



CITY OF LONG BEACH

DEPARTMENT OF PUBLIC WORKS

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December 21, 2010

Mr. Bruce Friedman
Federal Highway Administration
Office of Transportation Operations
400 Seventh Street, SW, HOTO
Washington, DC 20590

FINAL REPORT: Second Street Sharrows and Green Lane in the City of Long Beach, California (RTE 9-113E)

Dear Mr. Friedman:

Enclosed is the final report for the City of Long Beach Experiment RTE 9-113E which was granted by the Federal Highway Administration for the placement of sharrows augmented by a six-foot strip of green paint down the center of the travel lane on Second Street in the Belmont Shore commercial district.

The attached report summarizes the findings of before and after studies, including initial and subsequent counts and observations which serve as the City's final progress report based on twelve months of experience and observation.

The following conclusions are made at this time:

- The green lane facility has appeared to result in an approximate doubling of usage over the first 12 months of existence.
- The facility has been found to be popular with bicyclists. Bicyclists familiar with more traditional sharrows have noted that the additional emphasis resulting from the green pavement paint appears to be creating a heightened awareness by the motorists in the lane.
- Crash experience involving bicyclists is largely unchanged, while the crash rate per bicyclist is reduced from pre-project levels.
- Crash rate not involving bicyclists was higher than in the previous year but does not appear to be related to the installation of the green painted sharrow lane. Continuing review of crash experience is suggested.

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Mr. Bruce Friedman
December 21, 2010
Page 2

Based upon the promising results, it is recommended that the experiment continue to be permitted for three additional years with the City reporting on an annual basis.

Sincerely,



MARK CHRISTOFFELS
Deputy Director of Public Works/City Engineer

MC:SG:db
P:/ce/mark/letters/traffic/2ndstreetbikelanereportdec2010

Memorandum

Date: December 30, 2010 Project #: MB03000
Attn: Sumire Gant, City of Long Beach
From: Rock Miller, P.E., KOA Corporation
Subject: Second Street Sharrows and Green Lane – Progress Report: October 2010
Comments:

Second Street Sharrows and Green Lane

PROGRESS REPORT: OCTOBER, 2010

PROJECT PURPOSE

The City of Long Beach, California, received permission from the Federal Highway Administration to conduct an experiment along Second Street in the Belmont Shore commercial district. KOA Corporation assisted the City in securing the Request to Experiment (RTE) and by preparing the implementation design. The project provides for placement of Sharrow bicycle markings within the outer travel lanes of Second Street. Sharrows are approved for use by the State of California and they were recently approved by FHWA in the newly released 2009 edition of the Manual of Uniform Traffic Control Devices. However, to augment these devices, a six-foot strip of green paint was provided under the RTE down the center of the outer travel lanes to further indicate the appropriate position for bicyclists using the roadway and to emphasize the expected location for bicyclists to general traffic.

PRE PROJECT CONDITIONS AND BICYCLE USAGE

Second Street is a four-lane divided roadway passing through a commercial district of Long Beach known as Belmont Shore. The commercial district is approximately $\frac{3}{4}$ mile long and features 13 traffic signals densely spaced. Daily traffic levels are about 35,000 vehicles per day, and the corridor is known for frequent vehicular traffic congestion. Second Street is the nearest through arterial to the beach area of Long Beach and is a desired route for bicyclists traveling along the Beach. Bicycle usage is visibly higher than in other areas of Long Beach and Los Angeles County, due to a variety of factors, including limited parking, pleasant weather, friendly terrain, and a major City commitment to improving bicycling.

Upon FHWA approval of the demonstration, the City of Long Beach conducted a comprehensive analysis of bicycle usage of the roadway area prior to implementation of any changes. Bicycle traffic data was collected for three days from June 5-7, 2009, on Second Street at Corona Avenue with the assistance of the Long Beach Cyclists non-profit organization. The survey recorded 1200 cyclists over the 3-day period (Friday/Saturday/Sunday). The survey noted where each cyclist was riding, on the roadway or on the sidewalk.

The survey noted that 45% of cyclists were riding within the “door zone” where they could be struck by an opening door. 11% were riding within the right lane “taking the lane”, the position that is unlikely to be involved in a crash with a vehicle door opening. This position may also provide better visibility for motorists on side streets and driveways of approaching cyclists. Most of the remaining cyclists were riding or walking on the sidewalk. This usage pattern is used as the benchmark for conditions prior to project implementation.

INITIAL IMPLEMENTATION

Second Street was resurfaced within the project limits immediately prior to installation of the special treatments. The sharrow markings and green paint were applied overnight on June 24 and June 25, 2009. The new shared lanes were officially opened to traffic on Saturday June 27 in a “ribbon cutting” ceremony. Approximately 200 persons attended the opening festivity and rode bicycles on the shared lanes. The event received local newspaper publicity (Long Beach Press Telegram) for several days prior to and following implementation. Portable changeable message signs were provided on each end of the project area to advise all travelers about the Shared Bicycle/Auto Lane Ahead. Poster-signs were also provided in the median of 2nd Street at various locations indicating to Ride the Shared Lane.

FIGURE I – CYCLIST BEYOND DOOR ZONE



City staff and KOA staff have monitored the facility since its opening on a regular basis to insure that any issues are addressed. Informal observations continued through the summer, and a formal 3-day usage survey was repeated in late summer.

The installation did not generate any immediate concerns over safety to cyclists or improper usage by motorists. Over 3 million motorists and 50,000 cyclists used the facility in the first three months following implementation. Individual cyclists who use the lane appear to be very satisfied and comfortable. Many members of the project team have ridden bicycles within the lane and found the experience to be favorable.

Generally no incidents of rage or concern have been observed, noted, or recorded. Motorists occasionally follow slower cyclists, but it appears evident that they are not falling behind the flow of traffic and end up queued at the next red light. There is little net travel time loss from following cyclists. Motorists also sometimes change lanes to avoid slower cyclists, just as they do to avoid a car waiting for a parking space.

The project visibly increased the number of cyclists that choose to use the shared lane, but many cyclists continue to ride in the door zone or on the sidewalk. Interviews with individual cyclists indicate that they do not know they can ride on the green lane, or they do not wish to use the lane.

Some cyclists were observed to travel in the door zone to pass to the right of stopped vehicles in front of them, especially during peak flow periods when automobile traffic is extremely sluggish (similar to motorcycles on a freeway, except cyclists generally pass on the right). This activity probably also occurred before the lane was implemented.

The project included the use of special custom Share the Road signs, modified from standard to show the bicycle in line in front of the vehicle. These signs were installed about 2 months after the lane was marked. After installation, it was hoped that the signs may help cyclists to understand that they may ride in the lanes. Spot surveys of usage of the lanes indicate that there appears to be a gradual trend toward less use of undesirable riding locations, but there was no substantial change in usage that is attributed to the signs alone.

Public reaction has been generally positive. Most persons who have inquired about the project have reacted positively after they understand the goal and purpose. Some persons initially believed they could not drive their automobiles in the green lane. The number of these is not substantial enough to reduce overall equal use of both travel lanes, but it is the most frequent concern heard from motorists. When told that it is a shared lane, most persons have accepted and understood the purpose of the project.

The project has received a lot of discussion on internet websites and discussion boards. Videos of cyclists using the facility can be found on You Tube, and many references can be found on a web search for Long Beach Sharrows. The majority of this feedback has been positive among cyclist groups.

Local cyclists have asked for more sharrows to be installed at more frequent intervals within the lanes. There was originally one sharrow on the green paint at the start of each 200-foot block. A second sharrow was added near the end of each block in April, 2010.

Figure 2 – Modified Share the Road Signs



The east end of the facility has also attracted attention in the area where the green lane begins. The green stripe begins in the second block while cyclists are intended to merge from a bike lane east of the project area toward the center of the lane in the first block. A request has been made to extend the green lane and sharrows so that it begins at the intersection where the bicycle lane ends. A treatment similar to a bike box is being considered so that bicyclists are positioned in front of vehicles at the entry point to the green lane.

The paint used for the green lane does not have strong reflective properties. The paint utilizes a standard FAA specification for green paint used adjacent to airport runways. It has been requested that the paint be enhanced to show the green color more properly at night when the coloring is nearly undistinguishable. This has been countered by concern that the paint may be slippery when wet. Reflective glass beads used to create reflectivity also may increase slipperiness.

A suggestion has also been made to modify the Share the Road signs to show the green stripe on the sign as background for the bicycle and vehicle. These types of changes are being considered.

Most pending suggestions appear to be intended to improve public awareness of the proper usage of the green lane especially for bicyclists. Additional measures are being considered to improve awareness.

Figure 3 – Typical Block with Traffic and Land Use



The project was presented to the California Traffic Control Devices Committee in September, 2009. The State Committee voted to allow the experiment to continue and requested that monitoring reports be prepared and submitted to the committee. Committee members had concerns over a California Vehicle Code provision that requires bicyclists to ride as far to the right as is reasonably safe. The width of the green stripe may encourage cyclists to ride further to the left than the law intends. Committee members also expressed some concern over the need for proper or consistent usage of colored pavement. For this application, paint is being used in an area where motorists and bicyclists are expected to be joint users. In other California experiments under way colored pavement is being used in areas for long stretches within Class II bicycle lanes where motor vehicles should not be present.

The Committee also requested that the project attempt to collect or obtain data regarding comparative use of Sharrows at similar locations where the lane has not been painted. The project team indicated that they would attempt to provide this information where it is reasonably available from other communities.

PRE-PROJECT CRASH HISTORY

The crash history for Second Street was analyzed for the 12 months prior to implementation, with focus upon bicycle related crashes. Crash history is based upon Long Beach Police accident reports taken. The previous year found 34 accident reports, including 5 that were bicycle related. The actual written report for each bicycle related crash was closely analyzed to help establish a benchmark for the types of bicycle crashes that were being reported. A summary of each bicycle related crash is presented below:

DR #08-0056526 7/31/08 8:35 AM - Near Bay Shore:

Summary: Vehicle 1 N/B vehicle stopped in crosswalk to make Right Turn on Red to go E/B collided with a W/B (bicyclist, age 14) proceeding straight while riding on the sidewalk in wrong direction over the adjacent bridge. A pedestrian R/W violation was indicated on the report, but probably wrong way bicycle riding is a factor. Report clearly suggests bicyclist was riding, not walking the bicycle. The bicyclist was a minor injury, complaint of pain, cared by parents.

DR #08-0059045 8/9/09. 14:47 PM at Santa Ana Ave:

Summary: Vehicle 1 was stopped S/B and proceeded to make a Right Turn on Red to travel W/B and collided with V2, an E/B adult female bicyclist proceeding straight near the north curb in the street traveling in the wrong direction. Unknown Primary Collision Factor was noted in the police report. The bicyclist reported a minor scratch and complaint of pain

DR #09-0011287 2/13/09 18:00 PM - 100' west of Park Ave:

Summary: Vehicle 1 E/B adult male bicyclist proceeding straight collided with Vehicle 2, an E/B parked vehicle when its driver opened their door into the bicyclist. The report noted "Other hazardous movement". No injuries

DR #09-0031743 5/1/09 1138 AM - Near Glendora:

Summary: Report was coded to involve vehicle 1 E/B proceeding straight collided with W/B vehicle #2 backing. Unsafe starting or backing. One injury, complaint of pain. Report narrative does not match coding. Narrative indicates vehicle #2 (67 yr male) was riding bicycle near parked cars and moved left to pass a parked vehicle that was parked too far from the adjacent curb. V2 swerved into vehicle 1 while avoiding the parked vehicle.

DR #09-0036132 5/17/09 1630 pm. Near Park:

Summary: vehicle 1 E/B stopped collided with vehicle 2 E/B stopped. Unsafe speed. No injuries. Narrative indicates car was stopped at green light in heavy traffic and was rear ended by bicyclist who was inattentive.

Summary:

- 2 wrong way bicyclists
- One "door"
- One swerve to avoid door
- One rear end by bicycle.

Four of the five crashes are of the type that appear to be unrelated to the use of the green painted bicycle lane. These include wrong way and door related accidents. It is also noted that the detailed narrative in the crash reports often conflicted with the check-box coding that would normally be used for aggregate analysis. The check-boxes do not appear to do a good job allowing information to be summarized precisely.

PRIOR YEARS CRASH EXPERIENCE

Crash experience was also compiled for prior years to determine typical annual experience for the roadway. Crashes were not analyzed in detail, but annual crashes and annual crashes involving bicycles were noted. The results are as follows:

Year (June-June)	Total Crashes Reported	Total Bicycle Involved
2008-2009	34	5
2007-2008	41	5
2006-2007	35	2
2005-2006	n/a	n/a
2004-2005	37	3
2003-2004	45	5
2002-2003	42	4
2001-2002	42	4
2000-2001	46	2

THREE MONTHS USAGE REPORT

The bicycle counts and utilization study conducted before the green lanes were installed was repeated on 2nd Street thru Belmont Shore in mid-September (2010). A comparative analysis of the results is indicated below.

Three Months Usage – Comparative Analysis

Measure	Before Green Lane	After Green Lane	Change
Total Cyclists (Fri, Sat, Sun)	1252	1614	+364
On Sidewalk	533	415	-118
In Door Zone	612	667	+55
In Green Lane Area	160	561	+401
In Left Lane	15	19	+4

Perhaps the most significant change is related to the total number of cyclists counted. While seasonal effects could apply, the after-green count showed nearly 400 more cyclists over the 3-day count period, a 29% increase

in total bicyclist usage. It should also be noted that the increase in the number of cyclists riding on the area occupied by the green lane was also approximately equal to the total increase. We believe it is reasonable to assume that the presence of the green lane has been responsible for most of the increase in net usage.

One project goal was to reduce the number of cyclists on the sidewalk. The counts showed a 17% decrease in the number of cyclists using the sidewalk. They have evidently migrated to the street. A secondary goal of this project is was to move cyclists out of the door zone. The number of cyclists riding in the door zone increased slightly on a numerical basis, but the proportion of all cyclists riding in the door zone decreased. It is probable that some new bicyclists attracted to the facility did not ride within the painted area of the lanes.

Anecdotally, more car drivers seem to be using the left lane. Measurements of traffic prior to implementation indicated near equal use of both lanes. Some motorists are now observed to change to the left lane to pass slower cyclists. But others are observed to change back to the right lane after passing cyclists. There are other reasons for motorists to wish to avoid the curb lane, due to parallel parking, stopping buses, and cars waiting for pedestrians before turning right from the roadway. Due to overall capacity limitations and congestion, a significant shift in lane usage will not likely be measurable. Current bicycle usage is about one per 2-3 minutes, so few motorists will encounter a cyclist enough to produce a significant shift in lane use.

The painted green lane appears to be very successful in attracting cyclists to the facility and encouraging attracted cyclists to use the green lanes. 34% of all cyclists counted were using the green lane as designed, up from 12% before it was painted. And while there was reported initial confusion and fear about right use of the shared lane by both motorists and cyclists, time has passed and both groups have learned to share the space safely.

Interviews with selected restaurant and coffee shops have also indicated that they believe business generated by additional cyclists has improved. They are generally in favor of the experiment and have become more receptive to measures that would increase bicycle parking in the area.

TWELVE MONTH USAGE REPORT

The green lane facility was in place for one year at the start of summer of 2010. Bicycle usage counts were repeated during the mid summer to measure usage trends. The counts were also taken over a 3-day period (Friday/Saturday/Sunday). The results are indicated in the table below, however the results generally indicate that bicycle traffic has virtually doubled in the corridor over the past 12 months. There is no reason to explain the increase in usage other than the presence of the green lanes.

Summer 2010 Usage Table - Friday / Saturday / Sunday Combined

Measure	Before Green Lane	After Green Lane	Change
Total Cyclists (Fri, Sat, Sun)	1320	2428	+1176 (94%)
On Sidewalk	533	513	-20 (-3%)
In Door Zone	612	867	+255 (+42%)
In Green Lane Area	160	937	+777 (485%)
In Left Lane	15	111	+96 (680%)

The trend in usage seems to be a general extension of the 3-month usage pattern. Numerical usage of the sidewalk has been largely unchanged, but the percentage of all bicyclists riding on the sidewalk has been reduced. Usage of the green lanes is much higher than the usage of this portion of the roadway prior to implementation of the green lanes.

The number of cyclists riding in the “door zone” is higher than for the previous survey, but the percentage of bicyclists in the door zone is reduced. It is suggested that the green lanes have successfully attracted bicycle traffic to the facility, but the lanes have not been as effective in attracting existing bicycle traffic from the door zone to the green lane. Observations have also noted that bicyclists often travel in the door zone to pass to the right of queued vehicles due to traffic congestion.

12 MONTH CRASH COMPARISON

A study of reported accidents was conducted for the 12 months following implementation of the Green Lanes. The “After Year” was defined as June 1, 2009 to June 1, 2010.

There were a total of 50 accident reports, including 5 that were bicycle related for all collisions on Second Street from Bay Shore to Livingston. The total number of accidents was higher than in the prior year, but it is not apparent that the increase is due to the installation and use of the green painted bicycle lane. The total number of accidents involving bicycles was the same as the 12 months prior to implementation of the green lanes. Since usage of the green lanes has increased from the previous year, the accident rate per bicyclist has been reduced.

Each of the bicycle-related accidents was analyzed further to understand the types of crashes that were occurring. Summaries of the five crashes are as follows:

BICYCLE DETAIL

DR #09-0062945 8/22/09 15:45 PM - Near Pomona.

Summary: Other. Vehicle 1 (bicycle) proceeding straight in collision with vehicle 2 stopping to back up for a parking maneuver, resulting in injury to the bicyclist. Vehicle 1 was riding in the green lane per report. Minor injury, bike ride-able, refused treatment.

DR #09-0064689 8/29/09 14:43 PM - Near Glendora.

Summary: Vehicle 1 (bicycle) was E/B proceeding straight and collided with vehicle 2 who was making a westbound left turn. Brake failure was cited for the bicyclist. Brake failure was noted because bicycle was a fixed gear bicycle and had no traditional brakes. The report noted heavy congestion. The left turn vehicle may have turned across stopped vehicle traffic and struck the bicyclist who was passing to the right of stopped traffic and traveling in the door zone. Or may have just been poor visibility. Taken to hospital for treatment and released.

DR #09-0076356 10/10/09 13:09 PM - Near Santa Ana.

Summary: Vehicle 1 E/B was stopped to allow car in front to parallel-park in an empty space. Vehicle was struck by vehicle 2 (bicycle) proceeding straight at unsafe speed in rear. Bicyclist fled scene. VI driver said bicyclist admitted to being intoxicated and had no valid identification to present. No injuries noted.

DR #10-0023646 4/6/10 10:46 AM - Near Granada.

Summary: Coded as Vehicle 1 E/B proceeding straight collided with vehicle 2 E/B straight, unknown PCF. Report narrative indicated that the bicyclist said a passing vehicle hit his handlebars while changing lanes to pass him. Driver said bicyclist suddenly drifted to the left and hit the car. Report was unable to assign fault. Bicyclist was 81 yrs and was transported to hospital as precaution. Visible injuries were scrape and pain in shoulder

DR #10-0028162 4/23/10 20:20 pm - Near Park.

Summary: Vehicle 1 W/B was proceeding straight and collided (rear end) with W/B bicycle, due to unsafe speed. Bicyclist was pushed forward into a stopped municipal bus. Vehicle 1 DUI and cited. Vehicle 1 was observed to be swerving in its lane before the collision.

A brief summary is as follows:

- Two rear End by bicycle
- One left turn hit through bicyclist
- One unsafe passing
- One rear end by Automobile

The types of accidents reported seem at a glance to be different than the types noted before the green lane was introduced. There have been no reported crashes on the sidewalks, no reported "doorings", and no crashes involving motorists overtaking bicyclists since the green lane was painted. The types of crashes are too widely varied to draw any more detailed conclusions from the reports.

Since the annual total crash experience for the roadway in the past 12 months was higher than the annual average, it is appropriate to continue to monitor overall crash experience to determine if a trend is visible.

COMMENTS BY LAW ENFORCEMENT PERSONNEL

The project area is a popular nightlife corridor, with many bars and restaurants along the route. A traffic enforcement officer assigned to the project area filed this general comment and report on the green sharrow lanes:

“This email is in regards to the Sharrow lane in Belmont Shore (2nd St). I have noticed since the inception that, for the most part the lane is used the way that its designer intended it to be used, that people ride in the lane at approximately 10-15MPH and not completely disrupt the flow of traffic.”

“I have noticed that on Friday and Saturday nights (between the hours of 2200-0300) a lot of the party goers on 2nd St are riding their bicycles to the bars. I have seen that bar patrons will ride their bicycles at a very slow pace in the lane and backing up traffic. I have seen bicycle riders pulling their friends on skateboards to their next destination. I don’t think people are educated in the use of the lane because they are still riding their bikes on the sidewalk too.”

“These are just some of the issues that I have seen regarding the Sharrow lane.”

Other significant issues reported include an incident where an officer cited a bicyclist riding properly in the green lane for riding too far to the left of parked cars (as well as for riding with headphones on). Long Beach police have been advised that bicyclists riding in the green paint should not be cited for riding too far to the left.

Also a transit vehicle did not realize the lane could be used by general traffic initially and stopped for passengers in the left lane (on the first day of implementation).

SUMMARY AND CONCLUSIONS

The following conclusions are made at this time:

- The green lane facility has appeared to result in an approximate doubling of usage over the first 12 months of existence.
- The facility has been found to be popular with bicyclists. Bicyclists familiar with more traditional sharrow have noted that the additional emphasis resulting from the green pavement paint appears to be creating a heightened awareness by the motorists of bicycle usage in the lane.
- Crash experience involving bicyclists is largely unchanged, while the crash rate per bicyclist is reduced from pre-project levels.
- Crash rate not involving bicyclists was higher than in the previous year but does not appear to be related to the installation of the green painted sharrow lane. Continuing review of crash experience is suggested.

Based upon the promising results, it is recommended that the experiment continue to be permitted. FHWA may also wish to allow other agencies to experiment with similar or different sharrow treatments.

Figure 3 – Opening Day Ceremony

(Pictured: Tony Cruz, City’s Professional Cycling Ambassador; Andrea White-Kjoss, CEO BikeStation Long Beach; Suja Lowenthal, Member Long Beach City Council)



NEXT STEPS

The project remains a demonstration for FHWA and for California at this time. Based upon results to date, the project is considered a success in raising awareness and attracting cycling in the corridor. There is a need to educate more bicyclists on proper use of the lanes, but their use has not been misunderstood by new bicyclists.

Continued maintenance of the green paint has been a frequently asked question. If the treatment is ultimately approved for permanent usage, the City will consider a long life slurry treatment with green pigment, but the cost

of such a treatment was not found justifiable for a trial implementation, especially if it had to be removed at the end of the experiment.

The City intends to continue to review the existing treatment and take actions that are advisable to improve the success of the experiment. The City has also fielded numerous inquiries by other Cities and bicycle advocates about the experiment and has provided available information to inquiring parties. The Long Beach Press Telegram newspaper has run a few additional articles and USA Today has also reviewed the facility.

The project has won an award from the Institute of Transportation Engineers (ITE) for innovative design. A technical article about the lanes can be found at the following location that may require an ITE membership to view:

http://www.ite.org/councils/Ped_Bike/newsletters/PBCfall09.pdf

Other relevant sites with press coverage or commentary include:

http://www.presstelegram.com/news/ci_12700564

<http://la.streetsblog.org/2009/06/29/cyclists-pumped-about-long-beachs-green-sharrows/>

<http://www.lbpost.com/brian/7156>

http://www.youtube.com/watch?v=ec_aEo4pJeqE