MACARTHUR BART STATION
SAFE ROUTES TO TRANSIT
BICYCLE FACILITY FEASIBILITY STUDY

Final Report

Prepared For:

City of Oakland

Transportation Services Division

DMJM HARRIS | AECOM

June 20, 2008

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Transportation Services Division

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Submitted to:

City of Oakland
Transportation Services Division
250 Frank H. Ogawa Plaza, Suite 4314
Oakland, CA 94612

Prepared By:

DMJM HARRIS | AECOM
155 Grand Avenue, Suite 700
Oakland, CA 94612

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1.0 EXECUTIVE SUMMARY

This study has been performed to identify the optimal means for providing bicycle access to the MacArthur BART Station in the 40th Street / MacArthur corridor within Oakland, California. The optimal bicycle access plan would accommodate bicycle, pedestrian, and vehicle operations, while maintaining quality Alameda-Contra Costa Transit District (AC Transit) and Emeryville Transportation Management Association (Emery-Go-Round) service. The following transportation topics are addressed:

- Identification of Project Alternatives;
- Data Collection;
- Feasibility Analyses; and,
- Preliminary Conceptual Designs.

1.1 INTRODUCTION

The City of Oakland's and the City of Emeryville's current *Bicycle Master Plans* (BMP) recommend the installation of bicycle lanes on 40th Street, a four-lane arterial adjacent to the MacArthur Bay Area Rapid Transit (BART) Station. In Emeryville, bicycle lanes currently exist on 40th Street to the west of San Pablo Avenue. In Oakland, 40th Street is shared by vehicles, bicycles, and AC Transit and Emery-Go-Round buses, and has a landscaped center median, left-turn pockets, and mixed-use frontage.

The recently completed *40th Street Bikeway Feasibility Study* (2006) reviewed conditions in the 40th Street corridor within the City of Oakland. This study is herein referred to as the "40th Street Bikeway Study".[(1)] The *40th Street Bikeway Study* evaluated intersection operations to assess the potential impacts of the project on vehicular traffic. This study indicated that 40th Street would operate at an acceptable Level of Service (LOS) in current and future year (2025) scenarios with the removal of one travel lane in each direction to accommodate bicycle lanes, between Adeline Street and Piedmont Avenue.

Subsequent to the preparation of the 40th Street Bikeway Study, concerns were raised that additional review was warranted to evaluate other alternatives and the effects of the project on transit operations. The project stakeholders agreed that further study was needed to analyze:

a. The effects on transit of a lane reduction on 40th Street;
b. Alternative bicycle facility designs for 40th Street; and,
c. Alternative bicycle facility alignments on West MacArthur Boulevard and / or 41st Street / 42nd Street.

[(1)] *40th Street Bikeway Feasibility Study*, Korve Engineering, August 10, 2006.

Based on an evaluation of these alternatives, the plan would identify a recommended bicycle facility in the 40th Street corridor that provides high-quality bicycle access to the MacArthur BART Station without adversely affecting transit operations. The bicycle facility recommendations and the policy implications of this plan would be incorporated into the update of the City of Oakland's BMP.

Several development and improvement proposals have been approved, or are under consideration, within the proposed project study area. These developments and improvements include the:

- East Bay Bus Rapid Transit Project;
- MacArthur BART Station Transit Village;
- MacArthur BART Station Transit Hub Streetscape Improvement Project;
- Telegraph Avenue Pedestrian Streetscape Improvement Project; and,
- Kaiser Hospital Seismic Retrofit and Expansion Project.

The study area and planned development and improvements are shown in **Figure 1**.

A Technical Advisory Committee (TAC) was formed to provide input on the plan and develop consensus among key stakeholders to define a implementable bicycle access project. The TAC included representatives of the City of Oakland, AC Transit, Emery-Go-Round, City of Emeryville, BART, and Kaiser Hospital. The TAC provided input to guide the analyses and reach equitable conclusions for each task.

The project alternatives were evaluated utilizing multiple analysis methodologies and tools. Each of the analysis procedures was developed to evaluate particular components of the transportation network. The three evaluation methodologies included:

- Intersection Operations Analysis;
- Network Microsimulation; and,
- Bicycle Compatibility Index.

1.2 2007 EXISTING CONDITIONS

The City of Oakland BMP categorizes existing and proposed bicycle facilities into four primary groups per Caltrans' *Highway Design Manual* (HDM) standards: bicycle path (class 1), bicycle lane (class 2), arterial bicycle route (class 3A) and bicycle boulevard (class 3B). Arterial bicycle routes and bicycle boulevards are both shared roadway facilities. The distinction between the two types of facilities is that bicycle boulevards are optimized for bicycle traffic and arterial bicycle routes are not. That is, bicycle boulevards are typically designed to have low vehicle traffic volumes, traffic calming devices, and low vehicle speeds. Within the vicinity of the study area, a distinction between existing bicycle boulevards and existing arterial bicycle routes is not always defined. Where undefined, class 3A and class 3B facilities are more generally considered bicycle routes (class 3). The existing bicycle facilities within the project's area of influence are included in **Figure 2**.

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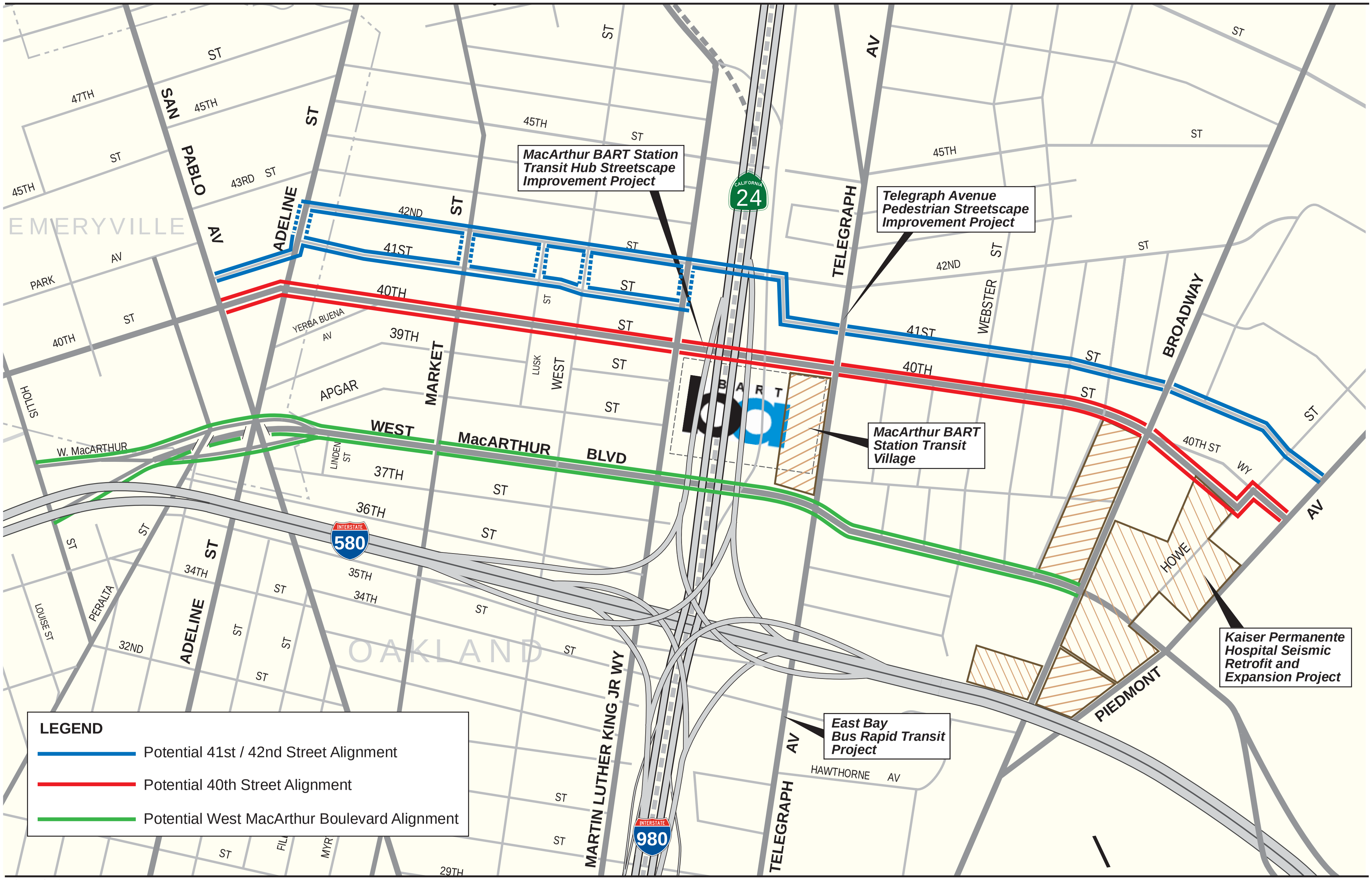

Project Location.ai

MacARTHUR BART STATION BICYCLE FEASIBILITY STUDY

Figure 1

PROJECT LOCATION AND PLANNED DEVELOPMENT

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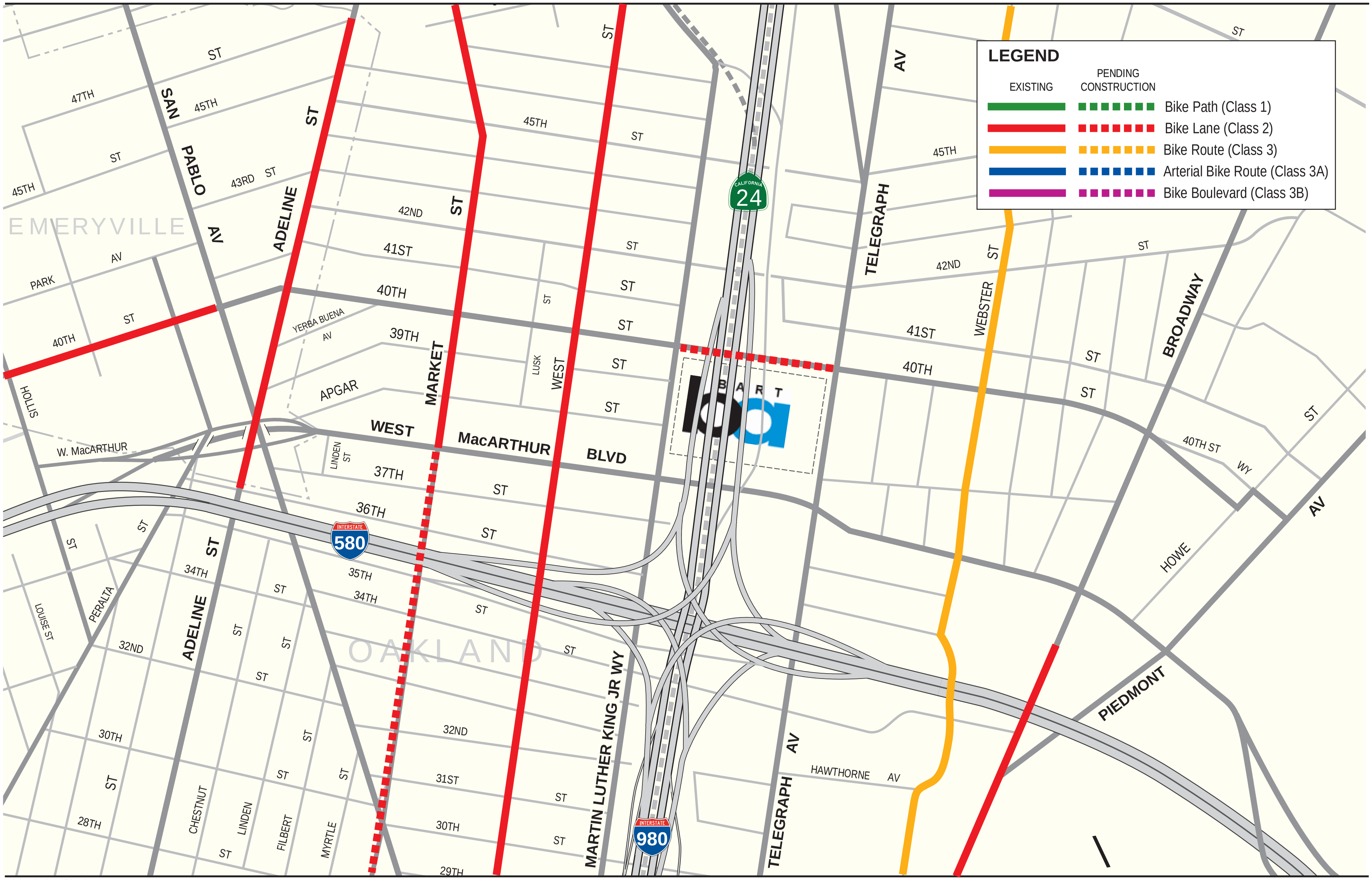

Existing Bicycle Facilities.ai

MacARTHUR BART STATION BICYCLE FEASIBILITY STUDY

Figure 2

EXISTING BICYCLE FACILITIES

Within the study area, bicycle lanes are provided on 40th Street (to the west of San Pablo Avenue), Adeline Street, Market Street, and Broadway (south of West MacArthur Boulevard). Additionally, bicycle lanes are to be constructed on 40th Street (between Martin Luther King, Jr. Way and Telegraph Avenue) as part of the MacArthur BART Station Transit Hub Streetscape Improvement Project. A designated bicycle route is provided on Webster Street. No existing bicycle facilities provide access to the MacArthur BART Station.

1.3 PROJECT ALTERNATIVES

The project alternatives were evaluated in a two-step process:

- Step 1: Initial Evaluation Alternatives – The purpose of this step was to "screen" the potential alternatives from a planning-level perspective. That is, to determine if the proposed routes would provide safe and direct access between the existing bicycle network and the MacArthur BART Station; regardless of geometric or operational constraints.
- Step 2: Feasibility Analysis Alternatives – The purpose of this step was to perform an engineering-level evaluation of the alternatives that meet the initial evaluation criteria. This analysis includes an evaluation of project-induced geometric modifications and multi-modal operational impacts.

Initial Evaluation Alternatives

A planning-level evaluation of the existing transportation facilities in the study area was conducted to determine which roadway segments were suitable for an engineering-level analysis. The West MacArthur Boulevard, 40th Street, and 41st / 42nd Street corridors were disaggregated into nine segments. Of the nine segments, two were eliminated from further study as they could not feasibly accommodate bicycle facilities. The two segments that were discarded from further analyses were the West MacArthur Boulevard (Hollis Street to Market Street) segment and the 41st Street / 42nd Street (San Pablo Avenue to Telegraph Avenue) segment.

The segment of West MacArthur Boulevard (between Hollis Street and Market Street) features narrow, high speed freeway ramps and poor connectivity through intersections.

The segment of 41st / 42nd Street (between San Pablo Avenue and Telegraph Avenue) was discarded from further analyses due to an uncontrolled crossing at the Telegraph Avenue connection, poor connectivity to the existing bicycle network, and poor connection to the MacArthur BART Station.

Feasibility Analysis Alternatives

The objective of the Potential Alternatives is to provide safe bicycle access to the MacArthur BART Station via the existing City of Emeryville and City of Oakland bicycle networks. As proposed in the *40th Street Bikeway Study*, bicycle lanes could be constructed on 40th Street between San Pablo Avenue and Piedmont Avenue. For the purposes of this analysis, the following alternatives have been evaluated:

- Lane Reduction Alternative – 40th Street (between San Pablo Avenue and Piedmont Avenue) or West MacArthur Boulevard (between Hollis Street and Broadway) could accommodate class 2 bicycle lanes with the removal of a travel lane (in each direction).
- Median Narrowing Alternative – 40th Street (between San Pablo Avenue and Piedmont Avenue) could accommodate class 2 bicycle lanes with the narrowing of the center median.
- Parking Removal Alternative – 40th Street (between San Pablo Avenue and Piedmont Avenue) and West MacArthur Boulevard (between Hollis Street and Broadway) could accommodate class 2 bicycle lanes with the removal of on-street parking.
- Bicycle Boulevard Alternative – 41st Street (between Telegraph Avenue and Broadway) is a residential roadway that could accommodate a class 3B bicycle boulevard.

1.4 FEASIBILITY ANALYSIS

The feasibility analysis addresses the effects of the alternatives, in the existing and future year conditions. The feasibility analysis only pertains to the Lane Reduction Alternative. Unlike the Lane Reduction Alternative, the Bicycle Boulevard Alternative, Parking Removal Alternative, the Median Narrowing Alternative would not impact transportation operations.

Baseline Conditions

In the 2007 Existing Conditions, many of the traffic signals operate less than optimally, given the transportation conditions. The traffic signal cycle lengths are longer than necessary, poorly coordinated, and the roadways with greater demand receive less green time than roadways with less demand. Signals that do not operate optimally result in higher average vehicle delays and longer average travel times. Since the subsequent feasibility analyses assume signal optimization at all study intersections, the existing signal timing must be modified to operate optimally for the purposes of this analysis. Therefore, all comparisons to the 2007 Existing Conditions will reflect the transportation impacts caused solely by the proposed project – not the signal optimization.

2030 Cumulative Conditions

The *40th Street Bikeway Study* – completed in 2006 – utilized the 2025 Alameda County Congestion Management Agency (ACCMA) travel demand model to forecast future traffic volumes. Prior to the initiation of this report, the ACCMA travel demand model was updated based on year 2030 forecasts. Therefore, this study utilizes year 2030 forecasts for the cumulative year analyses.

Traffic volumes are expected to grow significantly in the 2030 Cumulative Conditions. Based on the model projections, traffic volumes at the fourteen study intersections are expected to increase by an average of 128% and 80% during the AM and PM peak hours, respectively. The traffic volume increase at individual intersections is expected to vary in the Cumulative Conditions. However, significant traffic volume growth is expected at all study intersections on 40th Street and West MacArthur Boulevard.

The differences in the traffic volumes that are projected by utilizing the forecasts generated by the Year 2030 ACCMA model yield significantly different operational results than the forecasts generated by the Year 2025 ACCMA model.

The results of the intersection level of service analysis for the 2007 Existing, 2007 Existing (optimized), 2007 Lane Reduction Alternative (optimized), 2030 Cumulative (optimized), and 2030 Lane Reduction Alternative (optimized) Conditions is shown in **Table 1**.

In the 2030 Cumulative (optimized) Conditions, three of the 14 study intersections would operate at LOS E or LOS F. With the implementation of the Lane Reduction Alternative, seven intersections would degrade to operate at LOS E or LOS F in the 2030 Lane Reduction Alternative (optimized) Conditions. Based on the results of the 2030 Cumulative (optimized) Conditions intersection analysis, implementation of the Lane Reduction Alternative throughout the study corridors is infeasible.

The results of the transit operations analysis for the 2007 Existing, 2007 Existing (optimized), 2007 Lane Reduction Alternative (optimized), 2030 Cumulative (optimized), and 2030 Lane Reduction Alternative (optimized) Conditions is shown in **Table 2**.

In the eastbound direction of the 2030 Lane Reduction Alternative (optimized) Conditions, the simulated AC Transit travel time increased by 46 percent, from 5.4 minutes to 7.9 minutes with the implementation of the Lane Reduction Alternative. In the westbound direction of the 2030 Lane Reduction Alternative (optimized) Conditions, the simulated AC Transit travel time increased by 24 percent, from 4.5 minutes to 5.6 minutes with the implementation of the Lane Reduction Alternative. In the eastbound direction of the 2030 Lane Reduction Alternative (optimized) Conditions, the simulated Emery-Go-Round travel time increased by 82 percent, from 3.8 minutes to 6.9 minutes with the implementation of the Lane Reduction Alternative. In the westbound direction of the 2030 Lane Reduction Alternative (optimized) Conditions, the simulated Emery-Go-Round travel time increased by 40 percent, from 2.0 minutes to 2.8 minutes with the implementation of the Lane Reduction Alternative.

Table 1: Intersection Level of Service

	Intersection	Peak Hour	Level of Service				
			2007 Existing	2007 Existing (opt)	2007 Reduction (opt)	2030 Cumulative (opt)	2030 Reduction (opt)
1	40th St / Adeline St	AM	B	B	B	C	**E**
		PM	B	B	B	B	**E**
2	40th St / Market St	AM	B	A	B	D	**F**
		PM	C	A	C	C	**F**
3	40th St / West St	AM	B	B	B	C	**E**
		PM	C	B	B	B	**F**
4	40th St / MLK, Jr. Wy	AM	A	A	B	B	D
		PM	B	A	B	B	**F**
5	40th St / Telegraph Av	AM	B	A	B	D	**F**
		PM	B	A	B	**F**	**F**
6	40th St / Webster St	AM	B	B	B	A	B
		PM	A	A	B	A	C
7	40th St / Shafter Av	AM	A	A	A	A	B
		PM	A	A	B	A	B
8	40th St / Broadway	AM	B	B	B	B	C
		PM	B	A	B	C	D
9	W. MacArthur Bl / Market St	AM	B	B	B	C	**F**
		PM	C	B	B	D	**F**
10	W. MacArthur Bl / West St	AM	B	A	B	C	C
		PM	B	A	B	B	**E**
11	W. MacArthur Bl / MLK, Jr. Wy	AM	B	B	B	A	C
		PM	B	A	B	B	**F**
12	W. MacArthur Bl / Telegraph Av	AM	B	B	B	**F**	**F**
		PM	C	B	B	**F**	**F**
13	W. MacArthur Bl / Webster St	AM	A	A	B	B	C
		PM	B	A	B	B	D
14	W. MacArthur Bl / Broadway	AM	D	C	C	**F**	**F**
		PM	D	D	D	**F**	**F**

Source: DMJM Harris – June 2008
Notes:
Bold denotes intersections operating at LOS E or F.
"Opt" denotes that the signal timing has been optimized.
Weekday AM peak hour = 7:00 AM to 9:00 AM; Weekday PM peak hour = 4:00 PM to 6:00 PM.

Table 2: Transit Travel Time

Service Line	Direction(1)	Average Travel Time				
		2007 Existing	2007 Existing (opt)	2007 Reduction (opt)	2030 Cumulative (opt)	2030 Reduction (opt)
C	EB	6.5	5.7	5.8	6.8	8.5
	WB	---	---	---	---	---
F	EB	2.1	1.8	1.9	2.1	4.5
	WB	2.0	2.0	2.1	2.2	3.1
12(2)	EB	3.2	3.5	4.5	4.5	6.6
	WB	---	---	---	---	---
14	EB	6.6	5.4	6.1	7.1	10.2
	WB	4.5	3.6	3.9	4.0	6.6
18(2)	EB	3.9	2.8	3.6	3.9	4.0
	WB	2.3	2.6	3.0	2.6	6.8
57	EB	7.5	6.4	6.5	8.5	9.7
	WB	6.6	6.0	6.2	6.6	7.6
Total Buses	**EB**	**5.1**	**4.3**	**4.7**	**5.4**	**7.9**
	WB	**4.1**	**3.9**	**4.2**	**4.5**	**5.6**
Emery-Go-Round	EB	3.2	2.8	2.8	3.8	6.9
	WB	1.9	1.7	2.3	2.0	2.8
Total Shuttles	**EB**	**3.2**	**2.8**	**2.8**	**3.8**	**6.9**
	WB	**1.9**	**1.7**	**2.3**	**2.0**	**2.8**

Source: DMJM Harris – June 2008
Notes:
Average travel time in minutes.
"Opt" denotes that the signal timing has been optimized.
Analysis of weekday PM peak hour (5:00 PM to 6:00 PM).
Bus service line represents AC Transit route designation.
Emery-Go-Round shuttles includes the Hollis North, Hollis South, BART Shopper, and Watergate shuttles.
Analysis section includes 40th Street between Adeline Street and Telegraph Avenue.
(1) Relative to direction of travel with respect to 40th Street .
(2) Eastbound and westbound direction convention are opposite of AC Transit convention.

The results of the bicycle compatibility index (BCI) analysis for the 2007 Existing, 2007 Existing (optimized), 2007 Lane Reduction Alternative (optimized), 2030 Cumulative (optimized), and 2030 Lane Reduction Alternative (optimized) Conditions is shown in **Table 3**.

Table 3: Bicycle Compatibility Index

Segment	Direction	Level of Service				
		2007 Existing	2007 Existing (opt)	2007 Reduction (opt)	2030 Cumulative (opt)	2030 Reduction (opt)
40th St *btwn Market St and West St*	EB	E	E	B	E	B
	WB	D	D	B	E	B
40th St *btwn Shafter Av and Broadway*	EB	E	E	C	F	C
	WB	E	E	C	F	C
W. MacArthur Bl *btwn Market St and West St*	EB	E	E	C	E	C
	WB	D	D	B	E	D
W. MacArthur Bl *btwn Webster St and Broadway*	EB	E	E	C	F	D
	WB	E	E	C	F	E

Source: DMJM Harris – June 2008
Notes:
BCI = Bicycle Compatibility Index
"Opt" denotes that the signal timing has been optimized.
BCI calculated for weekday PM peak hour (4:00 PM to 6:00 PM).

Based on the results of the 2030 Lane Reduction Alternative (optimized) Conditions analysis, 40th Street would be more compatible for class 2 bicycle lanes than West MacArthur Boulevard. All of the evaluated 40th Street segments would operate at LOS B or LOS C with the implementation of the Lane Reduction Alternative. All of the evaluated West MacArthur Boulevard segments would operate at LOS C, LOS D, or LOS E with the implementation of the Lane Reduction Alternative. These improvements in BCI level of service are due to the lower traffic volumes and wider vehicle lane widths.

1.5 RECOMMENDED ALTERNATIVE

The traffic, transit, and bicycle analyses determined that the Lane Reduction Alternative would be infeasible throughout the study corridors in the 2030 Lane Reduction Alternative (optimized) Conditions. The Lane Reduction Alternative would cause significant adverse impacts to vehicle delay at several intersections as the operations would degrade to LOS E and LOS F. Additionally, the Lane Reduction Alternative would cause AC Transit buses and Emery-Go-Round shuttles to experience increases in delay of up to four minutes along the 0.7-mile long 40th Street corridor. However, class 2 bicycle lanes would be feasible if the roadway geometry could be maintained with a median narrowing.

These findings differ from the *40th Street Bikeway Study* recommendations due to the new ACCMA travel demand forecast models. The year 2025 model assumed much less land use (population and employment) growth than the year 2030 model assumes.

Based on the modifications to the Feasibility Analysis Alternatives, the Recommended Alternative consists of:

- West MacArthur Boulevard (BART Frontage Road to Telegraph Avenue) – Class 3A Arterial Bicycle Route;
- West MacArthur Boulevard (Telegraph Avenue to Broadway) – Class 2 Bicycle Lanes;
- 40th Street (San Pablo Avenue to Yerba Buena Avenue) – Class 3A Arterial Bicycle Route;
- 40th Street (Yerba Buena Avenue to Martin Luther King, Jr. Way) – Class 2 Bicycle Lanes;
- 40th Street (Telegraph Avenue to Webster Street) – Class 2 Bicycle Lanes;
- 41st Street (Webster Street to Montgomery Street) – Class 3B Bicycle Boulevard; and,
- 41st Street (Montgomery Street to Piedmont Avenue) – Class 2 Bicycle Lanes.

The Recommended Alternative bicycle facilities are shown in **Figure 3**. The recommended bicycle facilities would not significantly impact traffic, transit, pedestrian, or parking conditions in the 2007 Existing or 2030 Cumulative (optimized) Conditions.

The Recommended Alternative would require several modifications to the roadway network. The implementation of the proposed project would cost approximately $800,000.

The majority of the existing AC Transit stop facilities on 40th Street (between San Pablo Avenue and Telegraph Avenue) are located on the near-side of the intersection. Typically, these stops are bus bays. However, at designated bus stop locations the operator would frequently block the outside travel lane with the rear of the bus. In this case, the bus stop functions as a curbside stop rather than a bus bay.

The existing roadway and bus stop locations are constrained by the network geometry and signalization. The existing traffic signals are pretimed and cannot be adjusted to facilitate transit priority / preemption. The existing on-street parking serves local businesses and residents. Modifications to the on-street parking are infeasible based on these land uses. The existing geometry and pedestrian facilities constrain the implementation of queue jumping and acceleration / deceleration lanes. Therefore, modifications to the existing transit facilities are infeasible.

It should be noted that the transit facilities along the segment of 40th Street between Martin Luther King, Jr. Way and Telegraph Avenue would be reconfigured as part of the MacArthur BART Station Transit Hub Streetscape Improvement Project.

2.0 INTRODUCTION

This study has been performed to identify the optimal means for providing bicycle access to the MacArthur BART Station in the 40th Street / MacArthur corridor within Oakland, California. The optimal bicycle access plan would accommodate bicycle, pedestrian, and vehicle operations, while maintaining quality Alameda-Contra Costa Transit District (AC Transit) and Emeryville Transportation Management Association (Emery-Go-Round) service. The following transportation topics are addressed:

- Identification of Project Alternatives;
- Data Collection;
- Feasibility Analyses; and,
- Preliminary Conceptual Designs.

2.1 PROJECT DESCRIPTION

The City of Oakland's and the City of Emeryville's current *Bicycle Master Plans* (BMP) recommend the installation of bicycle lanes on 40th Street, a four-lane arterial adjacent to the MacArthur Bay Area Rapid Transit Station. In Emeryville, bicycle lanes currently exist on 40th Street to the west of San Pablo Avenue. In Oakland, 40th Street is shared by vehicles, bicycles, and AC Transit and Emery-Go-Round buses, and has a landscaped center median, left-turn pockets, and mixed-use frontage.

The recently completed *40th Street Bikeway Study* (2006) reviewed conditions in the 40th Street corridor with the City of Oakland. The *40th Street Bikeway Study* evaluated intersection operations to assess the potential impacts of the project on vehicular traffic. This study indicated that 40th Street would operate at an acceptable level of service in current and future year (2025) scenarios with the removal of one travel lane in each direction to accommodate bicycle lanes, between Adeline Street and Piedmont Avenue.

Subsequent to the preparation of the *40th Street Bikeway Study*, concerns were raised that additional review was warranted to evaluate other alternatives and the effects of the project on transit operations. The project stakeholders agreed further study was needed to analyze:

a. The effects on transit of a lane reduction on 40th Street;
b. Alternative bicycle facility designs for 40th Street; and,
c. Alternative bicycle facility alignments on West MacArthur Boulevard and / or 41st Street / 42nd Street.

Based on an evaluation of these alternatives, the plan would identify a recommended bicycle facility in the 40th Street corridor that provides high-quality bicycle access to the MacArthur BART Station without adversely affecting transit operations. The bicycle facility recommendations and the policy implications of this plan would be incorporated into the update of the City of Oakland's BMP.

2.2 NEARBY PROJECTS

Several development and improvement proposals have been approved, or are under consideration, within the study area. The study area location and planned development and improvements are shown in **Figure 4**. These developments and improvements include:

<u>AC Transit East Bay Bus Rapid Transit Project</u>
The AC Transit East Bay Bus Rapid Transit (BRT) Project would consist of transit modifications to an 18-mile long stretch of roadway between downtown Berkeley (north) and the Bay Fair BART Station (south). The system would allow buses to offer riders a rail-like transit experience that operates more quickly and reliably than the existing system. AC Transit is currently preparing an environmental impact report for the project in which several BRT alignment alternatives may be presented. These alternatives include the construction of median-running bus-only facilities. Within the study area, the BRT is proposed to utilize Telegraph Avenue and the MacArthur BART Station access road.

<u>MacArthur BART Station Transit Village</u>
The MacArthur BART Transit Village would consist of up to 675 units of high-density multi-family housing with unit sizes ranging from 550 square feet to 1,300 square feet. Building heights would range from four to six stories, or 50 to 85 feet tall. The project would include approximately 3,400 square feet of ground-floor retail neighborhood serving retail and 5,000 square feet of community space. The project would replace 300 to 600 of the existing MacArthur BART Station parking spaces. Public infrastructure upgrades would include a new public street through the site from Telegraph Avenue, the renovation of the existing BART entry plaza, a new public plaza adjacent to the retail space across from the BART plaza, improved shuttle circulation with an exclusive drop-off location, and streetscape improvements on 40th Street adjacent to the station.

<u>MacArthur BART Station Transit Hub Streetscape Improvement Project</u>
The MacArthur BART Station Transit Hub Streetscape Improvement Project is currently under construction and will include the following improvements on 40th Street between Martin Luther King, Jr. Way and Telegraph Avenue:

- Class 2 bicycle lanes (requires narrowing of center median);
- Crosswalk improvements at intersections;
- Installation of a traffic signal at the BART Frontage Road;
- Relocation of the crosswalk at the BART Frontage Road and creation of a mid-block pedestrian refuge in the median; and,
- Improved lighting, signage, and surface treatments in the underpass.

Telegraph Avenue Pedestrian Streetscape Improvement Project
The Telegraph Avenue Pedestrian Streetscape Improvement Project would include upgrades to the pedestrian facilities within Downtown Oakland, Northgate / Koreatown, Pill Hill, MacArthur Transit Village, and the Temescal District. Such improvements would include:

- High visibility crosswalks
- Corner curb bulb-outs
- Pedestrian countdown signals added at all signalized intersections; and,
- Improved lighting, signage, landscaping, and surface treatments.

Kaiser Hospital Seismic Retrofit and Expansion Project
The Kaiser Hospital Seismic Retrofit and Expansion Project would entail the phased replacement of the existing medical center with a new, comprehensively planned state-of-the-art medical center. The new medical center campus would be developed in three phases to ensure that the medical center could continue to provide uninterrupted medical service during implementation of the project.

The first phase is construction of a new 165,000 square foot medical services building on West Broadway along with a 738-space parking garage and a 34 space surface parking lot.

The second phase involves construction of a new 346-bed hospital (the same number of beds as the existing hospital), outpatient services offices, a central utilities plant and a 1,216 space parking garage.

The third phase includes construction of a new central administration medical services building of approximately 60,000 square feet and a 189 space parking facility. Three overhead pedestrian bridges are proposed, one over MacArthur Boulevard and two over Broadway to link the campus together. Most existing buildings on each of the sites would be demolished prior to each phase of construction.

2.3 STUDY SCOPE AND APPROACH

This feasibility study was prepared according to the scope of work as approved by the City of Oakland Transportation Services Division on January 31, 2007.

A Technical Advisory Committee was formed to provide input on the plan and develop consensus among key stakeholders to help define an implementable bicycle access project. The TAC included representatives of the City of Oakland, AC Transit, Emery-Go-Round, City of Emeryville, BART, and Kaiser Hospital. The TAC provided input to guide the scope and analyses and reach equitable conclusions for each task.

The following tasks were developed to identify the best bicycle access plan for the MacArthur BART Station in the 40th Street / MacArthur Boulevard corridor:

Task 1 – Identification of Project Alternatives

The preliminary analysis evaluated bikeway alternatives on nine segments. The segments with fatal flaws were eliminated and did not receive an engineering-level analysis. Three potential alignments were considered and are shown in **Figure 4**. The three alignments include:

1. West MacArthur Boulevard;
2. 40th Street; and,
3. 41st Street / 42nd Street.

Each of these three alignments was disaggregated into segments based on the key issues to be studied for each segment. It should be noted that the overall recommendations consider using different segments of different streets if they can be connected together to provide a viable bicycle facility. The three alignments were disaggregated into the following segments:

A. West MacArthur Boulevard (Broadway to Market Street);
B. West MacArthur Boulevard (Market Street to Hollis Street);
C. 40th Street (Piedmont Avenue to Broadway);
D. 40th Street (Broadway to Telegraph Avenue);
E. 40th Street (Telegraph Avenue to Martin Luther King, Jr. Way);
F. 40th Street (Martin Luther King, Jr. Way to San Pablo Avenue);
G. 41st Street (Piedmont Avenue to Broadway);
H. 41st Street (Broadway to Telegraph Avenue); and,
I. 41st Street / 42nd Street (Telegraph Avenue to San Pablo Avenue).

The planning-level evaluation of these alternatives, and the corresponding potential bicycle facilities figure, is included in Section 4.1 of this study.

Task 2 – Data Collection

Data were collected in the study area to supplement the feasibility analysis (task 3). The following types of data were obtained:

<u>Intersection Turning Movement Counts</u>
Intersection turning movement counts were obtained for the AM peak hour (7:00 AM to 9:00 AM) and PM peak hour (4:00 PM to 6:00PM) between December 2, 2004 and May 16, 2007 at the following 14 intersections (**Appendix A** contains the intersection turning movement count data):

1. 40th Street / Adeline Street;
2. 40th Street / Market Street;
3. 40th Street / West Street;
4. 40th Street / Martin Luther King Jr. Way;
5. 40th Street / Telegraph Avenue;
6. 40th Street / Webster Street;
7. 40th Street / Shafter Avenue;
8. 40th Street / Broadway;
9. West MacArthur Boulevard / Market Street;
10. West MacArthur Boulevard / West Street;
11. West MacArthur Boulevard / Martin Luther King Jr. Way;
12. West MacArthur Boulevard / Telegraph Avenue;
13. West MacArthur Boulevard / Webster Street; and,
14. West MacArthur Boulevard / Broadway.

The existing peak hour intersection turning movement traffic volumes and intersection operations are included in Section 3.1.2. Pedestrian and bicycle volumes and observations were also obtained at these intersections (**Appendix B** contains the intersection bicycle volume data). The corresponding pedestrian and bicycle volumes and observations are included in Section 3.3 and Section 3.4, respectively. Parking observations and accident data were obtained for these intersections and the approaching roadway segments. The results of the parking observations are included in Section 3.5 and the accident data is included in Section 3.6.

<u>Road Conditions Photo Catalog</u>
A road conditions photo catalog was developed for the following roadways:

- West MacArthur Boulevard (Market Street to Broadway);
- 40th Street (San Pablo Avenue to Piedmont Avenue); and,
- 41st Street (Telegraph Avenue to Piedmont Avenue).

The photo log includes roadway condition information (e.g., materials, landscaping, etc.) and is included in Section 3.1.1 of this study.

<u>Transit Data</u>
Data for AC Transit and Emery-Go-Round was collected and is included in Section 3.2. Transit data included bus route information, ridership, arrival / departure frequency, and bus stop and layover locations in the study area.

Roadway Cross Sections

Roadway cross section information was collected for each block for each of the roadways where an engineering level analysis was determined feasible (task 1). Blocks were aggregated into segments where common cross sections exist. The following segments were measured:

- West MacArthur Boulevard (Market Street to State Route 24 Undercrossing);
- West MacArthur Boulevard (State Route 24 Undercrossing);
- West MacArthur Boulevard (State Route 24 Undercrossing to Shafter Avenue);
- West MacArthur Boulevard (Shafter Avenue to Broadway);
- Howe Street (40th Street to 40th Street);
- 40th Street (San Pablo Avenue to Adeline Street);
- 40th Street (Adeline Street to Yerba Buena Avenue);
- 40th Street (Yerba Buena Avenue to Broadway) – except State Route 24 Undercrossing;
- 40th Street (Martin Luther King, Jr. Way to Telegraph Avenue);
- 40th Street (Broadway to Howe Street);
- 40th Street (Howe Street to Piedmont Avenue);
- 41st Street (Telegraph Avenue to Broadway);
- 41st Street (Broadway to Montgomery Street); and,
- 41st Street (Montgomery Street to Piedmont Avenue).

The cross section measurements are presented in Section 3.1.1.

Roadway Operations Data

Roadway operations data was collected during the PM peak hour (4:00 PM to 6:00 PM) on 40th Street between Adeline Street and Telegraph Avenue and is included throughout Section 3.0. The data collected includes:

- Automobiles and transit vehicle travel times;
- Intersection turning movement queue lengths; and,
- Incident delays caused by double parking and roadway blockages.

Task 3 – Feasibility Analysis

An intersection level of service analysis was conducted for the weekday AM and weekday PM peak hours at the study intersections (task 2) for the following scenarios:

- 2007 Existing Conditions;
- 2007 Existing (optimized) Conditions;
- 2007 40th Street Lane Reduction Alternative (optimized) Conditions;
- 2007 West MacArthur Boulevard Lane Reduction Alternative (optimized) Conditions;
- 2030 Cumulative (optimized) Conditions;
- 2030 40th Street Lane Reduction Alternative (optimized) Conditions; and,
- 2030 West MacArthur Boulevard Lane Reduction Alternative (optimized) Conditions.

In the 2007 Existing Conditions, many of the traffic signals operate less than optimally, given the transportation conditions. The traffic signal cycle lengths are longer than necessary, poorly coordinated, and the roadways with greater demand receive less green time than roadways with less demand. Signals that do not operate optimally result in higher average vehicle delays and longer average travel times. A 2007 Existing (optimized) scenario was developed to present an optimized 2007 Existing scenario. Therefore, all comparisons to the 2007 Existing Conditions will reflect the transportation impacts caused solely by the proposed project – not the signal optimization. Only optimization which could be easily implemented with the existing signal hardware is assumed (i.e. cycle length and signal timing).

For the purposes of the analysis and report, the 2007 40th Street Lane Reduction Alternative (optimized) Conditions and 2007 West MacArthur Boulevard Lane Reduction Alternative (optimized) Conditions have herein been consolidated and presented as the 2007 Lane Reduction Alternative (optimized) Conditions. The 2030 40th Street Lane Reduction Alternative (optimized) Conditions and 2030 West MacArthur Boulevard Lane Reduction Alternative (optimized) Conditions have herein been consolidated and presented as the 2030 Lane Reduction Alternative (optimized) Conditions.

A traffic simulation was conducted for 40th Street between Adeline Street and Telegraph Avenue. The traffic simulation was conducted specifically to measure the lane reduction impacts on transit vehicles. Since the greatest transit utilization occurs on 40th Street between Adeline Street and Telegraph Avenue, the microsimulation was limited to a small portion of the study area. The results of the simulation were utilized to determine project impacts on vehicle and transit operations. In addition to quantitative results, the qualitative traffic simulation results were utilized to determine where transit access improvements should be considered.

Pedestrian, bicycle, parking, and vehicle accident data were quantified throughout the study area and are presented in Section 3.0 of this study.

The Bicycle Compatibility Index (BCI) was utilized to evaluate the quality of bicycle access for the proposed alternatives for 40th Street and West MacArthur Boulevard. The BCI calculation utilizes the geometric characteristics of the bikeway and the traffic characteristics of the parallel vehicle travel way. This information is used to quantify a bicyclists' preference amongst bikeway alternatives. The BCI was determined at four locations with differing characteristics (e.g., bicycle facilities, traffic volumes, on-street parking, etc.) for the weekday PM peak hour (4:00 PM to 6:00 PM) of traffic operations. These analysis locations (eastbound and westbound directions) include:

- West MacArthur Boulevard (between Market Street and West Street);
- West MacArthur Boulevard (between Webster Street and Broadway);
- 40th Street (between Market Street and West Street); and,
- 40th Street (between Shafter Avenue and Broadway).

The operations analyses and feasibility evaluations were utilized to determine potential improvements and enhancements to the network to accommodate bicycle facilities. Given the findings of the feasibility analysis, the optimal bicycle access plan to the MacArthur BART Station was determined.

Task 4 – Preliminary Conceptual Designs

With the determination of the optimal bicycle access plan, the following designs, cross sections, and schematics were created:

- Roadway design plans;
- Roadway cross section diagrams; and,
- Proposed bicycle facilities map.

2.4 ANALYSIS METHODOLOGY

The proposed project was evaluated utilizing multiple analysis methodologies and tools. Each of the analysis procedures was developed to evaluate particular components of the transportation network.

Intersection Operations Analysis

An intersection operations analysis was conducted to determine the feasibility of the proposed project in relation to vehicular traffic carrying capacity. Typically, intersections are the constraint point for a roadway network as traffic control creates vehicle delays. Wherever conflicting traffic movements exist, traffic control is necessary.

The operating characteristics of intersections are described by the concept of level of service. Level of Service (LOS) is a qualitative description of the performance of an intersection based on the average delay per vehicle. Intersection levels of service range from LOS A, which indicates free flow or excellent conditions with short delays, to LOS F, which indicates congested or overloaded conditions with extremely long delays. In the study area, LOS A through D are considered excellent to satisfactory service levels, and LOS E and F represent unacceptable service levels.

The 14 signalized study intersections were evaluated using Trafficware's Synchro 7 software. The Synchro 7 software utilizes the 2000 *Highway Capacity Manual* (HCM) analysis methodology.[2] For signalized intersections, this methodology determines the capacity of each lane group approaching the intersection. The LOS is then based on average delay (in seconds per vehicle) for the various movements within the intersection. A combined weighted average delay and LOS are presented for the intersection. Level of service definitions for signalized and unsignalized intersections are shown in **Table 4**.

Table 4: Intersection Level of Service Definitions

LOS	Description	Delay (seconds/vehicle)	
		Signalized Intersections	Unsignalized Intersections
A	Little or no delay	≤ 10.0	≤ 10.0
B	Short traffic delay	> 10.0 and ≤ 20.0	> 10.0 and ≤ 15.0
C	Average traffic delay	> 20.0 and ≤ 35.0	> 15.0 and ≤ 25.0
D	Long traffic delay	> 35.0 and ≤ 55.0	> 25.0 and ≤ 35.0
E	Very long traffic delay	> 55.0 and ≤ 80.0	> 35.0 and ≤ 50.0
F	Extreme traffic delay	> 80.0	> 50.0

Source: *Highway Capacity Manual*, Transportation Research Board, 2000.

Network Microsimulation

A network microsimulation analysis was conducted to evaluate the impacts of the various alternatives on the transportation network – with a focus on transit. The microsimulation model produced a visual representation of the results and quantitative Measures of Effectiveness (MOE).

The purpose of the network microsimulation was two-fold: 1) the network microsimulation allowed the ability to assess transportation effects as a whole and for user definable modes (e.g., a specific transit route) and locations (e.g., intersection or corridor); and 2) the network microsimulation served as a pilot project to develop new tools for evaluating various aspects of transportation system (e.g., bus delay) that are not typically quantified.

The segment of 40th Street between Adeline Street and Telegraph Avenue was evaluated with PTV Vision's VISSIM 4.30 microsimulation software, which models the behavior and interactions between automobiles, transit vehicles, bicycles, and pedestrians. In addition

[2] As part of the 2000 HCM methodology, adjustments are typically made to the capacity of each intersection to account for various factors that reduce the ability of the streets to accommodate vehicles (such as the downtown nature of the area, number of pedestrians, vehicle types, lane widths, grades, lane widths, on-street parking, and queues). These adjustments are performed to ensure that the LOS analysis results reflect the operating conditions that are observed in the field.

to traffic volumes and network characteristics, transit routes, schedules, and ridership information were applied to accurately simulate the roadway operations. This section of 40th Street was evaluated due to the complex multi-modal interactions and high transit usage.

For the purposes of this analysis, transit travel time was utilized as the primary measure of effectiveness. Transit travel time represents the amount of time required for transit vehicles to traverse the network. The travel time is disaggregated by direction and mode (AC Transit buses and Emery-Go-Round shuttles). AC Transit buses are disaggregated by route since the distance traveled varies on a route-by-route basis. These results are intended to be utilized for comparative purposes as no significance criteria exist for travel time.

Bicycle Compatibility Index

The bicycle compatibility index is an instrument that can be used to predict bicyclists' perceptions of a specific roadway environment and ultimately determine the level of bicycle compatibility that exists on roadways within their jurisdictions.(3) The BCI methodology was developed for urban and suburban roadway segments (i.e., midblock locations that are exclusive of major intersections) and incorporates those variables that bicyclists typically use to assess the "bicycle friendliness" of a roadway (e.g., curb lane width, traffic volume, and vehicle speeds). The BCI model's level of service (LOS) designations provide the capability to assess roadways with respect to compatibility for shared-use operations by motorists and bicyclists and to plan for and design roadways that are bicycle compatible.

It should be noted that the bicycle compatibility index is not an adopted analysis standard of the City of Oakland. That is, within the context of this study the BCI is included for informational purposes. The feasibility of a specific alternative, at a specific location, cannot be determined based on this evaluation as no standards of significance have been developed.

Typically the BCI is utilized for operational evaluations, design, and planning purposes. The BCI is calculated utilizing the following factors:

- Type of bicycle facility;
- Bicycle facility width;
- Curb lane width;
- Traffic volumes and heavy vehicle volumes;
- Turning movement volumes;
- Traffic speeds;
- On-street parking and turnover; and,
- Local land use.

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(3) *The Bicycle Compatibility Index: A Level of Service Concept, Implementation Manual*. Federal Highway Administration. FHWA-RD-98-095

Bicycle compatibility index definitions for bicycle compatibility index evaluated facilities are shown in **Table 5**.

Table 5: Bicycle Compatibility Index Definitions

LOS	Compatibility Level[1]	BCI Range
A	Extremely High	≤ 1.50
B	Very High	> 1.50 and ≤ 2.30
C	Moderately High	> 2.30 and ≤ 3.40
D	Moderately Low	> 3.40 and ≤ 4.40
E	Very Low	> 4.40 and ≤ 5.30
F	Extremely Low	> 5.30

Source: *The Bicycle Compatibility Index: A Level of Service Concept, Implementation Manual*, Federal Highway Administration.

Notes:
(1) Qualifiers for compatibility level pertain to the average adult bicyclist.

3.0 2007 EXISTING CONDITIONS

This chapter provides a description of the existing transportation conditions in the study area. Included in this chapter are descriptions of the existing roadway and transit networks, and documentation of the existing traffic, transit, parking, pedestrian, and bicycle conditions.

3.1 ROADWAY CONDITIONS

This section provides a description of the existing roadway network and the existing operations. A photo log of the existing roadway segments is included in **Figure 5**. The existing typical cross sections of the study area roadways are included in **Figure 6**.

3.1.1 ROADWAY NETWORK

Local Access

40th Street is a four-lane roadway stretching from Shellmound Street eastward to Piedmont Avenue. Between San Pablo Avenue and Adeline Street, 40th Street accommodates four lanes of traffic and a center median with bus loading on both sides of the street (78 feet wide). Between Adeline Street and Yerba Buena Avenue, the roadway narrows to four lanes without a center median and includes permitted residential parking on both sides of the street (64 feet wide). Between Yerba Buena Avenue and Broadway – with the exception of the segment between Martin Luther King, Jr. Way and Telegraph Avenue – 40th Street accommodates four lanes of traffic, a center median, and permitted residential / metered commercial parking (80 feet wide). Between Broadway and Howe Street, the roadway accommodates three lanes of traffic (two westbound) and parking on the south side of the street (56 feet wide). At Howe Street, 40th Street is disconnected and jogs approximately 100 feet. Between Howe Street and Piedmont Avenue, 40th Street is a two lane roadway with metered parking on both sides of the street. 40th Street provides direct access to the MacArthur BART Station between Martin Luther King, Jr. Way and Telegraph Avenue with four travel lanes, a median, permitted parking, a taxi loading zone, and several bus stops (84 feet wide).

41st Street is a two-lane east-west residential street that extends from San Pablo Avenue to Piedmont Avenue. 41st Street is discontinuous as the roadway does not cross under SR-24. 41st Street includes several all-way stop controlled intersections and speed humps in the study area.

42nd Street is a two-lane east-west residential street that extends from Adeline Street to Broadway. 42nd Street is continuous and includes an underpass crossing the SR-24 overpass. 42nd Street includes several all-way stop controlled intersections and speed humps in the study area.

Adeline Street is a north-south arterial, stretching from 3rd Street northward to the City of Berkeley, where it ends at Shattuck Avenue. Near the proposed project, Adeline Street has one lane and a bicycle lane in each direction.

Broadway is a major arterial that runs in a north-south direction from Jack London Square in the south, past I-580, to SR 24 to the north. In the study area, Broadway consists of three through lanes in each direction. There are traffic signals at most of the major intersections, and separate left and right turn lanes at some key intersections.

Howe Street is a two lane north-south collector street that extends from MacArthur Boulevard to Pleasant Valley Avenue.

Market Street is a north-south arterial, stretching from Embarcadero West northward to the City of Berkeley, where it becomes Sacramento Street. Near the proposed project, Market Street has one lane of traffic in each direction and class 2 bicycle lanes.

Martin Luther King, Jr. Way is a north-south arterial extending from Downtown Oakland to Berkeley. In the study area, Martin Luther King, Jr. Way provides two travel lanes in each direction.

Piedmont Avenue is a two-lane, minor north-south arterial bounded by Broadway Avenue and 51st Street.

San Pablo Avenue is a major north-south arterial, stretching from downtown Oakland north to the City of San Pablo. It is part of AC Transit's Rapid Bus program, and traffic signals along the roadway provide priority to AC Transit buses. In the study area, San Pablo Avenue operates with two lanes in each direction.

Shafter Avenue is a two-lane north-south residential street in the study area.

Telegraph Avenue is a major north-south arterial, beginning at its intersection with Broadway in downtown Oakland and continuing north into Berkeley. Generally, there are two through lanes in each direction.

Webster Street is a two-lane north-south residential street in the study area.

West Street is a north-south arterial, stretching from 12th Street northward to Martin Luther King, Jr. Way. Near the proposed project, Market Street has one lane of traffic in each direction and class 2 bicycle lanes.

West MacArthur Boulevard is a major east-west arterial stretching from I-580 to Estudillo Boulevard in the City of San Leandro. Between Hollis Street and the I-580 Harrison Street interchange, this roadway is officially designated as West MacArthur Boulevard, but elsewhere referred to as MacArthur Boulevard. To the west of the proposed project, West MacArthur Boulevard operates with one lane in each direction for local traffic, with an additional expressway running underneath the intersections of Peralta Street / Emery Street and San Pablo Avenue / Adeline Street. The expressway operates with one westbound lane and two eastbound lanes, and surfaces at Market Street in the east and Hollis Street in the west. The expressway separates the two directions of local traffic by approximately 50 feet. To the east of the expressway, West MacArthur Boulevard is a six-lane facility with a raised center median.

Yerba Buena Avenue is a short east-west residential roadway consisting of two lanes. It runs from Adeline Street to 40th Street.

3.1.2 ROADWAY OPERATIONS

The majority of peak hour intersection turning movement count data for vehicles, bicyclists, and pedestrians used in the study was provided by the City of Oakland. Additional counts were conducted at locations where data was not provided. Data provided by the City of Oakland was examined and the relevant information was extracted. Generally, where redundant intersection turning movement counts existed, the newest data was utilized. However, other factors such as consistency were considered in this effort. Intersection vehicle, bicycle, and pedestrian counts were conducted between December 2, 2004 and September 15, 2007 at the following intersections:

1. 40th Street / Adeline Street;
2. 40th Street / Market Street;
3. 40th Street / West Street;
4. 40th Street / Martin Luther King Jr. Way;
5. 40th Street / Telegraph Avenue;
6. 40th Street / Webster Street;
7. 40th Street / Shafter Avenue;
8. 40th Street / Broadway;
9. West MacArthur Boulevard / Market Street;
10. West MacArthur Boulevard / West Street;
11. West MacArthur Boulevard / Martin Luther King Jr. Way;
12. West MacArthur Boulevard / Telegraph Avenue;
13. West MacArthur Boulevard / Webster Street; and,
14. West MacArthur Boulevard / Broadway.

Existing intersection operating conditions were evaluated for the weekday AM peak hour (7:00 AM to 9:00 AM) and weekday PM peak hour (4:00 PM to 6:00 PM). **Figure 7** presents the existing weekday AM and weekday PM peak hour traffic volumes for the study intersections. Screencaptures from the Synchro 7 software analysis are included in **Figure 8**.

Table 6 presents the results of the intersection LOS analysis for the 2007 existing weekday AM and weekday PM peak hour conditions (**Appendix C** contains the detailed calculations of the intersection LOS analysis). Currently, all study intersections operate with acceptable conditions (LOS D or better) during the weekday PM peak hour.

Table 6: Intersection Level of Service – 2007 Existing Conditions

Intersection		Control Type	Peak Hour	2007 Existing	
				LOS	Delay
1	40th St / Adeline St	Signal	AM	B	12.9
			PM	B	11.4
2	40th St / Market St	Signal	AM	B	13.8
			PM	C	20.9
3	40th St / West St	Signal	AM	B	14.8
			PM	C	20.2
4	40th St / MLK, Jr. Wy	Signal	AM	A	8.1
			PM	B	12.9
5	40th St / Telegraph Av	Signal	AM	B	12.8
			PM	B	16.6
6	40th St / Webster St	Signal	AM	B	14.4
			PM	A	5.1
7	40th St / Shafter Av	Signal	AM	A	7.1
			PM	A	8.0
8	40th St / Broadway	Signal	AM	B	15.7
			PM	B	19.4
9	W. MacArthur Bl / Market St	Signal	AM	B	16.6
			PM	C	24.5
10	W. MacArthur Bl / West St	Signal	AM	B	16.4
			PM	B	13.6
11	W. MacArthur Bl / MLK, Jr. Wy	Signal	AM	B	12.7
			PM	B	12.0
12	W. MacArthur Bl / Telegraph Av	Signal	AM	B	18.6
			PM	C	31.3
13	W. MacArthur Bl / Webster St	Signal	AM	A	7.4
			PM	B	11.3
14	W. MacArthur Bl / Broadway	Signal	AM	D	44.3
			PM	D	42.1

Source: DMJM Harris – June 2008
Notes:
Delay in seconds per vehicle for all intersections.
Weekday AM peak hour = 7:00 AM to 9:00 AM; Weekday PM peak hour = 4:00 PM to 6:00 PM.

3.2 TRANSIT CONDITIONS

The study area is served by public and private transit services. AC Transit buses and Emery-Go-Round, Kaiser Hospital, Oakland Children's Hospital, Summit Medical Center, and Caltrans shuttles operate service lines in the proposed project area. In the study area, the Kaiser Hospital, Oakland Children's Hospital, Summit Medical Center, and Caltrans shuttle services do not pick up / drop off passengers at any locations subject to geometric modifications. These shuttle services are not included in the transit analysis as the impacts to these shuttles services caused by the proposed project are expected to be similar to impacts to vehicular traffic. Therefore, herein the transit evaluation focused on the AC Transit and Emery-Go-Round network and operations. **Figure 9** illustrates the transit service in the study area.

3.2.1 TRANSIT NETWORK

Transit route and schedule information for the AC Transit local and transbay and Emery-Go-Round service is included below:

Local Service

Line 1 runs from Downtown Berkeley to the Bay Fair BART station along Telegraph Avenue and International Boulevard / East 14th Street during the early morning and late evenings. It stops one block from MacArthur BART at the intersection of Telegraph Avenue and 40th Street. It runs from 5:30 AM to 6:30 AM and 6:30 PM to 12:00 AM, every 15 to 20 minutes on weekdays and 5:30 AM to 8:30 AM and 5:30 PM to 12:00 AM every 15 to 20 minutes on weekends. Daytime service is provided by the 40L. This line is operated using 60-foot articulated buses with a 60 and 90 person seating and standing capacity, respectively.

Line 1R runs from Downtown Berkeley to the Bay Fair BART station along Telegraph Avenue and International Boulevard / East 14th Street. It stops one block from MacArthur BART at the intersection of Telegraph Avenue and 40th Street. It operates from 7:00 AM to 6:30 PM, every 15 minutes during the week and 10:30 AM to 5:30 PM every 20 minutes on weekends. Line 1R utilizes a different route on weekends as service is not provided on Telegraph Avenue. Early morning and late night service is provided by line 40. The line is operated with 60-foot articulated buses with a 60 and 90 person seating and standing capacity, respectively.

Line 12 is one of two lines that originate / terminate at the MacArthur BART station. The line connects MacArthur BART to downtown Oakland, passing the Children's Hospital and the Temescal, Piedmont, and Lakeshore neighborhoods. The line runs from 6:00 AM to 7:00 PM, every 20 minutes, on weekdays and 7:00 AM to 7:00 PM, every 30 minutes, on weekends. The line operates using standard 40-foot buses with a 40 and 60 person seating and standing capacity, respectively. Occasionally 30-foot buses service the route and have a 30 and 45 person seating and standing capacity, respectively

Line 14 also originates/terminates at the MacArthur BART station. It connects to the Dimond neighborhood in East Oakland, via Emeryville, West Oakland, Downtown Oakland and Fruitvale. The line runs from 6:00 AM to 7:30 PM, every 20 minutes off-peak and every 15 minutes peak during the weekdays and 7:00 AM to 7:00 PM every 30 minutes on the weekends. The line operates using standard 40-foot buses with a 40 and 60 person seating and standing capacity, respectively.

Line 15 runs from Downtown Berkeley to West Oakland and Downtown Oakland. The line stops one block from MacArthur BART at the intersection of 40th Street and Martin Luther King Jr. Way. The line operates from 6:00 AM to 9:30 PM, every 20 minutes during the day and every 30 minutes in the evening during the week. On weekends, the line operates from 6:30 AM to 10:30 PM, every 20 minutes during the day and 30 minutes in the evening. The line operates using standard 40-foot buses with a 40 and 60 person seating and standing capacity, respectively.

Line 18 runs from Albany to Park Boulevard via Shattuck Avenue, Telegraph Avenue and Martin Luther King Jr. Way, to Downtown Berkeley, West Oakland, and Downtown Oakland. The line stops at MacArthur BART on 40th Street, where it jogs from Martin Luther King Jr. Way to Telegraph Avenue. The line operates from 5:00 AM to 12:20 AM, every 15 minutes during the day and every 20 minutes in the evening during the week. On weekends, the line operates from 5:55 AM to 12:10 AM, every 20 minutes during the day and evening.

Line 51 runs from the Amtrak Station in Berkeley to Fernside Boulevard in Alameda via University Avenue, College Avenue, Broadway, the Posey Tube, and Santa Clara Avenue. It runs from 5:00 AM to 1:00 AM, every eight minutes during the day and 20 minutes in the early morning and late evenings during the weekdays. On weekends, the line runs from 5:00 AM to 1:00 AM, every 15 minutes during the day and 30 minutes in the early mornings and late evenings.

Line 57 runs from Emeryville to the Eastmont Transit Center in East Oakland, via 40th Street and W. MacArthur Boulevard, passing the MacArthur BART station and the Lakeshore and Dimond neighborhoods. The line runs from 5:30 AM to 12:00 AM, every 12 minutes during the day and every 20-30 minutes in the very early morning and late night during the week and 6:00 AM to 12:00 AM, every 15 minutes during the day and 30 minutes late at night. This line utilizes standard 40-foot buses with a 40 and 60 person seating and standing capacity, respectively.

Transbay Service

AC Transit operates 29 Transbay bus lines that operate across the Bay Bridge to the Transbay Transit Terminal in Downtown San Francisco. One of these lines directly serves the MacArthur BART station:

C Line is a peak-hour / peak direction Transbay service. The line serves MacArthur BART mornings from 5:55 AM to 8:55 AM with a 30-minute headway, with a trip time from the station to San Francisco of 25 minutes (the trip time on BART from the MacArthur station to the Montgomery station is 17 minutes). In the afternoon, the C Line connects the MacArthur BART station to Piedmont via 40th Street, Piedmont Avenue, Moraga Avenue and Highland Avenue every 30 minutes from 3:39 PM to 8:24 PM. Local fares apply to the afternoon trips from the MacArthur BART station into Piedmont. The line operates using standard 40-foot buses with a 30 and 90 person seating and standing capacity, respectively.

CB Line is a peak-hour / peak direction Transbay service. The line utilizes West MacArthur Boulevard mornings from 6:45 AM to 8:15 AM with a 30-minute headway, with a trip time from the station to San Francisco of 25 minutes (the trip time on BART from the MacArthur station to the Montgomery station is 17 minutes). In the afternoon, the C Line utilizes West MacArthur Boulevard every 30 minutes from 4:50 PM to 8:25 PM. Local fares apply to the afternoon trips from the MacArthur BART station into Piedmont.

F Line is a Transbay service line that serves the Ashby BART Station weekdays from 6:20 AM to 12:39 AM with a 30-minute headway, with a trip time from the station to San Francisco of 25 minutes. F Line travels on 40th Street to the west of Market Street.

It should be noted that the off-peak “all nighter” and school service lines were omitted from the AC Transit descriptions due to infrequent / off-peak hour service.

Emery-Go-Round Service

The Emery-Go-Round shuttle connects the MacArthur BART station with destinations within the City of Emeryville. There are six weekday routes that serve the MacArthur BART station (Watergate Express, BART Shopper, Hollis North, Hollis South, Powell, and Hollis) and a single route on weekends. On weekdays, four routes operate between 7:00 AM and 7:00 PM at 12 to 15 minute frequencies in peak commute times and at 20 to 22 minute frequencies midday.

The Watergate Express line utilizes MacArthur Boulevard to access I-580, exits at Powell Street, and proceeds west to Watergate Peninsula.

The BART Shopper line utilizes MacArthur Boulevard to access Market Street, proceeds west on 40th Street, north on Shellmound Street, turns around at 65th Street, south on Christie Avenue / Shellmound Street, and east on 40th Street to the MacArthur BART Station.

The Hollis North line utilizes MacArthur to access I-580, exits at Powell Street, proceeds north and west to the Amtrak Station, 59th Street to Hollis Street, north to 66th Street, and then turns around and proceeds to the MacArthur BART Station via Hollis Street.

The Hollis South line utilizes MacArthur Boulevard to access Market Street, proceeds west on 40th Street, north on San Pablo Avenue / Park Avenue / Hollis Street, circles the Amtrak Station at 59th Street, and proceeds to the MacArthur BART Station via Hollis Street / Park Avenue / 40th Street.

Between 5:45 AM and 7:00 AM and between 7:15 PM and 10:15 PM, these routes are consolidated into two routes (Powell and Hollis). These routes operate at 20 to 40 minute frequencies.

Saturday service operates from 9:30 AM to 9:30 PM with service every 30 to 40 minutes. Sunday service operates from 10:30 AM to 6:30 PM with service every 30 to 40 minutes.

Emery-Go-Round buses are equipped with NextBus technology, which allows patrons to access real-time location of vehicles or estimated arrival times from the internet or mobile devices. Emery-Go-Round has plans to install a NextBus sign at the MacArthur BART station to display the estimated arrival time of the Hollis and Powell routes. Emery-Go-Round is operated with 35-foot shuttle vehicles that carry approximately 45 passengers. Emery-Go-Round buses layover along the south side of 40th Street, east of the intersection with Martin Luther King, Jr. Way.

3.2.2 TRANSIT OPERATIONS

In the study area, substantial transit activity occurs on 40th Street between Adeline Street and Telegraph Avenue. During the PM peak hour, this 0.8 mile long stretch of 40th Street accommodates six AC Transit service lines (C, F, 12, 14, 18, and 57 lines) resulting in 40 one-way trips. Emery-Go-Round operates four service lines resulting in 34 one-way trips on 40th Street during the PM peak hour. The AC Transit buses make frequent stops on this stretch of 40th Street for boarding / alighting passengers at the 19 bus stops. Due to high traffic and transit trips, all transit operation analysis was conducted during the weekday PM peak hour (5:00 PM to 6:00 PM) of transit operations.

As noted in Section 2.4, the segment of 40th Street between Adeline Street and Telegraph Avenue was evaluated with PTV's VISSIM 4.30 microsimulation software, which models the behavior and interactions between automobiles, transit vehicles, bicycles, and pedestrians. In addition to traffic volumes and network characteristics, transit routes, schedules, and ridership information were applied to accurately simulate the roadway operations. This section of 40th Street was evaluated due to the complex multi-modal interactions and high transit usage. Due to the complex nature of the simulation model, a substantial amount of data collection and field observations are required for input and calibration.

The vehicle operations simulated within the VISSIM model are designed to replicate the vehicles operations observed in the study area. Vehicle types are defined within the model and are assigned class-specific attributes. That is, automobiles, shuttles, and busses are assigned independent performance characteristics such as acceleration, vehicle following behavior, desired speed, lane change behavior, etc. Additionally, the size and appearance of vehicles are assigned to replicate the vehicles observed in the field. As observed in the field, busses and shuttles were less maneuverable than automobiles. These vehicles were represented in the simulation accordingly.

A detailed survey of transit ridership was provided by AC Transit.[4] This data included specific ridership information pertaining to bus line-specific boarding and alighting data for individual bus stops along 40th Street. This information was evaluated and prepared for input into the VISSIM model. The bus stop locations and ridership data for the weekday PM peak hour is included in **Figure 10**.

It should be noted that the weekday PM peak hour transit ridership may not peak as sharply relative to other periods of the day as automobile traffic does. The peaking characteristics of the transit ridership may not correlate precisely with the peaking characteristics of the vehicular traffic volumes. However, the weekday PM peak hour for ridership does coincide with the weekday PM peak hour for traffic volumes and represents a reasonable hour for analysis.

Transit vehicle travel time surveys were conducted along the 40th Street corridor on September 19, 2007 during the AM and PM peak hours. The AC Transit buses were subject to the same sources of delay as the passenger vehicles. However, the delay experienced by buses varied based on bus stops, as well. This factor significantly affected the AC Transit bus travel time.

Bus stop delays along the corridor ranged from 11 seconds to 62 seconds during the survey periods. This delay was caused exclusively by bus clearance time and passenger boarding / alighting. The number of stops made by a bus varied by service line and passenger demands. At all bus stops along the 40th Street corridor, bus stop data collection included the number of passengers boarding / alighting and the corresponding amount of time required. Based on the data collection and field observations, a linear regression was utilized to quantify the relationship between boarding passengers and vehicle dwell time. Based on passenger boarding / alighting behavior, bus clearance time was determined to be approximately eight (8) seconds per stop. The bus clearance time accounts for the time from when a bus has reached a complete stop until just before the bus has prepared to depart – not including the boarding and alighting time. The majority of this time is allocated to the time required to open and close the doors. The time required for a bus to reenter the roadway is a function of the adjacent traffic and is independent of the bus clearance time. For each boarding / alighting passenger, an additional three (3) seconds would elapse. The time was determined to be additive as passengers did not exclusively utilize specific doors for boarding / alighting.

(4) Passenger boarding / alighting data was collected from June 2006 to June 2007 by AC Transit's automatic passenger counters. This data was provided by AC Transit's Long Range Planning & Data Analysis division.

Specific travel time trends could not be determined specific to the peak hours or direction for the AC Transit vehicles. Travel time for the buses ranged widely during the survey periods. Travel time for the AC Transit vehicles ranged from 210 seconds (3.5 minutes) to 600 seconds (10.0 minutes). The majority of the delay was caused by roadway congestion and traffic signals. Although passenger loading did impact bus travel time, a specific relationship between total passengers boarding / alighting and travel time could not be ascertained. Over the length of the corridor, delay caused by passenger boarding / alighting was substantially less than delay caused by other sources (i.e., congestion and traffic signals).

Emery-Go-Round shuttles were observed to function similarly to passenger vehicles as they did not have any passenger boarding / alighting locations along the corridor. Travel time surveys were not conducted specifically for Emery-Go-Round buses as they are analyzed as passenger vehicles for calibration purposes.

Two significant transit observations were noted for implementation in the VISSIM model: bus maneuvers and bus stop skipping. At designated bus stop locations, the operator would frequently block the outside travel lane with the rear of the bus. This maneuver appeared to be conducted for several reasons: blocked bus stop access by passenger vehicles, creating an ability to return to the travel way without conflicts with motorists and bicyclists, and insufficient designated bus stop storage length.

AC Transit buses did not stop at individual bus stops unless a passenger was boarding / alighting. Accordingly, bus stop skipping was accounted for in the VISSIM model.

Few passengers loaded / unloaded bicycles on the transit vehicles within the analysis section. Few special needs passengers (i.e, wheelchairs) were observed boarding / alighting the transit vehicles. Due to the lack of observations, the VISSIM model was not adjusted to account for these occurrences.

In addition to roadway and transit data collection and observations, pedestrian, bicycle, and parking information was utilized in the VISSIM model. The pedestrian, bicycle, and parking information are addressed in subsequent sections. Screencaptures from the VISSIM 4.30 software analysis are included in **Figure 11**.

Table 7 presents the results of the calibrated 40th Street travel time VISSIM analysis for the 2007 existing weekday PM peak hour conditions (**Appendix D** contains the data outputs from the microsimulation analyses). The results of the analysis are consistent with the travel time surveys and field observations.

The travel time required for AC Transit buses to traverse the 40th Street corridor is approximately five minutes in the eastbound direction and four minutes in the westbound direction. The travel time required for Emery-Go-Round shuttles to traverse the 40th Street corridor is approximately three minutes in the eastbound direction and two minutes in the westbound direction.

Table 7: Transit Travel Time – 2007 Existing Conditions

Service Line	Direction[1]	Average Travel Time 2007 Existing
C	EB	6.5
	WB	---
F	EB	2.1
	WB	2.0
12[2]	EB	3.2
	WB	---
14	EB	6.6
	WB	4.5
18[2]	EB	3.9
	WB	2.3
57	EB	7.5
	WB	6.6
Total Buses	**EB**	**5.1**
	WB	**4.1**
Emery-Go-Round	EB	3.2
	WB	1.9
Total Shuttles	**EB**	**3.2**
	WB	**1.9**

Source: DMJM Harris – June 2008
<u>Notes:</u>
Average travel time in minutes based on calibrated VISSIM simulation results.
Analysis of weekday PM peak hour (5:00 PM to 6:00 PM).
Bus service line represents AC Transit route designation.
Emery-Go-Round shuttles include the Hollis North, Hollis South, BART Shopper, and Watergate shuttles.
Analysis section includes 40th Street between Adeline Street and Telegraph Avenue.
(1) Relative to direction of travel with respect to 40th Street.
(2) Eastbound and westbound direction convention are opposite of AC Transit convention.

3.3 PEDESTRIAN CONDITIONS

Throughout the majority of the West MacArthur Boulevard and 40th Street corridors, pedestrian volumes are relatively low and an ample number of crosswalks are available. However, near the 40th Street access points to the MacArthur BART station, pedestrian traffic is heavy and the demand is accommodated by an uncontrolled mid-block crosswalk. This crosswalk is heavily utilized by pedestrians crossing to / from the north side of 40th Street to access vehicles, transit providers, and sidewalks on the south side of the street.

Pedestrian observations in the vicinity of the MacArthur BART Station were conducted on September 17, 2007. Despite the availability of pedestrian crosswalks, pedestrians frequently cross 40th Street illegally between Martin Luther King, Jr. Way and Telegraph Avenue. These crossings occurred frequently. However, pedestrians would often yield to oncoming vehicles and wait for gaps between platoons before crossing. In addition, pedestrians would utilize the undercrossing median as a refuge when crossing. However, on several occasions pedestrians crossed the street in front of vehicles causing the vehicles to slow – or even stop.

The majority of the signalized intersections have pedestrian signals, which provide pedestrians with adequate clearance time. The following intersections do not have pedestrian signals:

- 40th Street / West Street (eastern and western crossings);
- 40th Street / Webster Street (eastern and western crossings);
- West MacArthur Boulevard / West Street (eastern and western crossings);
- West MacArthur Boulevard / Martin Luther King, Jr. Way (eastern and western crossings); and,
- West MacArthur Boulevard / Webster Street (eastern and western crossings).

In addition to qualitative observations, pedestrian crossing volumes counts were conducted to supplement the intersection operation and microsimulation analyses. The majority of the pedestrian crossing volume counts were conducted in August of 2007 and the remainder of the data was provided by the City of Oakland. **Table 8** presents the pedestrian volumes crossing each of the 14 study intersection approaches during the weekday AM and weekday PM peak hour.

3.4 BICYCLE CONDITIONS

The City of Oakland's BMP categorizes existing and proposed bicycle facilities into four primary groups per Caltrans' *Highway Design Manual* standards: bicycle path (class 1), bicycle lane (class 2), arterial bicycle route (class 3A) and bicycle boulevard (class 3B). Arterial bicycle routes and bicycle boulevards are both shared roadway facilities. The distinction between the two types of facilities is that bicycle boulevards are optimized for bicycle traffic. That is, bicycle boulevards are typically designed to have low vehicle traffic volumes, traffic calming devices, and low vehicle speeds. Within the vicinity of the study area, a distinction between existing bicycle boulevards and existing arterial bicycle routes is not defined and all facilities are more generally considered bicycle routes (class 3). The existing bicycle facilities are described in **Figure 12**.

Table 8: Pedestrian Volumes – 2007 Existing Conditions

Intersection		Peak Hour	Pedestrian Crossing				
			North	South	East	West	Total
1	40th St / Adeline St	AM	1	30	13	7	51
		PM	7	1	7	1	16
2	40th St / Market St	AM	19	25	26	34	104
		PM	34	54	30	41	159
3	40th St / West St	AM	13	64	30	1	108
		PM	13	18	1	24	56
4	40th St / MLK, Jr. Wy	AM	41	33	28	38	140
		PM	40	35	29	40	144
5	40th St / Telegraph Av	AM	43	27	28	34	132
		PM	48	39	27	15	129
6	40th St / Webster St	AM	24	64	7	1	96
		PM	13	36	7	7	63
7	40th St / Shafter Av	AM	7	47	1	7	62
		PM	7	41	1	1	50
8	40th St / Broadway	AM	17	57	12	39	125
		PM	27	84	31	60	202
9	W. MacArthur Bl / Market St	AM	13	7	13	7	40
		PM	18	1	18	36	73
10	W. MacArthur Bl / West St	AM	1	13	1	18	33
		PM	7	13	1	30	51
11	W. MacArthur Bl / MLK, Jr. Wy	AM	14	14	18	18	64
		PM	11	11	13	13	48
12	W. MacArthur Bl / Telegraph Av	AM	30	7	41	41	119
		PM	13	47	24	41	125
13	W. MacArthur Bl / Webster St	AM	30	13	7	13	63
		PM	24	7	24	30	85
14	W. MacArthur Bl / Broadway	AM	30	30	76	7	143
		PM	24	70	41	7	142

Source: DMJM Harris – June 2008
Notes:
Weekday AM peak hour = 7:00 AM to 9:00 AM; Weekday PM peak hour = 4:00 PM to 6:00 PM.

3.4.1 BICYCLE NETWORK

In the study area, bicycle lanes are provided, or will be provided on 40th Street (to the west of San Pablo Avenue), Adeline Street, Market Street, West Street, and Broadway (south of West MacArthur Boulevard). Additionally, bicycle lanes will be constructed on 40th Street (between Martin Luther King, Jr. Way and Telegraph Avenue) as part of the MacArthur BART Station Transit Hub Streetscape Improvement Project. A designated class 3 bicycle route is provided on Webster Street. No existing bicycle facilities currently provide access to the MacArthur BART Station.

3.4.2 BICYCLE OPERATIONS

Bicycle volumes counts were conducted at each of the study intersections to supplement the intersection operation, microsimulation, and bicycle compatibility analyses. The majority of the bicycle volume counts were conducted in August of 2007 and the remainder of the data was provided by the City of Oakland. **Table 9** presents the bicycle volumes at each of the 14 study intersection approaches during the weekday AM and weekday PM peak hour. The individual bicycle turning movement volumes were aggregated and are presented by roadway approach.

The bicycle compatibility index was calculated at two locations on 40th Street and two locations on West MacArthur Boulevard (eastbound and westbound directions) for the weekday PM peak hour of traffic operations. Since traffic volumes are a significant factor in the BCI calculation, the PM peak hour (4:00 PM to 6:00 PM) of traffic operation was determined to be the most conservative for bicycle compatibility calculations. The results of the BCI calculations are included in **Table 10** (**Appendix E** contains the detailed calculations of the BCI analysis).

All eight of the segments operate at LOS D or worse during the weekday PM peak hour in the 2007 Existing Conditions. The existing compatibility level of bicycle lanes for 40th Street and West MacArthur Boulevard is moderately to extremely low.

It should be noted that the BCI level of service presented represents the most conservative period of the day – the highest traffic volumes. The BCI level of service would likely improve at these locations during other analysis periods.

Table 9: Bicycle Volumes – 2007 Existing Conditions

Intersection		Peak Hour	Roadway Approach				
			North	South	East	West	Total
1	40th St / Adeline St	AM	7	30	1	13	51
		PM	13	18	1	13	45
2	40th St / Market St	AM	14	12	16	20	62
		PM	16	21	5	13	55
3	40th St / West St	AM	24	18	7	24	73
		PM	13	13	7	1	34
4	40th St / MLK, Jr. Wy	AM	16	15	4	11	46
		PM	16	22	7	12	57
5	40th St / Telegraph Av	AM	13	17	6	4	40
		PM	13	17	1	3	34
6	40th St / Webster St	AM	1	13	7	1	22
		PM	1	7	1	7	16
7	40th St / Shafter Av	AM	1	7	7	24	39
		PM	1	13	1	7	22
8	40th St / Broadway	AM	5	19	12	18	54
		PM	3	13	27	21	64
9	W. MacArthur Bl / Market St	AM	1	7	13	1	22
		PM	7	1	1	13	22
10	W. MacArthur Bl / West St	AM	1	7	1	1	10
		PM	1	1	7	7	16
11	W. MacArthur Bl / MLK, Jr. Wy	AM	8	6	7	3	24
		PM	4	8	8	9	29
12	W. MacArthur Bl / Telegraph Av	AM	20	0	7	26	53
		PM	7	0	20	20	47
13	W. MacArthur Bl / Webster St	AM	7	0	7	33	47
		PM	13	0	46	20	79
14	W. MacArthur Bl / Broadway	AM	13	7	13	26	59
		PM	20	20	13	26	79

Source: DMJM Harris – June 2008
Notes:
Weekday AM peak hour = 7:00 AM to 9:00 AM; Weekday PM peak hour = 4:00 PM to 6:00 PM.

Table 10: Bicycle Compatibility Index – 2007 Existing Conditions

Segment	Direction	2007 Existing	
		LOS	BCI
40th St *btwn Market St and West St*	EB	E	4.69
	WB	D	4.40
40th St *btwn Shafter Av and Broadway*	EB	E	5.18
	WB	E	4.80
W. MacArthur Bl *btwn Market St and West St*	EB	E	4.44
	WB	D	3.99
W. MacArthur Bl *btwn Webster St and Broadway*	EB	E	5.08
	WB	E	5.10

Source: DMJM Harris – June 2008
Notes:
BCI = Bicycle Compatibility Index
BCI calculated for weekday PM peak hour (4:00 PM to 6:00 PM).

3.5 PARKING CONDITIONS

Existing on-street parking conditions were documented for West MacArthur Boulevard (between Market Street and Broadway) and 40th Street (between San Pablo Avenue and Piedmont Avenue). On-street parking conditions were evaluated during the weekday midday peak hour (1:30 PM to 3:00 PM) in July 2007. Based on the residential and commercial land uses in the area, as well as BART, the weekday midday peak has the highest parking occupancy. A summary of the observed on-street parking conditions is provided in **Table 11**. This table also includes a detailed evaluation of the on-street parking restrictions and the corresponding restriction locations.

It should be noted that a parking survey was not conducted during the evening peak hour (8:00 PM to 10:00PM) as observations indicated that parking occupancy is lower in the study area in the evening based on the local commercial land uses and BART-related parking.

On-street parking near the MacArthur BART station is highly occupied during the midday peak hour. Elsewhere, the parking occupancy is much lower. The majority of the highly occupied on-street parking locations (that are unrestricted) are utilized by BART patrons. The turnover rate at these locations was observed to be low as vehicles remain there throughout the day. Metered parking zones were observed to have a lower occupancy rates and have a much higher rate of turnover. These zones are utilized primarily by patrons of the local businesses.

Table 11: On-Street Parking Occupancy – 2007 Existing Conditions

Segment	Side of Road	Land Use	Parking Restriction	Occupied	Supply	Percent Occupied
40th St *btwn San Pablo Av and Adeline St*	North	I	No Parking(9)	0	0	-
	South	R / C	No Parking(9)	0	0	-
40th St *btwn Adeline St and Market St*	North(1)	R / I	Two-Hour(9)	11	28	39%
	South	R / I	Two-Hour(9)	6	30	20%
40th St *btwn Market St and MLK, Jr. Wy*	North	R / C	Two-Hour(9)	15	40	38%
	South	R	None(9)	35	42	83%
40th St *btwn MLK, Jr. Wy and Telegraph Av*	North	B	None(9)	38	39	97%
	South(2)	B	None(9)	20	21	95%
40th St *btwn Telegraph Av and Webster St*	North	R / C	None(9)	31	32	97%
	South	R / C	None(9)	31	31	100%
40th St *btwn Webster St and Broadway*	North	C	Metered(9)	9	28	32%
	South(3)	C	None(9)	14	29	48%
40th St *btwn Broadway and Piedmont Av*	North(4)	R	Varies(9)	8	9	89%
	South(5)	R	Varies(9)	24	30	80%
W. MacArthur Bl *btwn Market St and MLK, Jr. Wy*	North	R / C	None(9)	3	44	7%
	South	R / C	None	17	45	38%
W. MacArthur Bl *btwn MLK, Jr. Wy and Telegraph Av*	North(6)	B	None(9)	28	30	93%
	South(6)	B	None	33	38	87%
W. MacArthur Bl *btwn Telegraph Av and Webster St*	North	R / C	None(9)	18	28	64%
	South	R / C	None	15	31	48%
W. MacArthur Bl *btwn Webster St and Broadway*	North(7)	C	Two-Hour(9)	4	13	31%
	South(8)	P	None	15	31	48%

Source: DMJM Harris – June 2008
Notes:
On-street parking survey conducted on a weekday between 1:30 PM and 3:00 PM.
All metered parking has a two-hour time limit.
Land Use Abbreviations: B = BART; C = Commercial; I = Industrial; P = Park; R = Residential
(1) Approximately 200 feet of 40th Street is designated as a no parking zone.
(2) Approximately 600 feet of 40th Street is designated as a taxi / bus / passenger loading zone.
(3) Approximately 300 feet of 40th Street is metered parking.
(4) 40th Street (west of Howe Street) is a no parking zone. 40th Street (east of Howe Street) is metered parking. Minimal parking exists on Howe Street.
(5) 40th Street (west of Howe Street) is a two-hour parking zone. 40th Street (east of Howe Street) is metered parking. Minimal parking exists on Howe Street.
(6) Approximately 400 feet of West MacArthur Boulevard is two-hour parking.
(7) Approximately 200 feet of West MacArthur Boulevard is designated as a no parking zone.
(8) Approximately 300 feet of West MacArthur Boulevard is designated as a no parking zone.
(9) Roadway gutter pan is a minimum of six (6) feet wide.

Throughout the study area, five on-street parking restriction types were observed, including:

- No Parking Any Time (including transit stops);
- Loading / Unloading Zone (for passengers and taxis);
- Unrestricted Parking (with the exception of weekly street cleaning);
- Metered Parking (two-hour maximum limit between 9:00 AM and 6:00 PM); and,
- Unmetered Parking (two-hour maximum limit between 9:00 AM and 6:00 PM).

In addition to general on-street parking, many instances of illegal on-street double parking were observed in the eastbound direction of 40th Street between Martin Luther King, Jr. Way and Telegraph Avenue. The double parking occurrences were often brief (less than 30 seconds) and were for passenger loading / unloading. These maneuvers resulted in delays to upstream vehicles that would occasionally spill back to the intersection.

A taxi stand is located on the south side of 40th Street between Martin Luther King, Jr. Way and Telegraph Avenue. The stand has the capacity to accommodate three queued taxis. On several occasions the taxi stand would be utilized by four taxis – where the fourth taxi would block a travel lane. These delays were brief and did not result in significant delays to upstream vehicles.

3.6 SAFETY CONDITIONS

Historical collision data was examined for the study segments of 40th Street and West MacArthur Boulevard over a three year period (2004-2006).(5) All collisions involving vehicles, bicycles and/or pedestrians were noted. **Table 12** provides a summary of the collision data for the study area.

The segments of West MacArthur Boulevard and 40th Street (between Market Street and Broadway) experienced a similar number of vehicular collisions over the three-year period. The 40th Street segment had more pedestrian collisions and West MacArthur Boulevard segment had more vehicular and bicycle collisions. No bicycle collisions were reported on the remaining 40th Street segments (to the west of Market Street or to the east of Broadway) over the three-year period.

The majority of the bicycle-related collisions were caused by vehicles turning into the path of bicyclists. This resulted in several broadside collisions (bicyclists turning left into the path of vehicles) and sideswipes (vehicles turning right into the path of bicyclists). A large number of these collisions occurred at the 40th Street / Telegraph Avenue intersection and the West MacArthur Boulevard / Telegraph Avenue intersection.

(5) State Integrated Traffic Records System (SWITRS) collision data was provided by the City of Oakland and the California Highway Patrol. This data set includes details of all traffic collisions reported in the study area between January 1, 2004 and December 31, 2006.

Table 12: Segment Collision Summary

Segment[(1)]	Incident Type			Total
	Vehicle	Pedestrian	Bicycle	
40th St *btwn San Pablo Av and Market St*	11	1	0	12
40th St *btwn Market St and Broadway*	59	5	5[(2)]	69
40th St *btwn Broadway and Piedmont Av*	2	2	0	4
W. MacArthur Bl *btwn Market St and Broadway*	66	1	7[(3)]	74

Source: DMJM Harris – June 2008
Notes:
Data were collected over a three year period (January 1, 2004 to December 31, 2006).
(1) 40th Street (between San Pablo Avenue and Market Street) = 0.35 miles
40th Street (between San Pablo Avenue and Market Street) = 1.00 miles
40th Street (between San Pablo Avenue and Market Street) = 0.30 miles
West MacArthur Boulevard (between Market Street and Broadway) = 0.95 miles
(2) Persons injured = 2; Persons killed = 0
(3) Persons injured = 3; Persons killed = 0

It should be noted that the data does include the type of object that the motor vehicle collided with (e.g., pedestrian, motor vehicle, and fixed object). However, the data is not differentiated by type of vehicle (e.g., automobile, bus, and shuttle) or collision severity.

4.0 PROJECT ALTERNATIVES

This chapter provides a planning-level evaluation of the suitableness of existing transportation facilities in the study area to accommodate bicycle facilities. This evaluation was conducted to determine which roadway segments were suitable for a more detailed engineering-level analysis. That is, a geometric and operational evaluation of the facilities. Roadways that were determined to be unsuitable for bicycle facility improvements were discarded from further analysis. Three potential alignments were considered:

1. West MacArthur Boulevard;
2. 40th Street; and,
3. 41st Street / 42nd Street.

4.1 POTENTIAL ALTERNATIVES

The project alternatives were evaluated in a two-step process:

- Step 1: Initial Evaluation Alternatives – The purpose of this step is to "screen" the potential alternatives from a planning-level perspective. That is, to determine if the proposed routes would provide safe and direct access between the existing bicycle network and the MacArthur BART Station; regardless of geometric or operational constraints.
- Step 2: Feasibility Analysis Alternatives – The purpose of this step is to perform an engineering-level evaluation of the alternatives that meet the initial evaluation criteria. This analysis includes an evaluation of project-induced geometric modifications and multi-modal operational impacts.

Initial Evaluation Alternatives

Each of the three potential alignments were disaggregated into segments based on the key issues to be studied for each segment. It should be noted that the overall recommendations consider using different segments of different streets if they could be connected together to provide a viable bicycle facility. The three alignments were disaggregated into nine segments, as shown in **Figure 13**. The nine segments include:

A. West MacArthur Boulevard (Broadway to Market Street);
B. West MacArthur Boulevard (Market Street to Hollis Street);
C. 40th Street (Piedmont Avenue to Broadway);
D. 40th Street (Broadway to Telegraph Avenue);
E. 40th Street (Telegraph Avenue to Martin Luther King, Jr. Way);
F. 40th Street (Martin Luther King, Jr. Way to San Pablo Avenue);
G. 41st Street (Piedmont Avenue to Broadway);
H. 41st Street (Broadway to Telegraph Avenue); and,
I. 41st Street / 42nd Street (Telegraph Avenue to San Pablo Avenue).

A planning-level evaluation of the nine segments was conducted to determine which roadway segments were feasible for an engineering-level analysis. The criteria utilized to conduct this initial evaluation included: geometric configuration, roadway continuity, existing and future bicycle facilities, and potential transit and parking conflicts. The results of this evaluation are shown in **Table 13**.

Based on the preliminary analysis, two of the nine segments were discarded from further study. The segment of West MacArthur Boulevard between Market Street and Hollis Street would not be able to safely and adequately accommodate bicycle facilities. This segment of roadway functions as a grade separated freeway off-ramp with walls on either side. The roadway accommodates vehicles moving at a high rate of speed and is geometrically constrained. Additionally, the intersection of Adeline Street and San Pablo Avenue is a complex, six-legged intersection and vehicles utilizing West MacArthur Boulevard cannot cross via this intersection.

The segment of 41st Street and 42nd Street between Telegraph Avenue and San Pablo Avenue would not be able to adequately accommodate bicycle facilities. The 41st Street crossing at Telegraph Avenue is uncontrolled and is a high traffic intersection. The segment would require bicyclists to navigate an indirect route as 41st Street does not cross under the freeway. Additionally, this segment does not provide direct access to the MacArthur BART Station and would not synchronize with the Emeryville bicycle network.

An alternative to providing a jog at Webster Street would be to provide a jog at Telegraph Avenue. However, the 41st Street / Telegraph Avenue intersection is two-way stop-controlled and would be difficult for bicyclists to traverse. An evaluation of this intersection was conducted to determine if a signal is warranted in accordance with the methodology presented in the 2003 edition of the *Manual on Uniform Traffic Control Devices* (*MUTCD*) published by the Federal Highway Administration (FHWA). The results of these analyses determined that signalization of the intersection is not warranted. Therefore, providing a jog at Telegraph Avenue between 40th Street and 41st Street is not feasible and was discarded as a potential alternative.

Table 13: Potential Bicycle Facility Segments

Segment		Advantage	Disadvantage	Viable?
A	West MacArthur Boulevard *Broadway to Market St*	• Few buses • Six-lane roadway capacity		Yes
B	West MacArthur Boulevard *Market St to Hollis St*		• Tunnel freeway ramps • Poor crossing at San Pablo Avenue	No
C	40th Street *Piedmont Av to Broadway*	• Howe St to Broadway can accommodate class 2 bicycle lanes	• Discontinuous	Yes
D	40th Street *Broadway to Telegraph Av*	• Can accommodate class 2 bicycle lanes with lane reduction	• Potential bus conflicts	Yes
E	40th Street *Telegraph Av to MLK, Jr. Wy*	• Class 2 bicycle lanes installed by other projects		Yes
F	40th Street *MLK, Jr. Wy to San Pablo Av*	• May accommodate class 2 bicycle lanes	• Potential bus conflicts	Yes
G	41st Street *Piedmont Av to Broadway*	• May accommodate class 2 bicycle lanes	• Diagonal parking	Yes
H	41st Street *Broadway to Telegraph Av*	• Residential street suitable for Bicycle Boulevard	• Potential need to remove stop control on 41st Street	Yes
I	41st Street / 42nd Street *Telegraph Av to San Pablo Av*	• Residential streets suitable for Bicycle Boulevard	• Uncontrolled crossing at Telegraph Avenue jog • 41st Street does not cross under freeway • 1-2 blocks from BART station • Poor connection to Emeryville network	No

Source: DMJM Harris – June 2008
Notes:
Segments determined not to be viable were discarded from further analysis.

Feasibility Analysis Alternatives

The objective of the proposed project is to provide safe bicycle access to the MacArthur BART Station via the existing City of Emeryville and City of Oakland bicycle networks. As proposed in the *40th Street Bikeway Study*, bicycle lanes could be constructed on 40th Street between San Pablo Avenue and Piedmont Avenue. For the purposes of this analysis, the following alternatives have been evaluated:

- Lane Reduction Alternative – 40th Street (between San Pablo Avenue and Piedmont Avenue) or West MacArthur Boulevard (between Hollis Street and Broadway) could accommodate class 2 bicycle lanes with the removal of a travel lane (in each direction). This alternative would likely be the most cost efficient while providing the best access to the MacArthur BART Station. However, this alternative would result in vehicle, shuttle, and transit operational impacts to the transportation system.
- Median Narrowing Alternative – 40th Street (between San Pablo Avenue and Piedmont Avenue) could accommodate class 2 bicycle lanes with the narrowing of the center median. This modification does not require an operations analysis as adequate space for bicycle lanes would be provided, while maintaining the existing roadway lane configuration. However, this would be the most expensive of the proposed alternatives.
- Parking Removal Alternative – 40th Street (between San Pablo Avenue and Piedmont Avenue) and West MacArthur Boulevard (between Hollis Street and Broadway) could accommodate class 2 bicycle lanes with the removal of on-street parking. This modification does not require an operations analysis as adequate space for bicycle lanes would be provided, while maintaining the existing roadway lane configuration. However, this would substantially affect residential and commercial parking.
- Bicycle Boulevard Alternative – 41st Street (between Telegraph Avenue and Broadway) is a residential roadway that could accommodate a class 3B bicycle boulevard. This alternative does not require an operations analysis as geometric modifications to the roadway are not being considered.

The feasibility of the aforementioned alternatives was determined based on a variety of variables including safety, environmental impacts, network connectivity, and improvement cost. A qualitative assessment of bicycle planning, design, and education practices to be considered for bicycle facilities in the City of Oakland is contained in *A Survey of Planning, Design, and Education for Bikeways and Bus Routes on Urban Streets* (**Appendix F** contains this survey).[6]

(6) A Survey of Planning, Design, and Education for Bikeways and Bus Routes on Urban Streets. City of Oakland, Community & Economic Development Agency, Transportation Services Division, Bicycle / Pedestrian Facilities Program. June 2008.

5.0 FEASIBILITY ANALYSIS

The feasibility analysis addresses the effects of the potential project alternatives, in the existing and future year conditions. The traffic feasibility analysis only pertains to the Lane Reduction Alternative. Unlike the Lane Reduction Alternative, the Bicycle Boulevard Alternative, Parking Removal Alternative, and Median Narrowing Alternative would not impact transportation operations.

5.1 LANE REDUCTION ALTERNATIVE

The objective of the Lane Reduction Alternative is to provide improved safe bicycle access to the MacArthur BART Station via the existing City of Emeryville and City of Oakland bicycle networks. As proposed in the *40th Street Bikeway Study*, bicycle lanes were previously found to be feasible on 40th Street between San Pablo Avenue and Piedmont Avenue. For the purposes of this analysis, the West MacArthur Boulevard has been evaluated as an additional candidate for the construction of bicycle lanes. It should be noted that the 41st Street / 42nd Street corridor is also a bicycle facility alternative. However, it does not require an operations analysis as extensive modifications to the roadway are not required to implement a class 3 bicycle facility.

To accommodate bicycle lanes in the Lane Reduction Alternative, the removal of a travel lane (in each direction) on 40th Street and West MacArthur Boulevard would be required. Modifications to lane striping would be insufficient to accommodate bicycle lanes due to geometric constraints. The Lane Reduction Alternative roadway cross sections are shown in **Figure 14**.

5.2 SIGNIFICANCE CRITERIA

The City of Oakland's criteria were used to determine if the project would result in a significant impact to vehicle delay, on-street parking capacity, or transit ridership. The City of Oakland's significance criteria were developed in accordance with the *California Environmental Quality Act* (CEQA).

Traffic

A project would normally have a significant effect on the environment if it would cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections), or change the condition of an existing street (i.e., street closures, changing direction of travel) in a manner that would substantially impact access or traffic load and capacity of the street system, as defined below:

- At a study, signalized intersection, which is located **outside the Downtown**(7) area, the project would cause the level of service (LOS) to degrade to worse than LOS D (i.e., E);(8)
- 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., F);
- 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., F);
- 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., F);
- At a study, signalized intersection for **all areas** where the level of service is LOS F, the project would cause (a) the total intersection average vehicle delay to increase by two (2) or more seconds, or (b) an increase in average delay for any of the critical movements of four (4) seconds or more; or (c) the volume-to-capacity ("V/C") ratio exceeds three (3) percent (but only if the delay values cannot be measured accurately);
- At a study, unsignalized intersection "for **all areas**, the project would add ten (10) or more vehicles and after project completion satisfy the Caltrans peak hour volume warrant";
- Cause a roadway segment on the Metropolitan Transportation System to operate at LOS F or increase the V/C ratio by more than three (3) percent for a roadway segment that would operate at LOS F without the project;

It should be noted that the project is not located within the downtown area and no roadways in the study area are identified as facilities on the Metropolitan Transportation System. The majority of the traffic-specific criteria are not applicable to this analysis as no project-generated trips will be added to the network.

Parking

The Court of Appeals has held that parking is not part of the permanent physical environment, that parking conditions change over time as people change their travel patterns, and that unmet parking demand created by a project need not be considered a significant environmental impact under CEQA unless it would cause significant secondary effects.(9) Parking supply/demand varies by time of day, day of week, and seasonally. As parking demand increases faster than the supply, parking prices rise to reach equilibrium

(7) Downtown is defined in the Land Use and Transportation Element of the General Plan (page 67) as the area generally bounded by West Grand Avenue to the north, Lake Merritt and Channel Park to the east, the Oakland Estuary to the south and I-980/Brush Street to the west.

(8) LOS and delay calculations for local intersections should be based on the *Highway Capacity Manual*, Transportation Research Board, National Research Council, 2000 edition.

(9) San Franciscans Upholding the Downtown Plan v. the City and County of San Francisco (2002) 102 Cal.App.4th 656.

between supply and demand. Decreased availability and increased costs result in changes to people's mode and pattern of travel.

Parking deficits may be associated with secondary physical environmental impacts, such as air quality and noise effects, caused by congestion resulting from drivers circling as they look for a parking space. However, the absence of a ready supply of parking spaces, combined with available alternatives to auto travel (e.g., transit service, shuttles, taxis, bicycles or travel by foot), may induce drivers to shift to other modes of travel, or change their overall travel habits. Any such resulting shifts to transit service, in particular, would be in keeping with the City's "Transit First" policy.

Additionally, concerning potential secondary effects, cars circling and looking for a parking space in areas of limited parking supply is typically a temporary condition, often offset by a reduction in vehicle trips due to others who are aware of constrained parking conditions in a given area. Hence, any secondary environmental impacts that might result from a shortfall in parking, in the study area, are considered less than significant.

Transit

According to the City of Oakland's significance criteria, the project would have a significant impact if it would do the following:

- Increase the average ridership on AC Transit lines by three (3) percent at bus stops where the average load factor with the project in place would exceed 125% over a peak thirty minute period;
- Increase the peak hour average ridership on BART by three (3) percent where the passenger volume would exceed the standing capacity of BART trains; or
- Increase the peak hour average ridership at a BART station by three (3) percent where average waiting time at fare gates would exceed one minute.

Other Considerations

According to the City of Oakland's significance criteria, the project would have a significant effect if it would do the following:

- Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks;
- Substantially increase traffic hazards to motor vehicles, bicycles, or pedestrians due to a design feature (e.g., sharp curves or dangerous intersections) that does not comply with Caltrans design standards or incompatible uses (e.g., farm equipment);
- Result in less than two emergency access routes for streets exceeding 600 feet in length; or
- Fundamentally conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle routes).

Construction Period

Potential short-term construction impacts generated by the proposed project would include the impacts associated with the delivery of construction materials and equipment, removal of construction debris, and parking for construction workers.

5.3 2007 EXISTING (OPTIMIZED) CONDITIONS

In the 2007 Existing Conditions, many of the traffic signals operate less than optimally, given the transportation conditions. The traffic signal cycle lengths are longer than necessary, poorly coordinated, and the roadways with greater demand receive less green time than roadways with less demand. Signals that do not operate optimally result in higher average vehicle delays and longer average travel times. Since the subsequent feasibility analyses assume signal optimization at all study intersections, the existing signal timing has been modified to operate optimally for the purposes of this analysis. This is done so that comparisons to the 2007 Existing Conditions will reflect the transportation impacts to vehicle, shuttle, and transit delay caused solely by the proposed project – not the signal optimization.

The signal timing modifications were limited to cycle length, coordination, and timing splits – changes which can be easily made given the existing signal equipment. The optimization did not include any modifications to the control types and did not exceed the limitations of the signal control software (e.g., pretimed signal controllers could not function as actuated controllers). Additionally, vehicle and pedestrian clearance times were maintained.

The 2007 Existing (optimized) Conditions were developed to present the 2007 Existing Conditions with the implementation of signal optimization so that appropriate comparisons can be made. This modification would only impact the transportation analyses that are a function of signal timing – traffic and transit operations.

5.3.1 TRAFFIC OPERATIONS

Table 14 presents a comparison of the 2007 Existing and 2007 Existing (optimized) operating conditions, respectively, for the weekday AM and weekday PM peak hours. In all subsequent analyses, the 2007 Existing (optimized) Conditions will be presented in lieu of the 2007 Existing Conditions.

It should be noted that at several locations the delay increases slightly in the 2007 Existing (optimized) Conditions. This is the result of signal optimization of upstream and downstream intersections. Although the individual intersection delay may increase slightly, the overall optimized system improvements are substantial.

In the 2007 Existing (optimized) Conditions, none of the 14 intersections operate at LOS E or LOS F during the weekday AM or weekday PM peak hour.

Table 14: Intersection Level of Service – 2007 Existing (optimized) Conditions

Intersection		Peak Hour	2007 Existing		2007 Existing (opt)	
			LOS	Delay	LOS	Delay
1	40th St / Adeline St	AM	B	12.9	B	12.6
		PM	B	11.4	B	17.0
2	40th St / Market St	AM	B	13.8	A	8.2
		PM	C	20.9	A	9.3
3	40th St / West St	AM	B	14.8	B	14.7
		PM	C	20.2	B	12.6
4	40th St / MLK, Jr. Wy	AM	A	8.1	A	5.8
		PM	B	12.9	A	9.5
5	40th St / Telegraph Av	AM	B	12.8	A	7.9
		PM	B	16.6	A	9.6
6	40th St / Webster St	AM	B	14.4	B	10.2
		PM	A	5.1	A	7.3
7	40th St / Shafter Av	AM	A	7.1	A	9.7
		PM	A	8.0	A	8.8
8	40th St / Broadway	AM	B	15.7	B	13.3
		PM	B	19.4	A	8.4
9	W. MacArthur Bl / Market St	AM	B	16.6	B	10.8
		PM	C	24.5	B	13.4
10	W. MacArthur Bl / West St	AM	B	16.4	A	9.7
		PM	B	13.6	A	9.1
11	W. MacArthur Bl / MLK, Jr. Wy	AM	B	12.7	B	10.9
		PM	B	12.0	A	8.6
12	W. MacArthur Bl / Telegraph Av	AM	B	18.6	B	14.8
		PM	C	31.3	B	17.3
13	W. MacArthur Bl / Webster St	AM	A	7.4	A	7.3
		PM	B	11.3	A	9.6
14	W. MacArthur Bl / Broadway	AM	D	44.3	C	29.3
		PM	D	42.1	D	42.0

Source: DMJM Harris – June 2008
<u>Notes:</u>
Delay in seconds per vehicle for all intersections.
"Opt" denotes that the signal timing has been optimized.
Weekday AM peak hour = 7:00 AM to 9:00 AM; Weekday PM peak hour = 4:00 PM to 6:00 PM.

5.3.2 TRANSIT OPERATIONS

Table 15 presents a comparison of the 2007 Existing and 2007 Existing (optimized) transit operating conditions, respectively, for the weekday PM peak hour.

Table 15: Transit Travel Time – Baseline Conditions

Service Line	Direction[(1)]	Average Travel Time	
		2007 Existing	2007 Existing (opt)
C	EB	6.5	5.7
	WB	---	---
F	EB	2.1	1.8
	WB	2.0	2.0
12[(2)]	EB	3.2	3.5
	WB	---	---
14	EB	6.6	5.4
	WB	4.5	3.6
18[(2)]	EB	3.9	2.8
	WB	2.3	2.6
57	EB	7.5	6.4
	WB	6.6	6.0
Total Buses	**EB**	**5.1**	**4.3**
	WB	**4.1**	**3.9**
Emery-Go-Round	EB	3.2	2.8
	WB	1.9	1.7
Total Shuttles	**EB**	**3.2**	**2.8**
	WB	**1.9**	**1.7**

Source: DMJM Harris – June 2008
Notes:
Average travel time in minutes.
"Opt" denotes that the signal timing has been optimized.
Analysis of weekday PM peak hour (5:00 PM to 6:00 PM).
Bus service line represents AC Transit route designation.
Emery-Go-Round shuttles include the Hollis North, Hollis South, BART Shopper, and Watergate shuttles.
Analysis section includes 40th Street between Adeline Street and Telegraph Avenue.
(1) Relative to direction of travel with respect to 40th Street.
(2) Eastbound and westbound direction convention are opposite of AC Transit convention.

5.4 2007 LANE REDUCTION ALTERNATIVE (OPTIMIZED) CONDITIONS

This section presents the operational impacts of the Lane Reduction Alternative on the transportation network in the 2007 Existing Conditions.

5.4.1 TRAFFIC OPERATIONS

Table 16 presents the impacts of the Lane Reduction Alternative on intersection operations in the 2007 Existing (optimized) Conditions. It should be noted that the signal timing at all study intersections was optimized to accommodate the Lane Reduction Alternative roadway modifications.

In the 2007 Lane Reduction Alternative (optimized) Conditions, none of the 14 intersections would operate at LOS E or LOS F during the weekday AM or weekday PM peak hour.

It should be noted that at several locations the delay increases slightly in the 2007 Lane Reduction Alternative (optimized) Conditions. This is the result of signal optimization of upstream and downstream intersections. Although the individual intersection delay may increase slightly, the overall optimized system improvements are substantial.

Table 16: Intersection Level of Service – 2007 Lane Reduction Alternative (optimized) Conditions

Intersection		Peak Hour	2007 Existing (opt)		2007 Lane Reduction (opt)	
			LOS	Delay	LOS	Delay
1	40th St / Adeline St	AM	B	12.6	B	16.5
		PM	B	17.0	B	14.8
2	40th St / Market St	AM	A	8.2	B	13.5
		PM	A	9.3	C	21.9
3	40th St / West St	AM	B	14.7	B	10.1
		PM	B	12.6	B	13.9
4	40th St / MLK Wy	AM	A	5.8	B	12.3
		PM	A	9.5	B	14.7
5	40th St / Telegraph Av	AM	A	7.9	B	16.7
		PM	A	9.6	B	18.2
6	40th St / Webster St	AM	B	10.2	B	12.6
		PM	A	7.3	B	13.0
7	40th St / Shafter Av	AM	A	9.7	A	9.3
		PM	A	8.8	B	11.0
8	40th St / Broadway	AM	B	13.3	B	10.3
		PM	A	8.4	B	13.2
9	W. MacArthur Bl / Market St	AM	B	10.8	B	13.4
		PM	B	13.4	B	20.0
10	W. MacArthur Bl / West St	AM	A	9.7	B	13.4
		PM	A	9.1	B	16.0
11	W. MacArthur Bl / MLK, Jr. Wy	AM	B	10.9	B	11.2
		PM	A	8.6	B	13.3
12	W. MacArthur Bl / Telegraph Av	AM	B	14.8	B	16.7
		PM	B	17.3	B	14.8
13	W. MacArthur Bl / Webster St	AM	A	7.3	B	12.8
		PM	A	9.6	B	12.4
14	W. MacArthur Bl / Broadway	AM	C	29.3	C	32.9
		PM	D	42.0	D	42.6

Source: DMJM Harris – June 2008
Notes:
Delay in seconds per vehicle for all intersections.
"Opt" denotes that the signal timing has been optimized.
Weekday AM peak hour = 7:00 AM to 9:00 AM; Weekday PM peak hour = 4:00 PM to 6:00 PM.

5.4.2 TRANSIT OPERATIONS

Table 17 presents the impacts of the Lane Reduction Alternative on transit operations in the 2007 Existing (optimized) Conditions. The average travel time was determined by utilizing the VISSIM simulation software. It should be noted that the signal timing at all study intersections was optimized to accommodate the Lane Reduction Alternative roadway modifications.

Table 17: Transit Travel Time – 2007 Lane Reduction Alternative (optimized) Conditions

Service Line	Direction[1]	Average Travel Time	
		2007 Existing (opt)	2007 Lane Reduction (opt)
C	EB	5.7	5.8
	WB	---	---
F	EB	1.8	1.9
	WB	2.0	2.1
12[2]	EB	3.5	4.5
	WB	---	---
14	EB	5.4	6.1
	WB	3.6	3.9
18[2]	EB	2.8	3.6
	WB	2.6	3.0
57	EB	6.4	6.5
	WB	6.0	6.2
Total Buses	**EB**	**4.3**	**4.7**
	WB	**3.9**	**4.2**
Emery-Go-Round	EB	2.8	2.8
	WB	1.7	2.3
Total Shuttles	**EB**	**2.8**	**2.8**
	WB	**1.7**	**2.3**

Source: DMJM Harris – June 2008
<u>Notes:</u>
Average travel time in minutes.
"Opt" denotes that the signal timing has been optimized.
Analysis of weekday PM peak hour (5:00 PM to 6:00 PM).
Bus service line represents AC Transit route designation.
Emery-Go-Round shuttles includes the Hollis North, Hollis South, BART Shopper, and Watergate shuttles.
Analysis section includes 40th Street between Adeline Street and Telegraph Avenue.
(1) Relative to direction of travel with respect to 40th Street .
(2) Eastbound and westbound direction convention are opposite of AC Transit convention.

The majority of the simulated increases in transit travel time along the 40th Street corridor were minor. The largest simulated increase in AC Transit travel time occurred for the eastbound line 12 – where the travel time increased by 29 percent, from 3.5 minutes to 4.5 minutes. In the eastbound direction, the simulated AC Transit travel time increased by nine percent, from 4.3 minutes to 4.7 minutes. In the westbound direction, the simulated AC Transit travel time increased by 15 percent, from 3.9 minutes to 4.5 minutes. In the eastbound direction, the simulated Emery-Go-Round travel time experienced a negligible increase in travel time. In the westbound direction, the simulated AC Transit travel time increased by 35 percent, from 1.7 minutes to 2.3 minutes.

It should be noted that the reduction of 40th Street from two lanes to one lane in each direction would not be expected to increase the number of blockages on the vehicle travel lanes. Double parking would likely occur in the bicycle lanes and would only partially occupy the travel lane. Vehicles would have ample roadway width to pass a double-parked vehicle on the left. For example, as shown in **Figure 14C**, the 40th Street cross section between Yerba Buena Avenue and Martin Luther King, Jr. Way would be 32 feet wide in each direction. The effect of a double-parked vehicle with the implementation of the Lane Reduction Alternative is likely no different from the 2007 Existing Conditions.

5.4.3 BICYCLE OPERATIONS

The bicycle compatibility index was calculated at two locations on 40th Street and two locations on West MacArthur Boulevard (eastbound and westbound directions) for the weekday PM peak hour of traffic operations. At all four of the analysis locations, the Lane Reduction Alternative would result in the implementation of a dedicated class 2 bicycle lane, thus, increasing the level of comfort of the bicyclist. The results of the BCI calculations are included in **Table 18**.

All eight of the segments operate at LOS C or better in the 2007 Lane Reduction Alternative (optimized) Conditions. These improvements to bicycle compatibility are primarily due to the geometric modifications.

Based on the results of the 2007 Lane Reduction Alternative (optimized) Conditions analysis, 40th Street would be more compatible for class 2 bicycle lanes than West MacArthur Boulevard. This is due to the lower 40th Street traffic volumes and wider vehicle lane widths.

Table 18: Bicycle Compatibility Index – 2007 Lane Reduction Alternative (optimized) Conditions

Segment	Direction	2007 Existing (opt)		2007 Lane Reduction (opt)	
		LOS	BCI	LOS	BCI
40th St *btwn Market St and West St*	EB	E	4.69	B	2.02
	WB	D	4.40	B	1.92
40th St *btwn Shafter Av and Broadway*	EB	E	5.18	C	2.56
	WB	E	4.80	C	2.43
W. MacArthur Bl *btwn Market St and West St*	EB	E	4.44	C	2.70
	WB	D	3.99	B	2.23
W. MacArthur Bl *btwn Webster St and Broadway*	EB	E	5.08	C	3.40
	WB	E	5.10	C	3.34

Source: DMJM Harris – June 2008
Notes:
BCI = Bicycle Compatibility Index
"Opt" denotes that the signal timing has been optimized.
BCI calculated for weekday PM peak hour (4:00 PM to 6:00 PM).

5.5 2030 CUMULATIVE (OPTIMIZED) CONDITIONS

The *40th Street Bikeway Study* – completed in 2006 – utilized the 2025 Alameda County Congestion Management Agency (ACCMA) travel demand model to forecast future traffic volumes. Subsequent to the initiation of this report, the ACCMA travel demand model was updated to year 2030 land use and traffic forecasts. This report utilizes year 2030 forecasts for the cumulative year analyses (**Appendix G** contains ACCMA travel demand model plots).

The 2030 Cumulative (optimized) Conditions traffic forecast was developed based on the following data sources:

- ACCMA Travel Demand Model (Forecast Year 2030); and
- MacArthur BART Station Transit Village (Forecast Year 2030).[10]

Traffic volumes are expected to grow significantly in the 2030 Cumulative (optimized) Conditions. Based on the model projections, traffic volumes at the fourteen study intersections are expected to increase by an average of 128% and 80% during the AM and PM peak hours, respectively. The traffic volume increase at individual intersections is expected to vary in the 2030 Cumulative (optimized) Conditions. However, significant traffic volume growth is expected at all study intersections on 40th Street and West MacArthur Boulevard.

(10) *MacArthur BART Station Transit Village*, Fehr & Peers, August 2007.

The traffic volumes that are projected by utilizing the forecasts generated by the 2030 ACCMA travel demand model are significantly larger than the forecasts generated by the 2025 ACCMA travel demand model. The possible reasons for the discrepancies in the two models include:

<u>Forecast Year</u>
The current ACCMA model utilizes data projections for the Year 2030. The superseded ACCMA model utilized data projections for the Year 2025. Since additional, positive growth is expected in Alameda County between 2025 and 2030, deviations in the traffic forecasts would be expected in 2030. In this case, the increased horizon year likely results in greater traffic volume projections.

<u>Land Use Updates</u>
The current ACCMA models (Year 2025 and Year 2030) utilize input data in the form of land uses. These land uses act as zones of vehicle trip production and vehicle trip attraction. Trips to and from these zones are assigned to the modeled roadways. The forecasted land uses are expected to generate more trips in the Year 2030 than had been forecasted in the Year 2025 model. Therefore, more trips are assigned to the modeled roadways in the Year 2030 ACCMA model. The land uses in the Year 2030 ACCMA model are consistent with the land use projections provided by the Association of Bay Area Governments (ABAG).

The differences in the traffic volumes that are projected by utilizing the forecasts generated by the Year 2030 ACCMA model yield significantly different operational results than the forecasts generated by the Year 2025 ACCMA model.

5.5.1 TRAFFIC OPERATIONS

Figure 15 presents the weekday AM and weekday PM peak hour traffic volumes in the 2030 Cumulative (optimized) Conditions for the study intersections. **Table 19** presents the results of the intersection LOS analysis for the 2030 Cumulative (optimized) weekday AM and weekday PM peak hour conditions. It should be noted that the signal timing at all study intersections was optimized for the 2030 Cumulative (optimized) Conditions.

In the 2030 Cumulative (optimized) Conditions, three of the 14 intersections would operate at LOS E or LOS F during the weekday AM or weekday PM peak hour. These intersections include:

- 40th Street / Telegraph Avenue (PM peak hour);
- West MacArthur Boulevard / Telegraph Avenue (AM & PM peak hours); and,
- West MacArthur Boulevard / Broadway (AM & PM peak hours).

Table 19: Intersection Level of Service – 2030 Cumulative (optimized) Conditions

Intersection		Peak Hour	2030 Cumulative (opt)	
			LOS	Delay
1	40th St / Adeline St	AM	C	24.1
		PM	B	14.4
2	40th St / Market St	AM	D	41.4
		PM	C	28.8
3	40th St / West St	AM	C	21.3
		PM	B	14.5
4	40th St / MLK, Jr. Wy	AM	B	17.5
		PM	B	15.1
5	40th St / Telegraph Av	AM	D	43.1
		PM	**F**	**> 80.0**
6	40th St / Webster St	AM	A	9.9
		PM	A	6.8
7	40th St / Shafter Av	AM	A	8.0
		PM	A	6.2
8	40th St / Broadway	AM	B	18.2
		PM	C	25.7
9	W. MacArthur Bl / Market St	AM	C	33.9
		PM	D	51.9
10	W. MacArthur Bl / West St	AM	C	24.1
		PM	B	17.1
11	W. MacArthur Bl / MLK, Jr. Wy	AM	A	9.9
		PM	B	18.8
12	W. MacArthur Bl / Telegraph Av	AM	**F**	**> 80.0**
		PM	**F**	**> 80.0**
13	W. MacArthur Bl / Webster St	AM	B	12.0
		PM	B	12.0
14	W. MacArthur Bl / Broadway	AM	**F**	**> 80.0**
		PM	**F**	**> 80.0**

Source: DMJM Harris – June 2008
Notes:
Delay in seconds per vehicle for all intersections.
Bold denotes intersections operating at LOS E or F.
"Opt" denotes that the signal timing has been optimized.
Weekday AM peak hour = 7:00 AM to 9:00 AM; Weekday PM peak hour = 4:00 PM to 6:00 PM.

5.5.2 TRANSIT OPERATIONS

Table 20 presents the results of the 40th Street travel time analysis for the 2030 Cumulative (optimized) weekday PM peak hour conditions.

Table 20: Transit Travel Time – 2030 Cumulative (optimized) Conditions

Service Line	Direction[1]	Average Travel Time 2030 Cumulative (opt)
C	EB	6.8
	WB	---
F	EB	2.1
	WB	2.2
12[2]	EB	4.5
	WB	---
14	EB	7.1
	WB	4.0
18[2]	EB	3.9
	WB	2.6
57	EB	8.5
	WB	6.6
Total Buses	**EB**	**5.4**
	WB	**4.5**
Emery-Go-Round	EB	3.8
	WB	2.0
Total Shuttles	**EB**	**3.8**
	WB	**2.0**

Source: DMJM Harris – June 2008
Notes:
Average travel time in minutes.
"Opt" denotes that the signal timing has been optimized.
Analysis of weekday PM peak hour (5:00 PM to 6:00 PM).
Bus service line represents AC Transit route designation.
Emery-Go-Round shuttles include the Hollis North, Hollis South, BART Shopper, and Watergate shuttles.
Analysis section includes 40th Street between Adeline Street and Telegraph Avenue
(1) Relative to direction of travel with respect to 40th Street.
(2) Eastbound and westbound direction convention are opposite of AC Transit convention.

Based on the results of the VISSIM microsimulation, the average travel time required for AC Transit buses to traverse the 40th Street corridor is approximately six minutes in the eastbound direction and five minutes in the westbound direction. The average travel time required for Emery-Go-Round shuttles to traverse the 40th Street corridor is approximately four minutes in the eastbound direction and two minutes in the westbound direction.

5.5.3 BICYCLE OPERATIONS

The bicycle compatibility index was calculated at four locations (eastbound and westbound directions) for the weekday PM peak hour of traffic operations. The results of the 2030 Cumulative (optimized) Conditions BCI calculations are included in **Table 21**.

All of the BCI study segments on 40th Street and West MacArthur Boulevard would operate at LOS E or LOS F in the 2030 Cumulative (optimized) Conditions.

Table 21: Bicycle Compatibility Index – 2030 Cumulative (optimized) Conditions

Segment	Direction	2030 Cumulative (opt)	
		LOS	BCI
40th St *btwn Market St and West St*	EB	E	5.29
	WB	E	5.02
40th St *btwn Shafter Av and Broadway*	EB	F	> 5.30
	WB	F	> 5.30
W. MacArthur Bl *btwn Market St and West St*	EB	E	4.76
	WB	E	5.03
W. MacArthur Bl *btwn Webster St and Broadway*	EB	F	> 5.30
	WB	F	> 5.30

Source: DMJM Harris – June 2008
Notes:
BCI = Bicycle Compatibility Index
"Opt" denotes that the signal timing has been optimized.
BCI calculated for weekday PM peak hour (4:00 PM to 6:00 PM).

5.6 2030 LANE REDUCTION ALTERNATIVE (OPTIMIZED) CONDITIONS

This section presents the operational impacts of the Lane Reduction Alternative on the multi-modal transportation network in the 2030 Cumulative (optimized) Conditions.

5.6.1 TRAFFIC OPERATIONS

Table 22 presents the impacts of the Lane Reduction Alternative on intersection operations in the 2030 Cumulative (optimized) Conditions for the weekday AM and weekday PM peak hour. It should be noted that the signal timing at all study intersections was optimized to accommodate the Lane Reduction Alternative roadway modifications.

In the 2030 Lane Reduction Alternative (optimized) Conditions, ten of the 14 intersections would operate at LOS E or LOS F during the weekday AM or weekday PM peak hour. These intersections include:

- 40th Street / Adeline Street (AM & PM peak hours);
- 40th Street / Market Street (AM & PM peak hours);
- 40th Street / West Street (AM & PM peak hours);
- 40th Street / Martin Luther King, Jr. Way (PM peak hour);
- 40th Street / Telegraph Avenue (AM & PM peak hours);
- West MacArthur Boulevard / Market Street (AM & PM peak hours);
- West MacArthur Boulevard / West Street (PM peak hour);
- West MacArthur Boulevard / Martin Luther King, Jr. Way (PM peak hour);
- West MacArthur Boulevard / Telegraph Avenue (AM & PM peak hours); and,
- West MacArthur Boulevard / Broadway (AM & PM peak hours).

In the 2030 Cumulative (optimized) Conditions, three of the 14 study intersections would operate at LOS E or LOS F. With the implementation of the Lane Reduction Alternative, seven intersections would degrade to operate at LOS E or LOS F. Based on the results of the 2030 Cumulative (optimized) Conditions intersection analysis, implementation of the Lane Reduction Alternative is infeasible on 40th Street from Adeline Street to Martin Luther King, Jr. Way and on West MacArthur Boulevard from Market Street to Telegraph Avenue.

5.6.2 TRANSIT OPERATIONS

Table 23 presents the impacts of the Lane Reduction Alternative on transit operations in the 2030 Cumulative (optimized) Conditions. The average travel time was determined by utilizing the VISSIM microsimulation model. It should be noted that the signal timing at all study intersections was optimized to accommodate the Lane Reduction Alternative roadway modifications.

Table 22: Intersection Level of Service – 2030 Lane Reduction Alternative (optimized) Conditions

Intersection		Peak Hour	2030 Cumulative (opt)		2030 Lane Reduction (opt)	
			LOS	Delay	LOS	Delay
1	40th St / Adeline St	AM	C	24.1	**E**	**75.9**
		PM	B	14.4	**E**	**57.7**
2	40th St / Market St	AM	D	41.4	**F**	**> 80.0**
		PM	C	28.8	**F**	**> 80.0**
3	40th St / West St	AM	C	21.3	**E**	**75.9**
		PM	B	14.5	**F**	**> 80.0**
4	40th St / MLK, Jr. Wy	AM	B	17.5	D	39.7
		PM	B	15.1	**F**	**> 80.0**
5	40th St / Telegraph Av	AM	D	43.1	**F**	**> 80.0**
		PM	**F**	**> 80.0**	**F**	**> 80.0**
6	40th St / Webster St	AM	A	9.9	B	15.6
		PM	A	6.8	C	28.6
7	40th St / Shafter Av	AM	A	8.0	B	10.1
		PM	A	6.2	B	11.6
8	40th St / Broadway	AM	B	18.2	C	28.6
		PM	C	25.7	D	49.8
9	W. MacArthur Bl / Market St	AM	C	33.9	**F**	**> 80.0**
		PM	D	51.9	**F**	**> 80.0**
10	W. MacArthur Bl / West St	AM	C	24.1	C	33.7
		PM	B	17.1	**E**	**62.8**
11	W. MacArthur Bl / MLK, Jr. Wy	AM	A	9.9	C	29.2
		PM	B	18.8	**F**	**> 80.0**
12	W. MacArthur Bl / Telegraph Av	AM	**F**	**> 80.0**	**F**	**> 80.0**
		PM	**F**	**> 80.0**	**F**	**> 80.0**
13	W. MacArthur Bl / Webster St	AM	B	12.0	C	20.2
		PM	B	12.0	D	51.9
14	W. MacArthur Bl / Broadway	AM	**F**	**> 80.0**	**F**	**> 80.0**
		PM	**F**	**> 80.0**	**F**	**> 80.0**

Source: DMJM Harris – June 2008
Notes:
Delay in seconds per vehicle for all intersections.
Bold denotes intersections operating at LOS E or F.
"Opt" denotes that the signal timing has been optimized.
Weekday AM peak hour = 7:00 AM to 9:00 AM; Weekday PM peak hour = 4:00 PM to 6:00 PM.

Table 23: Transit Travel Time – 2030 Lane Reduction Alternative (optimized) Conditions

Service Line	Direction(1)	Average Travel Time	
		2030 Cumulative (opt)	2030 Lane Reduction (opt)
C	EB	6.8	8.5
	WB	---	---
F	EB	2.1	4.5
	WB	2.2	3.1
12(2)	EB	4.5	6.6
	WB	---	---
14	EB	7.1	10.2
	WB	4.0	6.6
18(2)	EB	3.9	4.0
	WB	2.6	6.8
57	EB	8.5	9.7
	WB	6.6	7.6
Total Buses	**EB**	**5.4**	**7.9**
	WB	**4.5**	**5.6**
Emery-Go-Round	EB	3.8	6.9
	WB	2.0	2.8
Total Shuttles	**EB**	**3.8**	**6.9**
	WB	**2.0**	**2.8**

Source: DMJM Harris – June 2008
Notes:
Average travel time in minutes.
"Opt" denotes that the signal timing has been optimized.
Analysis of weekday PM peak hour (5:00 PM to 6:00 PM).
Bus service line represents AC Transit route designation.
Emery-Go-Round shuttles includes the Hollis North, Hollis South, BART Shopper, and Watergate shuttles.
Analysis section includes 40th Street between Adeline Street and Telegraph Avenue.
(1) Relative to direction of travel with respect to 40th Street.
(2) Eastbound and westbound direction convention are opposite of AC Transit convention.

The majority of the simulated increases in transit travel time along the 40th Street corridor were minor. The largest simulated increase in AC Transit travel time occurred for the westbound line 18 – where the travel time increased from 2.6 minutes to 6.8 minutes. In the eastbound direction, the simulated AC Transit travel time increased by 46 percent, from 5.4 minutes to 7.9 minutes. In the westbound direction, the simulated AC Transit travel time increased by 24 percent, from 4.5 minutes to 5.6 minutes. In the eastbound direction, the simulated Emery-Go-Round travel time increased by 82 percent, from 3.8

minutes to 6.9 minutes. In the westbound direction, the simulated Emery-Go-Round travel time increased by 40 percent, from 2.0 minutes to 2.8 minutes.

It should be noted that the reduction of 40th Street from two lanes to one lane in each direction would not be expected to increase the number of blockages on the vehicle travel lanes. Double parking would likely occur in the bicycle lanes and would only partially occupy the travel lane. Vehicles would have ample roadway width to pass a double-parked vehicle on the left. As shown in **Figure 14C**, the 40th Street cross section between Yerba Buena Avenue and Martin Luther King, Jr. Way would be 32 feet wide in each direction. The effect of a double-parked vehicle with the implementation of the Lane Reduction Alternative is likely no different than the 2030 Cumulative (optimized) Conditions.

5.6.3 BICYCLE OPERATIONS

The bicycle compatibility index was calculated at four locations (eastbound and westbound directions) for the weekday PM peak hour of traffic operations in the 2030 Cumulative (optimized) Conditions. At all four of the analysis locations, the Lane Reduction Alternative would result in the implementation of a dedicated class 2 bicycle lane, thus, increasing the level of comfort of the bicyclist. The results of the BCI calculations are included in **Table 24**.

Table 24: Bicycle Compatibility Index – 2030 Lane Reduction Alternative (optimized) Conditions

Segment	Direction	2030 Cumulative (opt)		2030 Lane Reduction (opt)	
		LOS	BCI	LOS	BCI
40th St *btwn Market St and West St*	EB	E	5.29	B	2.22
	WB	E	5.02	B	2.13
40th St *btwn Shafter Av and Broadway*	EB	F	> 5.30	C	2.69
	WB	F	> 5.30	C	2.70
W. MacArthur Bl *btwn Market St and West St*	EB	E	4.76	C	3.10
	WB	E	5.03	D	3.56
W. MacArthur Bl *btwn Webster St and Broadway*	EB	F	> 5.30	D	3.76
	WB	F	> 5.30	E	4.81

Source: DMJM Harris – June 2008
Notes:
BCI = Bicycle Compatibility Index
"Opt" denotes that the signal timing has been optimized.
BCI calculated for weekday PM peak hour (4:00 PM to 6:00 PM).

Seven of the eight segments operate at LOS D or better in the 2030 Lane Reduction Alternative (optimized) Conditions. All of the 40th Street segments operate at LOS C or better. These improvements to bicycle compatibility are due to the geometric modifications.

Based on the results of the 2030 Lane Reduction Alternative (optimized) Conditions analysis, 40th Street would be more compatible for class 2 bicycle lanes than West MacArthur Boulevard. All of the evaluated 40th Street segments would operate at LOS B or LOS C with the implementation of the Lane Reduction Alternative. All of the evaluated West MacArthur Boulevard segments would operate at LOS C, LOS D, or LOS E with the implementation of the Lane Reduction Alternative. These improvements in BCI level of service are due to the addition of class 2 bicycle lanes.

6.0 RECOMMENDED ALTERNATIVE

The traffic, transit, and bicycle analyses determined that the Lane Reduction Alternative would be infeasible in many parts of the study corridors in the 2030 Cumulative (optimized) Conditions. The Lane Reduction Alternative would cause significant adverse impacts to vehicle delay at several intersections as the operations would degrade to LOS E and LOS F. Additionally, the Lane Reduction Alternative would cause AC Transit buses and Emery-Go-Round shuttles to experience increases in delay of up to four minutes along the 0.7-mile long 40th Street corridor. However, class 2 bicycle lanes would be feasible if the roadway geometry could be maintained with a median narrowing.

These findings differ from the previous *40th Street Bikeway Study* recommendations due to the variations in the ACCMA travel demand forecast models. The year 2025 model assumed much less cumulative growth than the year 2030 model assumes.

6.1 FEASIBLE ALTERNATIVES

Given the expected degradation of the network with the implementation of the Lane Reduction Alternative, the implementation of a bicycle facility without lane reductions was considered. The remaining three feasible alternatives included the:

- Median Narrowing Alternative – 40th Street (between San Pablo Avenue and Piedmont Avenue) could accommodate class 2 bicycle lanes with the narrowing of the center median.
- Parking Removal Alternative – 40th Street (between San Pablo Avenue and Piedmont Avenue) and West MacArthur Boulevard (between Hollis Street and Broadway) could accommodate class 2 bicycle lanes with the removal of on-street parking.
- Bicycle Boulevard Alternative – 41st Street (between Telegraph Avenue and Broadway) is a residential roadway that could accommodate a class 3B bicycle boulevard.

Additionally, although the Lane Reduction Alternative could not be implemented in its entirety, the results of the feasibility analysis showed that certain sections of the network could accommodate bicycle lanes with a travel lane reduction without adverse to transportation operations.

Per the consensus of the TAC, none of the alternatives was independently optimal for the following reasons:

- Median Narrowing Alternative – Although a median narrowing is geometrically feasible, this alternative is relatively expensive. In addition to the demolition of the existing median and reconstruction of a new, more narrow median, modifications to the existing traffic signals would be required. Also, the existing median is landscaped and contains a number of trees. The implementation of the Median Narrowing Alternative would require the removal of several of the trees and some of the landscape.

- Parking Removal Alternative – The removal of on-street parking for bicycle lanes would likely be contested by residents, business owners, and BART patrons. As discussed in Section 3.5, parking on 40th Street and West MacArthur Boulevard is well utilized. This alternative would likely be difficult to implement due to public opposition. Additionally, it should be noted that due to roadway configuration, the entirety of many class 2 bicycle lane segments would be located completely in roadway gutter pans. Many of the roadway gutter pans on 40th Street and West MacArthur Boulevard are approximately six (6) feet wide.
- Bicycle Boulevard Alternative – The bicycle boulevard alone would not provide direct access to the MacArthur BART Station and would only extend from Telegraph Avenue to Piedmont Avenue. This alternative would not provide a safe connection between 41st Street and the new bicycle lanes to be constructed on 40th Street between Martin Luther King, Jr. Way and Telegraph Avenue. The 41st Street / Telegraph Avenue intersection is not signalized and does not meet signalization warrants based on MUTCD criteria.
- Lane Reduction Alternative – As discussed in Section 5.6.1, the majority of the evaluated intersections would operate at LOS E or LOS F in the 2030 Cumulative (optimized) Conditions with the implementation of the Lane Reduction Alternative. However, several intersections would continue to operate acceptably with reduced capacity, including the 40th Street / Webster Street, 40th Street / Shafter Avenue, 40th Street / Broadway, and West MacArthur Boulevard / Webster Street intersections.

6.2 RECOMMENDED BICYCLE FACILITIES

Although not recommended in their entirety, the feasible alternatives were applied to the segments and examined on a case-by-case basis. Typically, the recommended alternatives were determined based on a variety of variables including safety, environmental impacts, network connectivity, and improvement cost. An explanation of the Recommended Alternative, on a segment-by-segment basis is presented as follows (these segments are shown in **Figure 5**):

<u>Segment A – West MacArthur Boulevard (Broadway to Market Street)</u>
Due to the unacceptable motor vehicle delay from a lane reduction, the segments that would be subject to this type of modification were minimized. However, based on the results of the feasibility analysis, a lane reduction is feasible between Telegraph Avenue and Broadway as the West MacArthur Boulevard / Webster Street intersection would not degrade to LOS E or LOS F. Therefore, a class 2 bicycle lane is recommended between Telegraph Avenue and Broadway. It should be noted that the signal cycle length and splits at the West MacArthur Boulevard / Webster Street intersection would need to be optimized to maintain adequate operating conditions.

Additionally, a class 3A arterial bicycle route is recommended between the MacArthur BART Station access roadway and Telegraph Avenue. With the implementation of these facilities, access may be provided between the MacArthur BART Station and Broadway.

It should be noted that class 2 bicycle lanes may be feasible between the MacArthur BART Station access roadway and Telegraph Avenue in the westbound direction as the roadway width is variable and a small amount of parking could be removed. The eastbound direction is subject to more constraints as a lane reduction is infeasible at the West MacArthur Boulevard / Telegraph Avenue intersection. The feasibility of class 2 bicycle lanes is subject to future study.

Segment B – West MacArthur Boulevard (Market Street to Hollis Street)
This segment was eliminated from the feasibility analysis per Section 4.1 of this report.

Segment C – 40th Street (Piedmont Avenue to Broadway)
This segment was considered for implementation of a bicycle facility based on low traffic volumes and direct access to the 40th Street / Broadway intersection. However, this segment was discarded as a lane reduction is not feasible on 40th Street to the West of Broadway. Alternatively, Segment G (41st Street, a parallel roadway) would provide adequate roadway width to accommodate bicyclists. Additionally, the 41st Street alternative roadway is continuous and accommodates less vehicle traffic. Therefore, Segment G is superior and Segment C was discarded as a recommended alternative.

Segment D – 40th Street (Broadway to Telegraph Avenue)
Based on the feasibility analysis, Segment D would operate adequately between Telegraph Avenue and Broadway with the implementation of the Lane Reduction Alternative in the 2030 Cumulative (optimized) Conditions. However, based on traffic volumes and bicycle facility connectivity, a bicycle facility on 41st Street is preferred to 40th Street. Therefore, a jog between 40th Street and 41st Street is recommended at Webster Street as Webster Street is an existing class 3 bicycle route.

It should be noted that the Segment D feasibility analysis did not include a quantitative evaluation of transit operations. Although the implementation of the Lane Reduction Alternative would be feasible for traffic operations in the 2030 Cumulative (optimized) Conditions, the corresponding impacts on transit operations cannot be determined given the analysis.

A median narrowing is recommended between Telegraph Avenue and Webster Street. The Telegraph Avenue to Webster Street segment of 40th Street is approximately 1,000 feet long and includes two unsignalized intersections (Clarke Street and Ruby Street). Additionally, the lane geometry at the Telegraph Avenue intersection could not be modified due to traffic demands. Any modification to the lane geometry would have to occur several hundred feet to the east of the intersection. Given the segment length, traffic demands, and intersection spacing, this segment would not well accommodate a lane reduction.

Segment E – 40th Street (Telegraph Avenue to Martin Luther King, Jr. Way)
This segment of 40th Street will be reconfigured as part of the MacArthur BART Station Transit Hub Streetscape Improvement Project. The reconfiguration will include improved pedestrian facilities and loading zones, the implementation of class 2 bicycle lanes, and maintain a four-lane roadway configuration for 40th Street.

Segment F – 40th Street (Martin Luther King, Jr. Way to San Pablo Avenue)

Due to the connectivity between the existing Emeryville bicycle network (terminates at the 40th Street / San Pablo Avenue intersection) and the proposed MacArthur BART Station Transit Hub Streetscape Improvement Project (terminates at the 40th Street / Martin Luther King, Jr. Way intersection), Segment F would provide an attractive direct connection between the two facilities.

Segment F is a four-lane roadway that consists of the following three typical 40th Street cross sections:

- San Pablo Avenue to Adeline Street is 78 feet wide with a raised center median and bus loading zones.
- Adeline Street to Yerba Buena Avenue is 64 feet wide with no center median and on-street parking.
- Yerba Buena Avenue to Martin Luther King, Jr. Way is 80 feet wide with a raised center median and on-street parking.

Due to operational and physical constraints, lane reductions on all three sections of Segment F would be infeasible. The constraints and corresponding recommendations are included as follows:

- The section of 40th Street between San Pablo Avenue and Adeline Street includes several bus stops and cannot be modified to accommodate bicycle lanes due to the transit facility operations. Since this roadway segment is operationally constrained, class 2 bicycle lanes are not feasible. This roadway segment would function as a class 3A arterial bicycle route.
- The section of 40th Street between Adeline Street and Yerba Buena Avenue includes on-street parking and no center median. Due to the high on-street parking occupancy, the removal of on-street parking to accommodate bicycle lanes would not be feasible for this roadway segment. This roadway segment would function as a class 3A arterial bicycle route. It should be noted that the removal of on-street parking would allow adequate width to implement class 2 bicycle lanes and maintain two lanes of roadway in each direction. The feasibility of the removal of on-street parking may be considered as part of a future study.
- The section of 40th Street between Yerba Buena Avenue and Martin Luther King, Jr. Way includes many residences and businesses. Due to a lack of off-street parking and high parking occupancy, the removal of on-street parking to accommodate bicycle lanes would not be feasible for this roadway segment. Additionally, the intersection operations within this roadway segment would degrade significantly in the 2030 Cumulative (optimized) Conditions with a lane reduction. Since this roadway segment has a wide center median, the median could be narrowed and the roadway segment could feasibly accommodate class 2 bicycle lanes. A median narrowing and the implementation of class 2 bicycle lanes is recommended for this roadway section.

Segment G – 41st Street (Piedmont Avenue to Broadway)

This roadway width and on-street parking varies on this segment of 41st Street. The low traffic volumes, continuous roadway connection, and gradual slope make this segment more desirable for bicyclists than Segment C (40th Street, a parallel roadway). The segment of 41st Street between Broadway and Montgomery Street includes parallel on-street parking in the westbound direction and angled on-street parking in the eastbound direction. The parking occupancy on both sides of the street is relatively high, as such, on-street parking removal is likely not feasible. Likewise, converting the angled parking into parallel parking would substantially reduce the number of parking spaces.

Although the segment is relatively wide, the angled parking configuration (eastbound side of roadway) limits the feasibility of installing class 2 bicycle lanes. Constructing bicycle lanes to the south of parked vehicles would result in inadequate space for parking maneuvers as the roadway width between the parking stalls and roadway centerline would decrease. That is, departing vehicles would cross into the conflicting westbound travel lane as the roadway width would narrow. Constructing bicycle lanes to the north (behind vehicles) would result in vehicle / bicycle conflicts within the bicycle lane. Both motorists and bicyclists would likely not proceed cautiously as both would assume the right-of-way. This would compromise the safety of bicyclists.

Designating this segment as a class 3A arterial bicycle route would likely improve safety conditions as bicyclists would proceed cautiously and increase awareness of parking conflicting maneuvers.

Currently, the distance between the roadway centerline and angled parking is approximately 16 feet. The implementation of sharrows would aid motorists in utilizing the far left of the travel way and bicyclists in utilizing the far right of the travel way. This configuration would not function as a dedicated bicycle lane but would distinguish which side of the roadway to use.

The segment of 41st Street between Montgomery Street and Piedmont Avenue could adequately accommodate class 2 bicycle lanes while maintaining metered on-street parking.

Segment H – 41st Street (Broadway to Telegraph Avenue)

This segment is a residential roadway that could be designated as a class 3B bicycle boulevard. As proposed in the discussion of Segment D (40th Street, parallel roadway), based on traffic volumes and bicycle facility connectivity, bicycle crossing of Telegraph Avenue at 41st Street is preferred to 40th Street. Therefore, a jog between 40th Street and 41st Street is recommended at Webster Street as Webster Street is an existing class 3 bicycle route.

An alternative to providing a jog at Webster Street would be to provide a jog at Telegraph Avenue. However, the 41st Street / Telegraph Avenue intersection is two-way stop-controlled and would be difficult for bicyclists to traverse. An evaluation of this intersection was conducted to determine if a signal is warranted in accordance with the methodology presented in the 2003 edition of the *Manual on Uniform Traffic Control Devices* published by the Federal Highway Administration. The results of these analyses determined that signalization of the intersection is not warranted. Therefore, providing a jog at Telegraph Avenue between 40th Street and 41st Street is not feasible and was discarded as a potential alternative.

Segment I – 41st Street / 42nd Street (Telegraph Avenue to San Pablo Avenue)
This segment was eliminated from the feasibility analysis per Section 3.1 of this report.

The Recommended Alternative bicycle facilities are shown in **Figure 16**. The Recommended Alternative roadway cross sections are shown in **Figure 17**. The recommended bicycle facilities would not significantly impact traffic, transit, pedestrian, or parking conditions in the 2007 Existing or 2030 Cumulative (optimized) Conditions.

6.2.1 BICYCLE OPERATIONS

The bicycle compatibility index was calculated at four locations (eastbound and westbound directions) for the weekday PM peak hour of traffic operations in the 2007 Existing (optimized) Conditions. At the section of 40th Street between Market Street and West Street the median would be narrowed and class 2 bicycle lanes would be installed. At the section of West MacArthur Boulevard between Webster Street and Broadway the roadway would be narrowed by one lane and class 2 bicycle lanes would be installed. At the other two locations no bicycle facilities would be constructed. The results of the BCI calculations for the 2007 Recommended Alternative Conditions are included in **Table 25**.

Table 25: Bicycle Compatibility Index – 2007 Recommended Alternative Conditions

Segment	Direction	2007 Existing (opt)		2007 Recommended	
		LOS	BCI	LOS	BCI
40th St *btwn Market St and West St*	EB	E	4.69	C	3.18
	WB	D	4.40	C	2.90
40th St *btwn Shafter Av and Broadway*	EB	E	5.18	E	5.18
	WB	E	4.80	E	4.80
W. MacArthur Bl *btwn Market St and West St*	EB	E	4.44	E	4.44
	WB	D	3.99	D	3.99
W. MacArthur Bl *btwn Webster St and Broadway*	EB	E	5.08	C	3.26
	WB	E	5.10	C	3.19

Source: DMJM Harris – June 2008
Notes:
BCI = Bicycle Compatibility Index
"Opt" denotes that the signal timing has been optimized.
BCI calculated for weekday PM peak hour (4:00 PM to 6:00 PM).

The two sections of roadway that would be modified to accommodate class 2 bicycle lanes would become more compatible for bicyclists as the BCI would improve to LOS C in both directions. The BCI in the eastbound and westbound sections of 40th Street between Market Street and West Street would improve from LOS E and LOS D, respectively, to LOS C. The BCI in the eastbound and westbound sections of West MacArthur Boulevard between Webster Street and Broadway would improve from LOS E to LOS C.

No bicycle improvements are recommended for the section of 40th Street between Shafter Avenue and Broadway or the section of West MacArthur Boulevard between Market Street and West Street. Accordingly, no changes in BCI are expected.

The results of the BCI calculations for the 2030 Recommended Alternative Conditions are included in **Table 26**.

Table 26: Bicycle Compatibility Index – 2030 Recommended Alternative Conditions

Segment	Direction	2030 Cumulative (opt)		2030 Recommended	
		LOS	BCI	LOS	BCI
40th St *btwn Market St and West St*	EB	E	5.29	D	3.79
	WB	E	5.02	D	3.51
40th St *btwn Shafter Av and Broadway*	EB	F	> 5.30	F	> 5.30
	WB	F	> 5.30	F	> 5.30
W. MacArthur Bl *btwn Market St and West St*	EB	E	4.76	E	4.76
	WB	E	5.03	E	5.03
W. MacArthur Bl *btwn Webster St and Broadway*	EB	F	> 5.30	D	3.61
	WB	F	> 5.30	E	4.66

Source: DMJM Harris – June 2008
Notes:
BCI = Bicycle Compatibility Index
"Opt" denotes that the signal timing has been optimized.
BCI calculated for weekday PM peak hour (4:00 PM to 6:00 PM).

The two sections of roadway that would be modified to accommodate class 2 bicycle lanes would become more compatible for bicyclists as the BCI would improve to LOS E or better in both directions. The BCI in the eastbound and westbound sections of 40th Street between Market Street and West Street would improve from LOS E to LOS D. The BCI in the eastbound and westbound sections of West MacArthur Boulevard between Webster Street and Broadway would improve from LOS F to LOS D and LOS E, respectively.

No bicycle improvements are recommended for the section of 40th Street between Shafter Avenue and Broadway or the section of West MacArthur Boulevard between Market Street and West Street. Accordingly, no changes in BCI are expected.

6.3 COST ESTIMATE

The Recommended Alternative would require several modifications to the roadway network (**Appendix H** contains the roadway modification plans). These modifications would include:

- Demolition;
- Curb and Gutter;
- Striping Removal;
- Striping;
- Markings;
- Landscaping;
- Asphalt Concrete Patching;
- Signal Removal; and,
- Signal Furnishing and Installation.

The implementation of the proposed project would cost approximately $800,000. A summary of the proposed cost estimate, by facility segment, is included in **Table 27** (**Appendix I** contains the complete cost estimate). This cost estimate is consistent with recent cost estimates within the City of Oakland.[11]

Table 27: Recommended Alternative Cost Estimate

Segment	Base Cost	Mobilization[1]	Contigencies[2]	Total Cost
40th Street / 41st Street	$528,000	$53,000	$189,000	$770,000
MacArthur Boulevard	$19,000	$2,000	$9,000	$30,000
Total	**$547,000**	**$55,000**	**$198,000**	**$800,000**

Source: DMJM Harris – June 2008
Notes:
Unit values are consistent with those provided by John Clay General Engineering Contractor, Inc. for a bid on the 40th Street, MacArthur Transit Hub Improvements Project that was submitted on August 20, 2007.
(1) Mobilization costs are assumed to be approximately 10% of the base cost.
(2) Contingencies are assumed to be approximately 35% of the base cost.

[11] Unit values are consistent with those provided by John Clay General Engineering Contractor, Inc. for a bid on the 40th Street, MacArthur Transit Hub Improvements Project that was submitted on August 20, 2007.

6.4 TRANSIT FACILITY IMPROVEMENTS

The majority of the existing AC Transit stop facilities on 40th Street (between San Pablo Avenue and Telegraph Avenue) are located on the near-side of the intersections. The location of the existing bus stops are shown in **Figure 10**. Typically, these stops are located outside of the travel way. However, as discussed in section 4.2.2, at designated bus stop locations the operator would frequently block the outside travel lane with the rear of the bus.

The locations of these stops feature advantages and disadvantages. The Transit Cooperative Research Program (TCRP) has developed a general set of guidelines to consider in locating bus stops. The TCRP comparison of the relative advantages and disadvantages of far-side, near-side, and mid-block stops is shown in **Table 28**.[12]

The majority of the bus stop location advantages and disadvantages provided in the TCRP comparative analysis are applicable to the facilities served by AC Transit. However, AC Transit has provided modifications to the TCRP analysis and several additional considerations. The AC Transit comparison of the relative advantages and disadvantages of far-side, near-side, and mid-block stops is shown in **Table 29**.

[12] This comparison is provided in Guidelines for the Location and Design of Bus Stops (Part B), TCRP Report 19. Transit Cooperative Research Program, 1666 K Street, 11th Floor Washington D.C. 20006.

Table 28: TCRP Comparative Analysis of Bus Stop Locations

	Advantage	Disadvantage
Far-Side Stop	• Minimizes conflicts between right turning vehicles and buses. • Provides additional right turn capacity by making curb lane available for traffic. • Minimizes sight distance problems on approaches to intersection. • Encourages pedestrians to cross behind the bus. • Creates shorter deceleration distances for buses since the bus can use the intersection to decelerate. • Results in bus drivers being able to take advantage of the gaps in traffic flow that are created at signalized intersections.	• May result in the intersections being blocked during peak periods by stopping buses. • May obscure sight distance for crossing vehicles. • May increase sight distance problems for crossing pedestrians. • Can cause a bus to stop far side after stopping for a red light, which interferes with both bus operations and all other traffic. • May increase number or rear-end accidents since drivers do not expect buses to stop again after stopping at a red light. • Could result in traffic queued into intersection when a bus is stopped in travel lane.
Near-Side Stop	• Minimizes interferences when traffic is heavy on the far side of the intersection. • Allows passengers to access buses closest to the crosswalk. • Results in the width of the intersection being available for the driver to pull away from the curb. • Eliminates the potential of double stopping. • Allows passengers to board and alight while the bus is stopped at a red light. • Provides driver with the opportunity to look for oncoming traffic, including other buses with potential passengers.	• Increases conflicts with right-turning vehicles. • May result in stopped buses obscuring curbside traffic control devices and crossing pedestrians. • May cause sight distance to be obscured for cross vehicles stopped to the right of the bus. • May block the through lane during peak period with queuing buses. • Increases sight distance problems for crossing pedestrians.
Mid-Block Stop	• Minimizes sight distance problems for vehicles and pedestrians. • May result in passenger waiting areas experiencing less pedestrian congestion.	• Requires additional distance for no-parking restrictions. • Encourages patrons to cross street at midblock (jaywalking). • Increases walking distance for patrons crossing at intersections.

Source: Transit Cooperative Research Program (TCRP); DMJM Harris – June 2008

Table 29: AC Transit Comparative Analysis of Bus Stop Locations

	Advantage	Disadvantage
Far-Side Stop	• Bus stops require less parking removal than near-side stops. • Drivers are able to maneuver the vehicle straight into the stop; whereas when turning into a bus stop, the bus may partially block the adjacent travel lane.	• May result in the intersections being blocked during peak periods by stopping buses if the stop is too short. Typically, if the stop is long enough, the driver will pull up past the intersection. • If drivers are unfamiliar with far-side bus stops, they may obscure sight distance for crossing vehicles; however, this is unlikely. • If pedestrians are unfamiliar with far-side bus stops, they may increase sight distance problems for crossing pedestrians; however, this is unlikely.
Near-Side Stop	• A near-side stop does not necessarily eliminate the potential for double stopping as the light may turn red while the bus is stopped. This may be classified as an extended stop.	• Increases transit delay as buses must wait for green signal prior to departing from bus stop. • Bus stops require more parking removal than far-side stops. • Encourages passengers to cross the street in front of the bus. This increases the opportunity for bus-pedestrian conflicts and increase transit delay.
Mid-Block Stop		• More difficult than near-side and far-side stop configurations for buses to depart bus stop due to conflicting traffic (i.e., fewer gaps). Typically, AC Transit will not consider a mid-block stop unless a pedestrian signal is nearby.

Source: AC Transit; DMJM Harris – June 2008

The majority of the existing near-side bus stops on 40th Street would function well as far-side stops. The far-side stops would likely improve right turn traffic capacity on 40th Street, improve sight distance problems, and allow bus drivers to utilize gaps in traffic flow to accelerate. This would effectively eliminate the need for bus drivers to block lanes of traffic to reenter the roadway.

Other improvements to transit operations and stops could include signal priority / preemption, construction of queue jumping lanes, and exclusive acceleration / deceleration lanes.

The existing roadway and bus stop locations are constrained by the network geometry and signalization. The existing traffic signals are pretimed and cannot be adjusted to facilitate transit priority / preemption without substantial improvements to the existing equipment. The existing on-street parking serves local businesses and residents. Modifications to the on-street parking would be extremely difficult based on these land uses. The existing geometry and pedestrian facilities constrain the implementation of queue jumping and acceleration / deceleration lanes. Therefore, modifications to the existing transit facilities are not recommended at this time.

It should be noted that the transit facilities along the segment of 40th Street between Martin Luther King, Jr. Way and Telegraph Avenue will be reconfigured as part of the MacArthur BART Station Transit Hub Streetscape Improvement Project.

6.5 CONCLUSIONS

The *40th Street Bikeway Feasibility Study* concluded that the addition of a class 2 bicycle lane on 40th Street between San Pablo Avenue and Piedmont Avenue would not significantly impact traffic operations based on year 2025 traffic forecasts. However, the *40th Street Bikeway Feasibility Study* did not evaluate the project effects on the transit network in substantial detail.

This study focuses on transit operations and included an evaluation of additional bicycle facility alternatives on multiple corridors. A preliminary, planning-level evaluation determined that two proposed segments – West MacArthur Boulevard (between Hollis Street and Market Street) and 41st Street / 42nd Street (between San Pablo Avenue and Telegraph Avenue) – could not adequately accommodate bicycle facilities. These segments were discarded from further analysis.

Utilizing the recently updated 2030 ACCMA travel demand model (the *40th Street Bikeway Feasibility Study* utilized the superseded 2025 ACCMA travel demand model), the feasibility analysis determined that the Lane Reduction Alternative would significantly impact the vehicle delay at several of the study intersections in the 2030 Cumulative (optimized) Conditions. Additionally, the Lane Reduction Alternative would increase transit travel time along 40th Street by several minutes.

Based on the operational and financial constraints, the Feasible Alternatives were modified. The Recommended Alternative included the modified bicycle facilities, median narrowing, and supplemental feasibility analyses. The Recommended Alternative includes the following bicycle facilities:

- West MacArthur Boulevard (BART Frontage Road to Telegraph Avenue) – Class 3A Arterial Bicycle Route;
- West MacArthur Boulevard (Telegraph Avenue to Broadway) – Class 2 Bicycle Lanes;
- 40th Street (San Pablo Avenue to Yerba Buena Avenue) – Class 3A Arterial Bicycle Route;
- 40th Street (Yerba Buena Avenue to Martin Luther King, Jr. Way) – Class 2 Bicycle Lanes;
- 40th Street (Telegraph Avenue to Webster Street) – Class 2 Bicycle Lanes;
- 41st Street (Webster Street to Montgomery Street) – Class 3B Bicycle Boulevard; and,
- 41st Street (Montgomery Street to Piedmont Avenue) – Class 2 Bicycle Lanes.

It should be noted that class 2 bicycle lanes may be feasible on West MacArthur Boulevard between the MacArthur BART Station access roadway and Telegraph Avenue with on-street parking removal and an evaluation of the variable roadway width. Class 2 bicycle lanes may be feasible on 40th Street between Adeline Street and Yerba Buena Avenue with on-street parking removal. The feasibility of these improvements could be evaluated as part of a future study.

The estimated construction cost of the Recommended Alternative is approximately $800,000.