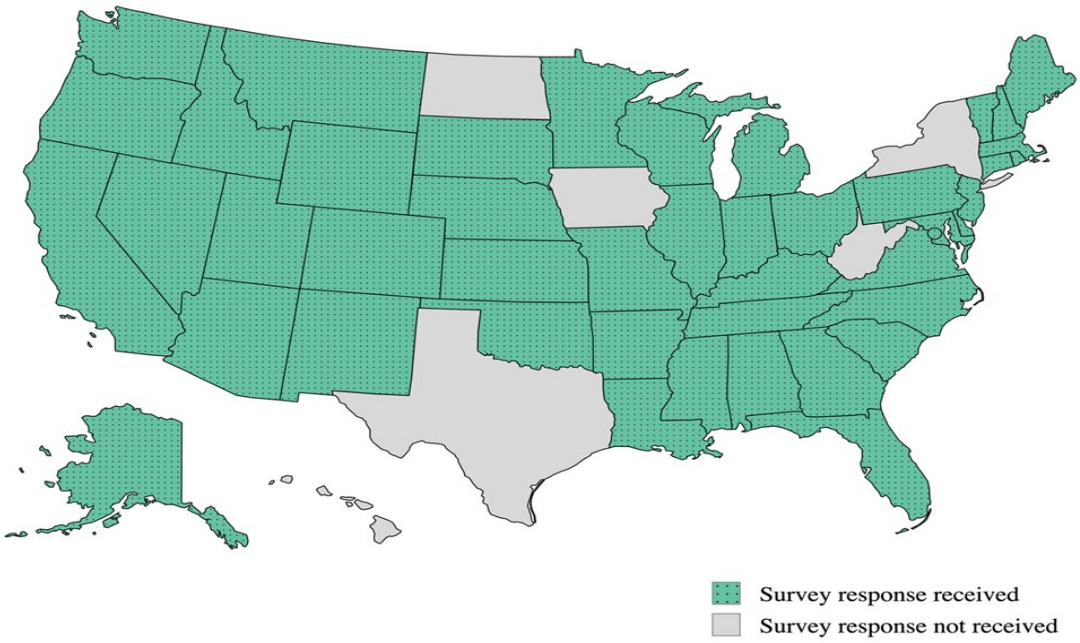
Safety Impacts of Fluorescent Yellow-Green Signs on Pedestrians



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PREPARED BY:

Henry Brown, Praveen Edara, Carlos Sun, Daeyeol Chang,

Zhu Qing, Priscilla Tobias, Jerrid Dinnen, and Melissa Jiang

Missouri Center for Transportation Innovation

PREPARED FOR:

Missouri Department of Transportation

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Henry Brown, https://orcid.org/0000-0003-1473-901X Praveen Edara, https://orcid.org/0000-0003-2707-642X Carlos Sun, https://orcid.org/0000-0002-8857-9648 Daeyeol Chang, https://orcid.org/0000-0001-8387-6291 Zhu Qing, https://orcid.org/0000-0002-3219-6971 Priscilla Tobias Jerrid Dinnen Melissa Jiang	

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16. Abstract

The Manual on Uniform Traffic Control Devices (MUTCD) specifies the use of yellow sheeting for pedestrian or bicycle signs and fluorescent yellow-green (FYG) for school signs, with an option for the use of FYG sheeting for pedestrian or bicycle warning signs. However, switching from yellow or fluorescent yellow (FY) to FYG for pedestrian and bicyclist signage could involve significant cost and effort for government agencies. The objective of this research study is to synthesize existing research and review the state of the practice regarding the use of FYG for pedestrian and bicyclist signs. The research methodology to meet these objectives includes a literature review, survey of departments of transportation (DOTs) and metropolitan planning organizations (MPOs), and follow up interviews with a subset of DOTs and MPOs. Findings from the literature review indicate that the results from previous research studies are inconclusive regarding the safety benefits of FYG (compared to yellow or FY) for pedestrian and bicyclist signs, and the research may be outdated. There is a wide range of agency practices for FYG signs for pedestrians and bicyclists among responding DOTs and MPOs, but many agencies allow FYG for pedestrians and bicyclists to some extent. Responding agencies have primarily switched to FYG for pedestrian and bicyclist signs based on a belief that the color stands out better and as part of other safety initiatives. None of the agencies that responded to the surveys indicated that they have performed any research studies to evaluate the safety performance of FYG signs for pedestrians and bicyclists. While a limited number of responding have seen improved safety performance with the use of FYG, the research did not identify significant and conclusive evidence regarding potential safety benefits associated with the use of FYG for pedestrian and bicyclist signs.

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By
Henry Brown, P.E.
Praveen Edara, Ph.D., P.E., P.T.O.E.
Carlos Sun, Ph.D., P.E., J.D.
Zhu Qing, Ph.D., P.E.
Daeyeol Chang, Ph.D.
University of Missouri

Priscilla Tobias, P.E., RSP2IB
Jerrid Dinnen, P.E., P.T.O.E.
Melissa Jiang, P.E.
Arora and Associates, P.C.

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Missouri Department of Transportation

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List of Abbreviations and Acronyms

AADT	annual average daily traffic
DOT	Department of Transportation
FHWA	Federal Highway Administration
FY	fluorescent yellow
FYG	fluorescent yellow-green
HAWK	high-intensity activated crosswalk
LPI	leading pedestrian interval
LRSP	local road safety plan
MassDOT	Massachusetts Department of Transportation
MnDOT	Minnesota Department of Transportation
MoDOT	Missouri Department of Transportation
MPO	metropolitan planning organization
MUTCD	Manual on Uniform Traffic Control Devices
NCDOT	North Carolina Department of Transportation
ODOT	Ohio Department of Transportation
OTO	Ozarks Transportation Organization
PHB	pedestrian hybrid beacon
RRFB	rectangular rapid flashing beacon
UDOT	Utah Department of Transportation
VRU	vulnerable road user

Abstract

The Manual on Uniform Traffic Control Devices (MUTCD) specifies the use of yellow sheeting for pedestrian or bicycle signs and fluorescent yellow-green (FYG) for school signs, with an option for the use of FYG sheeting for pedestrian or bicycle warning signs. However, switching from yellow or fluorescent yellow (FY) to FYG for pedestrian and bicyclist signage could involve significant cost and effort for government agencies. The objective of this research study is to synthesize existing research and review the state of the practice regarding the use of FYG for pedestrian and bicyclist signs. The research methodology to meet these objectives includes a literature review, survey of departments of transportation (DOTs) and metropolitan planning organizations (MPOs), and follow up interviews with a subset of DOTs and MPOs. Findings from the literature review indicate that the results from previous research studies are inconclusive regarding the safety benefits of FYG (compared to yellow or FY) for pedestrian and bicyclist signs, and the research may be outdated. There is a wide range of agency practices for FYG signs for pedestrians and bicyclists among responding DOTs and MPOs, but many agencies allow FYG for pedestrians and bicyclists to some extent. Responding agencies have primarily switched to FYG for pedestrian and bicyclist signs based on a belief that the color stands out better and as part of other safety initiatives. None of the agencies that responded to the surveys indicated that they have performed any research studies to evaluate the safety performance of FYG signs for pedestrians and bicyclists. While a limited number of responding have seen improved safety performance (e.g., increased yielding compliance) with the use of FYG, the research did not identify significant and conclusive evidence regarding potential safety benefits associated with the use of FYG for pedestrian and bicyclist signs. Overall, the research findings suggest a need for additional research into the potential safety benefits of FYG signs for bicyclists and pedestrians.

Executive Summary

Various safety countermeasures, including signage, can be used to improve safety for vulnerable road users (VRUs) such as pedestrians and bicyclists. Effective signage for pedestrians, such as pedestrian crosswalk signs, can help to improve pedestrian safety by increasing driver awareness of the presence of pedestrians. The Manual on Uniform Traffic Control Devices (MUTCD), which provides guidance for pedestrian signage, specifies the use of yellow sheeting for pedestrian or bicycle signs and fluorescent yellow-green (FYG) for school signs, with an option for the use of FYG sheeting for pedestrian or bicycle warning signs (FHWA 2023).

Several local agencies in Missouri have implemented the practice of using FYG for pedestrian warning signs. The current practice of the Missouri Department of Transportation (MoDOT) is to primarily use FYG only for school signs and to use fluorescent yellow (FY) for pedestrian and bicyclist signs. MoDOTs' use of FY exceeds the MUTCD standard for yellow warning signs, basing the transition on research and observations that the fluorescent color has superior visibility in day, night, and inclement weather. One exception involves cases where a state route and city route intersect, and the city uses FYG for other VRU applications such as pedestrian or bicycle warning signs. Because such instances are rare, MoDOT does not use FYG for bicycle or pedestrian warning signs on its roadways. However, MoDOT is considering changing its current pedestrian and bicyclist signs from FY to FYG if there is a documented safety benefit. Such a change would involve considerable cost and effort for MoDOT due to the large number of FY pedestrian and bicyclist signs on the state system. Through this project, MoDOT would like to know if there is fact-based evidence regarding safety benefits associated with the use of FYG for pedestrian and bicyclist signs to support consideration of a switch to FYG.

The objective of this research study is to synthesize existing research and review the state of the practice regarding the use of FYG for pedestrian and bicyclist signs. Attainment of the project objectives will help MoDOT to make data-driven decisions regarding the color of signs for pedestrians and bicyclists.

The research methodology to meet these objectives includes a literature review, survey of departments of transportation (DOTs) and metropolitan planning organizations (MPOs), and follow up interviews with a subset of DOTs and MPOs. The review of existing literature encompassed research studies and DOT guidance, policies, and standards (e.g., state MUTCDs or MUTCD supplements, traffic manuals, and design manuals). Separate surveys were developed for state DOTs and MPOs. Responses were received from 45 DOTs and 14 MPOs. Interviews were conducted with five DOTs and three MPOs regarding their practices for the use of FYG for pedestrian and bicyclist signage.

Overall, the results from previous research studies are inconclusive regarding the use of FYG for additional VRU applications such as pedestrian and bicyclist signs, and the research may be outdated. While some studies have shown increased stopping, slowing, and legibility distance

with the use of FYG compared to standard yellow, other studies have not found any changes in speeds or driving behavior associated with the use of FYG for pedestrian and bicyclist signs. Surveys in prior research studies have shown some user preference for FYG. While previous research suggests benefits to using fluorescent colors, the prior research has not shown that one fluorescent color provides superior safety benefits to other fluorescent colors. The literature search did not identify any research studies on FYG signs completed within the past ten years or any studies comparing FYG with FY for pedestrian and bicyclist signs.

There is a wide range of agency practices for FYG signs for pedestrians and bicyclists among responding DOTs and MPOs. Thirty-one DOTs that responded to the DOT survey use FYG for pedestrian signs to some extent, but only nine responding DOTs require FYG for pedestrian signs. Twenty-six responding DOTs use FYG for bicyclist signs to some extent, but only eight responding DOTs require FYG for bicyclist signs. Some DOTs have expanded use of FYG to include signs such as pedestrian, bicyclist, park zones, trail, playground, deaf child, and handicapped. Twenty-eight DOTs that responded to the survey indicated that they have developed policies, guidance, and/or standards for pedestrian and bicyclist signage. Seven responding MPOs use FYG to some extent for pedestrian signs, while four responding MPOs use FYG for bicyclist signs. Local agencies often follow state guidance regarding sign color. Other safety countermeasures for pedestrians and bicyclists implemented by responding agencies include high visibility crosswalks, rectangular rapid flashing beacons (RRFBs), pedestrian countdown timers, bicycle lanes/paths, pavement markings improvements, and pedestrian hybrid beacons (PHBs)/ high-intensity activated crosswalks (HAWK).

Responding agencies have primarily switched to FYG for pedestrian and bicyclist signs based on a belief that the FYG color stands out better and helps to improve driver awareness of VRUs (especially in urban areas) and as part of a pedestrian or bicyclist safety initiative. None of the responding agencies indicated that they switched to FYG based on an internal or external research study. Agencies have most often switched from yellow to FYG for pedestrian and bicyclist signs, although a few agencies have switched from FY to FYG. The switch to FYG is often implemented using a phased approach as part of routine maintenance activities.

Regarding agency perceptions of the safety performance of FYG signs for pedestrians and bicyclists, agencies responding to the surveys are generally unsure of the safety performance of FYG versus yellow or FY for pedestrian and bicyclist signs, although a limited number of DOTs and MPOs noted better safety performance with FYG based on performance measures. None of the responding agencies indicated that they have performed any research studies to evaluate the safety performance of FYG signs for pedestrians and bicyclists. Agency experiences regarding durability of FYG signs compared to other colors vary.

The research study also identified challenges to the use of FYG for pedestrian and bicyclist signs. Among the responding agencies that use FYG for pedestrians and bicyclists, the most cited challenges include the need for standards or policies for use, the need for performance data, cost, maintenance considerations, stakeholder coordination, the time and effort required to replace the signs, and the need to prioritize other pedestrian and bicyclist safety

countermeasures. Among the responding agencies that do not utilize FYG for pedestrian and bicyclist signs, the most cited reasons for not using FYG are lack of information on benefits, the time and effort to replace signs, the need for standards or policies for use, and a preference to keep FYG reserved for school signs.

Overall, the results of this study regarding the potential safety benefits of FYG for pedestrian and bicyclist signs are inconclusive. The results from previous research studies show mixed results regarding the safety performance of FYG for signs for pedestrian and bicyclist signs, and the research may be outdated. This research study did not identify any prior research studies on FYG signs completed within the past ten years or any studies comparing FYG with FY for pedestrian and bicyclist signs. In addition, none of the agencies that completed the surveys have completed any research studies on FYG signs for pedestrians and bicyclists. Most agencies are unsure of the safety performance of FYG signs compared to yellow or FY, although a limited number of agencies noted better safety performance with FYG signs. There is a wide range of agency practices for FYG signs for pedestrians and bicyclists. While many agencies utilize FYG for pedestrian and bicyclist signs to some extent, agencies have typically made the switch to FYG based on a belief that the FYG color stands out better and as part of safety initiatives. While a limited number of agencies have seen improved safety performance (e.g., increased yielding compliance) with the use of FYG, the research did not identify significant and conclusive evidence regarding potential safety benefits associated with the use of FYG for pedestrian and bicyclist signs. The research findings suggest a need for additional research into the potential safety benefits of FYG signs for pedestrians and bicyclists.

1. Introduction

Missouri experienced a record number of pedestrian fatalities (126) in 2020 (Smaltz 2021). Various safety countermeasures, including signage, can be used to improve safety for vulnerable road users (VRUs) such as pedestrians and bicyclists. Effective signage for pedestrians, such as pedestrian crosswalk signs, can help to improve pedestrian safety by increasing driver awareness of the presence of pedestrians. The Manual on Uniform Traffic Control Devices (MUTCD), which provides guidance for pedestrian signage, specifies the use of yellow sheeting for pedestrian or bicycle signs and fluorescent yellow-green (FYG) for school signs, with an option for the use of FYG sheeting for pedestrian or bicycle warning signs (FHWA 2023). An example pedestrian sign assembly in FYG is shown in Figure 1-1.

Figure 1-1. Example of pedestrian warning sign assembly in fluorescent yellow-green (Maryland State Highway Administration n.d.).

Several local agencies in Missouri have implemented the practice of using FYG for pedestrian warning signs. The current practice of the Missouri Department of Transportation (MoDOT) is to primarily use FYG only for school signs and to use fluorescent (FY) for pedestrian and bicyclist signs. One exception involves cases where a state route and city route intersect, and the city uses FYG for pedestrian or bicycle warning signs, MoDOT will use FYG signs at these specific intersections as the MUTCD prohibits intermixing yellow or FY with FYG signs at a given location. Because such instances are rare, MoDOT does not use FYG for bicycle or pedestrian warning signs on its roadways. However, MoDOT is considering changing its current pedestrian and bicyclist signs from FY to FYG only if there is substantial documented evidence such a change would provide a safety benefit. Such a change would involve considerable cost and effort for MoDOT due to the large number of FY pedestrian and bicyclist signs on the state system. Through this project, MoDOT would like to know if there is fact-based evidence regarding safety benefits associated with the use of FYG for pedestrian and bicyclist signs to support consideration of a switch to FYG.

1.1 Project Objective

The objective of this research study is to synthesize existing research and review the state of the practice regarding the use of FYG for pedestrian and bicyclist signs. The research methodology to meet these objectives includes a literature review, survey of departments of transportation (DOTs) and metropolitan planning organizations (MPOs), and follow up interviews with a subset of DOTs and MPOs. Attainment of the project objectives will help MoDOT to make data-driven decisions regarding the color of signs for pedestrians and bicyclists.

1.2 Report Overview

This report provides results from the literature review conducted for this project, including research studies and DOT policies and guidance. In addition, the report summarizes the surveys and interviews that were conducted with DOTs and MPOs. The final chapter of the report provides a summary of key research findings regarding the use of FYG for pedestrian and bicyclist signs. Appendices include a tabular summary of DOT policies and standards, the survey questionnaires, survey text responses, and interview questions.

2. Literature Review

This chapter provides an overview of the existing literature regarding the use of FYG for pedestrian and bicyclist signs, including research studies and DOT guidance, policies, and standards (e.g., state MUTCDs or MUTCD supplements, traffic manuals, and design manuals). Tabular summaries of DOT resources are provided in Appendix A.

2.1 Federal Highway Administration (FHWA) Guidance Regarding Use of Fluorescent Yellow-Green for Pedestrian and Bicyclist Signs

The 2023 version of the FHWA MUTCD provides guidance on the use of FYG for signs, as summarized below (FHWA 2023).

- The use of FYG is optional for signs for pedestrians and bicyclists. However, both standard yellow and FYG for pedestrian and bicyclist signs should not be used in the same area or zone.
- When a FYG background is used for pedestrians and bicyclists, a systematic approach featuring one background color within a zone or area should be used.
- Warning signs for schools and school buses must be FYG.
- FYG is allowed as an option for playground signs.
- Signs required or recommended in Parts 2 and 7 to be FYG may also be FYG in temporary traffic control zones.
- FYG (and several other colors) is not allowed for destination guide signs for shared use paths or community wayfinding signs.

FHWA also published guidance on how to conduct field studies to assess the impacts of FYG signs for bicyclists, pedestrians, and school crossings (Parker 1993). The FHWA guidance suggests the use of a before and after study with comparison sites.

2.2 General Literature Regarding Use of Fluorescent Yellow-Green for Pedestrian and Bicyclist Signs

Findings from a review of existing research studies indicate that the use of FYG for bicycle and pedestrian signs has shown mixed results for safety performance. In one of the first studies to evaluate the use of FYG for crossing signs, FYG signs were installed at five locations at Reagan National Airport in Washington, D.C. (Wortham 1995). Results showed reductions in speeds and near-misses with the FYG signs compared to standard yellow signs. A FHWA review of data from pilot studies conducted at multiple jurisdictions in 1992 and 1993 indicated that the use of FYG warning signs helped motorists to recognize the sign farther away than a standard yellow sign and improved the sign message visibility (Kittle 2000).

In the mid-1990s, FHWA sponsored a series of studies regarding the use of FYG at bicycle, pedestrian, and school crossings. One of these research studies, conducted in North Carolina,

included a traffic conflict study, laboratory study, and survey of pedestrians and drivers regarding the use of FYG. Measures of effectiveness for the traffic conflict study included drivers slowing and stopping and vehicle-pedestrian conflicts (Clark et al. 1996). Results showed that there were only marginal improvements in safety with the FYG (compared to standard yellow) as the number of drivers stopping and slowing increased significantly at three of seven sites, but there were no significant changes in vehicle-pedestrian conflicts. Clark et al. (1996) suggested that the use of FYG for pedestrian and bicyclist applications be designated as voluntary by FHWA.

For the laboratory study, three prototype Advance Pedestrian Crossing Signs (yellow with enclosed bead material, yellow with microprismatic material, FYG with microprismatic material) and three prototype Curve Ahead signs (yellow with enclosed bead material, FYG with microprismatic material, yellow with enclosed bead material and half-inch FYG border) were evaluated in a controlled environment under five different natural light conditions (Dutt et al. 1996). Study participants were shown slides of the prototype signs in various conditions. The study results indicated that the use of FYG signs led to improved legibility distances in bright daylight, backlight, and complex environments and could potentially improve driver awareness of warning signs.

The survey for the North Carolina study was conducted at four locations with midblock pedestrian crossings where FYG signs had been installed (Dutt et al. 1997). Results showed that respondents thought that, compared with standard yellow signs, the FYG signs were more visible, led to increased alertness for road users, and were more closely associated with caution.

In addition to the North Carolina study, the use of FYG at bicycle, pedestrian, and school crossings was evaluated at three sites in New York State through a before-after study and survey (Dhar and Woodin 1995). Standard yellow signs were replaced with FYG signs at the three sites for the before-after study. The sign layout for one of the sites is shown in Figure 2-1. Findings indicated that there were no significant differences in vehicle speeds before and after the FYG signs were installed. However, analysis of behavioral and conflict data indicated that FYG was associated with better performance than standard yellow as the percentage of motorists who slowed down or stopped for bicyclists or pedestrians increased with the use of FYG. Over half of the survey respondents recommended changing to the FYG. While the results showed some positive evidence of using FYG, the researchers did not make strong recommendations due to the short duration of the study and limited number of sites.

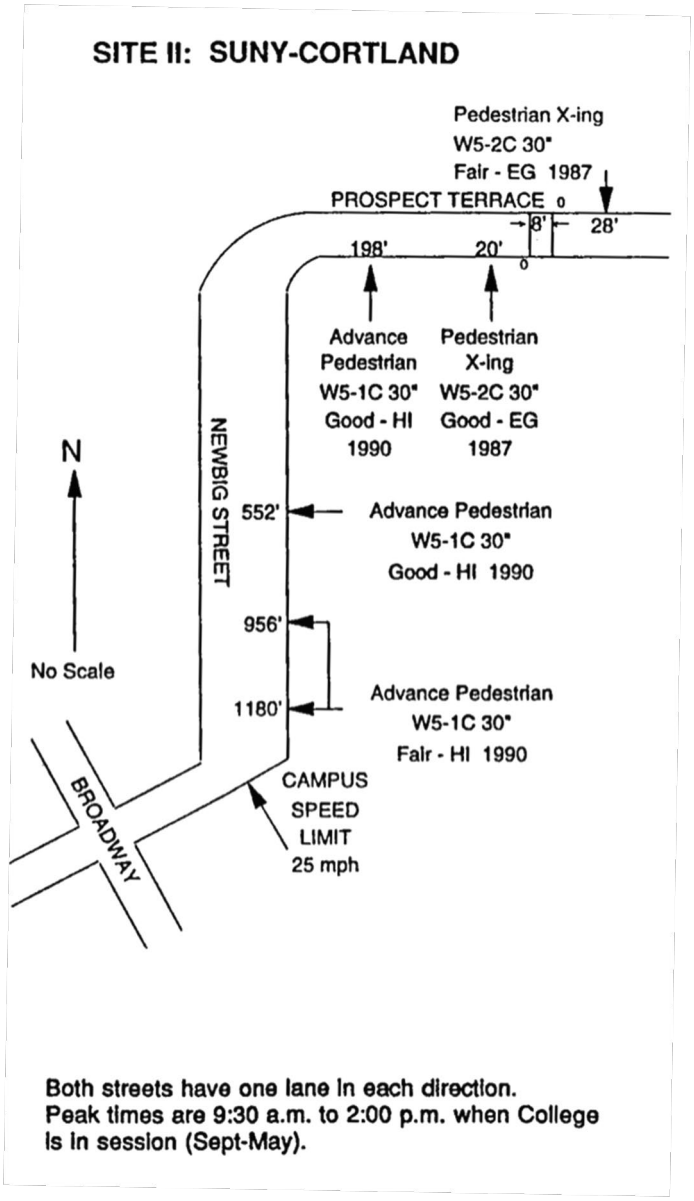

Figure 2-1. Sign layout for test site in New York study (Dhar and Woodin 1995).

The use of FYG for pedestrian signage was also investigated in Canada. Van Houten et al. (2002) replaced several pedestrian crossing signs (standard yellow) with FYG sheeting in Nova Scotia, Canada and found that the FYG crosswalk signs did not improve yielding behavior or reduce conflicts between motorists and pedestrians.

Other studies have investigated the effects of multiple sign colors, including FYG. Neale et al. (2002) investigated the use of four colors for signs for incident route trailblazing: fluorescent coral, fluorescent purple, FYG, and non-fluorescent purple. The study methodology included data collection in an instrumented vehicle driven by 91 participants on a test route in Virginia and a participant survey. The results showed no significant differences in driving performance

among the four different color combinations, although younger and older drivers indicated a preference for the FYG in the survey.

Schnell et al. (2001) assessed the effects of adding fluorescence to signs on legibility distance. The study encompassed six diamond signs and incorporated the following colors: yellow, fluorescent yellow, fluorescent yellow-green, pink, fluorescent pink, purple, and fluorescent purple. The study methodology consisted of nine participants driving through a test site in Iowa and verbally noting when the signs became legible. The results indicated that the use of fluorescence increased the legibility distance by 5.3 to 15.9 percent.

Inman et al. (2013) assessed the ability of drivers to notice speed limit and warning signs. Results showed that background clutter did not influence the detectability of fluorescent yellow-green warning signs.

Overall, the results from previous research studies are inconclusive, and the research may be outdated. While some studies have shown increased stopping, slowing, and legibility distance with the use of FYG compared to standard yellow, other studies have not found any changes in speeds or driving behavior associated with the use of FYG for pedestrian and bicyclist signs. Surveys in prior research studies have shown some user preference for FYG. While previous research suggests benefits to using fluorescent colors, the prior research has not shown that one fluorescent color provides superior safety benefits to other fluorescent colors. The literature search did not identify any research studies on FYG signs completed within the past ten years or any studies comparing FYG with FY for pedestrian and bicyclist signs.

A summary of findings from research studies on FYG signs is found in Table 2-1.

Table 2-1. Summary of findings from previous research studies on FYG signs.

Location	Reference	URL	Methodology	Key Findings
District of Columbia	Wortham 1995	https://trid.trb.org/View/426350	• Field study	• Reductions in speed and near-misses with FYG versus standard yellow
District of Columbia (metro area)	Inman et al. 2013	https://highways.dot.gov/sites/fhwa.dot.gov/files/FHWA-HRT-13-044.pdf	• Outdoor and laboratory study	• Background clutter did not influence the detectability of FYG warning signs
Missouri	Schnell et al. 2001	https://doi.org/10.3141/1754-04	• Field study	• Fluorescence increased legibility distance by 5.3 to 15.9 percent
Multiple	Kittle 2000	https://trid.trb.org/view/657925	• Review of data from pilot studies	• Improved sign visibility and legibility distance with FYG (compared to standard yellow)
New York	Dhar and Woodin 1995	https://trid.trb.org/View/496309	• Before-after study • Survey	• No significant differences in speeds (FYG versus standard yellow) • Increased slowing or stopping • Preference for FYG
North Carolina	Clark et al. 1996	https://doi.org/10.1177/0361198196153800105	• Field study	• Increased stopping and slowing at some sites with FYG (compared to standard yellow) • No significant changes in vehicle-pedestrian conflicts
North Carolina	Dutt et al. 1996	https://doi.org/10.1177/0361198196155300113	• Laboratory study	• Improved legibility distances in some environments
North Carolina	Dutt et al. 1997	https://doi.org/10.3141/1605-03	• Survey	• FYG signs more visible than standard yellow

Location	Reference	URL	Methodology	Key Findings
Nova Scotia	Van Houten et al. 2002	https://doi.org/10.3141/1818-18	• Field study	• No improvements in yielding behavior or conflict reductions with FYG (compared to standard yellow)
Virginia	Neale et al. 2002	https://doi.org/10.3141/1801-01	• Field study • Survey	• No significant differences in driving performance among four fluorescent colors • Some preference for FYG

2.3 DOT Policies, Guidance, and Standards for Pedestrian and Bicyclist Signage

A review of the policies and manuals for state DOTs found that 22 DOTs have adopted the MUTCD without modifying the MUTCD's intent on FYG being required for School Warning Signs and it also being optional for pedestrian, bicycle and playground warning signs. The remaining 29 DOTs have supplemented this guidance or do not have any information that could be found to confirm FYG is utilized beyond school zones. Of these 29 DOTs, California DOT (2024) and Oregon DOT (2023) require the location to be approved for FYG sign sheeting usage. Delaware DOT (2011, 2018a, 2018b) typically only uses FYG sign sheeting for in-street and post mounted pedestrian signs in beach areas. New York State DOT (2017) and Pennsylvania DOT (2014, 2021) expanded the optional usage of FYG sign sheeting beyond pedestrian, bicycle and playground warning signs as defined in the MUTCD. New York State DOT (2017) includes handicapped signs and Pennsylvania DOT (2021) includes Hiker, Watch Children and Trail crossing warning signs.

The state DOTs of Oklahoma (2009), Rhode Island (2004), Tennessee (n.d.), Utah (2011, 2013) and Wyoming (2014, 2018) have supplemented the MUTCD or have policies in place to only allow FYG sign sheeting for school zone warning signs and plaques. Two additional DOTs, Alaska (2016) and Nevada (2022a) allow FYG sign sheeting for pedestrian warning signs that occur within school zones. For these seven DOTs, FYG is not allowed to be used on any other sign that does not meet the conditions mentioned above.

Other DOTs have adopted supplements to the MUTCD or policies that expand the standard use or required use of FYG background sign sheeting for warning signs beyond school zones. Table 2-2 details the 14 DOTs that have expanded the usage of FYG with a list of signs for which the sign sheeting would be used.

Table 2-2. State DOTs that expanded the usage of FYG.

DOT	Reference Year	Signs FYG is Required
Connecticut	2023	Pedestrian and Bicycle -- (State Routes only)
District of Columbia	2023	Pedestrian
Georgia	2023	Pedestrian
Illinois	2021	School Zone Entrance and Speed Limit, Park Zones, Pedestrian
Kentucky	2021	School Bus, Bicycle, Share the Road, Pedestrian, In-Street Pedestrian, Overhead Pedestrian
Massachusetts	2022	Pedestrian
New Jersey	2014	Pedestrian, Bicycle -- (Unofficial Practice on State Routes)
New Mexico	2008, 2016	Pedestrian, Bicycle -- (Recommended)
North Carolina	2012, 2016, 2024	Pedestrian, Bicycle
North Dakota	2024	Pedestrian
Ohio	2012, 2019	Pedestrian, Bicycle, Trail, Playground, Safety Zones -- (State Routes)
South Carolina	2011, 2012, 2015	Deaf Child, Blind Child, Pedestrian, Bicycle, Handicapped, Playground, Trail Crossing, and Advisory Speed when used with Pedestrian, Bicycle, and School signs.
Texas	2014	Playground, Pedestrian in School Zones
Virginia	2013	Pedestrian, Bicycle, Playground

In summary, seven of the 51 DOTs limit the usage of FYG sign sheeting to warning signs within school zones while the remaining 44 states maintain optional or required usage for warning signs beyond school zones. In addition, six DOTs (Illinois, Kentucky, New York, Ohio, Pennsylvania, and South Carolina) use FYG sheeting beyond the conventional Pedestrian, Bicycle and Playground warning signs as defined in the MUTCD.

3. DOT Survey

This chapter provides an overview of the methodology and results for the DOT survey.

3.1 Methodology for DOT Survey

A survey was developed and administered to gain greater understanding of the state of the practice for the use of FYG for pedestrian and bicyclist signs by state DOTs in the United States. The survey, which included 40 questions, was reviewed by the topic panel before being sent to each state DOT via Qualtrics Survey Software (Qualtrics 2024). The survey was sent to one respondent from each DOT. The contact list for the survey was primarily developed based on the membership list of the AASHTO Committee on Safety and survey contact lists from previous safety-related surveys administered by the researchers. An effort was made to identify the appropriate person at each DOT to complete the survey. In addition, respondents were encouraged to collaborate with others at their DOT and to forward the survey to the staff who would be most capable of answering the questions and providing the most accurate information. Responses were received from 44 state DOTs and the District of Columbia DOT for a response rate of 88 percent. A map showing the survey respondents is provided in Figure 3-1.

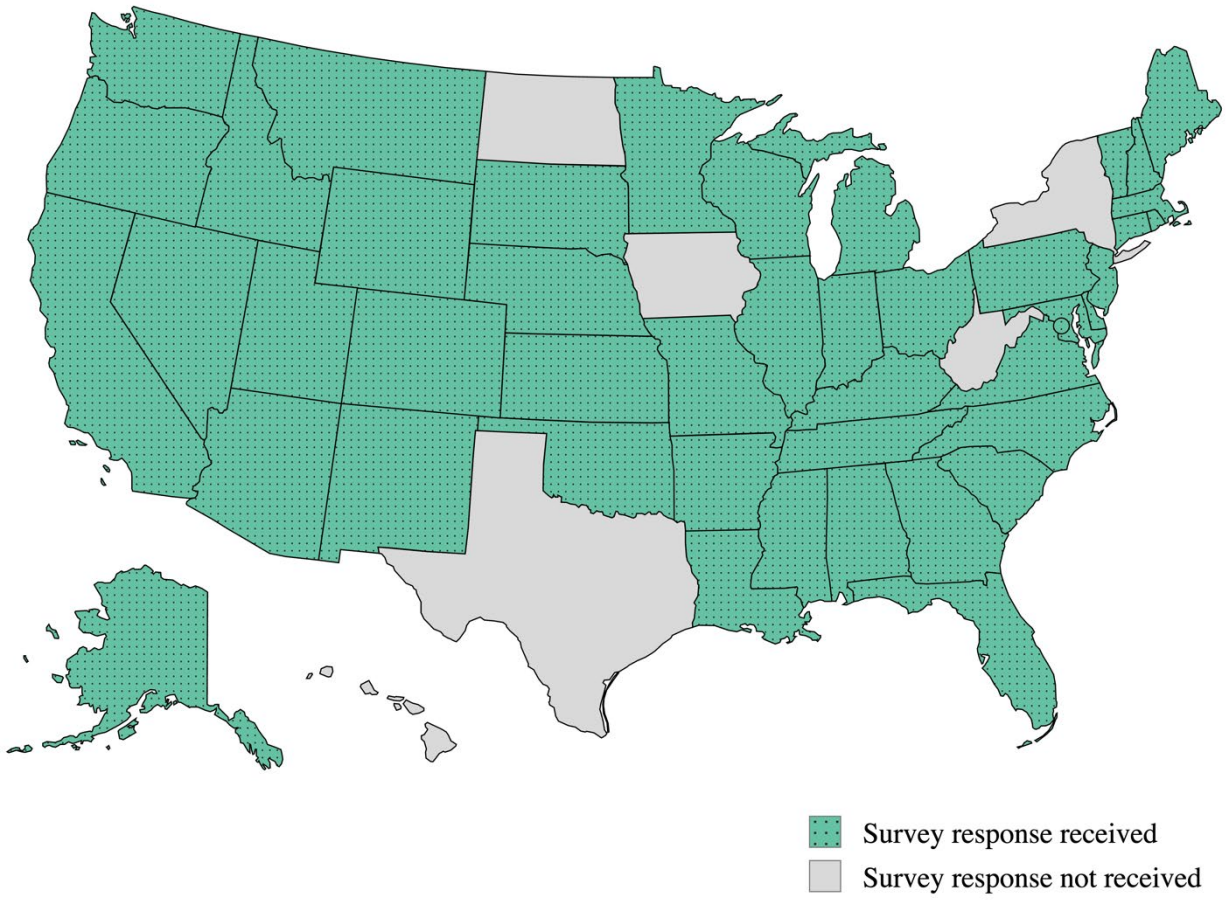

Figure 3-1. Respondents for DOT survey (map created with mapchart.net).

The survey covered various topics related to FYG signs for pedestrians and bicyclists, such as extent of use, rationale for switching to FYG (if applicable), research studies (internal or external), safety performance, implementation challenges, and use of other safety countermeasures for pedestrians and bicyclists. The survey utilized skip logic and display logic to show pertinent questions based on whether a DOT uses FYG for pedestrian or bicyclist signs. The number of questions viewed ranged from 10 to 38. Several of the multiple-choice questions included an option for other with a text entry field. A copy of the full survey can be found in Appendix B. Survey text responses, including comments, other text responses, and resources submitted, are provided in Appendix C.

3.2 Results for DOT Survey

This section first presents survey results for pedestrian signs, followed by survey results for bicyclist signs.

3.2.1 DOT Survey Results for Pedestrian Signs

The results for Question 1, shown in Table 3-1, indicate a wide range of DOT practices for FYG signs for pedestrians among responding DOTs. Sixteen responding DOTs allow for the optional use of FYG for pedestrian signs with no restrictions or approval process, while nine responding DOTs require FYG for pedestrian signs. Seven responding DOTs do not allow the use of FYG for pedestrian signs, while seven responding DOTs allow for the optional use of FYG for pedestrian signs for only specific conditions and/or with approval. One DOT mentioned in the other text field that it references the MUTCD (FHWA 2023). In the comments, one DOT noted that it wanted to keep the use of FYG exclusively for school children. Another DOT indicated that while FYG is mostly used for pedestrian signs and school zone signs, FY may be utilized if matching a community's other school zone signing in the vicinity of a state highway.

Table 3-1. DOT survey results for use of FYG for pedestrian signs (Question 1).

Response	Count	Percent
My agency does not allow the use of fluorescent yellow-green for pedestrian signs.	7	16%
In addition to using fluorescent yellow-green for school signs, my agency allows the **optional** use of fluorescent yellow-green for pedestrian signs **with no restrictions or approval process**.	16	36%
In addition to using fluorescent yellow-green for school signs, my agency allows for the **optional** use of fluorescent yellow-green for pedestrian signs **for only specific conditions and/or with approval**.	7	16%
In addition to using fluorescent yellow-green for school signs, my agency **requires** the use of fluorescent yellow-green for pedestrian signs.	9	20%
Other	5	11%
Total	**44**	**98%**

Note: Total number of respondents who viewed the question = 45.

The results for Question 2, regarding colors used for pedestrian signs, are provided in Table 3-2. The results indicate that 31 responding DOTs utilize FYG for pedestrian signs to some extent. Twenty-one responding DOTs use yellow, while 22 responding DOTs utilize FY. A map showing the use of FYG for pedestrian signs by state DOT is shown in Figure 3-2.

Table 3-2. DOT survey results for colors used for pedestrian signs (Question 2).

Response	Count	Percent
Yellow	21	47%
Fluorescent yellow	22	49%
Fluorescent yellow-green	31	69%
Total Responses	**44**	**98%**

Notes: Total number of respondents who viewed the question = 45. Respondents could select multiple answers.

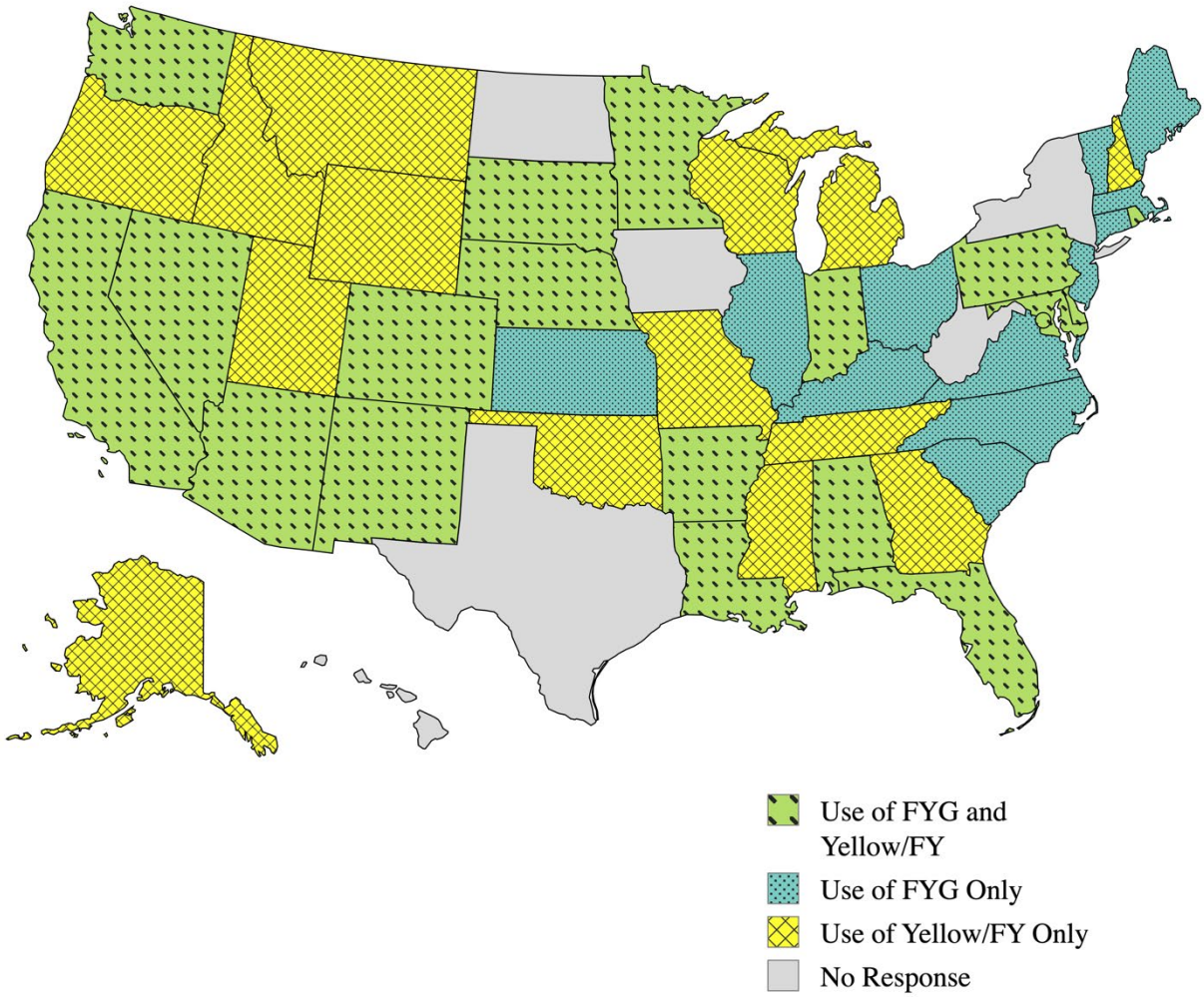

Figure 3-2. Use of FYG for pedestrian signs by state DOT (map created with mapchart.net).

The results for Question 3, shown in Table 3-3, indicate that 22 responding DOTs use FYG for all types of pedestrian signs. Some DOTs noted in the text responses that FYG is used for pedestrian school signs.

Table 3-3. DOT survey results for types of pedestrian signs with FYG (Question 3).

Response	Count
All types of pedestrian signs	22
Only some types of pedestrian signs	9
Total	**31**

Note: Total number of respondents who viewed the question = 31.

As shown by the results for Question 4 in Table 3-4, the extent of implementation of FYG for pedestrian signs varies significantly among responding DOTs. Responding DOTs most often implement FYG signs for pedestrians on a project basis, followed by systemwide implementation and incorporation into routine maintenance. Seven responding DOTs consider

requests by the public. Other text responses noted use of FYG signs for pedestrians at the discretion of the engineer or District.

Table 3-4. DOT survey results for extent of implementation of FYG for pedestrian signs (Question 4).

Response	Count
Systemwide	12
Project basis	15
Geographical regions	0
Corridors	4
Incorporated into routine maintenance (e.g., life cycle replacement, damaged signs)	10
As requested by the public	7
Other	8
Total responses	**31**

Notes: Total number of respondents who viewed the question = 31. Respondents could select multiple answers.

Question 5 asked DOTs what percentage of the pedestrian signs under their jurisdiction are FYG, and the results are shown in Table 3-5. The results indicate a wide range of responses, with 12 responding DOTs having FYG for 25 percent or less of pedestrian signs and seven responding DOTs having FYG for 76 percent or more of pedestrian signs.

Table 3-5. DOT survey results for percentage of FYG signs for pedestrians (Question 5).

Response	Count
76 percent to 100 percent	7
51 percent to 75 percent	4
26 percent to 50 percent	6
0 percent to 25 percent	12
Total	**29**

Note: Total number of respondents who viewed the question = 31.

The results for Question 6, provided in Table 3-6, indicate that DOTs have been using FYG for pedestrian signs for a significant length of time, with 26 responding DOTs utilizing FYG for pedestrian signs for six years or longer.

Table 3-6. DOT survey results for length of use of FYG for pedestrian signs (Question 6).

Response	Count
0 to 5 years	5
6 to 10 years	12
More than 10 years	14
Total	**31**

Note: Total number of respondents who viewed the question = 31.

As shown by the results for Question 7 in Table 3-7, responding DOTs have primarily switched to FYG for pedestrian signs based on engineering judgement, followed by implementation along with other countermeasures as part of a pedestrian safety initiative. None of the responding DOTs indicated that they switched to FYG based on an internal or external research study. Another reason provided in the text responses is the belief that the color stands out.

Table 3-7. DOT survey results for basis for switching to FYG for pedestrian signs (Question 7).

Response	Count
Engineering judgement	19
Implemented along with other countermeasures as part of a pedestrian safety initiative	11
Input from local agencies	4
Input from pedestrian advocacy groups	3
Research study (internal or external)	0
Other	4
Unsure	5
Total Responses	**31**

Notes: Total number of respondents who viewed the question = 31. Respondents could select multiple answers.

The results for Question 8, shown in Table 3-8, indicate that 23 responding DOTs switched from yellow to FYG for pedestrian signs, while only five responding DOTs switched from FY to FYG.

Table 3-8. DOT survey results for pedestrian sign color before FYG (Question 8).

Response	Count
Yellow	23
Fluorescent yellow	5
No response	0
Unknown	3
Total	**31**

Note: Total number of respondents who viewed the question = 31.

Questions 9 and 10 asked DOTs about the safety performance of FYG versus yellow and FY, respectively. As shown in Table 3-9, 17 responding DOTs are unsure of the safety performance of FYG compared to yellow, while three responding DOTs indicated that FYG has provided better safety performance than yellow for pedestrian signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction). As shown in Table 3-10, one DOT indicated that FYG has provided better safety performance than FY for pedestrian signs, while four DOTs are unsure of the safety performance of FYG compared to FY.

Table 3-9. DOT survey results for safety performance of FYG versus yellow for pedestrian signs (Question 9).

Response	Count
Fluorescent yellow-green has provided better safety performance than yellow for pedestrian signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)	3
Fluorescent yellow-green has provided better safety performance than yellow for pedestrian signs based on other factors	0
Fluorescent yellow-green has provided similar safety performance to yellow for pedestrian signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)	1
Fluorescent yellow-green has provided similar safety performance to yellow for pedestrian signs based on other factors	0
Other	2
Unsure	17
Total	**23**

Note: Total number of respondents who viewed the question = 23.

Table 3-10. DOT survey results for safety performance of FYG versus FY for pedestrian signs (Question 10).

Response	Count
Fluorescent yellow-green has provided better safety performance than fluorescent yellow for pedestrian signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)	1
Fluorescent yellow-green has provided better safety performance than fluorescent yellow for pedestrian signs based on other factors	0
Fluorescent yellow-green has provided similar safety performance to fluorescent yellow for pedestrian signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)	0
Fluorescent yellow-green has provided similar safety performance to fluorescent yellow for pedestrian signs based on other factors	0
Other	0
Unsure	4
Total	**5**

Note: Total number of respondents who viewed the question = 5.

Questions 11 and 12 asked about research studies related to the use of FYG for pedestrian signs. In response to Question 11, none of the 31 responding DOTs that use FYG for pedestrian signs indicated that they have performed any research studies to evaluate the safety performance of FYG signs for pedestrians. For Question 12, three responding DOTs noted that they are aware of research studies to evaluate the safety performance of FYG signs for pedestrians. In the text responses, one DOT indicated that a municipality has reported speed compliance and crash reductions on corridors that use FYG for pedestrian signs.

The results for Question 13, provided in Table 3-11, show that the most common type of sign sheeting currently used for pedestrian signs is diamond grade, followed by high intensity prismatic. Before DOTs switched to FYG, they most often utilized high intensity prismatic sheeting for pedestrian signs.

Table 3-11. DOT survey results for grade of sheeting for pedestrian signs (Question 13).

Time Period	Engineer Grade	High Intensity Prismatic	Diamond Grade	Unknown	Total
Current	0	10	16	4	30
Previously (Before Switch to Fluorescent Yellow-Green)	0	17	5	8	30

Note: Total number of respondents who viewed the question = 31.

Questions 14 and 15 sought information regarding other pedestrian safety countermeasures used by DOTs. As shown in Table 3-12, responding DOTs have implemented a wide range of other pedestrian safety countermeasures, most often high visibility crosswalks, rectangular rapid flashing beacons (RRFBs), and pedestrian countdown timers. Regarding the timing of implementation of these other pedestrian safety countermeasures, DOTs have typically implemented them before implementing FYG (Table 3-13). However, implementation after FYG received more responses than before implementation of FYG for these pedestrian safety countermeasures: FYG reflective strips on sign U-posts, leading pedestrian interval (LPI), pedestrian hybrid beacon (PHB)/ high-intensity activated crosswalk (HAWK) beacon, and RRFBs.

Table 3-12. DOT survey results for use of other pedestrian safety countermeasures (Question 14).

Pedestrian Safety Countermeasure	Count
Fluorescent yellow-green reflective strips on sign U-posts	15
High visibility crosswalks	28
Raised crosswalks	6
Overhead crosswalk lighting	12
In-roadway “Yield to Pedestrian” signs	12
Advance stop/yield bar and signs	19
Leading pedestrian interval (LPI)	15
Pedestrian countdown timers	25
PHB/HAWK	19
Raised medians and median islands	22
RRFB	26
Increasing traffic enforcement	6
Speed limit reduction	11
Other	1
None of the above	0
Total Responses	**31**

Notes: Total number of respondents who viewed the question = 31. Respondents could select multiple answers.

Table 3-13. DOT survey results for when other pedestrian safety countermeasures were implemented (Question 15).

Pedestrian Safety Countermeasure	Before Switching to FYG	Same Time as Switching to FYG	After Switching to FYG	Unknown	Total
Fluorescent yellow-green reflective strips on sign U-posts	2	2	7	4	**15**
High visibility crosswalks	13	3	2	9	**27**
Raised crosswalks	2	1	2	1	**6**
Overhead crosswalk lighting	3	0	2	7	**12**
In-roadway "Yield to Pedestrian" signs	5	2	1	4	**12**
Advance stop/yield bar and signs	9	3	0	7	**19**
Leading pedestrian interval (LPI)	2	0	7	6	**15**
Pedestrian countdown timers	10	2	5	8	**25**
PHB/HAWK	2	1	8	8	**19**
Raised medians and median islands	12	2	0	8	**22**
RRFB	5	5	9	7	**26**
Increasing traffic enforcement	4	0	0	2	**6**
Speed limit reduction	5	0	1	5	**11**
Other	0	0	0	0	**0**

Note: Total number of respondents who viewed the question = 31.

The results for Question 16, provided in Table 3-14, show that the most cited challenges faced by responding DOTs in the implementation of FYG for pedestrian signs are the need for standards or policies for use, need for performance data, and the time and effort required to replace the signs. Consistency in application and implementation was noted as a challenge in the text responses.

Table 3-14. DOT survey results for challenges faced in the implementation of FYG for pedestrian signs (Question 16).

Response	Count
Cost	1
Lack of agency buy-in	0
Maintenance considerations	0
Need for performance data	4
Need for standards or policies for use	5
Need to prioritize with other pedestrian safety countermeasures	0
Stakeholder coordination	3
Time and effort to replace signs	4
Other	2
None of the above	0
Total Responses	**11**

Notes: Total number of respondents who viewed the question = 31. Respondents could select multiple answers.

In response to Question 17, 13 responding DOTs indicated that they are aware of local jurisdictions in their state adopting FYG for pedestrian signs, while 16 responding DOTs are not aware of any local jurisdiction in their state adopting FYG for pedestrian signs. Text responses noted that local municipalities often or sometimes follow the state DOT policy.

Question 18 of the survey was shown to DOTs that do not use FYG for pedestrian signs and asked them for the reasons they do not utilize FYG for pedestrian signs. The results, provided in Table 3-15, show that the most cited reason is lack of information on benefits, followed by the time and effort to replace signs. Wanting to keep FYG reserved for school signs was most often cited in the other text responses.

Table 3-15. DOT survey results for reasons FYG is not used for pedestrian signs (Question 18).

Response	Count
Cost	0
Lack of agency-buy in	2
Lack of information on benefits	5
Maintenance considerations	1
Need for standards or policies for use	2
Other pedestrian safety initiatives are a higher priority	2
Time and effort to replace signs	3
Other	6
Unsure	1
Total Responses	**13**

Notes: Total number of respondents who viewed the question = 14. Respondents could select multiple answers.

3.2.2 DOT Survey Results for Bicyclist Signs

The results for Question 19, shown in Table 3-16, indicate a wide range of practices for FYG signs for bicyclists among responding DOTs. Twelve responding DOTs allow for the optional use of FYG for bicyclist signs with no restrictions or approval process, while eight responding DOTs require FYG for bicyclist signs. Thirteen responding DOTs do not allow the use of FYG for bicyclist signs, while five responding DOTs allow for the optional use of FYG for bicyclist signs for only specific conditions and/or with approval. One DOT mentioned in the other text field that it reserves use of FYG for cases where other treatments do not seem to be effective.

Table 3-16. DOT survey results for use of FYG for bicyclist signs (Question 19).

Response	Count	Percent
My agency does not allow the use of fluorescent yellow-green for bicyclist signs.	13	29%
In addition to using fluorescent yellow-green for school signs, my agency allows the optional use of fluorescent yellow-green for bicyclist signs with no restrictions or approval process.	12	27%
In addition to using fluorescent yellow-green for school signs, my agency allows for the optional use of fluorescent yellow-green for bicyclist signs for only specific conditions and/or with approval	5	11%
In addition to using fluorescent yellow-green for school signs, my agency requires the use of fluorescent yellow-green for bicyclist signs.	8	18%
Other	6	13%
Total	**44**	**98%**

Note: Total number of respondents who viewed the question = 45.

The results for Question 20, regarding colors used for bicyclist signs, are provided in Table 3-17. The results indicate that 26 responding DOTs utilize FYG for bicyclist signs to some extent. Twenty-two responding DOTs use yellow, while 21 responding DOTs utilize FY. A map showing the use of FYG for bicyclist signs by state DOT is shown in Figure 3-3.

Table 3-17. DOT survey results for colors used for bicyclist signs (Question 20).

Response	Count	Percent
Yellow	22	49%
Fluorescent yellow	21	47%
Fluorescent yellow-green	26	58%
Total Responses	**44**	**98%**

Note: Total number of respondents who viewed the question = 45.

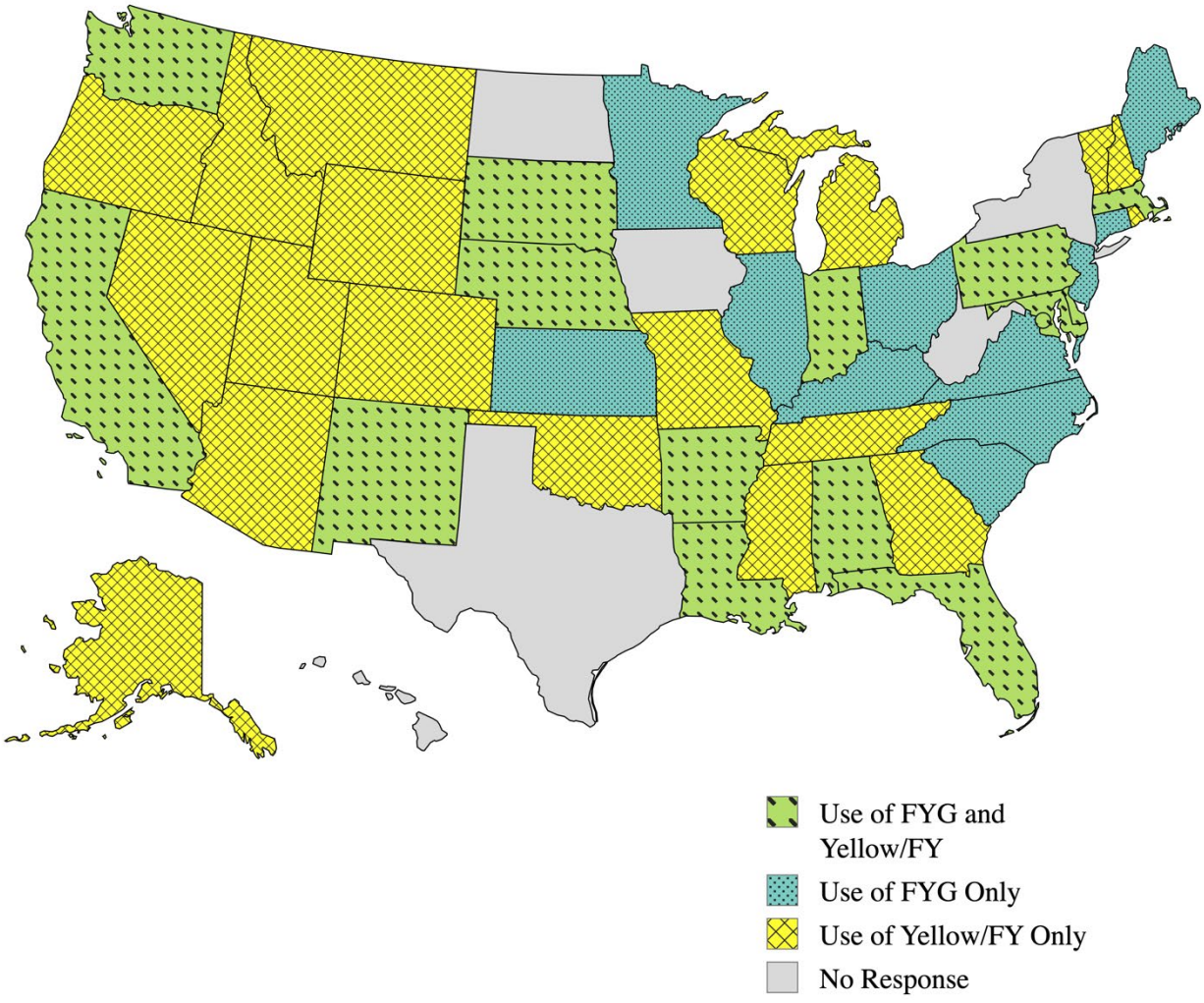

Figure 3-3. Use of FYG for bicyclist signs by state DOT (map created with mapchart.net).

The results for Question 21, shown in Table 3-18, indicate that 19 responding DOTs use FYG for all types of bicyclist signs. Text responses noted use for warning signs and differences in implementation by district.

Table 3-18. DOT survey results for types of bicyclist signs with FYG (Question 21).

Response	Count
All types of bicyclist signs	19
Only some types of bicyclist signs	7
Total	**26**

Note: Total number of respondents who viewed the question = 26.

As shown by the results for Question 22 in Table 3-19, the extent of implementation of FYG for bicyclist signs varies significantly among responding DOTs. Responding DOTs most often implement FYG signs for bicyclists on a systemwide or project basis, followed by response to public requests and corridor implementation. Other text responses noted use of FYG signs for bicyclists at the discretion of the engineer or district.

Table 3-19. DOT survey results for extent of implementation of FYG for bicyclist signs (Question 22).

Response	Count
Systemwide	10
Project basis	10
Corridors	5
Geographical regions	2
Incorporated into routine maintenance (e.g., life cycle replacement, damaged signs)	4
As requested by the public	6
Other	5
Total Responses	**25**

Notes: Total number of respondents who viewed the question = 26. Respondents could select multiple answers.

Question 23 asked DOTs what percentage of the bicyclist signs under their jurisdiction are FYG, and the results are shown in Table 3-20. The results indicate a wide range of responses, with nine responding DOTs having FYG for 25 percent or less of bicyclist signs and six responding DOTs having FYG for 76 percent or more of bicyclist signs.

Table 3-20. DOT survey results for percentage of FYG signs for bicyclists (Question 23).

Response	Count
76 percent to 100 percent	6
51 percent to 75 percent	3
26 percent to 50 percent	6
0 percent to 25 percent	9
Total	**24**

Note: Total number of respondents who viewed the question = 26.

The results for Question 24, provided in Table 3-21, indicate that DOTs have been using FYG for bicyclist signs for a significant length of time, with 20 responding DOTs utilizing FYG for bicyclist signs for six years or longer.

Table 3-21. DOT survey results for length of use of FYG for bicyclist signs (Question 24).

Response	Count
0 to 5 years	6
6 to 10 years	10
More than 10 years	10
Total	**26**

Note: Total number of respondents who viewed the question = 26.

As shown by the results for Question 25 in Table 3-22, responding DOTs have primarily switched to FYG for bicyclist signs based on engineering judgement, followed by implementation along with other countermeasures as part of a bicyclist safety initiative. None of the responding DOTs indicated that they switched to FYG based on an internal or external research study. Other reasons provided in the text responses are the belief that the color stands out and to provide consistency with other pedestrian signs.

Table 3-22. DOT survey results for basis for switching to FYG for bicyclist signs (Question 25).

Response	Count
Engineering judgement	16
Implemented along with other countermeasures as part of a bicyclist safety initiative	8
Input from local agencies	5
Input from bicyclist advocacy groups	5
Research study (internal or external)	0
Other	5
Unsure	5
Total Responses	**26**

Notes: Total number of respondents who viewed the question = 26. Respondents could select multiple answers.

The results for Question 26, shown in Table 3-23, indicate that 19 responding DOTs switched from yellow to FYG for bicyclist signs, while only five responding DOTs switched from FY to FYG.

Table 3-23. DOT survey results for bicyclist sign color before FYG (Question 26).

Response	Count
Yellow	19
Fluorescent yellow	5
Unknown	2
Total	**26**

Note: Total number of respondents who viewed the question = 26.

Questions 27 and 28 asked DOTs about the safety performance of FYG versus yellow and FY, respectively. As shown in Table 3-24, 15 responding DOTs are unsure of the safety performance of FYG compared to yellow for bicyclist signs, while one responding DOT indicated that FYG has provided better safety performance than yellow for bicyclist signs based on performance measures (e.g., crash reduction, conflict reduction, speed reduction). As shown in

Table 3-25, five responding DOTs are unsure of the safety performance of FYG compared to FY for bicyclist signs.

Table 3-24. DOT survey results for safety performance of FYG versus yellow for bicyclist signs (Question 27).

Response	Count
Fluorescent yellow-green has provided better safety performance than yellow for bicyclist signs based on performance measures (e.g., crash reduction, bicyclist conflict reduction, speed reduction)	1
Fluorescent yellow-green has provided better safety performance than yellow for bicyclist signs based on other factors	0
Fluorescent yellow-green has provided similar safety performance to yellow for bicyclist signs based on performance measures (e.g., crash reduction, bicyclist conflict reduction, speed reduction)	1
Fluorescent yellow-green has provided similar safety performance to yellow for bicyclist signs based on other factors	0
Other	2
Unsure	15
Total	**19**

Note: Total number of respondents who viewed the question = 19.

Table 3-25. DOT survey results for safety performance of FYG versus FY for bicyclist signs (Question 28).

Response	Count
Fluorescent yellow-green has provided better safety performance than fluorescent yellow for bicyclist signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)	0
Fluorescent yellow-green has provided better safety performance than fluorescent yellow for bicyclist signs based on other factors	0
Fluorescent yellow-green has provided similar safety performance to fluorescent yellow for bicyclist signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)	0
Fluorescent yellow-green has provided similar safety performance to fluorescent yellow for bicyclist signs based on other factors	0
Other	0
Unsure	5
Total	**5**

Note: Total number of respondents who viewed the question = 5.

Questions 29 and 30 asked about research studies related to the use of FYG for bicyclist signs. In response to Question 29, none of the 26 responding DOTs that use FYG for bicyclist signs

indicated that they have performed any research studies to evaluate the safety performance of FYG signs for bicyclists. For Question 30, none of the 26 responding DOTs that use FYG for bicyclist signs noted that they are aware of any research studies to evaluate the safety performance of bicyclist signs with FYG color.

The results for Question 31, provided in Table 3-26, show that the most common type of sign sheeting currently used for bicyclist signs is diamond grade, followed by high intensity prismatic. Before DOTs switched to FYG, they most often utilized high intensity prismatic sheeting for bicyclist signs.

Table 3-26. DOT survey results for grade of sheeting for bicyclist signs (Question 31).

Time Period	Engineer Grade	High Intensity Prismatic	Diamond Grade	Unknown	Total
Current	0	10	12	3	25
Previously (Before Switch to Fluorescent Yellow-Green)	0	17	3	4	24

Note: Total number of respondents who viewed the question = 26.

Questions 32 and 33 sought information regarding other bicyclist safety countermeasures used by DOTs. As shown in Table 3-27, responding DOTs have implemented a wide range of other bicyclist safety countermeasures, most often bicycle lanes/paths, pavement markings improvements, and RRFBs. Regarding the timing of implementation of these other bicyclist safety countermeasures, DOTs have typically implemented them before implementing FYG (Table 3-28). However, implementation after switching to FYG received more responses than implementation before switching to FYG for PHB/HAWK.

Table 3-27. DOT survey results for use of other bicyclist safety countermeasures (Question 32).

Bicyclist Safety Countermeasure	Count
Bicycle-activated signal detection	7
Bicycle boulevards	3
Bicycle lanes/paths (e.g., separate, shared use)	24
Bicycle path intersection treatments	13
Bicycle signals	5
Bicycle helmet laws	6
Bicyclist education	10
Fluorescent yellow-green reflective strips on sign U-posts	9
Lane narrowing	10
Overhead lighting	9
Pavement marking improvements	19
Advance stop/yield bar and signs	12
PHB/HAWK	12
Raised medians and median islands	14
RRFB	17
Increasing traffic enforcement	4
Speed limit reduction	11
Other	0
None of the above	0
Total Responses	**24**

Notes: Total number of respondents who viewed the question = 26. Respondents could select multiple answers.

Table 3-28. DOT survey results for when other bicyclist safety countermeasures were implemented (Question 33).

Bicyclist Safety Countermeasure	Before Switching to FYG	Same Time as Switching to FYG	After Switching to FYG	Unknown	Total
Bicycle-activated signal detection	2	0	2	3	7
Bicycle boulevards	1	0	0	2	3
Bicycle lanes/paths (e.g., separate, shared use)	14	2	4	4	24
Bicycle path intersection treatments	7	1	1	4	13
Bicycle signals	1	0	2	2	5
Bicycle helmet laws	4	0	0	2	6
Bicyclist education	7	0	1	2	10
Fluorescent yellow-green reflective strips on sign U-posts	1	4	2	2	9
Lane narrowing	6	0	1	3	10
Overhead lighting	5	0	1	3	9
Pavement marking improvements	14	0	2	3	19
Advance stop/yield bar and signs	7	1	1	3	12
PHB/HAWK	2	1	5	4	12
Raised medians and median islands	8	0	1	5	14
RRFB	6	3	5	3	17
Increasing traffic enforcement	1	1	0	2	4
Speed limit reduction	5	0	2	4	11
Other	0	0	0	0	0

Note: Total number of respondents who viewed the question = 26.

The results for Question 34, provided in Table 3-29, show that the most cited challenges faced by responding DOTs in the implementation of FYG for bicyclist signs are the need for standards or policies for use and need to prioritize with other bicyclist safety countermeasures. Consistency in application and rollout was noted as a challenge in the text responses.

Table 3-29. DOT survey results for challenges faced in the implementation of FYG for bicyclist signs (Question 34).

Response	Count
Cost	2
Lack of agency buy-in	0
Maintenance considerations	1
Need for performance data	3
Need for standards or policies for use	4
Need to prioritize with other bicyclist safety countermeasures	4
Stakeholder coordination	2
Time and effort to replace signs	2
Other	1
None of the above	0
Total Responses	**8**

Notes: Total number of respondents who viewed the question = 26. Respondents could select multiple answers.

In response to Question 35, seven responding DOTs indicated that they are aware of local jurisdictions in their state adopting FYG for bicyclist signs, while 16 responding DOTs are not aware of any local jurisdiction in their state adopting FYG for bicyclist signs. Text responses noted that local municipalities often or sometimes follow the state DOT policy.

Question 36 of the survey was shown to DOTs that do not use FYG for bicyclist signs and asked them for the reasons they do not utilize FYG for bicyclist signs. The results, provided in Table 3-30, show the most cited reason is lack of information on benefits, followed by the need for standards or policies for use. Wanting to keep FYG reserved for school signs was most often cited in the other text responses.

Table 3-30. DOT survey results for reasons FYG is not used for bicyclist signs (Question 36).

Response	Count
Cost	0
Lack of agency buy-in	2
Lack of information on benefits	7
Maintenance considerations	1
Need for standards or policies for use	3
Other bicyclist safety initiatives are a higher priority	1
Time and effort to replace existing signs	2
Other	8
Unsure	3
Total Responses	**19**

Notes: Total number of respondents who viewed the question = 19. Respondents could select multiple answers.

3.2.3 DOT Survey Results for General Comments and Policy Considerations

Questions 37 through 40 covered general comments and policy considerations and were shown to all survey respondents. For Question 37, 28 responding DOTs indicated that they have developed policies, guidance, and/or standards for pedestrian and bicyclist signage. A tabular summary of the resources submitted by DOTs in response to this question is provided in Appendix C. In response to Question 38, 14 responding DOTs indicated that they are planning to make changes to their existing policies or practices for pedestrian and bicyclist signage. The most common change described in the text responses was making updates for the 11th edition of the MUTCD. In response to Question 39, 28 responding DOTs indicated a willingness to participate in a follow-up interview to further discuss their DOT's practices for signage for bicyclists and pedestrians.

Question 40 provided responding DOTs with an opportunity to give general comments regarding signage for bicyclists and pedestrians. Example comments noted generally following the MUTCD guidance and leaving significant discretion to designers with review and enforcement of best practices from DOT personnel. A full list of comments submitted is provided in Appendix C.

3.3 Summary of DOT Survey Findings

A summary of key findings from the DOT survey is provided below.

3.3.1 Summary of DOT Survey Findings for Pedestrian Signs

- There is a wide range of DOT practices for FYG signs for pedestrians among responding DOTs. Thirty-one responding DOTs use FYG for pedestrian signs to some extent, but only nine responding DOTs require FYG for pedestrian signs.

- Twelve responding DOTs have FYG for 25 percent or less of pedestrian signs and seven responding DOTs have FYG for 76 percent or more of pedestrian signs.
- Responding DOTs most often implement FYG signs for pedestrians on a project basis, followed by systemwide implementation and incorporation into routine maintenance.
- Responding DOTs have primarily switched to FYG for pedestrian signs based on engineering judgement, followed by implementation along with other countermeasures as part of a pedestrian safety initiative. None of the responding DOTs indicated that they switched to FYG based on an internal or external research study.
- Twenty-three responding DOTs switched from yellow to FYG for pedestrian signs, while only five responding DOTs switched from FY to FYG.
- Responding DOTs are generally unsure of the safety performance of FYG versus yellow or FY, although four responding DOTs indicated that FYG has provided better safety performance than yellow or FY based on performance measures.
- None of the 31 responding DOTs that use FYG for pedestrian signs indicated that they have performed any research studies to evaluate the safety performance of FYG signs for pedestrians.
- The most common type of sign sheeting currently used for pedestrian signs is diamond grade. Before responding DOTs switched to FYG, they most often utilized high intensity prismatic sheeting for pedestrian signs.
- Responding DOTs have implemented a wide range of other pedestrian safety countermeasures, most often high visibility crosswalks, RRFBs, and pedestrian countdown timers.
- The most cited challenges faced by responding DOTs in the implementation of FYG for pedestrian signs are the need for standards or policies for use, need for performance data, and the time and effort required to replace the signs.
- Among the 14 responding DOTs that do not utilize FYG for pedestrian signs, the most cited reasons are lack of information on benefits, the time and effort to replace signs, and a preference to keep FYG reserved for school signs.

3.3.2 Summary of DOT Survey Findings for Bicyclist Signs

- There is a wide range of DOT practices for FYG signs for bicyclists among responding DOTs. Twenty-six responding DOTs use FYG for bicyclist signs to some extent, but only eight responding DOTs require FYG for bicyclist signs.
- Nine responding DOTs have FYG for 25 percent or less of pedestrian signs and six responding DOTs have FYG for 76 percent or more of pedestrian signs.
- Responding DOTs most often implement FYG signs for bicyclists on a systemwide or project basis, followed by response to public requests and corridor implementation.
- Responding DOTs have primarily switched to FYG for bicyclist signs based on engineering judgement, followed by implementation along with other countermeasures

as part of a bicyclist safety initiative. None of the responding DOTs indicated that they switched to FYG based on an internal or external research study.

- Nineteen responding DOTs switched from yellow to FYG for bicyclist signs, while only five responding DOTs switched from FY to FYG.
- Responding DOTs are generally unsure of the safety performance of FYG versus yellow or FY, although one responding DOTs indicated that FYG has provided better safety performance than yellow based on performance measures.
- None of the 26 responding DOTs that use FYG for bicyclist signs indicated that they have performed any research studies to evaluate the safety performance of FYG signs for bicyclists.
- The most common type of sign sheeting currently used for bicyclist signs is diamond grade. Before responding DOTs switched to FYG, they most often utilized high intensity prismatic sheeting for bicyclist signs.
- Responding DOTs have implemented a wide range of other bicyclist safety countermeasures, most often bicycle lanes/paths, pavement markings improvements, and RRFBs.
- The most cited challenges faced by responding DOTs in the implementation of FYG for bicyclist signs are the need for standards or policies for use and need to prioritize with other bicyclist safety countermeasures.
- Among the 19 responding DOTs that do not utilize FYG for bicyclist signs, the most cited reasons are lack of information on benefits, the need for standards or policies for use, and a preference to keep FYG reserved for school signs.

3.3.3 Summary of DOT Survey Findings for Policy Considerations

- Twenty-eight responding DOTs indicated that they have developed policies, guidance, and/or standards for pedestrian and bicyclist signage.
- Fourteen responding DOTs indicated that they are planning to make changes to their existing policies or practices for pedestrian and bicyclist signage, most commonly making updates for the 11th Edition of the MUTCD.

4. MPO Survey

This chapter provides an overview of the methodology and results for the MPO survey.

4.1 Methodology for MPO Survey

A survey was developed and administered to gain greater understanding of the state of the practice for the use of FYG for pedestrian and bicyclist signs by MPOs in the United States. The survey included 25 questions and was reviewed by the topic panel before it was sent to MPOs. The survey was distributed to specific MPO contacts and generally to MPOs throughout the country through the Association of Metropolitan Planning Organizations mailing list. Responses were received from 14 MPOs as shown in Table 4-1.

Table 4-1. Respondents for MPO Survey

Respondents for MPO Survey
Bend Metropolitan Planning Organization
Capital Area Metropolitan Planning Organization
Chicago Metropolitan Agency for Planning
Denver Regional Council of Governments
Fargo-Moorhead Metropolitan Council of Governments
Hampton Roads Transportation Planning Organization
KYOVA Interstate Planning Commission
McLean County Regional Planning Commission
Michiana Area Council of Governments
Oneida County Planning Agency
Ozarks Transportation Organization
Rockland County Government
Santa Fe MPO
Suffolk County Government

The survey covered various topics related to FYG signs for pedestrians and bicyclists, such as extent of use, rationale for switching to FYG (if applicable), research studies (internal or external), safety performance, implementation challenges, and use of other safety countermeasures for pedestrians and bicyclists. The survey utilized skip logic and display logic to show pertinent questions based on whether an MPO uses FYG for pedestrian or bicyclist signs. The number of questions viewed ranged from 7 to 23. Several of the multiple-choice questions included an option for other, with a text entry field. A copy of the full survey can be found in Appendix D. Survey text responses, including comments, other text responses, and resources submitted, are provided in Appendix E.

4.2 Results for MPO Survey

This section first presents survey results for pedestrian signs, followed by survey results for bicyclist signs.

4.2.1 MPO Survey Results for Pedestrian Signs

The results for Question 1, regarding the colors used for pedestrian signs, are shown in Table 4-2. The data indicates that seven responding MPOs use FYG for pedestrian signs to some extent. Both FY and Yellow are slightly more prevalent than FYG, with eight responding MPOs using each of those colors.

Table 4-2. MPO survey results for colors used for pedestrian signs (Question 1).

Response	Count	Percent
Yellow	8	57%
Fluorescent yellow	8	57%
Fluorescent yellow-green	7	50%
Total responses	**14**	**100%**

Notes: Total number of respondents who viewed the question = 14. Respondents could select multiple answers.

The results for Question 2, shown in Table 4-3, indicate that two responding MPOs use FYG for all types of pedestrian signs, while five responding MPOs use FYG for only certain types of pedestrian signs.

Table 4-3. MPO survey results for types of pedestrian signs with FYG (Question 2).

Response	Count
All types of pedestrian signs	2
Only some types of pedestrian signs	5
Total	**7**

Note: Total number of respondents who viewed the question = 7.

The results for Question 3, regarding the extent of implementation of FYG for pedestrian signs, show significant variation among responding MPOs, as seen in Table 4-4. Most often, MPOs implement FYG signs for pedestrians on a project basis and incorporate them into routine maintenance, followed by systemwide implementation. The options of corridors, geographical regions, and public requests were each noted only once by a responding MPO. Other text responses indicated the use of FYG signs for pedestrians at school zone crossings and in areas with higher pedestrian/bicyclist traffic.

Table 4-4. MPO survey results for extent of implementation of FYG for pedestrian signs (Question 3).

Response	Count
Systemwide	2
Project basis	3
Corridors	1
Geographical regions	1
Incorporated into routine maintenance (e.g., life cycle replacement, damaged signs)	3
As requested by the public	1
Other	3
Total responses	**7**

Notes: Total number of respondents who viewed the question = 7. Respondents could select multiple answers.

Question 4 asked MPOs what percentage of pedestrian signs under their jurisdiction are FYG. The results, shown in Table 4-5, indicate a wide range of responses. Three responding MPOs reported that 25 percent or less of their pedestrian signs are FYG, three reported 51-75 percent, and one MPO reported more than 76 percent of their pedestrian signs are FYG.

Table 4-5. MPO survey results for percentage of FYG signs for pedestrians (Question 4).

Response	Count
76 percent to 100 percent	1
51 percent to 75 percent	3
26 percent to 50 percent	0
0 percent to 25 percent	3
Total	**7**

Note: Total number of respondents who viewed the question = 7.

The results for Question 5, shown in Table 4-6, indicate the basis for switching to FYG for pedestrian signs. Responding MPOs primarily switched to FYG as part of a pedestrian safety initiative, implemented along with other countermeasures, followed by engineering judgement. None of the responding MPOs indicated that they switched to FYG based on input from local agencies, pedestrian advocacy groups, or a safety evaluation study. Another reason provided by two MPOs for switching to FYG was to comply with MUTCD requirements.

Table 4-6. MPO survey results for basis for switching to FYG for pedestrian signs (Question 5).

Response	Count
Engineering judgement	4
Implemented along with other countermeasures as part of a pedestrian safety initiative	6
Input from local agencies	0
Input from pedestrian advocacy groups	0
Safety evaluation study	0
Other	2
Unsure	2
Total responses	**7**

Notes: Total number of respondents who viewed the question = 7. Respondents could select multiple answers.

Question 6 asked MPOs about the safety performance of FYG compared to yellow and FY. As shown in Table 4-7, six responding MPOs are unsure of the safety performance of FYG versus yellow and FY. Only one responding MPO indicated that FYG has provided better safety performance than yellow or FY for pedestrian signs, based on driver compliance.

Table 4-7. MPO survey results for safety performance of FYG versus yellow or FY for pedestrian signs (Question 6).

Response	Count
Fluorescent yellow-green has provided better safety performance than yellow or fluorescent yellow for pedestrian signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)	0
Fluorescent yellow-green has provided better safety performance than yellow or fluorescent yellow for pedestrian signs based on other factors	1
Fluorescent yellow-green has provided similar safety performance to yellow or fluorescent yellow for pedestrian signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)	0
Fluorescent yellow-green has provided similar safety performance to yellow or fluorescent yellow for pedestrian signs based on other factors	0
Other	0
Unsure	6
Total	**7**

Note: Total number of respondents who viewed the question = 7.

Questions 7 and 8 inquired about evaluation and research studies related to the use of FYG for pedestrian signs. In response to Question 7, none of the seven MPOs that use FYG for pedestrian signs indicated that they have conducted any evaluation studies to assess the safety performance of FYG signs. For Question 8, three responding MPOs noted that they are aware of research studies evaluating the safety performance of FYG signs for pedestrians. One MPO cited

the FHWA report on the conspicuity of signs (Inman et al. 2013), while another mentioned the FHWA pilot study with the National Park Service (Kittle 2000).

Question 9 sought information regarding other pedestrian safety countermeasures used by MPOs. As shown in Table 4-8, responding MPOs have implemented a wide range of additional pedestrian safety countermeasures. The most common measures include high visibility crosswalks, RRFBs, in-roadway "Yield to Pedestrian" signs, and raised medians and median islands.

Table 4-8. MPO survey results for use of other pedestrian safety countermeasures (Question 9).

Response	Count
Fluorescent yellow-green reflective strips on sign U-posts	2
High visibility crosswalks	7
Raised crosswalks	4
Overhead crosswalk lighting	4
In-roadway "Yield to Pedestrian" signs	5
Advance stop/yield bar and signs	2
Leading pedestrian interval (LPI)	4
Pedestrian countdown timers	5
PHB/HAWK	4
Raised medians and median islands	5
RRFB	6
Increasing traffic enforcement	2
Speed limit reduction	4
Other	0
None of the Above	0
Total responses	**7**

Notes: Total number of respondents who viewed the question = 7. Respondents could select multiple answers.

The results for Question 10, shown in Table 4-9, indicate that the most cited challenges faced by responding MPOs in implementing FYG for pedestrian signs include the need for standards or policies for use, cost, maintenance considerations, stakeholder coordination, and the time and effort required to replace signs.

Table 4-9. MPO survey results for challenges faced in the implementation of FYG for pedestrian signs (Question 10).

Response	Count
Cost	2
Lack of agency buy-in	0
Maintenance considerations	2
Need for performance data	0
Need for standards or policies for use	3
Need to prioritize with other pedestrian safety countermeasures	1
Stakeholder coordination	2
Time and effort to replace signs	2
Other	1
None of the above	0
Total responses	**6**

Notes: Total number of respondents who viewed the question = 7. Respondents could select multiple answers.

Question 11 of the survey was directed at MPOs that do not use FYG for pedestrian signs, asking them for the reasons behind their decision. The results, shown in Table 4-10, indicate that the most frequently cited reasons are the cost and the time and effort required to replace existing signs, followed by a lack of information on the benefits.

Table 4-10. MPO survey results for reasons FYG is not used for pedestrian signs (Question 11).

Response	Count
Cost	3
Lack of agency buy-in	0
Lack of information on benefits	2
Maintenance considerations	1
Need for standards or policies for use	1
Other pedestrian safety initiatives are a higher priority	0
Time and effort to replace existing signs	3
Other	0
Unsure	1
Total responses	**6**

Notes: Total number of respondents who viewed the question = 7. Respondents could select multiple answers.

4.2.2 MPO Survey Results for Bicyclist Signs

The results for Question 12, regarding colors used for bicyclist signs, are shown in Table 4-11. Four responding MPOs use FYG for bicyclist signs to some extent. The most prevalent color is yellow, used by nine responding MPOs.

Table 4-11. MPO survey results for colors used for bicyclist signs (Question 12).

Response	Count	Percent
Yellow	9	64%
Fluorescent yellow	7	50%
Fluorescent yellow-green	4	29%
Total responses	**13**	**93%**

Notes: Total number of respondents who viewed the question = 14. Respondents could select multiple answers.

The results for Question 13, shown in Table 4-12, indicate that one responding MPO uses FYG for all types of bicyclist signs. Text responses mentioned the use of FYG for warning signs and as required by MUTCD.

Table 4-12. MPO survey results for types of bicyclist signs with FYG (Question 13).

Response	Count
All types of bicyclist signs	1
Only some types of bicyclist signs (please describe)	3
Total	**4**

Note: Total number of respondents who viewed the question = 4.

As shown by the results for Question 14 in Table 4-13, the extent of implementation of FYG for bicyclist signs varies among responding MPOs. Two MPOs implement FYG signs for bicyclists systemwide, one uses them on a project basis, and another incorporates FYG signs for bicyclists into routine maintenance.

Table 4-13. MPO survey results for extent of implementation of FYG for bicyclist signs (Question 14).

Response	Count
Systemwide	2
Project basis	1
Corridors	0
Geographical regions	0
Incorporated into routine maintenance (e.g., life cycle replacement, damaged signs)	1
As requested by the public	0
Other	0
Total responses	**3**

Notes: Total number of respondents who viewed the question = 4. Respondents could select multiple answers.

Question 15 asked MPOs what percentage of the bicyclist signs under their jurisdiction are FYG, and the results are shown in Table 4-14. The results indicate that one responding MPO has FYG for 76 percent or more of bicyclist signs, while two responding MPOs have FYG for 51 to 75 percent of bicyclist signs.

Table 4-14. MPO survey results for percentage of FYG signs for bicyclists (Question 15).

Response	Count
76 percent to 100 percent	1
51 percent to 75 percent	0
26 percent to 50 percent	2
0 percent to 25 percent	0
Total	**3**

Note: Total number of respondents who viewed the question = 4.

As shown by the results for Question 16 in Table 4-15, responding MPOs have switched to FYG for bicyclist signs mainly based on implementation along with other countermeasures as part of a bicyclist safety initiative, followed by engineering judgement. Another reason mentioned in the text responses is to comply with MUTCD.

Table 4-15. MPO survey results for basis for switching to FYG for bicyclist signs (Question 16).

Response	Count
Engineering judgement	1
Implemented along with other countermeasures as part of a pedestrian safety initiative	2
Input from local agencies	0
Input from pedestrian advocacy groups	0
Safety evaluation study (please describe and provide study link)	0
Other	1
Unsure	0
Total responses	**3**

Notes: Total number of respondents who viewed the question = 4. Respondents could select multiple answers.

Question 17 asked MPOs about the safety performance of FYG compared to yellow and FY. As shown in Table 4-16, one responding MPO indicated that FYG has provided better safety performance than yellow and FY for bicyclist signs based on performance measures, while two responding MPOs are unsure about the safety performance of FYG compared to yellow and FY for bicyclist signs.

Table 4-16. MPO survey results for safety performance of FYG versus yellow or FY for bicyclist signs (Question 17).

Response	Count
Fluorescent yellow-green has provided better safety performance than yellow or fluorescent yellow for bicyclist signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)	1
Fluorescent yellow-green has provided better safety performance than yellow or fluorescent yellow for bicyclist signs based on other factors	0
Fluorescent yellow-green has provided similar safety performance to yellow or fluorescent yellow for bicyclist signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)	0
Fluorescent yellow-green has provided similar safety performance to yellow or fluorescent yellow for bicyclist signs based on other factors	0
Other	0
Unsure	2
Total	**3**

Note: Total number of respondents who viewed the question = 4.

Questions 18 and 19 asked about research studies related to the use of FYG for bicyclist signs. In response to Question 18, none of the three responding MPOs that use FYG for bicyclist signs indicated that they have performed any research studies to evaluate the safety performance of FYG signs for bicyclists. For Question 19, none of the three responding MPOs that use FYG for bicyclist signs noted that they are aware of any research studies to evaluate the safety performance of bicyclist signs with FYG color.

Question 20 sought information regarding other bicyclist safety countermeasures used by MPOs. As shown in Table 4-17, responding MPOs have implemented a wide range of other bicyclist safety countermeasures, most often bicycle lanes/paths, pavement markings improvements, bicycle-activated signal detection, and bicycle path intersection treatments.

Table 4-17. MPO survey results for use of other bicyclist safety countermeasures (Question 20).

Response	Count
Bicycle-activated signal detection	3
Bicycle boulevards	2
Bicycle lanes/paths (e.g., separate, shared use)	3
Bicycle path intersection treatments	3
Bicycle signals	1
Bicycle helmet laws	1
Bicyclist education	2
Fluorescent yellow-green reflective strips on sign U-posts	2
Lane narrowing	2
Overhead lighting	1
Pavement marking improvement	3
Advance stop/yield bar and signs	1
PHB/HAWK	2
Raised medians and median islands	2
RRFB	2
Increasing traffic enforcement	1
Speed limit reduction	1
Other	1
None of the above	0
Total responses	**4**

Notes: Total number of respondents who viewed the question = 4. Respondents could select multiple answers.

The results for Question 21, provided in Table 4-18, show that the cited challenges faced by one responding MPO in the implementation of FYG for bicyclist signs are the need for standards or policies for use and stakeholder coordination.

Table 4-18. MPO survey results for challenges faced in the implementation of FYG for bicyclist signs (Question 21).

Response	Count
Cost	0
Lack of agency buy-in	0
Maintenance considerations	0
Need for performance data	0
Need for standards or policies for use	1
Need to prioritize with other bicyclist safety countermeasures	0
Stakeholder coordination	1
Time and effort to replace signs	0
Other	0
None of the above	0
Number of responses	**1**

Notes: Total number of respondents who viewed the question = 4. Respondents could select multiple answers.

Question 22 of the survey was shown to MPOs that do not use FYG for bicyclist signs and asked them for the reasons they do not utilize FYG for bicyclist signs. The results, provided in Table 4-19, show the most cited reasons are cost, lack of information on benefits, maintenance considerations, time, and effort to replace existing signs.

Table 4-19. MPO survey results for reasons FYG is not used for bicyclist signs (Question 22).

Response	Count
Cost	3
Lack of agency buy-in	1
Lack of information on benefits	3
Maintenance considerations	3
Need for standards or policies for use	2
Other bicyclist safety initiatives are a higher priority (please briefly describe other initiatives)	1
Time and effort to replace existing signs	3
Other	0
Unsure	3
Number of responses	**9**

Notes: Total number of respondents who viewed the question = 10. Respondents could select multiple answers.

4.2.3 MPO Survey Results for General Comments and Policy Considerations

Questions 23 through 25 covered general comments and policy considerations and were shown to all survey respondents. In response to Question 23, one responding MPO indicated that one local agency in its jurisdiction may make any changes to its existing policies or practices for pedestrian and bicyclist signage with the finalization of a crosswalk marking guide. In response to Question 24, six responding MPOs indicated a willingness to participate in a follow-up interview to further discuss practices for signage for bicyclists and pedestrians.

Question 25 provided responding MPOs with an opportunity to give general comments regarding signage for bicyclists and pedestrians. One comment noted various reasons for local agencies not switching to FYG for signs for bicyclists and pedestrians, such as lack of information on benefits, cost, time and effort to replace signs, low number of pedestrian and bicyclist signs, and a need for standards or policies. A full list of comments submitted is provided in Appendix E.

4.3 Summary of MPO Survey Findings

A summary of key findings from the MPO survey is provided below.

4.3.1 Summary of MPO Survey Findings for Pedestrian Signs

- Seven responding MPOs use FYG to some extent for pedestrian signs. Two responding MPOs use FYG for all types of pedestrian signs, while five use FYG for only certain types of pedestrian signs.
- Implementation varies, with some responding MPOs using FYG on a project basis, others incorporating it into routine maintenance, and a few applying it systemwide.
- There is a wide range in the percentage of FYG signs, with three responding MPOs reporting 25% or less, three reporting 51% to 75%, and one MPO reporting more than 76%.
- Responding MPOs primarily switched to FYG as part of pedestrian safety initiatives, along with other countermeasures, and based on engineering judgement.
- The majority of responding MPOs are unsure about the safety performance of FYG compared to yellow and FY, with only one MPO noting better performance based on driver compliance.
- None of the responding MPOs using FYG for pedestrian signs have conducted evaluation studies, but some are aware of external research studies on FYG signs.
- Common challenges include the need for standards or policies, cost, maintenance considerations, stakeholder coordination, and the time and effort required to replace signs.
- Responding MPOs also use other pedestrian safety countermeasures such as high visibility crosswalks, RRFBs, in-roadway "Yield to Pedestrian" signs, raised medians, and other measures to enhance pedestrian safety.

4.3.2 Summary of MPO Survey Findings for Bicyclist Signs

- Four responding MPOs use FYG for bicyclist signs to some extent, with yellow being the most prevalent color used by nine responding MPOs.
- Implementation of FYG for bicyclist signs varies, with two responding MPOs applying it systemwide and others using it on a project basis or incorporating it into routine maintenance.
- One responding MPO reports having FYG for 76% or more of bicyclist signs, and two responding MPOs have FYG for 51% to 75% of bicyclist signs.
- Responding MPOs switched to FYG mainly as part of bicyclist safety initiatives and based on engineering judgement.
- One responding MPO reported better safety performance of FYG based on performance measures, while others are unsure about the safety performance compared to yellow and FY.
- None of the responding MPOs using FYG for bicyclist signs have performed research studies to evaluate its safety performance.
- Challenges include the need for standards or policies and stakeholder coordination.
- Responding MPOs use various other bicyclist safety countermeasures, including bicycle lanes/paths, pavement marking improvements, bicycle-activated signal detection, and intersection treatments.

5. Agency Interviews

This chapter provides an overview of the methodology and results for the agency interviews.

5.1 Methodology for Agency Interviews

The research team conducted interviews with five state DOTs and three MPOs regarding their practices for using FYG for signage for bicyclists and pedestrians. A list of agencies that were interviewed is provided in Table 5-1. This list was developed in consultation with the TAC. Criteria for selection included diversity with respect to geography, use of FYG, experience with safety performance of FYG, and willingness to participate in an interview (28 DOTs, six MPOs). Example interview questions are provided in Appendix F. In addition to the eight interviews, the City of Columbia, Missouri responded to the interview questions in writing.

Table 5-1. Agencies that participated in interviews.

Agency	Colors for Pedestrian Signs*	Colors for Bicyclist Signs*	Notes
Massachusetts DOT (MassDOT)	FYG	FYG, yellow	Noted better safety performance with FYG in survey
Minnesota DOT (MnDOT)	FYG, yellow, FY	FYG	Noted similar safety performance with FYG in survey
North Carolina DOT (NCDOT)	FYG	FYG	Extensive experience (over 20 years) with FYG
Ohio DOT (ODOT)	FYG	FYG	Extensive experience (over 20 years) with FYG
Utah DOT (UDOT)	FY	FY	Use of FY
Denver Regional Council of Governments	FYG, yellow	-	Use of FYG for school zones and RRFB locations
Ozarks Transportation Organization	FYG, yellow, FY	FYG, yellow	Noted better safety performance with FYG in survey
Santa Fe MPO	Yellow, FYG	-	Use of yellow, transition to FYG

* As provided in survey response.

5.2 Results for DOT Interviews

5.2.1 Massachusetts DOT

The Massachusetts Department of Transportation (MassDOT) mandates the use of FYG signs for pedestrian areas and school zones statewide to enhance pedestrian safety. However, FYG signs are not required for bicycle facilities. The recent release of the 2023 MUTCD has prompted an ongoing review and update of MassDOT's practices to align with the latest standards.

Before the adoption of FYG, yellow was the standard color for pedestrian and bicyclist signs. The transition to FYG was driven by research and safety considerations, particularly for VRUs. Past reports from the Transportation Research Board and the National Cooperative Highway Research Program have highlighted the benefits of improving sign visibility through upgraded sheeting. The decision was also influenced by the cost-effectiveness of FYG signs as a low-cost safety improvement. In addition to FYG signs, MassDOT implements various safety measures such as pedestrian countdown timers, RRFBs, and PHBs. Initial observations suggest that FYG sign has contributed to better safety outcomes, though these improvements may result from the combined impact of multiple safety countermeasures. More detailed data is needed to evaluate the specific safety performance of FYG signs.

MassDOT manages a significant number of pedestrian and bicyclist signs. The replacement frequency of signs varies depending on their condition and environmental exposure. Sign replacement occurs through planned projects, spot projects, and on-call sign maintenance contracts. Funding programs, such as the MassDOT Chapter 90 Program, provide financial support to cities and towns for construction projects, promoting the adoption of MassDOT standards, including the use of FYG signs.

5.2.2 Minnesota DOT

The Minnesota Department of Transportation (MnDOT) has its own state MUTCD (Minnesota DOT 2024) and follows the national MUTCD (FHWA 2023) regarding sign color for pedestrian and bicyclist signs, with required use of FYG for school signs and optional use of FYG for pedestrian and bicyclist signs. MnDOT estimates that 95 percent of the pedestrian and bicyclist signs under its jurisdiction are FYG. The decision to use FYG at a specific location is typically based on engineering judgement and input from stakeholders. MnDOT maintains consistency with the sign color in the same area. FYG is generally utilized more frequently in urban areas in Minnesota, and local agencies often follow the MnDOT guidance regarding sign color.

As noted in MnDOT’s handbook on sign management and maintenance (Minnesota DOT 2014), the agency has switched to fluorescent sheeting for all warning signs and yellow delineators. MnDOT has not collected data to compare the safety performance of FYG and FY but believes that the color difference from other warning signs helps to improve driver awareness. In MnDOT’s experience, fluorescent colors have lower durability than non-fluorescent colors. A typical full life cycle for a sign in Minnesota is 12 to 15 years, and MnDOT sometimes undertakes sign replacement projects.

Other safety countermeasures for pedestrians and bicyclists that are emphasized by MnDOT include pedestrian signals with countdown timers, crosswalk markings, RRFBs, sidewalks, and trails. MnDOT is not planning to make any future changes to its policy for pedestrian and bicyclist signs as the agency does not see a need to require the use of FYG.

5.2.3 North Carolina DOT

The North Carolina Department of Transportation (NCDOT) has been using FYG for all pedestrian and bicyclist signs since 2000. The change from yellow to FYG was implemented through a policy change (North Carolina DOT 2000). The memorandum describing the policy change also required 30 in by 30 in warning signs for bicyclists and pedestrians to be increased in size to 36 in by 36 in. The color switch was implemented because the Traffic Engineer believed that the FYG color stood out more than yellow. Many local agencies in North Carolina follow NCDOT's policies regarding signage.

NCDOT has not encountered any issues with safety performance or durability of the FYG signs. There may have been some lag in obtaining the new sheeting at the time of the initial transition from yellow to FYG. NCDOT has seen improvements in the quality of the sheeting over the years. Since making the change to FYG, NCDOT has not undertaken any evaluation studies to compare the safety performance of FYG and yellow signs for bicyclists and pedestrians.

NCDOT emphasizes an array of other safety countermeasures for pedestrians and bicyclists including RRFBs, PHBs, crosswalks, pedestrian crossing islands, LPIs, and bicycle lanes or boulevards.

5.2.4 Ohio DOT

The Ohio Department of Transportation (ODOT) expanded its use of FYG beyond school zones over 22 years ago to include pedestrian, bicycle, trail, and playground signs. The Ohio Traffic Engineering Manual, Section 220-7 (2 - Signs | Ohio Department of Transportation) documents the agency's policy for the requirement of FYG for these signs (Ohio DOT 2019). This policy, which is stricter than the Ohio MUTCD, is applied consistently on state routes across each ODOT District. A key factor for expanding the use of FYG was to increase awareness of more VRUs. Existing yellow signs were allowed to remain in place until the end of their effective performance life (15 years). The process to upgrade signs to FYG included a combination of corridor and countywide improvements. This was accomplished through ODOT District maintenance forces as well as sign upgrade contracts. ODOT has approximately 1,600 pedestrian and bicycle signs and 1,120 School Zone (S1-1 series) signs in their asset management system. Systematic sign replacement projects are often contracted out by ODOT Districts. Individual sign replacements, when needed for knockdowns, damage, graffiti, etc. are done in-house.

ODOT has found that the cost difference between yellow and FYG sign sheeting is minimal, and the primary factor is labor. They found that costs could be kept to a minimum by replacing signs through a standard performance life cycle process.

The agency implements a variety of safety countermeasures to improve pedestrian and bicyclist safety. These include high visibility crosswalks which have been institutionalized by the agency and other treatments such as RRFBs, PHBs, LPI, bike lanes, refuge islands, curb bump outs, sidewalk/shared use paths (SUP). The Ohio DOT has also implemented road diets, typically 4 lanes converted to 3-lanes, and has seen a decrease in speed differential post-installation.

5.2.5 Utah DOT

The Utah Department of Transportation (UDOT) only uses FYG signs for school zones and does not anticipate expanding the use of FYG. The reasoning for this is based on a higher potential for crashes involving younger aged pedestrians and bicyclists that may result in fatalities or injuries. UDOT believes that keeping FYG signs to school zones heightens the awareness of motorists in these areas to school age road users. Upgrading signs to FYG would impact 1,100 Pedestrian (W11-2) signs and 400 Bicycle (W11-1) signs. UDOT has an inventory of signs that it has collected using a lidar survey and maintenance staff performs annual visual inspection of these signs. The biggest challenge to implement a full-scale changeover to FYG is cost (material and labor) for installation. The leadership of the Utah DOT would want to see proof of long-term data to support a change to policy.

Utah DOT has implemented RRFBs and PHBs/HAWKs at crosswalks. The location of implementation is based on crash data and sometimes based on other requests. Lighting at crossings, particularly at intersections, and sidewalk improvements are also being implemented. Trail crossing connectivity is a focus. The agency created a Trail Division within the DOT. The Utah DOT continues its ZERO fatality outreach efforts.

5.3 Results for MPO Interviews

5.3.1 City of Columbia, Missouri

The City of Columbia did not respond to the survey questionnaire and instead submitted written responses to the interview questions. The City of Columbia installed FYG in school zones and has started to install FYG pedestrian and bicycle signs outside of school zones. This is to make the signs stand out more. Prior to switching to FYG, the City used FY signs. They make their signs in-house, and with an inventory of approximately 300-400 signs, the replacement of signs occurs through attrition. Generally, the City of Columbia replaces their signs within 10 years. The durability between the two types of sign sheeting is similar, based on their experience.

5.3.2 Denver Regional Council of Governments

The Denver Regional Council of Governments (DRCOG) encourages member governments to consider their unique needs and conditions as they may use FYG signage for pedestrians and bicyclists, providing high-level guidance without a specific endorsement. This flexibility allows local agencies within DRCOG's planning area to implement FYG signs according to their unique needs and conditions, considering factors such as urban/suburban settings, pedestrian and cyclist volume, facility types, network role, and injury data. For example, urban areas like the City of Boulder utilize FYG signs more extensively for both pedestrian and bicyclist use, whereas

suburban communities like Lakewood closely adhere to MUTCD guidelines, reserving FYG signs primarily for pedestrian use. The City and County of Denver developed Uncontrolled Pedestrian Crossing Guidelines, and FYG signs are preferred for all new installations.

Before the adoption of FYG, yellow was the standard color for pedestrian and bicyclist signs. The transition to FYG signage has been driven by its enhanced visibility and engineering judgement, with the new MUTCD prompting some updated practices. Alongside FYG signs, other safety measures, such as RRFBs and pedestrian countdown timers, are being implemented to improve safety for pedestrians and bicyclists. Looking ahead, DRCOG plans to make further adjustments based on evaluations and feedback related to FYG signage to enhance pedestrian and bicyclist safety.

5.3.3 Ozarks Transportation Organization

The Ozarks Transportation Organization (OTO) represents Christian and Greene Counties and the cities of Battlefield, Nixa, Ozark, Republic, Springfield, Strafford, and Willard in Missouri. The interview included a representative from the OTO and the City of Springfield, who has been the most active with implementing FYG signs beyond school zones.

The City of Republic has primarily implemented yellow and typically only used FY and FYG near or adjacent to schools. The City of Nixa is switching to FYG for pedestrian signs beyond school zones and has installation completed for approximately 75% to 100% of their signs.

The City of Springfield began implementing FYG once it was allowed by the MUTCD and has upgraded all of their signs on their network. Similar to the Santa Fe MPO, the City of Springfield noted that in the urban environment, the standard yellow sign blends in with other signs and the surroundings (see Figure 5-1). The City of Springfield indicated that the FYG signs stand out to motorists, increase their expectation of pedestrians and bicyclists, and increase motorists' compliance of yielding to pedestrians at crossings.

Figure 5-1. City of Springfield (Missouri) and FYG in urban environment (Source: City of Springfield).

A recent compliance study performed by the City of Springfield indicated that motorists' compliance to yielding to pedestrians went from 3.80% when no crosswalk was present, to 26.87% when FY was used, and to 35.10% when FYG was used (see Table 5-2).

Table 5-2. City of Springfield, FYG compliance results for Kimbrough and Bennett intersection (Source: City of Springfield).

Kimbrough at Bennett	Date	Time	Compliance
No crosswalk	2/28/2023	11:46am	3.80%
Installed FY signs	3/24/2024	-	-
FY Compliance study	4/25/2023	10:54am	26.87%
Neon Yellow sign installed	5/1/23	-	-
Neon Yellow Compliance study	6/7/2023	10:40am	35.10%

The City of Springfield has used these compliance results to support safety messaging campaigns (See Figure 5-2) and to further communicate the need for motorists to yield to pedestrians. The City of Springfield recommends a shorter timeframe with respect to switching

over to FYG as it brings multiple benefits. These include 1) motorists seeing change quickly which can increase awareness of pedestrians and bicyclists, 2) motorist compliance should increase, especially when combined with education and enforcement campaigns, 3) agencies can use this as an opportunity to promote pedestrian safety efforts and 4) provides uniformity for signs for pedestrians and bicyclists. The City of Springfield has approximately 1,000 FYG pedestrian and bicycle signs and noted that the FYG signs are replaced every 12-15 years except for those facing south which are replaced approximately every 10 years. The City of Nixa indicated that maintenance consideration, time, and effort to replace signs are a challenge for pedestrian signs, but they have implemented FYG with other pedestrian safety countermeasures when possible. Cost, time, and effort to install bicycle signs are a challenge for the City of Nixa. The City of Ozark stated that lack of information on the benefits of FYG is the reason for not installing signs. The City of Republic stated cost considerations and time and effort to replace signs.

Figure 5-2. Safety messaging, City of Springfield (Missouri) (Source: City of Springfield).

The City of Springfield has developed and implemented their SGF Yields program, which is a pedestrian safety initiative that focuses on training drivers to recognize crosswalks and yield to pedestrians. Other Missouri communities are interested in the generic version of SGF Yields, Safe Across. The program combines specialty signs and safety messaging with the goal to increase and normalize driver compliance at crosswalks and promote courteous driving behavior. The City of Springfield uses signs with the FYG background to help drivers become sensitive to the crosswalk signs. Since the start of the program in 2017, driver compliance has increased from 25% to 60% in the 2nd quarter of 2024. Other pedestrian safety initiatives include RRFB, raised crosswalks, in-road temporary pedestrian signs, high visibility crosswalks, and contrast striping on concrete pavement. They are treating uncontrolled intersections as mid-block crossings, adding signage, markings, RRFB and/or PHB (HAWK). They are adding an extra set of LED indicators, above and below the sign panel, as part of the RRFB. In its efforts to continue to improve pedestrian safety, the City of Springfield is working on a Crosswalk Design Guide which will include pushing yield markings back at higher speed limit roads and potentially adding continental stripes at all crossings where pedestrian heads are installed.

5.3.4 Santa Fe MPO

The Santa Fe MPO includes the City of Santa Fe and parts of Santa Fe County in New Mexico. The MPO and the City collaborate on the planning, design, maintenance, and operations of roadways with a particular focus on safety. The City of Santa Fe has an extensive transportation network for pedestrians and bicyclists. The New Mexico DOT allows the use of FYG beyond school zones. Because of the high pedestrian and bicycle presence and infrastructure across the network, the City of Santa Fe has expanded the use of FYG beyond school zones. One key reason is that the standard yellow sign becomes "muted" in urban environments with other signs and surrounding infrastructure. The City of Santa Fe is currently replacing any existing pedestrian/school signs with FYG based on the MUTCD 11th Edition (FHWA 2023) (see Figure 5-3) as resources allow. The City of Santa Fe has upgraded over 1,500 signs in three months this year and prioritizes replacement based on location or requests. Staffing and funding have limited the ability to advance implementation of FYG and many other pedestrian and bicycle safety initiatives.

Section 1D.05 Color Code

Support:

01 The following color code establishes general meanings for 11 colors of a total of 13 colors that have been identified as being appropriate for use in conveying traffic control information.

Standard:

02 **The general meaning of the 13 colors shall be as follows:**

- **A. Black—regulation**
- **B. Blue—road-user services guidance, tourist information, and evacuation route**
- **C. Brown—recreational and cultural interest area guidance**
- **D. Coral—reserved for future designation (see Paragraph 4 of this Section)**
- **E. Fluorescent Pink—incident management**
- **F. Fluorescent Yellow-Green—pedestrian warning, bicycle warning, playground warning, school bus warning, and school warning**
- **G. Green—indicated movements or actions permitted and direction guidance**
- **H. Light Blue—reserved for future designation (see Paragraph 4 of this Section)**
- **I. Orange—temporary traffic control**
- **J. Purple—restricted to use only by vehicles with registered electronic toll collection (ETC) accounts**
- **K. Red—stop or prohibition**
- **L. White—regulation**
- **M. Yellow—warning**

03 **These colors shall be used only as prescribed for the specific devices or applications throughout this Manual.**

Figure 5-3. MUTCD 11th Edition Section 1D.05 (FHWA 2023).

With the recent completion of the local road safety plan (LRSP), pedestrian and bicycle safety initiatives are a priority. As part its implementation of the LRSP, the City of Santa Fe began using LPI at intersections on its arterials and has seen great success with this pedestrian safety treatment. The Santa Fe MPO has a neighborhood street safety program where they are looking at the public's perception of safety compared to design speed and speed limit. This also includes revisiting their policy on traffic impact studies and the criteria for projected growth to avoid over-design of roads which lends itself to higher vehicle speeds. They are revising the policy to include a requirement to consider safety. They are taking a proactive approach to updating and installing street lighting to address pedestrian safety. In addition to updating and

installing street lighting, the MPO and the City continue to install sidewalks, signs, and bike paths to improve pedestrian safety.

5.4 Summary of Findings from Agency Interviews

A summary of key findings from the agency interviews is provided below.

- Agencies typically switch to FYG based on a belief that the FYG stands out better and helps to improve driver awareness of VRUs (especially in urban areas) and sometimes as part of broader safety initiatives.
- The switch to FYG is often implemented using a phased approach as part of routine maintenance activities.
- Local agencies often follow state guidance regarding sign color.
- Some agencies that have switched to FYG believe that FYG provides better visibility and improved compliance, although formal research studies have not been undertaken.
- Agency experiences regarding durability of FYG signs compared to other colors vary.
- Challenges to implementation of FYG for pedestrian and bicyclist signs include cost (material and labor) for installation and a preference by some agencies to reserve FYG for school zones.

6. Conclusions

This chapter presents the overall conclusions of the research, organized by topic.

6.1 Research Studies and General Guidance Regarding FYG for Pedestrian and Bicyclist Signs

- The 2023 version of the MUTCD requires the use of FYG for warning signs for schools and school buses and allows for the optional use of FYG for signs for pedestrians and bicyclists and for playground signs (FHWA 2023).
- The results from previous research studies are inconclusive and show mixed results regarding the use of FYG for signs for pedestrian and bicyclist signs, and the research may be outdated. While some studies have shown increased stopping, slowing, and legibility distance with the use of FYG compared to standard yellow, other studies have not found any changes in speeds or driving behavior associated with the use of FYG for signs.
- Surveys conducted in prior research have shown some user preference for FYG.
- While previous research suggests benefits to using fluorescent colors, the prior research has not shown that one fluorescent color provides superior safety benefits to other fluorescent colors.
- The literature search did not identify any research studies on FYG signs completed within the past ten years or any studies comparing FYG with FY for pedestrian and bicyclist signs.

6.2 Agency Practices for FYG for Pedestrian and Bicyclist Signs

- A review of the policies and manuals for state DOTs found that 22 DOTs have adopted the MUTCD without modifying the MUTCD's intent on FYG being required for school warning signs and it also being optional for pedestrian, bicycle and playground warning signs.
- Some DOTs have expanded the use of FYG to include signs such as pedestrian, bicyclist, park zones, trail, playground, deaf child, and handicapped.
- Twenty-eight DOTs that responded to the survey indicated that they have developed policies, guidance, and/or standards for pedestrian and bicyclist signage.
- There is a wide range of DOT practices for FYG signs for pedestrians and bicyclists among agencies. Thirty-one responding DOTs use FYG for pedestrian signs to some extent, but only nine responding DOTs require FYG for pedestrian signs. Twenty-six responding DOTs use FYG for bicyclist signs to some extent, but only eight responding DOTs require FYG for bicyclist signs. Seven responding MPOs use FYG to some extent for pedestrian signs, while four responding MPOs use FYG for bicyclist signs.
- Local agencies often follow state guidance regarding sign color.

- The switch to FYG is often implemented using a phased approach as part of routine maintenance activities.
- Responding agencies have primarily switched to FYG for pedestrian and bicyclist signs based on a belief that the FYG color stands out better and helps to improve driver awareness of VRUs (especially in urban areas), followed by implementation along with other countermeasures as part of a pedestrian or bicyclist safety initiative. None of the responding agencies indicated that they switched to FYG based on an internal or external research study.
- Twenty-three responding DOTs switched from yellow to FYG for pedestrian signs, while only five responding DOTs switched from FY to FYG. Nineteen responding DOTs switched from yellow to FYG for bicyclist signs, while only five responding DOTs switched from FY to FYG.
- Responding agencies are generally unsure of the safety performance of FYG versus yellow or FY for pedestrian and bicyclist signs, although a limited number of agencies indicated that FYG has provided better safety performance than yellow or FY based on performance measures.
- None of the responding agencies indicated that they have performed any research studies to evaluate the safety performance of FYG signs for pedestrians and bicyclists.
- Agency experiences regarding durability of FYG signs compared to other colors vary.
- Among the agencies that use FYG for pedestrians and bicyclists, the most cited challenges include the need for standards or policies for use, need for performance data, cost, maintenance considerations, stakeholder coordination, the time and effort required to replace the signs, and the need to prioritize with other pedestrian and bicyclist safety countermeasures.
- Among the responding agencies that do not utilize FYG for pedestrian and bicyclist signs, the most cited reasons for not using FYG are lack of information on benefits, the time and effort to replace signs, the need for standards or policies for use, and a preference to keep FYG reserved for school signs.
- Other safety countermeasures for pedestrians and bicyclists implemented by responding agencies include high visibility crosswalks, RRFBs, pedestrian countdown timers, bicycle lanes/paths, pavement markings improvements, and PHBs/HAWKs.

A tabular survey of key findings for both the MPO and DOT surveys is provided in Table 6-1. Some key findings from this table are summarized below.

- Responding DOTs tend to use FYG more extensively than responding MPOs.
- Responding agencies utilize FYG more for pedestrian signs than for bicyclist signs.
- Most responding agencies that use FYG are unsure of the safety performance of FYG compared to yellow or FY. However, a limited number of agencies indicated better safety performance with FYG.

Table 6-1. Tabular summary of key findings for MPO and DOT surveys.

Description	DOT Survey*	MPO Survey*
Responding agencies that use FYG to some extent **(pedestrian signs)**	69%	50%
Responding agencies that use FYG to some extent **(bicyclist signs)**	58%	29%
Responding agencies indicating better safety performance for FYG (compared to yellow or FY) **(pedestrian signs)**	9%	7%
Responding agencies indicating similar safety performance for FYG (compared to yellow or FY) **(pedestrian signs)**	2%	0%
Responding agencies unsure of safety performance for FYG (compared to yellow or FY) **(pedestrian signs)**	47%	43%
Responding agencies indicating better safety performance for FYG (compared to yellow or FY) **(bicyclist signs)**	2%	7%
Responding agencies indicating similar safety performance for FYG (compared to yellow or FY) **(bicyclist signs)**	2%	0%
Responding agencies unsure of safety performance for FYG (compared to yellow or FY) **(bicyclist signs)**	44%	14%

* All percentages based on total number of responding agencies (45 DOTs, 14 MPOs)

6.3 Summary of Findings

Overall, the results of this study regarding the potential safety benefits of FYG for pedestrian and bicyclist signs are inconclusive. The results from previous research studies show mixed results regarding the safety performance of FYG for pedestrian and bicyclist signs, and the research may be outdated. This research study did not identify any prior research studies on FYG signs completed within the past ten years or any studies comparing FYG with FY for pedestrian and bicyclist signs. In addition, none of the agencies that completed the surveys have completed any research studies on FYG signs for pedestrians and bicyclists. Most agencies are unsure of the safety performance of FYG signs compared to yellow or FY, although a limited number of agencies noted better safety performance with FYG signs. There is a wide range of agency practices for FYG signs for pedestrians and bicyclists. While many agencies utilize FYG for pedestrian and bicyclist signs to some extent, agencies have typically made the switch to FYG based on a belief that the FYG color stands out better and as part of safety initiatives. While a limited number of agencies have seen improved safety performance (e.g., increased yielding compliance) with the use of FYG, the research did not identify significant and conclusive evidence regarding potential safety benefits associated with the use of FYG for pedestrian and bicyclist signs. The research findings suggest a need for additional research into the potential safety benefits of FYG signs for pedestrians and bicyclists.

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Appendix A: Summary of DOT Policies and Standards for Fluorescent Yellow-Green Signs for Pedestrians and Bicyclists

Table A-1. Summary of DOT policies, guidance, and standards regarding fluorescent yellow-green signs for pedestrians and bicyclists.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Alabama	Alabama Department of Transportation Signing Plan Design Guide Alabama DOT 2019-Standard Highway Signs	Alabama DOT 2019 Alabama DOT 2022	Standard Highway Signs: Index 71000 Index No.71051-71052 (SHS-0); 71072 (SHS-11), 71079 (SHS-17	https://www.dot.state.al.us/publications/Design/pdf/SigningPlanDesignGuide.pdf https://alletting.dot.state.al.us/Docs/Standard_Drawings/2024English/71000.pdf	Alabama DOT adopted the MUTCD with a state supplement. State supplement is not available online. There is not any special state guideline regarding fluorescent yellow-green (FYG) signs although the Alabama DOT Highway Design Standards do include both yellow or FYG for the pedestrian (W11-2), bicycle (W11-1), playground (W15-1), handicap (W11-9), and advisory speed plaque (W13-1P) signs. For school zones (S series), only the FYG is provided as an option.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Alaska	2016 Alaska Traffic Manual	Alaska Department of Transportation and Public Facilities 2016	1A.12 Color Code 2A.10 Sign Colors 2B.12 In-Street and Overhead Pedestrian Crossing Signs, 2C.03 Design of Warning Signs 2C.50 Non-Vehicular Warning Signs 7B Traffic Control for School Areas-Signs. 9B.18 Bicycle Warning and Combined Bicycle/ Pedestrian Signs	https://dot.alaska.gov/stwddes/dcstraffic/assets/pdf/atm/current/2016atms_inc.pdf	The 2016 Alaska Traffic Manual includes the MUTCD, 2009 Edition and the 2016 Alaska Traffic Manual Supplement. According to the Alaska Traffic Manual, FYG may only be used for bicyclist and pedestrian signs that are located within designated school zones. SCHOOL BUS STOP AHEAD (S3-1 or S3-100) signs may have either a yellow or FYG background.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Arizona	Arizona Supplement to the 2003 Manual on Uniform Traffic Control Devices, Sept 1, 2004	Arizona DOT 2004	Section 2B.12 Section 7B.07	https://azdot.gov/sites/default/files/2019/05/arizona-supplement-to-the-manual-on-uniform-traffic-control-devices-%282003-mutcd-edition%29_1.pdf	Arizona DOT adopted the MUTCD with a state supplement. Arizona allows the optional use of FYG for pedestrian signs with no restrictions or approval process. The In-Street Pedestrian Crossing sign shall have a black legend (except for the red STOP or YIELD sign symbols) and border on either a white and/or FYG background. All school warning signs in addition to a list of defined signs may have a FYG background with a black legend and border.
Arkansas	Arkansas 2014 Standard Specification for Highway Construction	Arkansas DOT 2014	Section 723.02	https://www.ardot.gov/wp-content/uploads/2020/10/Division-700.pdf	Arkansas adopted the MUTCD. There is not a state supplement nor any special state guideline regarding FYG. The Standard Specifications refer to MUTCD for color of signs.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
California	California MUTCD	California DOT 2024	Section 1A.12 Section 2B.12 Section 2C.03 Section 2C.49 Section 2C.50 Section 7B.07 Section 9B.18	https://dot.ca.gov/programs/safety-programs/camutcd/pubs	California has a state MUTCD, which adopted MUTCD. In addition to using FYG for school signs, California allows for the optional use of FYG for pedestrian signs and bicyclist signs for only specific conditions and/or with approval. The In-Street Pedestrian Crossing sign shall have a black legend (except for the red STOP or YIELD sign symbols) and border on a white background, surrounded by an outer yellow or FYG background area. The Overhead Pedestrian Crossing sign shall have a black legend and border on a yellow or FYG background at the top of the sign and a black legend and border on a white background at the bottom of the sign. Warning signs associated with pedestrians, bicyclists, and playgrounds may have a black legend and border on a yellow or FYG background.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Colorado	Colorado's Supplement to the MUTCD Standard Highway Signs Colorado DOT Roadway Design Guide 2023	Colorado DOT 2022 Colorado DOT 2023	n/a	https://www.codot.gov/safety/traffic-safety/design/signing-and-markings https://www.codot.gov/business/designsupport/bulletins_manuals/cdot-roadway-design-guide-2023/cdot-roadway-design-guide-2023.pdf	Colorado DOT adopted the MUTCD with a state supplement which amends 7C.03 to add "If used, the SCHOOL word marking may include a fluorescent yellow-green background for one approach lane". Colorado DOT Roadway Design Guide states “To maintain the systematic use of the FYG background for pedestrian, bicycle, and school warning signs in a jurisdiction, the fluorescent yellow-green background for pedestrian, bicycle, and school warning signs may be used in Temporary Traffic Control zones.” However, no special state guideline was found regarding when to use FYG signs.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Connecticut	Connecticut DOT Sign Catalog	Connecticut DOT 2021	40 Series-Warning Signs	https://portal.ct.gov/dot/traffic-engineering/catalog-of-signs https://portal.ct.gov/-/media/dot/documents/dtrafficdesign/signcatalogpdf.pdf https://portal.ct.gov/-/media/dot/documents/dtrafficdesign/signingguidelinespdf.pdf	The Connecticut DOT follows guidelines aligned with the national MUTCD regarding the use of FYG signs. Connecticut DOT requires using FYG signs for school, pedestrian, and bicycle warning signs on State roads. The Connecticut DOT Sign Catalog identifies FY for pedestrian (W11-2) signs on local roads (catalog number 41-4810 and 41-4811). It refers to catalog numbers 41-4829 and 41-4830 for state roads, which indicates FYG as the background color. 41-4601 and 41-4607 are FYG for Deaf Pedestrian Area/Deaf Child Area.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Delaware	Delaware Manual on Uniform Traffic Control Devices Delaware MUTCD Part 2 Signs Training Delaware Standard Highway Signs	Delaware DOT 2018a Delaware DOT 2011 Delaware DOT 2018b	MUTCD: Section 2B.12 Section 2C.03 Section 2C.49 Section 2C.56 Section 7B.07 Section 9B.18 Training: Slide 93	https://deldot.gov/Publications/manuals/de_mutcd/index.shtml https://regulations.delaware.gov/AdminCode/title2/2000/2400/2402.shtml https://deldot.gov/Publications/manuals/de_mutcd/pdfs/draft/DEMUTCD_Part2_T2_training_021011.pdf?cache=1721166162605 https://deldot.gov/Publications/manuals/de_mutcd/pdfs/DELAWARE-SIGN-BOOK-2018-EDITION.pdf	The Delaware DOT adopted the MUTCD with a state supplement. The Delaware Standard Highway Signs manual is used in combination with the 2018 Delaware MUTCD. The Standard Highway Signs manual provides detailed drawings of Delaware specific signs and outlines minimum retroreflective material requirements. In addition to using FYG for school signs, Delaware DOT allows the optional use of FYG for pedestrian, playground and bicycle crossings. In general, the DOT has reserved FYG for in-street pedestrian signs and pedestrian signs in beach areas as noted in their training material.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
District of Columbia	District of Columbia Department of Transportation (DDOT) Design and Engineering Manual	District DOT 2023	Chapter 44 Guidelines for Pavement Markings and Signage (Section 44.13 Traffic Signs)	https://ddotwiki.atlassian.net/wiki/spaces/COM/pages/2069271070/Standards+and+Manuals?preview=/2069271070/2381381633/DEM-2023-12_DDOT_DEM%20-%20Copy.pdf#StandardsandManuals-DesignandEngineeringManual	District DOT adopted the MUTCD. No State supplement. The District DOT Design and Engineering Manual describes the Department's procedures and standards for preparing project construction documents. Chapter 44.13 provides guidelines for the traffic engineer to determine the type and location of traffic control signs. This policy states that the sheeting for all School Zone (S1-1) crossing signs and sheeting for all mid-block Pedestrian and Advanced Pedestrian crossing (W11-2) signs must be Fluorescent High-Performance Lime Green –Diamond Grade.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Florida	Highway Signing Program Florida's Highway Sign Library	Florida DOT 2022a Florida DOT 2022b	n/a	https://www.fdot.gov/traffic/TrafficServices/FAQ-signing.shtm https://www.fdot.gov/traffic/trafficservices/signlibrary/listing.shtm	Florida DOT adopted the MUTCD along with state-specific supplements and standards. Florida DOT has specific guidelines for the use of FYG signs which are primarily applied to signs used in school zones and for pedestrian and bicycle warnings due to their enhanced visibility. Florida DOT mandates the use of FYG sheeting for certain signs like school advance signs (S1-1) and supplemental panels. The guidelines also specify not to mix these FYG signs with standard yellow retroreflective sheeting to maintain consistency and visibility.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Georgia	Georgia DOT Signing and Marking Design Guidelines	Georgia DOT 2023	Section 3.5	https://www.dot.ga.gov/PartnerSmart/DesignManuals/smguide/GDOT%20SIGNING%20AND%20MARKING%20DESIGN%20GUIDELINES.pdf	Georgia DOT adopted MUTCD with a state supplement. Specific guidelines for the use of FYG signs state: "All school zone signs (S1-1, S2-1, S3-1, S4-3, S4-5 and the top portion of S5-1) and pedestrian crossing signs (W11-2) shall have Type 11 (very high intensity) fluorescent yellow-green (FYG) reflective sheeting backgrounds."
Hawaii	n/a	n/a	n/a	n/a	Hawaii DOT adopted the MUTCD. No State supplement is available online. No special state guideline regarding FYG.
Idaho	Traffic Manual: Idaho Supplementary Guidance to the MUTCD	Idaho Transportation Department 2020	n/a	https://apps.itd.idaho.gov/apps/manuals/Traffic_Manual.pdf	Idaho Transportation Department adopted the MUTCD with a state supplement. No special state guideline regarding FYG.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Illinois	Illinois Supplement to the Manual on Uniform Traffic Control Devices, Revision 3	Illinois DOT 2021	Part 2, Chapter 2C, Park Zone Warning Signs Part 7, Chapter 7B, Traffic Control for School Areas, Signs	https://public.powerdms.com/IDOT/documents/2010838/Illinois%20Supplement%20to%20the%20Manual%20on%20Uniform%20Traffic%20Control%20Devices%2C%20Revision%203 https://public.powerdms.com/IDOT/documents/2604168/Illinois%20Supplement%20to%20MUTCD%20Summary%20of%20Changes	The Illinois MUTCD includes the national MUTCD amended by the Illinois Supplement to the MUTCD. Illinois MUTCD has information regarding the use of FYG. It is a standard for school zone entrances, speed Limit signs, and park zone warning signs. Illinois does have a sign fabrication manual, but it is not available online. The DOT has installed FYG signs for pedestrians and included the FYG reflective strip.
Indiana	The 2011 Indiana Manual on Uniform Traffic Control Devices with Revisions 1 & 2 & 3	Indiana DOT 2016	Section 1A.12 Part 2 and Part 7	https://www.in.gov/dot/div/contracts/design/mutcd/2011rev3/2011%20IMUTCD%20with%20Revisions%201%202%20and%203%20-Whole%20Document.pdf	Indiana DOT has a state MUTCD. In addition to using FYG for school signs, Indiana DOT allows the optional use of FYG for pedestrian, playground, and bicycle crossings.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Iowa	Traffic and Safety Manual	Iowa DOT 2022	Chapter 2 - Signing	https://iowadot.gov/traffic/Library/Traffic-and-Safety-Manual https://www.legis.iowa.gov/docs/ACO/rule/761.130.1.pdf	The Iowa DOT currently uses the 2009 MUTCD except for exceptions noted in 761 IAC 130.1. There are no special state guidelines regarding FYG.
Kansas	n/a	n/a	n/a	n/a	Kansas DOT adopted the MUTCD and does not have a supplement. No special state guideline regarding FYG.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Kentucky	Kentucky Traffic Operations Guidance Manual	Kentucky Transportation Cabinet 2021	Page 50, Sheeting	https://transportation.ky.gov/Organizational-Resources/Policy%20Manuals%20Library/Traffic%20Operations.pdf	Kentucky Transportation Cabinet adopted the MUTCD and does not have a supplement. The following signs shall be fabricated using Type XI FYG sheeting: All school and school bus warning signs; Bicycle Warning signs and SHARE THE ROAD plaques or diagonal downward pointing arrow plaques that supplement Bicycle Warning signs; Pedestrian Warning signs and diagonal downward pointing arrow plaques that supplement Pedestrian Warning signs; In-Street Pedestrian Crossing (R1-6) signs and Overhead Pedestrian Crossing (R1-9) signs; and supplemental plaques to any of these signs
Louisiana	MUTCD (Manual on Uniform Traffic Control Devices)	Louisiana Department of Transportation and Development n.d.	n/a	http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Traffic_Engineering/ManualsPublications/Pages/MUTCD.aspx	Louisiana Department of Transportation and Development adopted the MUTCD and does not have a supplement. No document referencing using FYG beyond school zones. The website includes links to MUTCD.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Maine	Traffic Engineering Instruction	Maine DOT 2010	TE-2 Engineering Instruction MUTCD	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.maine.gov%2Fmdot%2Ftraffic%2Fdocs%2Fei%2FTE2-Engineering_Instruction.doc&wdOrigin=BROWSELINK	Maine DOT adopted the MUTCD and does not have a state supplement. No document referencing using FYG beyond school zones.
Maryland	Maryland Manual on Uniform Traffic Control Device	Maryland DOT 2023	Section 1A.12	https://www.roads.maryland.gov/mdotsha/pages/Index.aspx?PageId=835	Maryland DOT has a state MUTCD which combined the FHWA MUTCD and Maryland supplement. For State owned, operated, and maintained roadways, FYG is only used for school warning. For other roadways, Maryland DOT allows the optional use of FYG for pedestrian, playground and bicycle crossings.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Massachusetts	The Massachusetts Amendments to the 2009 Manual on Uniform Traffic Control Devices	Massachusetts DOT 2022	Section 2B.12 Section 2B.53 Section 2C.49 Section 6F.13	https://www.mass.gov/doc/massachusetts-amendments-to-the-mutcd-2022/download	MassDOT adopted the MUTCD with a state supplement. FYG is used for pedestrian crosswalk.
Michigan	Michigan MUTCD	Michigan DOT 2022	Part 2 and Part 7	https://mdotjboss.state.mi.us/TSSD/getCategoryDocuments.htm?categoryPrjNumbers=2682785,1403854,1403855&category=MMUTCD	Michigan DOT has a state MUTCD which combines the FHWA MUTCD and Michigan supplement. In addition to using FYG for school signs, Michigan DOT allows the optional use of FYG for pedestrian, playground and bicycle crossings.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Minnesota	Minnesota MUTCD	Minnesota DOT 2024	Part 2, Chapter 2C and Part 7	https://dot.state.mn.us/trafficeng/publ/mutcd/	MnDOT adopted the MUTCD with a state supplement. In addition to using FYG for school signs, MnDOT allows the optional use of FYG for pedestrian, playground, and bicycle crossing (W11-1, W11-15, and W11-15a) signs and supplemental plaques may have FYG backgrounds. The W11-2 and W11-9 signs and their related supplemental plaques may have a FYG background with a black legend and border. Pedestrian and School Crossing signs and their related supplemental plaques may have a FYG background with a black legend and border.
Mississippi	n/a	n/a	n/a	n/a	Mississippi DOT adopted the MUTCD and does not have a state supplement. No document referencing using FYG beyond school zones.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Missouri	Engineering Policy Guide	Missouri DOT 2024	Section 903.6	https://epg.modot.org/index.php/Main_Page	MoDOT adopted the MUTCD with a state supplement. No policy/guideline referencing using FYG beyond school zones.
Montana	Montana DOT Sign Catalog	Montana DOT n.d.	n/a	https://www.mdt.mt.gov/other/webdata/external/maint/signcat/sis_catalog.pdf	Montana DOT adopted the MUTCD. No state supplement. No policy/guideline referencing using FYG beyond school zones.
Nebraska	Nebraska DOT Supplement to the MUTCD 2019	Nebraska DOT 2019	Section 7B.08 Page R-1 Page R-15	https://dot.nebraska.gov/media/j0klgqug/ne-mutcd-2019.pdf	Nebraska DOT adopted the MUTCD with a state supplement. In addition to using FYG for school signs, Nebraska DOT allows the optional use of FYG for pedestrian crossing.
Nevada	Nevada DOT Signing, Striping, And Traffic Control Design Guide Dec 2022 Nevada DOT Standard Plans for Roads and Bridges 2022	Nevada DOT 2022a Nevada DOT 2022b	Guide: Section 4.4.12 Pedestrian and Bicycle Signs Standard Plans: Detail TS-24	https://www.dot.nv.gov/home/showpublisheddocument/20978/638054014494070000 https://www.dot.nv.gov/home/showpublisheddocument/21537/638150725828230000	Nevada DOT adopted the MUTCD with a state supplement. This supplement states that Pedestrian Warning signs should be FYG in color for school zones only and for marked crosswalks.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
New Hampshire	n/a	n/a	n/a	n/a	New Hampshire DOT adopted the MUTCD and does not have a supplement. No policy/guideline referencing using FYG beyond school zones.
New Jersey	New Jersey Pedestrian Safety Action Plan Toolbox 2014	New Jersey DOT 2014	Intersections and Mid-Block crossings	https://www.dvrpc.org/transportation/safety/pdf/nj_pedestriansafetyactionplan-toolbox.pdf	New Jersey adopted the MUTCD and does not have a supplement. No formal design standards exist for the use of FYG. The Pedestrian Safety Action Plan does outline the use of FYG pedestrian signs. The current practice is to use FYG pedestrian and bicycle crossing signs for other signed crossing locations.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
New Mexico	New Mexico DOT Signing and Striping Manual 2008 New Mexico DOT Design Manual	New Mexico DOT 2008 New Mexico DOT 2016	Signing and Striping Manual: Section 2.1.11 Sign Sheeting Requirements, Page 2.1-15, Exhibit 2.1-J Section 2.9 School Signing, Page 2.9-1 Section 2.11 Bicycle and Multi-Use Facility Signing, Page 2.11.1 Design Manual: Chapter 910 Signing and Pavement Markings 910.4.9	https://studylib.net/doc/8757040/signing-and-striping-manual---new-mexico-department-of https://api.realfile.rtsclients.com/PublicFiles/f260a66b364d453e91ff9b3fedd494dc/8f92c9b2-cb07-4ce7-83f3-8a31eacddaed/910%20Signing%20and%20Pavement%20Markings	New Mexico DOT adopted MUTCD. The Signing and Striping Manual – New Mexico Department of Transportation supplements the MUTCD and is required to place and maintain signs on all state highways. This manual (Section 2.1.11) recommends FYG, minimum Type III or IV, for all pedestrian, school, and bicycle related warning signs and plaques. Further, Section 2.11.1 states that all bicycle warning signs in New Mexico shall use an approved FYG retroreflective sheeting material.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
New York	New York State Traffic Sign Handbook for Local Roads 2017	New York State DOT 2017	Chapter 7: Crossing Hazards	https://cornell.app.box.com/v/clrp-pb-tsh	New York State DOT adopted MUTCD with a supplement. FYG is standard for school warning signs. FYG is optional for pedestrian warning signs, handicapped signs, bicycle warning signs and playground signs.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
North Carolina	2009 North Carolina Supplement the Manual on Uniform Traffic Control Devices North Carolina DOT Signing and Delineation Unit (SDU) Procedures Manual Traffic Engineering Policies, Practices, and Legal Authority (TEPPL)	North Carolina DOT 2012 North Carolina DOT 2024 North Carolina DOT 2016	MUTCD Supplement: Section 4.8 Sign Designs, General Procedures Manual: 4.8 Sign Designs, General TEPPL: S-68 STANDARD PRACTICE for Retroreflective Sign Sheeting	https://connect.ncdot.gov/resources/safety/TrafficSafetyResources/2009%20NC%20Supplement%20to%20MUTCD.pdf https://connect.ncdot.gov/resources/safety/Pages/Signing-and-Delineation-Unit-Procedures-Manual.aspx?Method=SDU-04-08 https://connect.ncdot.gov/resources/safety/Teppl/TEPPL%20All%20Documents%20Library/S-68_practice.pdf	North Carolina adopted MUTCD with a supplement. Both the MUTCD and Supplement are located on their website. Grade B (FYG) shall be used for all school zone signs, bicycle and pedestrian crossing signs.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
North Dakota	North Dakota Traffic Operations Manual 2024	North Dakota DOT 2024	Pages 23-24	https://www.dot.nd.gov/sites/www/files/documents/construction-and-planning/Traffic-Operations-Manual.pdf	North Dakota DOT adopted MUTCD with a supplement. Pages 23-24 depict the use of FYG for pedestrian and school warning signs.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Ohio	Ohio Manual on Uniform Traffic Control Devices Traffic Engineering Manual	Ohio DOT 2012 Ohio DOT 2019	MUTCD: Section 2B.12 Section 2C.03 Traffic Engineering Manual: Section 220-7 Use of Fluorescent Yellow-Green Sheeting	https://www.dot.state.oh.us/roadway/omutcd/Documents/2012%20OMUTCD%20-%20Pt.%202.pdf https://www.transportation.ohio.gov/working/engineering/roadway/manuals-standards/tem/02#202WARNINGSIGNS:~:text=Yellow%2DGreen%20Sheeting-,The%20OMUTCD,-requires%20the%20use	ODOT adopted a state MUTCD. In addition to using FYG for school signs, ODOT allows the optional use of FYG for pedestrian, playground and bicycle warning signs. For roadways maintained by ODOT, these signs are typically fabricated with FYG reflective sheeting: School Advance Warning (S1-1), School Bus Stop Ahead (S3-1), SCHOOL BUS TURN AHEAD (S3-2), SCHOOL ENTRANCE (S3-H3), SCHOOL (S4-3P), yellow portions of School Speed Limit (S5-H1), In-Street Pedestrian Crossing (R1-6, R1-6b), and Overhead Pedestrian Crossing (R1-9), Bicycle (W11-1), Pedestrian (W11-2), Handicapped (W11 9), Bicycle/Pedestrian (W11-15), TRAIL CROSSING (W11-15a), Playground (W15-1), and SAFETY ZONE (W15-H2). The ODOT process for transitioning to FYG sheeting is described.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Oklahoma	Oklahoma DOT Traffic Engineering Standards & Specifications - Traffic Signing 2009	Oklahoma DOT 2009	Drawings T-116 to T-119	https://www.odot.org/traffic/traffic2009/T-119-School%20Area%20Traffic%20Control%20Signs-SZSD1-1-00.pdf	Oklahoma DOT adopted MUTCD with a supplement. The supplement is not available online. Drawings indicate FYG only approved for school warning signs. Pedestrian and bicycle signs use FY.
Oregon	Oregon DOT Traffic Sign Design Manual	Oregon DOT 2023	Chapter 2.2.2 Warning Signs Chapter 2.2.2.2 Fluorescent Yellow-Green	https://www.oregon.gov/ODOT/Engineering/Documents_TrafficStandards/Sign-Design-Manual.pdf	Oregon DOT adopted MUTCD with a supplement. FYG is standard for school warning signs. FYG can be used for pedestrian and bicycle warning signs if approved by the Regional Traffic Engineer. FY sign sheeting may be used for pedestrian and/or bicycle crossing signs if there is a need to call extra attention to a particular crossing.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Pennsylvania	Pennsylvania DOT MUTCD Supplement Traffic Engineer Manual (Pub.46)	Pennsylvania DOT 2021 Pennsylvania DOT 2014	Warning Sign Chapter Chapter 11.9	https://www.pahighways.com/mutcd/warning.html https://www.dot.state.pa.us/public/PubsForms/Publications/PUB%2046.pdf	Pennsylvania DOT adopted MUTCD with a supplement. They have various documents that contain the supplemental policies to the MUTCD. In addition to using FYG for school signs, Pennsylvania DOT allows the optional use of FYG for pedestrian, bicycle warning, hiker crossing, playground, watch children, and trail crossing warning signs along with plaques. The Traffic Engineering Manual, which supplements the MUTCD, and other manuals include Section 11.9, which speaks to traffic studies for Unsignalized Midblock Crosswalks and indicates a W11-2 sign with a W16-7P plaque with which FYG may be used.
Rhode Island	RIDOT Traffic Design Manual	Rhode Island DOT 2004	3.1 School Warning Sign	https://www.dot.ri.gov/documents/doingbusiness/trafdesignmanual.pdf	Rhode Island DOT adopted MUTCD and does not have a supplement. FYG is standard for school warning signs. There is no other use for FYG.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
South Carolina	South Carolina DOT MUTCD Supplement South Carolina DOT Engineering Directives South Carolina DOT Traffic Engineering Guidelines	South Carolina DOT 2011 South Carolina DOT 2015 South Carolina DOT 2012	MUTCD Supplement: Warning Signs Engineering Directives: ED-4 Reflective Sheeting for Rigid Highway Signs ED-19 MUTCD Traffic Engineering Guidelines: TG-20 Retroreflective Sign Post Panels TG-8 "Share the Road with Bicyclists"(R9-25-24) Sign	https://www.scdot.org/business/pdf/accessMgt/trafficEngineering/supplement_mutcd_rev_02-24-2023.pdf http://info2.scdot.org/ED/ED/ED-4.pdf http://info2.scdot.org/ED/ED/ED-19.pdf https://www.scdot.org/business/pdf/accessMgt/Traffic-Engineering-Guidelines/tg20.pdf	South Carolina adopted MUTCD with a supplement. The supplement refers to Engineering Directive (ED)-4, which provides direction for use of reflective sheeting on warning signs. The ED-4 identifies FYG for School, Deaf Child, Blind Child, and several Pedestrian and Bicycle signs, as well as Trail Crossing signs. Advisory Speed Plaques (W13-1P) shall use FYG only when used with school, pedestrian, or bicycle signs. The Traffic Engineering Guidelines states that retroflective sign post panels be applied to specific regulatory and warning signs, including pedestrian and school area signs (W11-2 and S1 series). For these W11-2 and S1 series, it notes FYG panels. "SHARE THE ROAD WITH BICYCLISTS" is required to have the bicycle symbol in black on FYG reflectorized background in the top portion of the panel.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
South Dakota	South Dakota Department of Transportation (SDDOT) Permanent Signing Manual	South Dakota DOT 2021	n/a	https://dot.sd.gov/media/documents/PermanentSigningManual.pdf	South Dakota DOT adopted MUTCD. Their Signing Manual is intended to be used in conjunction with the current edition of the Manual of Uniform Traffic Control Devices (MUTCD) and the SDDOT Standard Highway Signs and Markings (SHSM) book. While this manual notes pedestrian and bicycle warning signs, it does not mention color of signs. Sign design is based on the current MUTCD and the SHSM book.
Tennessee	Tennessee DOT Traffic Design Manual	Tennessee DOT n.d.	Section 2.8 Other Traffic Control Signs	https://www.tn.gov/content/dam/tn/tdot/traffic-engineering/tdmanualrewrite/TRAFFIC%20SIGN%20AND%20PAVMENT%20MARKING%20MANUAL.pdf	Tennessee DOT adopted MUTCD with a supplement. The manual only identifies all school warning signs to be FYG.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Texas	Texas MUTCD	Texas DOT 2014	n/a	https://ftp.txdot.gov/pub/txdot-info/trf/tmutcd/2011-rev-2/revision-2.pdf	Texas DOT adopted a state MUTCD. FYG is permitted for school warning signs and playground warning signs. Pedestrian warning signs can be FYG if located within a school zone to conform with FYG school signs.
Utah	Utah Manual on Uniform Traffic Control Devices Utah DOT Sign Manual	Utah DOT 2011 Utah DOT 2013	MUTCD: Chapter 2C, Warning Signs and Object Markers Signing Manual: Part 4, Warning Signs	https://drive.google.com/file/d/1JyNnvMXo5LgvhvSltSOh5miCxD84PSdJ/view https://drive.google.com/drive/folders/1Mr5S6Is-C_p4z_ToxNGQDmZ_3ZDKc3F9	UDOT adopted a state MUTCD. FYG is reserved for School warning signs only.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Vermont	Traffic Engineering Instructions (TEI)	Vermont Agency of Transportation 2018	TEI 18 - 200 2009 MUTCD Clarification of Sign Options on Non-Limited Access Highways	https://vtrans.vermont.gov/sites/aot/files/documents/TEI%2018-200%202009%20MUTCD%20Clarifications%20of%20Sign%20Options%20on%20Non-limited%20access%20highways.pdf	Vermont Agency of Transportation adopted MUTCD and does not have a supplement. No policy/guideline referencing using FYG beyond school zones.
Virginia	Virginia Supplement to the MUTCD	Virginia DOT 2013	Section 2A-5 Section 2B.12 Section 2C.49,50,51, V1 Section 9B.18	https://www.virginiadot.org/business/virginia_mutcd_supplement.asp	Virginia DOT adopted MUTCD with a supplement. FYG is standard for pedestrian, playground, bicycle and school warning signs.
Washington	Washington State DOT Traffic Manual	Washington State 2021	Section 2-8.21	https://www.wsdot.wa.gov/publications/manuals/fulltext/M51-02/Traffic.pdf	Washington State DOT adopted MUTCD with a supplement. FYG is standard for school signs. FYG is optional for pedestrian and bicycle warning signs.
West Virginia	Design Guide for Signing	West Virginia DOT 2018	Section 3.1, 3.6, 8.1.2	https://transportation.wv.gov/highways/engineering/Documents/2018%20Design%20Guide%20for%20Signing.pdf	West Virginia DOT adopted MUTCD with a supplement. There is not any other documentation regarding the use of FYG outside of school signs.

State	Title	Reference	Chapter / Section (If applicable)	URL	Summary
Wisconsin	Wisconsin Manual on Uniformat Traffic Control Devices (WMUTCD)	Wisconsin DOT 2017 (newer version is under development)	Section 2B.11, 2B.12, 2C.03, 2C.50, 2C.51, 2C.56 Figure 7B-1	https://wisconsindot.gov/dtsdManuals/traffic-ops/manuals-and-standards/wmutcd/mutcd-ch02c.pdf	Wisconsin DOT adopted MUTCD with a supplement. FYG is standard for school signs. FYG is optional for pedestrian, bicycle and playground warning sign.
Wyoming	Wyoming Department of Transportation Signing Manual Wyoming DOT Pedestrian and School Traffic Control Manual 2014	Wyoming DOT 2018 Wyoming DOT 2014	Pedestrian and School Traffic Control Manual: Chapter 2 and Chapter 3	https://dot.state.wy.us/files/live/sites/wydot/files/shared/Traffic%20data/SIGN_MANUAL_FINAL_SEP_2018.pdf https://dot.state.wy.us/files/live/sites/wydot/files/shared/Traffic%20data/Ped_Manual_12_23_2022.pdf	Wyoming DOT adopted MUTCD and does not have a supplement. State Manual identifies FYG for School Warning signs only. No other use for FYG.

Appendix B: DOT Survey

Missouri Department of Transportation

SAFETY IMPACTS OF FLUORESCENT YELLOW-GREEN SIGNS FOR PEDESTRIANS AND BICYCLISTS

DOT Survey

Letter to the Respondent

Dear Participant,

The Missouri Department of Transportation is sponsoring a research study titled "Safety Impacts of Fluorescent Yellow-Green Signs for Pedestrians and Bicyclists." The research is being performed by the University of Missouri and Arora and Associates. The project objective is to synthesize existing research and agency policies regarding the use of fluorescent yellow-green (FYG) for bicyclist and pedestrian signage to determine if there are significant safety benefits to bicyclists and pedestrians if FYG signs are utilized. Attainment of the project objectives will help MoDOT to make data-driven decisions regarding the use of FYG signs for pedestrians and bicyclists.

Your cooperation in completing this survey will help to ensure the success of this research project. This survey is being sent to one person from each state DOT. A separate survey is being distributed to various metropolitan planning organizations (MPOs). You have been identified as the appropriate person at your agency to complete this survey. The survey link that you received for completing the survey is unique for your agency. If it would be more appropriate for someone else at your agency to take this survey, please forward the email with the survey link to them or send their name and email address to Henry Brown (brownhen@missouri.edu). DOT survey responses will be shown in the published report. However, the identity of survey respondents will remain anonymous. Additional instructions are provided at the beginning of the survey. If you would like to download a PDF version of the survey for informational purposes, please click here.

Please complete this survey by May 31, 2024. Depending on your agency's practices for signs for bicyclists and pedestrians, the survey could involve between 10 to 38 questions or between 5 to 20 minutes to complete. If you have any questions, please contact Henry Brown at (573) 882-0832 or brownhen@missouri.edu. Any supporting materials may be sent by email to Henry or uploaded in lieu of providing URLs. Thank you for participating in this survey!

Survey Instructions

1. To begin the survey, click the forward arrow at the bottom of this page.
2. To view and print the entire survey for informational purposes, click on this survey link and download and print the document.
3. To save your partial answers and complete the survey later, close the survey. Answers are automatically saved upon closing the browser window. To return to the survey later, open the original email from Henry Brown and click on the survey link.
4. To pass a partially completed survey to a colleague, close the survey and forward the original email from Henry Brown to a colleague. Note that only one person may work on the survey at a time; the survey response should only be active on one computer at a time.
5. To view and print your answers after completing the survey, submit the survey by clicking "Submit" on the final page. Download and print the PDF on the following page which contains a summary of your responses.
6. To submit the survey, click on "Submit" on the last page.

Survey Tips

1. Survey navigation is conducted by selecting the forward and back arrows at the bottom of each page.
2. If you are unable to complete the survey in a single session, you can return to the survey at any time by reentering through the survey link.

Questions

Contact Information

Name _____
State _____
Job Title _____
Phone Number _____
Email Address _____

Section 1: Pedestrian Signs

1. Which of the following statements best describes your agency's use of fluorescent yellow-green for pedestrian signs?

   ☐ My agency does **not** allow the use of fluorescent yellow-green for pedestrian signs.
   ☐ In addition to using fluorescent yellow-green for school signs, my agency allows the **optional** use of fluorescent yellow-green for pedestrian signs **with no restrictions or approval process**.

- ☐ In addition to using fluorescent yellow-green for school signs, my agency allows for the **optional** use of fluorescent yellow-green for pedestrian signs **for only specific conditions and/or with approval**.
- ☐ In addition to using fluorescent yellow-green for school signs, my agency **requires** the use of fluorescent yellow-green for pedestrian signs.
- ☐ Other (please describe) _____

Comments:

_____

2. Which of the following colors does your agency currently use for pedestrian signs? Please select all that apply.

   - ☐ Yellow
   - ☐ Fluorescent yellow
   - ☐ Fluorescent yellow-green *(if not selected, skip to Question No. 18)*

3. Does your agency use fluorescent yellow-green for all types of pedestrian signs or only some types of pedestrian signs?

   - ☐ All types of pedestrian signs
   - ☐ Only some types of pedestrian signs (please describe) _____

Comments:

_____

4. To what extent has your agency implemented the use of fluorescent yellow-green for pedestrian signs? Please select all that apply.

   - ☐ Systemwide
   - ☐ Project basis
   - ☐ Corridors
   - ☐ Geographical regions
   - ☐ Incorporated into routine maintenance (e.g., life cycle replacement, damaged signs)
   - ☐ As requested by the public
   - ☐ Other (please describe) _____

Comments:

_____

5. What is the approximate percentage of pedestrian signs under your agency's jurisdiction that

are fluorescent yellow-green?

- ☐ 76 percent to 100 percent
- ☐ 51 percent to 75 percent
- ☐ 26 percent to 50 percent
- ☐ 0 percent to 25 percent

Comments:

_____

6. How long has your agency been using fluorescent yellow-green for pedestrian signs?

- ☐ 0 to 5 years
- ☐ 6 to 10 years
- ☐ More than 10 years

Comments:

_____

7. What was the basis for your agency's switch to fluorescent yellow-green for pedestrian signs? Please select all that apply.

- ☐ Engineering judgement
- ☐ Implemented along with other countermeasures as part of a pedestrian safety initiative
- ☐ Input from local agencies
- ☐ Input from pedestrian advocacy groups
- ☐ Research study (internal or external) (please describe and provide study link if possible) _____
- ☐ Other (please describe) _____
- ☐ Unsure

Comments:

_____

8. Before switching to fluorescent yellow-green for pedestrian signs, what color did your agency use for pedestrian signs?

- ☐ Yellow
- ☐ Fluorescent yellow
- ☐ Unknown

Comments:

_____

9. Which of the following statements best describes your agency's experience with using fluorescent yellow-green (compared to yellow) for pedestrian signs? *(Only display if answer to Question No. 8 is "Yellow.")*

   ☐ Fluorescent yellow-green has provided better safety performance than yellow for pedestrian signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)
   ☐ Fluorescent yellow-green has provided better safety performance than yellow for pedestrian signs based on other factors (please describe) _____
   ☐ Fluorescent yellow-green has provided similar safety performance to yellow for pedestrian signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)
   ☐ Fluorescent yellow-green has provided similar safety performance to yellow for pedestrian signs based on other factors (please describe) _____
   ☐ Other (please describe) _____
   ☐ Unsure

Comments:

_____

10. Which of the following statements best describes your agency's experience with using fluorescent yellow-green (compared to fluorescent yellow) for pedestrian signs? *(Only display if answer to Question No. 8 is "Fluorescent yellow.")*

    ☐ Fluorescent yellow-green has provided better safety performance than fluorescent yellow for pedestrian signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)
    ☐ Fluorescent yellow-green has provided better safety performance than fluorescent yellow for pedestrian signs based on other factors (please describe) _____
    ☐ Fluorescent yellow-green has provided similar safety performance to fluorescent yellow for pedestrian signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)
    ☐ Fluorescent yellow-green has provided similar safety performance to fluorescent yellow for pedestrian signs based on other factors (please describe) _____
    ☐ Other (please describe) _____
    ☐ Unsure

Comments:

---

11. Has your agency performed any research studies (e.g., crash reduction, pedestrian conflict reduction, speed reduction) to evaluate the safety performance of fluorescent yellow-green signs for pedestrians?

    ☐ Yes
    ☐ No

If you are willing to share these research studies, please provide URL(s) for the relevant documents in the box below, upload files, or email files to brownhen@missouri.edu: *(Display if answer to Question No. 11 = "Yes.")*

---

12. Are you aware of any research studies (e.g., crash reduction, pedestrian conflict reduction, speed reduction) performed by other entities to evaluate the safety performance of fluorescent yellow-green signs for pedestrians?

    ☐ Yes
    ☐ No

If you are willing to share these research studies, please provide URL(s) for the relevant documents in the box below, upload files, or email files to brownhen@missouri.edu: *(Display if answer to Question No. 12 = "Yes.")*

---

13. For pedestrian signs, what grade of sign sheeting does your agency currently use primarily and what grade of sign sheeting did your agency previously use primarily before switching to the fluorescent yellow-green color?

	Engineer Grade	**High Intensity Prismatic**	**Diamond Grade**	**Unknown**
Current	☐	☐	☐	☐
Previously (Before Switch to Fluorescent Yellow-Green)	☐	☐	☐	☐

Comments:

_____

14. What other pedestrian safety countermeasures does your agency use in conjunction with the use of fluorescent yellow-green for pedestrian signs? Please select all that apply.

- ☐ Fluorescent yellow-green reflective strips on sign U-posts
- ☐ High visibility crosswalks
- ☐ Raised crosswalks
- ☐ Overhead crosswalk lighting
- ☐ In-roadway "Yield to Pedestrian" signs
- ☐ Advance stop/yield bar and signs
- ☐ Leading pedestrian interval (LPI)
- ☐ Pedestrian countdown timers
- ☐ Pedestrian hybrid beacon (PHB)/ High-Intensity activated crosswalk (HAWK) beacon
- ☐ Raised medians and median islands
- ☐ Rectangular rapid flashing beacon (RRFB)
- ☐ Increasing traffic enforcement
- ☐ Speed limit reduction
- ☐ Other (please describe) _____
- ☐ None of the above

Comments:

_____

15. Based on your response to the previous question, a list of other pedestrian safety countermeasures used by your agency is shown below. Relative to the implementation of fluorescent yellow-green for pedestrian signs, when did your agency begin implementing each of the following pedestrian safety countermeasures? *(Only display selected responses from Question No. 14. Do not display question if answer to Question No. 14 = "None of the above.")*

	Before Switching to Fluorescent Yellow-Green	Same Time as Switching to Fluorescent Yellow-Green	After Switching to Fluorescent Yellow-Green	Unknown
Fluorescent yellow-green reflective strips on sign U-posts	☐	☐	☐	☐
High visibility crosswalks	☐	☐	☐	☐
Raised crosswalks	☐	☐	☐	☐
Overhead crosswalk lighting	☐	☐	☐	☐
In-roadway "Yield to Pedestrian" signs	☐	☐	☐	☐
Advance stop/yield bar and signs	☐	☐	☐	☐
Leading pedestrian interval (LPI)	☐	☐	☐	☐
Pedestrian countdown timers	☐	☐	☐	☐

	Before Switching to Fluorescent Yellow-Green	Same Time as Switching to Fluorescent Yellow-Green	After Switching to Fluorescent Yellow-Green	Unknown
Pedestrian hybrid beacon (PHB)/ High-Intensity activated crosswalk (HAWK) beacon	☐	☐	☐	☐
Raised medians and median islands	☐	☐	☐	☐
Rectangular rapid flashing beacon (RRFB)	☐	☐	☐	☐
Increasing traffic enforcement	☐	☐	☐	☐
Speed limit reduction	☐	☐	☐	☐
Other	☐	☐	☐	☐

Comments:

_____

16. Which of the following challenges has your agency faced in the implementation of fluorescent yellow-green for pedestrian signs? Please select all that apply.

    ☐ Cost
    ☐ Lack of agency buy-in
    ☐ Maintenance considerations
    ☐ Need for performance data

- ☐ Need for standards or policies for use
- ☐ Need to prioritize with other pedestrian safety countermeasures
- ☐ Stakeholder coordination
- ☐ Time and effort to replace signs
- ☐ Other (please describe) _____
- ☐ None of the above

Comments:

_____

17. Are you aware of any local jurisdictions in your state having adopted the use of fluorescent yellow-green for pedestrian signs?

- ☐ Yes (please describe) _____
- ☐ No

Comments:

_____

18. Which of the following is a reason for why your agency does not use fluorescent yellow-green for pedestrian signs? Please select all that apply. *(Display if answer for fluorescent yellow-green in Question No. 2 is blank)*

- ☐ Cost
- ☐ Lack of agency buy-in
- ☐ Lack of information on benefits
- ☐ Maintenance considerations
- ☐ Need for standards or policies for use
- ☐ Other pedestrian safety initiatives are a higher priority (please briefly describe other initiatives) _____
- ☐ Time and effort to replace existing signs
- ☐ Other (please describe) _____
- ☐ Unsure

Comments:

_____

Section 2: Bicyclist Signs

19. Which of the following statements best describes your agency's use of fluorescent yellow-

green for bicyclist signs?

- ☐ My agency does **not** allow the use of fluorescent yellow-green for bicyclist signs.
- ☐ In addition to using fluorescent yellow-green for school signs, my agency allows the **optional** use of fluorescent yellow-green for bicyclist signs **with no restrictions or approval process**.
- ☐ In addition to using fluorescent yellow-green for school signs, my agency allows for the **optional** use of fluorescent yellow-green for bicyclist signs **for only specific conditions and/or with approval**.
- ☐ In addition to using fluorescent yellow-green for school signs, my agency **requires** the use of fluorescent yellow-green for bicyclist signs.
- ☐ Other (please describe) _____

Comments:

_____

20. Which of the following colors does your agency currently use for bicyclist signs? Please select all that apply.

    - ☐ Yellow
    - ☐ Fluorescent yellow
    - ☐ Fluorescent yellow-green *(if not selected, skip to Question No. 36)*

21. Does your agency use fluorescent yellow-green for all types of bicyclist signs or only some types of bicyclist signs?

    - ☐ All types of bicyclist signs
    - ☐ Only some types of bicyclist signs (please describe) _____

Comments:

_____

22. To what extent has your agency implemented the use of fluorescent yellow-green for bicyclist signs? Please select all that apply.

    - ☐ Systemwide
    - ☐ Project basis
    - ☐ Corridors
    - ☐ Geographical regions
    - ☐ Incorporated into routine maintenance (e.g., life cycle replacement, damaged signs)
    - ☐ As requested by the public

☐ Other (please describe) _____

Comments:

_____

23. What is the approximate percentage of bicyclist signs under your agency's jurisdiction that are fluorescent yellow-green?

☐ 76 percent to 100 percent
☐ 51 percent to 75 percent
☐ 26 percent to 50 percent
☐ 0 percent to 25 percent

Comments:

_____

24. How long has your agency been using fluorescent yellow-green for bicyclist signs?

☐ 0 to 5 years
☐ 6 to 10 years
☐ More than 10 years

Comments:

_____

25. What was the basis for your agency's switch to fluorescent yellow-green for bicyclist signs? Please select all that apply.

☐ Engineering judgement
☐ Implemented along with other countermeasures as part of a bicyclist safety initiative
☐ Input from local agencies
☐ Input from bicyclist advocacy groups
☐ Research study (internal or external) (please describe and provide study link if possible) _____
☐ Other (please describe) _____
☐ Unsure

Comments:

_____

26. Before switching to fluorescent yellow-green for bicyclist signs, what color did your agency

use for bicyclist signs?

- ☐ Yellow
- ☐ Fluorescent yellow
- ☐ Unknown

Comments:

_____

27. Which of the following statements best describes your agency's experience with using fluorescent yellow-green (compared to yellow) for bicyclist signs? *(Only display if answer to Question No. 26 is "Yellow.")*

- ☐ Fluorescent yellow-green has provided better safety performance than yellow for bicyclist signs based on performance measures (e.g., crash reduction, bicyclist conflict reduction, speed reduction)
- ☐ Fluorescent yellow-green has provided better safety performance than yellow for bicyclist signs based on other factors (please describe) _____
- ☐ Fluorescent yellow-green has provided similar safety performance to yellow for bicyclist signs based on performance measures (e.g., crash reduction, bicyclist conflict reduction, speed reduction)
- ☐ Fluorescent yellow-green has provided similar safety performance to yellow for bicyclist signs based on other factors (please describe) _____
- ☐ Other (please describe) _____
- ☐ Unsure

Comments:

_____

28. Which of the following statements best describes your agency's experience with using fluorescent yellow-green (compared to fluorescent yellow) for bicyclist signs? *(Only display if answer to Question No. 26 is "Fluorescent yellow.")*

- ☐ Fluorescent yellow-green has provided better safety performance than fluorescent yellow for bicyclist signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)
- ☐ Fluorescent yellow-green has provided better safety performance than fluorescent yellow for bicyclist signs based on other factors (please describe) _____
- ☐ Fluorescent yellow-green has provided similar safety performance to fluorescent yellow for bicyclist signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)

- ☐ Fluorescent yellow-green has provided similar safety performance to fluorescent yellow for bicyclist signs based on other factors (please describe) _____
- ☐ Other (please describe) _____
- ☐ Unsure

Comments:

_____

29. Has your agency performed any research studies (e.g., crash reduction, bicyclist conflict reduction, speed reduction) to evaluate the safety performance of fluorescent yellow-green signs for bicyclists?

    - ☐ Yes
    - ☐ No

    If you are willing to share these research studies, please provide URL(s) for the relevant documents in the box below, upload files, or email files to brownhen@missouri.edu: *(Display if answer to Question No. 29 = "Yes")*

    _____

30. Are you aware of any research studies (e.g., crash reduction, bicyclist conflict reduction, speed reduction) performed by other entities to evaluate the safety performance of fluorescent yellow-green signs for bicyclists?

    - ☐ Yes
    - ☐ No

    If you are willing to share these research studies, please provide URL(s) for the relevant documents in the box below, upload files, or email files to brownhen@missouri.edu: *(Display if answer to Question No. 30 = "Yes")*

    _____

31. For bicyclist signs, what grade of sign sheeting does your agency currently primarily use and what grade of sign sheeting did your agency previously use primarily before switching to the fluorescent yellow-green color?

	Engineer Grade	High Intensity Prismatic	Diamond Grade	Unknown
Current	..	..	..	..
Previously (Before Switch to Fluorescent Yellow-Green)	..	..	..	..

Comments:

_____

32. What other bicyclist safety countermeasures does your agency use in conjunction with the use of fluorescent yellow-green for bicyclist signs? Please select all that apply.

- ☐ Bicycle-activated signal detection
- ☐ Bicycle boulevards
- ☐ Bicycle lanes/paths (e.g., separate, shared use)
- ☐ Bicycle path intersection treatments
- ☐ Bicycle signals
- ☐ Bicycle helmet laws
- ☐ Bicyclist education
- ☐ Fluorescent yellow-green reflective strips on sign U-posts
- ☐ Lane narrowing
- ☐ Overhead lighting
- ☐ Pavement marking improvements
- ☐ Advance stop/yield bar and signs
- ☐ Pedestrian hybrid beacon (PHB)/ High-Intensity activated crosswalk (HAWK) beacon
- ☐ Raised medians and median islands
- ☐ Rectangular rapid flashing beacon (RRFB)
- ☐ Increasing traffic enforcement
- ☐ Speed limit reduction
- ☐ Other (please describe) _____
- ☐ None of the above

Comments:

_____

33. Based on your response, a list of other bicyclist safety countermeasures used by your agency is shown below. Relative to the implementation of fluorescent yellow-green for bicyclist signs, when did your agency begin implementing each of the following pedestrian safety countermeasures? *(Only display selected responses from Question No. 32. Do not display question if answer to Question No. 32 = "None of the above.")*

	Before Switching to Fluorescent Yellow-Green	Same Time as Switching to Fluorescent Yellow-Green	After Switching to Fluorescent Yellow-Green	Unknown
Bicycle-activated signal detection	☐	☐	☐	☐
Bicycle boulevards	☐	☐	☐	☐
Bicycle lanes/paths (e.g., separate, shared use)	☐	☐	☐	☐
Bicycle path intersection treatments	☐	☐	☐	☐
Bicycle signals	☐	☐	☐	☐
Bicycle helmet laws	☐	☐	☐	☐
Bicyclist education	☐	☐	☐	☐
Fluorescent yellow-green reflective strips on sign U-posts	☐	☐	☐	☐

	Before Switching to Fluorescent Yellow-Green	Same Time as Switching to Fluorescent Yellow-Green	After Switching to Fluorescent Yellow-Green	Unknown
Lane narrowing	☐	☐	☐	☐
Overhead lighting	☐	☐	☐	☐
Pavement marking improvements	☐	☐	☐	☐
Advance stop/yield bar and signs	☐	☐	☐	☐
Pedestrian hybrid beacon (PHB)/ High-Intensity activated crosswalk (HAWK) beacon	☐	☐	☐	☐
Raised medians and median islands	☐	☐	☐	☐
Rectangular rapid flashing beacon (RRFB)	☐	☐	☐	☐
Increasing traffic enforcement	☐	☐	☐	☐
Speed limit reduction	☐	☐	☐	☐
Other	☐	☐	☐	☐

Comments:

_____

34. Which of the following challenges has your agency faced in the implementation of fluorescent yellow-green for bicyclist signs? Please select all that apply.

- ☐ Cost
- ☐ Lack of agency buy-in
- ☐ Maintenance considerations
- ☐ Need for performance data
- ☐ Need for standards or policies for use
- ☐ Need to prioritize with other bicyclist safety countermeasures
- ☐ Stakeholder coordination
- ☐ Time and effort to replace signs
- ☐ Other (please describe) _____
- ☐ None of the above

Comments:

_____

35. Are you aware of any local jurisdictions in your state having adopted the use of fluorescent yellow-green for bicyclist signs?

- ☐ Yes (please describe) _____
- ☐ No

Comments:

_____

36. Which of the following is a reason for why your agency does not use fluorescent yellow-green for bicyclist signs? Please select all that apply. *(Display if answer for fluorescent yellow-green in Question No. 20 is blank)*

- ☐ Cost
- ☐ Lack of agency buy-in
- ☐ Lack of information on benefits
- ☐ Maintenance considerations
- ☐ Need for standards or policies for use
- ☐ Other bicyclist safety initiatives are a higher priority (please briefly describe other initiatives) _____

- ☐ Time and effort to replace existing signs
- ☐ Other (please describe) _____
- ☐ Unsure

Comments:

_____

Section 3: Policy Considerations and Final Comments

37. Has your agency developed any policies, guidance, and/or standards for bicyclist and pedestrian signage?

    - ☐ Yes
    - ☐ No

If you are willing to share these policies, guidance documents, and/or standards, please provide URL(s) for the relevant documents in the box below, upload files, or email files to brownhen@missouri.edu: *(Display if answer to Question No. 37 = "Yes")*

_____

38. Is your agency planning to make any changes to its existing policies or practices for bicyclist and pedestrian signage?

    - ☐ Yes (please describe) _____
    - ☐ No

39. Would you be willing to participate in a follow-up interview to discuss in greater detail your agency's practices for signage for bicyclists and pedestrians?

    - ☐ Yes
    - ☐ No

40. Please provide any additional comments that you may have regarding signage for bicyclists and pedestrians.

_____
_____
_____

Submittal Instructions

To complete the survey and record your answers, please click the "Submit" button.

Please note that once you click the "Submit" button, you will not be able to modify your answers. To save your partial answers and complete the survey later, close the survey. Answers are automatically saved upon closing the browser window. To return to the survey later, open the original email from Henry Brown and click on the survey link. To pass a partially completed survey to a colleague, close the survey and forward the original email from Henry Brown to a colleague. Note that only one person may work on the survey at a time; the survey response should only be active on one computer at a time. To review your answers before submitting, please select the forward and back arrows at the bottom of each page.

End of Survey

Thank you for completing this survey. Your efforts are greatly appreciated. Your responses are very important, and your feedback is welcome. For your information, a copy of your responses is provided below. You may download your responses in pdf format using the "Download pdf" link shown below. If you have any questions or comments, please contact the principal investigator, Henry Brown:

Henry Brown, P.E.
E2509 Lafferre Hall
University of Missouri
Columbia, MO 65211
(573) 882-0832
brownhen@missouri.edu

Your responses have been recorded, and you may now close your browser.

Appendix C: Comments and Text Responses for DOT Survey

Table C-1. Comments for Question 1 (use of FYG for pedestrian signs).

Comment
ODOT Sign Policy, see page 96: https://www.oregon.gov/odot/Engineering/Documents_TrafficStandards/Sign-Policy-2024.pdf **primarily saved for school zones although can be used for peds if other treatments are not working
Fluorescent Yellow-Green is reserved for school signs.
CDOT's supplement to the 2009 MUTCD amends 7C.03 to add "If used, the SCHOOL word marking may include a fluorescent yellow-green background for one approach lane."
We wanted to keep the emphasis of FYG associated with school children, presumably the most vulnerable road users.
We also use Fluorescent green pedestrian signs outside of school zones as an added enhancement for high activity midblock crossing locations.
MoDOT reserves fluorescent yellow-green (FYG) for school signing to make those signs unique. The MUTCD requires school signs to be FYG, with that color as an option for pedestrian signs. However, MoDOT upgraded its yellow warning signs to fluorescent yellow in the early 2000s to gain the impact of a fluorescent color without compromising the FYG color significance to school signing
In general, we use fluorescent yellow-green for all pedestrian crossing and school zone signing now; however, there may be instances where fluorescent yellow is used if matching a community's other school zone signing in the area of the state highway.
CTDOT uses fluorescent yellow-green signs for school, pedestrian, bicycle warning signs on State roads. Municipalities can use yellow for pedestrians' signs on Town roads.
Warning signs regarding conditions associated with pedestrians, bicyclists, and playgrounds may have a black legend and border on a yellow or fluorescent yellow-green background. When a fluorescent yellow-green background is used, a systematic approach featuring one background color within a zone or area should be used. The mixing of standard yellow and fluorescent yellow-green backgrounds within a selected site area should be avoided.

Table C-2. Text responses for "Other" for Question 3 (types of pedestrian signs with FYG).

Types of Pedestrian Signs
School-related pedestrian signs
Only for school signs
W11-1, W11-2, W16-1, W16-7P, and W16-9P
Ped crossings
Signs in Pedestrian Safety Zones
It's optional to use fluorescent yellow-green.
Fluorescent Yellow-Green, Pedestrian Warning, Bicycle Warning, Playground Warning, School Bus and School Warning

Table C-3. Comments for Question 3 (types of pedestrian signs with FYG).

Comment
Only for the school zone signing. Other uses may be permitted with MnDOT signing approvals.
CDOT utilizes FYG for school related signs but does not have a policy specifically prohibiting them from other use. FYG is seen on signs drawing attention to school bus stops and school zone speed limits, not only on pedestrian signage. FYG is not typically used for pedestrian signs on state highways outside of the vicinity of a school, though there are instances of it along designated trails, especially as part of RRFB assemblies.
Signs in school zone
Focus on School Zones and as an added enhancement to other high pedestrian use locations systemically or evaluated when requests come in.
Only when directed or approved

Table C-4. Text responses for "Other" for Question 4 (extent of implementation of FYG for pedestrian signs).

Other - Text
When directed or approved for specific safety enhancements
Use of FYG is determined by the engineer, rather than specific mandate.
As Districts see the need
As requested by the municipality
School signs
Each individual District Traffic Engineer has the discretion of when to use these signs.
Fluorescent yellow-green and yellow are the options for the background of pedestrian signs based on our standards. Sign manufacturers can choose either color unless one color or other is specified by the entity installing the signs.
Allowed statewide but optional and used where regions want greater attention to the crossing and associated signing.

Table C-5. Comments for Question 4 (extent of implementation of FYG for pedestrian signs).

Comment
Depending on the corridor, we do not mix signs having yellow-green sheet with signs having yellow only sheeting.
System wide on the ODOT maintained system

Table C-6. Comments for Question 5 (percentage of FYG signs for pedestrians).

Comment
Estimated percentage. VDOT does not track sign inventory in a manner to respond to this question with certainty.
Except for work zones, we always use it.
Only in the school zones
Unsure
We typically use FYG for all new installations, but still have older installations that are yellow. We have also installed fluorescent yellow warning signs for the last several years in lieu of standard yellow, so there may be some fluorescent yellow signs as well.
Per our state regulations, PennDOT does not own or maintain any pedestrian signs. Local municipalities are responsible for installing and maintaining. We do not know the approximate percentage of fluorescent yellow-green vs yellow pedestrian signs.

Table C-7. Comments for Question 6 (length of use of FYG for pedestrian signs).

Comment
Institutionalization began with VDOT's 2007 Road & Bridge Specifications book.

Table C-8. Text responses for "Other" for Question 7 (basis for switching to FYG for pedestrian signs).

Other - Text
State Traffic Engineer believed it made the signs stand out.
Allowed as an option to yellow in the MUTCD for pedestrian and bicycle signs.
Option in MUTCD

Table C-9. Comments for Question 7 (basis for switching to FYG for pedestrian signs).

Comment
Not applicable
Provides a consistent look with school crossing signs.
VDOT does not have records with details on the basis of past decisions - anticipated basis is noted in our response.

Table C-10. Comments for Question 8 (pedestrian sign color before FYG).

Comment
Haven't totally swapped but most projects and pedestrian heavy corridors are getting them.
CDOT still utilizes standard yellow pedestrian signage when appropriate.
We haven't switched, we are still allowed to use fluorescent yellow. we added fluorescent yellow-green as optional.

Table C-11. Comments for Question 9 (safety performance of FYG versus yellow for pedestrian signs).

Comment
The implementation is part of an overall effort to implement a safer system, and no microscopic data, just on the one change to fluorescent yellow-green, has been undertaken. The observed experiences with increased driver attention and engineering judgement to limit changes to address the most vulnerable road users.
I don't believe we have studied the effect of FYG over standard yellow pedestrian warning signs.

Table C-12. Comments for Question 10 (safety performance of FYG versus FY for pedestrian signs.)

Comment
Have not done any studies relevant to the presence of fluorescent yellow-green signs and any performance measures such as crashes, pedestrian conflict, speed reduction, etc.) nor compared this with the presence of fluorescent yellow signs.

Table C-13. Comments for Question 13 (grade of sheeting for pedestrian signs).

Comment
FDOT Specs call for retroreflective and non-retroreflective sheeting systems to meet ASTM D4965.
SDDOT uses ASTM 4956 Type XI (diamond grade) sheeting for all STOP, ALL WAY, YIELD, and DO NOT ENTER signs; all warning signs; all overhead signs; all interstate guide signs; all delineators; and all school zone signs.
CDOT has not switched to exclusively FYG.
ASTM Type XI
All three grades above are in qualified product list (QPL), I believe we can use any of those grades sheeting.
We use Type IX for FYG.
Our FYG signs can be any level of fluorescent sheeting for the brands we have approved but are typically a Type XI sheeting due to the lack of an orientation requirement of the sheeting. Also, "Diamond Grade" is a 3M sheeting series.
Ground mounted pedestrian signs in Indiana are typically Type IX not Type XI.
We currently use Type XI sheeting for all signing, including pedestrian signing.

Table C-14. Text responses for "Other" for Question 14 (use of other pedestrian safety countermeasures).

Other - Text
Use of R10-15a sign at signalized intersections to reduce turning conflicts with pedestrians

Table C-15. Comments for Question 14 (use of other pedestrian safety countermeasures).

Comment
When pedestrian and/or bike signs are used, fluorescent yellow-green is VDOT's default regardless of other ancillary applications.
We would not use a ped sign at a signalized intersection.
In-street Pedestrian sign with fluorescent yellow-green in school zones.
Additional measures are only used if additional conspicuity is needed.
The items checked above are not at all crossings, just a list of the treatments we have used.
Pedestrian warning signs are on both sides of the roadway (left and right) at the crosswalk. Typically, the retroreflective strips on the signposts are only installed on the warning signs at the crosswalk.

Table C-16. Comments for Question 15 (when other pedestrian safety countermeasures were implemented).

Comment
We haven't switched to fluorescent yellow-green. We have as an option.
Used for increased conspicuity.
Not applicable
CDOT has not mandated a universal shift to FYG. Similarly, we don't tie the use of various countermeasures to FYG versus not. They are all tools in the toolbox.
Deployments are not tracked in a manner to enable precise response to this question. Estimated timeframes are noted above.
Many of these other treatments have been implemented for years in North Carolina.
Previous retroreflective strips on signposts were yellow to match yellow pedestrian warning signs. Retroreflective strips on signs posts are typically installed on the warning signs at the crosswalk on both sides of the roadway (not typically installed on the advance signposts).

Table C-17. Descriptions for Question 17 (use of FYG for pedestrian signs by local jurisdictions).

Description
Most local agencies are utilizing FYG for pedestrian signs.
Many local agencies use the state signing guidance.
South Burlington, Burlington
Locals must follow PennDOT standards which require either yellow or fluorescent yellow-green sheeting.
Many jurisdictions have installed FYG pedestrian signs.
Some municipalities follow CTDOT practice.
City of Tampa
Many local communities have been adopting FYG for pedestrian signs, but mostly on a location-specific basis.

Table C-18. Comments for Question 17 (use of FYG for pedestrian signs by local jurisdictions).

Comment
It is not uncommon for local jurisdictions to follow NCDOT guidance.
Agencies which selected the option of adopting the Virginia Supplement to the MUTCD would have followed the VDOT change. Virginia local jurisdictions have authority to establish their practices related to this so long as the federal MUTCD and Code of Virginia are complied with.
Not aware/unsure
Have seen them in communities but not sure what or how many local jurisdictions have adopted this as a standard.

Table C-19. Descriptions of other safety initiatives for Question 18 (reasons FYG is not used for pedestrian signs).

Description of Other Safety Initiatives
Reserved for school signing only.
Exploring and sharing benefits of PHB for example has been a higher priority.

Table C-20. Text responses for "Other" for Question 18 (reasons FYG is not used for pedestrian signs).

Other - Text
FYG is specifically limited to school signs in Alaska.
Want to reserve the brightest for the most vulnerable- mainly school age.
We maintain the FYG as a separate color for a specific and targeted use at school crossings.
Fluorescent Yellow-Green is reserved for school signs.
We limited the use of the yellow-green sheeting to school signs to have school signs stand out better. Our thought is that overuse of the color would water down its effectiveness.
Oklahoma DOT wants to restrict fluorescent yellow-green for school uses only.

Table C-21. Comments for Question 18 (reasons FYG is not used for pedestrian signs).

Comment
Fluorescent Yellow-Green is reserved for school signs. The thought being that they should be emphasized and identifiable.
Not sure on maintenance, not hugely cost prohibitive.
From what MoDOT has been able to determine, there is no safety benefit to move from fluorescent yellow to FYG. Transitioning to FYG for pedestrian signs would have significant impacts to maintenance which would not be justified unless there was a significant safety benefit. And FYG is specified as a color for school areas, using it for other applications waters down the FYG / school significance, where school children are more vulnerable than adult pedestrians due to age. Due to the MUTCD specifications FYG signing cannot be intermixed with yellow sign, switching to FYG would require entire intersections of signs to be replaced if/when just one yellow sign needed replacing. This would result in premature replacement of signs simply due to color and not due to service life.

Table C-22. Text responses for "Other" for Question 19 (use of FYG for bicyclist signs).

Other - Text
See response for pedestrian signs- reserved for cases where other treatments did not seem to work.
The only time we would consider using fluorescent yellow-green (FYG) for bicycle signing is if we had a location where a city and state route intersected and the city used FYG for their pedestrian signs. This would be done in order to be incompliance with the MUTCD on not mixing FYG with Yellow warning sign at a given location.
Only within the school zone
CDOT does not typically utilize FYG for bicyclist signs, however, it is sometimes seen on W11-15 signs, as they share a pedestrian and cyclist message.
We do not specify this.
Recommend fluorescent yellow-green for all bicyclist signing but not a required standard yet. Not too many of these signs on our state system.

Table C-23. Comments for Question 19 (use of FYG for bicyclist signs).

Comment
MoDOT reserves fluorescent yellow-green (FYG) for school signing to make those signs unique. The MUTCD requires school signs to be FYG, with that color as an option for bicycle signs. However, MoDOT upgraded its yellow warning signs to fluorescent yellow in the early 2000s to gain the impact of a fluorescent color without compromising the FYG color significance to school signing
Institutionalized with the VDOT 2007 Road & Bridge Specifications book.
Warning signs regarding conditions associated with pedestrians, bicyclists, and playgrounds may have a black legend and border on a yellow or fluorescent yellow-green background. When a fluorescent yellow-green background is used, a systematic approach featuring one background color within a zone or area should be used. The mixing of standard yellow and fluorescent yellow-green backgrounds within a selected site area should be avoided.
For ODOT-maintained highways, bicyclist signs and other designated signs will normally be fabricated with fluorescent yellow-green retroreflective sheeting.

Table C-24. Text responses for "Other" for Question 21 (types of bicyclist signs with FYG).

Other - Text
Warning signs
Warning signs
Depends on the District
Mixed-Use Trail signs
W11-1, W16-1, W16-7P, and W16-9P
Only W11-1 & W11 15 & W11 15a including supplemental panels

Table C-25. Comments for Question 21 (types of bicyclist signs with FYG).

Comment
In school zones

Table C-26. Text responses for "Other" for Question 22 (extent of implementation of FYG for bicyclist signs).

Other - Text
Up to the District
In school zones
Fluorescent yellow-green is an option for yellow based on our standards. The sign manufacturer can select either option unless the entity installing the signs specifies otherwise.
When directed or approved
Allowed statewide, but optional use based upon engineering judgement

Table C-27. Comments for Question 22 (extent of implementation of FYG for bicyclist signs).

Comment
System wide on the ODOT maintained system
This color of signs is applied for all sign activities - projects, maintenance, lifecycle replacement, etc. - across the state.
Crossings with mixed-use trails

Table C-28. Comments for Question 23 (percentage of FYG signs for bicyclists).

Comment
Only school zones
Bicyclist signs are local municipality responsibility even on state owned roadways. We do not know the percentage of yellow vs yellow-green.
FYG is only used for bicycle signs at mixed-use trails.
Estimated percentage. VDOT does not track sign inventory in a manner to respond to this question with certainty.
Unsure

Table C-29. Comments for Question 24 (length of use of FYG for bicyclist signs).

Comment
Institutionalization began with VDOT's 2007 Road & Bridge Specifications book.

Table C-30. Text responses for "Other" for Question 25 (basis for switch to FYG for bicyclist signs).

Other - Text
State Traffic Engineer thought it was more conspicuous.
Consistency with other ped signs.
Allowable as option to yellow in MUTCD.
allowed in MUTCD
For crossings of mixed-use trails

Table C-31. Comments for Question 25 (basis for switching to FYG for bicyclist signs).

Comment
VDOT does not have records with details based on past decisions - anticipated basis is noted in our response.

Table C-32. Comments for Question 26 (bicyclist sign color before FYG).

Comment
Yellow is still the standard color for most bicycle signing in Massachusetts. Fluorescent yellow-green signs are used only for crossings of mixed-use trails.

Table C-33. Text responses for "Other" Text for Question 27 (safety performance of FYG versus yellow for bicyclist signs).

Other - Text
Our allowance/ use of this color has more to do with consistent color of signs than anything.

Table C-34. Comments for Question 27 (safety performance of FYG versus yellow for bicyclist signs).

Comment
The implementation is part of an overall effort to implement a safer system, and no microscopic data, just on the one change to fluorescent yellow-green, has been undertaken. The observed experiences with increased driver attention and engineering judgement to limit changes to address the most vulnerable road users.

Table C-35. Comments for Question 28 (safety performance of FYG versus FY for bicyclist signs).

Comment
Again, no studies have been done on fluorescent yellow-green bicyclist signs.

Table C-36. Comments for Question 31 (grade of sheeting for bicyclist signs).

Comment
SDDOT uses ASTM D4956 Type XI (diamond grade) sheeting for all warning signs.
All three-grade sheeting is on the qualified product list (QPL). I believe any of grade sheeting stated above can be used.
ASTM Type XI
Ground mounted bicyclist signs in Indiana typically have Type IX reflective sheeting instead of Type XI (3M Diamond Grade or Avery Dennison OmniCube).
Retroreflective sheeting material shall be classified in accordance with and meet the requirements of ASTM D4956 for Retroreflective and Nonreflective Sheeting Systems.
We currently use Type XI sheeting for all signing, including bicycle signing.

Table C-37. Comments for Question 32 (use of other bicyclist safety countermeasures).

Comment
We would not use bike crossing signs at signalized intersections.
Maryland law requires all bicyclists under the age of 16 to wear a bicycle safety helmet when riding on public property.
Besides being used for crosswalks, RRFBs are also employed at certain crossings of mixed-use trails.
When pedestrian and/or bike signs are used, fluorescent yellow-green is VDOT's default regardless of other ancillary applications.

Table C-38. Comments for Question 33 (when other bicyclist safety countermeasures were implemented).

Comment
Many of these other treatments have been implemented for years in North Carolina.
Deployments are not tracked in a manner to enable precise response to this question. Estimated timeframes are noted above.
Not applicable

Table C-39. Text responses for "Other" for Question 34 (challenges faced in the implementation of FYG for bicyclist signs).

Other - Text
Consistency with application and roll out

Table C-40. Comments for Question 34 challenges faced in the implementation of FYG for bicyclist signs).

Comment
VDOT has not faced unique challenges implementing this color.
Not applicable

Table C-41. Text responses for "Other" for Question 35 (use of FYG for bicyclist signs by local jurisdictions).

Other - Text
Most local agencies are utilizing FYG for bicyclist warning signs.
Many local agencies use the state signing guidance.
It is an option for yellow sheeting in PennDOT standards that locals must follow.
Some municipalities follow CTDOT practice.
Certain municipalities use FYG for bicyclist signs, typically on a location-by-location basis, and normally in conjunction with mixed-use trails.

Table C-42. Comments for Question 35 (use of FYG for bicyclist signs by local jurisdictions).

Comment
Not aware of any other jurisdictions.
It is not uncommon for local jurisdictions to follow NCDOT guidance.
Agencies which selected the option of adopting the Virginia Supplement to the MUTCD would have followed the VDOT change. Virginia local jurisdictions have authority to establish their practices related to this so long as the federal MUTCD and Code of Virginia are complied with.

Table C-43. Text responses for "Other" for Question 36 (reasons FYG is not used for bicyclist signs).

Other - Text
Oklahoma DOT wants to restrict the use of fluorescent yellow-green to schools only.
See previous response.
FYG is for school related crossings only.
FYG is specifically limited to school signs in Alaska.
Reserve the use of FYG signs for School areas & applications.
No stated policy. Presumed that we do not wish to dilute the efficacy of FYG by over-use via universal adoption.
We limited the use of the yellow green sheeting to school signs in an effort to have school signs stand out better. Our thought is that overuse of the color would water down its effectiveness.

Table C-44. Comments for Question 36 (reasons FYG is not used for bicyclist signs).

Comment
Fluorescent Yellow-Green is reserved for school signs. The thought being that they should be emphasized and identifiable.
From what MoDOT has been able to determine, there is no safety benefit to move from fluorescent yellow to FYG. Transitioning to FYG for bicycle signs would have significant impacts to maintenance which would not be justified unless there was a significant safety benefit. And FYG is specified as a color for school areas, using it for other applications waters down the FYG / school significance, where school children are more vulnerable than adult pedestrians due to age. Due to the MUTCD specifications FYG signing cannot be intermixed with yellow sign, switching to FYG would require entire intersections of signs to be replaced if/when just one yellow sign needed replacing. This would result in premature replacement of signs simply due to color and not due to service life.

Table C-45. Resources submitted for Question 37 (development of policies, guidance, and/or standards for bicyclist and pedestrian signage).

State	Title	URL
Alabama	Standard Drawings (Section 71000: Roadway Signs Installation)	https://alletting.dot.state.al.us/Docs/Standard_Drawings/2024%20English/71000.pdf
Alabama	Standard Drawings (Section 70300: Traffic Control Markings and Legends)	https://alletting.dot.state.al.us/Docs/Standard_Drawings/2024%20English/70300.pdf
California	California MUTCD	https://dot.ca.gov/programs/safety-programs/camutcd/pubs
Colorado	CDOT Roadway Design Guide (Chapter 13: Bicycle and Pedestrian Facilities)	https://www.codot.gov/business/designsupport/bulletins_manuals/cdot-roadway-design-guide-2023/chapter_13_bicycle_and_pedestrian_facilities.pdf
Colorado	Updated Procedural Directive 1602.1: Elevating Bicycle and Pedestrian Opportunities in Colorado	https://www.codot.gov/programs/bikeped/documents/1602-1-2013-bicycle-and-pedestrian-policy
Florida	Traffic Engineering Manual (Chapter 2: Signs)	https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/traffic/trafficservices/studies/tem/tem-2024/chapter-2-signs.pdf?sfvrsn=b8e7d8bc_1
Florida	Standard Specifications for Road and Bridge Construction	https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/programmanagement/implemented/specbooks/fy-2024-25/fy2024-25ebookfinalcomp-revised3-4-24.pdf?sfvrsn=16ab03d_1
Florida	FDOT Design Manual (223 Bicycle Facilities)	https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/roadway/fdm/2024/2024fdm223bikes.pdf?sfvrsn=76b347c6_2
Florida	FDOT Design Manual (224 Shared Use Paths)	https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/roadway/fdm/2024/2024fdm224sharedusepaths.pdf?sfvrsn=3d7eaaa7_1

State	Title	URL
Florida	FDOT Design Manual (222 Pedestrian Facilities)	https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/roadway/fdm/2024/2024fdm222peds.pdf?sfvrsn=4d8dcc5c_2
Florida	FDOT Design Manual	https://www.fdot.gov/roadway/FDM/
Georgia	Pedestrian and Streetscape Guide	https://www.dot.ga.gov/DriveSmart/Travel/BikePed/PSG.pdf
Georgia	Design Policy Manual	https://www.dot.ga.gov/PartnerSmart/DesignManuals/DesignPolicy/GDOT-DPM.pdf
Kentucky	Traffic Operations Guidance Manual (TO-401-3: Sheeting)	https://transportation.ky.gov/Organizational-Resources/Policy%20Manuals%20Library/Traffic%20Operations.pdf
Maryland	Standard Sign Book	https://apps.roads.maryland.gov/businesswithsha/bizStdsSpecs/desManualStdPub/publicationsonline/oots/internet_signbook.asp
Massachusetts	Separated Bike Lane Planning & Design Guide	https://www.mass.gov/lists/separated-bike-lane-planning-design-guide
Massachusetts	Massachusetts Highway Department Project Development and Design Guide	https://www.mass.gov/doc/2006-project-development-and-design-guide/download
Massachusetts	The Massachusetts Amendments to the 2009 Manual on Uniform Traffic Control Devices	https://www.mass.gov/doc/massachusetts-amendments-to-the-mutcd-2022/download
Michigan	Michigan Department of Transportation Traffic and Safety/Standards and Special Details	https://mdotjboss.state.mi.us/TSSD/tssdHome.htm
Missouri	Engineering Policy Guide (903.20: Signing for Bicycle Facilities)	https://epg.modot.org/index.php/903.20_Signing_for_Bicycle_Facilities
Nevada	Signing, Striping, and Traffic Control Design Guide	https://www.dot.nv.gov/home/showpublisheddocument/20978/638054014494070000

State	Title	URL
North Carolina	Roadway Standard Drawings (Division 12)	https://connect.ncdot.gov/resources/Specifications/2024StandardRdwyDrawings/Division%2012%20Combined.pdf
North Carolina	Memorandum: New NCDOT Statewide Standard – Signs for Pedestrian Warning, School Advisory, School Crosswalk, School Bus Stop Ahead and Bicycle Related Signing	-
Ohio	Traffic Engineering Manual	https://www.transportation.ohio.gov/working/engineering/roadway/manuals-standards/tem
Oregon	Sign Policy & Guidelines	https://www.oregon.gov/odot/Engineering/Documents_TrafficStandards/Sign-Policy-2024.pdf
Oregon	Engineering Guidance	https://www.oregon.gov/odot/Engineering/Pages/Eng-Guidance.aspx
Pennsylvania	Revisions to Designs Manual, Part 2 Contextual Roadway Design	https://www.dot.state.pa.us/public/pubsforms/Publications/PUB%2013/March%202024%20Change%20No.%205.pdf
Pennsylvania	Publication 13: Design Manual Part 2 Contextual Roadway Design	https://www.dot.state.pa.us/public/pubsforms/Publications/PUB%2013/Pub%2013%20Title%20Page.pdf
Pennsylvania	Handbook of Approved Signs	https://www.dot.state.pa.us/public/pubsforms/Publications/PUB%20236.pdf
South Carolina	Engineer Directive 4: Reflective Sheeting for Rigid Highway Signs	http://info2.scdot.org/ED/ED/ED-4.pdf
Tennessee	Roadway Design Guidelines	https://www.tn.gov/tdot/roadway-design/design-standards/design-guidelines.html
Utah	Pedestrian Safety Flags (UDOT 06C-15)	https://drive.google.com/file/d/16XN_sPbGP8kcEtBeSG_CS3SGsZWzzj9T/view

State	Title	URL
Utah	Pedestrian Access Program (UDOT 06C-16)	https://drive.google.com/file/d/16UvD64ybXeakyNOXEI0F3Ie3vr2z9gwX/view
Utah	Safe Sidewalks Program (UDOT 06C-20)	https://drive.google.com/file/d/16Jj21OCcrljTEJ0BL7Ce4FSBfmOth28Y/view
Utah	Marked Pedestrian Crosswalks (UDOT 06C-27)	https://drive.google.com/file/d/17D5SjKkCrFNRYWLul9ney-1gpHBjwpZR/view
Utah	Share the Road Signs (UDOT 06C-63)	https://drive.google.com/file/d/17uc8cuxPbdHFQ9xSjVyNFMYapENT0TTt/view
Utah	Bicycle/ Pedestrian Trail Maintenance Responsibility (UDOT 08A2-06)	https://drive.google.com/file/d/1BMiLlaS10bLVRSL5xUFby3PGvrmT9Wv-/view
Utah	Utah Manual on Uniform Traffic Control Devices	https://drive.google.com/file/d/1JyNnvMXo5LgvhvSltSOh5miCxD84PSdJ/view
Virginia	Virginia Supplement to the Manual on Uniform Traffic Control Devices	https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/technical-guidance-documents/virginia-supplement-to-the-manual-on-uniform-traffic-control-devices-mutcd/
Washington State	Traffic Manual M 51-02 (Chapter 2: Signs)	https://wsdot.wa.gov/publications/manuals/fulltext/M51-02/Chapter2.pdf
Wisconsin	TEOpS Manual (Chapter 9: - Traffic controls for bicycle facilities)	https://wisconsindot.gov/Pages/doing-bus/local-gov/traffic-ops/manuals-and-standards/teops/ch09.aspx
Wisconsin	TEOps Manual (2-3-51: Pedestrian Crossing Warning Signs)	https://wisconsindot.gov/dtsdManuals/traffic-ops/manuals-and-standards/teops/02-03.pdf#2-3-51
Wyoming	WYDOT Pedestrian and School Traffic Control Manual	https://dot.state.wy.us/files/live/sites/wydot/files/shared/Traffic%20data/Ped_Manual_12_23_2022.pdf

Table C-46. Descriptions for Question 38 (consideration of future changes in policies or practices for bicyclist and pedestrian signage).

Description
Follow new MUTCD
In the process of updating the Delaware MUTCD-- minor changes to language anticipated.
Potentially based on changes in 11th Edition of MUTCD
Develop policies to be used statewide on system
It is an ever-evolving development depending on location and bicycle use.
The Project Development and Design Guide is in the process of being revised and updated. The Massachusetts MUTCD Amendments are in the process of being updated to reflect changes in the 11th Edition of the MUTCD.
Working on this as part of the Active Transportation Plan
With updates and the new MUTCD there is potential to make changes but no plans at this point
We will be making any necessary changes to comply with the new 11th edition of the MUTCD.
There is a Project Scoping Guide that Kittelson is helping us develop which is replacing our Multimodal Scoping Manual and updating our Roadway Design Guidelines (Ch. 3 is multimodal).
In process of rewriting to 11th Edition MUTCD

Table C-47. Comments for Question 40 (general comments).

Comment
CDOT typically does pretty well on this front but leaves significant discretion to the designers (and relies upon the Traffic design program to review/enforce best practices). The relevant policy directive is 1602, found here: https://www.codot.gov/programs/bikeped/documents/1602-1-2013-bicycle-and-pedestrian-policy
I would be interested to know if this is considered compliant in the MUTCD. If it is, we could use it.
We typically follow the MUTCD
I would refer any specific bicycle questions to our Bike / Ped Coordinator.
MassDOT's standards and practices regarding bicycle and pedestrian signing generally follow the requirements and guidance outlined in the MUTCD and the Massachusetts MUTCD Amendments.
We follow the MUTCD guidance to sign for pedestrians and bicyclists.
Unless there is evidence a switch to FYG for bicycle and pedestrian signs will have a significant and proven safety impact, MoDOT plans to continue using fluorescent yellow for these signs.
Our primary bicycle signing is regulatory and describes our graduated "move over" law (3' at 30-mph, 1' more for each 10-mph). Signing is by local advocates, subject to approval by the DOT and documented through an executed maintenance agreement.
Can you share the problem statement or the NCHRP project number for this work? A few in our agency would be interested in learning more. Also, would be interested in seeing a summary of the survey responses (state of the practice) if possible.
Any further discussion with TDOT should include the person who develops TDOT's standard drawings
Our Research Section performed the evaluation of the BLINKERSIGN® CROSSWALK LIGHTING SYSTEM back in 2014: https://vtrans.vermont.gov/sites/aot/files/planning/2014%20-%2013%20Evaluation%20of%20BlinkerSign%C2%AE%20Crosswalk%20Lighting%20System.pdf

Appendix D: MPO Survey

Missouri Department of Transportation

SAFETY IMPACTS OF FLUORESCENT YELLOW-GREEN SIGNS FOR PEDESTRIANS AND BICYCLISTS

MPO Survey

Letter to the Respondent

Dear Participant,

The Missouri Department of Transportation is sponsoring a research study titled "Safety Impacts of Fluorescent Yellow-Green Signs for Pedestrians and Bicyclists." The research is being performed by the University of Missouri and Arora and Associates. The project objective is to synthesize existing research and agency policies regarding the use of fluorescent yellow-green (FYG) for bicyclist and pedestrian signage to determine if there are significant safety benefits to bicyclists and pedestrians if FYG signs are utilized. Attainment of the project objectives will help MoDOT to make data-driven decisions regarding the use of FYG signs for pedestrians and bicyclists.

Your cooperation in completing this survey will help to ensure the success of this research project. This survey is being sent to representatives from various metropolitan planning organizations (MPOs). A separate survey is being distributed to each state department of transportation (DOT). You have been identified as the appropriate person at your agency to complete this survey. The survey link that you received for completing the survey is unique for your agency. If it would be more appropriate for someone else at your agency to take this survey, please forward the email with the survey link to them or send their name and email address to Henry Brown (brownhen@missouri.edu). Survey responses will be shown in the published synthesis report. However, the identity of survey respondents will remain anonymous. Additional instructions are provided at the beginning of the survey. If you would like to download a PDF version of the survey for informational purposes, please click here.

Please complete this survey by May 31, 2024. Depending on your agency's practices for signs for bicyclists and pedestrians, the survey includes 7 to 21 questions, and we estimate that the survey will take approximately 5 to 20 minutes to complete. If you have any questions, please contact Henry Brown at (573) 882-0832 or brownhen@missouri.edu. Any supporting materials

may be sent by email to Henry or uploaded in lieu of providing URLs. Thank you for participating in this survey!

Survey Instructions

1. To begin the survey, click the forward arrow at the bottom of this page.
2. To view and print the entire survey for informational purposes, click on this survey link and download and print the document.
3. To save your partial answers and complete the survey later, close the survey. Answers are automatically saved upon closing the browser window. To return to the survey later, open the original email from Henry Brown and click on the survey link.
4. To pass a partially completed survey to a colleague, close the survey and forward the original email from Henry Brown to a colleague. Note that only one person may work on the survey at a time; the survey response should only be active on one computer at a time.
5. To view and print your answers after completing the survey, submit the survey by clicking "Submit" on the final page. Download and print the PDF on the following page which contains a summary of your responses.
6. To submit the survey, click on "Submit" on the last page.

Survey Tips

1. Survey navigation is conducted by selecting the forward and back arrows at the bottom of each page.
2. If you are unable to complete the survey in a single session, you can return to the survey at any time by reentering through the survey link.

Questions

Contact Information

Name _____
Agency _____
Job Title _____
Phone Number _____
Email Address _____

Section 1: Pedestrian Signs

1. Which of the following colors do the local agencies in your MPO's jurisdiction use for pedestrian signs? Please select all that apply.

- ☐ Yellow
- ☐ Fluorescent yellow
- ☐ Fluorescent yellow-green *(if not selected, skip to Question No. 11)*

2. Do the local agencies in your MPO's jurisdiction typically use fluorescent yellow-green for all types of pedestrian signs or only some types of pedestrian signs?

   - ☐ All types of pedestrian signs
   - ☐ Only some types of pedestrian signs (please describe) _____

Comments:

_____

3. To what extent have the local agencies in your MPO's jurisdiction implemented the use of fluorescent yellow-green for pedestrian signs? Please select all that apply.

   - ☐ Systemwide
   - ☐ Project basis
   - ☐ Corridors
   - ☐ Geographical regions
   - ☐ Incorporated into routine maintenance (e.g., life cycle replacement, damaged signs)
   - ☐ As requested by the public
   - ☐ Other (please describe) _____

Comments:

_____

4. What is the approximate percentage of pedestrian signs under your MPO's jurisdiction that are fluorescent yellow-green?

   - ☐ 76 percent to 100 percent
   - ☐ 51 percent to 75 percent
   - ☐ 26 percent to 50 percent
   - ☐ 0 percent to 25 percent

Comments:

_____

5. What was the basis for local agencies under your MPO's jurisdiction switching to fluorescent yellow-green for pedestrian signs? Please select all that apply.

   - ☐ Engineering judgement
   - ☐ Implemented along with other countermeasures as part of a pedestrian safety initiative
   - ☐ Input from local agencies
   - ☐ Input from pedestrian advocacy groups
   - ☐ Research study (internal or external) (please describe and provide study link if possible) _____
   - ☐ Other (please describe) _____
   - ☐ Unsure

Comments:

_____

6. Which of the following statements best describes your MPO's experience with the use of fluorescent yellow-green for pedestrian signs?

   - ☐ Fluorescent yellow-green has provided better safety performance than yellow or fluorescent yellow for pedestrian signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)
   - ☐ Fluorescent yellow-green has provided better safety performance than yellow or fluorescent yellow for pedestrian signs based on other factors (please describe) _____
   - ☐ Fluorescent yellow-green has provided similar safety performance to yellow or fluorescent yellow for pedestrian signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)
   - ☐ Fluorescent yellow-green has provided similar safety performance to yellow or fluorescent yellow for pedestrian signs based on other factors (please describe) _____
   - ☐ Other (please describe) _____
   - ☐ Unsure

Comments:

_____

7. Have any of the local agencies in your MPO's jurisdiction performed evaluation studies (e.g., crash reduction, pedestrian conflict reduction, speed reduction) to evaluate the safety performance of fluorescent yellow-green signs for pedestrians?

☐ Yes
☐ No

If you are willing to share these evaluation studies, please provide URL(s) for the relevant documents in the box below, upload files, or email files to brownhen@missouri.edu: *(Display if answer to Question No. 7 = "Yes.")*

---

8. Are you aware of any research studies (e.g., crash reduction, pedestrian conflict reduction, speed reduction) performed by other entities to evaluate the safety performance of fluorescent yellow-green signs for pedestrians?

☐ Yes
☐ No

If you are willing to share these research studies, please provide URL(s) for the relevant documents in the box below, upload files, or email files to brownhen@missouri.edu: *(Display if answer to Question No. 8 = "Yes.")*

---

9. What other pedestrian safety countermeasures do the local agencies in your MPO's jurisdiction use in conjunction with the use of fluorescent yellow-green for pedestrian signs? Please select all that apply.

☐ Fluorescent yellow-green reflective strips on sign U-posts
☐ High visibility crosswalks
☐ Raised crosswalks
☐ Overhead crosswalk lighting
☐ In-roadway "Yield to Pedestrian" signs
☐ Advance stop/yield bar and signs
☐ Leading pedestrian interval (LPI)
☐ Pedestrian countdown timers
☐ Pedestrian hybrid beacon (PHB)/ High-Intensity activated crosswalk (HAWK) beacon
☐ Raised medians and median islands
☐ Rectangular rapid flashing beacon (RRFB)
☐ Increasing traffic enforcement
☐ Speed limit reduction
☐ Other (please describe) _____
☐ None of the above

Comments:

_____

10. Which of the following challenges have the local agencies in your MPO's jurisdiction faced in the implementation of fluorescent yellow-green for pedestrian signs? Please select all that apply.

    - ☐ Cost
    - ☐ Lack of agency buy-in
    - ☐ Maintenance considerations
    - ☐ Need for performance data
    - ☐ Need for standards or policies for use
    - ☐ Need to prioritize with other pedestrian safety countermeasures
    - ☐ Stakeholder coordination
    - ☐ Time and effort to replace signs
    - ☐ Other (please describe) _____
    - ☐ None of the above

Comments:

_____

11. Which of the following is a reason for why the local agencies in your MPO's jurisdiction do not use fluorescent yellow-green for pedestrian signs? Please select all that apply. *(Display if answer for fluorescent yellow-green in Question No. 1 is blank.)*

    - ☐ Cost
    - ☐ Lack of agency buy-in
    - ☐ Lack of information on benefits
    - ☐ Maintenance considerations
    - ☐ Need for standards or policies for use
    - ☐ Other pedestrian safety initiatives are a higher priority (please briefly describe other initiatives) _____
    - ☐ Time and effort to replace existing signs
    - ☐ Other (please describe) _____
    - ☐ Unsure

Comments:

_____

Section 2: Bicyclist Signs

12. Which of the following colors do the local agencies in your MPO's jurisdiction use for bicyclist signs? Please select all that apply.

    ☐ Yellow
    ☐ Fluorescent yellow
    ☐ Fluorescent yellow-green *(if not selected, skip to Question No. 22)*

13. Do the local agencies in your MPO's jurisdiction typically use fluorescent yellow-green for all types of bicyclist signs or only some types of bicyclist signs?

    ☐ All types of bicyclist signs
    ☐ Only some types of bicyclist signs (please describe) _____

Comments:

_____

14. To what extent have the local agencies in your MPO's jurisdiction implemented the use of fluorescent yellow-green for bicyclist signs? Please select all that apply.

    ☐ Systemwide
    ☐ Project basis
    ☐ Corridors
    ☐ Geographical regions
    ☐ Incorporated into routine maintenance (e.g., life cycle replacement, damaged signs)
    ☐ As requested by the public
    ☐ Other (please describe) _____

Comments:

_____

15. What is the approximate percentage of bicyclist signs under your MPO's jurisdiction that are fluorescent yellow-green?

    ☐ 76 percent to 100 percent
    ☐ 51 percent to 75 percent
    ☐ 26 percent to 50 percent
    ☐ 0 percent to 25 percent

Comments:

_____

16. What was the basis for local agencies under your MPO's jurisdiction switching to fluorescent yellow-green for bicyclist signs? Please select all that apply.

- ☐ Engineering judgement
- ☐ Implemented along with other countermeasures as part of a pedestrian safety initiative
- ☐ Input from local agencies
- ☐ Input from pedestrian advocacy groups
- ☐ Research study (internal or external) (please describe and provide study link if possible) _____
- ☐ Other (please describe) _____
- ☐ Unsure

Comments:

_____

17. Which of the following statements best describes your MPO's experience with the use of fluorescent yellow-green for bicyclist signs?

- ☐ Fluorescent yellow-green has provided better safety performance than yellow or fluorescent yellow for bicyclist signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)
- ☐ Fluorescent yellow-green has provided better safety performance than yellow or fluorescent yellow for bicyclist signs based on other factors (please describe) _____
- ☐ Fluorescent yellow-green has provided similar safety performance to yellow or fluorescent yellow for bicyclist signs based on performance measures (e.g., crash reduction, pedestrian conflict reduction, speed reduction)
- ☐ Fluorescent yellow-green has provided similar safety performance to yellow or fluorescent yellow for bicyclist signs based on other factors (please describe) _____
- ☐ Other (please describe) _____
- ☐ Unsure

Comments:

_____

18. Have any of the local agencies in your MPO's jurisdiction performed evaluation studies to evaluate the safety performance of fluorescent yellow-green signs for bicyclists?

- ☐ Yes
- ☐ No

If you are willing to share these evaluation studies, please provide URL(s) for the relevant documents in the box below, upload files, or email files to brownhen@missouri.edu: *(Display if answer to Question 18 = "Yes.")*

---

19. Are you aware of any research studies (e.g., crash reduction, pedestrian conflict reduction, speed reduction) performed by other entities to evaluate the safety performance of fluorescent yellow-green signs for bicyclists?

- ☐ Yes
- ☐ No

If you are willing to share these research studies, please provide URL(s) for the relevant documents in the box below, upload files, or email files to brownhen@missouri.edu: *(Display if answer to Question No. 19 = "Yes.")*

---

20. What other bicyclist safety countermeasures do the local agencies in your MPO's jurisdiction use in conjunction with the use of fluorescent yellow-green for bicyclist signs? Please select all that apply.

- ☐ Bicycle-activated signal detection
- ☐ Bicycle boulevards
- ☐ Bicycle lanes/paths (e.g., separate, shared use)
- ☐ Bicycle path intersection treatments
- ☐ Bicycle signals
- ☐ Bicycle helmet laws
- ☐ Bicyclist education
- ☐ Fluorescent yellow-green reflective strips on sign U-posts
- ☐ Lane narrowing
- ☐ Overhead lighting
- ☐ Pavement marking improvements

- ☐ Advance stop/yield bar and signs
- ☐ Pedestrian hybrid beacon (PHB)/ High-Intensity activated crosswalk (HAWK) beacon
- ☐ Raised medians and median islands
- ☐ Rectangular rapid flashing beacon (RRFB)
- ☐ Increasing traffic enforcement
- ☐ Speed limit reduction
- ☐ Other (please describe) _____
- ☐ None of the above

Comments:

_____

21. Which of the following challenges have the local agencies in your MPO's jurisdiction faced in the implementation of fluorescent yellow-green for bicyclist signs? Please select all that apply.

- ☐ Cost
- ☐ Lack of agency buy-in
- ☐ Maintenance considerations
- ☐ Need for performance data
- ☐ Need for standards or policies for use
- ☐ Need to prioritize with other bicyclist safety countermeasures
- ☐ Stakeholder coordination
- ☐ Time and effort to replace signs
- ☐ Other (please describe) _____
- ☐ None of the above

Comments:

_____

22. Which of the following is a reason for why the local agencies in your MPO's jurisdiction do not use fluorescent yellow-green for bicyclist signs? Please select all that apply. *(Display if answer for fluorescent yellow-green in Question No. 12 is blank.)*

- ☐ Cost
- ☐ Lack of agency buy-in
- ☐ Lack of information on benefits
- ☐ Maintenance considerations
- ☐ Need for standards or policies for use

- ☐ Other bicyclist safety initiatives are a higher priority (please briefly describe other initiatives) _____
- ☐ Time and effort to replace existing signs
- ☐ Other (please describe) _____
- ☐ Unsure

Comments:

_____

Section 3: Future Considerations and Final Comments

23. Are you aware of any local agencies in your MPOs jurisdiction that are planning to make any changes to their existing policies or practices for bicyclist and pedestrian signage?

    - ☐ Yes (please describe) _____
    - ☐ No

24. Would you be willing to participate in a follow-up interview to discuss in greater detail the use of signage for bicyclists and pedestrians in your MPO's jurisdiction?

    - ☐ Yes
    - ☐ No

25. Please provide any additional comments that you may have regarding signage for bicyclists and pedestrians.

_____
_____
_____

Submittal Instructions

To complete the survey and record your answers, please click the "Submit" button.

Please note that once you click the "Submit" button, you will not be able to modify your answers. To save your partial answers and complete the survey later, close the survey. Answers are automatically saved upon closing the browser window. To return to the survey later, open the original email from Henry Brown and click on the survey link. To pass a partially completed survey to a colleague, close the survey and forward the original email from Henry Brown to a colleague. Note that only one person may work on the survey at a time; the survey response

should only be active on one computer at a time. To review your answers before submitting, please select the forward and back arrows at the bottom of each page.

End of Survey

Thank you for completing this survey. Your efforts are greatly appreciated. Your responses are very important, and your feedback is welcome. For your information, a copy of your responses is provided below. You may download your responses in pdf format using the “Download pdf” link shown below. If you have any questions or comments, please contact the principal investigator, Henry Brown:

Henry Brown, P.E.
E2509 Lafferre Hall
University of Missouri
Columbia, MO 65211
(573) 882-0832
brownhen@missouri.edu

Your responses have been recorded, and you may now close your browser.

Appendix E: Comments and Text Responses for MPO Survey

Table E-1. Text responses for "Other" for Question 2 (types of pedestrian signs with FYG).

Other - Text
If not systemwide, near schools
Typically used in corridors with a history of pedestrian safety issues.
Typically, mid-block crossings, rail trail crossings and high traffic congested areas where people are walking/biking.
Typically, in school zones
Primarily for school zone crossings; occasionally at RRFB locations.

Table E-2. Comments for Question 2 (types of pedestrian signs with FYG).

Comment
Fluorescent yellow-green is used in school areas as required by MUTCD. Other areas may be yellow or fluorescent yellow-green.
It depends on the local agencies. For example, the City of Springfield and the City of Nixa use them for all pedestrian signs, the City of Republic on some and the City of Ozark does not use them at all. In the City of Republic, FY and FYG signs are mostly installed near or adjacent to schools, while most of the city has yellow signs.

Table E-3. Text responses for "Other" for Question 3 (extent of implementation of FYG for pedestrian signs).

Other - Text
School zones, primarily
Near schools
Typically school zones

Table E-4. Comments for Question 3 (extent of implementation of FYG for pedestrian signs).

Comment
The City of Springfield uses them systemwide in their jurisdiction, so excluding MoDOT roads.

Table E-5. Comments for Question 4 (percentage of FYG signs for pedestrians).

Comment
We don't have a regional sign inventory; it's only my observation. Most newer signs are fluorescent.
It depends on the local agencies. For example, the City of Springfield and the City of Nixa have them 76% to 100%, while City of Republic has them 0 to 25% and City of Ozark has none.

Table E-6. Text responses for "Other" for Question 5 (basis for switching to FYG for pedestrian signs).

Other - Text
To follow MUTCD requirements
MUTCD Requirement in school areas. It's not clear why we would have two colors for pedestrian signs, so agencies probably settle on a single color, rather than maintaining two colors.

Table E-7. Comments for Question 5 (basis for switching to FYG for pedestrian signs).

Comment
The City of Springfield started in 2021 with school signs (per MUTCD) and then started installing all in FYG.

Table E-8. Comments for Question 6 (safety performance of FYG versus yellow or FY for pedestrian signs).

Comment
Have not done before or after study.
CMAP is undertaking safety research but is using speeds from waypoint data to understand the relationships between safety performance, roadway geometry, speed, land use, and weather. To the best of my knowledge, signage is not part of the study.
Some local agencies are unsure. The City of Springfield added that during daytime the FYG has provided similar safety performance to yellow, or FY based on their yield checks: https://www.springfieldmo.gov/4921/Crosswalk-Compliance-Studies

Table E-9. Text responses for "Other" for Question 9 (use of other pedestrian safety countermeasures).

Other - Text
Education + enforcement: SGF Yields and SGF Across https://storymaps.arcgis.com/stories/abf31daa1db44535953695faab10b7ae
School-zone and park-zone automated traffic enforcement (speed cameras) in the City of Chicago

Table E-10. Comments for Question 9 (use of other pedestrian safety countermeasures).

Comment
City of Springfield all, City of Nixa has PHB, raised medians and median islands and City of Republic advanced stop/ yield bar and signs, speed limit reduction and policies for schools.
Primarily observed in Boulder, CO.

Table E-11. Text responses for "Other" for Question 10 (challenges faced in the implementation of FYG for pedestrian signs).

Other - Text
Unsure of these challenges

Table E-12. Comments for Question 10 (challenges faced in the implementation of FYG for pedestrian signs).

Comment
City of Springfield stated none of the above.

Table E-13. Text responses for "Other" for Question 13 (types of bicyclist signs with FYG).

Other - Text
The ones that apply via MUTCD
Bike warning signs only
Unclear what is meant here. Pathway signs are mostly yellow (red for stop signs, white for regulations, etc.). Roadway warnings of path crossings are yellow or fluorescent yellow-green.

Table E-14. Comments for Question 13 (types of bicyclist signs with FYG).

Comment
Only the City of Springfield uses FYG signs for bicyclist. All other local entities stated they use yellow signs.

Table E-15. Comments for Question 14 (extent of implementation of FYG for bicyclist signs).

Comment
Unclear what is meant here. Pathway signs are mostly yellow (red for stop signs, white for regulations, etc.). Roadway warnings of path crossings are yellow or fluorescent yellow-green.
Only City of Springfield uses FYG for bicyclists.

Table E-16. Text responses for "Other" for Question 16 (basis for switching to FYG for bicyclist signs).

Other - Text
To follow MUTCD

Table E-17. Comments for Question 16 (basis for switching to FYG for bicyclist signs).

Comment
Unclear what is meant here. Pathway signs is mostly yellow (red for stop signs, white for regulations, etc.). Roadway warnings of path crossings are yellow or fluorescent yellow-green.
Only City of Springfield uses FYG for bicyclists.

Table E-18. Comments for Question 17 (safety performance of FYG versus yellow or FY for bicyclist signs).

Comment
Unclear what is meant here. Pathway signing is mostly yellow (red for stop signs, white for regulations, etc.). Roadway warnings of path crossings are yellow or fluorescent yellow-green.
Only City of Springfield uses FYG for bicyclists.

Table E-19. Comments for Question 20 (use of other bicyclist safety countermeasures).

Comment
Only City of Springfield uses FYG for bicyclists.

Table E-20. Comments for Question 21 (challenges faced in the implementation of FYG for bicyclist signs).

Comment
Unclear what is meant here. Pathway signing is mostly yellow (red for stop signs, white for regulations, etc.). Roadway warnings of path crossings are yellow or fluorescent yellow-green.
Only City of Springfield uses FYG for bicyclists.

Table E-21. Comments for Question 25 (general comments).

Comment
I don't think the questions about bicyclists were sufficiently clear. Bicycles are treated as vehicles in Illinois, so are subject to appropriate signage. It wasn't entirely clear whether those signs are being considered in your research.
You may want to survey the major municipalities and county highway department in our county also, as they make decisions on that signage for their respective jurisdictions.
One local agency has indicated that they have not implemented FYG pedestrian and bicycle because of lack of information on benefits. Two local agencies stated costs and one of them also time and effort to replace existing bicycle signs. One also noted that the agency does not have a lot of bicycle signs in their jurisdiction. One agency sees a need for standards or policies. In 2023, the City of Springfield submitted a problem statement to NCHRP: G/17-10 "Inconsistent Ped. crossing signage for yield or stop condition" and legal topic to NCHRP on this topic.
The signage we have is the minimum necessary and there are no plans for additional signage in our area, unfortunately. New trails appear to be signed better than earlier trails, but, again, no plans are even being discussed for additional signage or updates to signage. Maintenance and supplemental funding has not been a priority.
The Assistant City Engineer in my department would be the best person to speak to regarding these topics. (She would have been the one to fill out this survey, but she is out on vacation.)

Appendix F: Example Interview Questions

This Appendix provides lists of example questions for agency interviews. These questions were customized for each agency.

Interview questions for State DOTs that Use FYG for Signs for Pedestrians and/or Bicyclists beyond School Zones.

1. What are your DOT's existing policies regarding the use of FYG for signs for pedestrians and bicyclists?
2. Does your DOT's use of FYG for signs for pedestrians and bicyclists vary based on certain criteria (e.g., ADT, urban/rural, facility type)? If so, what are those criteria?
3. Does your DOT's use of FYG differ by Region or District or is it tied to communities using it? If so, how?
4. Has the release of the 2023 MUTCD affected your practices for using FYG for signs for pedestrians and bicyclists? If so, how?
5. What were the primary factors that led your DOT to switch to FYG for signs for pedestrians and bicyclists? Was the decision based on any research? If so, what was the research?
6. What color sign (yellow or fluorescent yellow) did your DOT use for signs for pedestrians and bicyclists before switching to FYG?
7. What approach has your agency used to implement FYG (for example, corridor, systemic, community based, phased approach)?
8. How long did it take your DOT to switch to FYG for signs for pedestrians and bicyclists?
9. Does your DOT have any data after the switch that would indicate an improvement in safety performance associated with the use of FYG for signs for pedestrians and bicyclists?
10. Did your DOT face any implementation challenges in switching to FYG for pedestrians and bicyclists?
11. Approximately how many pedestrian and bicyclist signs does your DOT manage/maintain? Does your DOT contract out sign maintenance or perform it in-house?
12. How frequently does your DOT replace signs? Does this frequency vary based on roadway type or other factors?
13. What has been your DOT's experience with safety performance of FYG versus yellow or FY for signs for pedestrians and bicyclists?
14. What has been your DOT's experience with durability of FYG versus yellow or FY for signs for pedestrians and bicyclists?
15. Is your DOT considering conducting any evaluation studies for FYG for signs for pedestrians and bicyclists?

16. What other safety countermeasures for pedestrians and bicyclists does your DOT most frequently implement?
17. Based on your DOT's experience, does your DOT have any implementation suggestions for other DOTs regarding the use of FYG for signs for bicyclists and pedestrians?
18. Is your DOT considering any changes to its practices for signage for pedestrians and bicyclists in the future? If so, what are those changes?
19. In general, what are practices of local agencies in your state regarding sign color for pedestrians and bicyclists?

Interview questions for State DOTs that Do Not Use FYG for Signs for Pedestrians and/or Bicyclists beyond School Zones.

1. What are your DOT's existing policies regarding sign color for pedestrians and bicyclists?
2. Does your DOT's practices for signs for pedestrians and bicyclists vary based on certain criteria (e.g., ADT, urban/rural, facility type)? If so, what are those criteria?
3. Has the release of the 2023 MUTCD affected your practices for signage for pedestrians and bicyclists? If so, how?
4. Has your DOT performed any studies evaluating the performance of signs for pedestrians and bicyclists?
5. Approximately how many pedestrian and bicyclist signs does your DOT manage/maintain? Does your DOT contract out sign maintenance or perform it in-house?
6. How frequently does your DOT replace signs? Does this frequency vary based on roadway type or other factors?
7. What safety countermeasures for pedestrians and bicyclists does your DOT most frequently implement?
8. Is your DOT considering the use of FYG for signs for bicyclists and pedestrians in the future?
9. What are some of the challenges your DOT would face if a change to FYG for signs for pedestrians and bicyclists were to be considered?
10. Is your DOT considering any other changes to its policies for signs for pedestrians and bicyclists in the future?
11. In general, what are practices of local agencies in your state regarding sign color for pedestrians and bicyclists?

Interview questions for MPOs/Local Agencies that Use FYG for Signs for Pedestrians and/or Bicyclists beyond School Zones.

1. What are the policies of your agency (or agencies under your MPOs jurisdiction) regarding the use of FYG for signs for pedestrians and bicyclists?

2. (For MPOs) How do practices for the use of FYG for signs for pedestrians and bicyclists vary between agencies under your MPO's jurisdiction?
3. Have you coordinated your practice for the use of FYG with the state DOT? What feedback have you received by or given to the state DOT?
4. Does your agency's (or agencies' under your MPO's jurisdiction) use of FYG for signs for pedestrians and bicyclists vary based on certain criteria (e.g., ADT, urban/rural, facility type)? If so, what are those criteria?
5. Has the release of the 2023 MUTCD affected your practices for using FYG for signs for pedestrians and bicyclists? If so, how?
6. What were the primary factors that led your agency (or agencies under your MPO's jurisdiction) to switch to FYG for signs for pedestrians and bicyclists? Was the decision based on any research? If so, what was the research?
7. What color sign (yellow or fluorescent yellow) did your agency (or agencies under your MPO's jurisdiction) use for signs for pedestrians and bicyclists before switching to FYG?
8. How long did it take your agency (or agencies under your MPO's jurisdiction) to switch to FYG for signs for pedestrians and bicyclists?
9. Does your agency (or agencies under your MPO's jurisdiction) have any data after the switch that would indicate an improvement in safety performance associated with the use of FYG for signs for pedestrians and bicyclists?
10. Did your agency (or agencies under your MPO's jurisdiction) face any implementation challenges in switching to FYG for pedestrians and bicyclists?
11. Approximately how many pedestrian and bicyclist signs does your agency (or agencies under your MPO's jurisdiction)? Does your agency (or agencies under your MPO's jurisdiction) contract out sign maintenance or perform it in-house?
12. How frequently does your agency (or agencies under your MPO's jurisdiction) replace signs? Does this frequency vary based on roadway type or other factors?
13. What has been your agency (or agencies under your MPO's jurisdiction) experience with safety performance of FYG versus yellow or FY for signs for pedestrians and bicyclists?
14. What has been your agency's (or agencies' under your MPO's jurisdiction) experience with durability of FYG versus yellow or FY for signs for pedestrians and bicyclists?
15. What other safety countermeasures for pedestrians and bicyclists does your agency (or agencies under your MPO's jurisdiction) most frequently implement?
16. Based on your agency (or agencies under your MPO's jurisdiction) experience, does your agency have any implementation suggestions for other agencies regarding the use of FYG for signs for bicyclists and pedestrians?
17. Is your agency (or agencies under your MPO's jurisdiction) considering any changes to its practices for signage for bicyclists and pedestrians in the future? If so, what are those changes?

Interview questions for MPOs that Do Not Use FYG for Signs for Pedestrians and/or Bicyclists beyond School Zones.

1. What are your agency's (or agencies' under your MPO's jurisdiction) existing policies regarding sign color for pedestrians and bicyclists?
2. Does your agency's (or agencies' under your MPO's jurisdiction) practices for signs for pedestrians and bicyclists vary based on certain criteria (e.g., ADT, urban/rural, facility type)? If so, what are those criteria?
3. Has the release of the 2023 MUTCD affected your practices for signage for pedestrians and bicyclists? If so, how?
4. Approximately how many pedestrian and bicyclist signs does your agency (or agencies under your MPO's jurisdiction) manage/maintain? Does your agency (or agencies under your MPO's jurisdiction) contract out sign maintenance or perform it in-house?
5. How frequently does your agency (or agencies under your MPO's jurisdiction) replace signs? Does this frequency vary based on roadway type or other factors?
6. What safety countermeasures for pedestrians and bicyclists does your agency (or agencies under your MPO's jurisdiction) most frequently implement?
7. Is your agency (or agencies under your MPO's jurisdiction) considering the use of FYG for signs for bicyclists and pedestrians in the future?
8. What are some of the challenges your agency (or agencies under your MPO's jurisdiction) would face if a change to FYG for signs for pedestrians and bicyclists were to be considered?
9. Is your agency (or agencies under your MPO's jurisdiction) considering any other changes to its policies for signs for pedestrians and bicyclists in the future?