December 17, 2012

Mr. Steve Tweed
City of Long Beach, Department of Public Works
Traffic & Transportation Bureau, 10th Floor City Hall
333 West Ocean Boulevard
Long Beach, CA 90802

Subject: Broadway and Third Street Protected Bikeway 12-Month "Before" and "After" Study in the City of Long Beach

Dear Mr. Tweed:

KOA Corporation is pleased to present our study of before and after conditions for the protected bikeway demonstration project along Broadway and Third Street in the City of Long Beach. The protected bikeways were constructed as a demonstration project for Federal Highway Administration review. The 12-month "Before and After" analysis is presented in this report to evaluate Broadway and Third Street traffic conditions before and after implementation of the improvement measures. The attached report presents our findings and analysis.

This report is being submitted to you for comment and review. Please contact me if you have any questions concerning the study methodology or analysis. It has been a pleasure to provide this study report to the City of Long Beach.

Sincerely,

Min Zhou, P.E.
Vice President

J:\2012\JB23052 LB 12 Mo After Study 3rd & Broadway\Documents\Report\JB23052_LB_Before_After_Study-11-08-12.DOC

Broadway and Third Street Protected Bikeway Study
"Before" and 12-Month "After" Conditions

City of Long Beach
December 2012

Prepared for:
City of Long Beach
Department of Public Works
Traffic & Transportation Bureau
10th Floor City Hall
333 West Ocean Boulevard
Long Beach, CA 90802

Prepared by:

KOA CORPORATION
PLANNING & ENGINEERING

2141 West Orangewood Avenue, Suite A, Orange, CA 92868
714/573-0317 Phone

Job No: JB23052

Table of Contents

1. EXECUTIVE SUMMARY 1

1.1 Executive Summary 1

2. BACKGROUND 10

2.1 Design Concept 10
2.2 ADA Compliance 11
2.3 FHWA Review 11

3. PHYSICAL ROADWAY CONDITIONS 15

3.1 Broadway Roadway Conditions 15
3.1.1 Broadway Before Implementation 15
3.1.2 Broadway After Implementation 16
3.2 Third Street Roadway Conditions 17
3.2.1 Third Street Before Implementation 17
3.2.2 Third Street After Implementation 17

4. PEDESTRIAN AND BICYCLE USAGE 18

4.1 Broadway Pedestrian and Bicycle Usage 19
4.2 Third Street Pedestrian and Bicycle Usage 21

5. VEHICULAR TRAFFIC ANALYSIS 23

5.1 Roadway Segment Traffic Volumes 23
5.2 Intersection Peak Hour Traffic Volumes 24
5.3 Intersection Operations Analysis 29

6. SPEED AND BEHAVIORAL ANALYSIS 31

6.1 Conditions Before Implementation 31
6.2 Conditions After Implementation 31
6.3 Travel Time Delay Study 32

7. CRASH HISTORY 34

7.1 Crash History 34
7.1.1 Broadway Crash History 34
7.1.2 Third Street Crash History 35
7.2 Crash Data Comparison Before and After Implementation 36

8. PARKING CONDITIONS 39

8.1 Parking Background 39
8.1.1 On-Street Parking 39
8.1.2 Off-Street Parking 40
8.2 Parking Analysis 41
8.2.1 Parking Supply Inventory 41
8.2.2 Parking Demand 42
8.3 Parking Conclusion 44

9. DESIGN CONSIDERATIONS 46

9.1 Non-Standard Intersections 46
9.1.1 Broadway at Alamitos Avenue 46
9.1.2 Third Street at Alamitos Avenue 47
9.1.3 Crossing Light Rail Lines at Pacific Avenue and at Long Beach Boulevard. 47
9.1.4 Access to Hydrants 50
9.2 Pedestrian Impediments 50
9.3 Drainage 50
9.4 Driveway Conflicts 50

10. SUMMARY AND CONCLUSIONS 54

List of Figures

FIGURE 1.1 – CHANGE IN OVERALL USE OF 3RD STREET AND BROADWAY 2
FIGURE 1.2 – DECREASES IN BICYCLE AND VEHICLE COLLISIONS AND..... 2
85TH PERCENTILE TRAFFIC SPEEDS..... 2
FIGURE 1.3 – BICYCLE ACTIVITY ALONG BROADWAY, BEFORE AND AFTER IMPLEMENTATION..... 4
FIGURE 1.4 – CHANGES IN AM PEAK HOUR VOLUMES AFTER IMPLEMENTATION..... 6
FIGURE 1.5 – CHANGES IN PM PEAK HOUR VOLUMES AFTER IMPLEMENTATION..... 7
FIGURE 2.1 - PROJECT AREA..... 12
FIGURE 2.2 - PROJECT STREET CROSS-SECTIONS..... 13
FIGURE 3.1 – BROADWAY BEFORE IMPLEMENTATION..... 15
FIGURE 3.2 – BROADWAY AFTER IMPLEMENTATION..... 15
FIGURE 3.3 – PROJECT STREET CROSS-SECTIONS..... 16
FIGURE 3.4 – THIRD STREET BEFORE IMPLEMENTATION..... 17
FIGURE 3.5 – THIRD STREET AFTER IMPLEMENTATION..... 17
FIGURE 5.1 – STUDY AREA INTERSECTION LOCATIONS..... 24
FIGURE 5.2 – AM PEAK HOUR INTERSECTION VOLUMES, BEFORE IMPLEMENTATION..... 25
FIGURE 5.3 – PM PEAK HOUR INTERSECTION VOLUMES, BEFORE IMPLEMENTATION..... 26
FIGURE 5.4 – AM PEAK HOUR INTERSECTION VOLUMES, AFTER IMPLEMENTATION..... 27
FIGURE 5.5 – PM PEAK HOUR INTERSECTION VOLUMES, AFTER IMPLEMENTATION..... 28
FIGURE 7.1 – CRASH HISTORY RELATED TO BICYCLES, (ONE EXAMPLE) AFTER IMPLEMENTATION..... 38
FIGURE 8.1 – PUBLIC PARKING LOT LOCATIONS..... 40
FIGURE 8.2 – PARKING OCCUPANCY BY BLOCK..... 45
FIGURE 9.1 – DESIGN CONSIDERATIONS FOR BROADWAY AT ALAMITOS AVENUE..... 48
FIGURE 9.2 – DESIGN CONSIDERATIONS FOR THIRD STREET AT ALAMITOS AVENUE..... 49
FIGURE 9.3 – DESIGN CONSIDERATIONS FOR BROADWAY AT PACIFIC AVENUE..... 51
FIGURE 9.4 – DESIGN CONSIDERATIONS FOR BROADWAY BETWEEN MAGNOLIA AVENUE AND CHESTNUT AVENUE..... 52
FIGURE 10.1 – BICYCLE AND PEDESTRIAN COUNTS ON BROADWAY, BEFORE AND 12-MONTH AFTER IMPLEMENTATION..... 56
FIGURE 10.2 – BICYCLE AND PEDESTRIAN COUNTS ON THIRD STREET, BEFORE AND 12-MONTH AFTER IMPLEMENTATION..... 57

List of Tables

TABLE 1.1 – BICYCLE, PEDESTRIAN, AND VEHICLE ACTIVITY BEFORE AND AFTER IMPLEMENTATION 2
TABLE 1.2 – BICYCLE, PEDESTRIAN, AND VEHICLE ACTIVITY ON BROADWAY, BEFORE AND AFTER IMPLEMENTATION 3
TABLE 1.3 – BICYCLE, PEDESTRIAN, AND VEHICLE ACTIVITY ON THIRD STREET, BEFORE AND AFTER IMPLEMENTATION 5
TABLE 4.2 – PEDESTRIAN AND BICYCLE COUNTS, BROADWAY BETWEEN PACIFIC AVENUE AND PINE AVENUE, BEFORE AND AFTER IMPLEMENTATION 20
TABLE 4.3 – PEDESTRIAN AND BICYCLE COUNTS, THIRD STREET BETWEEN LINDEN AVENUE AND ELM AVENUE, BEFORE AND AFTER IMPLEMENTATION 21
TABLE 4.4 – PEDESTRIAN AND BICYCLE COUNTS, THIRD STREET BETWEEN PACIFIC AVENUE AND PINE AVENUE, BEFORE AND AFTER IMPLEMENTATION 22
TABLE 5.1 – VEHICULAR TRAFFIC COUNTS ON BROADWAY AND THIRD STREET, BEFORE AND AFTER IMPLEMENTATION 23
TABLE 5.2 – INTERSECTION OPERATIONS ANALYSIS RESULTS FOR BROADWAY, BEFORE AND AFTER IMPLEMENTATION 29
TABLE 5.3 – INTERSECTION OPERATIONS ANALYSIS RESULTS FOR THIRD STREET, BEFORE AND AFTER IMPLEMENTATION 30
TABLE 6.1 – TRAVEL TIME DELAY STUDY FOR BICYCLES ON BROADWAY AND THIRD STREET 32
TABLE 6.2 – TRAVEL TIME DELAY STUDY FOR VEHICLES ON BROADWAY AND THIRD STREET 33
TABLE 7.1 – SUMMARY OF THREE-YEAR VEHICLE, BICYCLE, AND PEDESTRIAN CRASH HISTORY ON BROADWAY AND THIRD STREET. 36
TABLE 7.2 – THREE-YEAR CRASH EXPERIENCE ON BROADWAY AND THIRD STREET, BEFORE AND AFTER IMPLEMENTATION 37
TABLE 8.1 – PARKING SUPPLY ON BROADWAY 41
TABLE 8.2 – PARKING SUPPLY ON THIRD STREET 42
TABLE 10.1 – BICYCLE, PEDESTRIAN, AND VEHICLE ACTIVITY ON BROADWAY AND THIRD STREET, BEFORE AND AFTER IMPLEMENTATION 55

Appendices

Appendix 4.1 – Bicycle Count Data Sheets
Appendix 4.2 – Pedestrian Count Data Sheets
Appendix 5.1 – Vehicular Traffic Count Data Sheets
Appendix 5.2 – Intersection Operations Analysis Worksheets for Conditions Before Project Implementation
Appendix 5.3 – Intersection Operations Analysis Worksheets for Conditions 12-Months After Project Implementation
Appendix 6.1 – Speed Survey Data Sheets
Appendix 7.1 – Crash History Data Sheets

1. Executive Summary

1.1 Executive Summary

In April 2011 the City of Long Beach installed two one-way cycle tracks (aka separated lanes) on Broadway and 3rd Streets, which transect the heart of the downtown area. The project provides one-way bikeways along the left side of each street, separated from traffic by a parking lane and a raised curb. One traffic lane was removed to accommodate the protected bike lane. Traffic signals were also modified at most intersections to provide bicycle signals and left turn arrows for vehicle traffic.

The FHWA requires a 12-month "Before" and "After" study to review the effects these changes have had on bicycle, pedestrian, and vehicle conditions along the two streets. This study therefore provides a technically comprehensive report to compare baseline conditions before construction of the cycle tracks with conditions after implementation of the project. The study is intended to not only meet the FHWA 12-month study requirement but also to provide a review of design issues beyond those approved in the Permission to Experiment.

The two project streets, Broadway and Third Street between Magnolia Avenue and Alamitos Avenue are both one-way streets each approximately one mile long, with 11 and 12 signalized cross intersections respectively. Before implementing the protected bikeway project, both Broadway and Third Street had three travel lanes with parking on both sides of the street. With implementation of the protected bikeway project in April 2011, both streets now provide a one-way bikeway along the left side of the one-way street, separated from traffic by a parking lane and a raised curb. The protected bikeway project also modified traffic signals at most intersections to provide bicycle signals and to install left turn arrows for motorists turning across the bike lane and across the adjacent pedestrian crosswalk.

Implementation of the protected bikeway project on 3rd and Broadway resulted in a 33% overall increase in the number of bicyclists using the two streets. At the same time there has been a nearly 60% decrease in the total number of bike and pedestrian related collisions, and a 30% decrease in the number of bicyclists on the sidewalk. The two streets have also experienced a 13% increase in the number of pedestrians since implementation of the project.

While the amount of bicycle and pedestrian activity on the two streets has increased significantly, vehicle traffic volumes and speeds are down since project implementation. Peak hour traffic counts are down by 12%, while 85th percentile traffic speeds have dropped on both streets. On 3rd Street, traffic speeds have dropped from 36 mph to 27 mph, and on Broadway speeds have gone from 30 mph to 26 mph.

An additional benefit of the project has been a reduction in collision rates. Prior to implementation, there had been an average of 6 bicycle-related collisions per year on the two streets. In the 1 year post-implementation study period just 3 bicycle-related collisions have occurred. Traffic accidents are also down. Rates for vehicle crashes dropped by nearly 25% after project implementation, from an average of about 70 per year for the previous three years to 53 per year during the one-year study period.

Table 1.1 summarizes the changes in bicycle, pedestrian, and vehicle activity on the two streets.

Table 1.1 – Bicycle, Pedestrian, and Vehicle Activity Before and After Implementation

Measure	Before Implementation	After Implementation
Total Bicycle Volume	437 (6 Hours)	583 (6 Hours) +33%
Total Pedestrian Volume	3,451 (6 Hours)	3,892 (6 Hours) +13%
Total Traffic Volume	6,300 (6 Hours)	5,550 (6 Hours) -12%
85th Percentile Traffic Speed	36 mph (3rd Street) 30 mph (Broadway)	27 mph (3rd Street) 26 mph (Broadway)
Bike-Related Collisions	6 Crashes per Year	3 Crashes per Year
Vehicle Crashes	69 per Year	53 per Year

Figure 1.1 illustrates the change in overall use of 3rd Street and Broadway by bicyclists, pedestrians, and vehicles.

FIGURE 1.1 – CHANGE IN OVERALL USE OF 3RD STREET AND BROADWAY

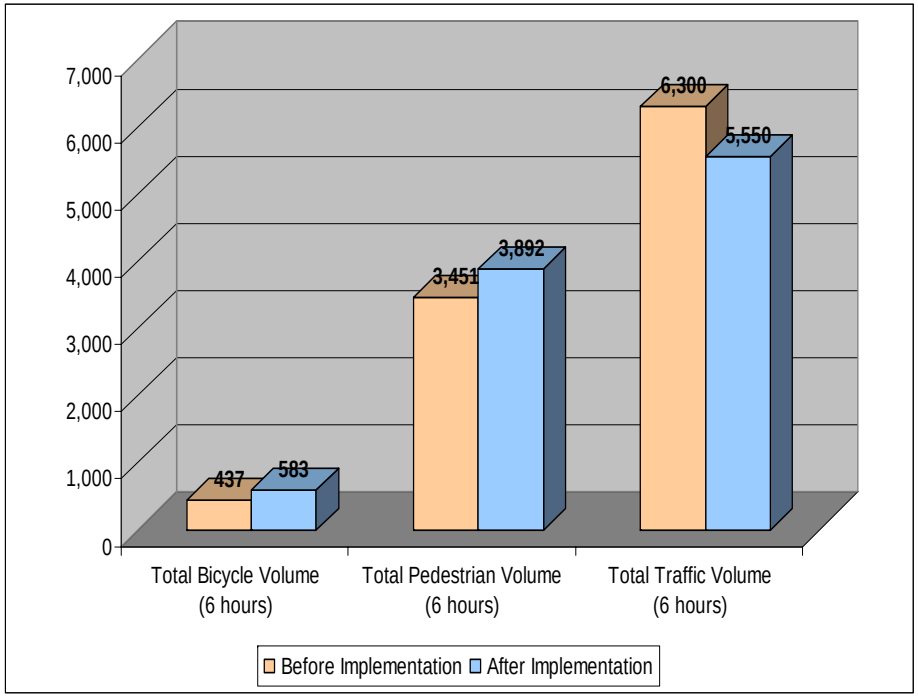


Figure 1.2 shows the decrease in bicycle and vehicle collisions, and the decrease in 85th percentile traffic speeds.

FIGURE 1.2 – DECREASES IN BICYCLE AND VEHICLE COLLISIONS AND 85TH

PERCENTILE TRAFFIC SPEEDS

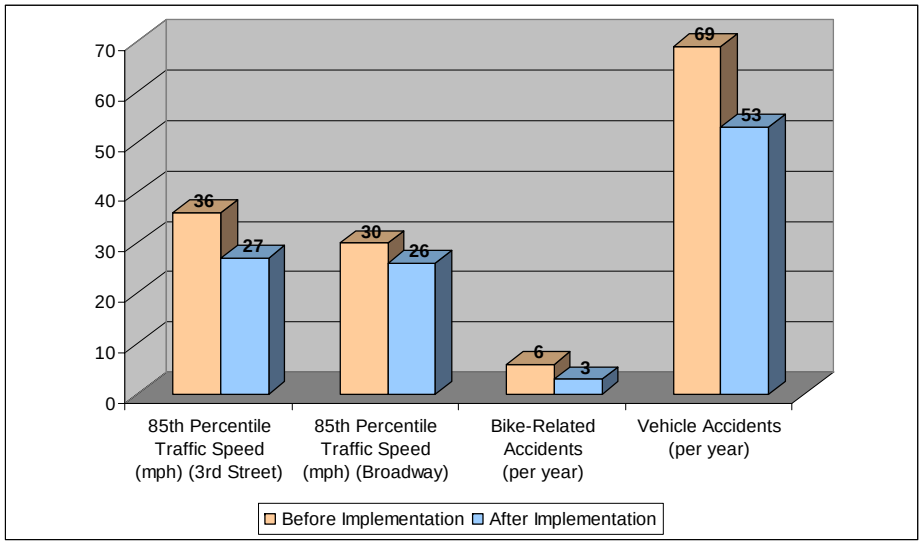


Table 1.2 summarizes the levels of bicycle, pedestrian, and vehicle activity on Broadway prior to and after implementation. The number of crashes involving bicycles is also documented in this table.

As shown in Table 1.2, average daily traffic volume on Broadway has decreased by about 700 per day since implementation. Peak hour traffic volumes have decreased by about 1,000 in six hours. The reason may be the decreased speed caused by the travel lane reduction. Bicycle volumes have increased by about 20%. Pedestrian volumes have also increased, perhaps indicating a public perception of a more "pedestrian friendly" environment. Three reported bicycle crashes have occurred over the 1-year trial period after implementation, compared with twelve crashes over the 3-year period prior to implementation (approximately four per year on average). This indicates conditions for cyclists are safer with the new configuration.

Table 1.2 – Bicycle, Pedestrian, and Vehicle Activity on Broadway, Before and After Implementation

Measure	Before Implementation	After Implementation
Average Daily Traffic Volume	13,100/day (average)	12,400/day (average)
Traffic Volume (6 Hours)	6,800	5,800
Bicycle Volume (6 Hours)	239	283
Pedestrian Volume (6 Hours)	1,946	2,296
Traffic Speed (85th Percentile)	30 MPH	26 MPH
Bicycle Crashes	12 (over 3 years)	3 (in one year)

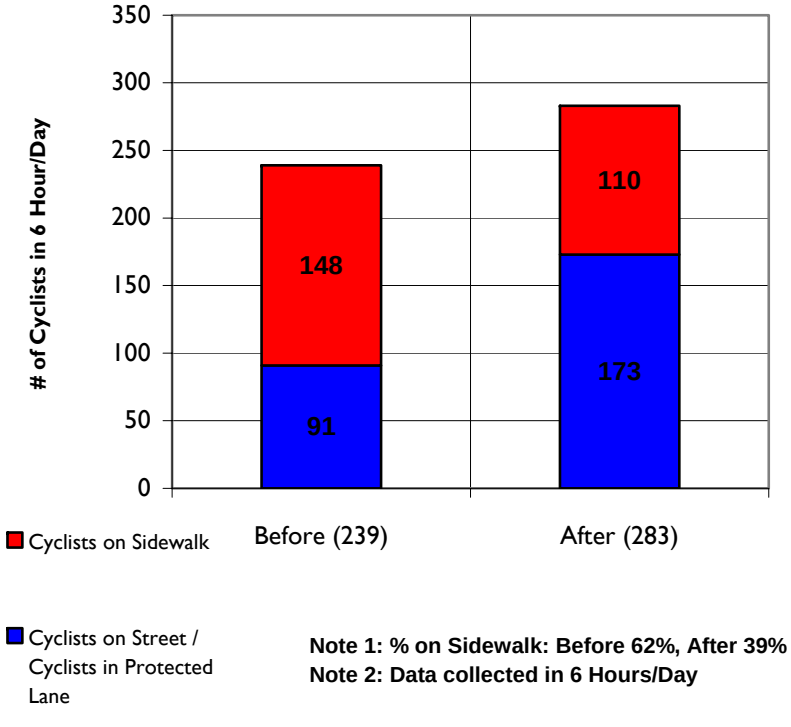
Figure 1.3 illustrates the bicycle volumes and distribution along the street before and after implementation of the project. The bicycle data includes six hours of counts (7am-9am, 11am-1pm, & 4pm-6pm) at two locations along Broadway.

As shown in Figure 1.3, the total bicycle volume on Broadway has increased from 239 to 283 after implementation, representing a growth of nearly 20%. More importantly, there are far fewer bicyclists riding on the sidewalk now, 39% comparing to 62% before implementation. Our study data also shows that the majority of the remaining 39% of cyclists riding on the sidewalk are

riding in the opposite direction of traffic, as Broadway is a one way street. The reduction in bicycle volume on the sidewalk results in less conflict and therefore a safer travel environment for both pedestrians and bicyclists.

Looking east on Broadway east of The Promenade. A cyclist rides on the protected bikeway

FIGURE 1.3 – BICYCLE ACTIVITY ALONG BROADWAY, BEFORE AND AFTER IMPLEMENTATION



Note 1: % on Sidewalk: Before 62%, After 39%
Note 2: Data collected in 6 Hours/Day

Total Bicycle Volumes along Broadway in 6 Hours/Day

Timeline	Cyclists on Street / Cyclists in Protected Lane	Cyclists on Sidewalk	Total Cyclist	Percent Cyclist on Sidewalk
Before (239)	91	148	239	62%
After (283)	173	110	283	39%

* Both Before & After bicycle data was collected from 7am-9am, 11am-1pm, and 4pm to 6 pm on a Thursday along Broadway between Linden Avenue and Elm Avenue, and between Pacific Avenue and Pine Avenue.

Table 1.3 summarizes the levels of bicycle, pedestrian, and vehicle activity along Third Street prior to and after implementation of the project.

Table 1.3 – Bicycle, Pedestrian, and Vehicle Activity on Third Street, Before and After Implementation

Measure	Before Implementation	After Implementation
Average Daily Traffic Volume	9,900/day (average)	9,800/day (average)
Traffic Volume (6 Hours)	5,800	5,300
Bicycle Volume (6 Hours)	198	300
Pedestrian Volume (6 Hours)	1,505	1,596
Traffic Speed (85th Percentile)	36 MPH	27 MPH
Bicycle Crashes	7 (over 3 years)	0 (in one year)

As shown in Table 1.3, average daily traffic volume on Third Street has remained about the same since implementation of the project. Peak hour traffic volume has decreased by about 100 per hour. Bicycle volumes have increased by about 50% (102 in 6 hours). Pedestrian volumes have decreased slightly. Bicycle crashes have decreased from seven over a 3-year period (approximately two per year on average), to none over the 1-year trial period. As with Broadway, the crash record for Third Street may indicate conditions for cyclists are safer with the new configuration.

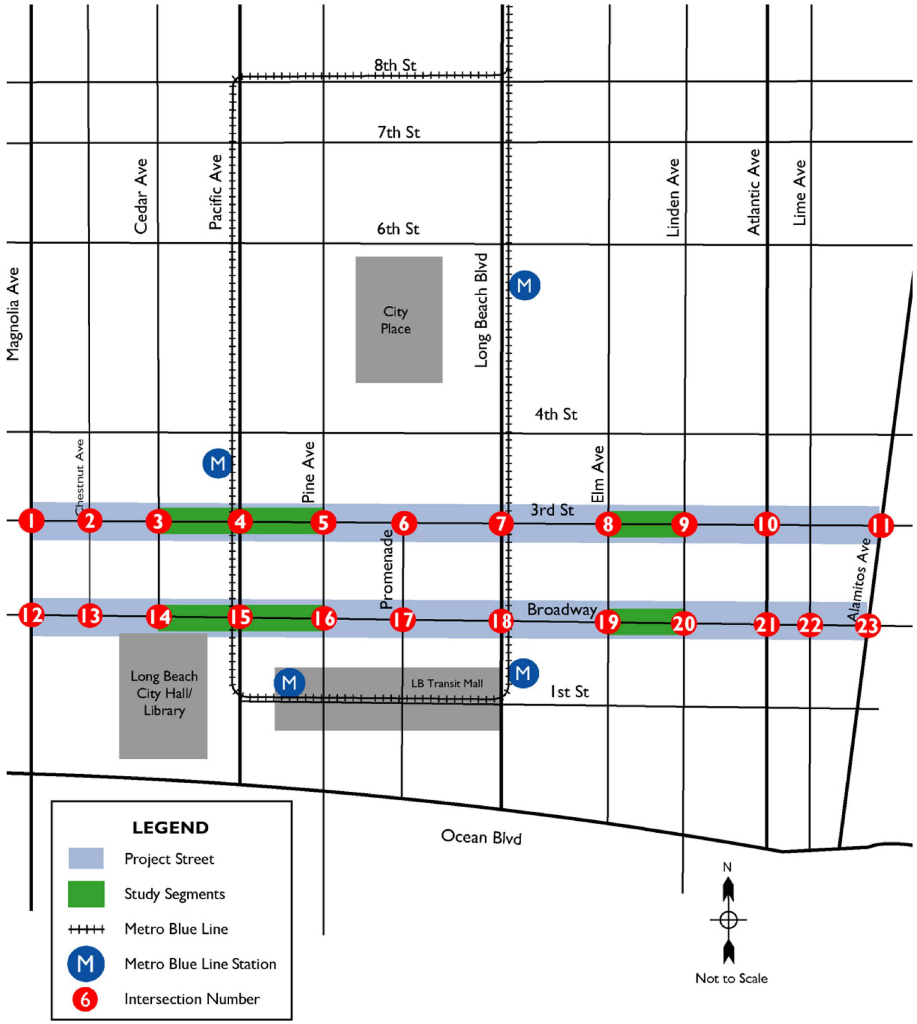
Although traffic volumes have decreased or remained about the same on both Broadway and Third Street, volumes are consistently higher on Broadway than on Third Street by about 2,500 to 3,000 per day.

Gains in overall bicycle volumes are higher on Third Street than on Broadway after implementation of the project.

Looking east on Third Street at The Promenade

Figures 1.4 and 1.5 show the changes in AM and PM peak hour traffic volumes, respectively.

FIGURE 1.4 - CHANGES IN AM PEAK HOUR VOLUMES AFTER IMPLEMENTATION



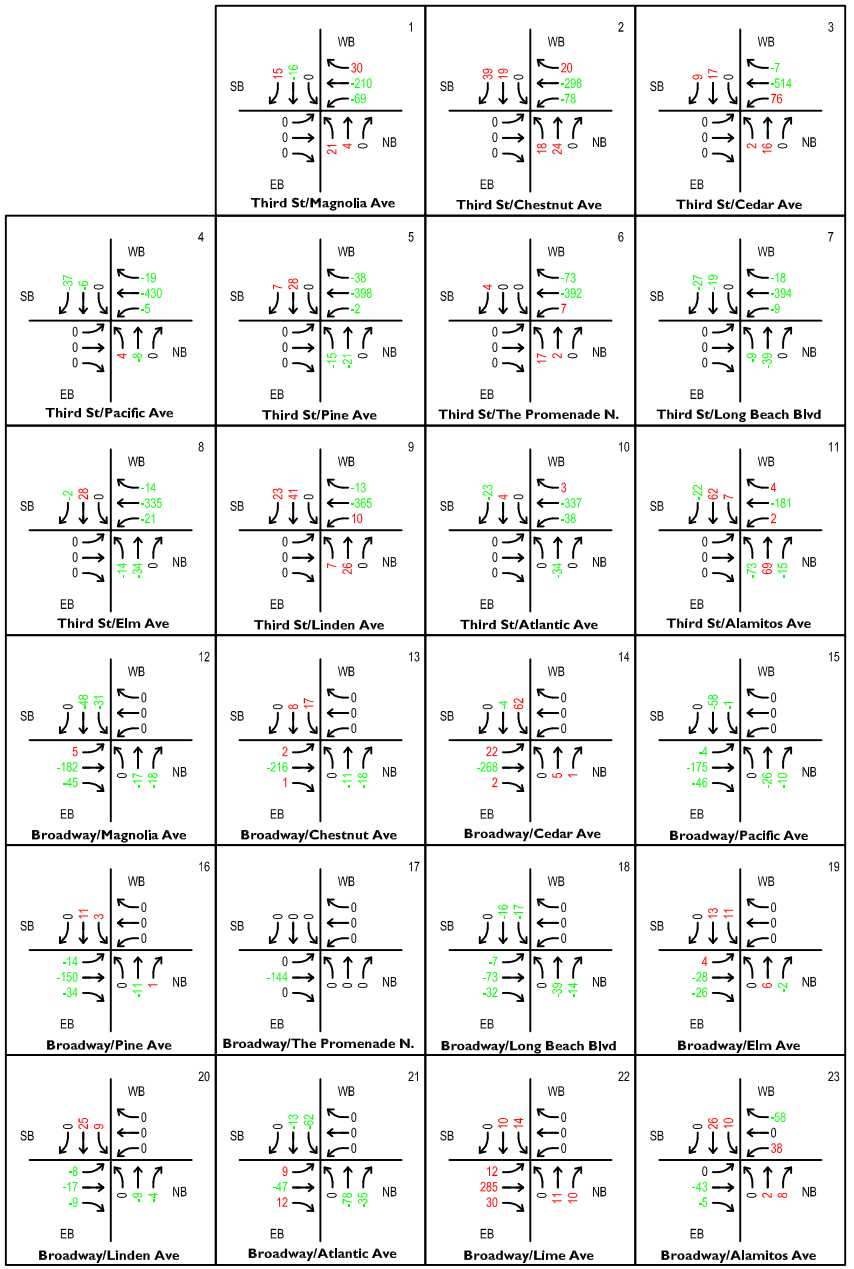
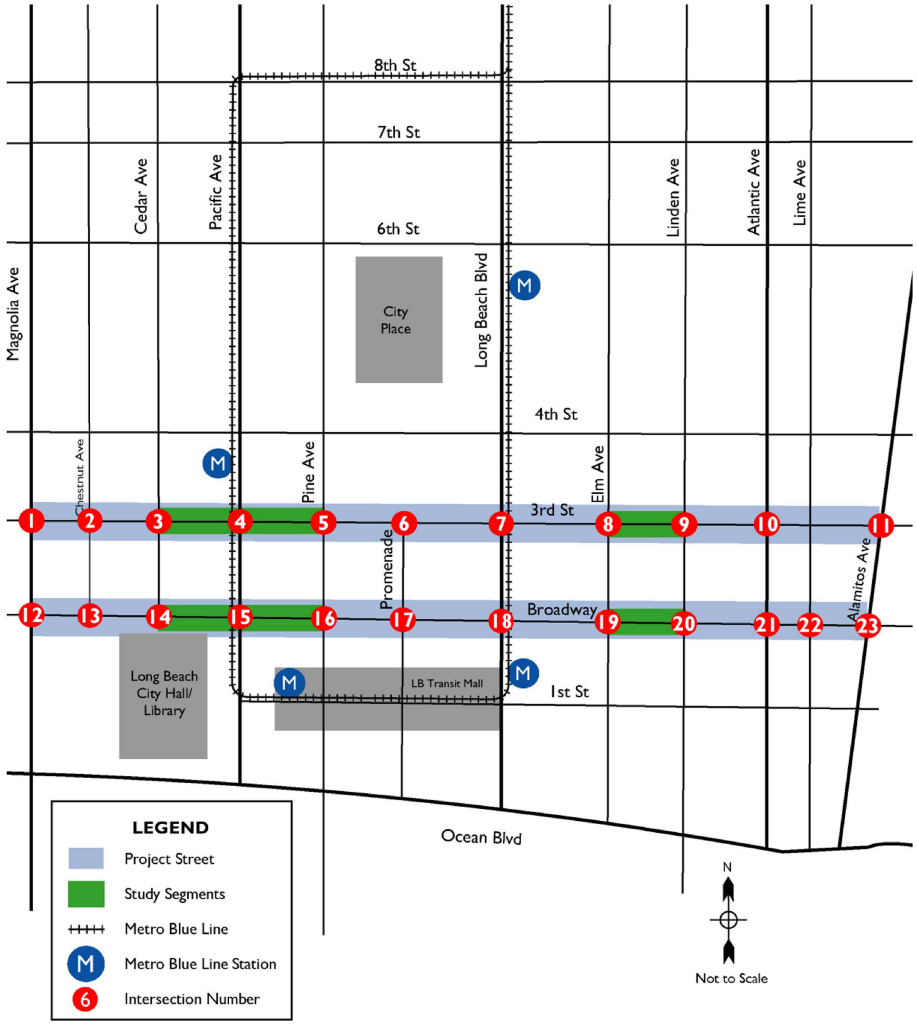


FIGURE 1.5 - CHANGES IN PM PEAK HOUR VOLUMES AFTER IMPLEMENTATION



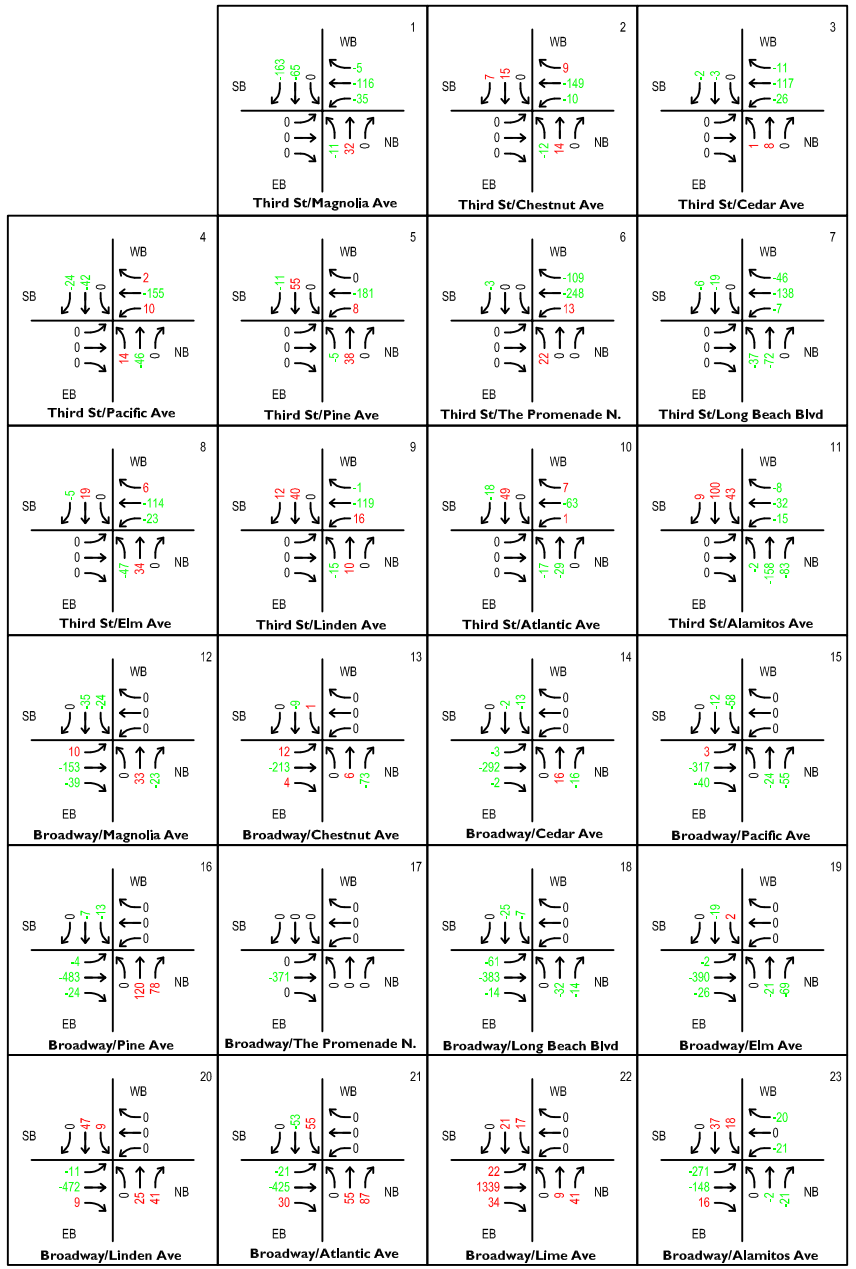
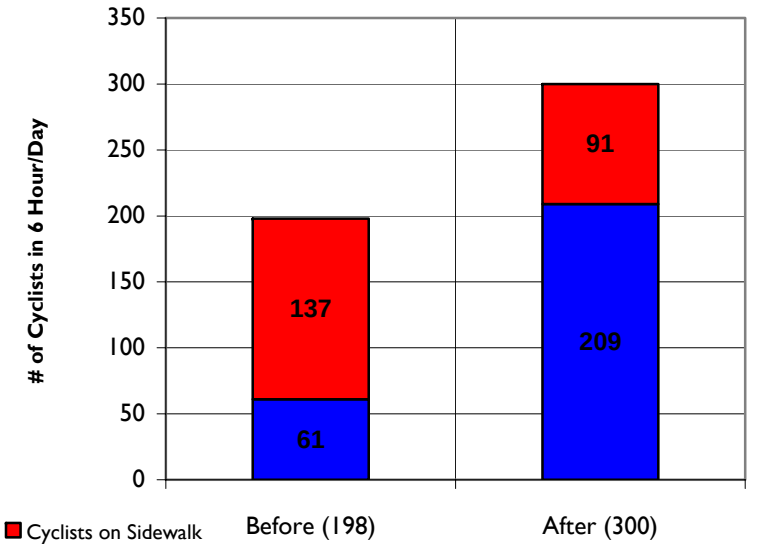


Figure 1.6 provides an illustration of bicycle volumes and distribution along Third Street before and after implementation of the project. The bicycle data includes 6 hours of counts (7am-9am, 11am-1pm, & 4pm-6pm) at two locations along Third Street.

As shown in Figure 1.6, the total bicycle volume on Third Street has increased from 198 to 300 after implementation, representing a 52% growth in bicyclist usage. There are also far fewer bicyclists riding on the sidewalk now than before implementation, 30% now comparing to 69% before. Our study data also shows that the majority of the remaining 30% of cyclists riding on the sidewalk are riding in the opposite direction of traffic, since Third Street is a one way street.

Observations were made of bicyclist and motorist compliance with the new street/bikeway configuration on Broadway and Third Street, and its associated controls and regulations, as well as crashes involving bicyclists, pedestrians, and vehicles. No bike-vehicle crashes/conflicts and no crashes related to bicycle/pedestrian signals were recorded in the 48-hour video observations. There were no observed conflicts related to left-turn vehicles/arrows, or bicycle/pedestrian conflicts involving parked vehicles. Vehicle compliance with left turn arrows was 100% during the observation period. Bicyclists were observed to comply with bike signals and most bicycles stayed in the protected lanes while they crossed the intersection.

FIGURE 1.6 – BICYCLE ACTIVITY ALONG THIRD STREET, BEFORE AND AFTER IMPLEMENTATION



Note 1: % on Sidewalk: Before 69%, After 30%
Note 2: Data collected in 6 Hours/Day

Total Bicycle Volumes along Third Street in 6 Hours/Day

Timeline	Cyclists on Street / Cyclists in Protected Lane	Cyclists on Sidewalk	Total Cyclist	Percent Cyclists on Sidewalk
Before (198)	61	137	198	69%
After (300)	209	91	300	30%

* Both Before & After bicycle data was collected from 7am-9am, 11am-1pm, and 4pm to 6 pm on a Thursday along Third Street between Linden Avenue and Elm Avenue, and between Pacific Avenue and Pine Avenue.

The 85th percentile speed of vehicles on Third Street has decreased from 36 mph before implementation of the project to 27 mph after implementation.

The appendices of this report contain background materials for this study. These materials include traffic volumes, bicycle volumes, pedestrian counts, observations, and speed survey data.

Typical design for the protected bikeway. Bikes and vehicles going through Third & Broadway stop for cross street traffic

2. Background

2.1 Design Concept

KOA Corporation (KOA) is evaluating the outcome of implementing protected bikeways adjacent to the inner (left) travel lanes along Broadway and Third Street in the City of Long Beach. In April 2011, the protected lanes were constructed after obtaining the Federal Highway Administration (FHWA)'s Request to Experiment (RTE) approval to be a demonstration project. The goal of this experimental project is to test the feasibility of providing protected bikeways on existing streets, and to facilitate and encourage the increased usage of bicycling as a significant mode of transportation throughout the City.

Buffered bike lane located on the right side of the roadway in San Francisco

Protected bikeways, aka "cycle tracks", are on-street exclusive bicycle facilities physically separated from vehicular traffic, parking, and sidewalks. They are generally developed along arterial streets to provide a safe riding environment for bicyclists. Protected bikeways are intended to serve as high-quality bicycle routes for cyclists who are reluctant to ride with the general traffic flow on an arterial roadway. Strong directional and informational signage or signals are generally provided to clearly delineate protected bikeways as an important part of a larger citywide bikeway system.

Protected bike lane located on the left side of the roadway in New York City

This design concept is new in Southern California; however, protected bikeways already exist in several communities throughout the United States and Europe. New York City, Washington D.C., Portland, Oregon, and San Francisco are among the cities that have recently implemented protected bikeway projects. New York City's Ninth Avenue Bicycle Path and

Complete Street project, implemented by NYC DOT in 2007, created the first urban on-street parking- and signal-protected bicycle facility in the United States. Washington, D.C.'s 15th Street NW separated bike lanes allow for contra-flow bicycle traffic. Portland now has two cycle tracks, a 1/3 mile facility along Broadway, and a 2/3 mile facility along Cully Boulevard. San Francisco's first parking-protected bikeway is located along John F. Kennedy Drive in Golden Gate Park.

Protected bikeways are being considered in other cities in California, but the Broadway/Third Street project is the first to be implemented in Southern California. Requests for additional protected bikeways are expected to follow the initial deployment.

2.2 ADA Compliance

According to the FHWA's "Questions and Answers about ADA/Section 504" website, public agencies must provide pedestrian access to the agency's streets and sidewalks for persons with disabilities as part of any construction or alteration of a facility that provides access to pedestrians. The current Public Rights-of-Way Accessibility Guidelines (PROWAG), dated November 1999, acknowledges that the AADAG (ADA Accessibility Guidelines manual) "does not contain technical specifications for accessible parallel parking". Even among informal guidelines, no approved guidelines for parallel parking on the left side of a one-way street are available at the Federal or state level.

The Protected Bikeways project effectively relocated the curbside parking on the left side of the roadways to the new curbside location 9 to 12 feet to the right. A disabled passenger transferring to a wheelchair on the right side of a parked vehicle would have the same level of accessibility as is typical with any left hand parallel parking space, consisting of an access route alongside a lane of moving traffic to curb ramps at an intersection. A disabled motorist transferring from a driver's seat on the left side of a parked vehicle to a wheelchair would be doing so on the bikeway shoulder at street pavement level, similar to an action performed with parallel parking on the right side of a roadway. Therefore, the Protected Bikeways project offers accessibility to sidewalks that is comparable to that provided by parallel parking spaces typically provided on either the left or right side of streets.

2.3 FHWA Review

FHWA requests one "before" and two "after" studies (6-month and 12-month) as part of the experimental approval process. Upon FHWA approval of the demonstration, the City of Long Beach therefore began a comprehensive analysis of bicycle usage of the project area to document the effects of the changes. The 6-month study (*Broadway and Third Street Protected Bikeway Study "Before" and 6-Month "After" Conditions)* was completed in February 2012. This report documents the data comparison for the 12-month "after" study in comparison with the "before" study submitted in November 2010.

The "Before" and "After" study presents levels of bicycle volume, pedestrian volume, traffic volume, vehicle speed, and specific usage patterns of the new bicycle facilities. The study also documents the safety record of the protected bikeway facility in comparison to pre-project conditions.

Figure 2.1 shows a map of the project area.

FIGURE 2.1 - PROJECT AREA

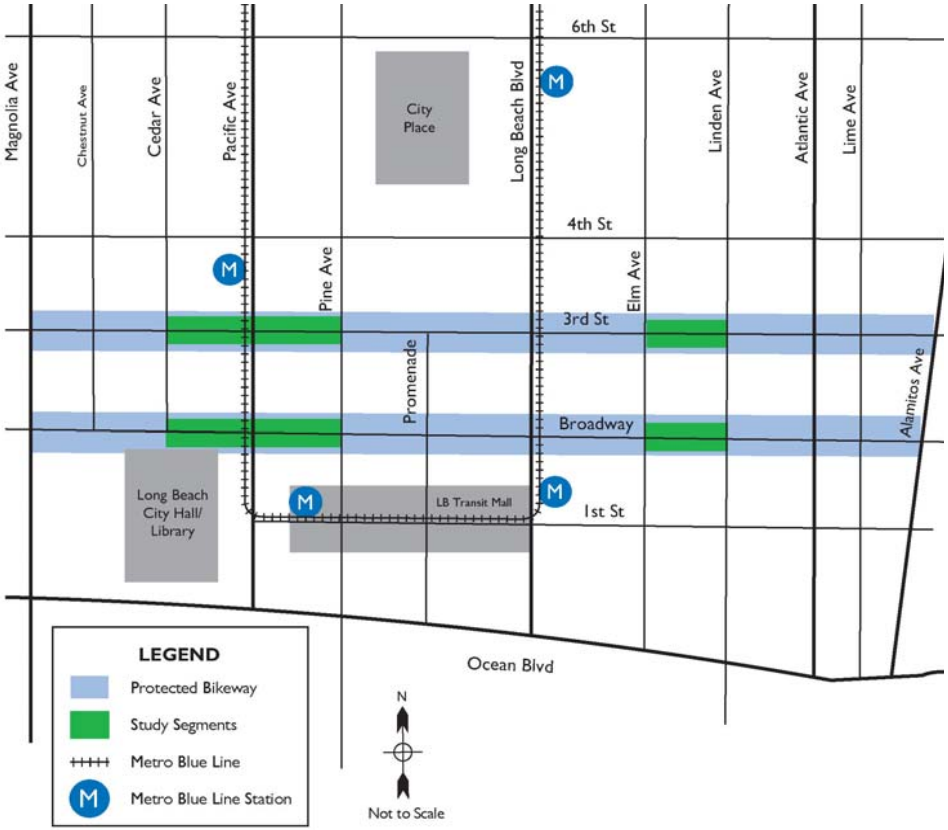


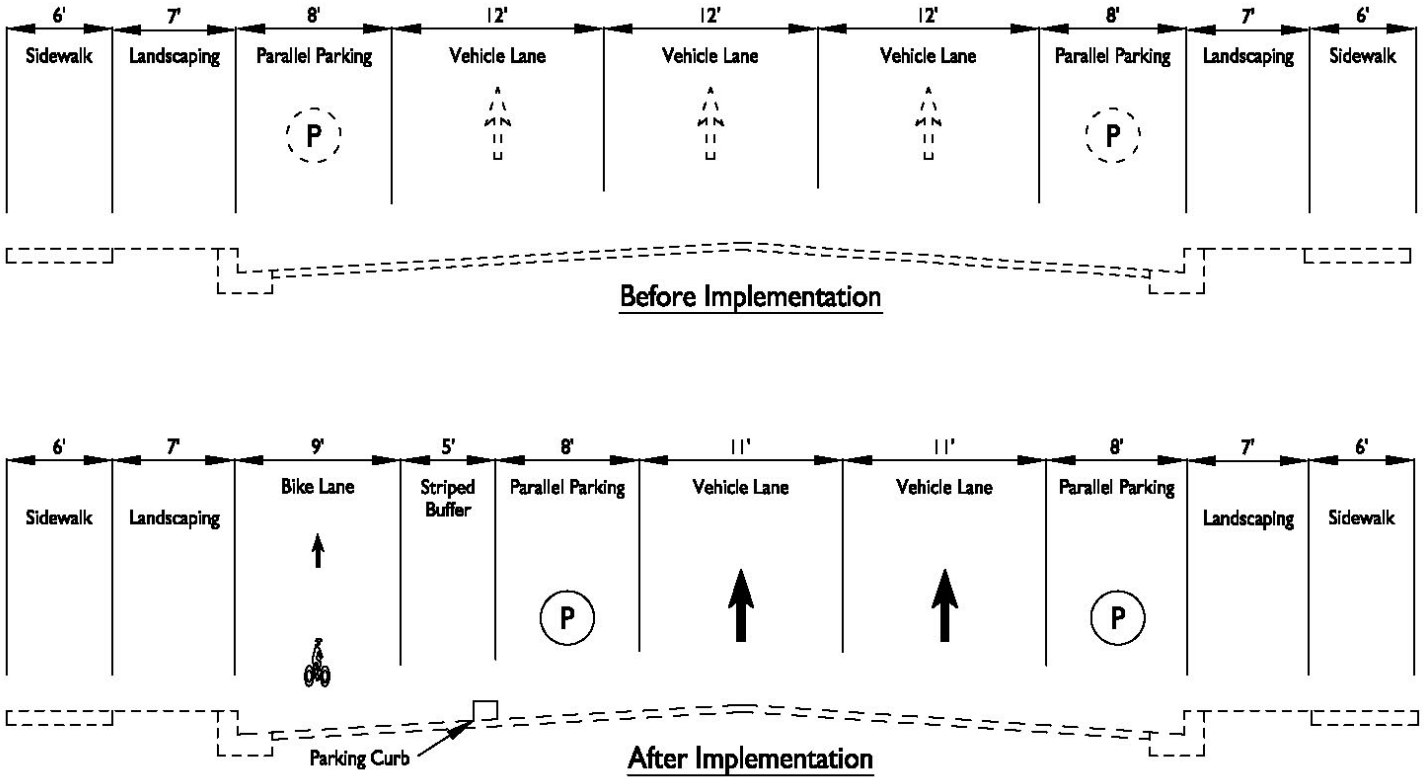
Figure 2.2 provides a typical cross-section drawing of Broadway and Third Street before and after implementation of the project. The typical cross-sections show the roadway configuration before and after implementation of the project. As implemented, the project consists of a one-way bicycle lane westbound along Third Street and eastbound along Broadway, separated from the traffic lanes by a raised curb and parking lane. This separation results in an east-west bikeway with minimum exposure to other traffic through downtown Long Beach. Furthermore, treatments to enhance bicyclist safety have been implemented at the intersections along the project corridor.

The Broadway/Third Street "Before" and "After" study evaluated data on the following street segments of these corridors:

- Broadway between Magnolia Avenue and Alamitos Avenue
- Third Street between Magnolia Avenue and Alamitos Avenue

This report summarizes the levels of bicycle, pedestrian, and vehicle activity; specific usage patterns; and other factors to evaluate the effectiveness of implementing the protected bikeway project. The study includes an effectiveness evaluation of improving bicycle safety while maintaining adequate traffic flow.

FIGURE 2.2 - PROJECT STREET CROSS-SECTIONS



•

Typical design configuration for the protected bikeway; Bikes and vehicles going through Third Street & Broadway have green lights

3. Physical Roadway Conditions

3.1 Broadway Roadway Conditions

Broadway is a one-way eastbound arterial street traversing a commercial/business district in the project vicinity. Several major streets cross Broadway in the project area, including (listed west to east): Pacific Avenue, Long Beach Boulevard, Atlantic Avenue, and Alamitos Avenue. The Long Beach Civic Center is located on the south side of Broadway between Magnolia Avenue and Pacific Avenue. There are Metro Blue Line light rail crossings of Broadway at Pacific Avenue and Long Beach Boulevard. The crossings are controlled by traffic signals, not railroad gates. The segment of Broadway included in the protected bikeway project is approximately one mile long. Figures 3.1 and 3.2 present a street-level view of Broadway before and after implementation of the project.

FIGURE 3.1 – BROADWAY BEFORE IMPLEMENTATION

Parallel parking along the north side of Broadway at Elm Avenue

3.1.1 Broadway Before Implementation

Prior to the start of the project, Broadway had a typical width of 52 feet in the project vicinity. The typical cross-section of the street was three eastbound lanes, no bike lane, and sidewalks on both sides of the street. There was no significant curvature or gradient along the street in the project area. Limited 24-minute curb parking was allowed on both sides of the street. No curb extensions, textured paving, or other devices designed to slow traffic or improve pedestrian conditions existed. Traffic signals were present along Broadway at Magnolia, Pacific, Pine, Long Beach Boulevard, Elm, Linden, Atlantic, and Alamitos. These signals used two-phase operation along Broadway, without left-turn signal phases. Pedestrian push buttons for north and south crosswalks, ramps, and parallel-bar style crosswalks were present. The street was posted with a speed limit of 30 mph.

FIGURE 3.2 – BROADWAY AFTER IMPLEMENTATION

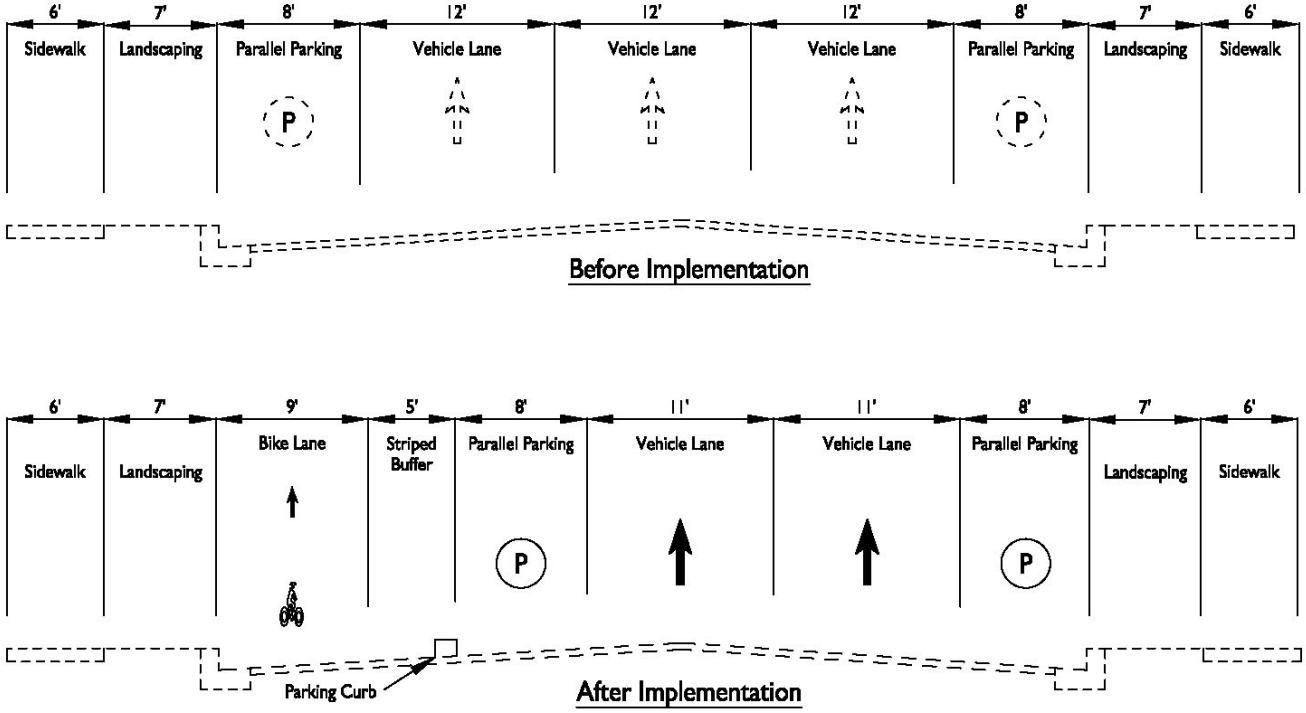
Cycle track on the north (left) side of Broadway and a modified signal at Elm Avenue

3.1.2 Broadway After Implementation

The project now provides a one-way bikeway located on the left side of the street, separated from traffic by a parking lane. The design required the elimination of one travel lane in order to provide space for the bicycle lane and the buffer area while maintaining most of the left side parking. Twenty-eight out of a total of 180 parking spaces were removed on Broadway as a result of the project. The before and after project configuration of each street is shown in Figure 3.3 below.

The cross-section of the street in the project area is now a 9-foot protected bike lane, 5-foot buffer, 8-foot parking lane, two 11-foot eastbound traffic lanes, and an 8-foot parking lane on the right side of the street. Sidewalks on both sides of the street remained unmodified. Traffic at signalized intersections is now controlled by bicycle signals and by left turn arrows for motorists turning across the bike lane and across the adjacent pedestrian crosswalk. The street is posted with a speed limit of 30 mph.

FIGURE 3.3 – PROJECT STREET CROSS-SECTIONS



3.2 Third Street Roadway Conditions

Third Street is a one-way westbound arterial street located one block (approximately 1/10 mile) north of Broadway. The segment of Third Street included in the protected bikeway project is approximately one mile long. Figures 3.4 and 3.5 present a street-level view of Third Street before and after implementation of the project.

FIGURE 3.4 – THIRD STREET BEFORE IMPLEMENTATION

Parallel parking located along the south side of Third Street at Long Beach Boulevard

3.2.1 Third Street Before Implementation

Third Street had a three-lane cross-section with a typical width of 52 feet. There were sidewalks but no bike lanes. Curb parking was allowed on both sides of the street. Traffic signals were present along Third Street at Alamitos, Atlantic, Linden, Elm, Long Beach Boulevard, Pine, Pacific, and Magnolia. These signals used two-phase operation. The posted speed limit on Third Street was 30 mph.

3.2.2 Third Street After Implementation

The project provides a protected bikeway on the left side of the street, separated from traffic by a raised curb and parking lane. One vehicle travel lane was removed. Twenty parking spaces out of a total of 184 were taken out on Third Street. The cross-section of the street and traffic signal control, phasing and protection is now the same as described above for Broadway. The 30 mph speed limit has been retained.

FIGURE 3.5 – THIRD STREET AFTER IMPLEMENTATION

Protected bikeway on the south (left) side of Third Street at Long Beach Boulevard

4. Pedestrian and Bicycle Usage

This section compares the "before" conditions prior to implementation of the protected bikeways with the "after" conditions, twelve months after project completion. The following information is included in the "before" and "after" evaluation of bicycle, pedestrian, and traffic conditions along Broadway and Third Street:

- Bikes on Sidewalk
- Bikes in Protected Lane
- Wrong-Way Bikes in Protected Lanes
- Bikes in Vehicle Lanes
- Skateboarders on Sidewalk
- Skateboarders on Street
- Electric Wheelchairs
- Pedestrian Volume
- Vehicle Volume
- Average Vehicle Speed
- Crashes or Observable Conflicts Involving Vehicles and Bicycles

Four street segments were used for the evaluation:

- Broadway between Elm Avenue and Linden Avenue
- Broadway between Pacific Avenue and Pine Avenue
- Third Street between Elm Avenue and Linden Avenue
- Third Street between Pacific Avenue and Pine Avenue

These sections were chosen as representative parts of the bikeway. In general the two streets are more commercial to the west and more residential to the east. The sections between Elm and Linden were chosen to represent the more residential portion whereas the sections between Pacific and Pine were chosen to represent the more commercial portion. As you will see from the data the more residential areas have higher numbers of bicyclists but lower numbers of pedestrians than the more commercial areas.

48-hour video traffic volume counts and bicycle and pedestrian surveys were conducted along these street segments to determine the levels of bicycle, pedestrian, and vehicle activity and associated conditions along Broadway and Third Street, prior to and subsequent to implementation of the project. Pedestrian and bicycle volumes were documented from the video recordings at mid-block locations along Broadway for the AM, Midday, and PM peak periods. Skateboarders and electric wheelchairs were also included in the peak hour counts.

Appendix 4.1 includes the count data sheets for bicycles, and Appendix 4.2 contains the count data sheets for pedestrians.

Looking east on Broadway at Promenade; two cyclists ride on the protected bikeway, but one of them rides the wrong way; a skateboarder is on the sidewalk

4.1 Broadway Pedestrian and Bicycle Usage

Table 4.1 summarizes levels of bicycle, pedestrian, and other activities along Broadway between Elm Avenue and Linden Avenue before and after implementation of the project. The total number of bicyclists has increased by 13%, while there has been a 41% decrease in the number of bicyclists riding on the sidewalk and in the street. The number of pedestrians increased by about 35%.

A cyclist rides in the vehicular lane on the opposite side of the protected bikeway on Broadway at Atlantic Avenue

Table 4.1 – Pedestrian and Bicycle Counts, Broadway between Linden Avenue and Elm Avenue, Before and After Implementation

Count Date	Before Implementation (Thursday, 6/10/2010)										After Implementation (Thursday, 6/7/2012)									
Description	7 AM - 9 AM			11 AM - 1 PM			4 PM - 6 PM			6-Hour Total	7 AM - 9 AM			11 AM - 1 PM			4 PM - 6 PM			6-Hour Total
	Male	Female	Total	Male	Female	Total	Male	Female	Total		Male	Female	Total	Male	Female	Total	Male	Female	Total	
Pedestrians	86	69	**155**	160	80	**240**	139	114	**253**	***648***	75	81	**156**	158	171	**329**	187	202	**389**	***874***
Bikes on Sidewalk	15	2	**17**	22	2	**24**	40	7	**47**	***88***	7	1	**8**	12	4	**16**	25	3	**28**	***52***
Bikes in Protected Lane	n/a	n/a	**n/a**	n/a	n/a	**n/a**	n/a	n/a	**n/a**	***n/a***	10	2	**12**	16	5	**21**	54	14	**68**	***101***
Wrong-Way Bikes in Protected Lane	n/a	n/a	**n/a**	n/a	n/a	**n/a**	n/a	n/a	**n/a**	***n/a***	0	0	**0**	3	1	**4**	3	1	**4**	***8***
Bikes on Street in Vehicle Lanes	10	1	**11**	15	4	**19**	26	2	**28**	***58***	0	0	**0**	2	0	**2**	2	0	**2**	***4***
Skateboarders on Sidewalk	3	0	**3**	4	0	**4**	2	1	**3**	***10***	1	2	**3**	0	1	**1**	6	7	**13**	***17***
Skateboarders on Street	2	0	**2**	1	0	**1**	2	5	**7**	***10***	0	0	**0**	0	0	**0**	1	1	**2**	***2***
Electric Wheelchairs	0	0	**0**	0	0	**0**	0	0	**0**	***0***	0	0	**0**	1	2	**3**	0	0	**0**	***3***
Overall Total	116	72	**188**	202	86	**288**	209	129	**338**	***814***	93	86	**179**	192	184	**376**	278	228	**506**	***1,061***
Total Cyclists	25	3	**28**	37	6	**43**	66	9	**75**	***146***	17	3	**20**	33	10	**43**	84	18	**102**	***165***

Table 4.2 summarizes levels of specific bicycle, pedestrian, and other activities along Broadway between Pacific Avenue and Pine Avenue before and after implementation of the project. The total number of bicyclists has increased by 27%, while the number of pedestrians has increased by about 12%. There has also been a significant decrease in the number of bicyclists riding in the street, apparently preferring to ride in the protected bikeway instead. The number of bicyclists riding on the sidewalk stayed the same.

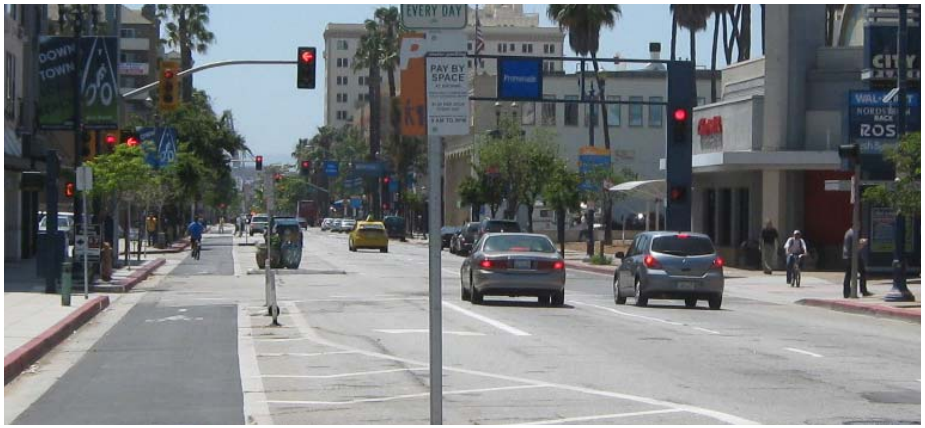
Cyclists ride on the protected bikeway on Broadway near Linden Avenue

Table 4.2 – Pedestrian and Bicycle Counts, Broadway between Pacific Avenue and Pine Avenue, Before and After Implementation

Count Date	Before Implementation (Monday, 6/14/2010)										After Implementation (Monday, 6/4/2012)									
Description	7 AM - 9 AM			11 AM - 1 PM			4 PM - 6 PM			6-Hour Total	7 AM - 9 AM			11 AM - 1 PM			4 PM - 6 PM			6-Hour Total
	Male	Female	Total	Male	Female	Total	Male	Female	Total		Male	Female	Total	Male	Female	Total	Male	Female	Total	
Pedestrians	130	155	**285**	285	266	**551**	235	227	**462**	***1,298***	166	180	**346**	283	307	**590**	246	267	**513**	***1,449***
Bikes on Sidewalk	9	2	**11**	12	2	**14**	27	8	**35**	***60***	9	0	**9**	17	2	**19**	30	0	**30**	***58***
Bikes in Protected Lane	n/a	n/a	**n/a**	n/a	n/a	**n/a**	n/a	n/a	**n/a**	***n/a***	6	1	**7**	20	1	**21**	13	7	**20**	***48***
Wrong-Way Bikes in Protected Lane	n/a	n/a	**n/a**	n/a	n/a	**n/a**	n/a	n/a	**n/a**	***n/a***	1	0	**1**	1	1	**2**	1	0	**1**	***4***
Bikes on Street in Vehicle Lanes	5	0	**5**	17	1	**18**	6	4	**10**	***33***	1	0	**1**	2	0	**2**	4	1	**5**	***8***
Skateboarders on Sidewalk	2	0	**2**	9	1	**10**	3	0	**3**	***15***	0	0	**0**	2	2	**4**	2	3	**5**	***9***
Skateboarders on Street	1	0	**1**	0	0	**0**	1	0	**1**	***2***	0	0	**0**	0	0	**0**	0	0	**0**	***0***
Electric Wheelchairs	1	0	**1**	6	2	**8**	4	2	**6**	***15***	0	1	**1**	1	2	**3**	0	0	**0**	***4***
Overall Total	148	157	**305**	329	272	**601**	276	241	**517**	***1,423***	183	182	**365**	326	315	**641**	296	278	**574**	***1,580***
Total Cyclists	14	2	**16**	29	3	**32**	33	12	**45**	***93***	17	1	**18**	40	4	**44**	48	8	**56**	***118***

4.2 Third Street Pedestrian and Bicycle Usage

Table 4.3 summarizes levels of specific bicycle, pedestrian, and other activities along Third Street between Elm Avenue and Linden Avenue before and after implementation of the project. Bicyclists are using the protected bikeway instead of riding on the sidewalk and in the street. The total number of bicyclists has increased by 49% and the number on the sidewalk has decreased by 38%.



A cyclist rides on the protected bikeway on Third Street at The Promenade, and another cyclist rides in the opposite direction on the sidewalk on the other side of the street

Table 4.3 – Pedestrian and Bicycle Counts, Third Street between Linden Avenue and Elm Avenue, Before and After Implementation

Count Date	Before Implementation (Friday, 6/11/2010)										After Implementation (Friday, 6/8/2012)									
Description	7 AM - 9 AM			11 AM - 1 PM			4 PM - 6 PM			6-Hour Total	7 AM - 9 AM			11 AM - 1 PM			4 PM - 6 PM			6-Hour Total
	Male	Female	Total	Male	Female	Total	Male	Female	Total		Male	Female	Total	Male	Female	Total	Male	Female	Total	
Pedestrians	147	115	**262**	137	120	**257**	214	155	**369**	***888***	71	76	**147**	139	150	**289**	120	130	**250**	***686***
Bikes on Sidewalk	15	4	**19**	29	7	**36**	31	4	**35**	***90***	10	2	**12**	15	5	**20**	21	3	**24**	***56***
Bikes in Protected Lane	n/a	n/a	**n/a**	n/a	n/a	**n/a**	n/a	n/a	**n/a**	***n/a***	28	5	**33**	25	13	**38**	38	16	**54**	***125***
Wrong-Way Bikes in Protected Lane	n/a	n/a	**n/a**	n/a	n/a	**n/a**	n/a	n/a	**n/a**	***n/a***	2	0	**2**	4	2	**6**	3	1	**4**	***12***
Bikes on Street in Vehicle Lanes	11	3	**14**	12	3	**15**	12	5	**17**	***46***	2	0	**2**	2	1	**3**	4	0	**4**	***9***
Skateboarders on Sidewalk	1	2	**3**	10	2	**12**	9	0	**9**	***24***	2	2	**4**	1	1	**2**	1	2	**3**	***9***
Skateboarders on Street	0	0	**0**	0	0	**0**	2	0	**2**	***2***	0	0	**0**	0	1	**1**	0	0	**0**	***1***
Electric Wheelchairs	2	3	**5**	5	5	**10**	6	5	**11**	***26***	1	1	**2**	0	1	**1**	1	1	**2**	***5***
Overall Total	176	127	**303**	193	137	**330**	274	169	**443**	***1,076***	116	86	**202**	186	174	**360**	188	153	**341**	***903***
Total Cyclists	26	7	**33**	41	10	**51**	43	9	**52**	***136***	42	7	**49**	46	21	**67**	66	20	**86**	***202***

Table 4.4 summarizes levels of bicycle, pedestrian, and other activities along Third Street between Pacific Avenue and Pine Avenue before and after implementation of the project. Bicyclists are using the protected bikeway, causing a decrease in the number of cyclists riding on the sidewalk and in the street. The total number of bicyclists has increased by 58%, and the number of pedestrians has increased by about 47%, indicating a more user-friendly environment for both groups.

A cyclist rides on the protected bikeway on Third Street west of Lime Avenue

Table 4.4 – Pedestrian and Bicycle Counts, Third Street between Pacific Avenue and Pine Avenue, Before and After Implementation

Count Date	Before Implementation (Tuesday, 6/15/2010)										After Implementation (Tuesday, 6/5/2012)									
Description	7 AM - 9 AM			11 AM - 1 PM			4 PM - 6 PM			6-Hour Total	7 AM - 9 AM			11 AM - 1 PM			4 PM - 6 PM			6-Hour Total
	Male	Female	Total	Male	Female	Total	Male	Female	Total		Male	Female	Total	Male	Female	Total	Male	Female	Total	
Pedestrians	72	41	**113**	190	119	**309**	128	67	**195**	***617***	84	90	**174**	177	192	**369**	176	191	**367**	***910***
Bikes on Sidewalk	13	1	**14**	14	2	**16**	15	2	**17**	***47***	4	4	**8**	21	1	**22**	5	0	**5**	***35***
Bikes in Protected Lane	n/a	n/a	**n/a**	n/a	n/a	**n/a**	n/a	n/a	**n/a**	***n/a***	13	6	**19**	14	2	**16**	18	4	**22**	***57***
Wrong-Way Bikes in Protected Lane	n/a	n/a	**n/a**	n/a	n/a	**n/a**	n/a	n/a	**n/a**	***n/a***	0	0	**0**	2	0	**2**	1	1	**2**	***4***
Bikes on Street in Vehicle Lanes	4	0	**4**	4	1	**5**	6	0	**6**	***15***	0	0	**0**	1	1	**2**	0	0	**0**	***2***
Skateboarders on Sidewalk	1	0	**1**	3	1	**4**	1	0	**1**	***6***	1	2	**3**	2	3	**5**	3	4	**7**	***15***
Skateboarders on Street	0	0	**0**	0	0	**0**	0	0	**0**	***0***	0	0	**0**	0	0	**0**	0	0	**0**	***0***
Electric Wheelchairs	1	0	**1**	4	0	**4**	3	2	**5**	***10***	2	2	**4**	5	5	**10**	2	3	**5**	***19***
Overall Total	91	42	**133**	215	123	**338**	153	71	**224**	***695***	104	104	**208**	222	204	**426**	205	203	**408**	***1,042***
Total Cyclists	17	1	**18**	18	3	**21**	21	2	**23**	***62***	17	10	**27**	38	4	**42**	24	5	**29**	***98***

5. Vehicular Traffic Analysis

This section presents the vehicular traffic volumes before and after implementation of the project. Intersection peak hour operations analysis was conducted for the study area intersections.

5.1 Roadway Segment Traffic Volumes

Vehicular traffic counts were conducted before and after implementation of the project along Broadway and Third Street at the following four street segments:

- Broadway between Elm Avenue and Linden Avenue
- Broadway between Cedar Avenue and Pacific Avenue
- Third Street between Elm Avenue and Linden Avenue
- Third Street between Cedar Avenue and Pacific Avenue

For "Before Implementation" conditions, average daily traffic volume on Broadway was about 11,700 per day (about 1,700 in the peak hour) between Elm Avenue and Linden Avenue, and about 14,350 per day (about 1,400 in the peak hour) between Cedar Avenue and Pacific Avenue. For 12-Month "After Implementation" conditions, average daily traffic volume on Broadway is now about 11,300 per day (about 1,300 in the peak hour) between Elm Avenue and Linden Avenue and about 13,600 per day (about 1,100 in the peak hour) between Cedar Avenue and Pacific Avenue.

The Average Daily Traffic (ADT), AM peak hour, and PM peak hour traffic volumes are summarized in Table 5.1 for Broadway and Third Street.

Table 5.1 – Vehicular Traffic Counts on Broadway and Third Street, Before and After Implementation

Street Segment Location	Before Implementation (Thursday, 6/10/2010)			After Implementation (Thursday, 6/7/2012)		
	AM Peak Hour	PM Peak Hour	Daily Traffic	AM Peak Hour	PM Peak Hour	Daily Traffic
Broadway between Elm Avenue and Linden Avenue	533	1,704	11,706	578	1,335	11,287
Broadway between Cedar Avenue and Pacific Avenue	919	1,375	14,348	838	1,108	13,572
Third Street between Elm Avenue and Linden Avenue	1,378	523	9,308	1,090	475	8,375
Third Street between Cedar Avenue and Pacific Avenue	1,301	637	10,409	1,287	666	11,167

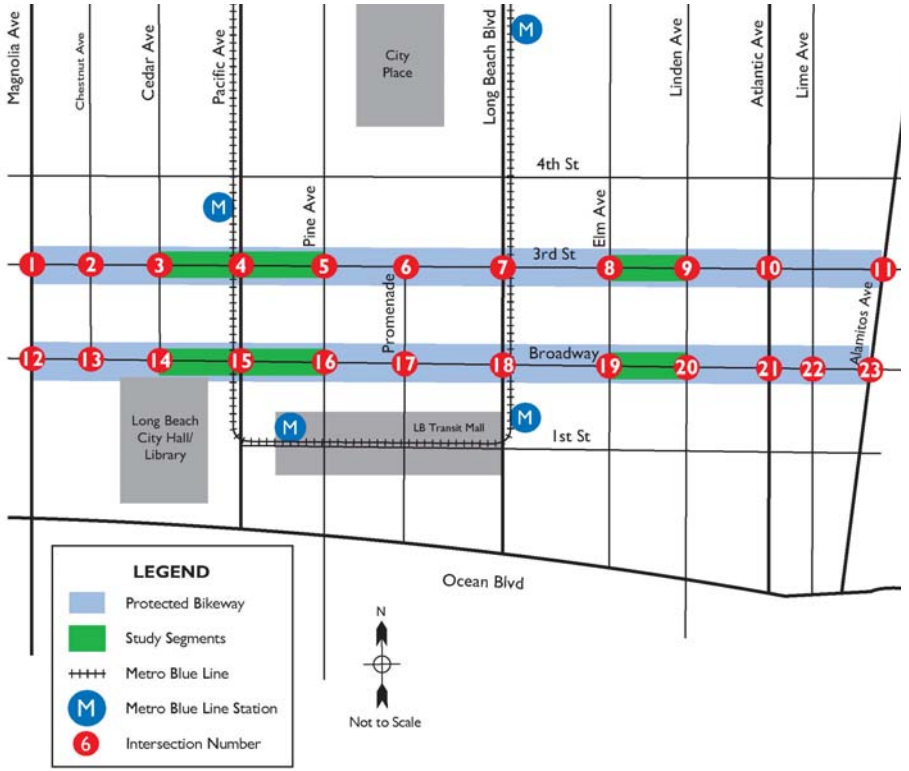
Appendix 5.1 includes the vehicular traffic count data sheets conducted in June, 2012.

5.2 Intersection Peak Hour Traffic Volumes

Vehicular AM and PM peak hour intersection traffic counts were conducted before and after implementation of the project at the following 23 intersections along Broadway and Third Street, as shown on Figure 5.1:

- Broadway and Magnolia Avenue
- Broadway and Chestnut Avenue
- Broadway and Cedar Avenue
- Broadway and Pacific Avenue
- Broadway and Pine Avenue
- Broadway and The Promenade
- Broadway and Long Beach Boulevard
- Broadway and Elm Avenue
- Broadway and Linden Avenue
- Broadway and Atlantic Avenue
- Broadway and Lime Avenue
- Broadway and Alamitos Avenue
- Third Street and Magnolia Avenue
- Third Street and Chestnut Avenue
- Third Street and Cedar Avenue
- Third Street and Pacific Avenue
- Third Street and Pine Avenue
- Third Street and The Promenade
- Third Street and Long Beach Boulevard
- Third Street and Elm Avenue
- Third Street and Linden Avenue
- Third Street and Atlantic Avenue
- Third Street and Alamitos Avenue

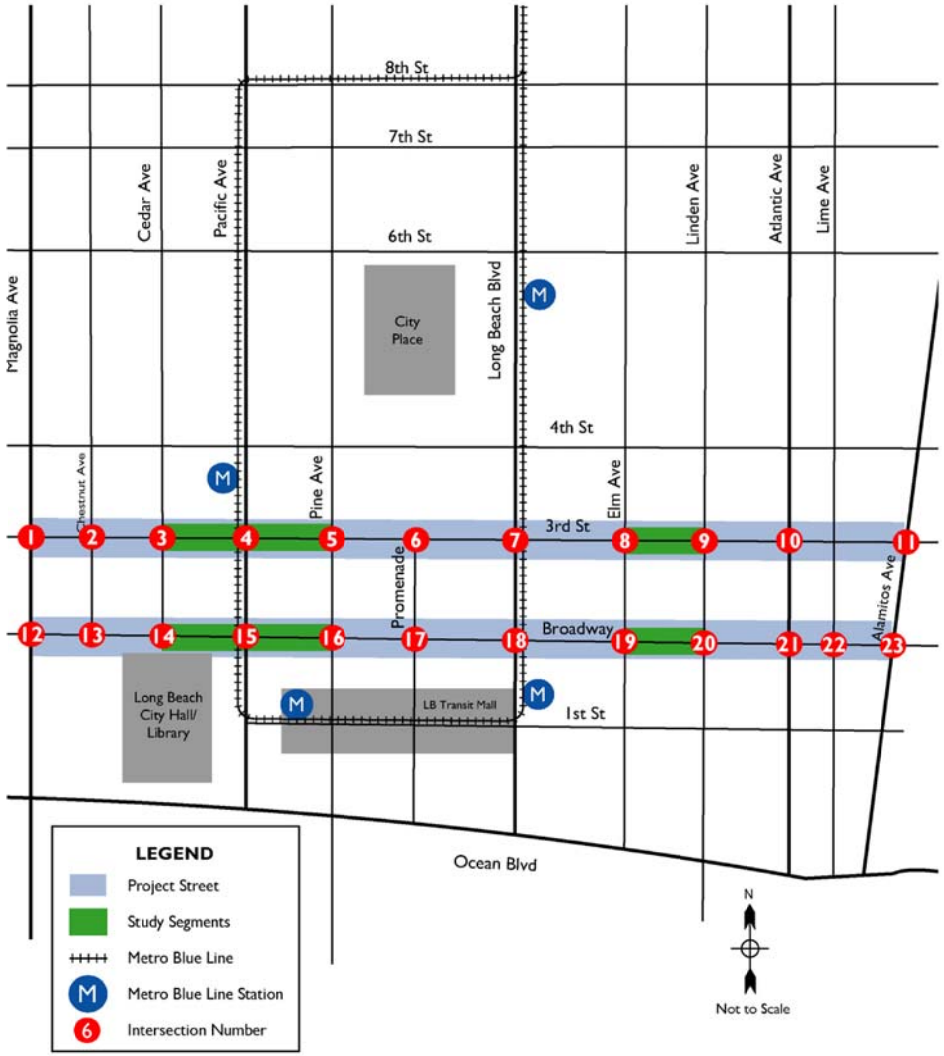
FIGURE 5.1 – STUDY AREA INTERSECTION LOCATIONS



Figures 5.2 and 5.3 show the AM and PM peak hour intersection traffic counts for conditions before the implementation of the project.

Figures 5.4 and 5.3 show the AM and PM peak hour intersection traffic counts for conditions 12 months after implementation of the project. The intersection counts were collected in June, 2012. Intersection traffic count data sheets for 2012 conditions are included in Appendix 5.1 of this report.

FIGURE 5.2 - AM PEAK HOUR INTERSECTION VOLUMES, BEFORE IMPLEMENTATION



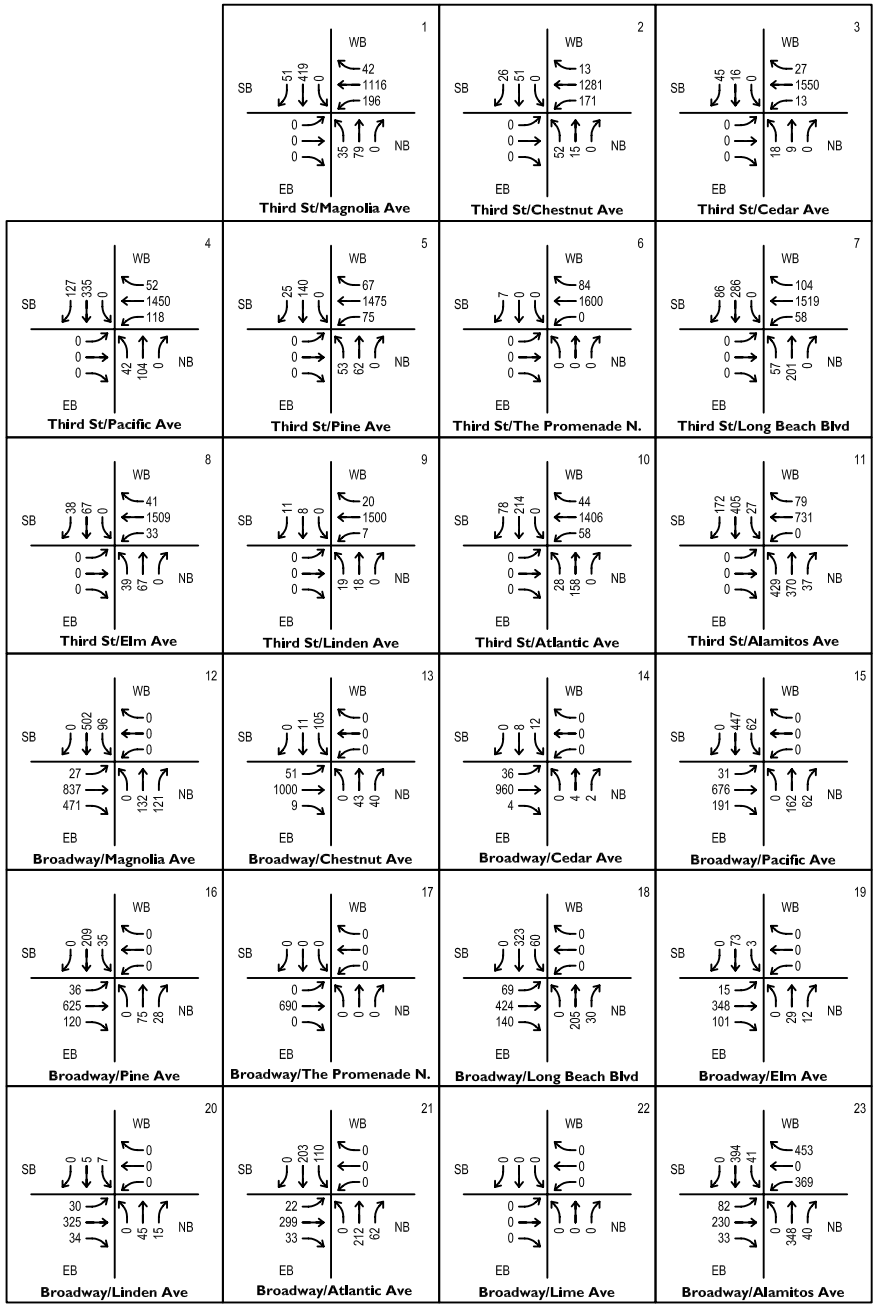
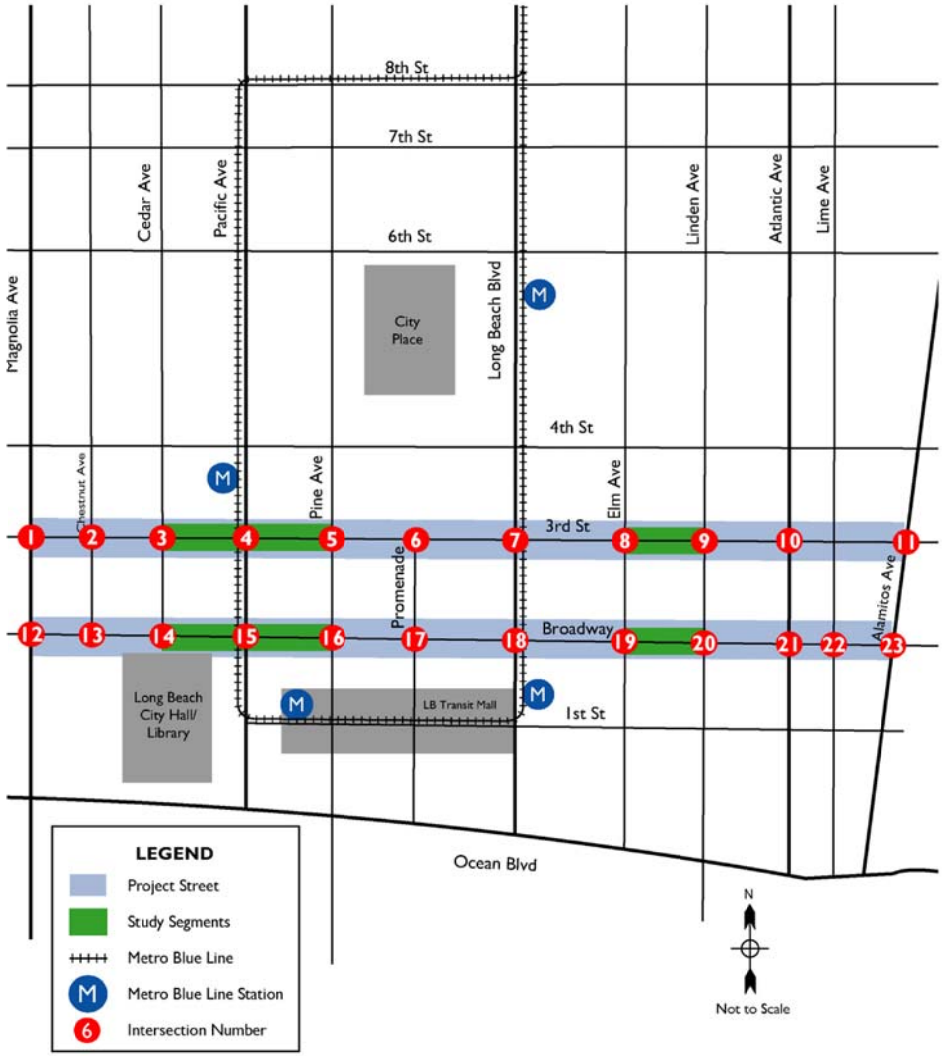


FIGURE 5.3 - PM PEAK HOUR INTERSECTION VOLUMES, BEFORE IMPLEMENTATION



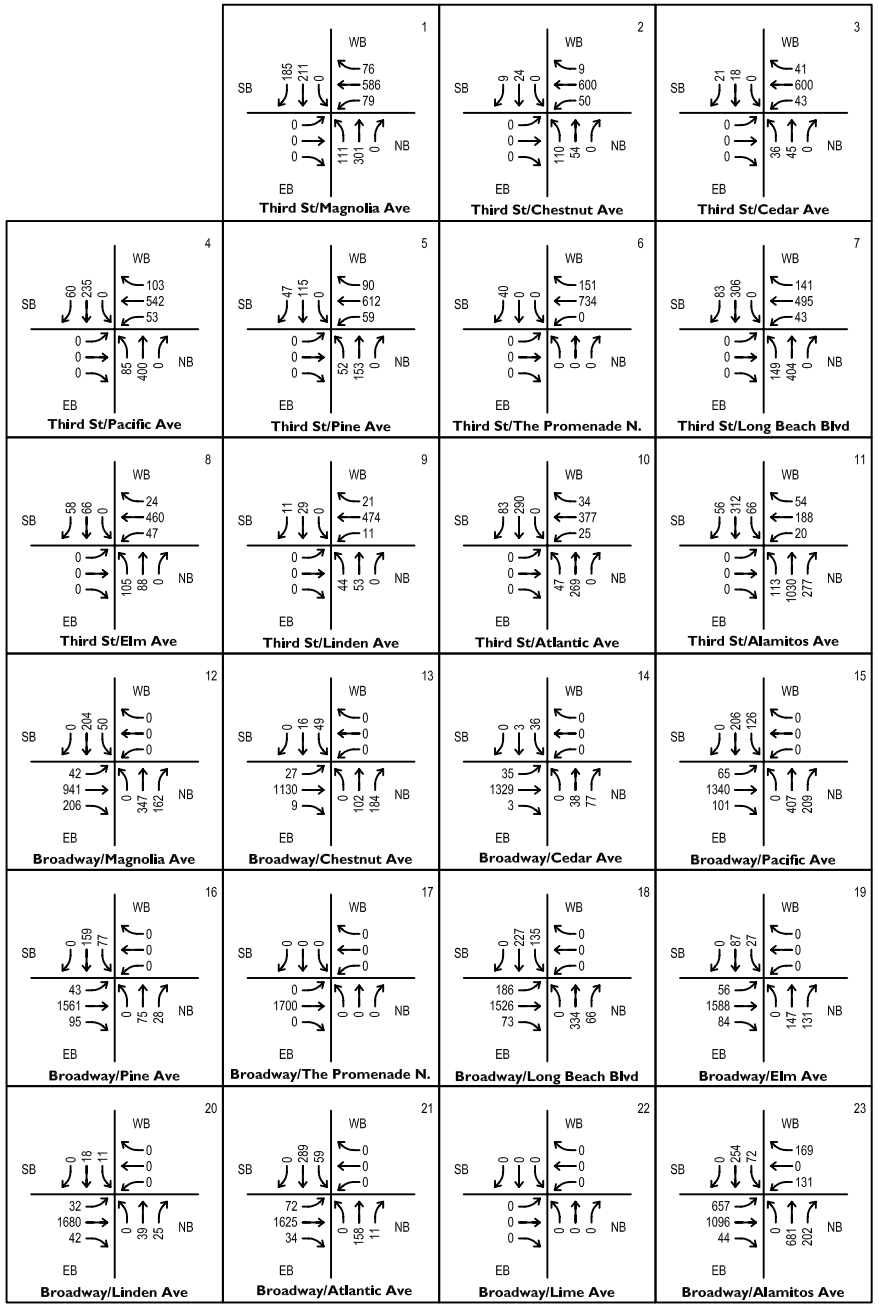
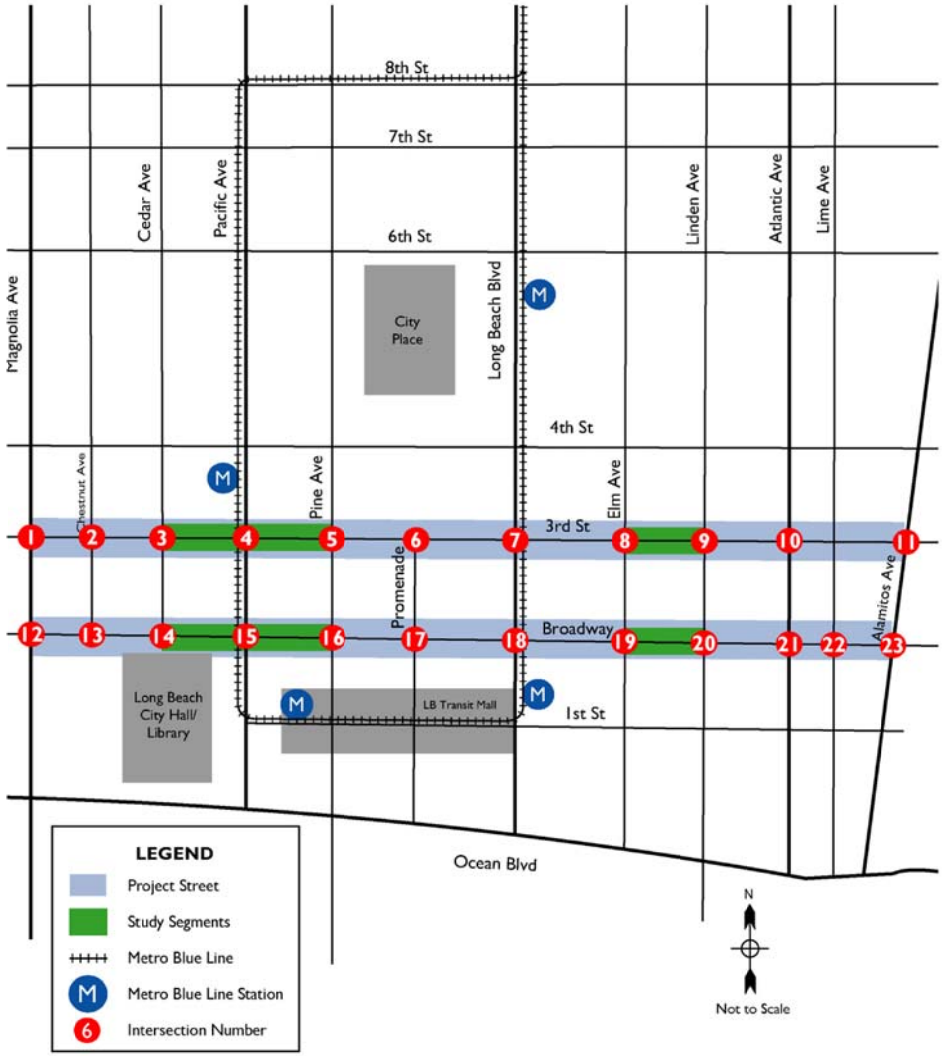


FIGURE 5.4 - AM PEAK HOUR INTERSECTION VOLUMES, AFTER IMPLEMENTATION



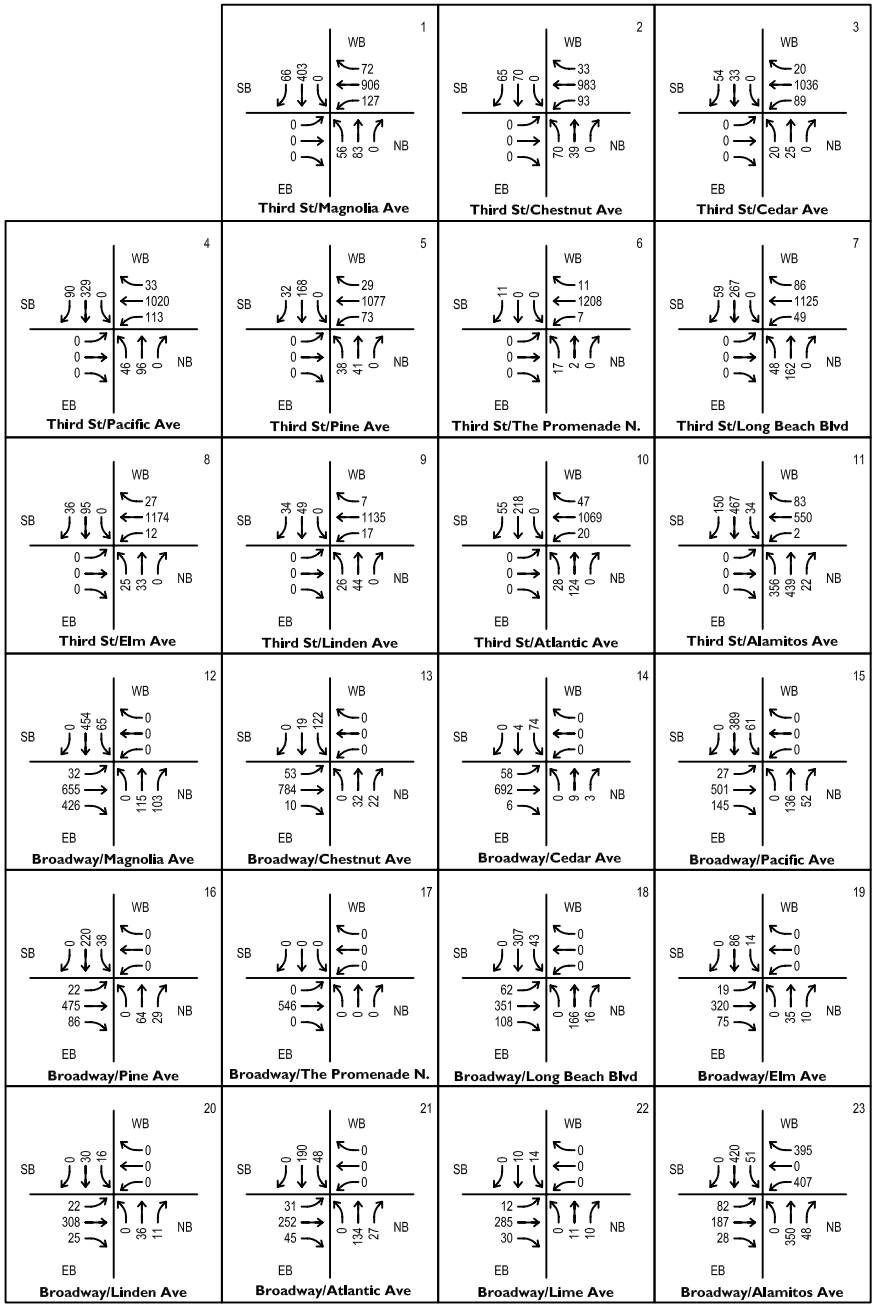
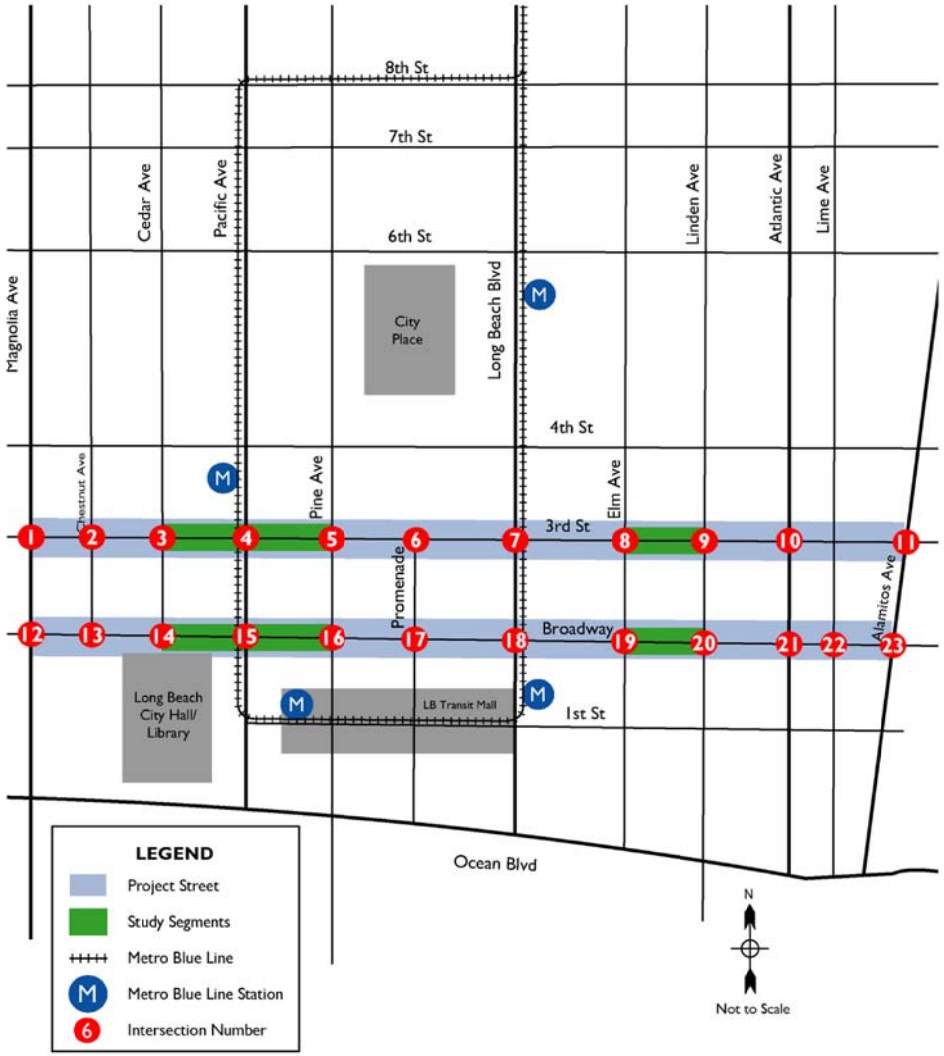
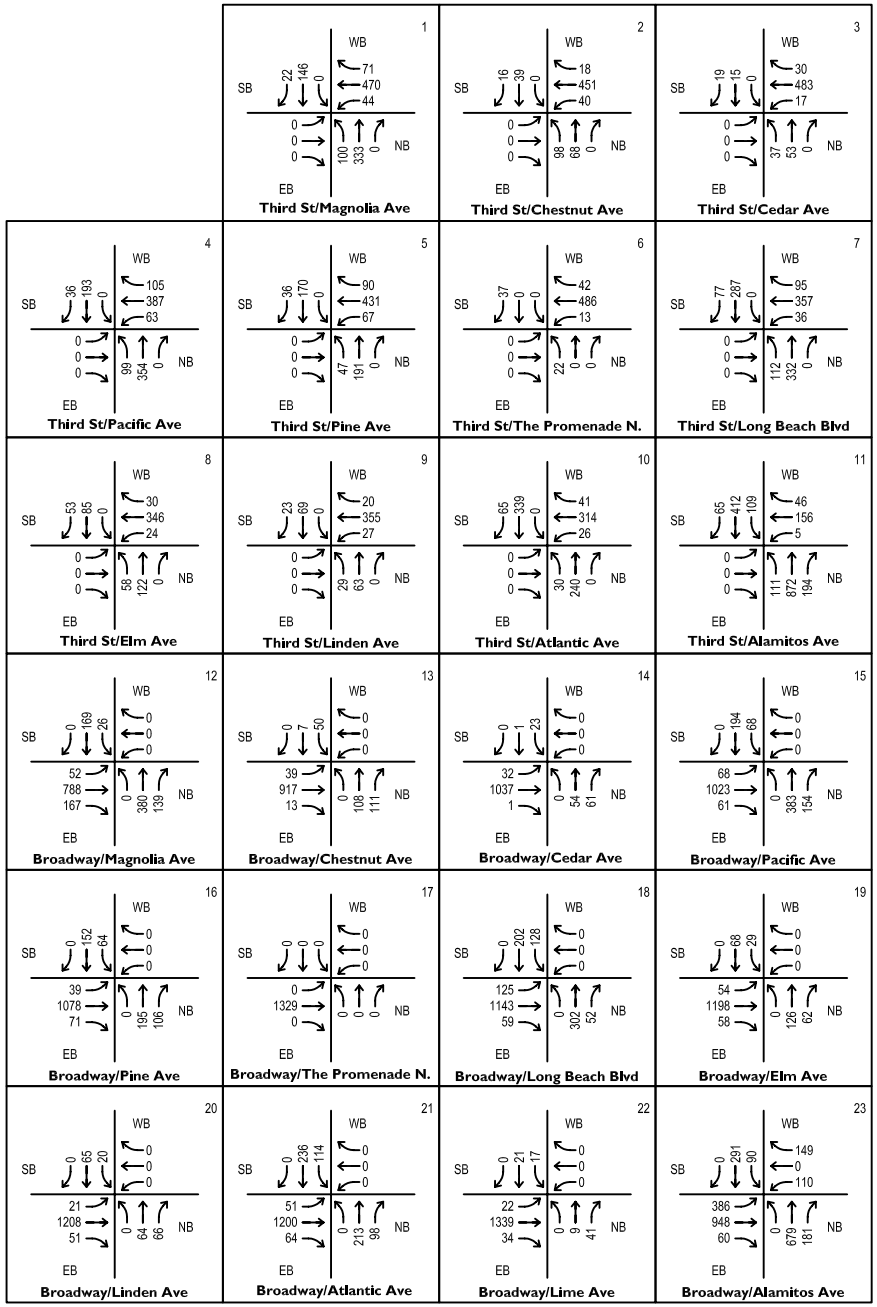


FIGURE 5.5 - PM PEAK HOUR INTERSECTION VOLUMES, AFTER IMPLEMENTATION





5.3 Intersection Operations Analysis

Intersection AM and PM peak hour operations analysis was conducted for the study area intersections, for "before" and "after" implementation of the project conditions. Tables 5.2 and 5.3 summarize the intersection operations analysis results for study area intersections along Broadway and Third Street, respectively.

As shown on Table 5.2, all the study area intersections on Broadway are operating at Level of Service "C" or better. Appendices 5.2 and 5.3 include the intersection operations analysis worksheets for conditions before and 12 months after implementation of the project, respectively.

Looking east on Broadway at Elm Avenue; the intersection is operating at Level of Service "A"

Table 5.2 – Intersection Operations Analysis Results for Broadway, Before and After Implementation

No.	Intersection	Peak Hour	Before		After	
			Delay (Sec)	LOS	Delay (Sec)	LOS
1	Broadway and Magnolia Ave	AM	12.5	B	13.5	B
		PM	11.7	B	14.1	B
2	Broadway and Chestnut Ave	AM	5.3	A	8.0	A
		PM	8.1	A	8.7	A
3	Broadway and Cedar Ave	AM	6.3	A	13.1	B
		PM	11.4	B	12.7	B
4	Broadway and Pacific Ave	AM	5.9	A	7.4	A
		PM	11.5	B	13.3	B
5	Broadway and Pine Ave	AM	10.0	B	6.2	A
		PM	13.6	B	11.8	B
6	Broadway and The Promenade	AM	1.1	A	2.6	A
		PM	2.4	A	4.5	A
7	Broadway and Long Beach Blvd	AM	5.6	A	6.1	A
		PM	8.8	A	14.2	B
8	Broadway and Elm Ave	AM	4.0	A	5.8	A
		PM	8.1	A	9.2	A
9	Broadway and Linden Ave	AM	4.7	A	8.4	A
		PM	5.5	A	8.1	A
10	Broadway and Atlantic Ave	AM	13.2	B	17.9	B
		PM	9.2	A	11.5	B
11	Broadway and Lime Ave	AM	7.3	A	6.1	A
		PM	4.5	A	4.1	A
12	Broadway and Alamitos Ave	AM	27.6	C	32.5	C
		PM	24.3	C	22.9	C

As shown on Table 5.3, all the study area intersections on Third Street are operating at Level of Service "B" or better. Appendices 5.2 and 5.3 include the intersection operations analysis worksheets for conditions before and 12 months after implementation of the project, respectively.

Looking west on Third Street at the Promenade; the intersection is operating at Level of Service "A"

Table 5.3 – Intersection Operations Analysis Results for Third Street, Before and After Implementation

No.	Intersection	Peak Hour	Before		After	
			Delay (Sec)	LOS	Delay (Sec)	LOS
13	3rd St and Magnolia Ave	AM	12.1	B	16.8	B
		PM	16.4	B	23.7	C
14	3rd St and Chestnut Ave	AM	3.3	A	8.7	A
		PM	6.4	A	9.8	A
15	3rd St and Cedar Ave	AM	4.8	A	8.4	A
		PM	3.9	A	6.0	A
16	3rd St and Pacific Ave	AM	7.8	A	10.8	B
		PM	8.2	A	10.5	B
17	3rd St and Pine Ave	AM	4.4	A	7.8	A
		PM	6.0	A	13.1	B
18	3rd St and The Promenade	AM	2.4	A	2.9	A
		PM	7.0	A	6.9	A
19	3rd St and Long Beach Blvd	AM	11.3	B	13.8	B
		PM	11.7	B	11.4	B
20	3rd St and Elm Ave	AM	4.2	A	9.6	A
		PM	11.5	B	14.8	B
21	3rd St and Linden Ave	AM	3.3	A	5.9	A
		PM	8.9	A	11.2	B
22	3rd St and Atlantic Ave	AM	8.8	A	13.8	B
		PM	8.7	A	11.6	B
23	3rd St and Alamitos Ave	AM	15.5	B	13.4	B
		PM	5.3	A	5.5	A

6. Speed and Behavioral Analysis

This section presents the speed and behavioral analysis for the conditions "before" and "after" implementation of the project. Time delay studies for bicycles and motor vehicles are also discussed in this section.

Appendix 6.1 includes the speed survey data sheets.

6.1 Conditions Before Implementation

Six hours of observations were conducted to record bicyclist and pedestrian behavior along the street before implementation of the project. Some cyclists were observed riding on the street against traffic, which according to recent studies of collision data in Long Beach has been the number one cause of bicycle related crashs over the past 10 years. Between Pine Avenue and Pacific Avenue, over 65% of bicyclists and many skateboarders were observed riding on the sidewalk. There was also considerable pedestrian volume from Long Beach Transit and Metro buses picking up and dropping off riders along this segment of Broadway.

The 85th percentile speed along Broadway in the project vicinity was 30.1 mph before implementation of the project. This means that on Broadway between Linden Avenue and Elm Avenue, approximately 15% of vehicles were traveling above the posted speed limit based on radar surveys. Along Third Street the 85th percentile speed in the project vicinity was 36 mph before implementation of the project (15% of the vehicles were traveling above 36 mph).

Observations of traffic conditions along Third Street between Linden Avenue and Elm Avenue noted frequent vehicle activity in and out of apartment parking lots and alleys. There were restaurants with bike deliveries during the busy lunchtime hour. There were some obstructions along this street segment such as restaurants with gates providing access directly onto the sidewalk for patio seating. Three potential conflicts between pedestrians, bicyclists, skateboarders, and turning vehicles were observed along this street segment.

Along Third Street between Pine Avenue and Pacific Avenue, traffic volume was observed as moderate. Approximately 50% of vehicles were observed to be traveling above the posted speed limit based on radar surveys.

6.2 Conditions After Implementation

The 85th percentile speed along Broadway in the project vicinity after project implementation was 26 mph based on the latest speed survey done in June, 2012. Few vehicles observed were traveling above the posted speed limit of 30 mph, based on radar surveys.

After implementation 53% of bicyclists were observed riding in the protected bikeway on Broadway. Bicyclists riding on the sidewalk on Broadway dropped significantly from over 65% down to 39% of the total bicyclist volume. Only 2% of cyclists were observed riding in the vehicle lanes.

The 85th percentile speed along Third Street in the project vicinity is now 27 mph based on the latest speed survey completed in June, 2012. Few vehicles were observed traveling above the posted speed limit of 30 mph, based on radar surveys.

Observation indicates that 61% of bicyclists are now riding in the protected bikeway on Third Street. Bicyclists riding on the sidewalk on Third Street are still common, but have dropped by over 50% from almost 70% before

installation of the protected lanes to just 30% after installation of the lanes. Just 5% of cyclists were observed riding in the vehicle lanes, mainly in the early evening hours.

6.3 Travel Time Delay Study

A travel time delay study was used to quantify the amount of time it takes to travel from one end of the project to the other. Results are quantified by measures such as total transit time, level of service (LOS) and average speed.

The results of the travel time delay study for bicycles are shown in Table 6.1. As shown, the average travel time for the 1-mile segment of Broadway is approximately 8 minutes regardless of time of day. On Third Street, the average travel time varies from about 7 minutes up to 9 minutes depending on time of day. Average speed is generally between 6 and 7 mph on both streets.

Table 6.1 – Travel Time Delay Study for Bicycles on Broadway and Third Street

Broadway Travel Time Delay Study															
Magnolia to Alamitos	AM Peak Period					MD Peak Period					PM Peak Period				
	Travel Time (min:sec)	Average Speed mph	Number of Signals	Number of Stops	G/R	Travel Time (min:sec)	Average Speed mph	Number of Signals	Number of Stops	G/R	Travel Time (min:sec)	Average Speed mph	Number of Signals	Number of Stops	G/R
Run 1	08:05	6.4	11	4.0	1.8	08:40	6.3	11	6.0	0.8	08:11	6.6	11	5.0	1.2
Run 2	07:50	6.1	11	5.0	1.2	06:50	7.8	11	4.0	1.8	07:40	7.1	11	3.0	2.7
Run 3	08:00	6.4	11	5.0	1.2	08:00	6.3	11	5.0	1.2	08:00	6.7	11	5.0	1.2
Average	**07:58**	**6.3**	**11**	**4.7**	**1.4**	**07:50**	**6.8**	**11**	**5.0**	**1.2**	**07:57**	**6.8**	**11**	**4.3**	**1.5**

3rd Street Travel Time Delay Study															
Alamitos to Magnolia	AM Peak Period					MD Peak Period					PM Peak Period				
	Travel Time (min:sec)	Average Speed mph	Number of Signals	Number of Stops	G/R	Travel Time (min:sec)	Average Speed mph	Number of Signals	Number of Stops	G/R	Travel Time (min:sec)	Average Speed mph	Number of Signals	Number of Stops	G/R
Run 1	07:05	7.8	10	4.0	1.5	07:00	7.5	10	3.0	2.3	08:40	6.2	10	5.0	1.0
Run 2	08:00	6.7	10	5.0	1.0	08:50	6.0	10	6.0	0.7	08:30	6.4	10	5.0	1.0
Run 3	06:50	7.8	10	4.0	1.5	07:10	7.6	10	4.0	1.5	09:31	5.6	10	6.0	0.7
Average	**07:18**	**7.4**	**10**	**4.3**	**1.3**	**07:40**	**7.0**	**10**	**4.3**	**1.3**	**08:54**	**6.1**	**10**	**5.3**	**0.9**

The results of the travel time delay study for vehicles are shown in Table 6.2. As shown, the average travel time for vehicles on Broadway is approximately 3 minutes regardless of time of day. On Third Street, the average vehicle travel time is about 2 ½ minutes. Average speed is generally between 18 and 19 mph on Broadway and 23 to 27 mph on Third Street depending on time of day.

Table 6.2 – Travel Time Delay Study for Vehicles on Broadway and Third Street

Broadway Travel Time Delay Study																
Magnolia to Alamitos	AM Peak Period					MD Peak Period						PM Peak Period				
	Travel Time (min:sec)	Average Speed mph	Number of Signals	Number of Stops	G/R	Travel Time (min:sec)	Total Delay (sec)	Average Speed mph	Number of Signals	Number of Stops	G/R	Travel Time (min:sec)	Average Speed mph	Number of Signals	Number of Stops	G/R
Run 1	02:53	19.2	11	2.0	4.5	03:07	49	17.8	11	2.0	4.5	02:22	23.2	11	0.0	11
Run 2	02:55	18.9	11	1.0	10	03:02	38	18.2	11	1.0	10	03:20	16.5	11	2.0	4.5
Run 3	03:00	18.3	11	2.0	4.5	03:10	59	17.5	11	2.0	4.5	03:25	16.1	11	2.0	4.5
Average	**02:56**	**18.8**	**11**	**1.7**	**5.6**	**03:06**	**48.7**	**17.8**	**11**	**1.7**	**5.6**	**03:02**	**18.6**	**11**	**1.3**	**7.3**

3rd Street Travel Time Delay Study																
Alamitos to Magnolia	AM Peak Period					MD Peak Period						PM Peak Period				
	Travel Time (min:sec)	Average Speed mph	Number of Signals	Number of Stops	G/R	Travel Time (min:sec)	Total Delay (sec)	Average Speed mph	Number of Signals	Number of Stops	G/R	Travel Time (min:sec)	Average Speed mph	Number of Signals	Number of Stops	G/R
Run 1	02:04	27.2	10	0	10	02:03	0	27.3	10	0.0	10	02:27	22.9	10	0	10
Run 2	02:03	27.3	10	0	10	02:53	46	19.6	10	2.0	4	02:28	22.8	10	0	10
Run 3	02:07	26.4	10	0	10	02:01	0	27.9	10	0.0	10	02:23	23.5	10	0	10
Average	**02:05**	**27.0**	**10**	**0**	**10**	**02:19**	**15.3**	**24.9**	**10**	**0.7**	**14**	**02:26**	**23.1**	**10**	**0**	**10**

7. Crash History

This section presents the crash history for the conditions "before" and "after" implementation of the project.

7.1 Crash History

Crash history is based on police crash reports taken and recorded in the City of Long Beach Police Department database. Appendix 7.1 includes the crash history data sheets.

7.1.1 Broadway Crash History

The crash history for Broadway was analyzed for the three years prior to implementation, with the focus on bicycle-related crashes. Analysis of the three previous years found twelve bicycle-related crashes on Broadway. The actual written report for each bicycle-related crash was closely analyzed to help establish a benchmark for the types of bicycle crashes reported. These reports are summarized below (complete reports are included in Appendix 7.1):

- 4/18/09. 12:00 PM. Broadway/Chestnut Avenue (at intersection): A vehicle traveling eastbound on Broadway and proceeding straight at the intersection with Chestnut Avenue collided with a bicycle traveling westbound (wrong way) and proceeding straight.

- 7/19/09 22:00. Broadway/Chestnut Avenue (at Intersection): A vehicle traveling eastbound and making a right turn south onto Chestnut Avenue collided with a bicycle traveling southbound on Chestnut Avenue proceeding straight.

- 9/10/09 18:28. Broadway/Atlantic Avenue (20 feet south of intersection): A vehicle traveling eastbound on Broadway and proceeding straight collided with a bicycle traveling southbound on Atlantic Avenue.

- 4/6/10 14:32. Broadway/Pacific Avenue (at intersection): A bicycle traveling northbound on Pacific Avenue and proceeding straight collided with a vehicle traveling northbound at Broadway.

- 6/13/10 19:22. Broadway/Elm Avenue (six feet north of intersection): A vehicle traveling southbound on Elm Avenue and proceeding straight through the intersection with Broadway collided with a bicycle traveling eastbound on Broadway proceeding straight.

- 6/25/10 18:35. Broadway/Pacific Avenue (at intersection): A vehicle traveling north on Pacific Avenue and proceeding straight through the intersection collided with a bicycle traveling east on Broadway and proceeding straight.

- 7/30/10 17:50. Broadway/Atlantic Avenue (at intersection): A vehicle traveling westbound on Broadway, proceeding straight collided with a bicycle traveling eastbound on Broadway, making a right turn onto Atlantic Avenue.

- 9/13/10 10:53. Broadway/Linden Avenue (at intersection): A vehicle traveling eastbound on Broadway making a left turn onto Linden Avenue collided with a bicycle traveling northbound on Linden Avenue.

- 10/14/10 20:41. Broadway/Alamitos Avenue (six feet west of intersection): A vehicle traveling eastbound on Broadway and proceeding straight through the intersection with Alamitos Avenue collided with a bicycle traveling eastbound on Broadway and proceeding straight.

- 11/15/11 16:47. Broadway/Elm Avenue (60 feet west of Elm Avenue): A vehicle traveling eastbound on Broadway and making a left-turn approximately 60 feet west of Elm Avenue collided with a bicycle traveling eastbound on Broadway and proceeding straight.

- 5/16/12 07:00. Broadway/Alamitos Avenue: A vehicle traveling eastbound on Broadway made a right-turn and collided with a bike going south and proceeding straight on Alamitos. The primary cause was stated as unknown, however based on the description of the accident it is believed the bicyclist was on the wrong side of the street or coming off of the sidewalk.

- 10/01/12 11:57. Broadway/Linden Avenue: A vehicle traveling eastbound on Broadway and making a left turn onto Linden collided with a bike traveling northbound and proceeding straight on Linden. The cause was determined to be improper turning by the vehicle.

- 11/15/12 16:47. Broadway/Elm Avenue: A vehicle traveling eastbound on Broadway and making a left-turn onto Elm Avenue collided with a bike also traveling eastbound on Broadway and proceeding straight. The primary cause was determined to be improper turning by the vehicle.

Within one year following project completion just three bicycle-related crashes have been reported on Broadway in the project area. This is a 25% reduction from the number of crashes reported per year in the prior three years.

7.1.2 Third Street Crash History

The crash history for Third Street was analyzed for the three years prior to implementation, with the focus on bicycle-related crashes. Analysis of the three previous years found seven bicycle-related crashes for Third Street. The reports are summarized below (complete reports are included in Appendix 7.1):

- 3/4/09 11:03. Third Street/Atlantic Avenue (six feet south of intersection): A vehicle traveling westbound on Third Street and making a right turn onto Atlantic Avenue collided with a bicycle traveling northbound and proceeding straight on Atlantic Avenue.

- 7/4/09 21:32. Third Street/Chestnut Avenue (10 feet west of intersection): A vehicle traveling westbound on Third Street and making a right turn onto Chestnut Avenue collided with a bicycle traveling northbound and proceeding straight on Chestnut Avenue.

- X2/12/10 13:10. Third Street/Linden Avenue (eight feet south of intersection): A bicycle traveling westbound on Third Street collided with a vehicle proceeding westbound on Third Street.

- 6/24/10 19:21. Third Street/Elm Avenue (four feet north of intersection): A vehicle traveling west on Third Street and making a right turn onto Elm Avenue collided with a bicycle traveling eastbound on Third Street (wrong way) stopped in the road.

- 9/16/10 19:14. Third Street/Pine Avenue (six feet east of intersection): A vehicle traveling southbound on Pine Avenue and proceeding straight collided with a bicycle proceeding westbound on Third Street making a left-turn onto Pine Avenue.

- 11/15/10 13:24. Third Street/ Pine Ave (at intersection): A vehicle traveling westbound on Third Street and making a right turn onto Pine Avenue collided with a bicycle traveling northbound on Pine Avenue.

Within one year following project completion no bicycle-related crashes have been reported on Third Street in the project area. This is a 100% reduction from the number of crashes reported in the prior three years. Annual crashes involving vehicles, bicycles, and pedestrians are summarized in Table 7.1.

7.2 Crash Data Comparison Before and After Implementation

Crash experience for all types of vehicles on both streets was compiled for the three years prior to implementation and the year following implementation to determine typical annual experience for the roadway. Non-bicycle crashes were not analyzed in detail, but annual crashes and annual crashes involving bicycles are noted in Table 7.2.

Table 7.1 – Summary of Three-Year Vehicle, Bicycle, and Pedestrian Crash History on Broadway and Third Street

3rd Street	Vehicle	Bike	Ped	Bike+Ped	Total
April 2008 - March 2009	34	1	1	2	36
April 2009 - March 2010	23	2	2	4	27
April 2010 - March 2011	27	4	2	6	33
April 2011 - March 2012	20	0	0	0	20
Broadway	**Vehicle**	**Bike**	**Ped**	**Bike+Ped**	**Total**
April 2008 - March 2009	38	1	2	3	41
April 2009 - March 2010	44	3	1	4	48
April 2010 - March 2011	40	8	1	9	49
April 2011 - March 2012	33	3	1	4	37
Combined	**Vehicle**	**Bike**	**Ped**	**Bike+Ped**	**Total**
April 2008 - March 2009	72	2	3	5	77
April 2009 - March 2010	67	5	3	8	75
April 2010 - March 2011	67	12	3	15	82
April 2011 - March 2012	53	3	1	4	57

Table 7.2 – Three-Year Crash Experience on Broadway and Third Street, Before and After Implementation

Project Conditions	Year (Apr-Apr)	Total Number of Reported Crashes	Number of Crashes Involving Bicycles
Before Implementation	2008 - 2009	77	2
	2009 - 2010	75	5
	2010 - 2011	82	12
After Implementation	2011 - Present	57	3

In the three years before implementation, there were a total of 19 bicycle-involved crashes along Broadway and Third Street, including:

- Three wrong way bicyclists
- Two crashes in the parked vehicle "door zone"
- Five crashes involving right-turning vehicles
- Two crashes involving left-turning vehicles
- Seven other intersection crashes

Five of the nineteen crashes were of the type that might be reduced if the protected lanes reduced wrong way cycling or reduced bicycling in the "door zone".

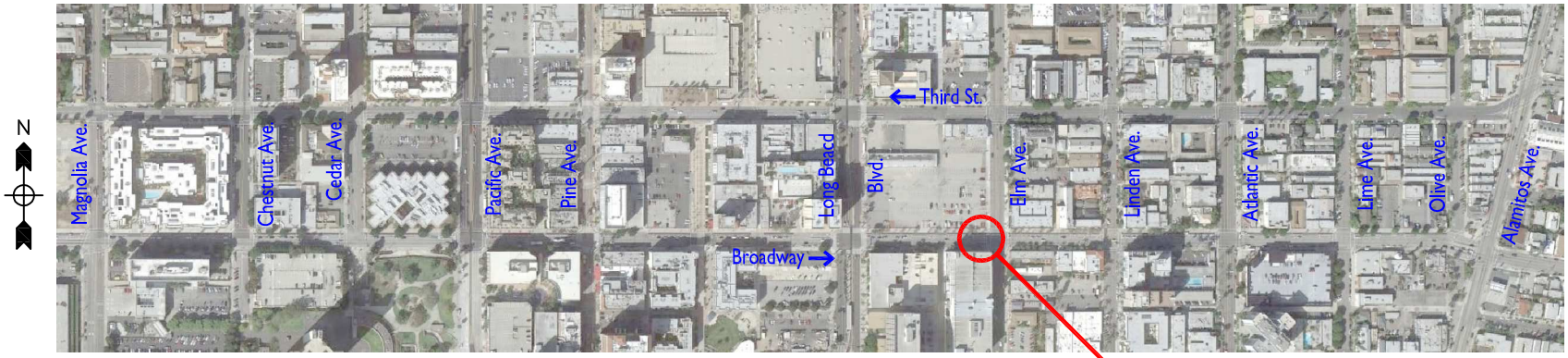
Since implementation, there have been only three crashes involving bicycles (all on Broadway). These have been attributed to left-turning vehicles (see Figure 7.1 on the next page).

The vehicle collision rate fell by nearly 25% on Broadway and Third Street after implementation of the separated lanes. On Third Street they fell by nearly 30 percent and on Broadway by 20%.

A truck parked in the protected bikeway forcing the cyclist to use the vehicular lane or sidewalk

FIGURE 7.1 - CRASH HISTORY RELATED TO BICYCLES,
(ONE EXAMPLE) AFTER IMPLEMENTATION

* After implementation, there are no crash involving bicycles on Third Street.



Location	BROADWAY 60' West of ELM AVENUE		Date	11/15/2011	Time	4:47 PM	
Crash Party 1 EB			Crash Party 2 EB			Probable Cause of Accident	Injury
Vehicle Type	Direction	Movement	Vehicle Type	Direction	Movement		Total / Kids
Motor Vehicle	Eastbound	Making Left Turn	Bicycle	Eastbound	Proceeding Straight	Improper Turning	1 / 0

* After implementation, there are three crashes involving bicycles on Broadway.

J:\2012\JB23052 LB 12 Mo After Study 3rd & Broadway\Analysis\Figures\Accident\Crash_After_Summary.dwg

8. Parking Conditions

This section presents parking conditions along Third and Broadway before and after implementation of the protected bikeway project. The analysis documents the available parking supply and demand along both streets in the project area.

8.1 Parking Background

Before implementing the protected bikeway project, both Third Street and Broadway had three travel lanes with parking on both sides of the street. With the protected bikeway project the streets now provide a bikeway along the left side of each street, separated from traffic by a parking lane and a raised curb. The parking lane along the left side of the street forms a buffer between the protected bikeway and the vehicle lanes.

The protected bikeway project involved removal of one traffic lane on both Broadway and Third Street and installation of protected bikeways on the left side of each street. Parking was retained on both sides of each street, however twenty-eight parking spaces were removed on Broadway and twenty parking spaces were removed on Third Street as a result of the project. Pay parking is now allowed along the right curb, and time limit parking is allowed along the left curb.

Parking conditions along Broadway and Third Street were evaluated to determine the after implementation parking demand along each street. The following provides a description of Broadway, Third Street, the adjacent off-street lots, and the local street network in the study area.

8.1.1 On-Street Parking

Broadway is a one-way eastbound arterial street traversing a commercial/business district in the downtown area of Long Beach. The street has a curb-curb width of 52 feet in the project vicinity. The typical cross-section of the street is now a 9-foot protected bike lane, 5-foot buffer, 8-foot parking lane, two 11-foot eastbound traffic lanes, and an 8-foot parking lane on the right side of the street. There are sidewalks on both sides of the street. The segment of Broadway that includes the protected bikeway is approximately one mile long.

Third Street is a one-way westbound arterial street traversing a commercial/business district in downtown Long Beach. The street has a curb-curb width of 52-feet in the project vicinity. The typical cross-section of the street is now a 9-foot protected bike lane, 5-foot buffer, 8-foot parking lane, two 11-foot westbound traffic lanes, and an 8-foot parking lane on the right side of the street. There are sidewalks on both sides of the street. The segment of Third Street included in the protected bikeway project is approximately one mile long.

Land use along Broadway is a mix of commercial offices, retail, restaurant, and other commercial businesses, high-density residential, and government offices. Along Third Street land use is dominated by high-density residential, commercial offices, retail, and restaurant businesses. On-street parking along both Broadway and Third Street is currently allowed along the entire length of both streets in the project area, except short segments where red curb exists, generally near intersections and driveways.

Approximately 152 on-street parking spaces are provided along the segment of Broadway between Magnolia Avenue and Alamitos Avenue. There are 65 spaces on the left (north) side, 87 spaces on the right (south) side. On

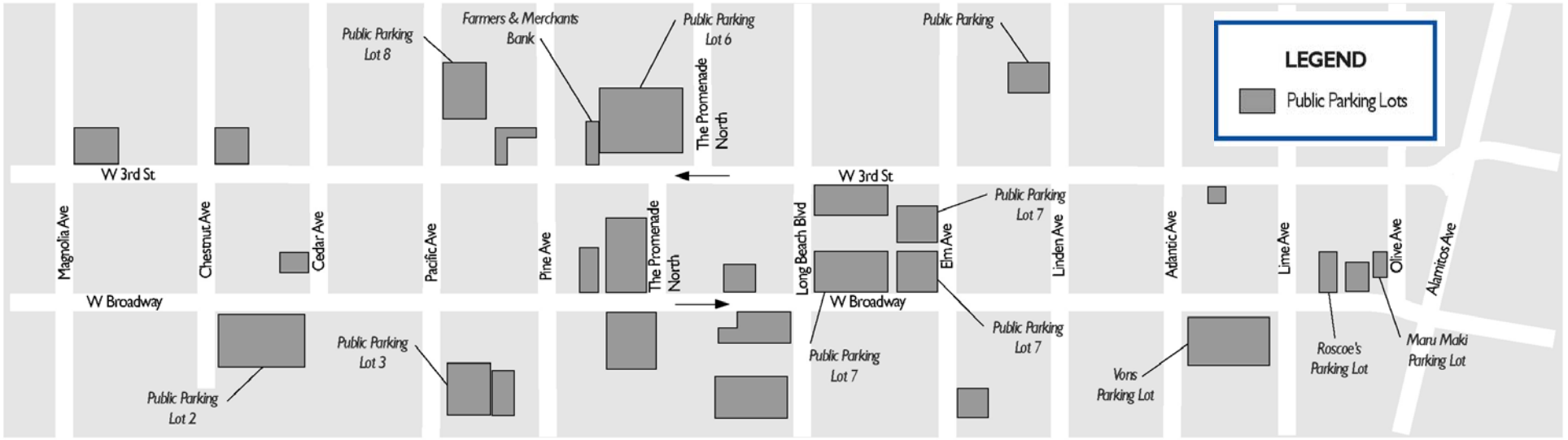
Third Street, approximately 164 on-street parking spaces are provided along the segment between Magnolia Avenue and Alamitos Avenue with 62 spaces on the left (south) side and 102 spaces on the right (north) side.

8.1.2 Off-Street Parking

There are several available off-street parking lots and structures adjacent to Broadway and Third Street that would be available for any excess parking demand along the two streets. Figure 8.1 illustrates the off-street parking lot locations. These facilities include the following public lots in addition to several lots associated with shopping centers and private businesses along Broadway and Third Street:

- Public Parking Lot 2
- Public Parking Lot 3
- Public Parking Lot 6
- Public Parking Lot 7
- Public Parking Lot 8

FIGURE 8.1 – PUBLIC PARKING LOT LOCATIONS



8.2 Parking Analysis

The following examines the parking supply/demand balance along Broadway and Third Street after implementation of the protected bikeway project.

8.2.1 Parking Supply Inventory

KOA Corporation inventoried the two streets to determine the overall supply of parking spaces. The inventory of available parking was conducted along each street on a block-by block basis within the study area. Table 8.1 summarizes the existing parking supply for Broadway.

On-street parallel parking is available on both sides of Third between Chestnut Avenue and Magnolia Avenue

Table 8.1 – Parking Supply on Broadway

Street Segment	Parking Supply on Broadway		
	North Side	South Side	Total Spaces
Alamitos-Lime	3	8	11
Lime-Atlantic	5	12	17
Atlantic-Linden	5	11	16
Linden-Elm	6	10	16
Elm-LBB	6	4	10
LBB-Promenade	6	12	18
Promenade-Pine	8	9	17
Pine-Pacific	5	9	14
Pacific-Cedar	8	0	8
Cedar-Chestnut	7	0	7
Chestnut-Magnolia	6	12	18
Total Spaces	65	87	152

Table 8.2 summarizes the existing parking supply for Third Street.

Table 8.2 – Parking Supply on Third Street

Street Segment	Parking Supply on Third Street		
	North Side	South Side	Total Spaces
Alamitos-Lime	10	0	10
Lime-Atlantic	12	3	15
Atlantic-Linden	10	6	16
Linden-Elm	9	7	16
Elm-Long Beach	9	9	18
Long Beach-Promenade	5	4	9
Promenade-Pine	11	10	21
Pine-Pacific	7	5	12
Pacific-Cedar	5	6	11
Cedar-Chestnut	11	5	16
Chestnut-Magnolia	13	7	20
Total Spaces	102	62	164

For segments where no parking stalls are marked, the parking supply on Broadway and Third Street was estimated based upon the length of curb available between driveways and the length of a typical vehicle parking space, 20 to 25 feet.

8.2.2 Parking Demand

KOA conducted parking occupancy surveys along the two streets. The parking occupancy surveys include evaluation of parking conditions for both streets on a weekday (Wednesday, May 23, 2012). The surveys were conducted between the hours of 8:00 AM and 6:00 PM. Parking occupancy counts were collected once per hour for the two streets during this time interval.

The peak period of parking demand for Broadway occurred from approximately 12:00 PM to 1:00 PM. On-street parking usage was highest on the north (left) side of Broadway, where there was an overall utilization rate of about 85% to 100% along most segments of the street. On the south (right) side, occupancy varied from about 50% up to 100%. There was a peak demand of 130 vehicles parked on Broadway in 152 available parking spaces, for an overall occupancy rate of about 85%.

On Third Street, peak parking demand occurred from approximately 5:00 PM to 6:00 PM. On-street parking usage was approximately the same on both sides of the street. There was wide variation by street segment, however, with some segments having just 25% to 50% occupancy, and others having 90% to 100% occupancy. There were a total of 118 vehicles parked on Third Street at the peak hour in 164 available parking spaces, for an overall occupancy rate of about 70%.

Additional parking demand information is provided in Appendix 8.1 of this report.

In conclusion, the parking occupancy survey shows that the overall peak parking demand for Broadway and Third Street is within current capacity, although certain segments are parked at 100% of capacity during the peak hours. If the parking configuration is changed, however, some parking demand could be shifted to other nearby streets and parking lots.

Existing weekday curb parking demand along Broadway and Third Street in the study area is summarized by block in Tables 8.3 and 8.4, respectively.

Parking on Broadway west of the Promenade

Table 8.3 – Peak Parking Demand, Broadway

Street Segment	North Side Curb Parking Supply	North Side Curb Parking Demand	South Side Curb Parking Supply	South Side Curb Parking Demand
Magnolia-Chestnut	6	6	12	12
Chestnut-Cedar	7	7	0	0
Cedar-Pacific	8	6	0	0
Pacific-Pine	5	5	9	9
Pine-Promenade	8	7	9	7
Promenade-LBB	6	6	12	10
LBB-Elm	6	5	4	2
Elm-Linden	6	5	10	8
Linden-Atlantic	5	5	11	11
Atlantic-Lime	5	5	12	10
Lime-Alamitos	3	3	8	8
Total	65	60	87	77
Occupancy	N/A	92%	N/A	89%

Table 8.4 – Peak Parking Demand, Third Street

Street Segment	North Side Curb Parking Supply	North Side Curb Parking Demand	South Side Curb Parking Supply	South Side Curb Parking Demand
Magnolia-Chestnut	13	11	7	7
Chestnut-Cedar	11	11	5	5
Cedar-Pacific	5	4	6	1
Pacific-Pine	7	7	5	4
Pine-Promenade	11	3	10	5
Promenade-LBB	5	3	4	2
LBB-Elm	9	5	9	5
Elm-Linden	9	7	7	4
Linden-Atlantic	10	9	6	6
Atlantic-Lime	12	11	3	3
Lime-Alamitos	10	10	0	0
Total	102	81	62	42
Occupancy	N/A	79%	N/A	68%

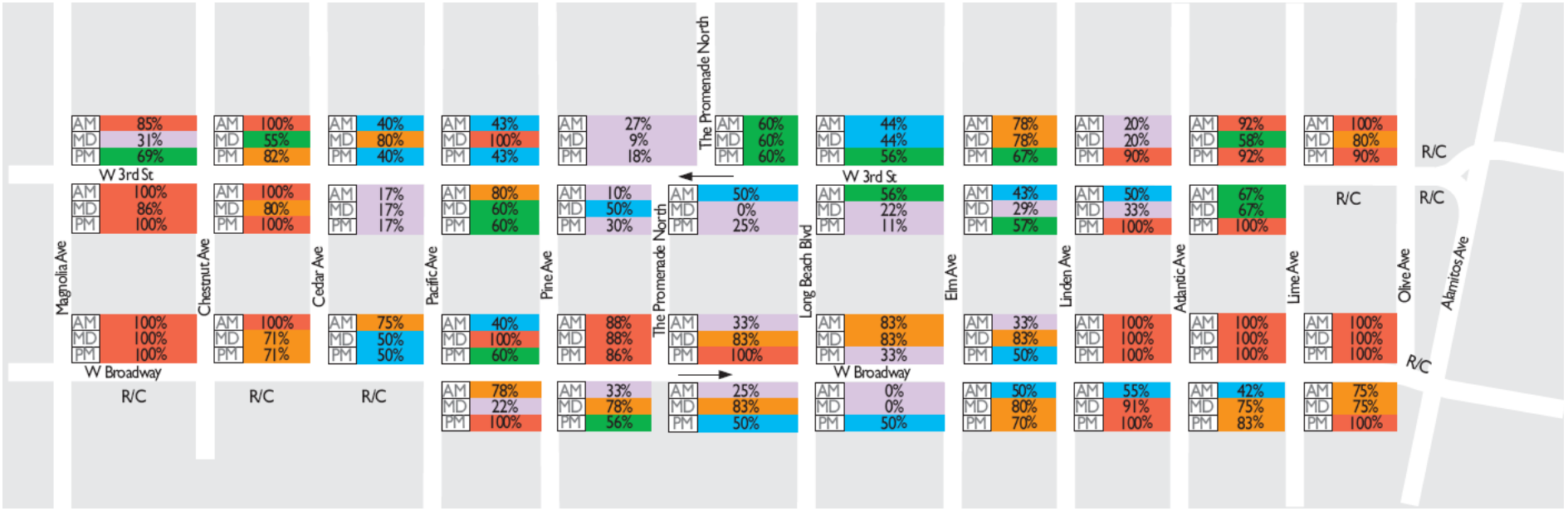
8.3 Parking Conclusion

Overall peak parking demand is currently within available capacity along both Broadway and Third Street, however many blocks are at 85% to 100% occupancy during the peak time periods. Parking occupancy varies widely by time of day. If there is a change in the on-street parking supply, some vehicles could be displaced from curb parking to off-street parking. Observation of the off-street parking supply in the project area indicates that any vehicles displaced from curbside parking could be accommodated in the adjacent off-street lots.

On Third Street between the Promenade and Long Beach Boulevard, a truck parked in the buffer zone to load furniture

Figure 8.2 summarizes the peak on-street parking occupancy for Broadway and Third Street by time of day.

FIGURE 8.2 – PARKING OCCUPANCY BY BLOCK



Looking east on Broadway west of Chestnut Avenue; On-street parking spaces are mostly occupied

ON-STREET PARKING LEGEND

- 0%-40% Occupancy
- 40%-55% Occupancy
- 55%-70% Occupancy
- 70%-85% Occupancy
- 85% + Occupancy
- R/C Red Curb

9. Design Considerations

The protected bike lanes in Long Beach presented several design challenges. This section outlines the key challenges and how they were addressed. Key design challenges and considerations include the following:

- Non-Standard Intersections
  - Intersections with light rail crossing
  - Transition onto and off of separated lanes
- Pedestrian Impediments
- Drainage
- Driveway Conflicts
- Sight Distance
- ADA Compliance

9.1 Non-Standard Intersections

Most intersections on the bikeway are standard right angle, 4 way intersections. About 50% of these intersections are signalized. The treatment for these intersections has been discussed earlier.

However there are two styles of intersections that were considered non-standard and presented design challenges. The first of these are intersections where a light rail line runs down the center of the cross street. There were four of these intersections. The second is where the separated lanes start and end at the east end of the project area. There are two of these intersections. One at Broadway and Alamitos, where the separated lane on Broadway ends, and the other at 3rd and Alamitos, where the 3rd Street separated lane begins. The start and finish of the lanes at the west end of the project area were not problematic as they in effect dead end at a freeway that bounds the western edge of the downtown area.

9.1.1 Broadway at Alamitos Avenue

There is a design consideration with the implementation of the project on the eastbound approach of Broadway at Alamitos Avenue. Figure 9.1 illustrates the design considerations associated with where the eastbound dedicated bike lane on Broadway ends at Olive Avenue prior to Alamitos Avenue.

Where the eastbound bike lane ends at Olive Avenue, there is a natural tendency for bicyclists to proceed along the north side of Broadway (the left side of the street) and onto the sidewalk. This is due to the lack of a bike lane on the 102-foot stretch of Broadway between Olive Avenue and Alamitos Avenue. From the sidewalk bicyclists either cross Alamitos at the crosswalk or go north on the sidewalk and cross Alamitos at the crosswalk on the south side of Third Street. When bicyclists cross at the Broadway crosswalk the result is a conflict with motorists who are simultaneously turning left from Broadway onto Alamitos.

Right turns from Broadway onto Alamitos Avenue are also difficult. The current configuration of the separated lanes does not provide any guidance for bicyclists who want to make a right turn or to proceed straight on Broadway. There is no warning sign or guide sign prior to the end of the bike lane. As a result bicyclists going right or straight tend to make one of two moves. Either they stay on the left side of the street up to the intersection and then cross Broadway at the crosswalk, or they merge with traffic one to two blocks west of the Alamitos intersection and move to the right side of the street, where they then ride with the flow of traffic. As shown on Figure 9.1, when bicycles are turning right from the left turn lane at the same time with the left-turning motor vehicles, the conflicting

movements may be hazardous especially when the eastbound vehicular traffic volumes on Broadway are quite high.

9.1.2 Third Street at Alamitos Avenue

There is a design consideration with the implementation of the project on Third Street west of Alamitos Avenue. Figure 9.2 illustrates how the design for Third at Alamitos has resulted in a short merge distance for the westbound vehicular lanes. The westbound merge distance is only 200 feet which starts approximately 135 feet west of Alamitos Avenue. Northbound vehicles from Alamitos Avenue merge with westbound through traffic on Third Street during the same phase of the signal. As shown on Figure 9.2, the northbound left turn traffic is 400 vehicles per hour and the westbound through traffic is 730 vehicles per hour. With such high conflicting vehicular traffic, the westbound merge movement will be difficult with a short 200-foot merge distance.

Another consideration is the conflicting merge movement between the westbound through motor vehicles and bicycles. On Third Street east of Alamitos Avenue, bicyclists tend to ride on the right side of the street when they share the road with the motor vehicles. On Third Street west of Alamitos Avenue, westbound through bicycles need to merge left to go to the protected bikeway on the left side of the street. The left-merging bicyclist movements potentially conflict with westbound through motor vehicles. Without guide signs, it may be confusing for the bicyclists on how to proceed. The bicyclists may not be aware that they need to merge left until they travel past Alamitos Avenue, and then realize that the protected bikeway is on the left side of the street.

9.1.3 Crossing Light Rail Lines at Pacific Avenue and at Long Beach Boulevard

The separated bike lanes cross light rail lines at four intersections: Broadway and Pacific, Broadway and Long Beach Boulevard, Third and Pacific, and Third and Long Beach Boulevard. Each of these intersections is signalized as are most other intersections along the route, but are more difficult to deal with because of the complexity resulting from dealing with the trains. All other signals along the route have standard phasing and timing, but signals at these four intersections also respond to an approaching train. As a result it is more complicated using bike signals at these four intersections as they would need to synch with both the normal traffic signals as well as the train signals.

As a result of the issues associated with the light rail signal timing it was decided not to use signals to control bicycle movements at these four intersections, but instead to use a "weave" to place the bicyclists on the right hand side of left turning vehicles, thus avoiding turning conflicts and potential left hooks.

Figure 9.3 shows the design associated with the protected bikeway weave through the eastbound left turn lane at the conflict with the Blue Line at Broadway and Pacific. Green pavement marking is provided to guide bicyclists through the weave to the protected bikeway located on the right side of the eastbound left turn lane.

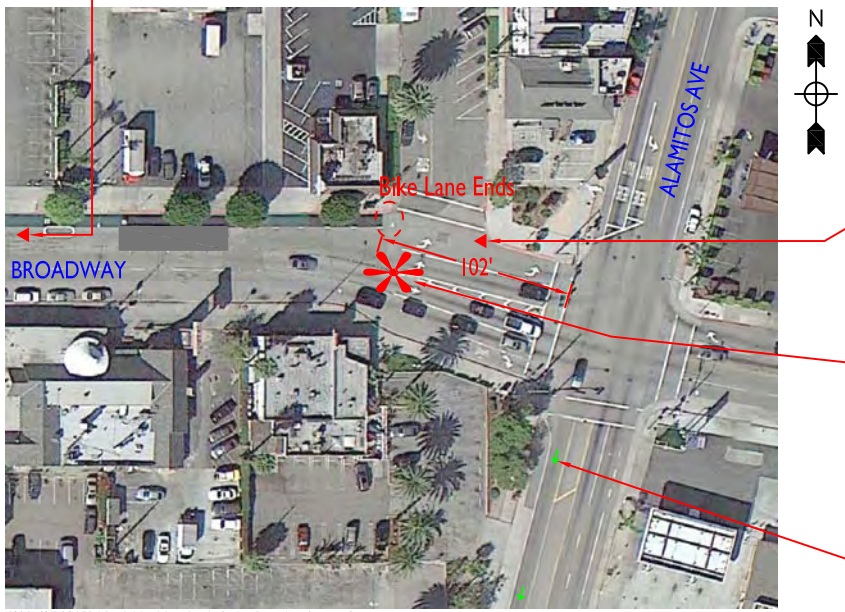
Based on field observations, the eastbound protected bikeway weaving through the eastbound left turn lane appears to function properly. No significant problems have been identified. The green pavement clearly identifies the weaving movement, and the current design seems adequate.

FIGURE 9.1 - DESIGN CONCERNS FOR BROADWAY AT ALAMITOS AVENUE

View looking east on Broadway where the bike lane ends at Olive Avenue prior to Alamitos Avenue.

Concern #2 - Bicycles Turning Right from the Left Turn Lane is Hazardous				
When the bike lane ends at Olive Avenue, some bicyles may likely ride on the road with motor vehicles. When bicycles are turning right from the Left Turn Lane at the same time with the left turn motor vehicles, the conflicting movements may be hazardous.	Eastbound Vehicle Traffic on BROADWAY	EBL	EBT	EBR
	AM Peak Hour Traffic	386	948	60
	Green Time/Cycle	27 sec./75 sec.		

View looking east at the northwest corner of Broadway and Alamitos Avenue where there are 2 bike racks on the sidewalk and a bikeway sign identifying that the southbound bikeway leads to Bluff Park.



J:\2012\JB23052 LB 12 Mo After Study 3rd & Broadway\Design\Broadway_Alamitos.dwg

Concern #1 - Bike Lane Ends Prior to Alamitos Avenue
The eastbound dedicated bike lane on Broadway ends at Olive Avenue approximately 102' prior to Alamitos Avenue. Some cyclists are confused where to proceed when they reach Olive Avenue. Should they ride on the crosswalk/sidewalk or on the roadway with motor vehicles? There is no warning sign prior to the end of the bike lane.

"Share the Road" Bikeway on Alamitos Avenue.

FIGURE 9.2 - DESIGN CONCERNS FOR THIRD STREET AT ALAMITOS AVENUE

View looking east on Third Street at the end of the merge.

View looking west on Third Street at the start of the merge.

View looking east on Third Street west of Alamitos Avenue.

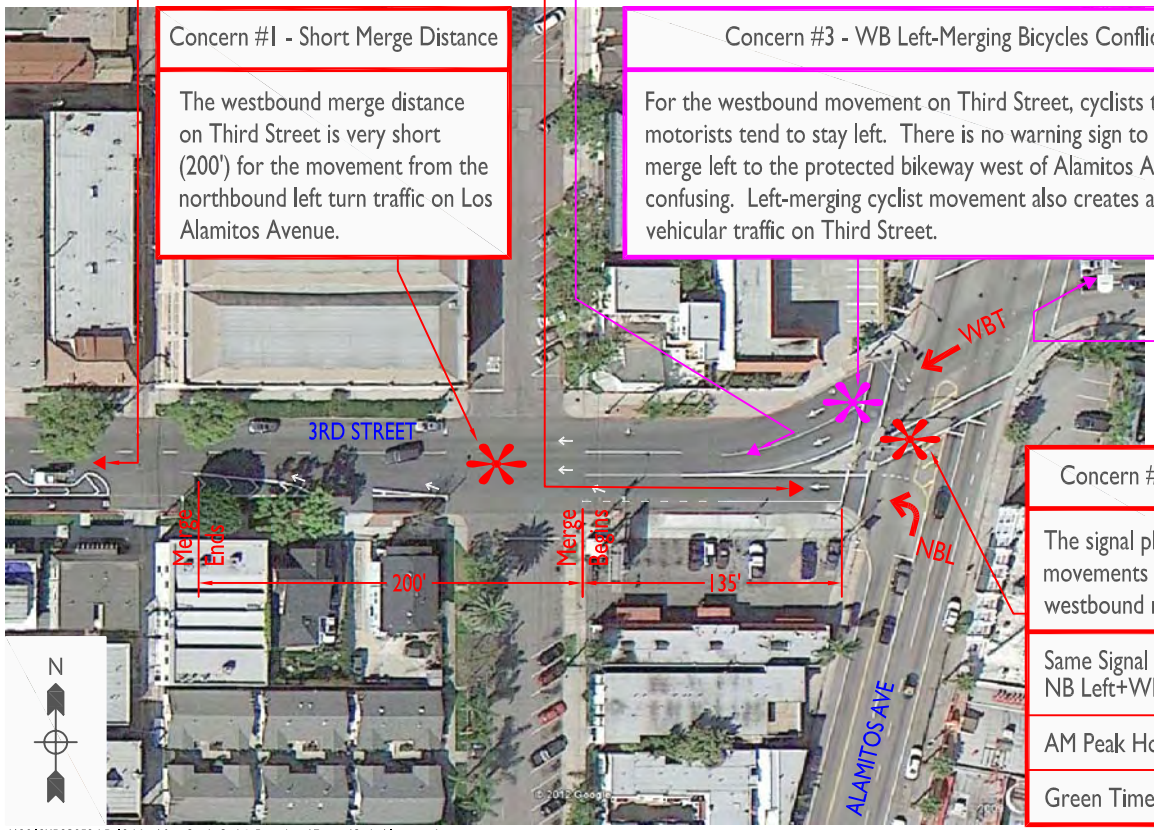
View looking westb on Third Street east of Alamitos Avenue.

Concern #1 - Short Merge Distance

The westbound merge distance on Third Street is very short (200') for the movement from the northbound left turn traffic on Los Alamitos Avenue.

Concern #3 - WB Left-Merging Bicycles Conflict with Through Vehicles

For the westbound movement on Third Street, cyclists tend to stay right and motorists tend to stay left. There is no warning sign to guide cyclists to merge left to the protected bikeway west of Alamitos Avenue, which may be confusing. Left-merging cyclist movement also creates a conflict with through vehicular traffic on Third Street.



Concern #2 - Same Phase Vehicular Westbound Merge Conflict

The signal phase of Northbound left turn and Westbound through movements contributes to the vehicular conflict of the Third Street westbound merge issue west of Los Alamitos Avenue.

Same Signal Phase NB Left+WB Thru	NBL	WBT
AM Peak Hour Traffic	400	730
Green Time/Cycle	46 sec./75 sec.	

J:\2012\JB23052 LB 12 Mo After Study 3rd & Broadway\Design\3rd_Alamitos.dwg

9.1.4 Access to Hydrants

Fire hydrants are located on the north side of Broadway adjacent to the separated lane. In order to ensure access to the hydrants cuts were made in the curb so that hoses could be run from the fire trucks to the hydrants. The parallel parking configuration on Broadway was revised per Fire Authority's request to provide a fire lane clearance for an existing fire hydrant located on the north side of Broadway. The fire lane clearance required the removal of two parallel parking spaces. With the revised treatment, one parking space remains between the fire lane and the eastbound left turn lane on Broadway at Chestnut Avenue. This one remaining parking space is difficult to use.

9.2 Pedestrian Impediments

Round pole foundations are used to support signs in the buffer area between the bike lane and parked cars. The sign pole foundations protrude out of the ground several inches, and they are similar to the color of the pavement, making them difficult to see and thus easier to trip on. The design consideration of the sign pole foundation is a global problem along the protected bikeway not limited to one location. Figure 9.4 illustrates the design consideration associated with the sign pole foundation.

9.3 Drainage

Drainage problems have only been observed at two locations after a heavy rain storm. Pooling was observed on the parking side of the curb that runs along the right side of the protected bike lanes. Both locations are in the western half of the Broadway corridor. Pooling of storm water at those two locations appears to be easily remedied by partial removal of the curb.

9.4 Driveway Conflicts

Motorists crossing the separated lanes to enter a driveway raise the potential for a "left hook" collision with bicyclists in the protected bikeway. There has been one reported collision between a motorist and a bicyclist at a driveway along the left edge of the two corridors.

At locations where curbside parking is allowed close to the driveway, the potential for conflict could increase. The highest potential conflict is NOT between a left-turning motorist and a slow-moving bicyclist, because a parked car immediately upstream of a driveway approach will effectively force motorists to slow for a tight-radius turn. A higher potential conflict exists for a fast-pedaling bicyclist running into a car turning into the driveway. In practice, such a collision has not been recorded in the first 12 months. Possible explanations may be that fast cyclists tend to prefer the vehicle travel lanes to the protected bikeway, or those cyclists that pedal fast in the protected bikeway can see over, through, or between parked cars for incoming left-turning vehicles.

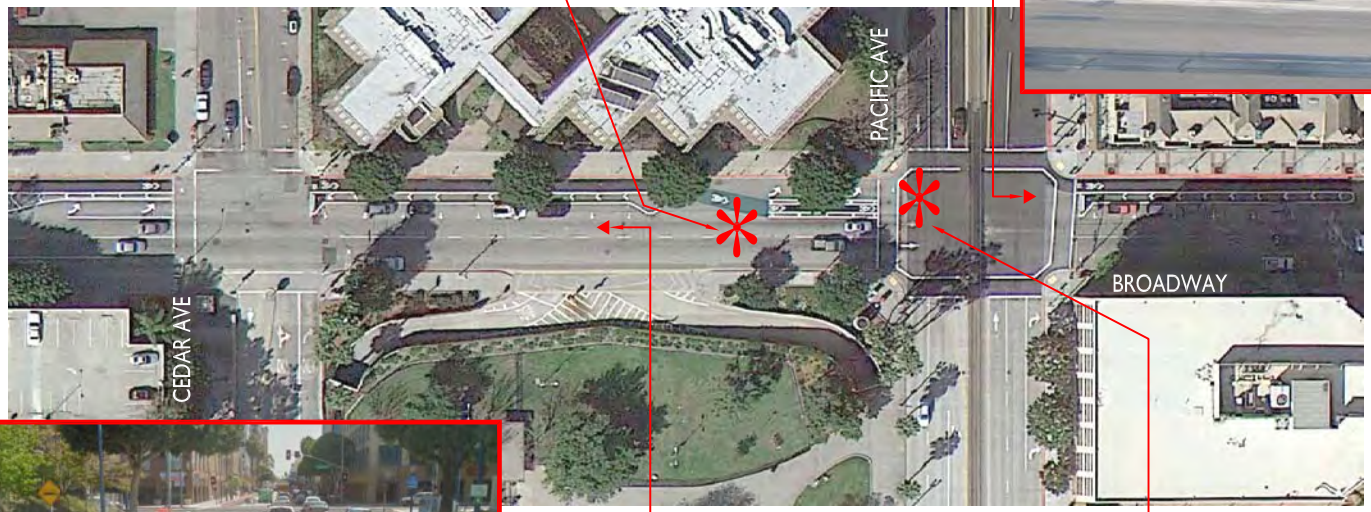
Problems are not expected for motorists exiting a driveway and making a left hand turn into the travel lanes as this is the same movement that would be done with or without the separated lanes.

FIGURE 9.3 - DESIGN CONCERNS FOR BROADWAY AT PACIFIC AVENUE

Concern #2 - Protected Bikeway Weaving Design

Based on field observation, the eastbound protected bikeway weaving through the eastbound left turn lane appears to function properly. No significant problem is identified. The green pavement marking clearly identifies the weaving movement, and the current design is adequate.

View looking west on Broadway at the protected bikeway weave (green pavement marking) with the eastbound left turn lane.



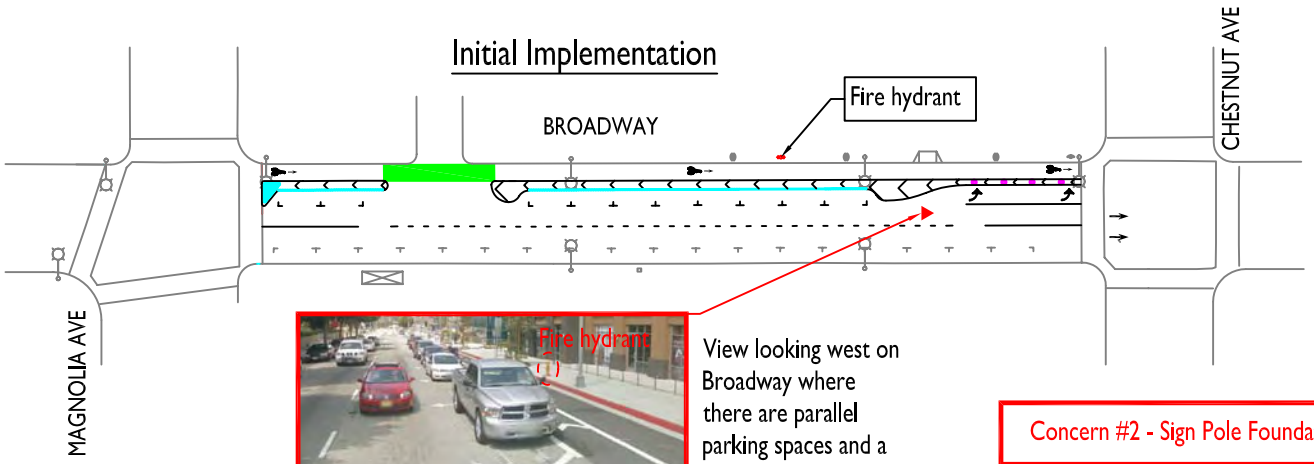
View looking east on Broadway at the protected bikeway weave (green pavement marking) with the eastbound left turn lane.

Concern #1 - Protected Bikeway Weave through Eastbound Left Turn Lane due to Transit Conflict

The eastbound protected bikeway must weave through the eastbound left turn movement because the traffic signal at the intersection of Pacific Avenue and Broadway cannot be modified to include a dedicated bike signal for the protected bikeway due to conflict with the transit line along Pacific Avenue. The eastbound protected bikeway uses the same signal phase as the eastbound vehicular through movement. Green pavement marking is provided to guide cyclists through the weave to the bike lane located on the right side of the eastbound left turn lane.

J:\2012\JB23052 LB 12 Mo After Study 3rd & Broadway\Design\Broadway_Pacific.dwg

FIGURE 9.4 - DESIGN CONCERNS FOR BROADWAY BETWEEN MAGNOLIA AVENUE AND CHESTNUT AVENUE



View looking west on Broadway where there are parallel parking spaces and a fire hydrant on the north side of the street.

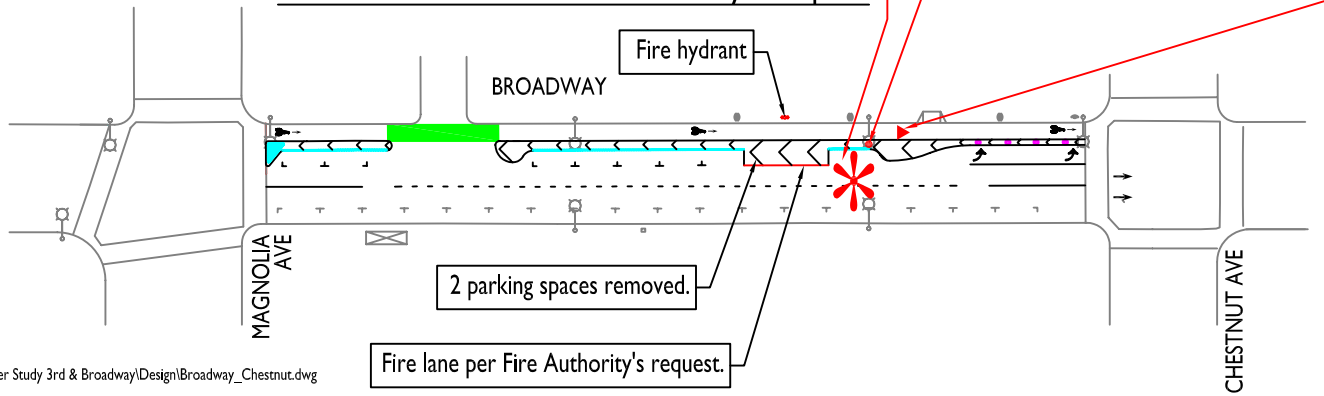
Sign pole foundation is similar to the color of pavement.

Concern #2 - Sign Pole Foundation is a tripping hazard

The sign pole foundations may be tripping hazards because they stick out of the ground and the color is similar to the pavement.

Concern #1 - One Remaining Parking Space Difficult to Use

There is one remaining parking space located between the eastbound left turn pocket and the fire lane for the fire hydrant. The one remaining parking space is difficult to use.



View looking west on Broadway where 2 parking spaces were removed to provide fire lane per Fire Authority's request.

J:\2012\JB23052 LB 12 Mo After Study 3rd & Broadway\Design\Broadway_Chestnut.dwg

Looking west on Third Street east of Cedar Avenue; There is a driveway opening between the parking spaces and the westbound left turn lane at Cedar Avenue

Looking west on Third Street east of Elm Avenue; There is a driveway opening between the parking spaces

10. Summary and Conclusions

The City of Long Beach implemented protected bikeways along Broadway and Third Street between Magnolia Avenue and Alamitos Avenue in downtown Long Beach. The project provided a bikeway along the left side of each of the two one-way streets and separated from traffic by a parking lane. This "Before and After" study was conducted to provide a baseline of comparison for evaluating the applicability and effectiveness of implementing the protected bikeways.

The street segments included in the evaluation are as follows:

- Broadway between Magnolia Avenue and Alamitos Avenue
- Third Street between Magnolia Avenue and Alamitos Avenue

Traffic volume counts and bicycle and pedestrian surveys were conducted along these street segments to determine the levels of bicycle, pedestrian, and traffic activity and associated conditions along Broadway and Third Street, prior to and subsequent to implementation of the project. This section summarizes the effectiveness of the protected bikeway project by comparing the "before" conditions prior to implementation to the "after" conditions, one year after project completion.

Typical design configuration for the protected bikeway

Typical striping configuration for the protected bikeway and on-street parking.

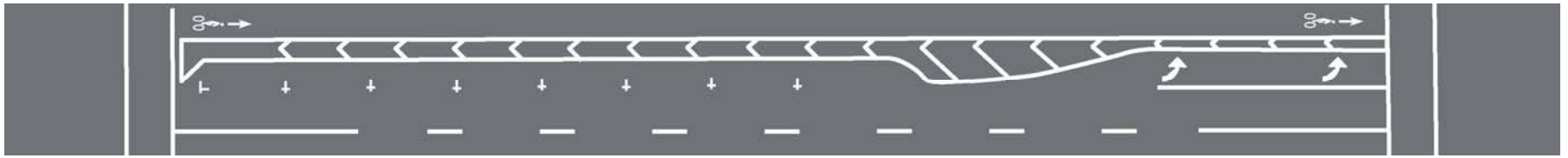


Table 10.1 summarizes the levels of traffic, bicycle, and pedestrian activity along Broadway and Third Street within the project limits before and after implementation of the project. There has been a modest decrease in peak hour and daily traffic volumes, while bicycle and pedestrian volumes have increased. There has been a marked decrease in bicycle and motor vehicle involved crashes.

Figures 10.1 and 10.2 present a summary of vehicle traffic, bicyclists, pedestrians, skateboarders and wheelchairs along Broadway and Third Street, respectively. Based on video observation, approximately 56% of cyclists riding on the sidewalk along Broadway are riding westbound against traffic. Along Third Street, approximately 71% of cyclists riding on the sidewalk are riding eastbound against traffic.

Table 10.1 – Bicycle, Pedestrian, and Vehicle Activity on Broadway and Third Street, Before and After Implementation

Measure	Broadway		Third Street	
	Before Implementation	After Implementation	Before Implementation	After Implementation
Vehicle Daily Volume	11,700 ~ 14,350/day	11,300 ~ 13,600/day	9,300 ~ 10,400/day	8,400 ~ 11,200/day
Vehicle Peak Hour Volume	1,400 ~ 1,700/hour	1,100 ~ 1,300/hour	1,300 ~ 1,400/hour	1,100 ~ 1,300/hour
Bicycle Peak Hour Volume	/6 hours 45 ~ 75/2 hours (23 ~ 38/hour)	/6 hours 50 ~ 100/2 hours (25 ~ 50/hour)	/6 hours 25 ~ 50/2 hours (13 ~ 25/hour)	/6 hours 40 ~ 80/2 hours (20 ~ 40/hour)
Pedestrian Peak Hour Volume	/6 hours 250 ~ 550/2 hours (125 ~ 275/hour)	/6 hours 390 ~ 590/2 hours (195 ~ 295/hour)	/6 hours 300 ~ 400/2 hours (150 ~ 200/hour)	/6 hours2 90 ~ 370/2 hours (145 ~ 185/hour)
Vehicle Traffic Speed	30.1 MPH (85th Percentile)	19 ~ 33 MPH (85th Percentile)	36 MPH (85th Percentile)	21 ~ 32 MPH (85th Percentile)
Bicycle Crashes	12 (over 3 years)	3 crashes in prior year	7 (over 3 years)	No crashes in prior year

FIGURE 10.1 - BICYCLE AND PEDESTRIAN COUNTS ON BROADWAY,
BEFORE AND 12-MONTH AFTER IMPLEMENTATION

Total AM, Mid-Day, & PM Peak Period (6-Hour) Volumes	Count Date	BROADWAY (Between Cedar Avenue and Pine Avenue)							
		On the Street				On the Sidewalk			
		Skate-boarder	Cyclist in Vehicle Lane	Wrong Way in Protected Lane	Cyclist in Protected Lane	Cyclist	Pedestrian	Skate-boarder	Electric Wheelchair
Before Implementation	Monday 6/14/2010	2	33	n/a	n/a	60	1,298	15	15
			Total Cyclist = 93						
After Implementation	Monday 6/4/2012	0	8	4	48	58*	1,449	9	4
			Total Cyclist = 118						

Vehicle Traffic	Count Date	AM Peak Hour	PM Peak Hour	Average Daily Traffic
Before	Thursday 6/10/2010	919	1,375	14,348
After	Thursday 6/7/2012	838	1,108	13,572

Count Date	BROADWAY (Between Elm Avenue and Linden Avenue)							
	On the Street				On the Sidewalk			
	Skate-boarder	Cyclist in Vehicle Lane	Wrong Way in Protected Lane	Cyclist in Protected Lane	Cyclist	Pedestrian	Skate-boarder	Electric Wheelchair
Thursday 6/10/2010	10	58	n/a	n/a	88	648	10	0
		Total Cyclist = 146						
Thursday 6/7/2012	2	4	8	101	52	874	17	3
		Total Cyclist = 165						

Count Date	AM Peak Hour	PM Peak Hour	Average Daily Traffic
Thursday 6/10/2010	533	1,704	11,706
Thursday 6/7/2012	578	1,335	11,287

* Based on peak hour video count observation, approximately 56% of the cyclists riding on the sidewalk along Broadway are riding westbound against traffic.

J:\2012\JB23052 LB 12 Mo After Study 3rd & Broadway\Analysis\Figures\Cross Sections\Before_After_Counts.dwg

FIGURE 10.2 - BICYCLE AND PEDESTRIAN COUNTS ON THIRD STREET, BEFORE AND 12-MONTH AFTER IMPLEMENTATION

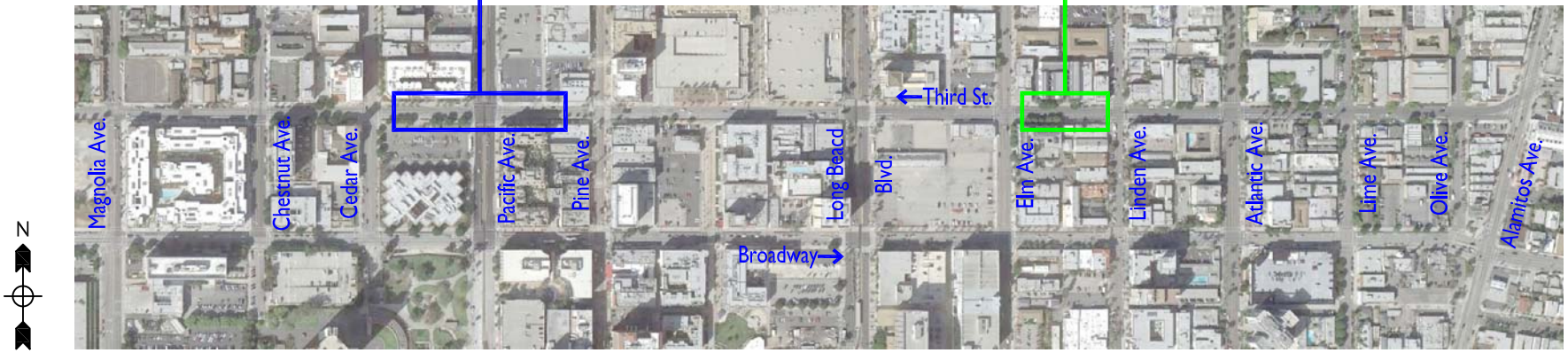
Total AM, Mid-Day, & PM Peak Period (6-Hour) Volumes	Count Date	THIRD STREET (Between Cedar Avenue and Pine Avenue)							
		On the Street				On the Sidewalk			Electric Wheelchair
		Skate-boarder	Cyclist in Vehicle Lane	Wrong Way in Protected Lane	Cyclist in Protected Lane	Cyclist	Pedestrian	Skate-boarder	
Before Implementation	Tuesday 6/15/2010	0	15	n/a	n/a	47	617	6	10
			Total Cyclist = 62						
After Implementation	Tuesday 6/5/2012	0	2	4	57	35*	910	15	19
			Total Cyclist = 98						

Vehicle Traffic								
Before	Thursday 6/10/2010	AM Peak Hour	1,301	PM Peak Hour	637	Average Daily Traffic	10,409
After	Thursday 6/7/2012		1,287		666		11,167

Count Date	THIRD STREET (Between Elm Avenue and Linden Avenue)							
	On the Street				On the Sidewalk			Electric Wheelchair
	Skate-boarder	Cyclist in Vehicle Lane	Wrong Way in Protected Lane	Cyclist in Protected Lane	Cyclist	Pedestrian	Skate-boarder	
Friday 6/11/2010	2	46	n/a	n/a	90	888	24	26
		Total Cyclist = 136						
Friday 6/8/2012	1	9	12	125	56	686	9	5
		Total Cyclist = 202						

Thursday 6/10/2010	AM Peak Hour	1,378	PM Peak Hour	523	Average Daily Traffic	10,409
Thursday 6/7/2012		1,090		475		8,375

* Based on 48-hour video count observation, approximately 71% of the cyclists riding on the sidewalk along Third Street are riding eastbound against traffic.



J:\2012\JB23052 LB 12 Mo After Study 3rd & Broadway\Analysis\Figures\Cross Sections\Before_After_Counts.dwg

Observations were made of traffic conditions along the two streets. Before implementation, vehicles traveling along Broadway and Third Street above the posted speed limit were observed, and cyclists were observed riding on the street against traffic. Cyclists were observed riding on the sidewalk. Many pedestrians were observed crossing Broadway without using the crosswalks.

After implementation, there has been a significant reduction in the 85th percentile vehicle speed along Broadway (from 30.1 MPH before implementation to 26 MPH after implementation). The average (mean) speed has also decreased. The 85th percentile speed is now significantly lower on Third Street, having declined from 36 MPH before implementation to 27 mph after implementation.

Observations using 48-hour video recordings were made of bicyclist and motorist compliance with the new street/bikeway configuration on Broadway and Third Street, and its associated controls and regulations; as well as collisions involving bicyclists, pedestrians, and vehicles. Only one bike-vehicle crash has been observed along Broadway after implementation of the project. No bike/vehicle crashes have been observed along Third Street after implementation. This may indicate that conditions for cyclists are safer with the new configuration.

There have been no bicycle conflicts or crashes related to the bike/pedestrian signals, the left-turn arrows, or parked vehicles since implementation of the project. Vehicle compliance with left turn arrows was 100% during the observation period. Bicyclists were observed to comply with bike signals and most bicycles stayed in the protected lanes while they crossed the intersection. The three recorded collisions involved vehicles turning left improperly, colliding with bicyclists in the protected lane.

The number of bikes observed on the sidewalk along both Broadway and Third Street has decreased substantially compared with before implementation. Before implementation, 63% of cyclists along Broadway were riding on the sidewalk. After implementation, just 27% have been observed riding on the sidewalk. Along Third Street, 70% of cyclists were riding on the sidewalk before implementation. After implementation just 28% have been observed riding on the sidewalk.

Although it is still common to see bikes on the sidewalk along Broadway and Third Street, this is likely due to the one-way configuration of the street and the cycle track. It is likely that the number of cyclists riding on the sidewalk would decrease substantially if the protected bikeways were converted to two-way operation.

Traffic volumes have decreased on both Broadway and Third Street, however volumes are consistently higher on Broadway than on Third Street, by about 2,000 per day. Bicycle volumes have increased by about 30% to 60% on the two streets after implementation.

KOA Corporation hopes that the analysis and observations made for the Broadway and Third Street Protected Bikeway "Before" and "After" Study will help the City of Long Beach evaluate the benefits of the project and plan for possible future applications of the protected bike lanes concept.