assigned Movement				7	4	14	3	8	18	5	2	12	1	6	16						
Adjusted Flow Rate ( v ), veh/h				124	593		284	245		192	723	712	32	559	539						
Adjusted Saturation Flow Rate ( s ), veh/h/ln				1810	1743		1810	1759		1810	1900	1862	1810	1900	1829						
Queue Service Time ( g s ), s				8.1	30.0		18.6	12.9		12.5	42.9	43.2	2.1	33.6	33.7						
Cycle Queue Clearance Time ( g c ), s				8.1	30.0		18.6	12.9		12.5	42.9	43.2	2.1	33.6	33.7						
Green Ratio ( g/C )				0.08	0.25		0.17	0.33		0.12	0.42	0.42	0.03	0.33	0.33						
Capacity ( c ), veh/h				151	435		301	585		220	794	778	59	624	601						
Volume-to-Capacity Ratio ( X )				0.818	1.363		0.941	0.418		0.869	0.911	0.915	0.538	0.896	0.897						
Back of Queue ( Q ), ft/ln ( 50 th percentile)				95.6	855.1		283.2	136.8		150	512.1	507.3	23.7	387.3	373.3						
Back of Queue ( Q ), veh/ln ( 50 th percentile)				3.8	34.2		11.3	5.5		6.0	20.5	20.3	0.9	15.5	14.9						
Queue Storage Ratio ( RQ ) ( 50 th percentile)				0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00						
Uniform Delay ( d 1 ), s/veh				54.1	45.0		49.5	31.1		51.8	32.9	32.9	57.2	38.4	38.4						
Incremental Delay ( d 2 ), s/veh				4.1	177.8		36.1	0.2		6.3	6.5	6.9	0.3	1.1	1.1						
Initial Queue Delay ( d 3 ), s/veh				0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0						
Control Delay ( d ), s/veh				58.2	222.8		85.6	31.2		58.1	39.3	39.9	57.4	39.4	39.5						
Level of Service (LOS)				E	F		F	C		E	D	D	E	D	D						
Approach Delay, s/veh / LOS				194.4		F		60.4		E		41.8		D		40.0		D			
Intersection Delay, s/veh / LOS				71.1									E								
Multimodal Results				EB			WB			NB			SB								
Pedestrian LOS Score / LOS				2.30		B		2.29		B		1.92		B		1.93		B			
Bicycle LOS Score / LOS				1.67		B		1.36		A		1.89		B		2.08		B			

# HCS7 Signalized Intersection Results Summary

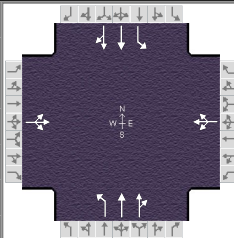
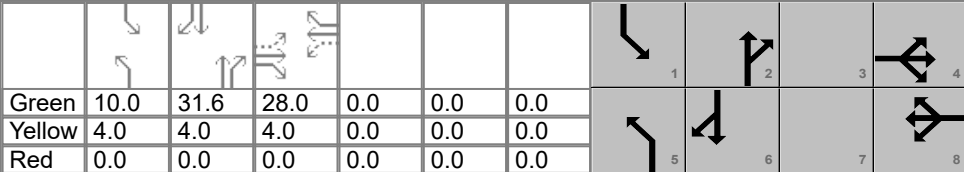
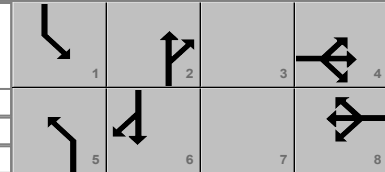
General Information						Intersection Information													
Agency		Krupka Consulting				Duration, h		0.250											
Analyst		PK		Analysis Date		Feb 23, 2021		Area Type							Other				
Jurisdiction		San Jose		Time Period		6:00 - 7:00 PM		PHF							0.92				
Urban Street		Autumn Street		Analysis Year		2020		Analysis Period							1> 6:00				
Intersection		San Carlos		File Name		DW C 1 mod 1 022321.xus													
Project Description		DW C+G-B P 6-7 for Autumn Assessment																	
Demand Information				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Demand ( v ), veh/h				248	781	326	241	383	78	233	1170	207	153	1221	300				
Signal Information																			
Cycle, s	120.2	Reference Phase	2																
Offset, s	0	Reference Point	End																
Uncoordinated	Yes	Simult. Gap E/W	On																
Force Mode	Fixed	Simult. Gap N/S	On																
				Green	10.9	3.7	40.6	19.0	26.0	0.0									
				Yellow	4.0	4.0	4.0	4.0	4.0	0.0									
				Red	0.0	0.0	0.0	0.0	0.0	0.0									
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase				3		8		7		4		1		6		5		2	
Case Number				2.0		3.0		2.0		3.0		2.0		3.0		2.0		3.0	
Phase Duration, s				23.0		30.0		23.0		30.0		22.6		52.3		14.9		44.6	
Change Period, ( Y+R c ), s				4.0		4.0		4.0		4.0		4.0		4.0		4.0		4.0	
Max Allow Headway ( MAH ), s				3.1		3.1		3.1		3.1		3.1		3.1		3.1		3.1	
Queue Clearance Time ( g s ), s				19.7		28.0		19.1		14.2		18.5		41.0		10.9		36.0	
Green Extension Time ( g e ), s				0.0		0.0		0.0		3.8		0.1		4.2		0.1		4.5	
Phase Call Probability				1.00		1.00		1.00		1.00		1.00		1.00		0.99		1.00	
Max Out Probability				1.00		1.00		1.00		0.18		1.00		0.80		0.00		0.59	
Movement Group Results				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement				3	8	18	7	4	14	1	6	16	5	2	12				
Adjusted Flow Rate ( v ), veh/h				270	849	354	262	416	85	253	1272	225	136	1083	266				
Adjusted Saturation Flow Rate ( s ), veh/h/ln				1810	1809	1610	1810	1809	1610	1810	1809	1610	1810	1809	1610				
Queue Service Time ( g s ), s				17.7	26.0	26.0	17.1	12.2	5.2	16.5	39.0	11.7	8.9	34.0	15.8				
Cycle Queue Clearance Time ( g c ), s				17.7	26.0	26.0	17.1	12.2	5.2	16.5	39.0	11.7	8.9	34.0	15.8				
Green Ratio ( g/C )				0.16	0.22	0.22	0.16	0.22	0.22	0.15	0.40	0.40	0.09	0.34	0.34				
Capacity ( c ), veh/h				286	783	348	286	783	348	280	1454	647	164	1221	544				
Volume-to-Capacity Ratio ( X )				0.942	1.085	1.017	0.916	0.532	0.243	0.904	0.875	0.348	0.828	0.887	0.490				
Back of Queue ( Q ), ft/ln ( 50 th percentile)				272.5	444.3	383.5	254	136.4	51.9	236.5	443.7	110.7	100.4	370.6	151.5				
Back of Queue ( Q ), veh/ln ( 50 th percentile)				10.9	17.8	15.3	10.2	5.5	2.1	9.5	17.7	4.4	4.0	14.8	6.1				
Queue Storage Ratio ( RQ ) ( 50 th percentile)				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Uniform Delay ( d 1 ), s/veh				50.0	47.1	47.1	49.8	41.7	39.0	49.9	33.2	25.0	53.7	37.6	31.6				
Incremental Delay ( d 2 ), s/veh				37.5	57.6	52.7	31.5	0.4	0.1	26.5	6.0	0.1	0.4	0.7	0.0				
Initial Queue Delay ( d 3 ), 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				
Control Delay ( d ), s/veh				87.6	104.7	99.8	81.3	42.1	39.1	76.4	39.2	25.1	54.2	38.4	31.6				
Level of Service (LOS)				F	F	F	F	D	D	E	D	C	D	D	C				
Approach Delay, s/veh / LOS				100.4		F		55.2		E		42.8		D		38.6		D	
Intersection Delay, s/veh / LOS				58.9						E									
Multimodal Results				EB			WB			NB			SB						
Pedestrian LOS Score / LOS				2.45		B		2.45		B		2.43		B		2.44		B	
Bicycle LOS Score / LOS				1.70		B		1.12		A		1.93		B		1.99		B	



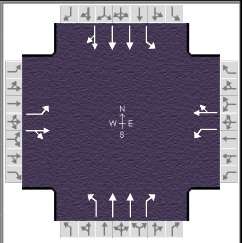
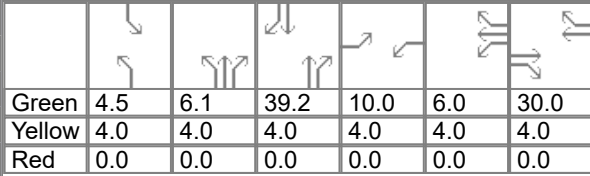
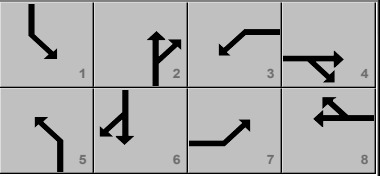
# HCS7 Signalized Intersection Results Summary

General Information						Intersection Information																		
Agency		Krupka Consulting				Duration, h		0.250																
Analyst		PK		Analysis Date		1/29/2021		Area Type		Other														
Jurisdiction		San Jose		Time Period		6:00 - 7:00 PM		PHF		0.92														
Urban Street		Autumn Street		Analysis Year		2020		Analysis Period		1> 6:00														
Intersection		Santa Clara		File Name		DW C 2 mod 1 022321.xus																		
Project Description		DW C+G-B P 6-7 Autumn_SSE Layout																						
Demand Information				EB			WB			NB			SB											
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R									
Demand ( v ), veh/h				381	799	771	747	828	319	246	136	231	287	330	292									
Signal Information																								
Cycle, s	120.4	Reference Phase	2																					
Offset, s	0	Reference Point	End																					
Uncoordinated	Yes	Simult. Gap E/W	On																					
Force Mode	Fixed	Simult. Gap N/S	On	Green	15.0	3.6	31.9	16.1	2.9	31.0	Yellow	4.0	4.0	4.0	4.0	0.0	4.0	Red	0.0	0.0	0.0	0.0	0.0	0.0
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT						
Assigned Phase				3		8		7		4		1		6		5		2						
Case Number				2.0		4.0		2.0		4.0		2.0		4.0		2.0		4.0						
Phase Duration, s				20.1		35.0		23.0		37.9		19.0		35.9		26.6		43.4						
Change Period, ( Y+R c ), s				4.0		4.0		4.0		4.0		4.0		4.0		4.0		4.0						
Max Allow Headway ( MAH ), s				3.1		3.2		3.1		3.2		3.1		3.2		3.1		3.2						
Queue Clearance Time ( g s ), s				15.9		33.0		21.0		35.9		17.0		29.1		22.4		21.9						
Green Extension Time ( g e ), s				0.1		0.0		0.0		0.0		0.0		2.8		0.2		2.8						
Phase Call Probability				1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00						
Max Out Probability				1.00		1.00		1.00		1.00		1.00		0.01		1.00		0.00						
Movement Group Results				EB			WB			NB			SB											
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R									
Assigned Movement				3	8	18	7	4	14	1	6	16	5	2	12									
Adjusted Flow Rate ( v ), veh/h				414	868	838	812	652	595	402	222	377	312	359	317									
Adjusted Saturation Flow Rate ( s ), veh/h/ln				1757	1900	1610	1757	1900	1720	1810	1900	1610	1810	1900	1610									
Queue Service Time ( g s ), s				13.9	31.0	31.0	19.0	33.9	33.9	15.0	11.7	27.1	20.4	18.9	19.9									
Cycle Queue Clearance Time ( g c ), s				13.9	31.0	31.0	19.0	33.9	33.9	15.0	11.7	27.1	20.4	18.9	19.9									
Green Ratio ( g/C )				0.13	0.26	0.26	0.16	0.28	0.28	0.12	0.26	0.26	0.19	0.33	0.33									
Capacity ( c ), veh/h				469	489	414	554	535	484	225	503	426	339	622	527									
Volume-to-Capacity Ratio ( X )				0.882	1.776	2.022	1.465	1.219	1.228	1.783	0.442	0.885	0.920	0.576	0.602									
Back of Queue ( Q ), ft/ln ( 50 th percentile)				177.1	1571.7	1651.5	627.7	815.6	755.6	732.2	135.5	272.7	285.3	215.6	193									
Back of Queue ( Q ), veh/ln ( 50 th percentile)				7.1	62.9	66.1	25.1	32.6	30.2	29.3	5.4	10.9	11.4	8.6	7.7									
Queue Storage Ratio ( RQ ) ( 50 th percentile)				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
Uniform Delay ( d 1 ), s/veh				51.3	44.7	44.7	50.7	43.3	43.3	52.7	36.9	42.5	48.1	33.6	33.9									
Incremental Delay ( d 2 ), s/veh				15.5	357.4	468.4	218.9	114.6	119.8	360.2	0.1	2.7	24.9	0.3	0.4									
Initial Queue Delay ( d 3 ), 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									
Control Delay ( d ), s/veh				66.8	402.2	513.2	269.7	157.9	163.1	412.9	37.0	45.2	72.9	33.9	34.3									
Level of Service (LOS)				E	F	F	F	F	F	F	D	D	E	C	C									
Approach Delay, s/veh / LOS				380.5		F		203.5		F		191.0		F		46.4		D						
Intersection Delay, s/veh / LOS				237.2						F														
Multimodal Results				EB			WB			NB			SB											
Pedestrian LOS Score / LOS				2.30		B		2.29		B		2.45		B		2.44		B						
Bicycle LOS Score / LOS				2.24		B		2.19		B		1.04		A		1.30		A						

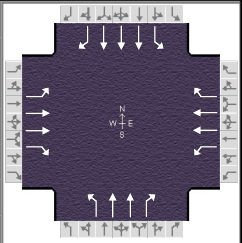
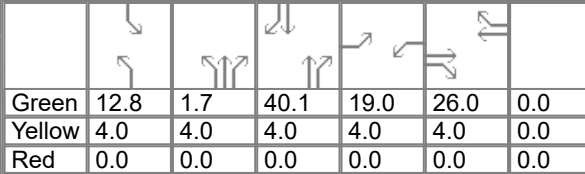
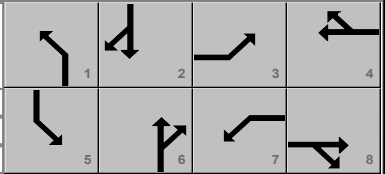
# HCS7 Signalized Intersection Results Summary

General Information						Intersection Information													
Agency		Krupka Consulting				Duration, h		0.250											
Analyst		PK		Analysis Date		1/29/2021		Area Type		Other									
Jurisdiction		San Jose		Time Period		6:00 - 7:00 PM		PHF		0.92									
Urban Street		Autumn Street		Analysis Year		2020		Analysis Period		1> 6:00									
Intersection		San Fernando		File Name		DW C 2 mod 1 022321.xus													
Project Description		DW C+G-B P 6-7 Autumn_SSE Layout																	
Demand Information				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Demand ( v ), veh/h				107	96	611	70	27	56	297	578	238	316	1347	124				
Signal Information																			
Cycle, s	81.6	Reference Phase	2																
Offset, s	0	Reference Point	End																
Uncoordinated	Yes	Simult. Gap E/W	On																
Force Mode	Fixed	Simult. Gap N/S	On																
				Green	10.0	31.6	28.0	0.0	0.0	0.0									
				Yellow	4.0	4.0	4.0	0.0	0.0	0.0									
				Red	0.0	0.0	0.0	0.0	0.0	0.0									
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase						4				8		5		2		1		6	
Case Number						8.0				8.0		2.0		4.0		2.0		4.0	
Phase Duration, s						32.0				32.0		14.0		35.6		14.0		35.6	
Change Period, ( Y+R c ), s						4.0				4.0		4.0		4.0		4.0		4.0	
Max Allow Headway ( MAH ), s						3.4				3.4		3.1		3.1		3.1		3.1	
Queue Clearance Time ( g s ), s						30.0				14.1		12.0		25.8		12.0		22.6	
Green Extension Time ( g e ), s						0.0				1.9		0.0		5.8		0.0		5.8	
Phase Call Probability						1.00				1.00		1.00		1.00		1.00		1.00	
Max Out Probability						1.00				0.55		1.00		0.01		1.00		0.00	
Movement Group Results				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement				7	4	14	3	8	18	5	2	12	1	6	16				
Adjusted Flow Rate ( v ), veh/h					885			166		423	611	552	235	554	538				
Adjusted Saturation Flow Rate ( s ), veh/h/ln					1651			784		1810	1900	1711	1810	1900	1843				
Queue Service Time ( g s ), s					15.9			0.0		10.0	23.7	23.8	10.0	20.6	20.6				
Cycle Queue Clearance Time ( g c ), s					28.0			12.1		10.0	23.7	23.8	10.0	20.6	20.6				
Green Ratio ( g/C )					0.34			0.34		0.12	0.39	0.39	0.12	0.39	0.39				
Capacity ( c ), veh/h					616			333		222	736	663	222	736	714				
Volume-to-Capacity Ratio ( X )					1.436			0.499		1.910	0.830	0.833	1.059	0.753	0.753				
Back of Queue ( Q ), ft/ln ( 50 th percentile)					1168.1			59.8		746.3	245	222	161.7	210.9	205.1				
Back of Queue ( Q ), veh/ln ( 50 th percentile)					46.7			2.4		29.9	9.8	8.9	6.5	8.4	8.2				
Queue Storage Ratio ( RQ ) ( 50 th percentile)					0.00			0.00		0.00	0.00	0.00	0.00	0.00	0.00				
Uniform Delay ( d 1 ), s/veh					27.7			20.7		35.8	22.6	22.6	35.8	21.6	21.6				
Incremental Delay ( d 2 ), s/veh					205.4			0.4		416.0	0.4	0.4	36.2	0.1	0.1				
Initial Queue Delay ( d 3 ), s/veh					0.0			0.0		0.0	0.0	0.0	0.0	0.0	0.0				
Control Delay ( d ), s/veh					233.1			21.1		451.8	22.9	23.0	72.0	21.7	21.7				
Level of Service (LOS)					F			C		F	C	C	F	C	C				
Approach Delay, s/veh / LOS				233.1	F		21.1	C		137.4	F		30.6	C					
Intersection Delay, s/veh / LOS				118.1						F									
Multimodal Results				EB			WB			NB			SB						
Pedestrian LOS Score / LOS				2.27	B		2.27	B		1.68	B		1.68	B					
Bicycle LOS Score / LOS				1.95	B		0.76	A		1.49	A		2.09	B					

# HCS7 Signalized Intersection Results Summary

General Information						Intersection Information													
Agency		Krupka Consulting				Duration, h		0.250											
Analyst		PK		Analysis Date		1/29/2021		Area Type		Other									
Jurisdiction		San Jose		Time Period		6:00 - 7:00 PM		PHF		0.92									
Urban Street		Autumn Street		Analysis Year		2020		Analysis Period		1> 6:00									
Intersection		Park		File Name		DW C 2 mod 1 022321.xus													
Project Description		DW C+G-B P 6-7 Autumn_SSE Layout																	
Demand Information				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Demand ( v ), veh/h				114	272	274	261	125	100	184	1300	77	50	1547	182				
Signal Information																			
Cycle, s	119.8	Reference Phase	2																
Offset, s	0	Reference Point	End																
Uncoordinated	Yes	Simult. Gap E/W	On																
Force Mode	Fixed	Simult. Gap N/S	On																
Green	4.5	6.1	39.2	10.0	6.0	30.0													
Yellow	4.0	4.0	4.0	4.0	4.0	4.0													
Red	0.0	0.0	0.0	0.0	0.0	0.0													
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase				7		4		3		8		5		2		1		6	
Case Number				2.0		4.0		2.0		4.0		2.0		3.0		2.0		4.0	
Phase Duration, s				14.0		34.0		24.0		44.0		18.6		53.3		8.5		43.2	
Change Period, ( Y+R c ), s				4.0		4.0		4.0		4.0		4.0		4.0		4.0		4.0	
Max Allow Headway ( MAH ), s				3.1		3.2		3.1		3.2		3.1		3.1		3.1		3.1	
Queue Clearance Time ( g s ), s				10.1		32.0		20.6		14.9		14.5		44.2		4.8		30.4	
Green Extension Time ( g e ), s				0.1		0.0		0.0		1.7		0.2		4.1		0.0		8.8	
Phase Call Probability				0.98		1.00		1.00		1.00		1.00		1.00		0.75		1.00	
Max Out Probability				0.00		1.00		1.00		0.01		0.08		0.81		0.00		0.29	
Movement Group Results				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement				7	4	14	3	8	18	5	2	12	1	6	16				
Adjusted Flow Rate ( v ), veh/h				124	593		284	245		192	1354	80	42	991	468				
Adjusted Saturation Flow Rate ( s ), veh/h/ln				1810	1743		1810	1759		1810	1809	1610	1810	1900	1794				
Queue Service Time ( g s ), s				8.1	30.0		18.6	12.9		12.5	42.2	3.7	2.8	28.4	28.4				
Cycle Queue Clearance Time ( g c ), s				8.1	30.0		18.6	12.9		12.5	42.2	3.7	2.8	28.4	28.4				
Green Ratio ( g/C )				0.08	0.25		0.17	0.33		0.12	0.41	0.41	0.04	0.33	0.33				
Capacity ( c ), veh/h				151	436		302	587		220	1488	662	68	1243	587				
Volume-to-Capacity Ratio ( X )				0.818	1.360		0.939	0.417		0.870	0.910	0.121	0.617	0.797	0.797				
Back of Queue ( Q ), ft/ln ( 50 th percentile)				95.3	851.8		281.4	136.1		148.4	462.5	34.8	31.4	323.6	306.2				
Back of Queue ( Q ), veh/ln ( 50 th percentile)				3.8	34.1		11.3	5.4		5.9	18.5	1.4	1.3	12.9	12.2				
Queue Storage Ratio ( RQ ) ( 50 th percentile)				0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00				
Uniform Delay ( d 1 ), s/veh				54.0	44.9		49.3	30.9		51.7	33.2	21.8	56.8	36.7	36.7				
Incremental Delay ( d 2 ), s/veh				4.1	176.3		35.5	0.2		5.6	3.2	0.0	0.3	0.2	0.3				
Initial Queue Delay ( d 3 ), s/veh				0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0				
Control Delay ( d ), s/veh				58.1	221.2		84.8	31.1		57.2	36.3	21.9	57.1	36.8	37.0				
Level of Service (LOS)				E	F		F	C		E	D	C	E	D	D				
Approach Delay, s/veh / LOS				193.0		F	59.9		E	38.1		D	37.5		D				
Intersection Delay, s/veh / LOS				65.9						E									
Multimodal Results				EB			WB			NB			SB						
Pedestrian LOS Score / LOS				2.59		C	2.44		B	1.92		B	1.93		B				
Bicycle LOS Score / LOS				1.67		B	1.36		A	1.89		B	1.55		B				

# HCS7 Signalized Intersection Results Summary

General Information						Intersection Information															
Agency		Krupka Consulting				Duration, h		0.250													
Analyst		PK		Analysis Date		1/29/2021		Area Type						Other							
Jurisdiction		San Jose		Time Period		6:00 - 7:00 PM		PHF						0.92							
Urban Street		Autumn Street		Analysis Year		2020		Analysis Period						1> 6:00							
Intersection		San Carlos		File Name		DW C 2 mod 1 022321.xus															
Project Description		DW C+G-B P 6-7 Autumn_SSE Layout																			
Demand Information						EB			WB			NB			SB						
Approach Movement						L	T	R	L	T	R	L	T	R	L	T	R				
Demand ( v ), veh/h						248	781	326	241	383	78	233	1170	207	153	1221	300				
Signal Information																					
Cycle, s		119.7	Reference Phase		2																
Offset, s		0	Reference Point		End																
Uncoordinated		Yes	Simult. Gap E/W		On																
Force Mode		Fixed	Simult. Gap N/S		On																
Green						12.8	1.7	40.1	19.0	26.0	0.0										
Yellow						4.0	4.0	4.0	4.0	4.0	0.0										
Red						0.0	0.0	0.0	0.0	0.0	0.0										
Timer Results						EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase						3		8		7		4		1		6		5		2	
Case Number						2.0		3.0		2.0		3.0		2.0		3.0		2.0		3.0	
Phase Duration, s						23.0		30.0		23.0		30.0		22.5		49.8		16.8		44.1	
Change Period, ( Y+R c ), s						4.0		4.0		4.0		4.0		4.0		4.0		4.0		4.0	
Max Allow Headway ( MAH ), s						3.1		3.1		3.1		3.1		3.1		3.1		3.1		3.1	
Queue Clearance Time ( g s ), s						19.6		28.0		19.0		14.2		18.5		42.0		12.7		29.2	
Green Extension Time ( g e ), s						0.0		0.0		0.0		3.8		0.1		3.8		0.2		9.2	
Phase Call Probability						1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Max Out Probability						1.00		1.00		1.00		0.18		1.00		0.89		0.01		0.43	
Movement Group Results						EB			WB			NB			SB						
Approach Movement						L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement						3	8	18	7	4	14	1	6	16	5	2	12				
Adjusted Flow Rate ( v ), veh/h						270	849	354	262	416	85	253	1272	225	165	1319	324				
Adjusted Saturation Flow Rate ( s ), veh/h/ln						1810	1809	1610	1810	1809	1610	1810	1809	1610	1810	1725	1610				
Queue Service Time ( g s ), s						17.6	26.0	26.0	17.0	12.2	5.2	16.5	40.0	12.0	10.7	27.2	20.0				
Cycle Queue Clearance Time ( g c ), s						17.6	26.0	26.0	17.0	12.2	5.2	16.5	40.0	12.0	10.7	27.2	20.0				
Green Ratio ( g/C )						0.16	0.22	0.22	0.16	0.22	0.22	0.15	0.38	0.38	0.11	0.34	0.34				
Capacity ( c ), veh/h						287	786	350	287	786	350	280	1386	617	194	1736	540				
Volume-to-Capacity Ratio ( X )						0.938	1.080	1.013	0.912	0.530	0.242	0.904	0.918	0.365	0.851	0.760	0.600				
Back of Queue ( Q ), ft/ln ( 50 th percentile)						269.6	440	380.7	251.4	135.7	51.5	235.1	471.6	114.3	124.3	281.5	193.2				
Back of Queue ( Q ), veh/ln ( 50 th percentile)						10.8	17.6	15.2	10.1	5.4	2.1	9.4	18.9	4.6	5.0	11.3	7.7				
Queue Storage Ratio ( RQ ) ( 50 th percentile)						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Uniform Delay ( d 1 ), s/veh						49.8	46.8	46.8	49.5	41.4	38.7	49.7	35.1	26.5	52.5	35.5	33.1				
Incremental Delay ( d 2 ), s/veh						36.5	55.9	51.4	30.6	0.3	0.1	26.3	9.4	0.1	2.5	0.4	0.2				
Initial Queue Delay ( d 3 ), 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				
Control Delay ( d ), s/veh						86.3	102.8	98.3	80.1	41.8	38.8	76.0	44.5	26.6	55.0	35.8	33.3				
Level of Service ( LOS )						F	F	F	F	D	D	E	D	C	E	D	C				
Approach Delay, s/veh / LOS						98.7		F		54.6		D		46.7		D		37.1		D	
Intersection Delay, s/veh / LOS						58.0						E									
Multimodal Results						EB			WB			NB			SB						
Pedestrian LOS Score / LOS						2.60		C		2.60		C		2.44		B		2.44		B	
Bicycle LOS Score / LOS						1.70		B		1.12		A		1.93		B		1.49		A	

# Appendix D



## MEMORANDUM

To: Google

From: Nelson\Nygaard

Date: November 12, 2020

Subject: SAP Egress Traffic Simulation Results under High and Low Traffic Management Scenarios

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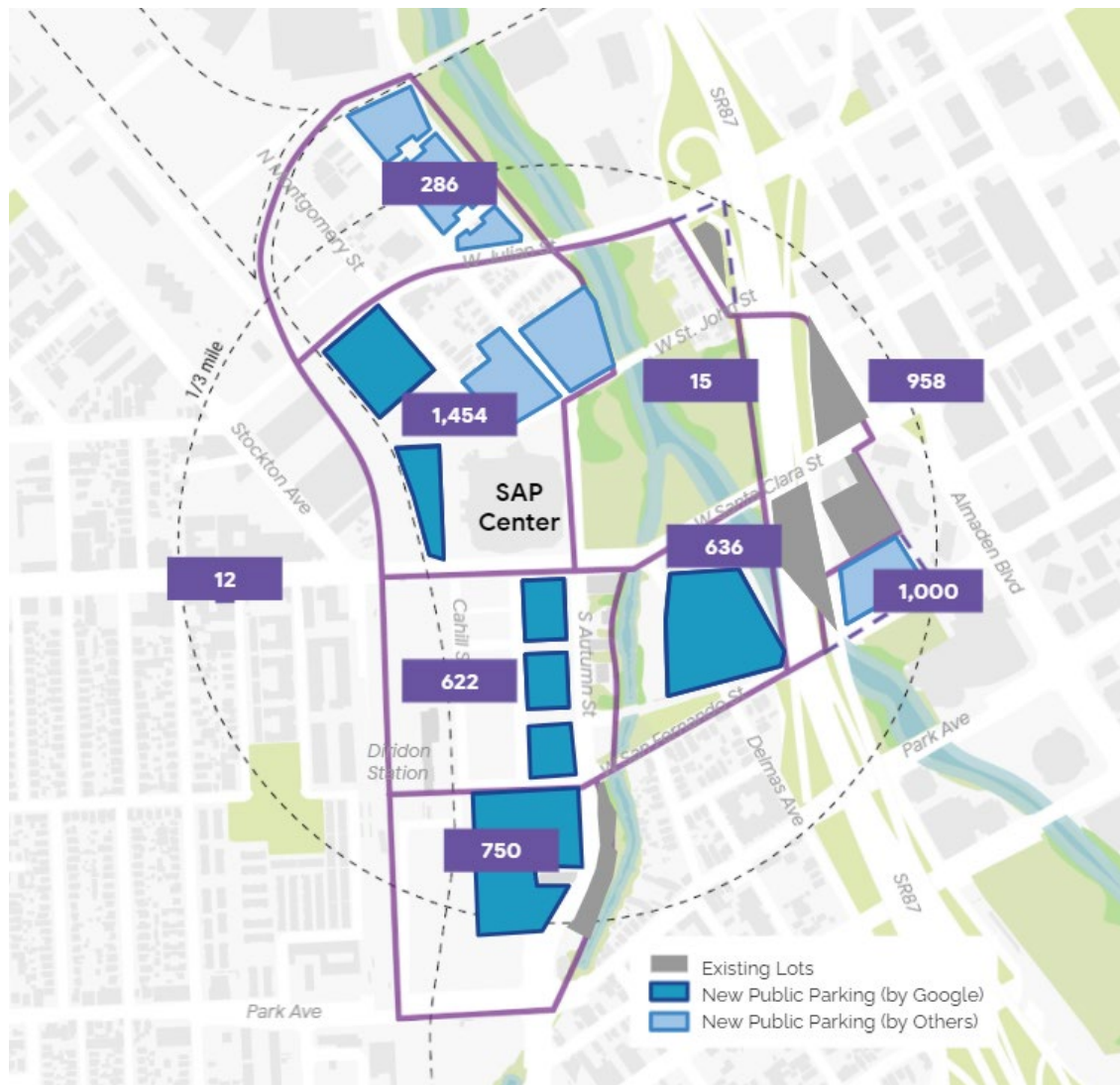
Traffic simulations conducted for the SAP Center Egress Analysis sought to determine whether parking facilities surrounding the SAP Center could appropriately accommodate vehicles leaving the SAP Center after an event. While no existing egress threshold exists, the analysis examined how many vehicles could egress within 30 minutes of an event at the request of Sharks Sports & Entertainment LLC (SSE). If more than 30 minutes would be required, the modeling analysis sought to determine the time required to fully empty out the facilities that would take longer, and the percentage from each facility that could egress within 30 minutes. Model results report the number of vehicles that exit at each driveway of a parking facility onto the road network. This memo outlines the modeling and network assumptions in place for the SAP Center Egress Analysis.

### Parking Facilities

Figure 1 shows the parking distribution within a 1/3-mile of the SAP Center evaluated for this analysis. The parking distribution utilizes a more conservative approach (with more parking spaces than required by the Arena Management Agreement) that distributes parking throughout areas surrounding the SAP Center in response to SSE preferences. This parking distribution is illustrative and represents just one feasible parking approach.



Figure 1 – Parking Facilities analyzed in SAP Center Egress Modeling Scenarios



*Illustrative diagram showing a potential parking distribution option.*

## Network and Scenario Assumptions

Two different network scenarios were analyzed, varying in the level of traffic management interventions, as well as additional operational and street closures at Park and Cahill for informational purposes\*. See Figure 2 for key network assumptions and Figures 3 – 4 for a map summary of the High Traffic Management (HTM) and Low Traffic Management (LTM) scenarios.

Traffic management assumptions include the ability to reverse lane directions, utilize dynamic lanes for vehicle egress, and adjusting signal phasing or cycling timing.

These traffic management scenarios are not intended to reflect the full range of potential traffic management options that could be implemented under the flexible Transportation and Parking Management Plan for the SAP Center but appear to be representative of a likely range of management options for modeling purposes.

**Figure 2 – Post-Event Traffic Operations Key Network Assumptions**

	High Traffic Management Scenario	Low Traffic Management Scenario
<b>Roads with Closures</b>	<b>Santa Clara</b> (Cahill to Delmas) <b>Autumn</b> (Lot D exit to St. John) <b>St. John</b> (Montgomery to Autumn) <b>S Montgomery</b> (Santa Clara to San Fernando) <b>San Fernando</b> (Autumn to Adobe exit)	<b>Santa Clara</b> (Cahill to Autumn) <b>Autumn</b> (Santa Clara to St. John) <b>St. John</b> (Montgomery to Autumn) <b>S Montgomery</b> (Santa Clara to San Fernando)
<b>One-way Operations</b>	<b>Julian WB</b> (Montgomery to Stockton) <b>Montgomery NB</b> (ABC North exit to Julian) <b>Montgomery SB</b> (Lot E exit to Santa Clara) <b>Cahill SB</b> (Santa Clara to Park) <b>Autumn SB</b> (Lot D exit to Park) use of center turn lane for egress when transitioning to 3 lanes <b>Delmas SB</b> (San Fernando to Park) <b>San Fernando WB</b> (Core exit to Cahill) <b>San Fernando EB</b> (Core exit to Autumn, Adobe exit to Almaden) <b>Park EB</b> (Cahill to Autumn)	<b>San Fernando EB</b> (Delmas to Almaden) <b>Delmas SB</b> (San Fernando to Park)
<b>Other Network Assumptions</b>	<b>Santa Clara/Cahill</b> intersection right-in/right-out <b>Cahill and Autumn</b> 2-lanes transitioning to 3-lanes SB with use of Dynamic Lane or center turn lane <b>Delmas</b> 3-lanes SB (requires use of parking lane) <b>Block E</b> second exit onto Santa Clara <b>Exit Time</b> all vehicles leave at same time despite distance to garage Convert one thru-lane to left turn lane on WB Julian at Stockton	<b>Delmas</b> 2-lanes SB <b>Block E</b> second exit onto Santa Clara <b>Exit Time</b> all vehicles leave at same time despite distance to garage

\*Additional network operations tested included a closure on Cahill from Santa Clara to San Fernando, limiting operations at Park/Cahill intersection to right-in, right-out.

Figure 3 – Post Event Traffic Operations: High Traffic Management

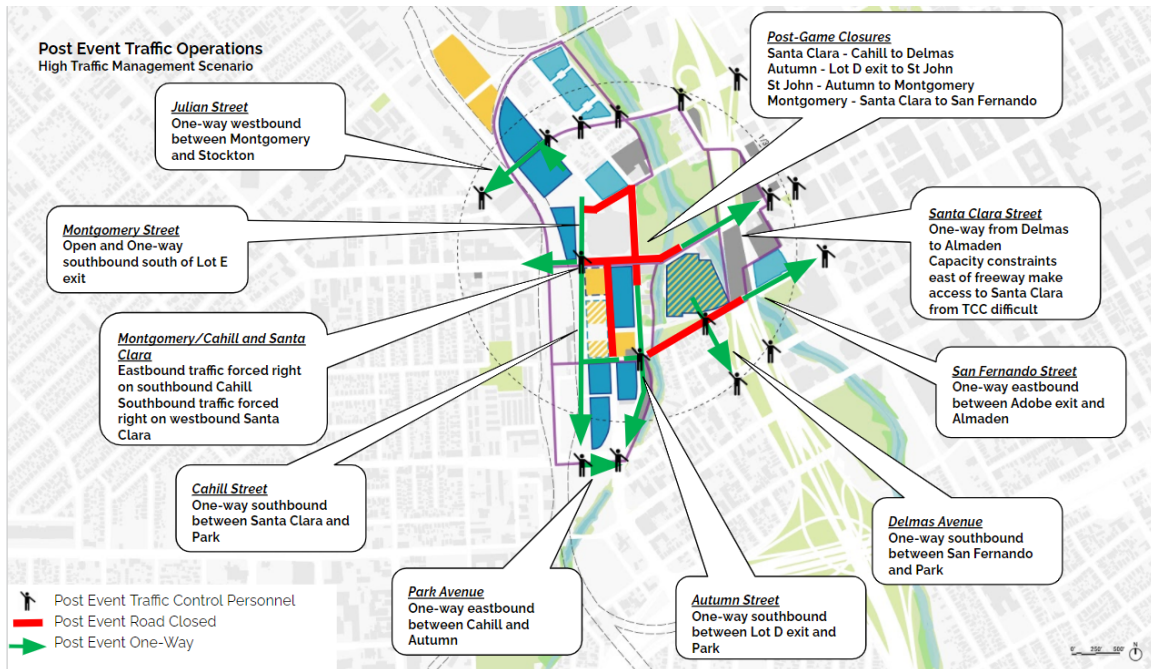
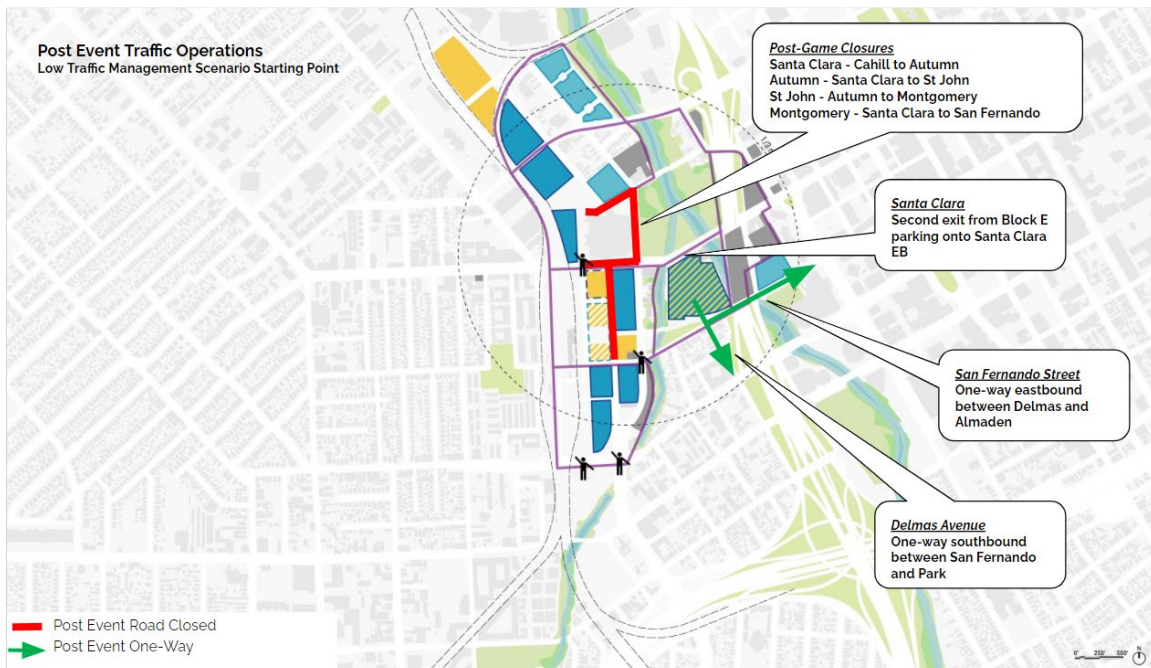


Figure 4 – Post Event Traffic Operations: Low Traffic Management



## Modeling Assumptions

### Modeling Software

Traffic simulations were run in Synchro 9's SimTraffic software.

### Timing

Games were assumed to start at 7:00pm on weekdays, and lasting 2 hours and 45 minutes until parking egress would begin. Traffic simulations began modeling a 30-minute increment at 9:45pm, followed by three five-minute increments were modeled to report vehicle exits within 35 minutes, within 40 minutes, and within 45 minutes. A final 15-minute increment summed up vehicle exits within a full hour. Background traffic volumes from IDAX traffic counts conducted on December 27<sup>th</sup>, 2018, a Saturday evening with a Sharks game.

### Parking Facilities Trip Generation

It is assumed in all scenarios that parking facilities are full and start emptying simultaneously, regardless of distance from the event venue, as Synchro 9's SimTraffic software does not allow simulations to incorporate walking time to the parking facilities from the SAP Center. Further, it does not cap the number of driveway exits to the capacity of the parking facility: if a garage or lot empties 100% of the reserved stalls prior to 30-minutes and roadway capacity allows, additional "vehicle exits" will occur at that driveway. This oversaturates the roadway network artificially near quickly exiting facilities and may prevent downstream facilities from recording as many exits as they may otherwise allow. The facilities receiving these negative impacts differ between the varied scenarionetworks.

### Trip Distribution

Once vehicles exit the parking facilities, trip distribution assumptions common to all traffic management scenarios include:

- Roughly 60% of vehicle trips head north from the garage or parking lot exits, and roughly 40% work south.
- From Block E, 50% of vehicle trips exit north to Santa Clara, turning right thereafter, and 50% exit south to San Fernando.
- 25% of vehicle trips from the Almaden Financial Plaza parking facility exit north to Santa Clara and 75% exit south to San Fernando.
  - Of vehicles from Almaden Financial Plaza and Adobe Garage exiting through San Fernando, 70% go south and 30% go north on Almaden.
- Santa Clara eastbound lanes are closed between Cahill and Delmas and westbound lanes are closed between Almaden and Cahill.
  - No vehicles can cross Santa Clara west of Almaden. Vehicles heading north on Delmas or Autumn must turn right on Santa Clara.

## Non-Auto Modes

VTa Light Rail is incorporated in model as a road with vehicles to simulate the train service and the at-grade crossings.

There are no pedestrian or bicyclist volumes included in turning movement counts and incorporated into traffic signal timing.

## Traffic Signal Timing

Model runs in each scenario are based on existing signal phasing from City of San Jose, with optimization of timings and phasing in Synchro at some intersections to maximize vehicle exit movements for each scenario.

## Peak Hour Factor

Each internal roadway segment within the SAP Center Egress Modeling Synchro network had a peak-hour factor set to 0.5, pushing more vehicles into a concentrated time period at the start of the hour, compared to the default of 0.92 for urban areas. Peak hour factors reflect the consistency of traffic volume across an hour, with lower values experiencing more peaking. This condition best reflects the period immediately after an event ends, when attendees retreat to their vehicles to begin a commute back home.

## Key Takeaways and Results

- All scenarios allow approximately 4,000 vehicles to exit their respective parking garages in under 30 minutes.
- All scenarios allow for at least 4,600 vehicles to exit in 45 minutes.
- Slightly more vehicles can exit within 30 minutes in the HTM scenario compared to LTM scenario.
- Slightly more vehicles can exit within 45 minutes under the LTM scenario than in the HTM scenario.
- Slightly more vehicles can exit within 30 minutes under the LTM scenario because of more direct access to Santa Clara for vehicles heading north.
- Lots closer to SAP Center are positively impacted by more traffic management vs. lots further away that are negatively impacted by less direct access to Santa Clara.

Figure 5 – Traffic Simulation Results

Scenario	Assumed Capacity	30 minutes		45 minutes	
		Vehicles Exited	Overall % of Capacity	Vehicles Exited	Overall % of Capacity
High Traffic Management	5,733	4,033	70%	4,959	86%
Low Traffic Management	5,733	3,916	68%	5,026	88%