

EVALUATION OF SOLID AND DASHED GREEN PAVEMENT FOR BICYCLE LANES

REQUEST TO EXPERIMENT

Submitted to:

California Traffic Control Devices Committee

Submitted by:

City and County of San Francisco
Municipal Transportation Agency

BACKGROUND

The City of San Francisco has an extensive network of on-street bikeways, and is continually working to improve its bicycle route network to encourage more bicycling and to improve safety. Bikeway improvement projects in San Francisco are complicated by the City's topography, a high demand for on-street parking, and high volumes of transit and motor vehicle traffic on many streets. To address the unique conditions along San Francisco's bicycle route network, a series of Supplemental Design Guidelines were developed as part of the 2005 San Francisco Bicycle Plan Update. These guidelines are intended to provide design guidance for unique bikeway facility situations within San Francisco. The Supplemental Design Guidelines also propose experimental facilities such as colored bicycle lanes. This request for experimentation is for the use of green colored pavement in several locations along San Francisco's bicycle route network.

NATURE OF THE PROBLEM

Bicycle lanes in the U.S. are typically striped on the right side of roadways, adjacent to the curb or edge of roadway, or adjacent to parked motor vehicles, where on-street parking is permitted. Some of San Francisco's bicycle lanes, while compliant with existing design standards, are located on atypical roadways. Examples of these unique situations include: bicycle lanes striped in between narrow motor vehicle turn lanes and thru lanes; left-turn bicycle lanes; and locations where motorists must cross bicycle lanes at acute angles. In these situations, additional attention by bicyclists and motorists is required to encourage safe merging behavior and proper lane placement, and to discourage motorists from encroaching into space designated for bicyclists. San Francisco proposes experimenting with green colored pavement in several locations to determine if it improves safe merging behavior and compliance with proper lane placement by both bicyclists and motorists.

DESCRIPTION OF PROPOSED EXPERIMENT

San Francisco proposes experimenting with the use of both solid green colored pavement and dashed green colored pavement as shown in Figures 1-10. Solid green colored pavement is proposed along portions of bicycle lanes demarcated by solid white lines to emphasize proper lane placement and discourage motorist encroachment, and dashed green colored pavement is proposed along dashed portions of bicycle lanes to encourage safe merging behaviour between bicyclists and motorists. This proposal for colored pavement is similar to typical traffic striping layouts, where solid markings indicate areas where lane changes are prohibited and dashed markings indicate areas where merging maneuvers are permitted. As outlined in the Manual on Uniform Traffic Control Devices (MUTCD), when used for guidance or regulation of traffic, colored pavements are traffic control devices. Currently only yellow, white, red and blue pavement markings are approved for use as traffic control devices. This experiment proposes the use of a non-standard green colored pavement as a traffic control device.

To date, other U.S. studies on colored bicycle facilities have focused on the use of a solid colored treatment within conflict/merge areas. The City of New York is currently experimenting with the use of a solid colored treatment in a standard bicycle lane to determine its effectiveness at reducing encroachment by motorists.

RELATED FHWA STUDIES

City of New York - Evaluation of Solid Green Bicycle Lanes to Increase Compliance and Bicycle Safety (Ongoing) – FHWA Experiment No. 9-79 (E)

City of Chicago - Green Pavement Markings for Bike Lanes (Ongoing) - FHWA Experiment No. 9-77(E)

State of Vermont - Solid Green Bike Lane in a Potential Conflict Area (Ongoing) - FHWA Experiment No. IX-67(E)

City of Portland, Oregon- Evaluation of the Blue Bike Lane Treatment used in Bicycle-Motor Vehicle Conflicts Areas in Portland, Oregon (Completed) - FHWA Publication No. FHWA-RD-00-150, August 2000

COLORED MATERIAL DETAILS

Recent Federal Highway Administration (FHWA) approved studies by the Cities of Chicago and New York, and by the State of Vermont, have all used the color green for experimental colored bicycle facilities. The Bicycle Technical Committee (BTC) and the Pavement Markings Technical Committee (PMTTC) of the National Committee on Uniform Traffic Control Devices (NCUTCD) have suggested the use of the color green for experimental colored bicycle facilities.

Before application of a colored material on public right-of-way, San Francisco will test multiple materials to compare durability, ease of application, ease of maintenance, and visibility under varying light and weather conditions. Based upon an initial review of available products, the preferred colored material will likely be a micro surface binder consisting of a colored synthetic bitumen emulsion, with glass beads added to provide retroreflectivity.

SCOPE AND WORK PLAN

San Francisco proposes conducting a before-and-after study that will include counts of motorists and bicyclists, wheel path tracking at merge locations to determine if the green pavement markings change vehicle tracking behaviour, reported crash data, and observational data on motorist and bicyclist behaviour and conflicts that can be used as crash surrogates.

LOCATIONS

Below is a list of proposed locations for the before-and-after study, with a brief description of the existing design configuration. Additional locations may be added, and some of the locations below may be removed from consideration upon further review. Photo simulations of proposed locations are shown in Figures 1-10 at the end of this document.

1. 8th Street at Brannan Street (Through bicycle lane between through and right-turn only travel lanes)
2. Alemany Boulevard at Ocean Avenue (Through bicycle lane between through and right-turn only travel lanes)
3. Alemany Boulevard at Rousseau Street (Left-turn only bicycle lane between through and left-turn only travel lanes)
4. Alemany Boulevard at San Jose Avenue, Northbound (Through bicycle lane between through and right-turn only travel lanes)
5. Alemany Boulevard at San Jose Avenue, Southbound (Left-turn only bicycle lane between right-turn only and left-turn only travel lanes)
6. Alemany Boulevard at Sickles Avenue (Through bicycle lane that motorists must merge across at acute angle)
7. Division Street at 9th Street (Through bicycle lane that motorists must merge across at acute angle)
8. Howard Street at 11th Street (Left-turn only bicycle lane between through and left-turn only travel lanes)
9. Market Street at 10th Street (Through bicycle lane between through and right-turn only travel lanes)
10. San Jose Avenue at Guerrero Street (Through bicycle lane that motorists must merge across at acute angle)

DATA COLLECTION

Observations will be recorded by video camera with before and after data collected and tabulated. Each location will be observed multiple times during peak activity periods (typically on weekdays during the hours of approximately 7am-9am and 4pm-6pm). The before data collection will be separated from the after data collection by several weeks. User surveys of both motorists and bicyclists may also be utilized to collect information on user perception of the meaning of the colored material. The following observations will be recorded:

- Number of motor vehicles encroaching into bicycle lane
- Motorists' distance of encroachment into bicycle lane (wheel path tracking)
- Number of conflicts* between bicyclists and motorists
- Motor vehicle and bicycle volumes
- Bicyclists' behavior (signaling, shoulder checks, etc.)
- Motorists' behavior (signaling, yielding right-of-way, frequency of aggressive behavior, etc.)
- Durability of the colored material

*Conflicts will be defined by the research team prior to the beginning of the study. Typical indications of a conflict are sudden braking, swerving, or acceleration. Variable interpretations of what constitutes a conflict will be minimized by having the same researcher viewing before and after data.

SCHEDULE

The following timeline assumes that permission to experiment will be granted by the California Traffic Control Devices Committee (CTCDC) and the FHWA by Fall of 2008:

- Fall 2008 - Winter 2008- Conduct material testing
- Winter 2008 - Spring 2009 - Secure Contracts to install colored material and conduct experiment
- Spring 2009 - Summer 2009 - Restore white pavement markings where faded and collect Before data
- Summer 2009 - Fall 2009 - Apply Variable (Installation of Colored Material)
- Fall 2009 - Winter 2009 - Collect After Data
- Winter 2009 - Spring 2010 - Submit progress report to FHWA
- Spring 2009 - Summer 2010 – Submit final report to FHWA

EVALUATION PROCEDURES

If statistically significant improvements occur in the following behaviour areas, colored bicycle lane treatments should be considered for standardization:

- Reduction of motor vehicles encroaching into bicycle lane
- Reduction of motorists' distance of encroachment into bicycle lane (wheel path tracking study)
- Reduction of conflicts between bicyclists and motorists
- Improved bicyclist behavior (signaling, shoulder checks, etc.)
- Improved motorist behavior (signaling, yielding right-of-way, reduction of aggressive behavior, etc.)
- Awareness by motorists that bicyclists are traveling along a bicycle route
- Awareness of proper lane placement for bicyclists and motorists

REPORTING

Reporting will be submitted as specified by the Federal Highway Administration (FHWA). A semiannual progress report will be submitted for the duration of the experimentation and a final report on the results will be provided to the FHWA Office of Transportation Operations within three months following the completion

completion of the experimentation.

ADMINISTRATION

The San Francisco Municipal Transportation Agency will be the sponsoring agency. Consultant services may be utilized as needed. The concept of green colored pavement as a traffic control device is not protected by patent or copyright.

REMOVAL OF EXPERIMENTATION INSTALLATIONS

The San Francisco Municipal Transportation Agency will remove experimentation installations within three months of completion of the experiment if the FHWA or CTCDC reaches a decision that changes to the MUTCD or the California Supplement of the MUTCD are not warranted. Additionally, the San Francisco Municipal Transportation Agency will terminate the experimentation if significant safety concerns are found to be attributable to the experimentation.



Figure 1 – Existing (Above) and Proposed (Below) Conditions on 8th Street at Brannan Street

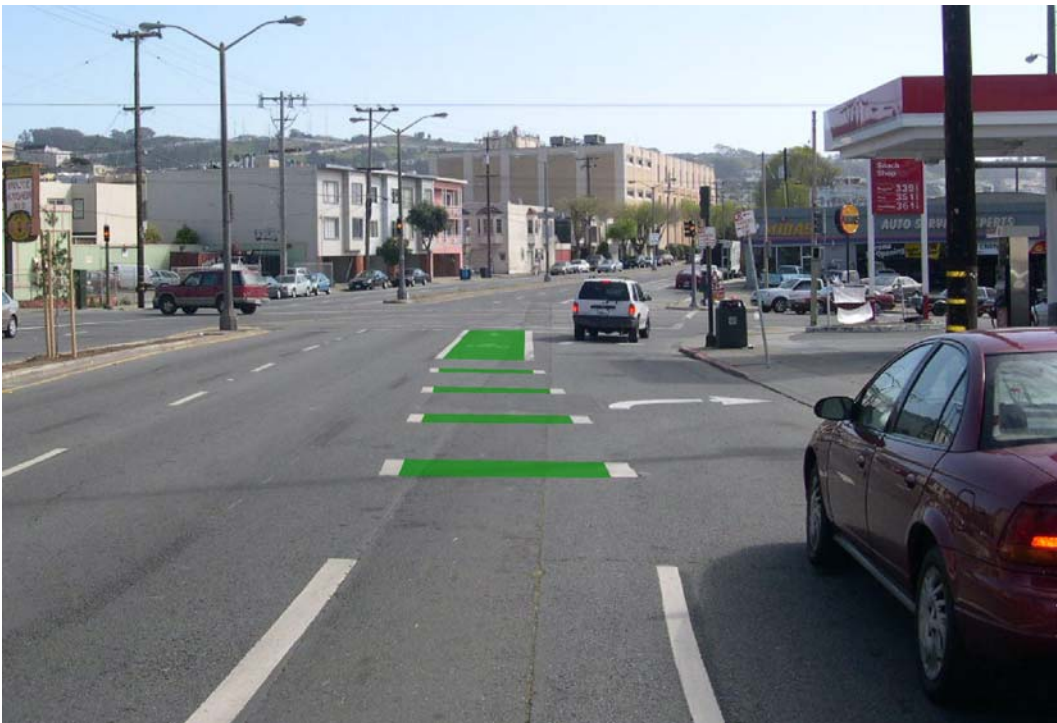


Figure 2 – Existing (Above) and Proposed (Below) Conditions on Alemany Boulevard at Ocean Avenue



Figure 3 – Existing (Above) and Proposed (Below) Conditions on Alemany Boulevard at Rousseau Street



Figure 4– Existing (Above) and Proposed (Below) Conditions on NB Alemany Boulevard at San Jose Avenue



Figure 5– Existing (Above) and Proposed (Below) Conditions on SB Alemany Boulevard at San Jose Avenue



Figure 6– Existing (Above) and Proposed (Below) Conditions on Alemany Boulevard at Sickles Avenue

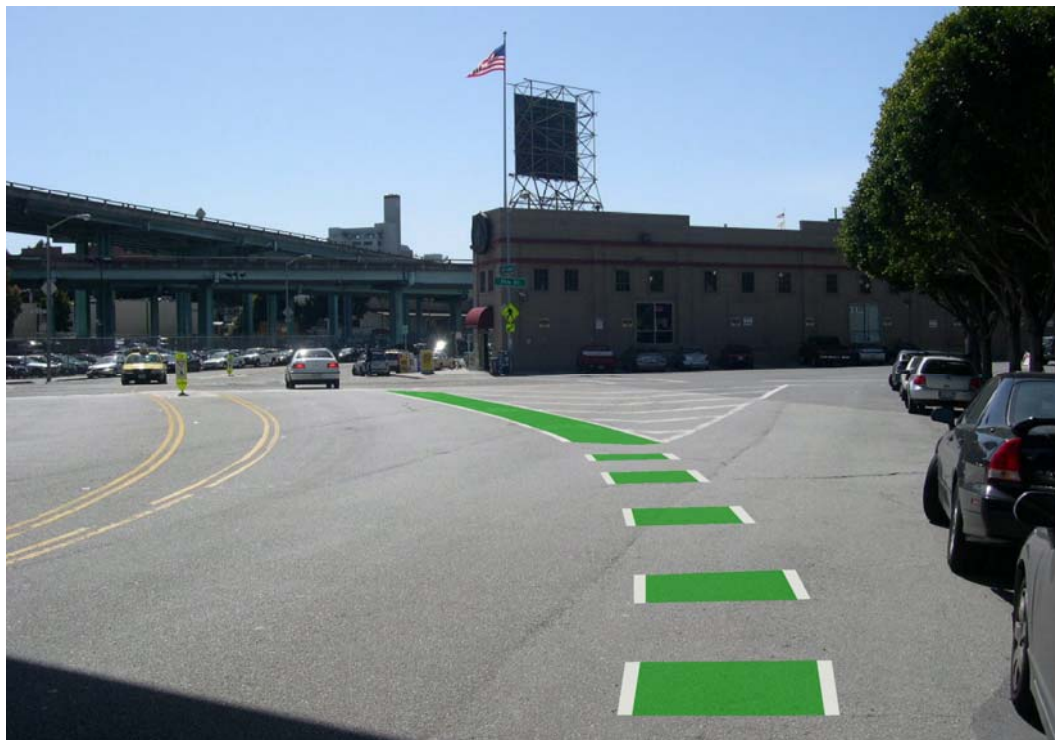


Figure 7– Existing (Above) and Proposed (Below) Conditions on Division Street at 9th Street



Figure 8 – Existing (Above) and Proposed (Below) Conditions on Howard Street at 11th Street



Figure 9 – Existing (Above) and Proposed (Below) Conditions on Market Street at 10th Street



Figure 10 – Existing (Above) and Proposed (Below) Conditions on San Jose Avenue at Guerrero Street