THE CITY OF
NOVATO
CALIFORNIA

REGULAR MEETING

AGENDA
BICYCLE/PEDESTRIAN ADVISORY COMMITTEE

Wednesday, March 9, 2016 - 7:00PM
922 Machin Ave
Womack Conference Room-2nd Floor

A. Call to Order

B. Approval of Final Agenda

C. Public Comment
(Anyone wishing to speak on non-agenda items will be recognized at this time. These items can legally have no action as they are not on the agenda. There is a three minute time limit).

D. Committee Organizational Items
D-1-Approval of January 13, 2016 Meeting Minutes.
D-2-Resignaton of Clayton Perry.

E. Committee Reports

F. Staff Reports
F-1- Olive Avenue Class II Bike Lanes Project, CIP No. 13-009 - Construction scheduled for Summer 2016.
F-2- Grant Avenue Bridge Rehabilitation Project, CIP No. 09-003 - Design Development.
F-3- Safe Pathways to School Project, Sidewalk closure on Arthur Street and Plum Street, CIP No. 16-010 – Construction scheduled for summer 2016.
F-4- DeLong Avenue and Ignacio Boulevard Highway Interchanges Resurfacing, CIP No. 13-003 - Construction scheduled for summer 2016. (General Business item G-4).
F-5- Vineyard Road Improvements, CIP No. 15-017 – The project is federally funded. Current design development efforts include public Right of Way verification - survey and assessment of required ADA improvements.
F-6- Safe Pathways to Schools Crosswalk Improvements - Ignacio Boulevard and South Novato Boulevard, CIP No. 16-008 – This project will install crosswalk markings and controls at two locations on Ignacio Boulevard where none exist and install enhancements at two existing crossing locations on South Novato Boulevard. The specific locations are Ignacio at Country Club Drive and at Laurelwood Drive (west) and South Novato Boulevard at Lark Court and at Yukon Way. The specific enhancements include continental style markings, rectangular rapid flashing beacons, pedestrian refuge and signage.

G. General Business
(Anyone wishing to speak on agenda items will be recognized after the Committee has concluded their initial discussions. There is a three minute time limit for public comment per item.)

Approximate Time	***Item/Attachments***	***Purpose and Actions***
20 minutes	G-1: Preliminary discussion of proposed 16/17 CIP Budget Presentation by Julian Skinner, Engineering Manager	*Committee discussion and receive recommendation. Action.*
20 minutes	G-2: Optional Use of Green Colored Pavement in Marked Bicycle Lanes and Intersections. Petr Skala – presentation Attachment G-2:	*Committee discussion and receive recommendation. Action.*
5 minutes	G-3: League of American Bicyclists Examples of BFC Applications for similar size communities (40,000 to 70,000 residents). Attachment G-3: Applications	*Committee discussion. No action.*
5 minutes	G-4: Confirm next meeting date (Wednesday May 11, 2016).	*Receive recommendation. Action.*

H. Adjournment

Attachments: G-2- Use of Colored Pavement in Marked Bicycle Lanes
G-3- Applications hard copies (pdf's were e-mailed to members on January 28, 2016)

AFFIDAVIT OF POSTING

I, Julie Eichner certify that on March 4, 2016, I caused to be posted the agenda of the Wednesday, March 9, 2016 meeting of the Bicycle/Pedestrian Advisory Committee of the City of Novato, California, on the City of Novato Community Service Boards in City Hall and the Police Department.

/Julie Eichner/
Administrative Clerk II

AMERICANS WITH DISABILITIES ACT

In compliance with the Americans with Disabilities Act, if you need assistance to participate in this meeting, please contact Julie Eichner at (415) 899-8994. Notification at least 48 hours prior to the meeting will enable the City to make reasonable accommodation to help insure accessibility to this meeting.

THE CITY OF NOVATO CALIFORNIA

MEMORANDUM

DATE: March 9, 2016

TO: City of Novato Bicycle and Pedestrian Advisory Committee (BPAC)

FROM: Petr Skala, City of Novato liaison to BPAC

SUBJECT: **USE OF GREEN COLORED PAVEMENT IN MARKED BICYCLE LANES.**

REQUEST

On February 2, 2016 the City Council requested staff research (including discussions with the BPAC) and provide information back to council concerning use of green colored pavement in marked bicycle lanes.

RECOMMENDATION

Provide recommendation to City Council regarding use and application of green colored pavement in marked bicycle lanes included with the DeLong Avenue and Ignacio Boulevard Highway Interchanges Resurfacing project.

BACKGROUND

Cities in North America have been experimenting with the application of colored pavement, primarily to highlight bicycle motor vehicle conflict areas since the mid 1990's. The application of color to an entire corridor is a more recent practice.

Such bike lanes can be found all over Europe, but are new to the United States and relatively scarce in the US. The city of Portland, Ore., claims to have been the first to install colored bike lanes in 2008.

Subsequent to Portland's blue bike lane experiment, on April 15, 2011 the U.S. Department of Transportation, Federal Highway Administration (FHWA) approved interim experiments utilizing green colored pavement.

Green was selected over blue or red because in the US blue roadway markings are reserved to designate accessibility parking while red markers are sometimes used to alert motorists of wrong way driving

Communities across the US (Chicago, IL; New York, NY; St. Petersburg, FL; San Francisco, CA; Columbia, MO; Long Beach, CA; Austin, TX; Nashville, TN; Missoula, MT; Golden, CO to name some), have introduced a proposal for a pilot project to create green-colored bicycle lanes.

Typical application examples are: Within bike lanes or cycle tracks, across turning conflict areas such as vehicle right turn lanes, across intersections, particularly through wide or complex intersections where the bicycle path may be unclear, across driveways and Stop or Yield-controlled cross-streets.

EXPERIENCE

Cities report generally positive response to colored pavement from both bicyclists and motor vehicle drivers. There is a need to further improve technical expertise for installing and maintaining colored pavement (experiences with material selection, application techniques, and the impact of climatic factors). Thermoplastic is the most commonly used material and spot applications are the most frequent type of installation.

Attachments:

1. FHWA Memorandum
2. Chapter 3G of California MUTCD 2014 Edition
3. Item D in Paragraph 18 of Section 1A.10 of California MUTCD 2014 Edition
4. National Association of City Transportation Officials (NACTO); supplemental information
5. Preliminary Project Plans for the DeLong Avenue and Ignacio Boulevard Highway Interchanges Resurfacing; CIP Project No. 13-003

U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: **INFORMATION**: MUTCD – Interim Approval for Optional Use of Green Colored Pavement for Bike Lanes (IA-14)

Date: APR 15 2011

From: Jeffrey A. Lindley
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:

1		2		3		4	
x	y	x	y	x	y	x	y
0.230	0.754	0.266	0.500	0.367	0.500	0.444	0.555

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:

1		2		3		4	
x	y	x	y	x	y	x	y
0.230	0.754	0.336	0.540	0.450	0.500	0.479	0.520

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

CHAPTER 3G. COLORED PAVEMENTS

Section 3G.01 General

Support:

01 Colored pavements consist 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.

02 If non-retroreflective colored pavement, including bricks and other types of patterned surfaces, is used as a purely aesthetic treatment and is not intended to communicate a regulatory, warning, or guidance message to road users, the colored pavement is not considered to be a traffic control device, even if it is located between the lines of a crosswalk.

Standard:

03 **If colored pavement is used within the traveled way, on flush or raised islands, or on shoulders to regulate, warn, or guide traffic or if retroreflective colored pavement is used, the colored pavement is considered to be a traffic control device and shall be limited to the following colors and applications:**

- **A. Yellow pavement color shall be used only for flush or raised median islands separating traffic flows in opposite directions or for left-hand shoulders of roadways of divided highways or one-way streets or ramps.**
- **B. White pavement color shall be used for flush or raised channelizing islands where traffic passes on both sides in the same general direction or for right-hand shoulders.**

04 **Colored pavements shall not be used as a traffic control device, unless the device is applicable at all times.**

Guidance:

05 *Colored pavements used as traffic control devices should be used only where they contrast significantly with adjoining paved areas.*

06 *Colored pavement located between crosswalk lines should not use colors or patterns that degrade the contrast of white crosswalk lines, or that might be mistaken by road users as a traffic control application.*

determines significant safety concerns are directly or indirectly attributable to the experimentation. The FHWA's Office of Transportation Operations has the right to terminate approval of the experimentation at any time if there is an indication of safety concerns. If, as a result of the experimentation, a request is made that this Manual be changed to include the device or application being experimented with, the device or application will be permitted to remain in place until an official rulemaking action has occurred.

I. An agreement to provide semi-annual progress reports for the duration of the experimentation, and an agreement to provide a copy of the final results of the experimentation to the FHWA's Office of Transportation Operations within 3 months following completion of the experimentation. The FHWA's Office of Transportation Operations has the right to terminate approval of the experimentation if reports are not provided in accordance with this schedule.

Support:

12 A change includes consideration of a new device to replace a present standard device, an additional device to be added to the list of standard devices, or a revision to a traffic control device application or placement criteria.

Guidance:

13 *Requests for a change to this Manual should contain the following information:*

A. A statement indicating what change is proposed;

B. Any illustration that would be helpful to understand the request; and

C. Any supporting research data that is pertinent to the item to be reviewed.

Support:

14 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 this Manual. The FHWA issues an Interim Approval by official memorandum signed by the Associate Administrator for Operations and posts this memorandum on the MUTCD website. The issuance by FHWA of an interim approval will typically result in the traffic control device or application being placed into the next scheduled rulemaking process for revisions to this Manual.

15 Interim approval is considered based on the results of successful experimentation, results of analytical or laboratory studies, and/or review of non-U.S. experience with a traffic control device or application. Interim approval considerations include an assessment of relative risks, benefits, costs, impacts, and other factors.

16 Interim approval allows for optional use of a traffic control device or application and does not create a new mandate or recommendation for use. Interim approval includes conditions that jurisdictions agree to comply with in order to use the traffic control device or application until an official rulemaking action has occurred.

16a Refer to Table 1A-101(CA) for the status of Interim Approvals issued by FHWA in California.

Standard:

17 **A jurisdiction, toll facility operator, or owner of a private road open to public travel** (see definition in Section 1A.13) **that desires to use a traffic control device for which FHWA has issued an interim approval shall request permission from FHWA.**

Guidance:

18 *The request for permission to place a traffic control device under an interim approval should contain the following:*

A. A description of where the device will be used, such as a list of specific locations or highway segments or types of situations, or a statement of the intent to use the device jurisdiction-wide;

B. An agreement to abide by the specific conditions for use of the device as contained in the FHWA's interim approval document;

C. An agreement to maintain and continually update a list of locations where the device has been installed; and

D. An agreement to:

1. 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

2. 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.

Option:

19 A State may submit a request for the use of a device under interim approval for all jurisdictions in that State, as long as the request contains the information listed in Paragraph 18.

Support:

19a Figure 1A-101(CA) shows the process for the use of traffic control devices in California approved as interim approval by FHWA.

Guidance:

20 *A local jurisdiction, toll facility operator, or owner of a private road open to public travel (see definition in Section 1A.13) using a traffic control device or application under an interim approval that was granted by FHWA either directly or on a statewide basis based on the State's request should inform the State of the locations of such use.*

21 *A local jurisdiction, toll facility operator, or owner of a private road open to public travel (see definition in Section 1A.13) that is requesting permission to experiment or permission to use a device or application under an interim approval should first check for any State laws and/or directives covering the application of the MUTCD provisions that might exist in their State.*

Option:

22 A device or application installed under an interim approval may remain in place, under the conditions established in the interim approval, until an official rulemaking action has occurred.

Support:

23 A diagram indicating the process for incorporating new traffic control devices into this Manual is shown in Figure 1A-2.

24 For additional information concerning interpretations, experimentation, changes, or interim approvals, visit the MUTCD website at http://mutcd.fhwa.dot.gov.

Standard:

25 **Requests shall be made to the FHWA for experimenting with any new traffic control device, its application or manner of use, or a provision not specifically described in the Manual on Uniform Traffic Control Devices.**

Support:

26 In addition to the requirements of the FHWA, experimental traffic control devices are subject to the laws, regulations and policies of the State of California.

Standard:

27 **The agency shall request and receive approval from the California Traffic Control Devices Committee and Federal Highway Administration, when needed, prior to installation of experimentation devices on public roadways in California.**

Support:

28 For information contact:

Executive Secretary,
California Traffic Control Devices Committee
(916) 654-7312.

29 The California MUTCD contains the official standards and policies of the State of California for the design, application, and placement of traffic control devices.

30 Experimentation is defined as research involving the acts of testing, evaluating, analyzing or discovering the effect of a specific device, principle, supposition, etc., usually carried out in an operational context. Experimentation could also be performed in a laboratory. The request for experimentation is a submission specifically requesting approval to use a non-standard device on public roadways for purposes of gathering verification data.

31 As used herein, the term "device" includes not only signs, signals, and markings, but also their application and manner of use.

Guidance:

32 *Requests for experimentation, interpretation, or changes relating to the California edited portion of the California MUTCD should be sent to:*

Executive Secretary,
California Traffic Control Devices Committee – MS36
P.O. Box 942874, Sacramento, CA-94274-0001

National Association of City Transportation Officials (NACTO)

Colored Bike Facilities

Description

Colored pavement within a bicycle lane increases the visibility of the facility, identifies potential areas of conflict, and reinforces priority to bicyclists in conflict areas and in areas with pressure for illegal parking. Colored pavement can be utilized either as a corridor treatment along the length of a bike lane or cycle track, or as a spot treatment, such as a bike box, conflict area, or intersection crossing marking. Color can be applied along the entire length of bike lane or cycle track to increase the overall visibility of the facility. Consistent application of color across a bikeway corridor is important to promote clear understanding for all users

Typical Applications

- Within bike lanes or cycle tracks.
- Across turning conflict areas such as vehicle right turn lanes.
- Across intersections, particularly through wide or complex intersections where the bicycle path may be unclear.
- Where typical vehicle movements frequently encroach into bicycle space, such as across ramp-style exits and entries where the prevailing speed of turning traffic at the conflict point is low enough that motorist yielding behavior can be expected.
- Color may be applied along an entire corridor, with gaps in coloring to denote crossing areas.
- May not be applicable for crossings in which bicycles are expected to yield right of way, such as when the street with the bicycle route has Stop or Yield control at an intersection.

Maintenance

- Colored pavement requires varying levels of maintenance depending on materials.
- Because the effectiveness of makings depends entirely on their visibility, maintaining markings should be a high priority.
- Colored facilities should be maintained to be free of potholes, broken glass, and other debris.

For complete information visit:
http://nacto.org/publication/urban-bikeway-design-guide/bikeway-signing-marking/colored-bike-facilities/

Colored Pavement Material Guidance

Description
Colored pavement can be utilized either as a corridor treatment along the length of a bike lane or cycle track, or in limited locations as a spot treatment, such as a bike box, conflict area, or intersection crossing marking. Colored pavement for use within bikeways treatments may take the form of an overlay, when the colored material is placed on top of the pavement or embedded, when the colored material is mixed into the pavement.

Overlay:
Paint, sometimes with additives such as reflective glass beads for retro reflectivity and sand for skid resistance, is the most widely used method to mark road surfaces. Paint is considered a non-durable pavement marking, is easily worn by vehicle tires and the elements in snowy winter climates, and often requires annual reapplication. Paint is the least expensive of the overlay materials.

Durable Liquid Pavement Markings (DLPM) include **epox**y and **Methyl Methacrylate (MMA)**. Epoxies are adhesive, waterborne acrylics that are typically applied as a paint or spray. MMA are 2-part liquids comprised of a resin and activator. While both coatings can be skid resistant, retro reflective and can adhere to concrete or asphalt surfaces, epoxies are sensitive to moisture and temperature and may require long dry times. MMA may be installed at any temperature, is durable and dries quickly, but is more expensive than epoxy.

Thermoplastic, another type of durable pavement marking, is a type of plastic made from polymer resins that becomes a homogenized liquid when heated and hard when cooled. Thermoplastic can be pre-formed in specific shapes, such as tiles that can be assembled like a puzzle to color bicycle facilities. Thermoplastic can also be used for bicycle lane symbols, arrows, pavement legends and shared lane markings.

Thermoplastic tends to last longer than epoxy and is easier to apply then MMA. Retro reflective and anti-skid materials can be applied or mixed throughout the plastic.

Embedded:
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. One well-known use of colored asphalt is Bend, Oregon's red bike lanes, which utilize a localized red pigment in the colored asphalt. The tinted asphalt was applied over fresh black asphalt before the year 2000 and has worn well with regular street sweeping and maintenance, but has faded over time. Green pigment options are available.

Previous Experimentation and the History of Color Application in North America
Cities in North America have been experimenting with the application of colored pavement, primarily to highlight bicycle motor vehicle conflict areas since the mid 1990's, the application of color to an entire corridor is a more recent practice. Between 1997 and 1999, the City of Portland, with support from the Federal Highway Administration (FHWA), conducted an experiment in which 10 conflict areas were marked with blue paint or thermoplastic and accompanying signing. *(City of Portland Office of Transportation. (1999). Portland's Blue Bike Lanes., US Department of Transportation. (2000). Evaluation of Blue Bike Lane Treatment used in Bicycle-Motor Vehicle Conflict Areas in Portland, Oregon.)*

The study results demonstrated that thermoplastic was more durable than paint, which disappeared after the first winter season. The experiment reported positive results for decreased cyclist and motor vehicle driver conflicts at the ten study sites, but the treatments applied were less visible than desired in low light conditions.
Subsequent to Portland's blue bike lane experiment, the FHWA approved interim experiments utilizing green colored pavement in communities across the US including Chicago (IL), New York (NY), St. Petersburg (FL), San Francisco (CA), Columbia (MO), Long Beach (CA), Austin (TX), Nashville (TN), Missoula (MT), Golden (CO), the Minnesota Department of Transportation (for Minneapolis), and the Pennsylvania Department of Transportation.

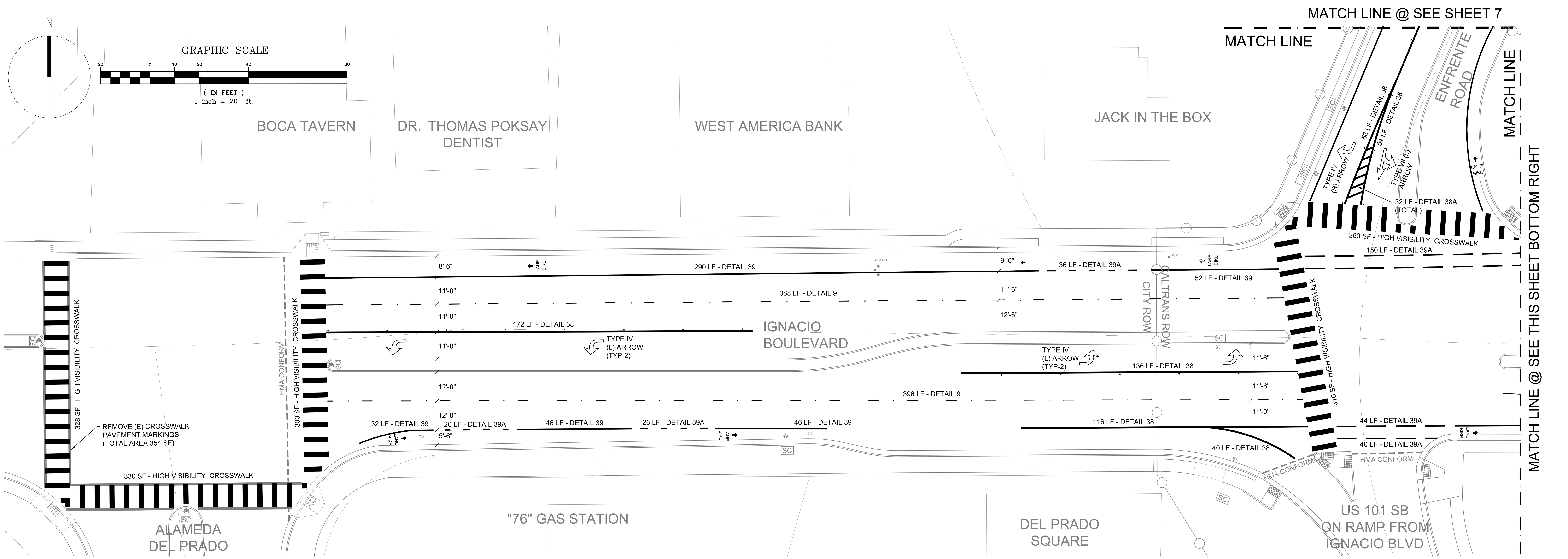
Treatment Application Summary - <u>Spot Treatments</u>

Material Type	Pros	Cons
Paint Recommended for temporary, pilot, or experimental spot treatments.	Easy application and moderate dry time.	Proven to wear quickly in areas with moderate to heavy motor vehicle traffic.
DLPM MMA is more appropriate for spot treatments than epoxy.	Material is durable if installed according to manufacturer specifications. MMA has quick dry times and good durability.	Epoxy can have long dry times, causing increased disruption to roadway traffic. Requires special installation equipment.
Thermoplastic Recommended for spot treatments. Ideal for intersection treatments and other high-traffic conflict areas.	Quick cure time minimizes traffic impact. Relatively low-cost equipment investment. Easy spot maintenance. Shown to wear well in conflict areas.	May be cost-prohibitive for large scale applications.
Colored Asphalt Recommended for Corridor treatments.	Not recommended due to complexity of paving operations.	Spot maintenance is difficult and may result of color loss when trenching occurs. Requires equipment and expertise to install.

Treatment Application Summary – <u>Corridor Treatments</u>

Material Type	Pros	Cons
Paint Recommended for corridor treatments. Ideal for protected bicycle facilities like cycle tracks.	Cost-effective along corridors with low or no motor vehicle traffic impacts.	Can be slick when wet. Not durable in high wear locations.
DLPM Recommended for corridor treatment.	Materials are long-lasting and can be cheaper than thermoplastic.	Requires special installation equipment
Thermoplastic Not recommended for long corridors due to cost.	Material is known to have long life and good performance qualities in the US and Europe.	Cost-prohibitive in corridor applications.
Colored Asphalt Recommended for corridor treatments.	Long lasting treatment. Should be coupled with initial construction or repaving for cost savings. Has same lifespan of standard asphalt. Proven long-term use as an effective treatment in Europe. Requires little maintenance.	Requires cleaning of machinery or maintenance of special machinery for colored applications. Colored asphalt is not retroreflective by itself; in the Netherlands a white thermoplastic stripe is used for visibility. Can require special attention at joints between colored and standard asphalt.

For complete information visit:
http://nacto.org/publication/urban-bikeway-design-guide/bikeway-signing-marking/colored-pavement-material-guidance/



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PAVEMENT DELINEATION and MARKINGS
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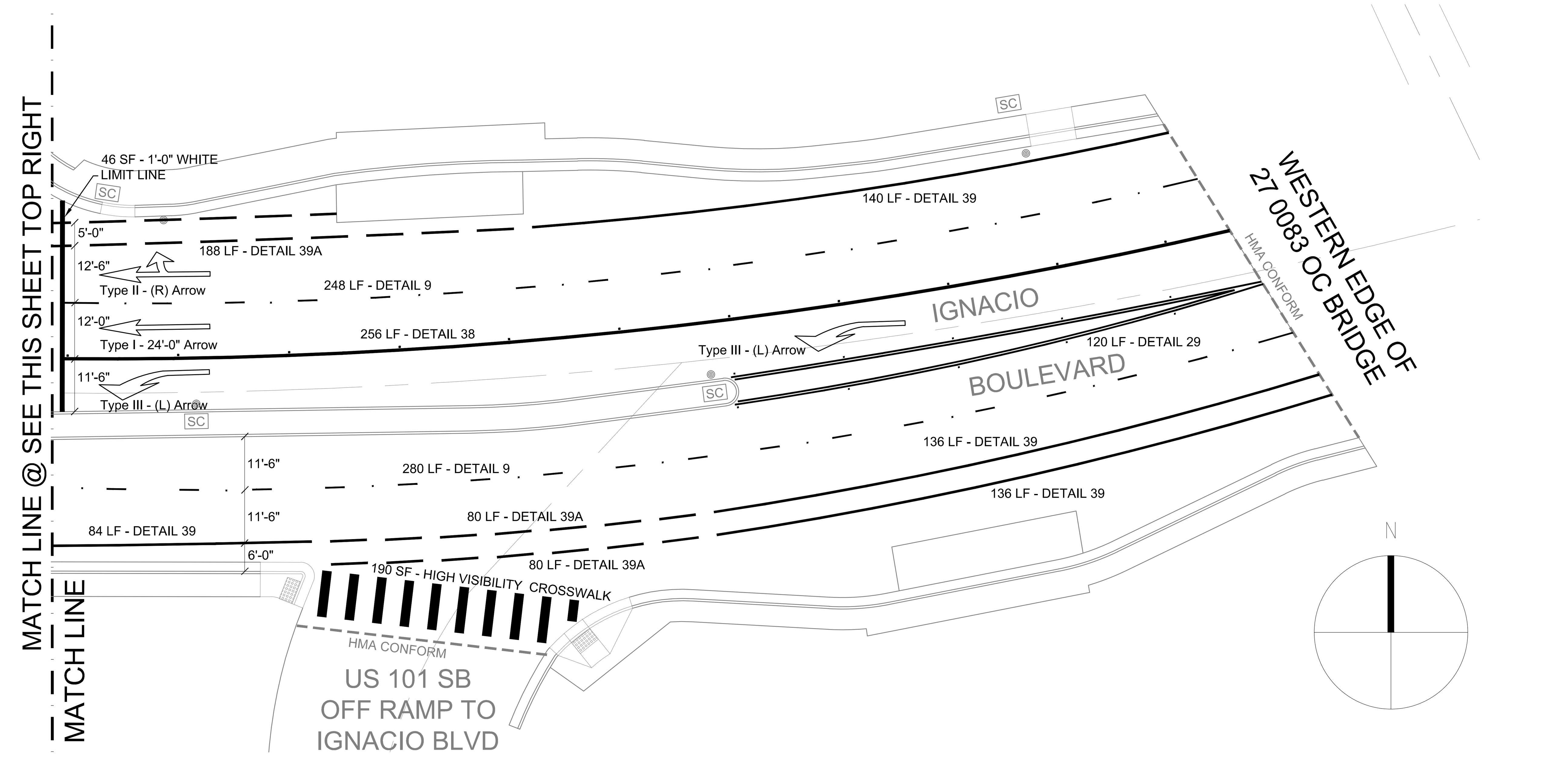

Number	Date	Description	By
8			
7			
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1	2/23/2016	CALTRANS ENCROACHMENT PERMIT	PS

Revision Block

Drawn By: P.S.
Designed By: P.S.
Checked By: J.S.
Scale: 1"=20'

CITY OF NOVATO CALIFORNIA

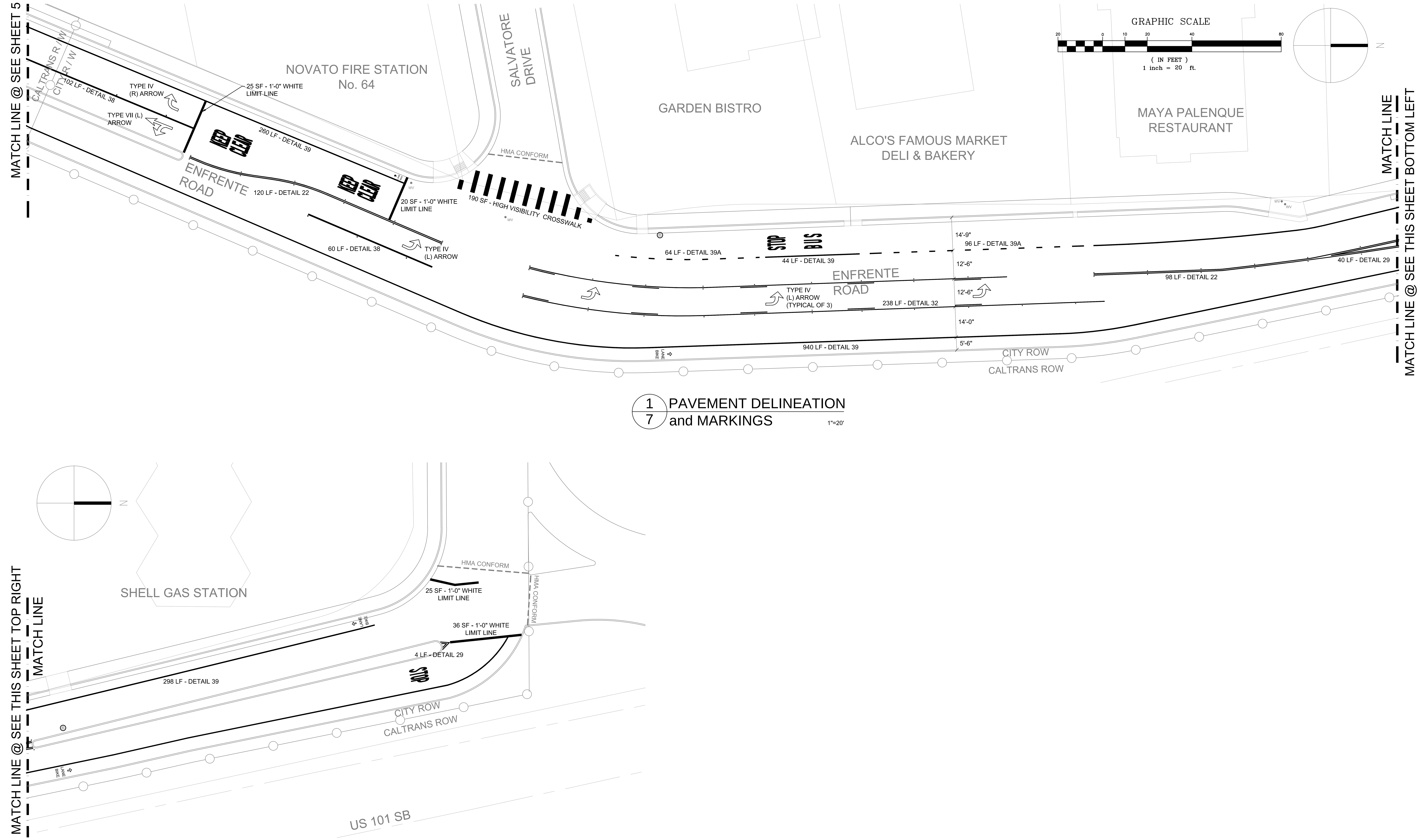
City of Novato
Department of Public Works
Engineering Division

Submitted: ______ , 20
Engineering Manager
Approved By:
City Engineer Date

REGISTERED PROFESSIONAL ENGINEER
JULIAN SKINNER
No. 69802
Exp.
CIVIL
STATE OF CALIFORNIA

DeLong Ave and Ignacio Blvd Highway Interchange Resurfacing
Bridge: 27 0083 OC Ignacio Buolevard; Rte: 101
PAVEMENT DELINEATION - IGNACIO BOULEVARD

Date: April, 2016
Sheet 5 of 7
Project No. 13-003



Number	Date	Description	By
8			
7			
6			
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4			
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2			
1	2/23/2016	CALTRANS ENCROACHMENT PERMIT	PS

Revision Block

Drawn By: P.S.
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CITY OF NOVATO CALIFORNIA

City of Novato

Department of Public Works
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REGISTERED PROFESSIONAL ENGINEER JULIAN SKINNER No. 69802 Exp. ____ CIVIL STATE OF CALIFORNIA

DeLong Ave and Ignacio Blvd Highway Interchange Resurfacing

Enfrente Road

PAVEMENT DELINEATION - ENFRENTE ROAD

Date: April, 2016
Sheet 7 of 7
Project No. 13-003