TO: Public Works Department/Traffic Engineering Division Personnel  
FROM: Scott Brunner, Director, Traffic Engineering Division  
DATE: December 16, 2015  
SUBJECT: Traffic Engineering Division Technical Policy Memo #TPM-15-003  
Use of Green Colored Bicycle Markings  
EFFECTIVE: December 16, 2015  
EXPIRES: December 31, 2017  

PURPOSE

Broward County has a significant number of bicyclists using its streets, bike routes and paths, and wishes to enhance the safety and visibility of bike lanes with the use of green pavement and/or bike lane symbols and arrows with green background. The purpose of this memorandum is to establish County policy regarding the Federal Highway Administration’s (FHWA’s) issuance of Interim Approval to Broward County for the use of green colored pavement in bicycle lanes, extensions of bicycle lanes, and within other potential traffic conflict areas. “Interim Approval” by FHWA allows interim use, pending official FHWA rulemaking, of a new traffic control device, or allows a revision to the manner in which an existing traffic control device is used as described in the Manual on Uniform Traffic Control Devices (MUTCD).

BACKGROUND

On April 15, 2011, FHWA Associate Administration for Operations Jeffrey A. Lindley released an official memorandum authorizing “Interim Approval for Optional Use of Green Colored Pavement for Bike Lanes (IA-14).” This memorandum summarized FHWA’s research findings, conclusions and conditions of Interim Approval utilizing green bike lanes and markings (Attachment 1). Broward County received FHWA Interim Approval for green colored bike lanes and bike markings with green background on September 4, 2013 (Attachment 2), and such approval extends to all municipalities for which Broward County has traffic control authority through an inter-local traffic services agreement.

In accordance with FHWA Interim Approval, Broward County has committed to the following requirements of the April 15, 2011 Memorandum:

1) Broward County agrees to comply with the technical conditions detailed in the memorandum.
2) Broward County agrees to maintain an inventory of all locations where green colored pavement is installed.

3) Per Section, 1A.10 of the 2009 MUTCD, Broward County agrees to restore the site of the Interim Approval to a condition that complies with the provisions of the Manual "within 3 months following the issuance of a Final Rule on this traffic control device." Also, the County agrees to terminate the use of the device at any time it determines significant safety concerns are attributable to the device.

IMPLEMENTATION

Approved Green Bike Lane Applications Maintained by Broward County

The following types of green bike markings are approved for installation and will be maintained by Broward County on County jurisdictional roadways and on municipal jurisdictional roadways for which the local municipality has entered an inter-local traffic services agreement with the County:

1. Pre-formed thermoplastic bike lane markings consisting of white bike lane symbols and arrows on green background. The white and green thermoplastic colors must meet the requirements of the MUTCD. The markings shall consist of individual rectangular units that are heat-applied or epoxied to the asphalt. The preformed markings shall have a valid Florida Department of Transportation (FDOT) Approved Product List (APL) certification and must be pre-approved by the Traffic Engineering Division.

2. Pre-formed thermoplastic bike "sharrow" markings consisting of white bike lane symbols and chevrons on green background. The white and green thermoplastic colors must meet the requirements of the MUTCD. The markings shall consist of individual rectangular units that are heat-applied or epoxied to the asphalt. The preformed markings shall have a valid Florida Department of Transportation (FDOT) Approved Product List (APL) certification and must be pre-approved by the Traffic Engineering Division.

3. Pre-formed thermoplastic bike lane transition, crossover, and conflict area markings consisting of white markings on green background, or green areas supplementing other pre-existing pavement markings. The white and green thermoplastic colors must meet the requirements of the MUTCD. The markings shall consist of individual or connected polygonal units that are heat-applied or epoxied to the asphalt. The shape, pattern and dimensions are to be determined by the engineer based on actual conditions. The preformed marking material shall have a valid Florida Department of Transportation (FDOT) Approved Product List (APL) certification and must be pre-approved by the Traffic Engineering Division.
Conditionally Approved Green Bike Lane Applications that May be Maintained by Local Municipalities

In addition to the types of markings described in the previous section, the following types of green bike markings are conditionally approved for installation by local municipalities, subject to a written agreement in which the local municipality agrees to perpetually maintain the markings at its own cost. The following will not be installed and maintained by Broward County unless the local municipality enters into a maintenance and compensation agreement with the County:

1. Continuous designated green bike lanes consisting of white bike lane symbols on a continuous green painted asphalt surface. The green paint and paint color must meet the requirements of the MUTCD, and shall have an FDOT APL product approval. The paint shall include anti-skid additives, such as sharp silica or calcined bauxite, to be introduced into the paint at a mixture rate determined by the engineer and acceptable to the County. The paint may also include retroreflective additives such as glass spheres, also to be introduced into the paint at a mixture rate determined by the engineer and acceptable to the County. The white bike logos and arrows installed within the continuous green bike lane shall be retroreflective thermoplastic, including pre-formed retroreflective markings. The preformed markings shall have a valid Florida Department of Transportation (FDOT) Approved Product List (APL) certification and must be pre-approved by the Traffic Engineering Division.

2. Continuous designated green bike lanes consisting of white bike lane symbols on a continuous green bike lane surfaced with a durable liquid pavement marking (DLPM), consisting of either epoxy or Methyl Methacrylate (MMA). The green DLPM must meet the requirements of the MUTCD, and shall have an FDOT APL product approval. The DLPM mixture must be skid-resistant and can be retroreflective as determined by the engineer, and approved by the County. The white bike logos and arrows installed within the continuous green bike lane shall be retroreflective thermoplastic, including pre-formed retroreflective markings suitable for application to the DLPM. The preformed markings shall have a valid Florida Department of Transportation (FDOT) Approved Product List (APL) certification and must be pre-approved by the Traffic Engineering Division.

3. Continuous designated green bike lanes consisting of white bike lane symbols on a continuous pre-formed green thermoplastic bike lane surface. The white and green thermoplastic colors must meet the requirements of the MUTCD. The markings shall consist of assembled units that are heat-applied or epoxied to the asphalt. The preformed markings shall have a valid Florida Department of Transportation (FDOT) Approved Product List (APL) certification and must be pre-approved by the Traffic Engineering Division.

4. Continuous designated green bike lanes consisting of white bike lane symbols on a continuous green-colored ("embedded") asphalt composition. Colored asphalt is composed of the same material as standard asphalt, but has a colored pigment added. The colored asphalt may be installed as a thin layer over conventional asphalt to reduce cost. The colored asphalt pigments must comply with the MUTCD. The white bike logos and arrows installed within the continuous green bike lane shall be retroreflective thermoplastic, including pre-formed retroreflective markings. The preformed markings shall have a valid Florida Department of Transportation (FDOT) Approved Product List (APL) certification and must be pre-approved by the Traffic Engineering Division.
5. Green bike boxes and other designated bike travel areas or conflict areas. The local municipality may install and perpetually maintain green-colored bike boxes or other designated green-colored bike travel areas or conflict areas utilizing any of the above methods, subject to the design being pre-approved by the Traffic Engineering Division.

**Bike Lane Signage Maintained by Broward County**

Broward County will maintain appropriate MUTCD-compliant bike lane signage on all County jurisdictional roadways, and on municipal jurisdictional roadways for which the local municipality has entered an inter-local traffic services agreement with the County, subject to plans approval by the Traffic Engineering Division. Municipalities may install and maintain bike safety educational signs subject to plans approval by the Traffic Engineering Division and a written agreement in which the local municipality agrees to perpetually maintain the signs at its own cost.

**EFFECTIVE DATE**

This policy shall be in effect through December 31, 2017, unless superseded by an updated technical policy memorandum.

**APPROVED**

Scott Brunner, P.E.  
Division Director

Date

C. Andrew Sebo, Acting Assistant Director, Traffic Engineering Division  
Yves d'Anjou, County Signal Operations Engineer, Traffic Engineering Division  
Carmelo Caratozzolo, County Traffic Operations Engineer, Traffic Engineering Division
Scott Brunner  
Director  
Broward County Traffic Engineering  
2300 West Commercial Boulevard  
Fort Lauderdale, FL 33309

Dear Mr. Brunner:

Thank you for your letter of August 19 requesting approval to use green colored pavement on a countywide basis for marked bicycle lanes in the County of Broward. Your request was made under the provisions of Section 1A.10 in the 2009 Edition of the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) and our Interim Approval Memorandum IA-14 dated April 15, 2011.

Your request is approved. It is recommended that you provide a list of locations where the device will be used to the Florida Department of Transportation in accordance with Paragraph 20 of Section 1A.10 in the MUTCD.

For recordkeeping purposes, we have assigned your Interim Approval request the following number and title: "IA-14.46 – Green Colored Pavement for Bicycle Lanes – Broward County, FL.” Please reference this number in any future correspondence.

Thank you for your interest in improving highway safety for bicyclists. If we can be of further assistance on this matter, please contact Mr. Kevin Dunn at kevin.dunn@dot.gov.

Sincerely yours,

Mark R. Kehrli  
Director, Office of Transportation  
Operations
Subject: INFORMATION: MUTCD – Interim Approval for Optional Use of Green Colored Pavement for Bike Lanes (IA-14)

Date: APR 15 2011

From: Jeffrey A. Lindsey
Associate Administrator for Operations

In Reply Refer To: HOTO-1

To: Federal Lands Highway Division Engineers
Division Administrators

Purpose: The purpose of this memorandum is to issue an Interim Approval for the optional use of green colored pavement in marked bicycle lanes and in extensions of bicycle lanes through intersections and other traffic conflict areas. Interim Approval allows interim use, pending official rulemaking, of a new traffic control device, a revision to the application or manner of use of an existing traffic control device, or a provision not specifically described in the Manual on Uniform Traffic Control Devices (MUTCD).

Background: Chapter 3G of the 2009 MUTCD contains provisions regarding the use of colored pavements. Paragraph 1 of Section 3G.01 describes colored pavement as consisting of differently colored road paving materials, such as colored asphalt or concrete, or paint or other marking materials applied to the surface of a road or island to simulate a colored pavement.

If colored pavement is used to regulate, warn, or guide traffic, the colored pavement is considered to be a traffic control device. Paragraph 3 of Section 3G.01 limits the use of colored pavement used as a traffic control device to the colors yellow and white. Paragraph 2 of Section 3G.01 discusses the use of colored pavement as a purely aesthetic treatment that is not intended to regulate, warn, or guide traffic and is therefore not considered to be a traffic control device. Part 9, Traffic Control for Bicycle Facilities, of the 2009 MUTCD does not mention colored pavement.

A number of experiments have been conducted in the United States and in other countries around the world to determine the value of designating a particular pavement color to communicate to road users that a portion of the roadway has been set aside for exclusive or preferential use by bicyclists and to enhance the conspicuity of a bicycle lane or a bicycle lane extension. Green, blue, and red are among the colors that have been tested for this purpose. Because these colored pavements are intended to regulate, warn, or guide traffic (motorists and bicyclists) and thus are serving as more than just an aesthetic treatment, they are considered to be traffic control devices.
For the past 10 years in the United States, green has been the only color that has received official FHWA approval for colored pavement experiments on bicycle facilities. Blue colored pavement cannot be designated for exclusive or preferential use in bicycle facilities because it is already the primary color of the international symbol of accessibility parking symbol (see Figure 3B-22 of the 2009 MUTCD) and it is also used for the lines that are adjacent to parking spaces that are reserved for use only by persons with disabilities. The use of red colored pavement has not been approved for any bicycle-related experiments in the United States because it is currently being tested for a different potential use.

**Research on Green Colored Pavement for Bike Lanes:** Agencies across the United States are showing an increased interest in using colored pavement specifically for bicycle facilities, and many of them have submitted requests to the FHWA to experiment with colored pavement. During the past 10 years, the FHWA has approved experiments with green colored pavement for a variety of State and local governmental agencies, including the following: the Vermont Agency of Transportation; the City of Chicago, IL; the City of New York, NY; the City of St. Petersburg, FL; the City of San Francisco, CA; the City of Portland, OR; the City of Columbia, MO; the City of Long Beach, CA; the City of Austin, TX; the City of Nashville, TN; the City of Missoula, MT; the City of Golden, CO; the Minnesota DOT (for Minneapolis); and the Pennsylvania DOT (for Philadelphia). In these experiments, green colored pavement is being used as a traffic control device to designate locations where bicyclists are expected to operate, and areas where bicyclists and other roadway traffic might have potentially conflicting weaving or crossing movements.

**FHWA Evaluation of Results:** The Office of Transportation Operations has reviewed the available data and considers the experimental green colored pavement to be satisfactorily successful for the bicycle applications that were tested. Positive operational effects have been noted in the experiments, such as bicyclists positioning themselves more accurately as they travel across intersections and through conflict areas, and no notable negative operational effects have been observed. The research has also shown that bicyclists and motorists both have a positive impression of the effect of the green colored pavement, with bicyclists saying that they feel safer when the green colored pavement is present, and motorists saying that the green colored pavement gives them an increased awareness that bicyclists might be present and where those bicyclists are likely to be positioned within the traveled way.

The design of the experimental green colored pavement is not proprietary and can be used by any jurisdiction that requests and obtains interim approval from the FHWA to use green colored pavement. The FHWA believes that the experimental green colored pavement has a low risk of safety or operational concerns.

This Interim Approval does not create a new mandate compelling the use of green colored pavement, but will allow agencies to install green colored pavement, pending official MUTCD rulemaking, to enhance the conspicuity of a bicycle lane or a bicycle lane extension.

**Conditions of Interim Approval:** The FHWA will grant Interim Approval for the optional use of green colored pavement in marked bicycle lanes and in extensions of bicycle lanes through intersections and traffic conflict areas to any jurisdiction that submits a written request to the Office of Transportation Operations. A State may request Interim
Approval for all jurisdictions in that State. Jurisdictions using green colored pavement under this Interim Approval must agree to comply with the technical conditions detailed below, to maintain an inventory list of all locations where green colored pavement is installed, and to comply with Item D in Paragraph 18 of Section 1A.10 of the 2009 MUTCD, which requires:

"An agreement to restore the site(s) of the Interim Approval to a condition that complies with the provisions in this Manual within 3 months following the issuance of a Final Rule on this traffic control device; and terminate use of the device or application installed under the interim approval at any time that it determines significant safety concerns are directly or indirectly attributable to the device or application. The FHWA’s Office of Transportation Operations has the right to terminate the interim approval at any time if there is an indication of safety concerns."

1. General Conditions:

The use of green colored pavement is optional. However, if an agency opts to use green colored pavement under this Interim Approval, the following design and installation requirements shall apply, and shall take precedence over any conflicting provisions of the MUTCD.

2. Allowable Uses:

Green colored pavement may be used within a bicycle lane or within an extension of a bicycle lane to enhance the conspicuity of the bicycle lane or extension.

The use of green colored pavement under this Interim Approval is limited to the following applications:

a. Green colored pavement may be installed within bicycle lanes as a supplement to the other pavement markings that are required for the designation of a bicycle lane. Green colored pavement shall not be used instead of the longitudinal line required by Paragraph 2 of Section 9C.04 of the 2009 MUTCD or instead of the word, symbol, and arrow pavement markings illustrated in Figure 9C-3 of the 2009 MUTCD and required by Item C in Paragraph 6 of Section 3D.01 of the 2009 MUTCD. The green colored pavement may be installed for the entire length of the bicycle lane or for only a portion (or portions) of the bicycle lane. Green colored pavement may be installed as a rectangular background behind the word, symbol, and arrow pavement markings in a bicycle lane as a means of enhancing the conspicuity of these word, symbol, and arrow pavement markings.

b. If a pair of dotted lines is used to extend a bicycle lane across an intersection or driveway (see Section 3B.08 of the 2009 MUTCD) or a ramp, green colored pavement may be installed between these lines as a supplement to the lines. Green colored pavement shall not be used instead of these dotted lines to extend a bicycle lane across an intersection, driveway, or ramp. The green colored pavement may be installed for the entire length of the bicycle lane extension or for only a portion (or portions) of the bicycle lane extension. The pattern of the green colored pavement may be dotted in a manner that matches the pattern of the
dotted lines, thus filling in only the areas that are directly between a pair of dotted line segments that are on opposite sides of the bicycle lane extension.

c. If a pair of dotted lines is used to extend a bicycle lane across the beginning of a turn bay where drivers who desire to turn must cross the bicycle lane when moving out of the through lane in order to turn (see Figures 9C-1, 9C-4, and 9C-5 of the 2009 MUTCD), green colored pavement may be installed between these lines as a supplement to the lines. Green colored pavement shall not be used instead of these dotted lines to extend a bicycle lane across the beginning of a turn bay. The green colored pavement may be installed for the entire length of the bicycle lane extension or for only a portion (or portions) of the bicycle lane extension. The pattern of the green colored pavement may be dotted in a manner that matches the pattern of the dotted lines, thus filling in only the areas that are directly between a pair of dotted line segments that are on opposite sides of the bicycle lane extension.

3. Design of Green Colored Pavement:

a. The daytime chromaticity coordinates for the color used for green colored pavement shall be as follows:

\[
\begin{array}{cccc}
1 & 2 & 3 & 4 \\
\begin{array}{cc}
x & y \\
0.230 & 0.754 \\
0.266 & 0.500 \\
0.367 & 0.500 \\
0.444 & 0.555 \\
\end{array}
\end{array}
\]

The daytime luminance factor (Y) shall be at least 7, but no more than 35.

b. The nighttime chromaticity coordinates for the color used for green colored pavement shall be as follows:

\[
\begin{array}{cccc}
1 & 2 & 3 & 4 \\
\begin{array}{cc}
x & y \\
0.230 & 0.754 \\
0.336 & 0.540 \\
0.450 & 0.500 \\
0.479 & 0.520 \\
\end{array}
\end{array}
\]

c. Green colored pavement may be retroreflective, but there is no requirement or recommendation that it be retroreflective.

d. If green paint or other marking materials applied to the roadway surface are used to simulate a green colored pavement, consideration should be given to selecting pavement marking materials that will minimize loss of traction for bicyclists (see Paragraph 4 of Section 3A.04 of the 2009 MUTCD).

4. Other:

Except as otherwise provided above, all other provisions of the MUTCD that are applicable to colored pavements shall apply to green colored pavement.
Any questions concerning this Interim Approval should be directed to Mr. Bruce Friedman at bruce.friedman@dot.gov.

cc:
Associate Administrators
Chief Counsel
Chief Financial Officer
Directors of Field Services
Director of Technical Services