April 28, 2021

To: Stephanie Pollack, Acting Administrator
Federal Highway Administration
US Department of Transportation
1200 New Jersey Ave. SE
Washington, DC 20590

From: John H. McDonald

RE: Comments on proposed MUTCD section 9E.14, "Bicycle Route Pavement Markings"

I welcome the addition of section 9E.14, "Bicycle Route Pavement Markings," to the proposed 11th edition of the Manual on Uniform Traffic Control Devices. In 2012, I began a volunteer program to paint bicycle route pavement markings (which we call "bike blazes") on three bicycle routes in Baltimore, Maryland (the Gwynns Falls Trail, the Jones Falls Trail, and Middle Branch Trail). Since that time, many users have reported that the pavement markings have made these routes much easier to navigate. I have bicycled on bike routes in Seattle, Portland, Buffalo, Pittsburgh, Washington DC, and many smaller cities, and most of the routes I've ridden on had confusing or poorly signed sections that would be greatly improved with pavement markings. Even when post-mounted guide signs are adequate, I feel that pavement markings are a valuable supplement, for the following reasons:

Figure 1: Pavement marking on Jones Falls Trail, Baltimore.

---Bicycle users need to be wary of potholes, cracks, debris, and other hazards, so they focus much of their attention on the pavement. They will therefore see a pavement marking where they might overlook a post-mounted guide sign. **With pavement markings supplementing guide signs, bicycle users are less likely to get lost.**

---Many bicycle users have, at some point, had the frustrating experience of getting lost while trying to follow a signed bicycle route, due to missing or overlooked post-mounted guide signs. This means that following an unfamiliar bicycle route using guide signs is anxiety-inducing, as the user may not be confident they are still on the route whenever they cannot see a sign. On the Baltimore trails, we use a pavement marking before and after every intersection (including at every cross street, even where the route goes straight). This provides repeated reinforcement that the user is on the desired route, a density of reassurance that, if implemented using guide

signs, would be expensive and would contribute to the visual clutter of the urban environment. **Bicycle users following a dense set of pavement markings are more relaxed and confident.**

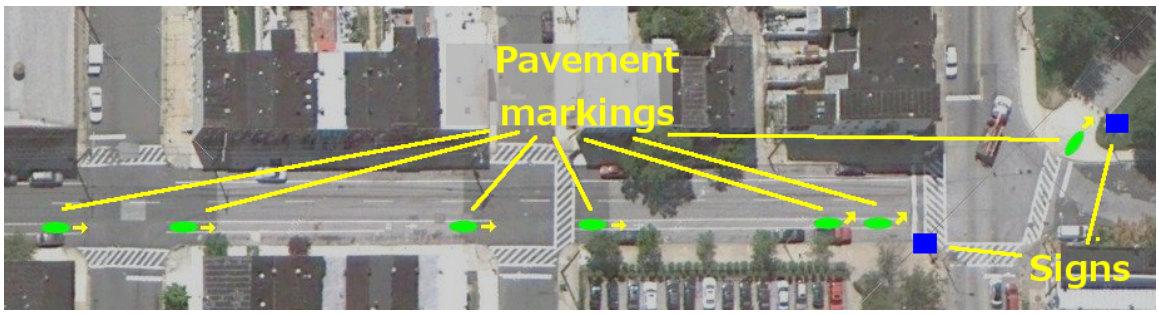

Figure 2. Positions of pavement markings and signs on street with standard bicycle lane (Jones Falls Trail on Bayard Street, Baltimore).

---Where there is a pavement marking before and after every intersection, near the corners, bicycle users on cross streets are made aware of the bicycle route when they cross it. This is useful for users of the bike route who leave it and want to return to it. It also helps advertise the bike route to people who may be unaware of it. In an urban area with a high density of streets, using post-mounted guide signs facing each cross street would be an expensive and visually cluttered means of achieving the same ends. **Bike routes with frequent pavement markings are visible to everyone who crosses them.**

---Where there is a pavement marking before and after every intersection, bicycle users following a route who come to an intersection without pavement markings immediately know that they are no longer on the route, and they need only go back to the previous intersection to see where they went wrong. Post-mounted reassurance guide signs are generally placed every few blocks on straight sections of bicycle routes, so a route user who gets off-route can go a long distance before they realize that the absence of signs means they are lost. **Bicycle users are more likely to get back on route after a missed turn when there are frequent pavement markings.**

While I am therefore glad to see the recognition of bicycle route pavement markers in the proposed MUTCD, I have some suggestions for improvements:

1) The proposed Standard in section 9E.14 says

> "Pavement marking route markers shall be limited to shared-use paths or separated bicycle lanes. Pavement marking route markers shall not be used in standard bicycle lanes, buffer-separated bicycle lanes, or in shared lanes."

I recommend this be changed to an Option:

> "Pavement marking route markers may be used on shared-use paths, separated bicycle lanes, standard bicycle lanes, buffer-separated bicycle lanes, or in shared lanes."

Bicycle route pavement markers are *especially* valuable where a bicycle route uses standard bicycle lanes, buffer-separated bicycle lanes, or shared lanes. This is because wayfinding on a shared-use path or separated bicycle lane is usually fairly easy; intersections with other shared-use paths or separated bicycle lanes are rare, so the user can confidently follow the path or lane they are on. Intersecting standard bicycle lanes are common in many cities, and shared lanes look just like regular streets, so the user on a standard bicycle lane or shared lane can easily get confused at many intersections without the guidance provided by pavement markings.

Many bicycle routes contain a mix of shared-use paths, standard bicycle lanes and shared lanes. For example, the 11.2-mile Gwynns Falls Trail in Baltimore includes 9.1 miles of shared-use path and four sections of standard bicycle lanes and shared lanes, totalling 2.1 miles, while the 10.7-mile Jones Falls Trail includes one 0.6-mile section of shared lanes. Pavement markers on a shared-use path that disappear when a bicycle route switches to a bicycle lane or shared lane, as required by the draft Standard in section 9E.14, could be confusing, especially for the inexperienced bicycle users who seek out shared-use paths. If they were following pavement markers and the markers ended, they could conclude either that the route ended unexpectedly, or they were lost. **Pavement markers that continue through the non-path sections of a bike route are much more reassuring than markers that come and go.**

The proposed section 9E.14 does not give a reason for banning pavement markings in standard bicycle lanes and shared lanes. The only concern I can think of is that bicycle pavement markings could be confusing for car users; they might follow an arrow into a mixed-use path or contraflow lane, for example. This concern could be allayed by making the bicycle pavement markings small enough that they will be inconspicuous to car drivers (but still large enough that bicycle users can see them from across an intersection). The pavement markings we use in Baltimore are a 4-inch-wide by 13-inch tall green oval with white border and background (similar to M1-8), which is inconspicuous and illegible to a car driver while being easily visible to a bicyclist. I therefore recommend the addition of the following Guidance:

> "To reduce confusion or distraction to car users, any bicycle route pavement marking used on standard bicycle lanes, buffer-separated bicycle lanes, or in shared lanes should be much smaller than pavement markings directed to car drivers, while still being conspicuous to bicycle users."

I personally think the 4-inch-wide markers we've used in Baltimore, while decently visible, would be even better if they were a little bigger. If you want to require a specific maximum size, I would suggest a maximum width of somewhere around 8 inches, but this is not based on any field trials, just my personal impression.

2) The proposed Standard in section 9E.14 says

> "Except as provided in Paragraph 4, pavement markings simulating official guide signs for bicycle routes shall be supplemental to the sign(s) and shall not be a substitute for the sign(s)."

This sentence is unclear to me. I *think* it may mean that "Bicycle routes should have signs at every turn, with pavement markings only used to make wayfinding easier." If that is the intent, I think this sentence should be **deleted**. On a relatively short bicycle route in an urban or suburban area, I would agree that most users would expect to see a sign at every turn, so they should be able to follow the route using signs alone. However, on a long-distance bicycle route, such as the U.S. Bicycle Route System or the statewide bicycle routes in some states, the primary users are touring bicyclists, and their primary means of wayfinding are printed or electronic maps and cuesheets. These long-distance bicycle routes are valuable to their intended users even if there are no wayfinding signs (consider the thousands of touring bicyclists who use the Adventure Cycling Association's mapped routes, which are largely unsigned). I can easily imagine a state highway department deciding to mark a long-distance bicycle route using only pavement markings, because they are much less expensive and labor-intensive than signs. While, in an ideal world, every bicycle route would be marked with a copious number of signs, a long-distance bicycle route marked only with pavement markings and no signs would be much better than one with no signs and no pavement markings. **I do not think the MUTCD should have a Standard that prohibits a bicycle route that uses only pavement markings for wayfinding.**

3) The proposed Guidance in section 9E.14 includes the sentence:

> "A systematic methodology of locating the sign adjacent to the bicycle route pavement marking should be used that includes locations where either the sign or the pavement marking can exist alone to avoid overuse of the guide sign or the pavement marking."

This sentence is unclear to me. I think it may be trying to say "It is not necessary to have a guide sign adjacent to each pavement marking; nor is it necessary to have a pavement marking adjacent to each guide sign"; if so, it should be rewritten to say that more clearly.

4) The proposed Guidance in section 9E.14 includes the sentence:

> "The route marker pavement marking should not be elongated."

I assume this is a typo and should read "should be elongated," because the bicycle route pavement markings shown in Fig. 9E-15 are elongated; all the other pavement markings (lane markings, arrows, bicycle detector marking) shown in Figs. 9E-1 to 9E-16 are elongated; and it makes sense to elongate bicycle pavement markings for the same reason that car-directed pavement markings are elongated, to counteract the foreshortening caused by viewing at a low angle.

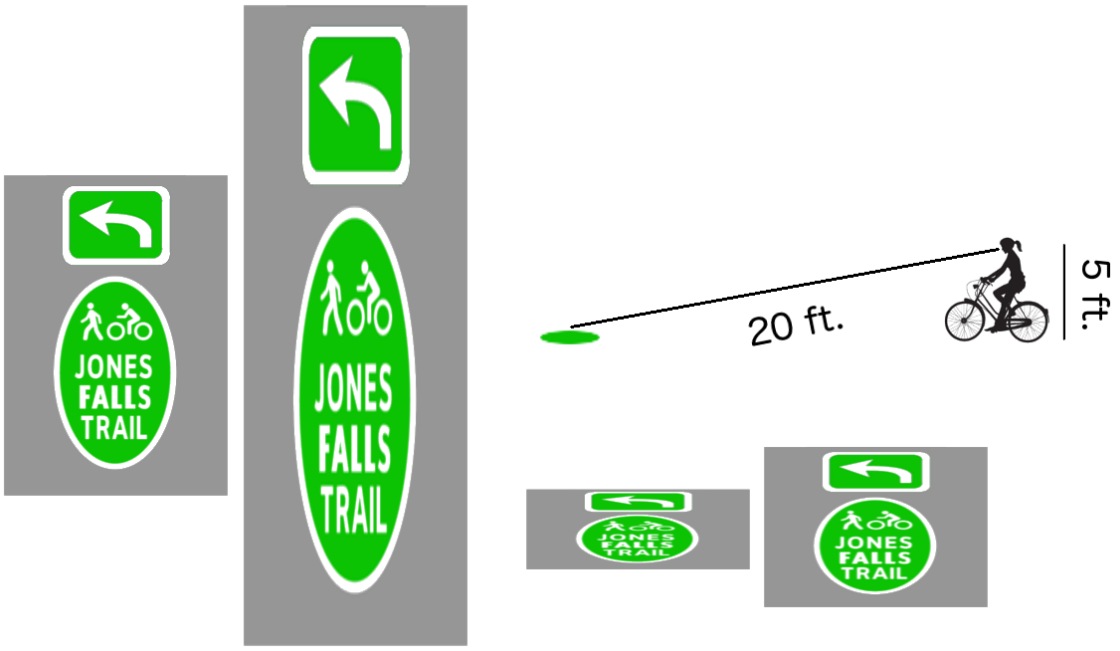

Figure 3. Left: Unstretched pavement marking and marking with 2:1 stretch. Right: Same markings as viewed from 20 feet away and 5 feet off the ground.

5) Because bicycle route pavement markings usually accompany post-mounted guide signs and plaques, I feel it is helpful when they look similar; otherwise, users may conclude that they mark different routes or convey different kinds of information. I therefore recommend adding the following Guidance to section 9E.14 (the first sentence is modeled on section 3A.03, which refers to car-directed markings):

> "When pavement markings that simulate official bicycle route signs are used, the colors should be the same as those that are used for the official route signs. However, if the background color of a guide sign matches a colored pavement (a green sign and green-painted pavement, for example), a contrasting background color (such as black or brown) should be used for the pavement marking on the colored pavement."

6) The proposed Guidance in section 9E.14 says:

> "The location, size, and materials of the route marker pavement marking should be considered that will minimize loss of traction for bicycles under wet conditions."

Many bicyclists have had bad experiences with worn thermoplastic pavement markings that are slippery when wet, and they may want to avoid riding over bike route pavement markings even if they are made with a non-slippery material (since they may not be able to tell by looking whether they are slippery or not). Figure 9E-15 shows pavement markings that fill the width of the lane of a shared-use path. This size could be perceived to be a slipping hazard when wet. It would also be expensive compared to a smaller marker, and much larger than is necessary for visibility to bicyclists (compare to a pole-mounted guide sign such as MI-8, which has a minimum width of 12 inches). I therefore recommend adding a sentence to this Guidance:

> "The location, size, and materials of the route marker pavement marking should be considered that will minimize loss of traction for bicycles under wet conditions. To allow bicyclists to avoid riding over pavement markings that may appear slippery when wet, pavement markings in a one-way path or bicycle lane should be less than one-fourth the width of the path or lane, and pavement markings in a two-way path or bicycle lane should be less than one-eighth the width of the path or lane