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From the Desk of the Director



By: Khaled Ksaibati

This newsletter issue contains all kind of useful information. To begin with, we have multiple workshops coming up and we are hoping that you will take advantage of these workshops. You can find the details for these workshops on our website as well as on the last page of the newsletter. In addition, The 27th Annual Transportation and Safety Congress will be held in-person in Casper on April 12th and 13th. So mark your calendars.

The first article in this newsletter describes an ongoing study on pavement marking. The findings of that study will help not only WYDOT but also all counties around the state. The upcoming potential changes to pavement marking requirements as stated in the MUTCD as well as the recent increases in the prices of pavement marking paint would require all transportation agencies to be more focused on how to provide the best level of pavement marking based on available resources and national requirements. The second article describes a very important issue related to updating the county road fund manual. We are hoping that we will be able to secure the funding from WYDOT to make it a reality and we will keep you posted on that effort.

On a different note, we have received requests for signs from seven different counties this year. We have already summarized all requests and submitted them to WYDOT by the deadline. I would like to thank all participating counties. I would also like to mention that we will have a regular round of safety improvement projects in the upcoming year.

Finally, we are so lucky to live in a region where we can experience the fall coloration. Make sure that you take advantage of this special event before it is too late.

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Don't Forget!

Sign up for our upcoming in-person workshop:
Constructing and Maintaining Durable Concrete

- ***Session 1: October 20, 2021 8:00 AM—4:00 PM at the Holiday Inn in Rock Springs***
- ***Session 2: October 21, 2021 8:00 AM—4:00 PM at the Holiday Inn Express in Casper***

Register online at
<https://www.uwyo.edu/wyt2/Workshops/index.html>

PAVEMENT MARKING & PAVEMENT MARKING RETROREFLECTIVITY

By: Uttara Roy



Pavement markings are fundamental elements of roadway networks therefore their maintenance is critical. Currently, the Wyoming Department of Transportation (WYDOT) periodically resurfaces its road pavement markings. The Wyoming Technology Transfer Center is working together with WYDOT to develop pavement marking plans and maintenance procedures to enhance the cost effectiveness of the program. Furthermore, with the advent of new vehicle technologies such as advanced driver assistance systems (ADAS) and connected/autonomous vehicles (CAVs), pavement marking standards are required to be updated. Such state-of-the-art technologies use machine vision systems, which are algorithms employed to process images from the vehicles' video cameras in order to analyze the surroundings particularly the pavement markings. It is believed that updating pavement marking standards will enhance the ability of machine vision systems when it comes to detecting and identifying the markings. WYDOT is planning to implement the suggested marking specifications and a comprehensive pavement marking management program in the near future. The changes in pavement marking standards will impact not only WYDOT operations but also pavement markings on local roads.

The National Committee on Uniform Traffic Control Devices (NCUTCD) provides suggestions to the Federal Highway Administration (FHWA) regarding amendments to the Manual on Uniform Traffic Control Devices (MUTCD). As of June 2019, the following recommendations (National Committee on Uniform Traffic Control Devices, 2020), which would facilitate machine vision systems to recognizing pavement markings, are discussed. The first is that longitudinal pavement markings would be six inches wide for expressways, freeways, and their connecting ramps. For non-freeways with speed limits of fifty-five miles per hour or higher and average daily traffic volumes of six thousand vehicles per day or higher, edge lines ought to be six inches wide. If such conditions are not satisfied, longitudinal lines are required to be four to six inches wide. In the current MUTCD (Federal Highway Administration, 2009), longitudinal lines may be four to six inches wide regardless of the road's functional classification and traffic volume. Also, wide lines, of which



widths are double those of typical longitudinal lines, are suggested to be eight inches or wider when striped in conjunction with four-inch lines and ten inches or wider when striped in conjunction with six-inch lines. Furthermore, NCUTCD recommended a guidance note stating that, for expressways and freeways, broken longitudinal lines be fifteen feet long. The spacing between the lines is suggested to be twenty-five feet. Hence, the combined length of a broken line segment and spacing would be forty feet. Another suggestion from the NCUTCD is that interchange ramps ought to have dotted line extensions similar to the ones shown in Figures 1 and 2. As shown in Figure 2, the dotted line ought to be extended from the gore point to the upstream beginning point of the taper.

Another suggestion from the NCUTCD is that interchange ramps ought to have dotted line extensions similar to the ones shown in Figures 1 and 2. As shown in Figure 2, the dotted line ought to be extended from the gore point to the upstream beginning point of the taper. This suggestion is also applicable to freeway on-ramp acceleration lanes, auxiliary lanes within weaving freeway segments and intersections with auxiliary lanes. In the current MUTCD, dotted lines of freeway ramps without auxiliary lanes are optional. For freeway ramps having auxiliary lanes, the current MUTCD specifies that dotted lines within the lanes' transition taper areas are optional. Deploying optional dotted line extensions is also suggested by NUTCD for two-lane highway passing lane and climbing lane sections.

With the recommended changes to the MUTCD made to accommodate machine vision systems discussed, it is worth exploring pavement marking practices of a variety of states, especially those which implemented the suggested pavement marking specifications. For instance, Missouri's longitudinal lines, belonging to main roads, are six inches wide. However, because the centerline of two-lane highways consists of two lines, each's width is four inches. That is also applicable to conditions in which a line is composed of dual lines such as those of multilane undivided highways (Missouri Department of Transportation, 2019). California is also implementing six-inch longitudinal lines as suggested by the California Department of Transportation (Caltrans), Google, and Tesla (American Traffic Safety Services Association, 2019; Falsetti, 2017). Colorado is not only widening its longitudinal markings to six inches on 3,000 lane miles of its roadways but also striping black lines succeeding the white broken lines on their concrete pavement segments as shown in Figure 3 to enhance contrast (Principe, 2019). With this aim, the Wyoming Technology Transfer Center researchers are working to develop strategic long-term pavement marking management plans for Wyoming.

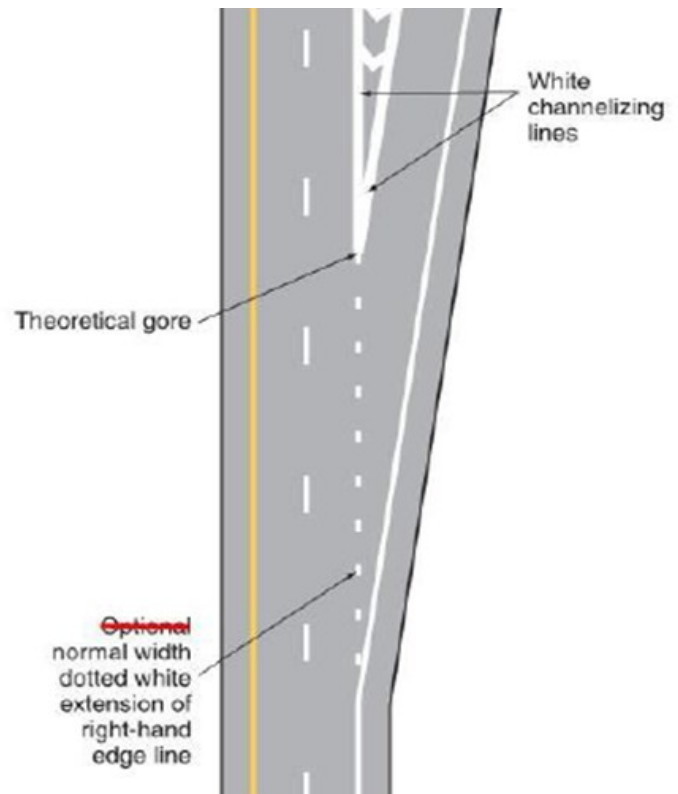


Figure 1: Dotted line extension at freeway ramp.
Source: National Committee on Uniform Traffic Control Devices (2020).

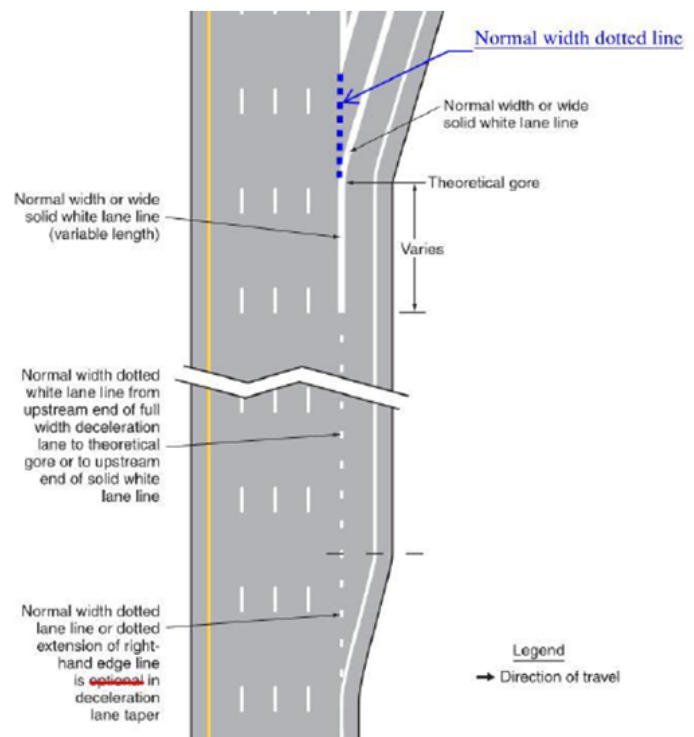


Figure 2: Dotted line extension at freeway ramp with deceleration lane.
Source: National Committee on Uniform Traffic Control Devices (2020).

The plans take into consideration NCUTCD's suggested pavement marking specifications that accommodate machine vision systems as well as other parameters. So far, a survey to state DOTs which have weather trends similar to Wyoming was developed and disseminated. Next, the researchers will evaluate WYDOT's pavement marking management practices and specifically ask about their current pavement marking management plans. The aim is to aid WYDOT in implementing the newly purchased pavement marking retroreflectometer and analyze its data. Afterwards, a five-year and ten-year pavement marking management plans will be developed for WYDOT. The plans would include the criteria for choosing the pavement marking materials such as pavement marking striping cost, marking life cycle cost, marking retroreflectivity, and the service life. The plans would also factor in the latest pavement marking standards intended to accommodate machine vision systems including those of contrast markings, pavement surface types, traffic loads, road functional classifications, land uses, minimum required marking retroreflectivity levels, interruption of traffic at the time of striping, quality control at the time of striping, method of inspecting the markings, deployment of deicing salts, snowplow operations, and other relevant information.



Figure 3: Black markings succeeding white markings.

Source: (Principe, 2019).

A database containing all the pavement marking management data will be developed which will be used to establish inspection and maintenance schedules. The developed pavement marking plans should be useful not only to WYDOT but also to local governments in Wyoming.

References

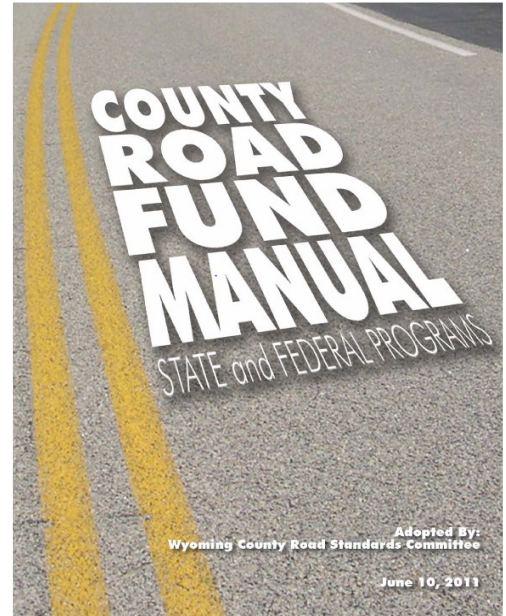
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UPDATING WYOMING COUNTY ROAD FUND MANUAL

By: Muhammad Tahmidul Haq

The Wyoming County Road Fund Manual (CRFM) has been established to provide the minimum requirements and guidelines needed to meet County Road Fund legislation and fulfill County Commissioner responsibilities and duties in Wyoming. The Manual serves two separate but related objectives: (i) firstly, to serve as a reference guide for each county in its use of County Road Construction Funds and (ii) secondly, to serve as a reference guide for the counties, the Wyoming Department of Transportation (WYDOT), and the Federal Highway Administration for numerous state-funded and federally funded transportation programs. The Manual also demonstrates a defined level of oversight by a Wyoming-registered professional engineer during the development of the project design and for project contract documents, project construction, and project final acceptance.

The manual was last revised in June 2011, and it was prepared based on the information available on the Federal and State Highway Design Guide, AASHTO Green Book, AASHTO Roadside Design Guide, Manual on Uniform Traffic Control Devices (MUTCD), etc. Ten years have been passed and most of the Federal and State Highway Manuals were updated with new information and revised design criteria and values. For example, WYDOT Road Design Manual has recently been updated and incorporates design guides for Interstate Highways, NHS Arterial (Non-Interstate), and non-NHS State Highways. Therefore, updating the County Road Fund Manual has become a vital task for Wyoming County Roads Standard Committee to compliance with all the recent changes and updated information.



The Wyoming Technology Transfer Center, counties, and WYDOT have developed a proposal to update the 2010 CRFM. The main goal of this study is to reorganize and update Wyoming County Road Fund Manual while addressing significant changes to governance of county road funding, project bidding and contract procedure, road and bridge standards, guidelines as well as design specifications. In support of this broader goal, the study is aimed to fulfill the following three objectives:

- The first objective is reorganizing the Manual in a manner that there will be one section dedicated for County Commissioners and another section designated for road and bridge engineers/road supervisors.
- The second objective is to identify all the recent changes in the road and bridge standards, guidelines, and design specifications. This will be achieved by conducting a comprehensive review of the updated Manuals at the State- and National-levels.
- The third objective is to incorporate all the potential changes into the Wyoming County Road Fund Manual. This will be achieved by establishing an advisory group. This group will review the changes, provide their feedbacks, and finally facilitate the full implementation of the updated Manual.

The following benefits can be achieved by performing this study:

- Serve to guide Wyoming Counties in their administration of road and bridge projects using the most updated funding sources.
- Outline the recent changes in road and bridge standards and guidelines for Wyoming Counties to follow for the establishment, location, design, construction, and reconstruction of roads and bridges under their jurisdiction.
- Serve Counties in compliance with the updated Wyoming Statute, assist in addressing public complaints, assist in meeting legal challenges, and support program funding.
- Serve to guide WYDOT and FHWA in the administration of their funding programs.

The proposal will be submitted to the WYDOT RAC for potential funding. **If the study is funded, input from all counties would be needed to ensure that the new version of the CRFM is as beneficial as it can be to all users around the state.**



NO PASSING ZONE SYSTEM (NPZS) LOAN PROGRAM



The University of Wyoming, in cooperation with WYDOT, developed a device that utilizes the two-vehicle method for establishing passing/no passing zones on roadways. The WYT2 and WYDOT recreated the original No Passing Zone System (NPZS) to make it available for local governments in Wyoming. The development of the \$10K system was made possible through WYDOT funding.

If you are interested in using the NPZS, you will need to provide contact information and the estimated use time (up to two weeks). You will also need to state if you would like to pick it up at our Laramie office at no fee or have it delivered. There is a fee of \$100 each way for that option.

A training video is available for instructions on best practices for use and collecting data.

To submit a request, please complete the form found at:

www.uwyo.edu/wyt2/npzs-loan-program/index.html



The University of Wyoming, WYDOT, and the T2 center is NOT liable for any implications/litigations associated with using the data generated by the NPZS. It is your agency's responsibility to confirm the accuracy of data.

For more information about the NPZS loan program, please contact us with any questions (307) 766-6743 or email us at wyt2c@uwyo.edu



Upcoming Workshops

- **Local Project Administration (LPA) Certification — October 13, 2021**
- **Constructing and Maintaining Durable Concrete — October 20, 2021**
- **Constructing and Maintaining Durable Concrete — October 21, 2021**
- **Care and Repair of Asphalt Pavements—Something for Everyone — March 9, 2022**
- **Care and Repair of Asphalt Pavements—Something for Everyone — March 16, 2022**
- **Transportation and Safety Congress — April 12-13, 2022**
- **WMTC Sessions**
 - **Aggregate Seminar — December 1-3, 2021, January 24-26, 2022, and May 16-18, 2022**
 - **Asphalt Seminar — December 6-8, 2021, January 31-February 2, 2022, and May 23-25, 2022**
 - **Concrete Field Testing — December 13-15, 2021, February 7-9, 2022, and May 11-13, 2022**

For more information and to register for upcoming workshops, please click this link: <http://www.uwyo.edu/wyt2/workshops/>

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