

City of Arts & Innovation

Transportation Committee

TO: TRANSPORTATION COMMITTEE MEMBERS DATE: FEBRUARY 8, 2018

FROM: PUBLIC WORKS DEPARTMENT WARDS: 1 & 3

SUBJECT: BROCKTON AVENUE RESTRIPING PROJECT – UPDATE

ISSUE:

Review of post-construction traffic data pertaining to the Brockton Avenue Restriping Project.

RECOMMENDATION:

That the Transportation Committee receive and file the post-construction traffic data supporting the retention of the existing striping configuration on Brockton Avenue.

COUNCIL RECOMMENDATION:

On December 6, 2016, the City Council reviewed this matter and unanimously voted to direct the Public Works Department to analyze Brockton Avenue for an additional year. City Council requested that staff return to the Transportation Committee with an update on traffic operations, bike activity, consider a two-way left turn lane between the block of Tequesquite Avenue and 14th Street, provide a cost estimate to restripe the roadway back to 4 through lanes, provide grant implications if the road is restriped to 4 through lanes, and provide detailed pre and post-project accident analysis including bicycle involved incidents. In addition, City Council requested that Redwood Drive and/or Pine Street be considered for traffic calming measures to address speeding and/or increased traffic volumes associated with the project.

BACKGROUND:

On April 22, 2013 and October 2, 2013, the Utility Services/Land Use/Energy Development Committee reviewed the Brockton Avenue Restriping Project proposal and recommended approval to City Council. On October 22, 2013, the City Council approved the Brockton Avenue Restriping Project.

Brockton Avenue between Mission Inn Avenue and Beatty Drive (Project) was restriped to reduce the accident rate and severity, improve sidewalk connectivity, encourage increased walking and biking, and maintain acceptable roadway operations. The Project reduced the number of through lanes from four to two, installed Class II bike lanes, and installed a two-way left-turn lane between Tequesquite Avenue and Beatty Drive to separate the left-turn motorists from through traffic. Brockton Avenue retained the four-lane configuration between Fourteenth Street and Tequesquite Avenue to best serve Riverside Community Hospital and accommodate future growth. Additionally, the project maintained on-street parking where lane widths permitted, converted traffic signals at selected intersections to protected/permissive,

coordinated signals to optimize traffic, and repaved portions of the street. In conjunction with the improvements, the Project also constructed new concrete sidewalk where it was missing, and reconstructed damaged concrete curb, gutter, sidewalk and driveways.

The Public Works Department completed the project in November 2014 and the anticipated benefits included:

- 1) Enhanced motorist safety by shifting left-turning vehicles from through lanes onto a two-way left-turn lane, increasing sight distance for motorists entering Brockton Avenue from the side streets, and discouraging speeding;
- 2) Improved access and response times for emergency vehicles;
- 3) Increased pedestrian safety by constructing missing segments of sidewalk and reducing exposure across travel lanes;
- 4) Encouraged increased biking and enhanced safety as the result of installation of the Class II bike lanes and bike buffers;
- 5) Increased on-street parking; and
- 6) Allowed Riverside Transit Agency (RTA) buses to pick up and drop off passengers without obstructing the travel lanes.

The combined benefits of these improvements were expected to improve roadway safety, maintain acceptable traffic operations, facilitate turning maneuvers, and maintain satisfactory travel speeds.

DISCUSSION:

The Public Works Department conducted 6, 24, and 36-month post-construction traffic studies to assess accidents, traffic volumes, travel speeds, and bicycle and pedestrian activity along Brockton Avenue and surrounding streets. Table 1 reflects the Brockton Avenue 10-year pre-construction accident history and estimated accident reduction rates based on the Federal Highway Administration figures.

Table 1: Brockton 10-Year Accident History and Estimated Reduction (Before Project)

Type	Total	*Estimated Reduced By	*Estimated % Reduction
Rear End	87	58	67%
Sideswipe	45	31	69%
Broadside	142	17	12%
Head-On	31	1	3%
Pedestrian	13	13	100%
Bicyclist Involved	15	15	100%
Hit Object	22	0	0%
Overturned	2	0	0%
Other	5	1	20%
Not Stated	5	1	20%
Totals	367	137	37%

* Estimated accident reduction figures are based on Federal Highway Administration's road diet studies

Table 2 reflects a 24% post project accident reduction (Nov. 2014-Nov. 2017) along Brockton

Avenue indicating Brockton Avenue functions much safer. The 24% is lower than FHWA's 37% projected figure but nonetheless is significant as broadside and head-on type accidents which tend to cause the more serious injuries were significantly reduced and both types of accidents exceeded the projected reduction values.

Table 2: 36-Month Pre and Post-Construction Accident Analysis on Brockton Avenue

Type	36-Month Historical Average (Pre-Project)	36-Month Total (After Project)	% Increase / Reduction (Post-Project vs. 36 Month Historical Average)
Rear End	26.1	28	7%
Sideswipe	13.5	4	-70%
Broadside	42.6	29	-32%
Head-On	9.3	4	-57%
Pedestrian	3.9	5	28%
Bicyclist	4.5	8	78%
Hit Object	6.6	5	-24%
Overturned	0.6	1	67%
Other	1.5	0	-100%
Not Stated	1.5	0	-100%
Totals	110.1	84	24% Decrease

Since the accident rates for both pedestrian and bicycle involved incidents increased after project completion, Table 3 provides collision details reflecting the accident factor(s) and parties at fault as determined by the Riverside Police Department.

Table 3: Post-Project Pedestrian and Bicyclist Accident Analysis on Brockton Avenue

Party Involved	Date	Collision Factor	Party at Fault	Injury Type
Pedestrian	6/30/15	Brockton Ave at 14 th St - Vehicle vs Skateboard at signalized intersection. Officer unable to determine collision factor based on the conflicting statements of who had the right-of-way to enter the intersection	Unknown	Injury to skate boarder
	3/8/16	Brockton Ave at Jurupa Ave - Motorist turning right failed to yield to the pedestrian in the crosswalk who had the right-of-way	Motorist	¼" cut to forehead of pedestrian
	10/26/16	Brockton Ave at Tequesquite Ave - Motorist turning right failed to yield to the pedestrian in the crosswalk who had the right-of-way	Motorist	Pain to knee of pedestrian
	11/4/16	Brockton Ave at Terracina Ave - Motorist turning right failed to yield to the pedestrian in the crosswalk who had the right-of-way	Motorist	Abrasions and possible broken ankle to pedestrian
	10/26/17	Brockton Ave at Bandini Ave – Incident under investigation and report not	TBD	Fatality

		available.		
Bicyclist	1/9/15	Brockton Ave at Tequesquite - SB Motorists turning left failed to yield to oncoming bicyclist who had a green light	Motorist	Bloody nose and hurt back of bicyclist
	5/5/15	Brockton at Beatty - Bicyclist was riding on the wrong side of the road and collided with a right-turning motorist	Bicyclist	Bicyclist refused treatment – minor injury
	7/23/15	Brockton Ave south of Beatty - Bicyclist was attempting to cross the street (midblock) when she got too close to the motorist and her handle bars “tagged” the oncoming vehicle	Bicyclist	Bicyclist had head and neck pain
	10/18/15	NB motorist collided with a bicyclist traveling westbound on Jurupa Ave. The bicyclist (homeless) entered the intersection on a red light and hit the motorist who had received a green light	Bicyclist	Non-Injury
	3/8/16	NB motorist collided with a bicyclist traveling westbound on Jurupa Ave. The bicyclist had a green light when the NB motorist entered on a red light and turned left, the motorist was unable to avoid hitting the bicyclist	Motorist	Bruise to left knee of bicyclist
	6/14/16	NB motorist collided with a NB traveling bicyclist, north of Ramona Dr. Bicyclist veered into the travel lane as he was attempting to cross the street midblock	Bicyclist	Bicyclist had pain to legs, arms, and back
	2/22/17	SB motorist collided with a bicyclist traveling EB on 14 th St. The bicyclist failed to stop for the red indication and collided with the motorist	Bicyclist	Abrasion to left side of bicyclist’s forehead
	4/3/17	SB motorist was making a right-turn onto 14 th St when a SB bicyclist could not stop in time and hit the right-turning vehicle. Based on statements the officer could not make a sound conclusion as to who was at fault	Unknown	Laceration to bicyclist right index finger, pain to left knee and wrist

In summary, almost half (6 of 13, 46%) of the incidents were motorist right-of-way violations at signalized intersections, involved bicyclists not traveling on Brockton Avenue (3 of 13, 23%), or were caused by bicyclists attempting to cross midblock (2 of 13, 15%). These incidents, amounting to 11 of the 13 total incidents, are not associated with the Brockton Avenue Restriping project as the collision factors were attributed to erratic driving and failing to yield right-of-way. The connecting sidewalks and buffered Class II bike lanes encourage a healthier and active lifestyle and based on the detailed analysis of the accident reports, the Project

components have not contributed to increased pedestrian or biking conflicts.

Although the number of through lanes on Brockton Avenue were reduced from four to two, Brockton Avenue continues to operate efficiently. The Federal Highway Administration conducted several studies on road diets and concluded that there is only a slight capacity reduction when a 4-lane roadway is reduced to 3-lanes. The studies determined that the 3-lane conversion projects have minimal effect on roadway capacity because the left-turning vehicles are accommodated in a common two-way left-turn lane and through traffic travels unimpeded.

Table 4 illustrates the measured traffic levels along studied roadway segments before and after project implementation. The 2017 trend shows that traffic patterns and volumes are generally decreasing and stabilizing when compared to the after-counts performed in 2016 and the initial 2014 counts (before project). The decrease can be attributed to the completion of large area projects including: State Route 91 HOV, Riverside Community Hospital Phase I, Riverside Grade Separation, and the Streeter Grade Separation. Table 4 also illustrates that Brockton Avenue and the surrounding streets have sufficient capacity to accommodate existing traffic volumes and continued growth in the area.

Table 4: Adjacent Roadway Volume and Capacity

Location	Average Daily Traffic (ADT)				2016 vs 2017	2014 vs 2017	% Capacity
	Before (2014)	*After (2015)	**After (2016)	***After (2017)			
Merrill east of Brockton	1101	2230	1313	985	-25%	-11%	7.8%
Sunnyside east Brockton	342	360	388	309	-20%	-10%	10.0%
Dewey west of Brockton	1134	2726	1745	1544	-12%	36%	12.4%
Twelfth west of Brockton	511	524	521	749	44%	47%	24.2%
Garden Home west of Brockton	347	1101	179	271	51%	-22%	8.7%
Terracina east of Brockton	1000	2689	1992	1721	-14%	72%	55.6%
Sunnyside west of Brockton	489	604	392	309	-21%	-37%	10.0%
Pine south of 13th	2542	3411	3223	2849	-12%	12%	22.8%
Redwood south of 13th	2198	3181	3434	3398	-1%	55%	27.2%
Palm south of Tequesquite	6578	9335	9411	4412	-53%	-33%	24.5%
Palm north of Beachwood	6797	9335	9411	8395	-11%	24%	46.4%
Palm north of Central	7226	9916	8626	7397	-14%	2%	41.1%
Palm north of Elmwood	7364	9537	9444	8377	-11%	14%	46.5%
Palm north of Gardena	7105	9835	8596	7284	-15%	3%	40.5%
Palm south of Beatty	8104	10993	8626	10819	25%	33%	60.1%
Magnolia north of Ramona	21142	23296	22059	17781	-19%	-16%	53.9%
Magnolia north of Oakwood	21037	25946	22345	19676	-12%	-6%	59.6%
Magnolia south of Elizabeth	22954	30958	24600	22596	-8%	-2%	68.5%
Magnolia south of Ramona	20673	24921	22318	18520	-17%	-10%	56.1%
Brockton north of Dewey	9800	11572	11279	10170	-10%	4%	56.5%
Brockton north of Tenth	13967	14194	14380	11030	-23%	-21%	61.3%
Brockton south of Bandini	13341	11964	12720	11980	-6%	-10%	66.5%
Totals	175752	218628	197002	170572	-13%	-3%	

*Counts taken March 2015, **Counts taken March 2016, ***Counts taken in October 2017

The figure that stands out in Table 4 is the 2015 spike in traffic volumes after completion of the project which shows a 24% increase to the overall traffic figures. In 2016 the overall traffic volume decreased by almost 10% when compared to 2015 and the traffic activity continues to reduce and stabilize. The 2017 counts reflect a 13% decrease vs 2016 and an overall 3% lower figure when compared to the 2014 before-project counts. The downward trend of area traffic volumes is illustrated below in Figure 1.

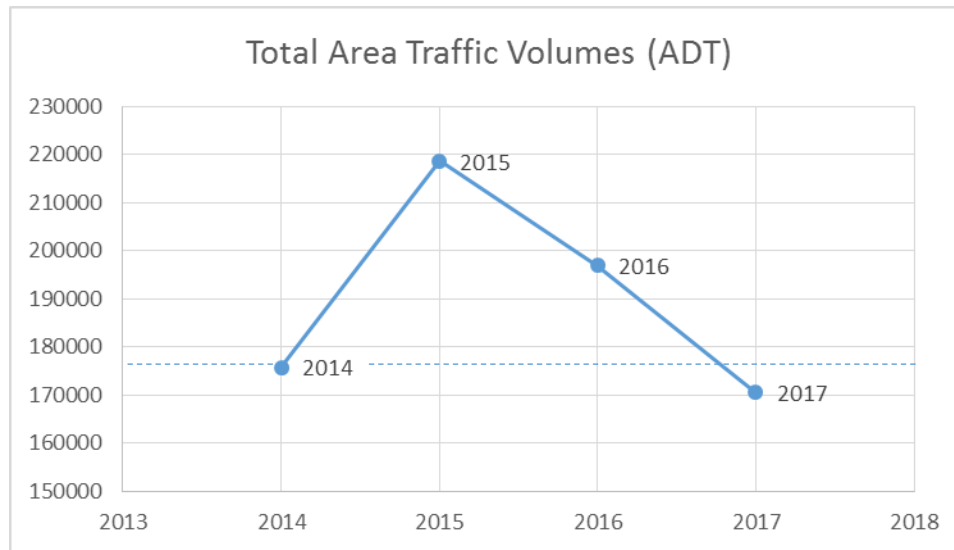


Figure 1

Because counts were taken during different months of the year, the overall 2017 lower figure may be attributed to variations in driver behavior in October vs March. Traffic can vary by month and season and typically colder months experience less traffic when compared to warmer months as there tends to be fewer outdoor activities. The State of Florida published a research paper in 1997 titled *Variability in Traffic Monitoring Data* and determined that the month of March ranks as the 4th most volatile month in traffic volumes when compared to other months including October, which is the 4th most stable month. The 2017 figures suggest that traffic has steadied and the volume figures are similar to the before-project counts.

Per the Bicycle Master Plan, the project installed Class II buffered bike lanes on Brockton Avenue to accommodate bicyclists and provide them with wider and more accommodating biking facilities compared to the existing bike lanes on Magnolia Avenue which parallels the Brockton Avenue corridor. Table 5 shows 3-day bicycle counts along Brockton Avenue near Bandini Avenue and Terracina Avenue. The counts were taken during a typical weekday and weekend and the count locations were selected due to their central position within the project limits. The project included 2-ft bike lane buffers which provide greater separation between moving vehicles and bicyclists, thereby enhancing safety and creating more inviting biking facilities.

Table 5: 24-Hour Brockton Avenue Bicycle and Pedestrian Counts

Date	Day of the Week	@ Bandini Avenue		@ Terracina Drive	
		# of Pedestrians	# of Bicyclists	# of Pedestrians	# of Bicyclists
6/9/16	Thursday	112	81	57	37
6/11/16	Saturday	163	82	24	40
6/12/16	Sunday	113	112	42	22

3-Day Total		388	275	123	99
10/26/17	Thursday	142	75	207	21
10/28/17	Saturday	106	66	38	38
10/29/17	Sunday	113	75	34	34
3-Day Total		361	216	279	93
2016 vs 2017		-7%	-21%	127%	-6%

The decreased volumes in biking from 2016 vs 2017 may be attributed to the months the counts were taken as June is typically warmer than October and more outdoor activities including biking is expected in the warmer months. In addition, the pedestrian count at Terracina Drive more than doubled in 2017 as Riverside City College (RCC) was in session in October and was not in session June 9-12, 2016. The 2016 and 2017 figures reflect an active community and the sidewalk and Class II bike lane improvements continue to promote a healthier lifestyle and provide safe and inviting biking and walking facilities.

The project's configuration allowed for maintaining and/or expanding on-street parking on Brockton Avenue. Public Works conducted parking studies at 7:30 am, 10:00 am, 1:00 pm, and 4:00 pm on three different dates (Normal RCC Session, RCC's Finals Week, and while RCC was on semester break) on the following blocks to determine impacts:

Table 6 – Parking Count Locations on Brockton Avenue

Easterly Side of Brockton Avenue	Westerly Side of Brockton Ave
Jurupa Avenue to Maplewood Place	Fourteenth Street to Tequesquite Avenue
Maplewood Place to Garden Home Court	Tequesquite Avenue to Alta Vista Drive
Garden Home Court to Rosewood Place	Alta Vista Drive to Homewood Court
Rosewood Place to Oakwood Place	Homewood Court to Ramona Drive
Oakwood Place to Linwood Place	Ramona Drive to Larchwood Place
Linwood Place to Bandini Avenue	Larchwood Place to Highland Place
Bandini Avenue to Elmwood Court	Highland Place to Beechwood Place
Elmwood Court to Beechwood Place	Beechwood Place to Elmwood Court
Beechwood Place to Chapman Place	Elmwood Court to Bandini Avenue
Chapman Place to Larchwood Place	Bandini Avenue to Linwood Place
Larchwood Place to Ramona Drive	Linwood Place to Oakwood Place
Ramona Drive to Terracina Avenue	Oakwood Place to Rosewood Place
Terracina Avenue to Rice Road	Rosewood Place to Edgewood Place
Rice Road to Tequesquite Avenue	Edgewood Place to Maplewood Place
Tequesquite Avenue to Fourteenth Street	Maplewood Place to Rubidoux Avenue
	Rubidoux Avenue to Jurupa Avenue

The Council report dated December 6, 2016 shows a detailed breakdown of the on-street parking figures but in general the blocks closest to RCC and Terracina Avenue had the greatest parking fluctuations. Table 7 shows an on-street parking count during the 4 time periods on the segments with the greatest parking demand and closest to the RCC campus.

Table 7 – Parking Counts on Segments with Greatest Parking Demand

Segment	RCC Normal Session	RCC Finals Week	Semester Break
Ramona to Terracina	70	56	0
Terracina to Rice	9	9	0
Rice to Tequesquite	17	5	0
Homewood to Ramona	24	3	0
Tequesquite to Alta Vista	22	15	14
Total	142	88	14

Allowing RCC students to park on Brockton Avenue, close to Terracina Drive, reduces the impacts to local neighborhoods and provides residents with reasonable parking opportunities for themselves and their guests. Public Works reached out to RCC and the school indicated that it may not be until 2021 that the school floats a bond measure to construct a parking structure in order to significantly increase on-campus parking facilities.

The other segments along Brockton Avenue did not have substantial on-street parking demand and were not impacted by RCC's schedule.

Another post-project measurement of the corridor is travel speeds on Brockton Avenue as motorists will use alternate routes, including residential streets such as Pine Street and Redwood Drive, to bypass congestion or reduce travel time.

To minimize delay associated with the Project and discourage cut-through traffic onto parallel streets, the Project installed protected/permissive improvements at four key Brockton Avenue Intersections including: University Avenue, Bandini Avenue, Thirteenth Street, and Tequesquite Avenue. Staff installed new signal timing plans following the completion of the project to make the corridor operate more efficiently.

Figure 2 illustrates the routes driven and measured using GPS equipment in 2016 to determine if local streets provide faster travel speeds compared to Brockton Avenue.

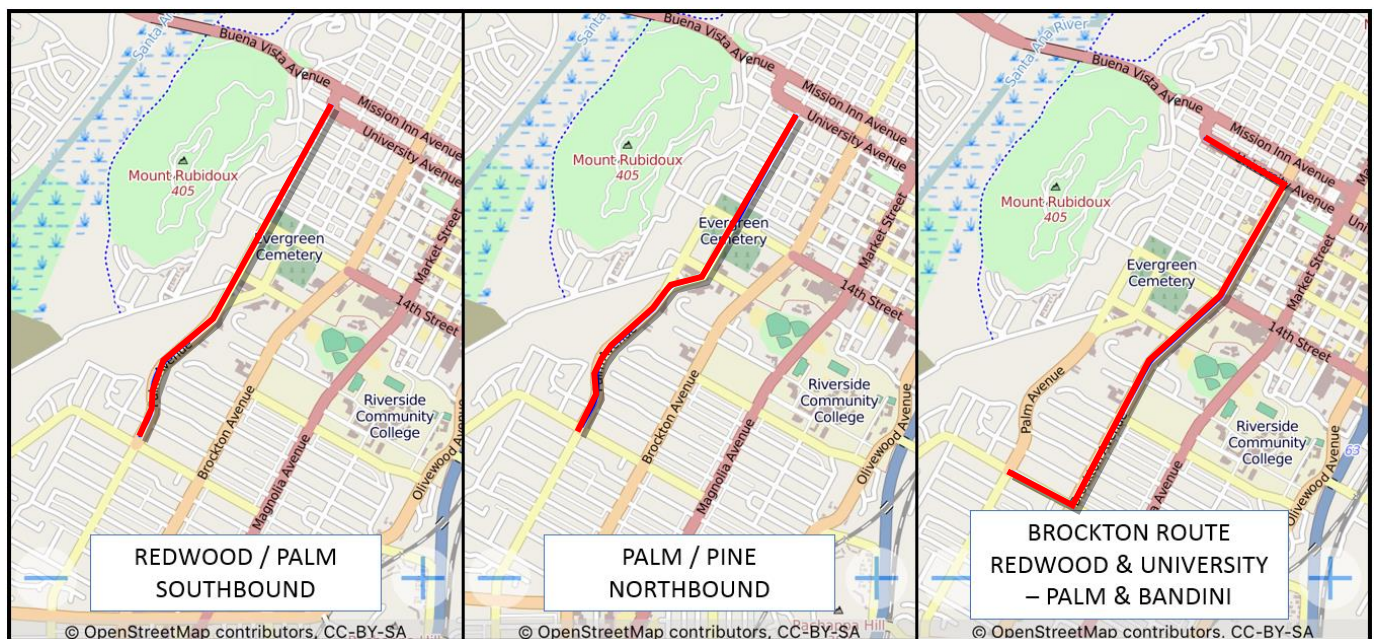


Figure 2

Synchronized traffic signals provide optimum progression than traversing the stop signs on Redwood Drive or Pine Street. Protected/permissive phasing allows left-turn movements during the green left-turn arrow (protected phase) and during gaps in traffic during the green ball indication (permissive phase). Figures 3 and 4 reflect that neither Redwood Drive nor Pine Street provide higher travel speeds (including time spent stopped), so motorists are not encouraged to divert from Brockton Avenue onto these roadways.

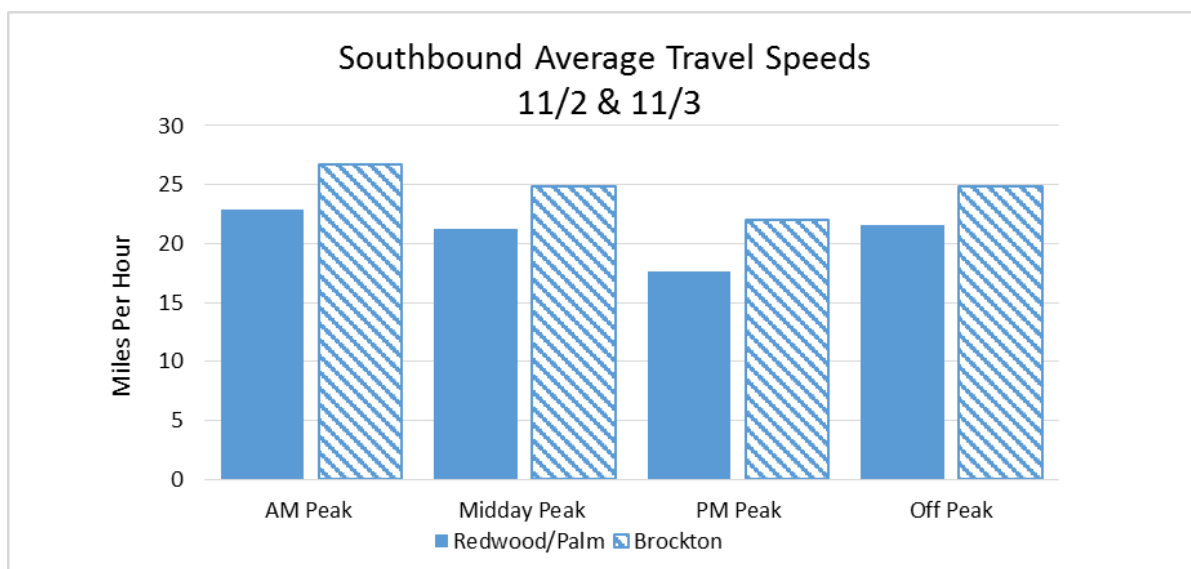


Figure 3

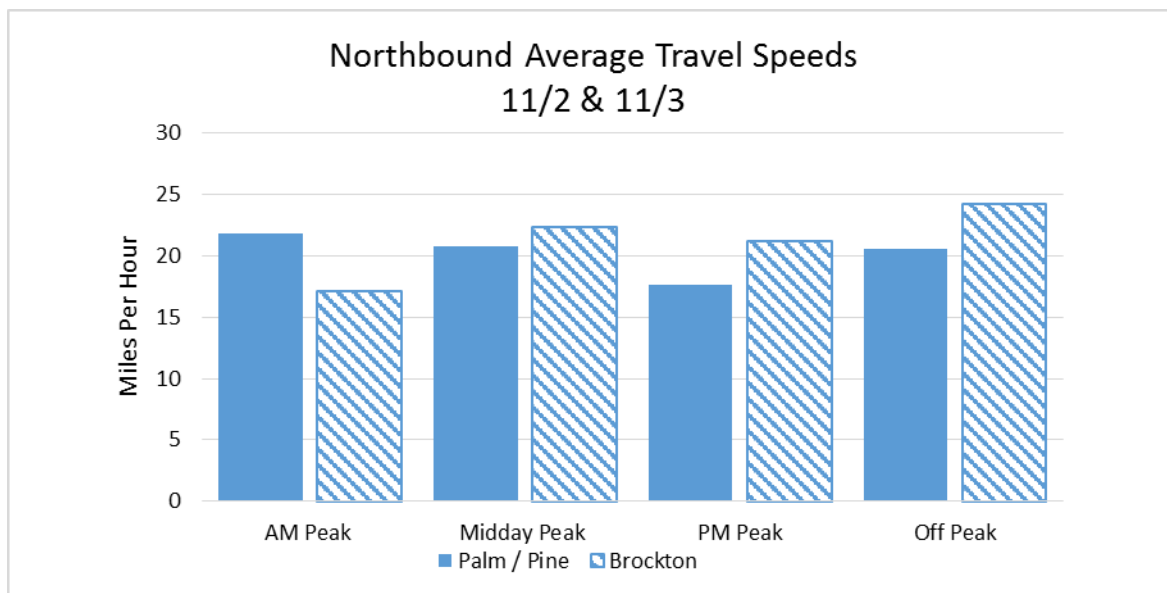


Figure 4

Brockton Avenue provides the highest average travel speed during all hours of the day in both directions, with the exception of the northbound direction from 7 to 9 am. The lower average speed during the AM peak in the northbound direction can be attributed to the high volume of motorists travelling towards the downtown and schools during this time. However, avoiding Redwood Drive / Pine Street and travelling further to use Brockton Avenue does provide a higher average travel speed for seven of the eight measured scenarios. The frequency of stop-controlled intersections along Redwood & Pine contributes to the lower average travel speeds.

Lower average travel speeds may not deter or prevent cut-through traffic, so the Public Works Department conducted a Neighborhood Cut-Through Traffic Analysis on Redwood Drive in June 2015 and concluded that 78% of all traffic that enters Redwood Drive is neighborhood traffic and not cutting through. Nonetheless, Table 4 shows that Redwood Drive has seen a 55% increase in traffic volumes since the completion of the project and Pine Street has experience a modest 12% increase in that same time period. The cut-through traffic volume on Redwood Drive is approximately 22% of all traffic which corresponds to 750 daily motorists. The Public Works Department had secured grant funding to install traffic circles on both Redwood Drive and Pine Street but subsequent to grant award, residents requested that the City rescind grant funding for the traffic circles as they preferred to maintain the existing stop-controlled intersections. Residents expressed that the traffic circles would address the upper end speeding concerns but felt they may encourage cut-through traffic as the traffic circles would have eliminated the multi-way stops. The Public Works Department may collaborate with local neighborhoods to consider other traffic calming measures including speed feedback signs, timed turn restrictions, or others measures to discourage cut-through traffic via Redwood Drive.

While the data indicates that the Brockton Avenue Striping Project provides measurable benefits, residents' perception and experiences related to a project are also important when evaluating a project's benefit to the community. As such, the Public Works Department conducted and received in excess of 600 responses to a mailed and electronic survey that asked several questions related to safety, ease of use, and a desire to retain certain project features.

For the purposes of this report, the “survey area” is generally bounded by Mission Inn Avenue to the north, Olivewood Avenue to the east, Jurupa Avenue to the south, and Mount Rubidoux to the west. City Staff also conducted in-person surveys of businesses along Brockton Avenue using a modified version of the residential/motorist survey.

The survey results indicated that a slight majority of residents (53%) believe that the project has not been overall beneficial due to a perceived low-utilization of bike lanes and lack of a passing lane. In contrast, 56% of businesses believe the project has been beneficial citing increased parking availability, increased visibility entering/exiting their business, and attracting additional customers as a positive impact. The survey responses mirror previous community engagement efforts prior to the project’s implementation and elevate the importance of measured safety benefits and findings with the restriping project – which may not be readily apparent to the motorists and residents.

After completing a 6, 24, and 36-month after-project traffic study the data continues to support overall benefits of the Brockton Avenue Restriping Project. After reviewing the latest set of traffic volumes and determining the collision factors of the post-project pedestrian and bicyclist accidents, the Public Works Department concludes the following:

- The Project has reduced the number of accidents along Brockton Avenue by 24%. This reduction figure is significant as broadside and head-on collisions were reduced at a higher rate than anticipated. Broadside and head-on collisions tend to cause the more severe injuries.
- Traffic volumes and operations appear to have normalized as the 2017 traffic volumes are 13% lower than the 2016 figures and overall 3% lower than the volumes conducted in 2014, prior to project commencement
- The increase in pedestrian and bicycle incidents after project completion are primarily due to motorists not yielding the right-of-way at signalized intersections. Three of the eight bicycle incidents involved bicyclists not riding on Brockton Ave and 2 other incidents involved bicyclists veering into oncoming traffic while attempting to cross the street.
- The survey results do not warrant change to the current striping configuration, less than 50% of respondents were against keeping the bike lanes.
- 24-Hour Bicycle and Pedestrian Volumes continue to show moderate use of the Class II bike lanes and sidewalk facilities
- Over 50% of businesses found the project to be beneficial
- Traffic volumes on Magnolia Avenue, Brockton Avenue, and surrounding streets have generally decreased since 2015 suggesting other large projects or factors contributed to traffic detouring via Brockton Ave and surrounding streets.
- The pre and post project 85th percentile speed (the speed that 85 percent of vehicles do not exceed) has remained relatively unchanged as it decreased by 3 mph, from 41 mph to 38 mph.
- Brockton continues to provide higher average travel speeds when compared to the adjacent routes of Redwood Avenue and Pine Street.
- Public Works Department is willing to work with local neighborhoods from Redwood Drive to consider traffic calming measures. Pine Street had a moderate traffic volume increase and no additional traffic measures are recommended

- On-street parking demand is greatest within the blocks near Terracina Avenue and is associated with RCC students. Parking within these blocks does not impact residential properties and discourages RCC students from spilling over onto local streets.
- Public Works will seek to install a two-way left-turn lane between Tequesquite Avenue and Fourteenth Street by removing one of the two southbound through lanes in an upcoming striping project

FISCAL IMPACT:

There are no costs associated with receipt and review of the 36-month post-construction project traffic study data.

The City was awarded \$420,030 by the Bicycle Transportation Account (BTA) grant to implement the Brockton Avenue Restriping Project and the City would not be liable for returning those grant funds if the corridor was restriped and the Class II bike lanes were removed. Restriping Brockton Avenue between Mission Inn Avenue and Beatty Drive to reestablish the 4 through lane configuration is anticipated to cost approximately \$540,000.

Prepared by: Kris Martinez, Public Works Director
Certified as to
availability of funds: Adam Raymond, Chief Financial Officer/City Treasurer
Approved by: Al Zelinka, FAICP, Assistant City Manager
Approved as to form: Gary G. Geuss, City Attorney

Attachments:

1. Project Location Map
2. Brockton Avenue 3-Lane Illustration
3. Brockton Avenue Restriping Project Data Report, dated April 24, 2015
4. Survey Questions and Responses