NELSON
NYGAARD

MEMORANDUM

To: Jane Carney, College Preparatory School

From: Bonnie Nelson, Colin Burgett & Magnus Barber

Date: August 9, 2012

Subject: The College Preparatory School Traffic Study

This memorandum describes the results of a Traffic Study including the analysis of traffic level of service (LOS) on intersections adjacent to The College Preparatory School. The analysis is intended to assess the significance of potential traffic impacts to study intersections resulting from increased enrollment at The College Preparatory School (College Prep) in Oakland, California.

INTRODUCTION

Purpose

The purpose of the analysis described in this report is to assess the potential traffic impacts resulting from increase student enrollment (the "Proposed Project") at each of the study intersections identified by College Prep based on prior discussions with City staff.

Background

College Prep is a four-year private high school located at 6100 Broadway, adjacent to State Route 24 (SR-24) west of the Caldecott Tunnel. Figure 1 shows the Project Location and adjacent streets. Figure 2 shows Project Site Access based on the site layout.

Vehicle access is provided by a single driveway on Broadway, located approximately 50 feet east of the intersection of Broadway with Brookside Avenue and the SR-24 Eastbound On-Ramp. Vehicle access via the College Prep driveway is limited, by school policy, to right-in/right-in vehicle movements. In addition, a portion of vehicle trips are accommodated by off-street parking on Golden Gate Way and Broadway (north/east of the Project driveway).

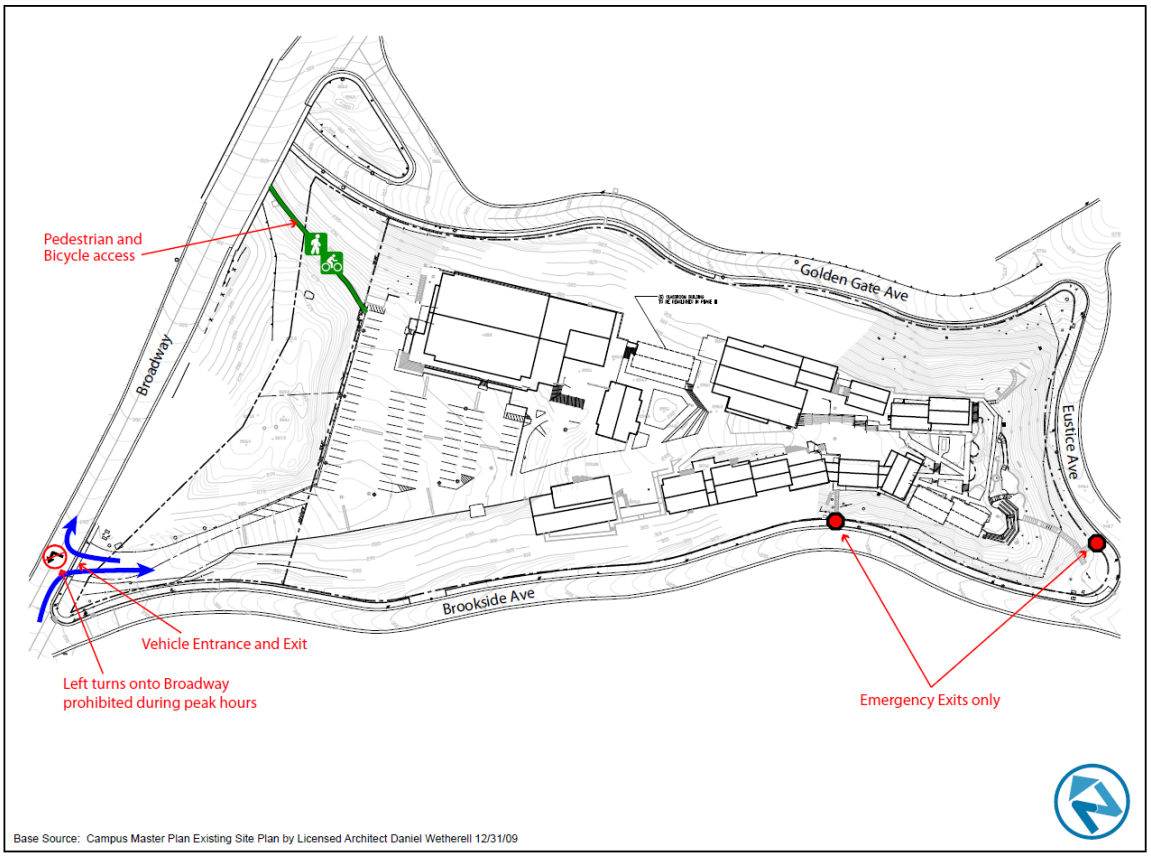
Report Format

This report is divided into the following sections:

1. Project Description
2. Intersection Analysis Methodology
3. Project Trips
4. Intersection Analysis
5. Summary of Findings

Figure 1 Project Location

Figure 2 Project Site Access



1. PROJECT DESCRIPTION

College Prep is requesting formal approval from the City of Oakland to allow for an increase in permitted enrollment from 340 to 375 students, representing an increase of approximately 10 percent over "baseline" conditions.

- The proposed increase in permitted enrollment is described as the "**Proposed Project**" for purposes of this LOS analysis.
- This LOS analysis does not assume any physical changes to campus access under the "Proposed Project". Rather, this analysis is entirely based on traffic volumes that would result from increased enrollment.

The corresponding increase in faculty population, to accommodate additional students, is also accounted for in this assessment, since the vehicle trip rates (on a "per student" basis) include non-student trips. The anticipated increase in traffic, resulting from the Project, is described in Section 3 of this report.

2. INTERSECTION ANALYSIS METHODOLOGY

The methodology for assessing potential intersection impacts, as conducted for this report, is summarized below.

Study Intersections

Based on prior communication with City staff, this LOS analysis is based on AM and PM peak period motor vehicle turning movement volumes at the following locations:

- Intersection of Broadway & Brookside Avenue & SR-24 Eastbound On-Ramp (approximately 50 feet west of the College Prep driveway located on Broadway)
    - For LOS analysis purposes, this side-street stop-sign controlled intersection is treated as two separate study intersections for purposes of this report:
        1. Broadway & SR-24 Eastbound On-Ramp; and
        2. Broadway & Brookside Avenue
    - At both side-street stop-controlled study intersections (#1 and #2), traffic LOS is based on average vehicle delay for the stop-controlled approach consistent with Highway Capacity Manual (HCM) methodology.
- Intersection of Broadway & Keith Avenue
    - This signalized intersection is described for analysis purposes (in this report) as Study Intersection #3.
    - At signalized intersections, traffic LOS is based on average vehicle delay for all approaches, consistent with HCM methodology.

Turning movement volumes for analysis purposes are based on traffic counts conducted when school was in session on Thursday, September 9, 2010 (see Attachment A). There were 372 students enrolled at College Prep on this date.

Analysis Scenarios

The LOS analysis at each study intersection is based on the potential traffic impact resulting from the addition of Project trips (resulting from increased enrollment) on "Baseline" LOS. The following scenarios were evaluated:

- Existing LOS (based on September 9, 2010 counts that occurred when 372 students were enrolled)
- Baseline LOS (based on subtracting trips generated by enrollment exceeding 340 students on the count date)
- Baseline plus Project LOS (based on the addition of trips generated by the Proposed Project that would increase permitted enrollment from 340 to 375 students)

The anticipated volume, distribution and assignment of Project trips is described in Section 3 of this report ("Project Trips").

Intersection Evaluation Criteria

Based on City of Oakland impact criteria guidelines[1], the Proposed Project would have a significant impact on traffic operations at a study intersection if any of the following traffic load and capacity and/or traffic safety thresholds are exceeded as a result of the Proposed Project:

Traffic Load and Capacity Thresholds:

1 At a study, signalized intersection which is located outside the Downtown area, the project would cause the level of service (LOS) to degrade to worse than LOS D (i.e., LOS E);

2 At a study, signalized intersection which is located within the Downtown area, the project would cause the LOS to degrade to worse than LOS E (i.e., LOS F); **NOTE: THIS CRITERION DOES NOT APPLY TO THIS ANALYSIS SINCE ALL STUDY INTERSECTIONS ARE LOCATED OUTISDE OF THE DOWNTOWN AREA.**

3 At a study, signalized intersection outside the Downtown area where the level of service is LOS E, the project would cause the total intersection average vehicle delay to increase by four (4) or more seconds or degrade to worse than LOS E (i.e., LOS F);

4 At a study, signalized intersection for all areas where the level of service is LOS E, the project would cause an increase in the average delay for any of the critical movements of six (6) seconds or more or degrade to worse than LOS E (i.e., LOS F);

5 At a study, signalized intersection for all areas where the level of service is LOS F, the project would cause (a) the overall volume-to-capacity ("V/C") ratio to increase 0.01 or more or (b) the critical movement V/C ratio to increase 0.02 or more;

6 At a study, unsignalized intersection the project would add ten (10) or more vehicles and after project completion satisfy the Caltrans peak hour volume traffic signal

[1] City of Oakland *CEQA Threshold of Significance Guidelines*, August 24, 2011.

warrant; **NOTE: THIS CRITERION WILL APPLY TO THE UNSIGNALIZED STUDY INTERSECTIONS: (1) BROADWAY & SR-24 EASTBOUND; (2) BROADWAY & BROOKSIDE AVENUE.**

7 For a roadway segment of the Congestion Management Program (CMP) Network, the project would cause (a) the LOS to degrade from LOS E or better to LOS F or (b) the V/C ratio to increase 0.03 or more for a roadway segment that would operate at LOS F without the project. **NOTE: THIS CRITERION DOES NOT APPLY TO THIS ANALYSIS SINCE THE STUDY INTERSECTIONS ARE NOT LOCATED ON DESIGNGATED CMP FACILITIES**[2]**.**

8 Cause congestion of regional significance on a roadway segment on the Metropolitan Transportation System (MTS) evaluated per the requirements of the Land Use Analysis Program of the CMP consistency with City policies concerning infill and transit-oriented development, the proximity of the project to other jurisdictions, and the magnitude of the project's contribution based on V/C ratios. **NOTE: THIS CRITERION DOES NOT APPLY TO THIS ANALYSIS SINCE THE STUDY INTERSECTIONS ARE NOT LOCATED ON DESIGNGATED CMP FACILITIES**[3]**.**

9 Result in substantially increased travel times for AC Transit buses. [NOTE: Factors to consider in evaluating the potential impact include, but are not limited to, the proximity of the project site to the transit corridor(s), the function of the roadway segment(s), and the characteristics of the potentially affected bus route(s). The evaluation may require a qualitative and/or quantitative analysis depending upon these relevant factors.].

Traffic Safety Thresholds

10. Directly or indirectly cause or expose roadway users (e.g., motorists, pedestrians, bus riders, bicyclists) to a permanent and substantial transportation hazard due to a new or existing physical design feature or incompatible uses [NOTE: Factors to consider in evaluating the potential impact to roadway users due to physical design features and incompatible uses include, but are not limited to, collision history and the adequacy of existing traffic controls.]

11. Directly or indirectly result in a permanent substantial decrease in pedestrian safety [**NOTE**: Consider whether factors related to pedestrian safety such as, but not limited to, the following are substantial in nature:

- Degradation of existing pedestrian facilities, including the following:
    - Removal of existing pedestrian refuge islands and/or bulbouts

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[2] In Oakland, the CMP Network includes all state highways plus the following streets: portions of Martin Luther King Jr. Way, Webster/Posey Tubes, 23rd Ave., 29th Ave., and Hegenberger Rd. (Source: City of Oakland *CEQA Threshold of Significance Guidelines*, August 24, 2011; Page 23).

[3] Ibid.

  - Increase of street crossing distance
  - Permanent removal or significant narrowing of an existing sidewalk, path, marked crossing, or pedestrian access way
  - Increase in pedestrian or vehicle volume at unsignalized or uncontrolled intersections
  - Sidewalk overcrowding
- Addition of new vehicle travel lanes and/or turn lanes
- Permanent removal of existing sidewalk-street buffering elements (e.g., on-street parking.]

12. Directly or indirectly result in a permanent substantial decrease in bicyclist safety [**NOTE**: Consider whether factors related to bicyclist safety such as, but not limited to, the following are substantial in nature:

- Removal or degradation of existing bikeways
- Addition of new vehicle travel lanes and/or turn lanes
- Addition of vehicle driveway entrances(s) that degrade(s) bicycle safety, with consideration given to the following:
  - Number of proposed vehicle driveway entrances
  - Location of proposed vehicle driveway entrance(s)
  - Visibility between bicyclists on travelway and motorists using the proposed vehicle driveway entrance(s)]

13. Directly or indirectly result in a permanent substantial decrease in bus rider safety [**NOTE**: Consider whether factors related to bus rider safety such as, but not limited to, the following are substantial in nature:

- Removal or degradation of existing bus facilities
- Siting of bus stops in locations without marked crossings, with insufficient sidewalks, or in isolated or unlit areas
- Addition of new bus riders that creates overcrowding at a bus stop];

14. Generate substantial multi-modal traffic traveling across at-grade railroad crossings that cause or expose roadway users (e.g., motorists, pedestrians, bus riders, bicyclists) to a permanent and substantial transportation hazard. [NOTE: If the project will generate substantial multi-modal traffic across an at-grade railroad crossing, a Diagnostic Review will be required in consultation with the California Public Utilities Commission. The Review should include roadway and rail descriptions, collision history, traffic volumes for all modes, train volumes, vehicular speeds, train speeds, and existing rail and traffic controls.] **NOTE: THIS CRITERION DOES NOT APPLY SINCE THERE NO AT-GRADE RAILROAD CROSSINGS NEAR THE PROJECT SITE.**

3. PROJECT TRIPS

The section describes existing and anticipated future travel patterns, including:

- Trip generation forecast for the Proposed Project
- Trip distribution & assignment forecast for trips resulting from the Proposed Project, for the purpose of determining the specific volume of trips that would pass through each study intersection

Trip Generation Forecast

This section describes the steps that were taken to develop a forecast of vehicle trip generation resulting from the Proposed Project.

Existing Traffic Patterns

Nelson\Nygaard reviewed existing trip generation data, described in the College Prep *Transportation Demand Management Study* (TDM Study) prepared in March 2011. Key data from that report, pertaining to existing travel patterns, is summarized below.

Employee and Student Travel Mode Survey

According to a survey of existing travel patterns for students and employees (summarized on Figures 3 through 5 on the following page):

- Over 80% of College Prep affiliates (i.e., students and staff) used an automobile to arrive at school. Faculty/staff used a car to get to school at a slightly higher rate than students
- While a large majority of students and staff arrive by automobile, less than half of all students either drive to school alone or are driven by their parents as a single student.
- Over 30% of all students carpool, either with a student or parent driver and multiple passengers in the car.
- Use of alternative modes, particularly carpooling and travel by BART, were more common for students than for staff. However, staff was more likely to bike to school.
- There appears to be a higher non-automobile mode share for those living east of the Caldecott Tunnel. The cities with the highest non-automobile mode share are those that are best served by BART, with direct service to the Rockridge BART station, located less than a mile from the school.

Figure 3 Auto vs. Non-Auto Mode Share by Population

Mode	All	Students	Faculty/Staff
Automobile	81%	79%	88%
Non-Auto	19%	21%	12%

Source: College Prep TDM Study Survey, 2010

Figure 4 Travel Mode Share by Population

Travel Mode	Student	Faculty/Staff	Combined
Drove Alone	12%	75%	22%
Driven by a Parent Alone	36%	0%	30%
Carpooled	31%	13%	28%
Walked	3%	3%	3%
Biked	2%	8%	3%
BART	14%	1%	12%
AC Transit	2%	0%	1%

Source: College Prep TDM Study Survey, 2010

Figure 5 Mode to School by City of Residence

City:	% Non-Automobile	% Automobile	Total # Respondents
Berkeley	20%	80%	108
Oakland	15%	85%	210
San Francisco	14%	86%	7
Piedmont	8%	92%	26
Alameda	0%	100%	27
Walnut Creek	61%	39%	18
Concord	33%	67%	3
Lafayette	23%	77%	31
Orinda	21%	79%	34
Moraga	13%	87%	15

Source: College Prep TDM Study, March 2011

Observed Traffic Flows

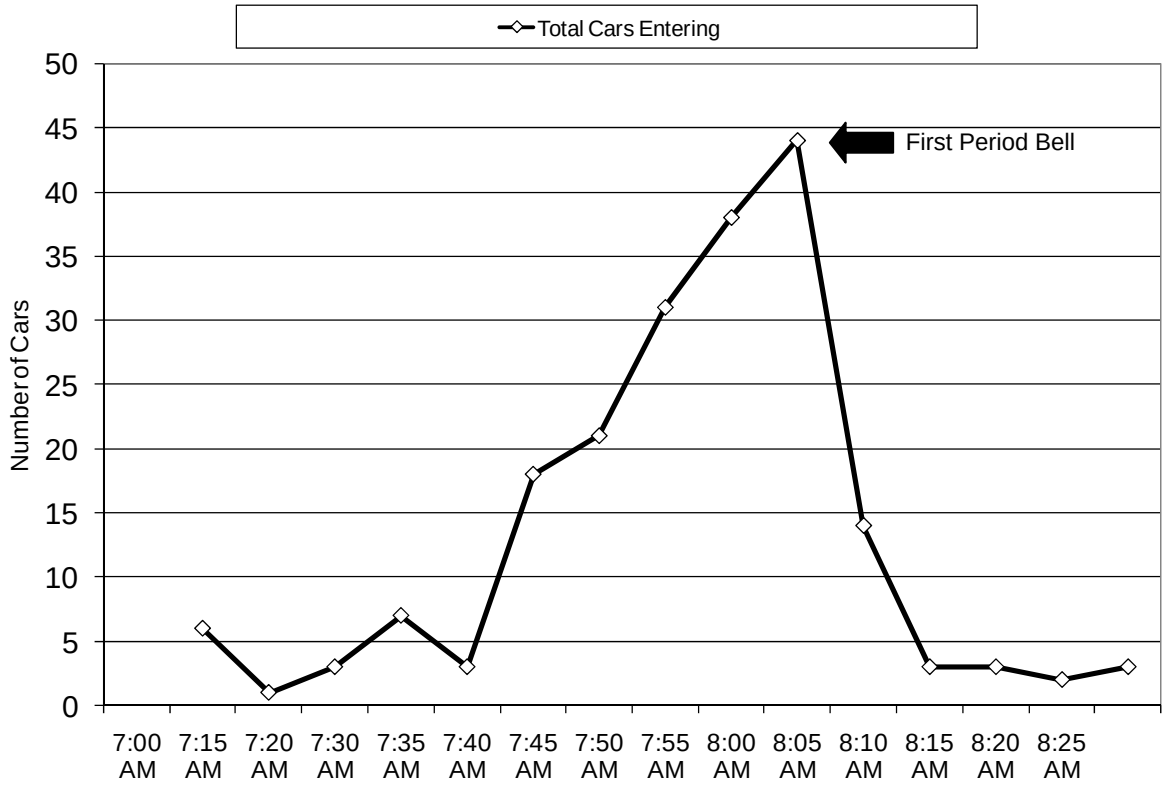
Traffic conditions observed by Nelson\Nygaard during the morning arrival and afternoon departure periods, as described in the College Prep TDM Study, are summarized below. Based on a review of the traffic flow data described in the TDM Study: the peak hour of traffic generated by College Prep (at a time when actual enrollment is estimated at 372 students) is estimated to be less than 200 peak hour vehicle trips.

AM Peak Hour

Key observations, identified in the TDM Study, included the following:

- On the observation day the first student arrived on campus at 7 a.m., while the vast majority of arrivals occurred at or after 7:45 a.m., concentrated immediately before the first period bell which rings at 8:05 a.m. From this time until just after 8 a.m. there was an intense concentration of activity as the majority of students and faculty arrive at school during a period of about 20 minutes.
- Observations noted another small wave of activity corresponding to the start of second period at 8:55 a.m.

Figure 6 AM Peak Hour Traffic Flow (Observed November 2010)



Source: College Prep TDM Study, March 2011

The AM Peak Hour drop-off was observed to operate without significant internal delays (within campus) based on observations conducted as part of the TDM Study which noted that:

- The measures that College Prep has implemented with a double drop-off line appear to be functioning reasonably well.
- Internal traffic congestion was noted in the parking lot during the peak activity period, but the drop off lines were found to "generally keep traffic moving, avoid conflicts with traffic on Upper Broadway, and prevent any significant backups for traffic accessing the parking lot.
- Despite the signage at the exit directing drivers to make right turns only onto Upper Broadway, the TDM study noted that "*drivers did occasionally attempt to make a left turn out of the school driveway. When this occurred, a long line of cars backed up while trying to exit the lot, as shown in the photo to the right. This did not cause any severe congestion issues, but it did slow down exiting cars and worsened congestion in the lot*".

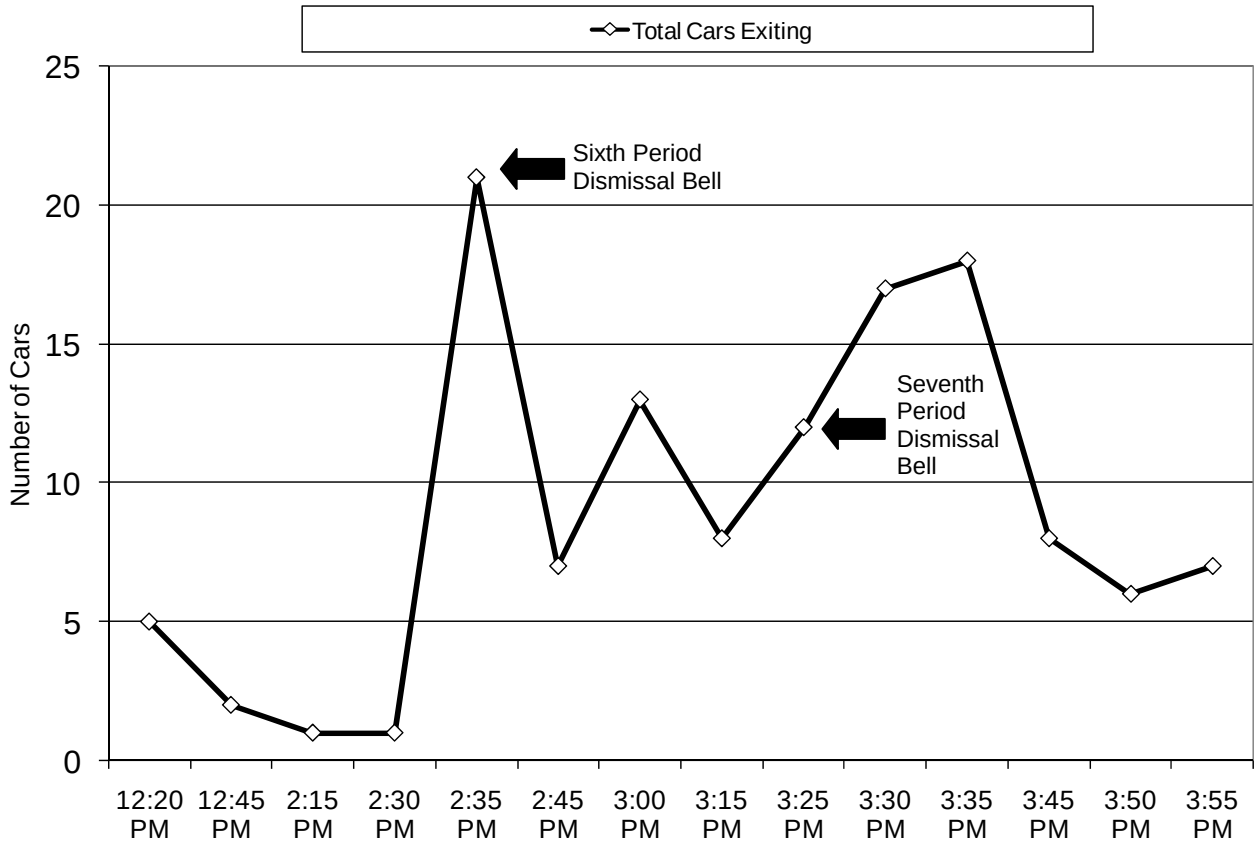
On campus AM Peak traffic conditions at College Prep.

Source: Photo taken by Andy Dean, 8 AM, Tuesday, November 7, 2010

Afternoon Pick-Up/ School Departure Observations

Observations of the afternoon pick-up/school departure period were also conducted as part of the TDM study, and correspond with the "school peak" that occurs between 2:30 and 3:45 PM. Therefore, the afternoon observations do not directly apply to the PM Peak Hour for traffic analysis purposes, which occurs between 5:00 and 6:00 PM at adjacent intersections.

Figure 7 Afternoon Traffic Flow (Observed November 2010)



Source: College Prep TDM Study, March 2011

Parking Locations

Parking locations were also identified as part of the TDM Study, which is useful for determining the path of travel for Project trips (i.e., "trip assignment"). Impacts to parking are not directly relevant for analysis purposes.

College Prep currently allows only students in 3 person carpools or more to park on campus. As a result, most faculty park on campus and most students park off campus. During the observation day it was noted that a few student cars park on campus with only one student inside, highlighting the fact that there is limited ability to enforce the carpool requirement, especially after the first period bell. Anecdotally, students in the focus group mentioned that they always find spots available on campus if they arrive late and Golden Gate Avenue and Broadway are fully occupied.

Figure 8 Parking Locations of Student and Faculty Drivers

	Students	Faculty
On campus	12%	96%
On Broadway, west of school entrance	29%	0%
On Golden Gate Avenue below Hwy 24	60%	4%

Source: College Prep TDM Study, Survey

Parking Occupancy

On-campus Parking Occupancy

At the time the parking counts summarized on Figure 9 were conducted, there were 79 marked spaces on campus including two disabled parking spaces and two visitor spaces. However, the lot can hold over 100 cars at maximum capacity, including approximately 20 informal spaces along the driveway and two by the basketball hoop. The current parking supply, following modifications that were completed in summer 2011 is 107 spaces. Based on the counts summarized on Figure 9, on-campus parking is effectively full by the start of second period at 9 a.m.

Off-campus Parking Occupancy

The remainder of campus parking demand is served by existing off-street parking. College Prep has taken measures to limit off-street parking to certain areas:

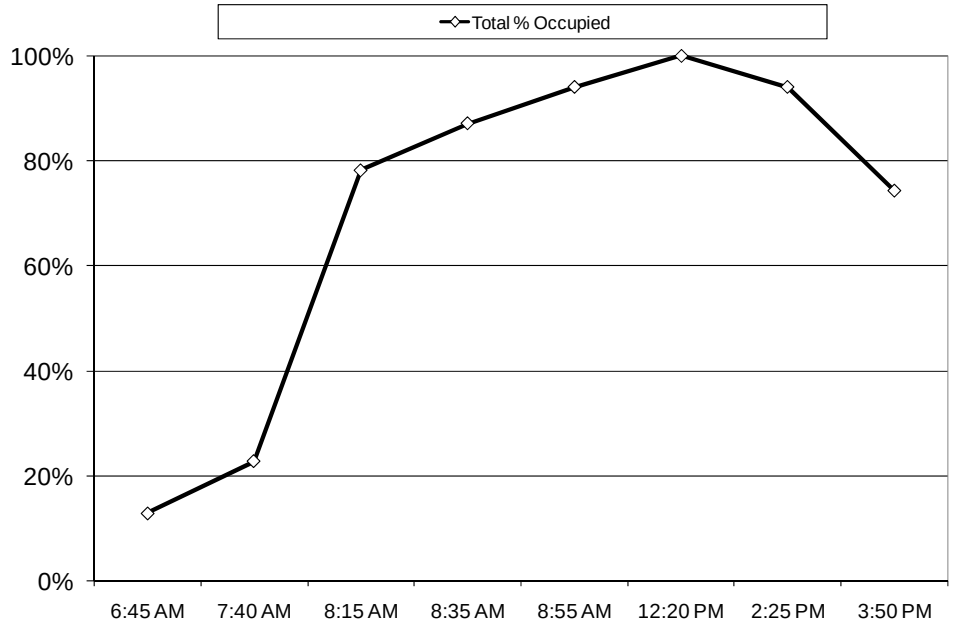
Brookside Avenue: Students are not allowed by school policy to park on Brookside Avenue, a residential street where neighbors have expressed concerns in the past about impacts from College Prep student parking. Maximum parking occupancy on Brookside Avenue was at 6:45 a.m. Occupancy dropped throughout the day, with street parking virtually always available, demonstrating that College Prep affiliates are not parking on that street.

Broadway: On-street parking on Broadway adjacent to the campus was full by 8:15 a.m.

Golden Gate Avenue: This non-residential area below the freeway is an area where College Prep students can park without impacting residential streets. Parking on Golden Gate Avenue below the freeway was empty at 6:45 a.m. and was completely full (27 cars) by 8:30 a.m based on observations identified in the TDM Study. Based on those observations, these were likely all College Prep students.

Figure 9 On-campus Parking Occupancy

	TOTALVEHICLES	% *Marked* Spaces Occupied	% Total Capacity Occupied
6:45 AM	13	15%	13%
7:40 AM	23	28%	23%
8:15 AM	79	80%	78%
8:35 AM	88	87%	87%
8:55 AM	95	94%	94%
12:20 PM	101	94%	100%
2:25 PM	95	92%	94%
3:50 PM	75	81%	74%



Source: College Prep TDM Study, March 2011

Project Trip Generation Forecast

Nelson\Nygaard prepared a forecast of vehicle trips that would be generated by the Proposed Project based on observed traffic volumes, as described in the College Prep TDM Study, and trip generation rates for "high schools" as described in the Institute of Transportation Engineering (ITE) *Trip Generation*.

Figure 10 summarizes the vehicle trip generation forecast for the Proposed Project.

- Since the rate of traffic generation at College Prep exceeds that of a typical high school, the "adjusted vehicle trip generation rates" were used to forecast vehicle trips generated by the Proposed Project.
- The review of traffic flow data described in the TDM Study indicates that a total of 280 vehicles arrived on campus in 2008 (with 353 students enrolled) and 240 vehicles arrived in 2010 (with 372 students enrolled), including vehicles that did not remain on campus (student drop-offs) and vehicles that parked off campus on Broadway and Golden Gate Way. Although this volume of traffic includes some vehicles that likely arrived outside of the AM Peak Hour, all College Prep vehicles arriving (or dropping students off) are included in the estimated AM Peak Hour trip generation for purposes of this analysis.
- Those arriving AM vehicles that, drop students off on campus or on Broadway, generate 2 peak hour trips (1 AM inbound trip and 1 AM outbound trip). Therefore, the total AM Peak Hour trip generation is estimated at 412 AM Peak Hour trips based on 2008 observations, and 346 AM Peak Hour trips based on 2010 observations.
- To provide a conservative assessment for traffic analysis purposes: the adjusted trip generation rate that was used for forecast project trips, for the purpose of this analysis, is based on the higher 2008 rate of trip generation. The 2008 rate for AM Peak Hour trips is 1.17 vehicle trips per student. The PM Peak Hour and Daily rates were extrapolated by adjusting the ITE base trip rates to reflect the higher rate of AM Peak Hour vehicle trips generated by College Prep (compared to the ITE AM Peak Hour base rate for typical high schools).
- Although the trip generation rates are shown on a "per student" basis, the trip generation rates shown include both student and non-student trips.
- The portion of vehicle trips during each period that would be inbound and outbound was derived directly from the ITE rates (68% inbound during the AM Peak Hour; 47% inbound during the PM Peak Hour for adjacent street traffic; and 50% inbound for Daily Traffic).

Figure 10 Project Trip Generation Forecast

TRIP GENERATION BASED ON UNADJUSTED ITE RATES (see note 1)							
	Student Population	AM Peak Hour Trips	AM Peak Hour ITE Rate	PM Peak Hour (2) Trips	PM Peak Hour (2) ITE Rate	Weekday Trips	Weekday Rate
Baseline Condition	340	143	0.42	44	0.13	581	1.71
Proposed Project	375	158	0.42	49	0.13	641	1.71
Net Increase	35	15		5		60	
2008 & 2010 ESTIMATED TRIP GENERATION (see note 3)							
Year 2008 (see note 4)	353	412	1.17	127	0.36	1,131	3.20
Year 2010 (see note 5)	372	346	0.93	107	0.29	1,016	2.73
TRIP GENERATION FORECAST FOR PROPOSED PROJECT BASED ON ADJUSTED TRIP RATES (see note 6)							
	Student Population	AM Peak Hour Trips	AM Peak Hour College Prep Rate	PM Peak Hour (2) Trips	PM Peak Hour (2) College Prep Rate	Weekday Trips	Weekday College Prep Rate
Baseline	340	398	1.17	122	0.36	1,088	3.20
Baseline plus Project	375	439	1.17	135	0.36	1,200	3.20
Net Increase with Proposed Project	***35***	***41***	***0.79***	***13***	***0.36***	***112***	**3.21**

Notes:

1. Unadjusted ITE rates based on ITE *Trip Generation* rate for "High School".
2. PM Peak Hour rates based on **peak hour of adjacent street** (not peak hour of "generator").
3. Based on AM observations described in College Prep TDM Study (Nelson\Nygaard March 2011). PM rate adjusted based on proportional increase over ITE rate (dervied from AM observations). Daily rate adjusted to reflect increased peak trips.
4. Year 2008 trip generation based on 280 AM inbound trips (including vehicles parking on Broadway and Golden Gate Way, and students dropped-off on Broadway, as described in the *College Prep TDM Study)* plus estimated 132 outbound trips generated by parent drop-offs. (PM & Daily trip generation rates extrapolated based on proportional increase over ITE rate for AM Peak).
5. Year 2010 trip generation based on 240 AM inbound trips (including vehicles parking on Broadway and Golden Gate Way, and students dropped-off on Broadway, as described in the *College Prep TDM Study)* plus estimated 106 outbound trips generated by parent drop-offs. (PM & Daily trip generation rates extrapolated based on proportional increase over ITE rate for AM Peak).
6. Adjusted ITE rates for College Prep based on Year 2008 observations to provide a conservative assessment.

Source: Nelson\Nygaard 2012

Based on this forecasting method, the Proposed Project will generate the following net increases in trip generation over Baseline Conditions:

- **+41 vehicle trips during the AM Peak Hour** (28 inbound + 13 outbound)
- **+13 vehicle trips during the PM Peak Hour** (6 inbound + 7 outbound)
- **+112 daily vehicle trips** (56 inbound + 56 outbound)

Project Trip Distribution & Assignment

This section describes the anticipated:

- Project trip distribution
  - General path of travel based on origin and destination patterns) for the net increase in vehicle trips that would be generated by the Proposed Project (see Figures 11 and 12); and
- Project trip assignment:
  - The specific turning movements, anticipated for Project-generated trips, at each study intersection, as shown on Figure 13.

Figure 11 Trip Origins based on Student & Staff Places of Residence

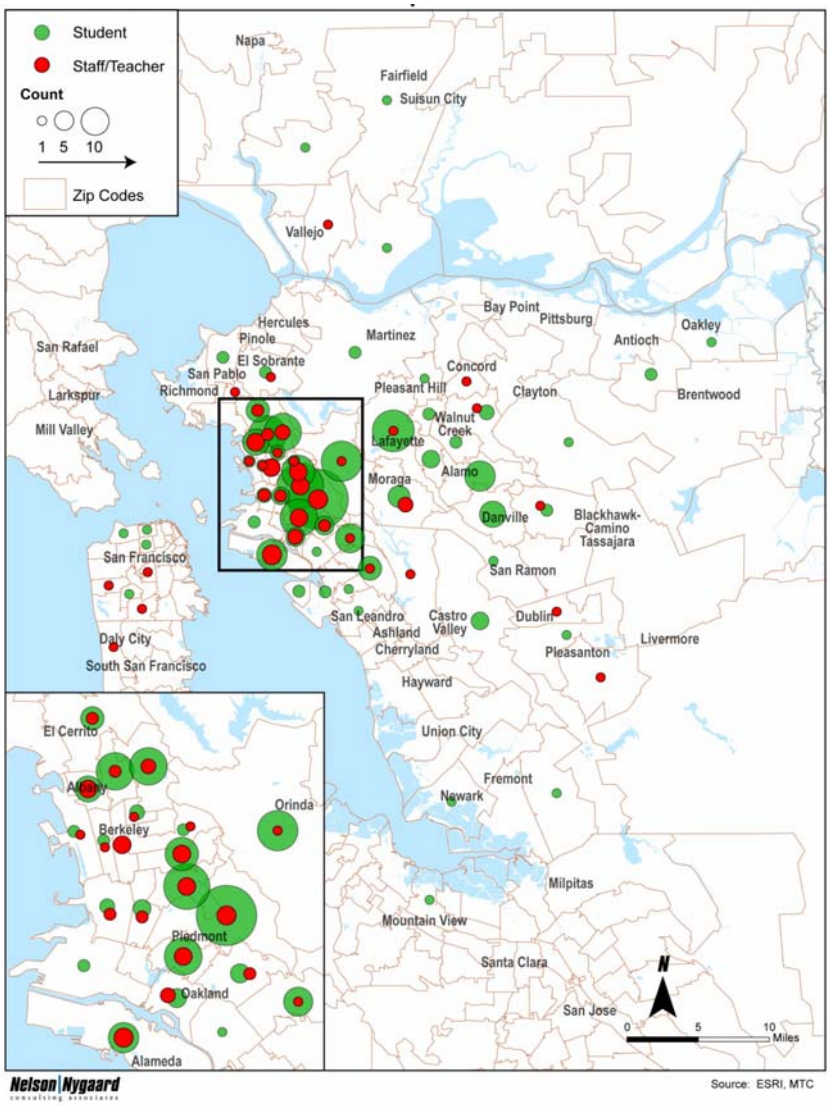


Figure 12 Project Trip Distribution

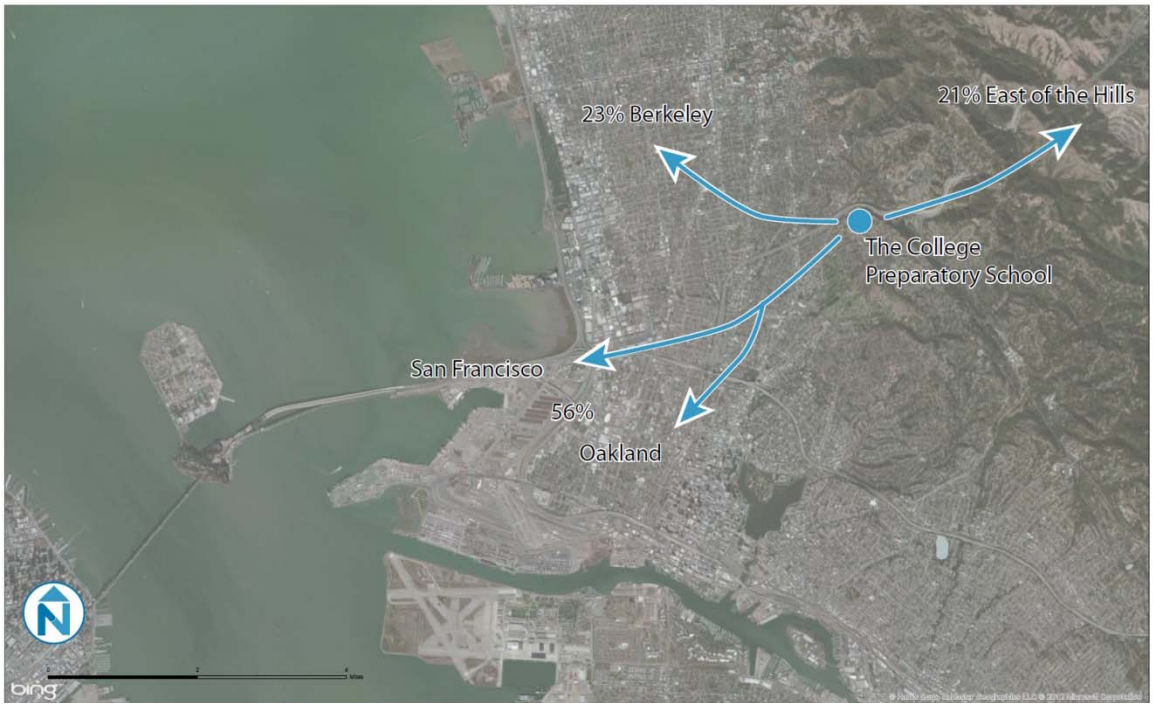
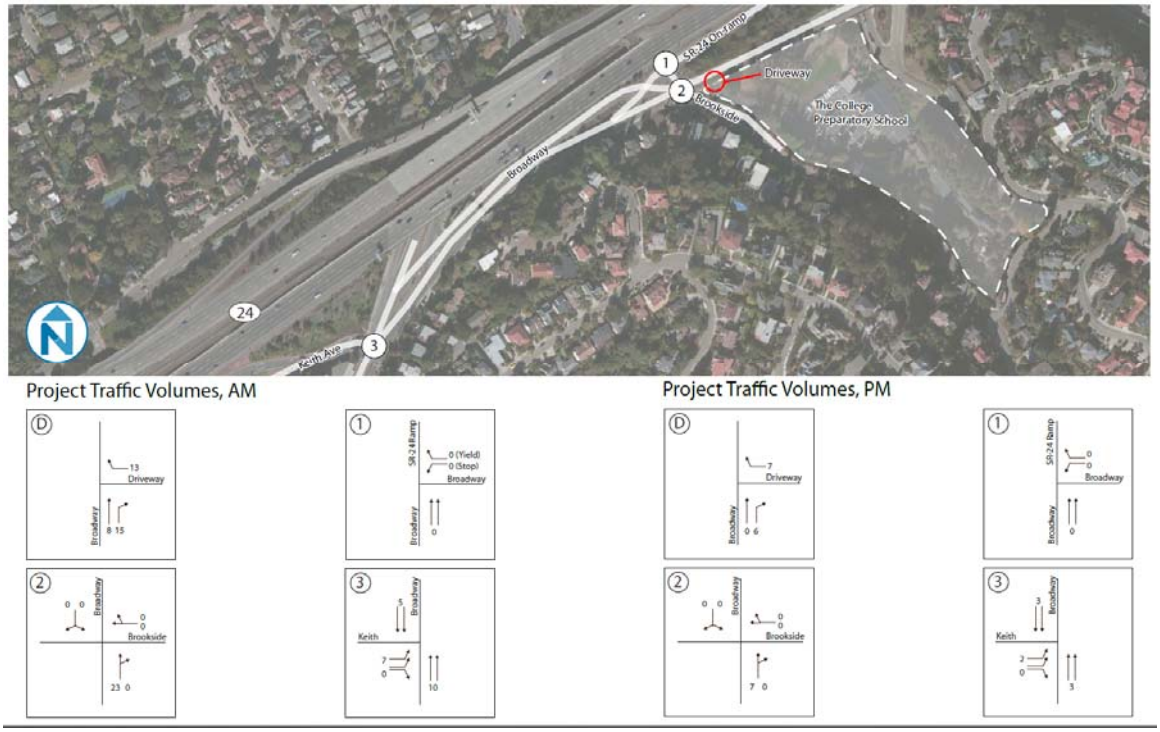


Figure 13 Project Trip Assignment



4. INTERSECTION ANALYSIS

This section summarizes the analysis of potential traffic impacts at each of the study intersections identified by College Prep based on discussions with City staff:

1. Broadway & SR-24 Eastbound On-ramp (side-street stop-sign controlled intersection)
2. Broadway & Brookside Avenue(side-street stop-sign controlled intersection)
3. Broadway & Keith Avenue (signalized intersection)

Traffic Load & Capacity

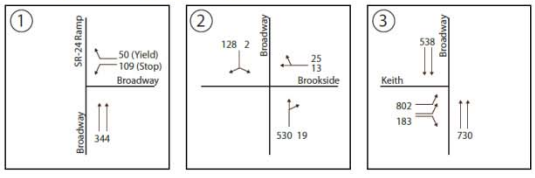
This section describes the level of service (LOS) analysis that was conducted at each study intersection to evaluate the significance of potential impacts to traffic load and capacity.

Existing Traffic Volumes & Level of Service

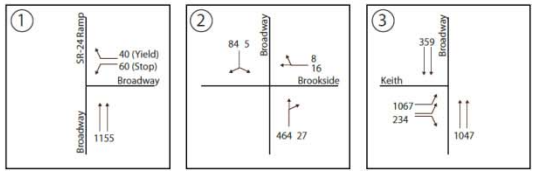
Existing AM and PM Peak Hour turning movement volumes at each study intersection are summarized on Figure 7, based on traffic counts conducted on Thursday, September 9, 2010. (See Appendix A for traffic count sheets).

Figure 14 Existing Peak Hour Traffic Volumes

Existing Traffic Volumes, AM



Existing Traffic Volumes, PM



Source: September 9, 2010 Traffic Count Data (see Appendix A)

Figure 15 Level of Service Definitions

LOS	Flow Type	Operational Characteristics	Intersection Control Delay (seconds/vehicle)	
			Signal Control	2-Way-Stop or All-Way Stop Control
A	Stable Flow	Free-flow conditions with negligible to minimal delays. Excellent progression with most vehicles arriving during the green phase and not having to stop at all. Nearly all drivers find freedom of operation.	< 10	0 – 10
B	Stable Flow	Good progression with slight delays. Short cycle-lengths typical. Relatively more vehicles stop than under LOS A. Vehicle platoons are formed. Drivers begin to feel somewhat restricted within groups of vehicles.	> 10 – 20	> 10 – 15
C	Stable Flow	Relatively higher delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear. The number of vehicles stopping is significant, although many still pass through without stopping. Most drivers feel somewhat restricted.	> 20 – 35	> 15 – 25
D	Approaching Unstable Flow	Somewhat congested conditions. Longer but tolerable delays may result from unfavorable progression, long cycle lengths, and/or high volume-to-capacity ratios. Many vehicles are stopped. Individual cycle failures may be noticeable. Drivers feel restricted during short periods due to temporary back-ups.	> 35 – 55	> 25 – 35
E	Unstable Flow	Congested conditions. Significant delays result from poor progression, long cycle lengths, and high volume-to-capacity ratios. Individual cycle failures occur frequently. There are typically long queues of vehicles waiting upstream of the intersection. Driver maneuverability is very restricted.	> 55 – 80	> 35 – 50
F	Forced Flow	Jammed or grid-lock type operating conditions. Generally considered to be unacceptable for most drivers. Zero or very poor progression, with over-saturation or high volume-to-capacity ratios. Several individual cycle failures occur. Queue spillovers from other locations restrict or prevent movement.	> 80	> 50

Source: Highway Capacity Manual (HCM) 2000

Existing Conditions

Figure 9 summarizes the Existing LOS at each study intersection based on:

- Turning movement counts conducted on Thursday, September 9, 2010; and
- Vehicle queue observations identified in a March 2011 traffic study prepared for the East Bay Municipal Utility District (East Bay MUD)[4] noted the following:
  - Although LOS calculations based strictly on traffic volumes indicated LOS E during PM Peak Hour approach at Broadway & SR-24 Eastbound Ramp (and LOS B at Broadway & Brookside): review of the East Bay MUD study indicate that actual delay during congested periods constitute LOS F conditions during the PM Peak Hour due to queue spill-back from SR-24
  - Since current operations (in late July/early August) do not represent typical "peak" travel conditions (i.e., during a period of reduced travel and summer vacations, etc.), it is not possible to verify whether the peak spill-back and LOS F conditions identified in the East Bay MUD remain applicable or not. Therefore, for analysis purposes: this study will defer to the findings of the East Bay MUD study, identifying Existing LOS F conditions at the stop-controlled approaches to SR-24 Eastbound during the PM Peak Hour.

Figure 16 Existing Level of Service (September 9, 2010 traffic counts)

#	Location	AM Peak Hour	PM Peak Hour
1	Broadway and SR-24 ramp	B	E/F*
2	Brookside and Broadway	C	B/F*
3	Broadway at Keith	B	B

Source: Nelson\Nygaard 2012

*LOS F conditions based on PM Peak Hour observations described in the March 2011 East Bay MUD study, which documented additional delay due to spill-back from SR-24, thus resulting in LOS F conditions that differ from LOS results as modeled for this report in Appendix B.

Prior observations contained in the College Prep TDM Study also noted:

- The Broadway/Brookside/SR-24 on-ramp intersection has inadequate sight lines and should be modified. This intersection is currently slated for reconstruction as part of the settlement agreement between the City of Oakland and Caltrans over the Caldecott Tunnel fourth bore project.

[4] *Dingee Backhoe Replacement Project Traffic Study*, prepared for East Bay Municipal Utility District by Fehr & Peers, March 2011. (See page 12 for Existing LOS analysis and citation noting "field observations indicate LOS F conditions due to queue spill-back from SR-24").

Assessment of Project Impact on Baseline LOS

College Prep enrollment on September 9, 2010 has been identified as 372 students. Therefore, the Intersection LOS analysis, as applied to the September 9, 2010 turning movement counts, is based on the following two traffic analysis scenarios:

- **Baseline LOS** is based on the "baseline" enrollment level of 340 students.
- **Baseline plus Project LOS** is based on the additional traffic that would be generated by the Proposed Project (i.e., increase in permitted enrollment of 35 students). The volume of additional traffic that would be generated, and the anticipated travel path for those vehicle trips, is described in the section of this report titled "Project Trips".

Figure 10 provides a comparison of Baseline and Baseline Plus Project LOS at each of the three study intersections.

LOS Findings

Based on the LOS analysis described above and summarized on Figure 10:

- The Proposed Project would not result in unacceptable LOS at any study intersection under Baseline Plus Project Conditions.
- The Proposed Project would not trigger a signal warrant at any unsignalized study intersection under Baseline Plus Project Conditions.

Therefore, Project impacts on traffic load and capacity at study intersections are less than significant under Baseline plus Project Conditions.

Figure 17 Peak Hour Level of Service –Baseline and Baseline plus Project Conditions

PEAK HOUR LEVEL OF SERVICE -- BASELINE & BASELINE PLUS PROJECT CONDITIONS

Intersection	Intersection Control	Existing Baseline Conditions (2)				Baseline plus Project Conditions (3)				Unsignalized Impact Assessment		*Project Impact under Existing plus Project conditions*
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour				
		Average Vehicle Delay	LOS	Average Vehicle Delay	LOS	Average Vehicle Delay	LOS	Average Vehicle Delay	LOS	Project addes 10 or more peak hour trips?	Signal warrant met based on approach volume?	
1. Broadway & SR-24 EB On-Ramp	Stop-sign (side-street only)	14	B	**46 / >50 (4)**	**E/ F (4)**	12	B	**46 / >50**	**E / F (4)**	NO	YES (AM only)	*Less than Significant. Project does not generate peak hour trips on delayed approach to SR-24, and PM approach volume (approaching stop-sign) does not trigger signal warrant.*
2. Broadway & Brookside Ave	Stop-sign (side-street only)	16	C	**14 / >50 (4)**	**B / F (4)**	17	C	**14/ >50**	**F (4)**	YES (AM only)	NO	*Less than Significant. Side-street approach volumes from Brookside do not meet signal warrants.*
3. Broadway & Keith Ave	Signalized	16	B	14	B	17	B	14	B			*Less than Significant. Intersection operates at acceptable LOS B during AM & PM analysis periods.*

Notes:

1. **Based indicates failing conditions (LOS E or worse).**
2. Existing Baseline LOS based on subtracting a portion of school-generated traffic (for enrollment exceeding baseline level) from Existing (September 2010 counts).
3. Existing plus Project LOS based on additiona to addition of Project-generated trips to Existing Baseline.
4. LOS E during PM Peak Hour based on September 2010 volumes (see Appendix B LOS reports); however, LOS F conditions were identified during PM Peak Hour based on documented and observed spill-back of vehicle queues from SR-24 (see footnote 4, East Bay MUD traffic study prepared March 2011).

Source: Nelson\Nygaard 2012

Traffic Safety Impacts at Study Intersections

This section provides an assessment of potential traffic safety impacts resulting from the Proposed Project at each of study intersection.

Reported Collisions at Study Intersections

Collision data was retrieved from the Statewide Integrated Traffic Records System (SWITRS) for the last three complete years (2009 – 2011).

- For Oakland as a whole there were 16,946 records, but only 15 collisions occurred in the vicinity of the school.
- The most frequent causes of accidents were speeding, impairment due to alcohol or drugs, and unsafe lane changes. None of the collisions involved pedestrians or cyclists.

Figure 18 Reported Intersection Collisions (2009-2011)

ACCIDENT YEAR	PRIMARY RD	SECONDARY RD
2009	BROADWAY	GOLDEN GATE AV
2009	BROADWAY	KEITH
2010	BROADWAY	KEITH AV
2010	BROADWAY	KEITH AV
2009	KEITH AV	BROADWAY
2009	KEITH AV	BROADWAY
2009	RT 24	BROADWAY
2009	RT 24	BROADWAY
2009	RT 24	BROADWAY
2009	RT 24	BROADWAY
2010	RT 24	BROADWAY
2010	RT 24	BROADWAY
2010	RT 24	BROADWAY
2010	RT 24	BROADWAY
2011	RT 24	BROADWAY

Source: SWTTRS

Collision Rate Assessment

A commonly used measure of collision frequency is “collisions per million vehicles”:

- The statewide average is 0.43 collisions per million vehicles.
- To carry out this analysis for the study area, the nine collisions more than 500 feet from the Broadway/RT 24 intersection were eliminated as they almost certainly occurred on the freeway rather than on the local streets surrounding the school. As seen in Figure 19,

the analysis for the two study intersections shows that collisions occur at around half the statewide average rate.

Figure 19 Reported Collisions per Million Vehicles at Study Intersections

Intersection	PM Peak Volume	Average Daily Traffic	Estimated Annual Vehicles	Reported Collisions 2009-2011	Avg. Annual Collisions	Estimated Collisions per Million Vehicles (MV)
Broadway & Keith	2,707	27,070	8,121,000	5	1.7	0.21
Broadway & SR-24 & Brookside	1,759	17,590	5,277,000	3	1.0	0.19

Source: Nelson\Nygaard 2012

Potential Transit Ridership Impacts

Currently one AC Transit line directly serves campus:

- **Line 605:** A "school" line that serves a number of schools in Oakland and Berkeley, running from downtown Berkeley and the UC Berkeley campus down College Avenue, up Broadway Avenue and Broadway Terrace, and through Montclair ending at Head Royce High School.

There are also three lines that serve Rockridge BART. AC Transit riders could transfer to the campus shuttle for direct access to the school. AC Transit lines serving Rockridge BART are:

- **Lines 51A:** Runs from Rockridge BART south on College Avenue and Broadway Avenue through downtown Oakland, through the tunnel to the City of Alameda, down Webster Street and Santa Clara Avenue in Alameda, and ends at Fruitvale BART in Oakland.
- **Line 51B:** Runs from Rockridge BART north on College Avenue towards Berkeley, through downtown Berkeley and down University Avenue to Berkeley Amtrak or Berkeley Marina.
- **Line 49:** Runs in a loop from Rockridge BART up College Avenue towards Berkeley, loops through downtown Berkeley, down Dwight to West Berkeley and back up Ashby to Rockridge BART.

There are a few students who currently take AC Transit from Oakland, Berkeley, or El Cerrito. A number of these also indicated that they take the shuttle to campus. Based on existing AC Transit service, College Prep students living in Oakland, Berkeley, and Alameda are the most likely candidates for expanding AC Transit ridership to school.

However, the College Prep TDM Study noted that "given the very low current use of AC Transit, there does not appear to be significant potential to expand AC Transit ridership at the present time." Based on that observation, and noting the dispersed pattern of trip origins to and from campus, significant impact impacts to AC Transit ridership are not anticipated to result from the Proposed Project.

Summary of Findings

Based on the focused analysis of study intersections described in this report, the following findings were made.

- Project impacts to traffic load and capacity at study intersection are **less than significant** based on the following findings:
  - The Proposed Project will not cause the level of service (LOS) at any signalized study intersection to degrade to worse than LOS D (i.e., LOS E or F).
  - The Proposed Project will not cause any signal warrants to be met at unsignalized study intersections.
  - The Proposed Project will not result in substantially increased travel times for AC Transit buses, because:
    - Increased student enrollment is not anticipated to result in a significant increase in AC Transit ridership generated by trips to/from College Prep; and
    - The Proposed Project is not anticipated to result in significant increases in travel delay for buses traveling on Broadway, based on the findings of the Intersection LOS analysis.
- Project impacts traffic safety at study intersections will be **less than significant**
  - The Proposed Project will not generate traffic affecting movements at study intersections with reported collisions that exceed the Statewide average.
  - The Proposed Project will not directly or indirectly cause or expose roadway users (e.g., motorists, pedestrians, bus riders, bicyclists) to a permanent and substantial transportation hazard due to a new or existing physical design feature or incompatible uses
  - The Proposed project will not directly nor indirectly result in a permanent substantial decrease in pedestrian safety, nor will the Project result in modifications to sidewalks or travel lanes.
  - The Proposed Project will not directly or indirectly result in a permanent substantial decrease in bicyclist safety.
  - The Proposed Project will not directly or indirectly result in a permanent substantial decrease in bus rider safety

Appendix A Traffic Count Sheets

ALL TRAFFIC DATA, INC
(916)771-8700
FAX 786-2879

City of Oakland — Broadway & Brookside Ave — Date: 9/9/2010
10-7309-003

	Broadway Southbound				Brookside Ave Westbound				Broadway Northbound				Brookside Ave Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int Total
7:00	0	0	0	0	0	12	1	13	3	2	0	5	67	29	2	98	116
7:15	0	0	0	0	0	8	0	8	2	2	0	4	73	60	5	138	150
7:30	0	0	0	0	0	20	14	34	6	4	3	13	50	80	0	130	177
7:45	0	0	0	0	1	19	14	34	5	3	9	17	71	95	8	174	225
Total	0	0	0	0	1	59	29	89	16	11	12	39	261	264	15	540	668
8:00	0	0	0	0	1	14	10	25	6	4	11	21	81	160	6	247	293
8:15	0	0	0	0	0	22	6	28	5	1	4	10	83	138	2	223	261
8:30	0	0	0	0	0	32	11	43	6	1	1	8	109	137	3	249	300
8:45	0	0	0	0	0	12	2	14	6	1	2	9	60	92	2	154	177
Total	0	0	0	0	1	80	29	110	23	7	18	48	333	527	13	873	1031
16:00	0	0	0	0	1	12	2	15	1	0	0	1	173	105	3	281	297
16:15	0	0	0	0	0	8	8	16	5	2	1	8	186	117	7	310	334
16:30	0	0	0	0	0	12	5	17	3	5	1	9	225	116	4	345	371
16:45	0	0	0	0	0	10	4	14	2	0	0	2	230	138	6	374	390
Total	0	0	0	0	1	42	19	62	11	7	2	20	814	476	20	1310	1392
17:00	0	0	0	0	1	9	3	13	4	0	1	5	254	105	9	368	386
17:15	0	0	0	0	0	14	10	24	2	0	2	4	314	133	7	454	482
17:30	0	0	0	0	2	15	16	33	4	1	4	9	304	111	6	421	463
17:45	0	0	0	0	2	8	9	19	4	1	1	6	283	115	5	403	428
Total	0	0	0	0	5	46	38	89	14	2	8	24	1155	464	27	1646	1759
Grand Total	0	0	0	0	8	227	115	350	64	27	40	131	2563	1731	75	4369	4850
Apprch%	0.0%	0.0%	0.0%		2.3%	64.9%	32.9%		48.9%	20.6%	30.5%		58.7%	39.6%	1.7%		
Total %	0.0%	0.0%	0.0%	0.0%	0.2%	4.7%	2.4%	7.2%	1.3%	0.6%	0.8%	2.7%	52.8%	35.7%	1.5%	90.1%	

City of Oakland — Broadway & Brookside Ave — Date: 9/9/2010

AM Peak Hr Begins at: 745 AM

	Broadway Southbound				Brookside Ave Westbound				Broadway Northbound				Brookside Ave Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int Total
745	0	0	0	0	1	19	14	34	5	3	9	17	71	95	8	174	225
800	0	0	0	0	1	14	10	25	6	4	11	21	81	160	6	247	293
815	0	0	0	0	0	22	6	28	5	1	4	10	83	138	2	223	261
830	0	0	0	0	0	32	11	43	6	1	1	8	109	137	3	249	300
Total Volume	0	0	0	0	2	87	41	130	22	9	25	56	344	530	19	893	1079
% App Total.	0.0%	0.0%	0.0%		1.5%	66.9%	31.5%		39.3%	16.1%	44.6%		38.5%	59.4%	2.1%		
PHF	0.000				0.756				0.667				0.897				

PM Peak Hr Begins at: 500 PM

	Broadway Southbound				Brookside Ave Westbound				Broadway Northbound				Brookside Ave Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int Total
500	0	0	0	0	1	9	3	13	4	0	1	5	254	105	9	368	386
515	0	0	0	0	0	14	10	24	2	0	2	4	314	133	7	454	482
530	0	0	0	0	2	15	16	33	4	1	4	9	304	111	6	421	463
545	0	0	0	0	2	8	9	19	4	1	1	6	283	115	5	403	428
Total Volume	0	0	0	0	5	46	38	89	14	2	8	24	1155	464	27	1646	1759
% App Total.	0.0%	0.0%	0.0%		5.6%	51.7%	42.7%		58.3%	8.3%	33.3%		70.2%	28.2%	1.6%		
PHF	0.000				0.674				0.667				0.906				

ALL TRAFFIC DATA, INC
(916)771-8700
FAX 786-2879

City of Oakland — Broadway & Keith Ave — Date: 9/9/2010
10-7309-002

	Broadway Southbound				Keith Ave Westbound				Broadway Northbound				Keith Ave Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int Total
7:00	0	89	0	89	0	0	0	0	0	70	0	70	74	0	17	91	250
7:15	0	98	0	98	0	0	0	0	0	97	0	97	95	0	22	117	312
7:30	0	105	0	105	0	0	0	0	0	125	0	125	131	0	35	166	396
7:45	0	124	0	124	0	0	0	0	0	146	0	146	182	0	48	230	500
Total	0	416	0	416	0	0	0	0	0	438	0	438	482	0	122	604	1458
8:00	0	119	0	119	0	0	0	0	0	167	0	167	225	0	36	261	547
8:15	0	144	0	144	0	0	0	0	0	222	0	222	227	0	58	285	651
8:30	0	151	0	151	0	0	0	0	0	195	0	195	168	0	41	209	555
8:45	0	133	0	133	0	0	0	0	0	131	0	131	122	0	33	155	419
Total	0	547	0	547	0	0	0	0	0	715	0	715	742	0	168	910	2172
16:00	0	97	0	97	0	0	0	0	0	197	0	197	148	0	46	194	488
16:15	0	76	0	76	0	0	0	0	0	193	0	193	209	0	70	279	548
16:30	0	88	0	88	0	0	0	0	0	232	0	232	243	0	43	286	606
16:45	0	106	0	106	0	0	0	0	0	247	0	247	224	0	51	275	628
Total	0	367	0	367	0	0	0	0	0	869	0	869	824	0	210	1034	2270
17:00	0	93	0	93	0	0	0	0	0	263	0	263	225	0	47	272	628
17:15	0	93	0	93	0	0	0	0	0	272	0	272	278	0	48	326	691
17:30	0	78	0	78	0	0	0	0	0	262	0	262	280	0	59	339	679
17:45	0	95	0	95	0	0	0	0	0	250	0	250	284	0	80	364	709
Total	0	359	0	359	0	0	0	0	0	1047	0	1047	1067	0	234	1301	2707
Grand Total	0	1689	0	1689	0	0	0	0	0	3069	0	3069	3115	0	734	3849	8607
Apprch%	0.0%	100.0%	0.0%		0.0%	0.0%	0.0%		0.0%	100.0%	0.0%		80.9%	0.0%	19.1%		
Total %	0.0%	19.6%	0.0%	19.6%	0.0%	0.0%	0.0%	0.0%	0.0%	35.7%	0.0%	35.7%	36.2%	0.0%	8.5%	44.7%	

City of Oakland — Broadway & Keith Ave — Date: 9/9/2010

AM Peak Hr Begins at: 745 AM

	Broadway Southbound				Keith Ave Westbound				Broadway Northbound				Keith Ave Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int Total
745	0	124	0	124	0	0	0	0	0	146	0	146	182	0	48	230	500
800	0	119	0	119	0	0	0	0	0	167	0	167	225	0	36	261	547
815	0	144	0	144	0	0	0	0	0	222	0	222	227	0	58	285	651
830	0	151	0	151	0	0	0	0	0	195	0	195	168	0	41	209	555
Total Volume	0	538	0	538	0	0	0	0	0	730	0	730	802	0	183	985	2253
% App Total.	0.0%	100.0%	0.0%		0.0%	0.0%	0.0%		0.0%	100.0%	0.0%		81.4%	0.0%	18.6%		
PHF	0.891				0.000				0.822				0.864				

PM Peak Hr Begins at: 500 PM

	Broadway Southbound				Keith Ave Westbound				Broadway Northbound				Keith Ave Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int Total
500	0	93	0	93	0	0	0	0	0	263	0	263	225	0	47	272	628
515	0	93	0	93	0	0	0	0	0	272	0	272	278	0	48	326	691
530	0	78	0	78	0	0	0	0	0	262	0	262	280	0	59	339	679
545	0	95	0	95	0	0	0	0	0	250	0	250	284	0	80	364	709
Total Volume	0	359	0	359	0	0	0	0	0	1047	0	1047	1067	0	234	1301	2707
% App Total.	0.0%	100.0%	0.0%		0.0%	0.0%	0.0%		0.0%	100.0%	0.0%		82.0%	0.0%	18.0%		
PHF	0.945				0.000				0.962				0.894				

Appendix B Level of Service Reports

MOVEMENT SUMMARY - BASELINE

Site: Broadway at SR24 AM

Broadway at SR24
Stop (Two-Way)

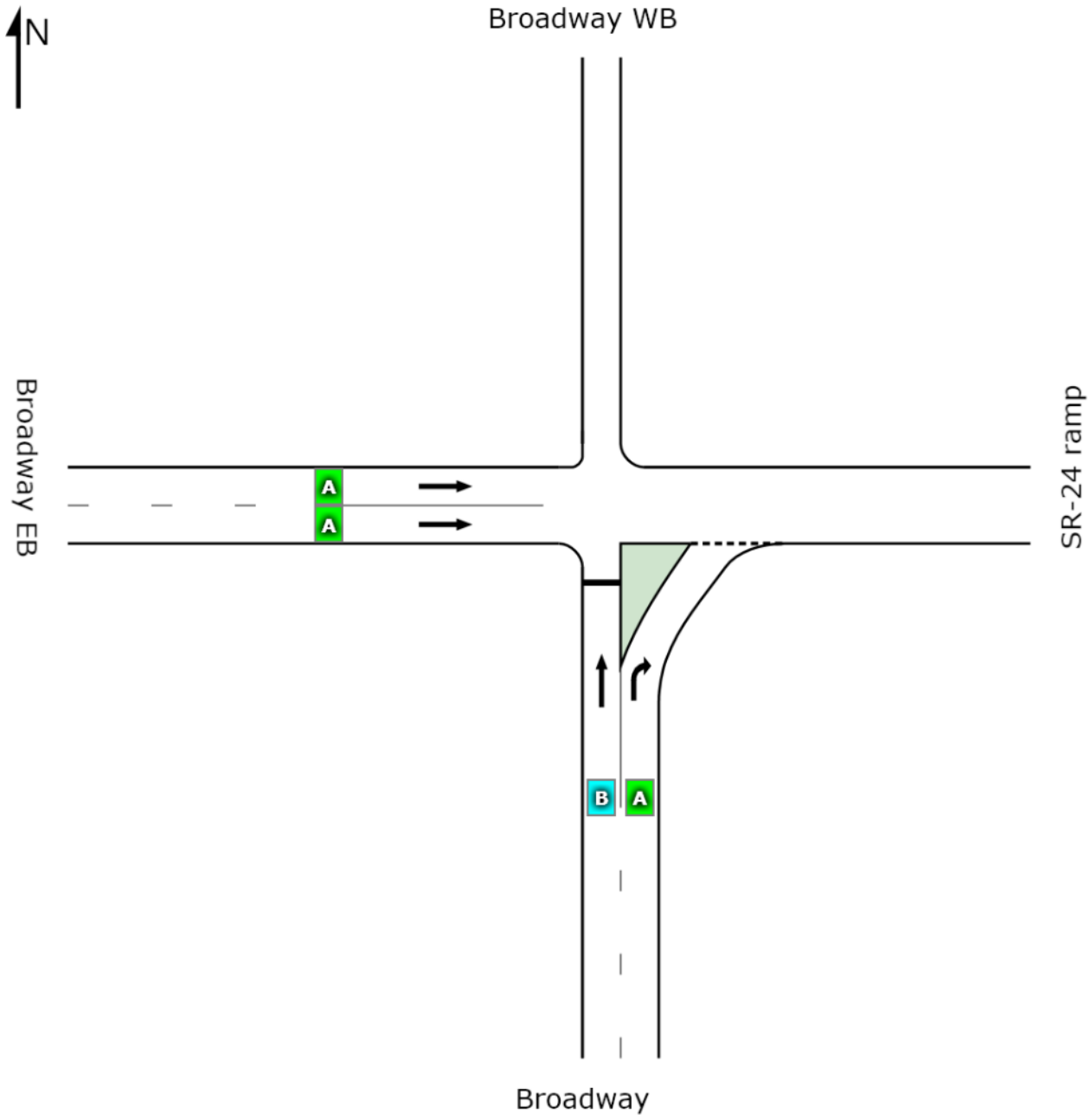
Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Broadway											
8	T	118	3.0	0.224	13.8	LOS B	0.8	21.7	0.52	0.97	23.6
18	R	54	3.0	0.092	7.2	LOS A	0.4	10.6	0.56	0.73	27.6
Approach		173	3.0	0.224	11.7	LOS B	0.8	21.7	0.53	0.90	24.7
West: Broadway EB											
2	T	374	3.0	0.169	0.0	LOS A	0.0	0.0	0.00	0.00	40.0
Approach		374	3.0	0.169	0.0	NA	0.0	0.0	0.00	0.00	40.0
All Vehicles		547	3.0	0.224	3.7	NA	0.8	21.7	0.17	0.28	33.5

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
HCM Delay Model used. Geometric Delay not included.

LEVEL OF SERVICE SUMMARY - BASELINE

Broadway at SR24
Stop (Two-Way)



	South	East	North	West	Intersection
LOS	B	NA	NA	NA	NA

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
HCM Delay Model used. Geometric Delay not included.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	507	19	2	0	128	0	0	0	0	31	25
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.76	0.76	0.76	1.00	1.00	1.00	0.67	0.67	0.67
Hourly flow rate (vph)	0	563	21	3	0	168	0	0	0	0	46	37
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	168			584			724	674	84	663	748	574
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	168			584			724	674	84	663	748	574
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	86	93
cM capacity (veh/h)	1409			990			283	375	975	374	340	518

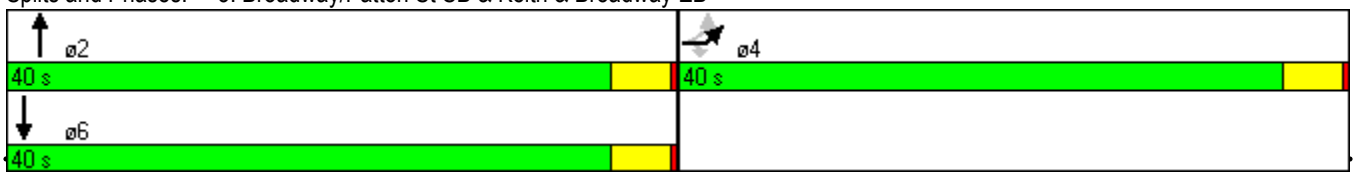
Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	584	171	84
Volume Left	0	3	0
Volume Right	21	168	37
cSH	1700	990	402
Volume to Capacity	0.34	0.00	0.21
Queue Length 95th (ft)	0	0	19
Control Delay (s)	0.0	0.2	16.3
Lane LOS		A	C
Approach Delay (s)	0.0	0.2	16.3
Approach LOS			C

Intersection Summary				
Average Delay	1.7			
Intersection Capacity Utilization	37.8%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	EBL2	EBL	EBR	NBL	NBT	NBR	SBL	SBT	SBR	SWL	SWR
Lane Configurations											
Volume (vph)	795	0	183	0	720	0	0	533	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.97	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00
Frt			0.850								
Flt Protected		0.950									
Satd. Flow (prot)	0	3433	1583	0	3539	0	0	3539	0	0	0
Flt Permitted		0.950									
Satd. Flow (perm)	0	3433	1583	0	3539	0	0	3539	0	0	0
Right Turn on Red			Yes			Yes			Yes		
Satd. Flow (RTOR)			199								
Link Speed (mph)		30			30			30		30	
Link Distance (ft)		524			392			115		203	
Travel Time (s)		11.9			8.9			2.6		4.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)											
Lane Group Flow (vph)	0	864	199	0	783	0	0	579	0	0	0
Turn Type	Perm	NA	Perm		NA			NA			
Protected Phases		4			2			6			
Permitted Phases	4		4								
Total Split (s)	40.0	40.0	40.0		40.0			40.0			
Total Lost Time (s)		4.0	4.0		4.0			4.0			
Act Effct Green (s)		36.0	36.0		36.0			36.0			
Actuated g/C Ratio		0.45	0.45		0.45			0.45			
v/c Ratio		1.08dl	0.24		0.49			0.36			
Control Delay		17.9	2.9		16.9			15.3			
Queue Delay		0.0	0.0		0.0			0.0			
Total Delay		17.9	2.9		16.9			15.3			
LOS		B	A		B			B			
Approach Delay		15.1			16.9			15.3			
Approach LOS		B			B			B			

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green			
Control Type: Pretimed			
Maximum v/c Ratio: 0.56			
Intersection Signal Delay: 15.7		Intersection LOS: B	
Intersection Capacity Utilization 69.8%		ICU Level of Service C	
Analysis Period (min) 15			
dl Defacto Left Lane. Recode with 1 though lane as a left lane.			

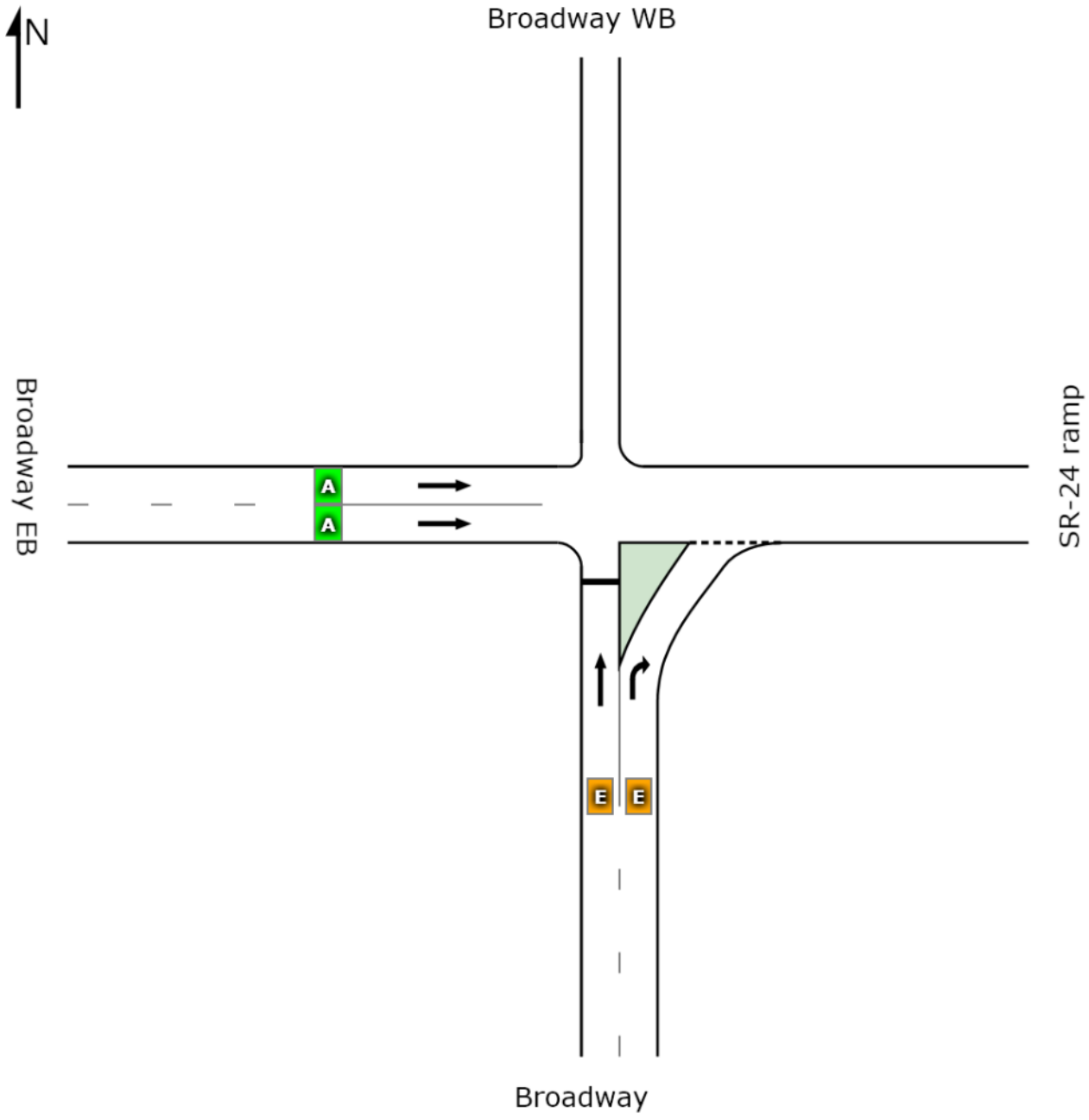
Splits and Phases: 3: Broadway/Patton St SB & Keith & Broadway EB



LEVEL OF SERVICE SUMMARY - BASELINE

Site: Broadway at SR24 PM

Broadway at SR24
Stop (Two-Way)



	South	East	North	West	Intersection
LOS	E	NA	NA	NA	NA

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
HCM Delay Model used. Geometric Delay not included.

MOVEMENT SUMMARY - BASELINE

Site: Broadway at SR24 PM

Broadway at SR24
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Broadway											
8	T	65	3.0	0.431	45.8	LOS E	1.5	39.7	0.89	1.06	15.2
18	R	43	3.0	0.304	37.4	LOS E	1.2	30.1	0.90	1.00	17.2
Approach		109	3.0	0.431	42.4	LOS E	1.5	39.7	0.90	1.04	16.0
West: Broadway EB											
2	T	1255	3.0	0.567	0.0	LOS A	0.0	0.0	0.00	0.00	40.0
Approach		1255	3.0	0.567	0.0	NA	0.0	0.0	0.00	0.00	40.0
All Vehicles		1364	3.0	0.567	3.4	NA	1.5	39.7	0.07	0.08	35.7

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
HCM Delay Model used. Geometric Delay not included.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	457	27	5	0	84	0	0	0	0	16	8
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.76	0.76	0.76	1.00	1.00	1.00	0.67	0.67	0.67
Hourly flow rate (vph)	0	508	30	7	0	111	0	0	0	0	24	12
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	111			538			615	606	55	591	646	523
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	111			538			615	606	55	591	646	523
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			100	100	100	100	94	98
cM capacity (veh/h)	1479			1030			374	409	1012	416	388	554

Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	538	117	36
Volume Left	0	7	0
Volume Right	30	111	12
cSH	1700	1030	431
Volume to Capacity	0.32	0.01	0.08
Queue Length 95th (ft)	0	0	7
Control Delay (s)	0.0	0.5	14.1
Lane LOS		A	B
Approach Delay (s)	0.0	0.5	14.1
Approach LOS			B

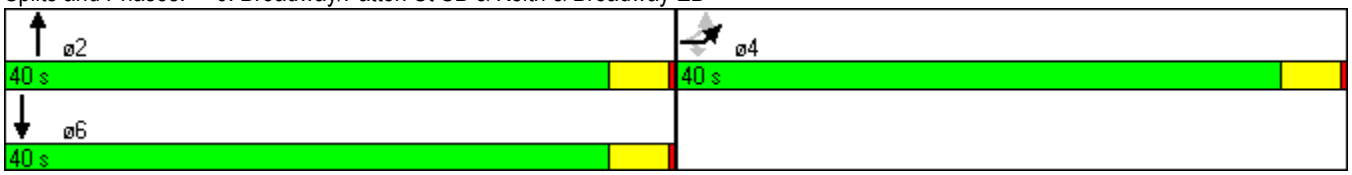
Intersection Summary				
Average Delay	0.8			
Intersection Capacity Utilization	35.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	EBL2	EBL	EBR	NBL	NBT	NBR	SBL	SBT	SBR	SWL	SWR
Lane Configurations											
Volume (vph)	1065	0	234	0	1044	0	0	356	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	3433	1583	0	3539	0	0	3539	0	0	0
Flt Permitted		0.950									
Satd. Flow (perm)	0	3433	1583	0	3539	0	0	3539	0	0	0
Right Turn on Red			Yes			Yes			Yes		
Satd. Flow (RTOR)			254								
Link Speed (mph)		30			30			30		30	
Link Distance (ft)		524			392			115		203	
Travel Time (s)		11.9			8.9			2.6		4.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)											
Lane Group Flow (vph)	0	1158	254	0	1135	0	0	387	0	0	0
Turn Type	Perm	NA	Perm		NA			NA			
Protected Phases		4			2			6			
Permitted Phases	4		4								
Total Split (s)	40.0	40.0	40.0		40.0			40.0			
Total Lost Time (s)		4.0	4.0		4.0			4.0			
Act Effct Green (s)		36.0	36.0		36.0			36.0			
Actuated g/C Ratio		0.45	0.45		0.45			0.45			
v/c Ratio		1.45dl	0.30		0.71			0.24			
Control Delay		22.1	2.9		20.9			14.1			
Queue Delay		0.0	0.0		0.0			0.0			
Total Delay		22.1	2.9		20.9			14.1			
LOS		C	A		C			B			
Approach Delay		18.6			20.9			14.1			
Approach LOS		B			C			B			

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green			
Control Type: Pretimed			
Maximum v/c Ratio: 0.75			
Intersection Signal Delay: 18.9		Intersection LOS: B	
Intersection Capacity Utilization 79.8%		ICU Level of Service D	
Analysis Period (min) 15			

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

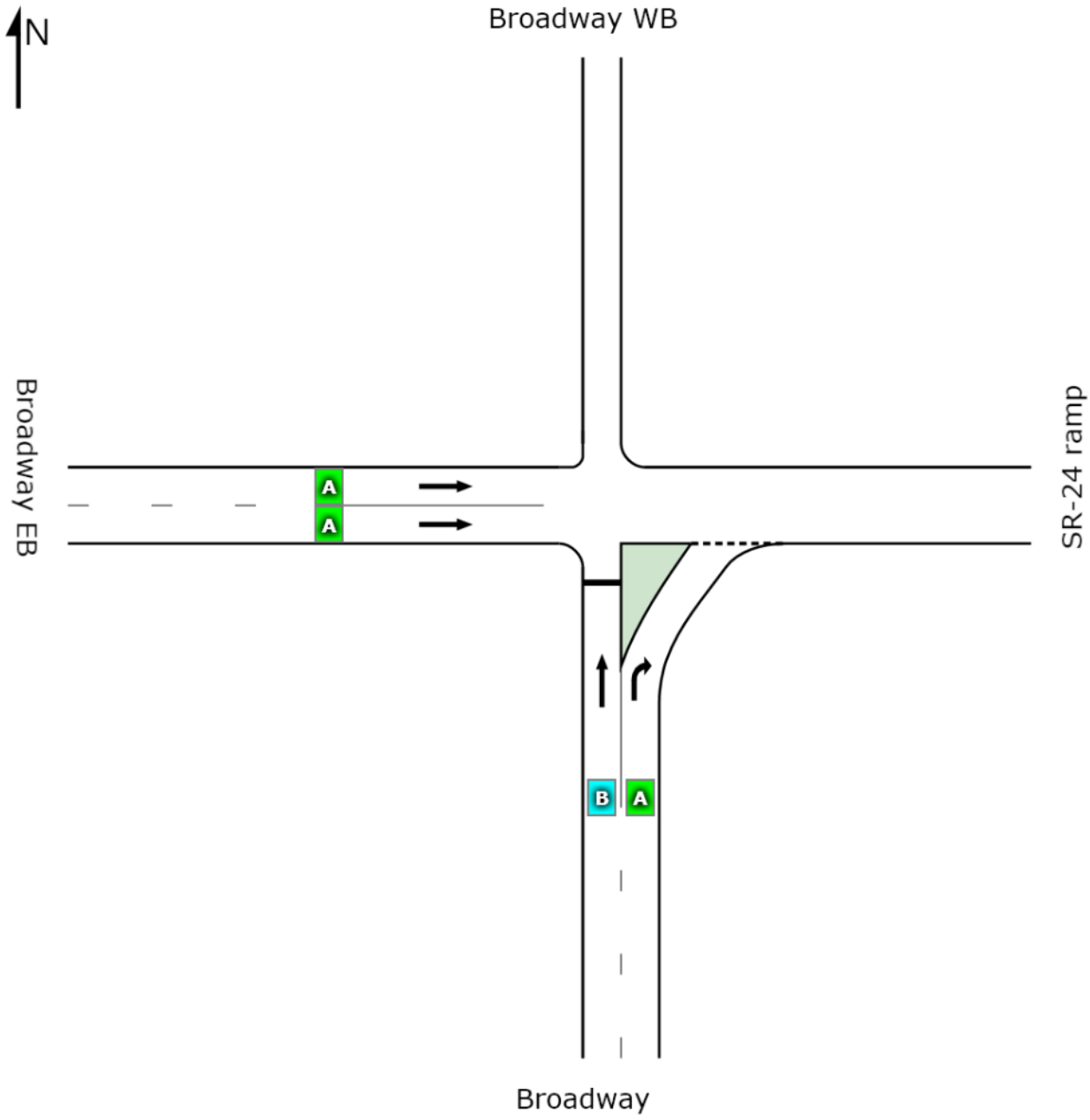
Splits and Phases: 6: Broadway/Patton St SB & Keith & Broadway EB



LEVEL OF SERVICE SUMMARY - EXISTING

Site: Broadway at SR24 AM

Broadway at SR24
Stop (Two-Way)



	South	East	North	West	Intersection
LOS	B	NA	NA	NA	NA

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
HCM Delay Model used. Geometric Delay not included.

MOVEMENT SUMMARY - EXISTING

Site: Broadway at SR24 AM

Broadway at SR24
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Broadway											
8	T	118	3.0	0.224	13.8	LOS B	0.8	21.7	0.52	0.97	23.6
18	R	54	3.0	0.092	7.2	LOS A	0.4	10.6	0.56	0.73	27.6
Approach		173	3.0	0.224	11.7	LOS B	0.8	21.7	0.53	0.90	24.7
West: Broadway EB											
2	T	374	3.0	0.169	0.0	LOS A	0.0	0.0	0.00	0.00	40.0
Approach		374	3.0	0.169	0.0	NA	0.0	0.0	0.00	0.00	40.0
All Vehicles		547	3.0	0.224	3.7	NA	0.8	21.7	0.17	0.28	33.5

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
HCM Delay Model used. Geometric Delay not included.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	530	19	2	0	128	0	0	0	0	31	25
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.76	0.76	0.76	1.00	1.00	1.00	0.67	0.67	0.67
Hourly flow rate (vph)	0	589	21	3	0	168	0	0	0	0	46	37
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	168			610			749	699	84	689	773	599
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	168			610			749	699	84	689	773	599
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	86	93
cM capacity (veh/h)	1409			969			270	363	975	359	329	501

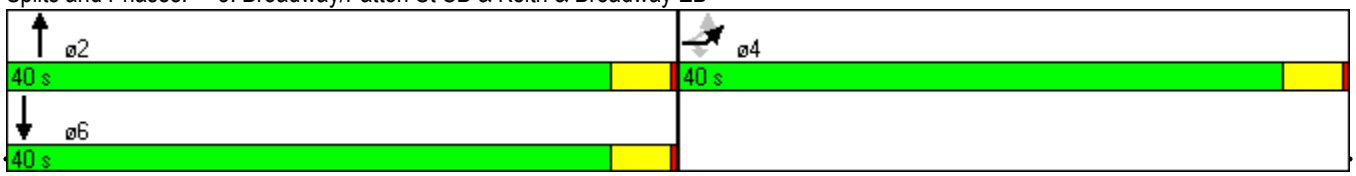
Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	610	171	84
Volume Left	0	3	0
Volume Right	21	168	37
cSH	1700	969	389
Volume to Capacity	0.36	0.00	0.22
Queue Length 95th (ft)	0	0	20
Control Delay (s)	0.0	0.2	16.8
Lane LOS		A	C
Approach Delay (s)	0.0	0.2	16.8
Approach LOS			C

Intersection Summary				
Average Delay	1.7			
Intersection Capacity Utilization	39.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	EBL2	EBL	EBR	NBL	NBT	NBR	SBL	SBT	SBR	SWL	SWR
Lane Configurations											
Volume (vph)	802	0	183	0	730	0	0	538	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.97	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00
Frt			0.850								
Flt Protected		0.950									
Satd. Flow (prot)	0	3433	1583	0	3539	0	0	3539	0	0	0
Flt Permitted		0.950									
Satd. Flow (perm)	0	3433	1583	0	3539	0	0	3539	0	0	0
Right Turn on Red			Yes			Yes			Yes		
Satd. Flow (RTOR)			199								
Link Speed (mph)		30			30			30		30	
Link Distance (ft)		524			392			115		203	
Travel Time (s)		11.9			8.9			2.6		4.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)											
Lane Group Flow (vph)	0	872	199	0	793	0	0	585	0	0	0
Turn Type	Perm	NA	Perm		NA			NA			
Protected Phases		4			2			6			
Permitted Phases	4		4								
Total Split (s)	40.0	40.0	40.0		40.0			40.0			
Total Lost Time (s)		4.0	4.0		4.0			4.0			
Act Effct Green (s)		36.0	36.0		36.0			36.0			
Actuated g/C Ratio		0.45	0.45		0.45			0.45			
v/c Ratio		1.09dl	0.24		0.50			0.37			
Control Delay		18.0	2.9		17.0			15.3			
Queue Delay		0.0	0.0		0.0			0.0			
Total Delay		18.0	2.9		17.0			15.3			
LOS		B	A		B			B			
Approach Delay		15.2			17.0			15.3			
Approach LOS		B			B			B			

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green			
Control Type: Pretimed			
Maximum v/c Ratio: 0.56			
Intersection Signal Delay: 15.8		Intersection LOS: B	
Intersection Capacity Utilization 70.2%		ICU Level of Service C	
Analysis Period (min) 15			
dl Defacto Left Lane. Recode with 1 though lane as a left lane.			

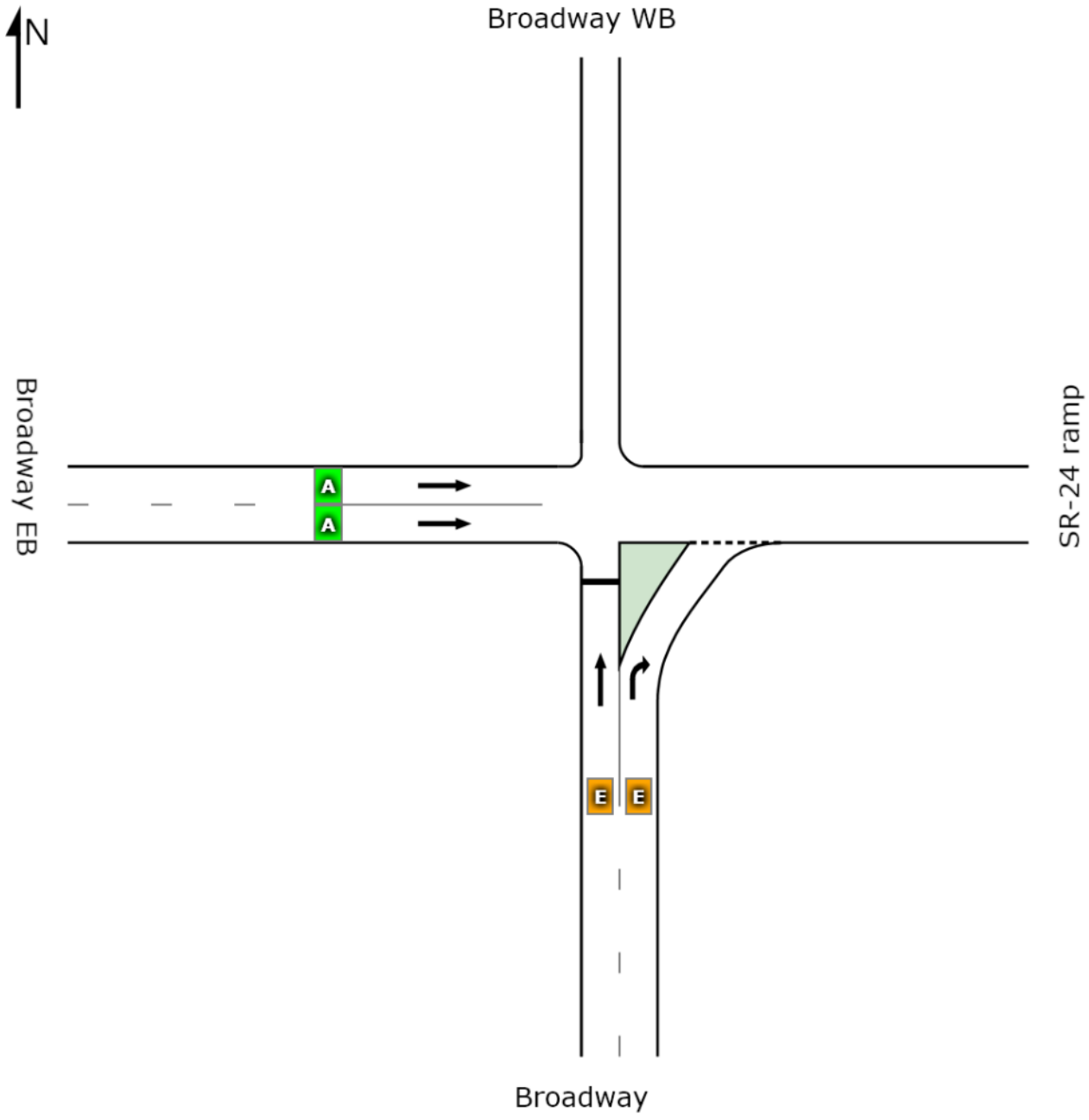
Splits and Phases: 3: Broadway/Patton St SB & Keith & Broadway EB



LEVEL OF SERVICE SUMMARY

Site: Broadway at SR24 Existing PM

Broadway at SR24
Stop (Two-Way)



	South	East	North	West	Intersection
LOS	E	NA	NA	NA	NA

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
HCM Delay Model used. Geometric Delay not included.

MOVEMENT SUMMARY - EXISTING

Broadway at SR24
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Broadway											
8	T	65	3.0	0.431	45.8	LOS E	1.5	39.7	0.89	1.06	15.2
18	R	43	3.0	0.304	37.4	LOS E	1.2	30.1	0.90	1.00	17.2
Approach		109	3.0	0.431	42.4	LOS E	1.5	39.7	0.90	1.04	16.0
West: Broadway EB											
2	T	1255	3.0	0.567	0.0	LOS A	0.0	0.0	0.00	0.00	40.0
Approach		1255	3.0	0.567	0.0	NA	0.0	0.0	0.00	0.00	40.0
All Vehicles		1364	3.0	0.567	3.4	NA	1.5	39.7	0.07	0.08	35.7

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
HCM Delay Model used. Geometric Delay not included.

SIDRA INTERSECTION

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	464	27	5	0	84	0	0	0	0	16	8
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.76	0.76	0.76	1.00	1.00	1.00	0.67	0.67	0.67
Hourly flow rate (vph)	0	516	30	7	0	111	0	0	0	0	24	12
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	111			546			623	614	55	599	654	531
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	111			546			623	614	55	599	654	531
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			100	100	100	100	94	98
cM capacity (veh/h)	1479			1024			370	404	1012	411	384	549

Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	546	117	36
Volume Left	0	7	0
Volume Right	30	111	12
cSH	1700	1024	426
Volume to Capacity	0.32	0.01	0.08
Queue Length 95th (ft)	0	0	7
Control Delay (s)	0.0	0.5	14.2
Lane LOS		A	B
Approach Delay (s)	0.0	0.5	14.2
Approach LOS			B

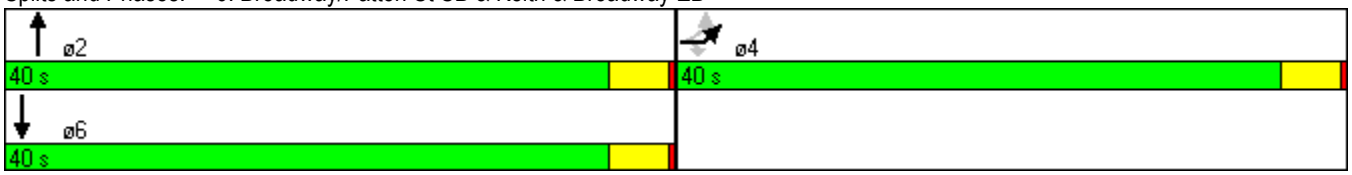
Intersection Summary				
Average Delay	0.8			
Intersection Capacity Utilization	36.1%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	EBL2	EBL	EBR	NBL	NBT	NBR	SBL	SBT	SBR	SWL	SWR
Lane Configurations											
Volume (vph)	1067	0	234	0	1047	0	0	359	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	3433	1583	0	3539	0	0	3539	0	0	0
Flt Permitted		0.950									
Satd. Flow (perm)	0	3433	1583	0	3539	0	0	3539	0	0	0
Right Turn on Red			Yes			Yes			Yes		
Satd. Flow (RTOR)			254								
Link Speed (mph)		30			30			30		30	
Link Distance (ft)		524			392			115		203	
Travel Time (s)		11.9			8.9			2.6		4.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)											
Lane Group Flow (vph)	0	1160	254	0	1138	0	0	390	0	0	0
Turn Type	Perm	NA	Perm		NA			NA			
Protected Phases		4			2			6			
Permitted Phases	4		4								
Total Split (s)	40.0	40.0	40.0		40.0			40.0			
Total Lost Time (s)		4.0	4.0		4.0			4.0			
Act Effct Green (s)		36.0	36.0		36.0			36.0			
Actuated g/C Ratio		0.45	0.45		0.45			0.45			
v/c Ratio		1.46dl	0.30		0.71			0.24			
Control Delay		22.1	2.9		21.0			14.1			
Queue Delay		0.0	0.0		0.0			0.0			
Total Delay		22.1	2.9		21.0			14.1			
LOS		C	A		C			B			
Approach Delay		18.6			21.0			14.1			
Approach LOS		B			C			B			

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green			
Control Type: Pretimed			
Maximum v/c Ratio: 0.75			
Intersection Signal Delay: 18.9		Intersection LOS: B	
Intersection Capacity Utilization 80.0%		ICU Level of Service D	
Analysis Period (min) 15			

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

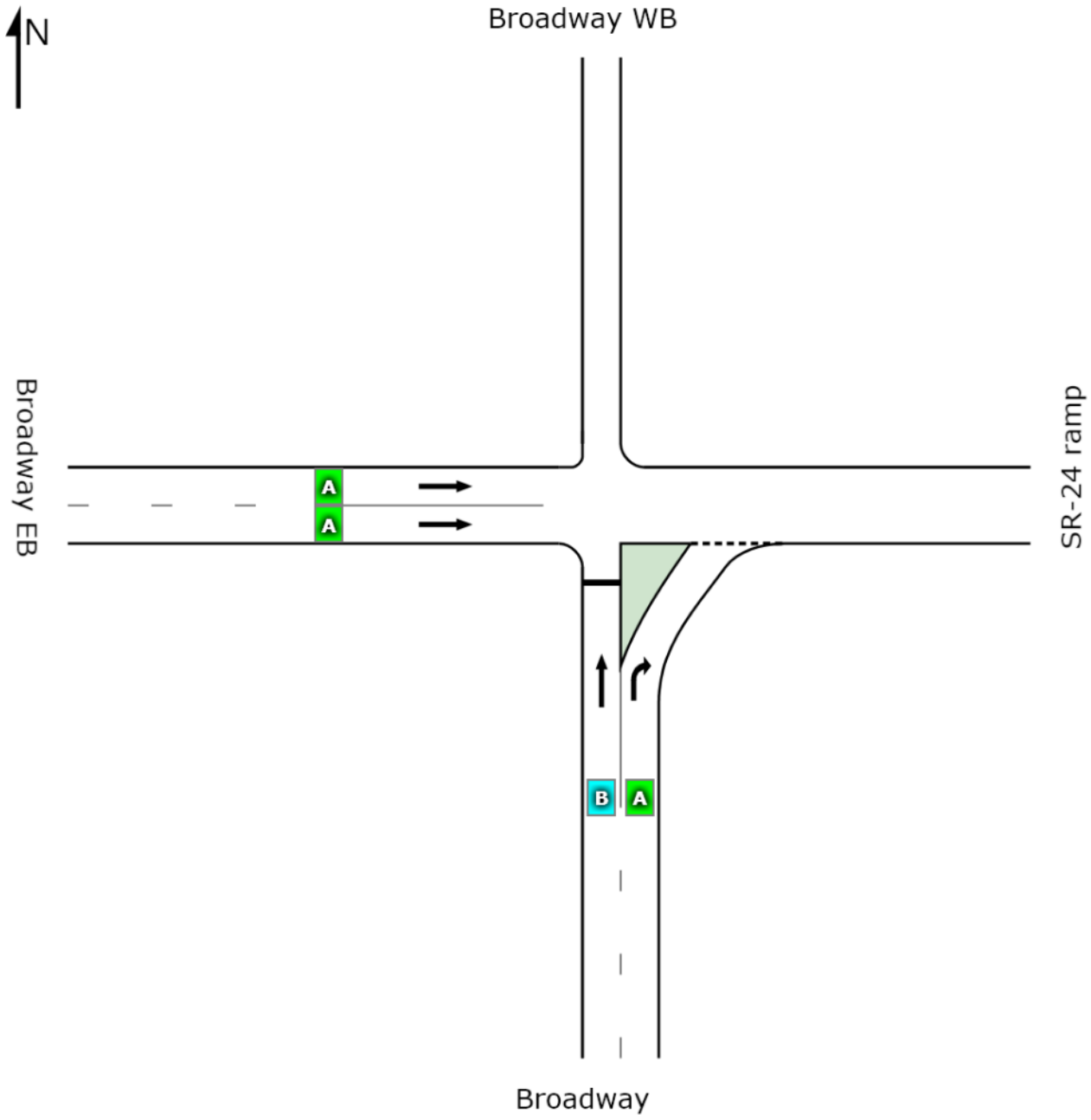
Splits and Phases: 6: Broadway/Patton St SB & Keith & Broadway EB



LEVEL OF SERVICE SUMMARY - PLUS PROJECT

Site: Broadway at SR24 AM

Broadway at SR24
Stop (Two-Way)



	South	East	North	West	Intersection
LOS	B	NA	NA	NA	NA

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
HCM Delay Model used. Geometric Delay not included.

MOVEMENT SUMMARY - PLUS PROJECT

Site: Broadway at SR24 AM

Broadway at SR24
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Broadway											
8	T	118	3.0	0.224	13.8	LOS B	0.8	21.7	0.52	0.97	23.6
18	R	54	3.0	0.092	7.2	LOS A	0.4	10.6	0.56	0.73	27.6
Approach		173	3.0	0.224	11.7	LOS B	0.8	21.7	0.53	0.90	24.7
West: Broadway EB											
2	T	374	3.0	0.169	0.0	LOS A	0.0	0.0	0.00	0.00	40.0
Approach		374	3.0	0.169	0.0	NA	0.0	0.0	0.00	0.00	40.0
All Vehicles		547	3.0	0.224	3.7	NA	0.8	21.7	0.17	0.28	33.5

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
HCM Delay Model used. Geometric Delay not included.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	530	19	2	0	128	0	0	0	0	31	25
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.76	0.76	0.76	1.00	1.00	1.00	0.67	0.67	0.67
Hourly flow rate (vph)	0	589	21	3	0	168	0	0	0	0	46	37
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	168			610			749	699	84	689	773	599
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	168			610			749	699	84	689	773	599
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	86	93
cM capacity (veh/h)	1409			969			270	363	975	359	329	501

Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	610	171	84
Volume Left	0	3	0
Volume Right	21	168	37
cSH	1700	969	389
Volume to Capacity	0.36	0.00	0.22
Queue Length 95th (ft)	0	0	20
Control Delay (s)	0.0	0.2	16.8
Lane LOS		A	C
Approach Delay (s)	0.0	0.2	16.8
Approach LOS			C

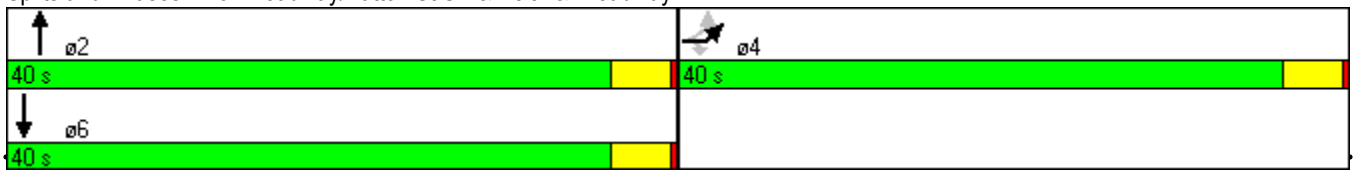
Intersection Summary				
Average Delay	1.7			
Intersection Capacity Utilization	39.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	EBL2	EBL	EBR	NBL	NBT	NBR	SBL	SBT	SBR	SWL	SWR
Lane Configurations											
Volume (vph)	802	0	183	0	730	0	0	538	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.97	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00
Frt			0.850								
Flt Protected		0.950									
Satd. Flow (prot)	0	3433	1583	0	3539	0	0	3539	0	0	0
Flt Permitted		0.950									
Satd. Flow (perm)	0	3433	1583	0	3539	0	0	3539	0	0	0
Right Turn on Red			Yes			Yes			Yes		
Satd. Flow (RTOR)			199								
Link Speed (mph)		30			30			30		30	
Link Distance (ft)		524			392			115		203	
Travel Time (s)		11.9			8.9			2.6		4.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)											
Lane Group Flow (vph)	0	872	199	0	793	0	0	585	0	0	0
Turn Type	Perm	NA	Perm		NA			NA			
Protected Phases		4			2			6			
Permitted Phases	4		4								
Total Split (s)	40.0	40.0	40.0		40.0			40.0			
Total Lost Time (s)		4.0	4.0		4.0			4.0			
Act Effct Green (s)		36.0	36.0		36.0			36.0			
Actuated g/C Ratio		0.45	0.45		0.45			0.45			
v/c Ratio		1.09dl	0.24		0.50			0.37			
Control Delay		18.0	2.9		17.0			15.3			
Queue Delay		0.0	0.0		0.0			0.0			
Total Delay		18.0	2.9		17.0			15.3			
LOS		B	A		B			B			
Approach Delay		15.2			17.0			15.3			
Approach LOS		B			B			B			

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 0.56
Intersection Signal Delay: 15.8 Intersection LOS: B
Intersection Capacity Utilization 70.2% ICU Level of Service C
Analysis Period (min) 15
dl Defacto Left Lane. Recode with 1 though lane as a left lane.

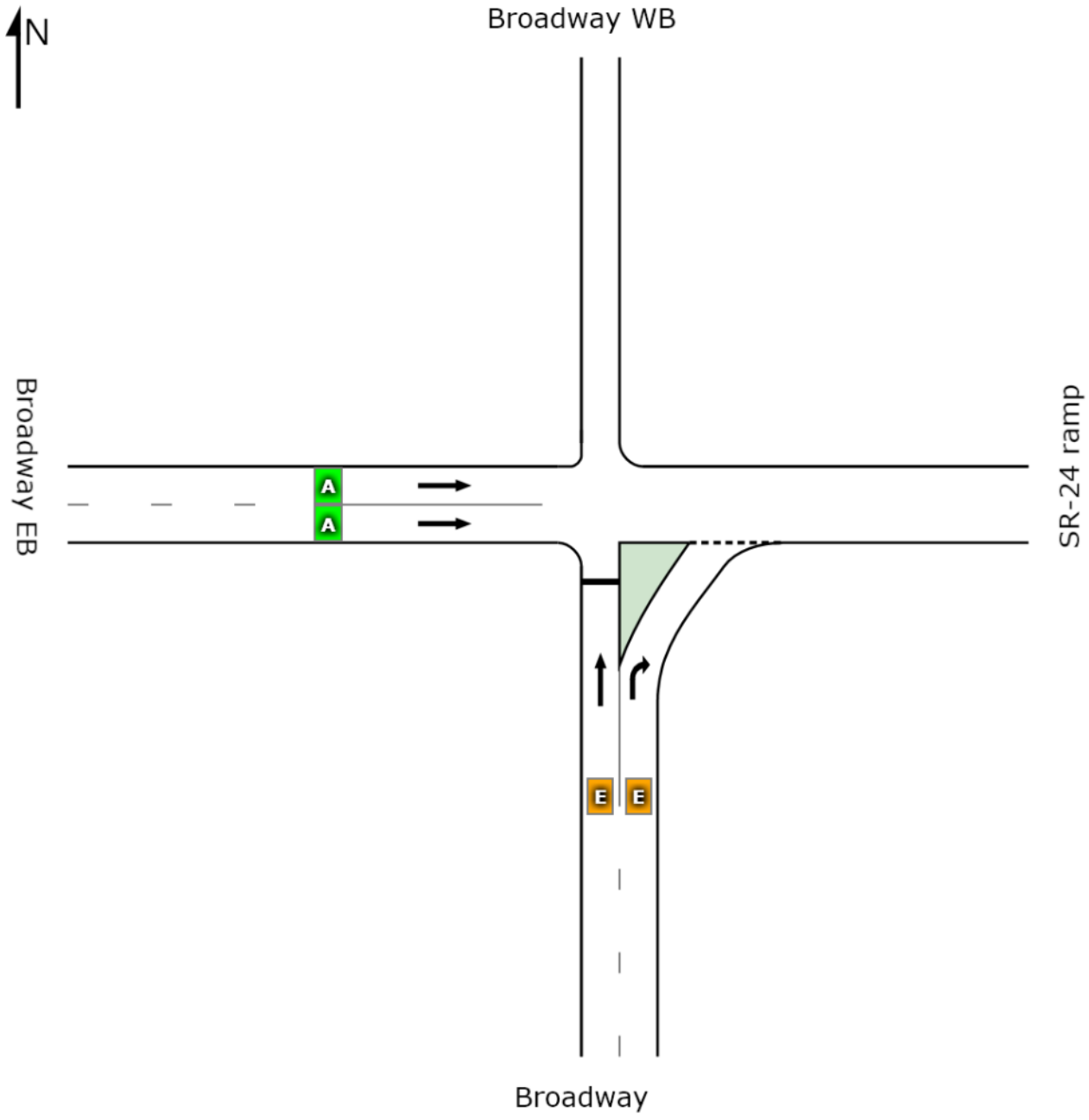
Splits and Phases: 3: Broadway/Patton St SB & Keith & Broadway EB



LEVEL OF SERVICE SUMMARY - PLUS PROJECT

Site: Broadway at SR24 PM

Broadway at SR24
Stop (Two-Way)



	South	East	North	West	Intersection
LOS	E	NA	NA	NA	NA

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
HCM Delay Model used. Geometric Delay not included.

MOVEMENT SUMMARY - PLUS PROJECT

Site: Broadway at SR24 PM

Broadway at SR24
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Broadway											
8	T	65	3.0	0.431	45.8	LOS E	1.5	39.7	0.89	1.06	15.2
18	R	43	3.0	0.304	37.4	LOS E	1.2	30.1	0.90	1.00	17.2
Approach		109	3.0	0.431	42.4	LOS E	1.5	39.7	0.90	1.04	16.0
West: Broadway EB											
2	T	1255	3.0	0.567	0.0	LOS A	0.0	0.0	0.00	0.00	40.0
Approach		1255	3.0	0.567	0.0	NA	0.0	0.0	0.00	0.00	40.0
All Vehicles		1364	3.0	0.567	3.4	NA	1.5	39.7	0.07	0.08	35.7

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
HCM Delay Model used. Geometric Delay not included.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	464	27	5	0	84	0	0	0	0	16	8
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.76	0.76	0.76	1.00	1.00	1.00	0.67	0.67	0.67
Hourly flow rate (vph)	0	516	30	7	0	111	0	0	0	0	24	12
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	111			546			623	614	55	599	654	531
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	111			546			623	614	55	599	654	531
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			100	100	100	100	94	98
cM capacity (veh/h)	1479			1024			370	404	1012	411	384	549

Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	546	117	36
Volume Left	0	7	0
Volume Right	30	111	12
cSH	1700	1024	426
Volume to Capacity	0.32	0.01	0.08
Queue Length 95th (ft)	0	0	7
Control Delay (s)	0.0	0.5	14.2
Lane LOS		A	B
Approach Delay (s)	0.0	0.5	14.2
Approach LOS			B

Intersection Summary				
Average Delay	0.8			
Intersection Capacity Utilization	36.1%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	EBL2	EBL	EBR	NBL	NBT	NBR	SBL	SBT	SBR	SWL	SWR
Lane Configurations											
Volume (vph)	1067	0	234	0	1047	0	0	359	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	3433	1583	0	3539	0	0	3539	0	0	0
Flt Permitted		0.950									
Satd. Flow (perm)	0	3433	1583	0	3539	0	0	3539	0	0	0
Right Turn on Red			Yes			Yes			Yes		
Satd. Flow (RTOR)			254								
Link Speed (mph)		30			30			30		30	
Link Distance (ft)		524			392			115		203	
Travel Time (s)		11.9			8.9			2.6		4.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)											
Lane Group Flow (vph)	0	1160	254	0	1138	0	0	390	0	0	0
Turn Type	Perm	NA	Perm		NA			NA			
Protected Phases		4			2			6			
Permitted Phases	4		4								
Total Split (s)	40.0	40.0	40.0		40.0			40.0			
Total Lost Time (s)		4.0	4.0		4.0			4.0			
Act Effct Green (s)		36.0	36.0		36.0			36.0			
Actuated g/C Ratio		0.45	0.45		0.45			0.45			
v/c Ratio		1.46dl	0.30		0.71			0.24			
Control Delay		22.1	2.9		21.0			14.1			
Queue Delay		0.0	0.0		0.0			0.0			
Total Delay		22.1	2.9		21.0			14.1			
LOS		C	A		C			B			
Approach Delay		18.6			21.0			14.1			
Approach LOS		B			C			B			

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green			
Control Type: Pretimed			
Maximum v/c Ratio: 0.75			
Intersection Signal Delay: 18.9		Intersection LOS: B	
Intersection Capacity Utilization 80.0%		ICU Level of Service D	
Analysis Period (min) 15			

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

Splits and Phases: 6: Broadway/Patton St SB & Keith & Broadway EB