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Road TTAP Talk

Flashing Yellow Arrow Left Turn Display

by Dr. Airton G. Kohls

If you travel around the country there is a good chance you have noticed a new style of left-turn traffic signal at intersections. This new signal display includes a Flashing Yellow Arrow (FYA) that indicates that left turns are permitted but must yield to oncoming traffic and pedestrians. Motorists occasionally misunderstand the circular green ball typically used during left-turn permissive movements, believing to have the same "protected" right of way as indicated by the green ball on a through movement. Now, the combination of a flashing indication and a yellow arrow should encourage caution during the left turn movement.

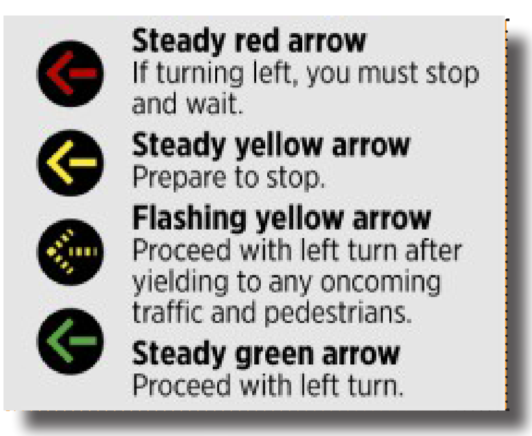
A comprehensive national study to evaluate the operational and safety advantages of left-turn controls used in different states was conducted for the Federal Highway Administration and results are reported in National Cooperative Highway Research Program Report 493. Results showed that the Flashing Yellow Arrow helped prevent crashes, improved left turn efficiency and provided additional traffic management flexibility by allowing the use of any left-turn mode of operation by time of day. It was also demonstrated that FYA can be programmed to avoid the "yellow trap" that is associated with some permissive turns at the end of the circular green display.

The Flashing Yellow Arrow is currently deployed at more than 500 intersections across the country and the typical operation is demonstrated in the figure below.

The 2009 Edition of the Manual on Uniform Traffic Control Devices incorporates the optional use of the Flashing Yellow Arrow indication in Chapter 4D.04. With its inclusion in the MUTCD, use of FYA indications is sure to increase across the nation. With the introduction of this new signal indication in any area, it will be very important to educate and inform the public of the proper response.

To learn more about the use of flashing yellow arrows for permissive left turns:

- 2009 MUTCD:http://mutcd.fhwa.dot.gov/kno_2009.htm
- NCHRP Report 493: http://trb.org/publications/nchrp/nchrp_rpt_493.pdf



In this issue...

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The views, opinions, and recommendations contained within this newsletter are those of the authors and do not necessarily reflect the views of FHWA and TDOT.

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From the Director

As I write this it is early fall, the leaves have largely fallen and we're in a bit of a cold snap. It feels good to get away from summer's heat. Now, it's time to get the chores done to be ready for winter.

We just finished the election season, and, frankly, it's good not to be barraged by all the ads. You will all know the results as you read this. What they mean for transportation is unclear. Rep. James Oberstar, D-MN, Chair and long-time member of the House Committee on Transportation and Infrastructure (T&I), was defeated. One of the leading House experts on transportation policy, Rep. Oberstar was a staunch defender of the Highway Trust Fund. I had the privilege of meeting him this past summer and found his grasp of transportation issues impressive. Rep. Oberstar was known for his bi-partisan approach to transportation issues and was, in fact, a close personal friend of Tennessee congressman and fellow T&I committee member Jimmy Duncan. Before the election, Rep. Oberstar had been working aggressively to move the surface transportation reauthorization bill forward. In my opinion, his defeat will move the already overdue reauthorization bill down on the legislative priority list.

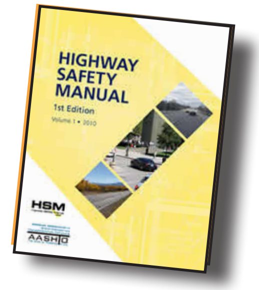
Closer to home, we will have a new Governor and a greatly changed state legislature. During the election campaign, I heard little discussion of transportation issues from any candidate at any level. At press time, the Governor-elect had not announced his cabinet appointees. So, the approaches that the new administration and the legislature will take for our transportation infrastructure remain to be seen. They won't have it easy given the challenges we face economically.

On a sad note, I had the opportunity recently to examine a rural location outside Tennessee where five members of a family, including three young children, drowned in a tragic auto accident. Their car left the road at a point where there was a sharp turn to cross a creek, turned over, and ended up submerged in a plunge pool at the end of a box culvert. The outside shoulder had a sudden drop-off to the water, with no guard rail protection. There did not appear to be adequate warning of the impending curve, despite a 55 mph speed limit on the two-lane collector road. The thought of what those poor people went through in their last moments horrifies me. The neighbors recounted numerous stories about other crashes at the location, so there was plenty of warning that a dangerous situation existed. This tragedy is a reminder that we need to be proactive about safety. Take a hard look when you're driving over your roads and streets. Ask yourself how you can take positive steps to improve safety. Don't let it take a tragedy to move you to action.

As always, please feel free to contact us for technical assistance, training, or information. We look forward to serving you.

David

NEW Highway Safety Manual to the rescue, to save more lives...



Reprinted from the Summer 2010: Volume 4, Issue 2 Safety Compass, FHWA

Prior to this first edition of the Highway Safety Manual (HSM), transportation professionals did not have a recognized national resource for quantitative information on crash frequency prediction. As a result, safety considerations often carried little weight in the project development process, limiting the ability of transportation professionals to discuss and act upon safety-focused recommendations during project development. An effective resource was urgently needed to quantify and predict the expected crash frequency of elements considered in road planning, design, construction, operation, and maintenance.

The HSM begins to fill this gap, providing transportation professionals with a set of proven analysis tools for crash frequency prediction to encourage explicit consideration of the safety-related effects of transportation decisions. HSM provides current knowledge, techniques and methodologies to quantify safety impacts – similar to the way operational impacts are quantified in the Highway Capacity Manual, and environmental impacts through the NEPA process.

The HSM provides the best factual information and tools in a useful form to facilitate roadway decisions based on explicit consideration of the effects of these decisions on potential future crash frequency and severity.

What is in the HSM?

The HSM is organized into four parts:

Part A describes the purpose and scope of the HSM, explaining the relationship of the HSM to planning, design, operations, and maintenance activities. *Part A* also includes fundamentals of the processes and tools described in the HSM. A chapter based on fundamentals provides background information needed to apply the predictive method, crash modification factors, and evaluation methods provided in Parts B, C, and D of the HSM.

Part B presents suggested steps to monitor and reduce crash frequency and severity on existing roadway networks. It includes methods useful for identifying improvement sites, diagnosis, countermeasure selection, economic appraisal, project prioritization, and effectiveness evaluation. The chapters in Part B discuss the network screening process, diagnosis, selection of countermeasures, project prioritization, and safety effectiveness evaluation.

Part C describes the predictive method for estimating expected average crash frequency of a network, facility or individual site. *Part C* can also be used as a source for safety performance functions (SPFs). SPFs estimate crash frequency as a function of traffic volume and roadway characteristics. The chapters in *Part C* provide the predictive method for segments and intersections for rural two-lane roads, rural multilane highways, and urban and suburban arterials.

Part D provides a catalog of crash modification factors (CMFs), which represent the change in crash frequency due to a particular treatment, for the purpose of potential crash frequency reduction. CMFs are used to estimate the change in the expected average crash frequency plus or minus the standard error provided with the CMF. Treatments are provided for roadway segments, intersections, interchanges, special facilities, and road networks.

Software Support.

The Highway Safety Manual methodologies will be supported by the following software programs.

- **SafetyAnalyst** provides a set of software tools used by state and local highway agencies for highway safety management. SafetyAnalyst is applicable to Part B of the HSM. The SafetyAnalyst software is available through AASHTO, and additional information can be found at www.safetyanalyst.org.
- The **Interactive Highway Safety Design Model (IHSDM)** is a suite of software analysis tools for evaluating the safety and operational effects of geometric design decisions on highways. The IHSDM Website summarizes the capabilities and applications

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of the evaluation modules and provides a library of the research reports documenting their development. Information on the IHSDM is available at www.tfhrc.gov/safety/ihsdm/ihsdm.htm.

⏩ The **Crash Modification Factors Clearinghouse** houses a web-based database of CMFs along with supporting documentation to help transportation engineers identify the most appropriate counter-measure for their safety needs. Using this site at www.cmfclearinghouse.org, users are able to search on CMFs or submit their own CMFs to be included in the clearinghouse.

The HSM is now on sale at http://bookstore.transportation.org. Search under code *HSM-1.*

- Cost: $325 for AASHTO members. $390 for non-members.
- Discounts are available for those states taking HSM training.

The Office of Safety has initiated several activities to assist with the deployment and implementation of the HSM which include training, marketing, outreach, technical assistance, and data support. Current HSM training courses and webinars are available or under development from the National Highway Institute. http://nhi.fhwa.dot.gov

Benefits of HSM

⏩Potential for reduced crash frequency and severity in a jurisdictions transportation system as a whole.

⏩Cost savings in the overall operation of the system as well as the planning, design, and construction of projects.

⏩Many of the methods in the HSM can compensate for the variability of crash data to provide more stable and reliable results. These results can lead to more effective planning for safety investment.

⏩Analysis tools for predicting the impact of these decisions on road safety can lead to more efficient investments.

⏩Provides opportunities to realize cost savings during project development, operations, and maintenance activities.

⏩Decisions can be made based on quantitative evaluations that predict changes in crash frequency based on the type of treatments used, instilling confidence that safety funds are being applied most effectively.

⏩Time spent justifying a safety decision will be reduced by conducting a definitive, science-based analysis.

⏩The tools in the HSM make it possible to integrate safety analysis into the project development process in the most cost-effective manner.

To find out more about the Highway Safety Manual, visit the HSM Website at www.highwaysafetymanual.org and/or http://safety.fhwa.dot.gov/hsm; or call Esther Strawder at 202-366-6836.

Chip Sealing

Reprinted with permission from the Baystate Roads Program LTAP, Tech Notes #53

This preventive maintenance technique is typically applied to low volume, asphaltic concrete pavements to avoid or defer major rehabilitation. Past research on the effectiveness of seal coating has shown that both short and medium-term benefits are associated with this treatment. Studies have shown that chip sealing's effectiveness can be measured in relation to the initial pavement condition. Pavements in relatively poor condition were generally associated with higher initial performance jumps but lower reductions in their rate of deterioraton. Pavements in relatively good condition were generally associated with lower performance jumps but greater reductions in their deterioration rates.

The topic of chip seals arouses different responses from different municipalities. Many have used them for years and swear by them while others would not use them if they were free. Because the treatment can stretch dwindling municipal funds, this article identifies some benefits as well as the pitfalls.

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Chip sealing provides a cost effective solution to renewing road surfaces, protecting the underlying structure from moisture damage, and sealing minor surface disintegration.

There are two main reasons why people are dissatisfied with chip seal performance. One, people often expect too much from them. The purpose of a chip seal is simply what the name implies: it seals the surface of the pavement, repelling water which is the primary cause of pavement distress.

Chip seals also can add skid resistance to worn pavement. Pavement surface integrity can be restored giving new life to a dried-out, raveling surface. The seals are typically applied to roadways under 1,500 average daily traffic (ADT). Roadways with ADT between 1,500 and 12,000 can be sealed successfully if traffic control (speed of traffic) is maintained during and after construction. Chip seals do not add structural strength to pavement. A badly alligatored surface with depressions indicates water problems or base failure that must be corrected prior to placing a chip seal. Sealing an alligatored surface probably will not hold the pavement together. In fact, the cracks will reopen, wasting the expenditure. In such cases, solve the drainage problems, then consider recycling and sealing.

The second reason for dissatisfaction is that the application was executed or inspected incorrectly. The success of chip sealing relies on the use of proper materials, equipment, calibration, weather considerations, and experienced contractors. If small problems are overlooked, big problems result.

First, consider the components of a chip seal. An emulsion is a combination of asphalt, water and an emulsifying agent. The emulsifying agent causes the asphalt to disperse in the water making a mixture stable This preventive maintenance technique is typically applied to low volume, asphaltic concrete pavements to avoid or defer major rehabilitation. Past research on the effectiveness of seal coating has shown that both short and medium-term benefits are associated with this treatment. Studies have shown that chip sealing's effectiveness can be measured in relation to the initial pavement condition. Pavements in relatively poor condition were generally associated with higher initial performance jumps but lower reductions in their rate of deterioration. Pavements in relatively good condition were generally associated with lower performance jumps but greater reductions in their deterioration rates. enough for mixing, pumping and prolonged storage. Polymer modified emulsions (PME) incorporate polymers into the asphalt prior to emulsifying. PME's have been shown to have better stone retention and longer service life than conventional emulsions. Particular problems are the charges on the emulsions and stone. There are anionic (negative charged) and cationic (positively charged) emulsions and stone. This presents the potential user with the problem of matching the charged emulsion with a stone (aggregate) of the opposite charge. Using a cationic emulsion with a cationic stone will result in a natural magnetic repulsion, which means that the stone will push away from the emulsion. This causes an immediate problem with a chip seal. The most commonly used emulsions RS-2 (E-2) and CRS-2 (E-3) and polymer emulsions RS-2P and CRS-2P are anionic and cationic respectively.

Care must be taken to choose the proper combination of aggregate and emulsion. The emulsion supplier can do a simple test to assure material compatibility. The supplier provides a letter stating that the test showed proper material compatibility.

Although most people know that concrete goes through a "setting-up" process, many don't know that emulsions also have a setting-up process called "breaking". The asphalt separates from the water and forms a continuous film on the pavement. Aggregates must be placed and the first roller pass accomplished before the emulsion breaks or the stone will not adhere properly.

A high percentage of fines (finely crushed or powdered material) in the aggregate causes another problem: the fine material will absorb the emulsion. If the aggregate particles are dusty or coated with clay, the emulsified asphalt may not stick. The dust produces a film that prevents the asphalt from adhering to the aggregate. Using a pre-coated aggregate or a

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washed aggregate can solve this problem. Approved aggregates are AASHTO #8, #67, and #7. Washed aggregate is required to have less than 1.0% material passing the 200 sieve to meet specification.

PREPARATIONS

Now that we understand the materials and have checked their compatibility, we are ready to start the seal coating process. Clean out the surface cracks between ¼ and 1 inch width and seal them. Clean the grass and weeds from the gutter and curb areas. The seal coat performance is only as good as the surface to which the seal coat is applied. Care should be taken to assure that the roadway is clean and free of any substances that will prevent the emulsion from bonding to the pavement. Power brooms, vacuum trucks, blowers and high-pressure water are some of the equipment and methods utilized to clean the roadway.

APPLICATION

The contractor must submit a chip seal design at least two weeks prior to the start of the project. It should be noted that even if you are doing the project in-house you should have a chip seal design to assure success of the application.

All equipment, distributors, chippers and rollers should be calibrated annually. The contractor, as well as the municipal equipment if being done in-house, should have a current copy of the equipment calibration. If the temperatures of the air, road surface and aggregate are above 60 degrees and rising you are ready to start. If a current calibration is not available, check the equipment as follows:

1. Check the distribution rates of both the asphalt distributor and the chipper on the small test strip to be sure you have met the design specifications.
2. Measure the area of the strip and record the level in the distributor before and after spreading.
3. Check the application rate of the spreader by placing a three foot by three foot (one square yard) flat pan under the spreader as it moves through the test area.
4. Weigh the chips on the pan, subtract the pan's weight and you have the pounds of aggregate per square yard that has been applied.
5. Match both figures to your design and, if they are within acceptable limits, you can start work.

Heated liquid asphalt is applied to the roadway surface

6. Check the color of the emulsion as it is applied. If it is black, the emulsion has "broken", with the water separating from the asphalt too soon. Stop the project and get new emulsion. The emulsion should be creamy dark brown in color before "breaking".

The application should be watched carefully because misaligned spray bars can cause streaking. This means some areas are getting too much asphalt (resulting in bleeding) and some not enough (resulting in loss of aggregate). If this happens, stop the project and have the spray bars recalibrated. If the pads on the roller are worn or missing, the tires will pick up the aggregate. If you see this happening, stop the project and have the pads replaced. Be sure to check the tire pressure on rubber-tired rollers because uneven pressures produce uneven results. The contractor should provide enough rubber-tired rollers for full coverage in one pass. Avoid back rolling, as this will tend to move aggregate exposing asphalt which increases pick up on rollers.

Rubberized chip seals are yet another way to yield high performance out of limited highway department dollars. This chip seal has the added benefits of having a darker color, a higher control of dust, high early chip retention, better adhesion at lower temperatures, and a more efficient sweeping surface. These features allow the rubber chip seal to be used on roads where there are higher traffic volumes and higher travel speeds. High quality asphalt cement is blended with

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recycled tire rubber at elevated temperatures for a specific amount of time to produce a material that has improved temperature susceptibility, flexibility, and resistance to aging.

Now that you have seen that sealing is a complicated process of many small parts, you can appreciate the need for care in choosing the correct situation and preparing surfaces correctly. By taking your time and following the procedures set forth, your efforts should result in a successful chip seal that will stretch your municipal dollars. Just don't expect this procedure to perform miracles. Chip sealing is a preventative measure. Choose candidates wisely.

TIPS FOR A SUCCESSFUL SEAL COAT

Rubber-tired rollers should be used, allowing equipment to follow contours of the road. Steel-wheeled rollers tend to crush the aggregate. This can cause the aggregate to pop out of the emulsion and also may create more uneven results.

A properly constructed chip seal should have one-half to two-thirds of a typical stone imbedded in the asphalt after the surface is rolled and cured.

Application of too much stone may also be a problem. If the mix is more stone than the emulsion can hold, the loose stone may push the adhered stone out of the emulsion under compaction.

The area can be swept after a day or two but only after the emulsion has broken. Check the emulsion by scraping the chips from the small area and inspecting the asphalt. If it is a brown color, wait. If it is black, the emulsion has broken and the sweeping may be started. To prevent loss of adhered aggregate, it is a good practice to wait as long as possible before sweeping. Through the next week, check the surface and remove any remaining loose aggregate.

Try to keep traffic off the new application for as long as possible. If road closure is not an option consider use of leader or pilot vehicles to control speed of traffic during the operations. Restricting traffic for twenty-four hours will assure a greater chance of success, but may not be realistic. Now, remove the work zone traffic-control devices leaving the loose stone signs in place for an additional week after the project is completed (in reverse order of placement) and allow traffic to follow a leader or pilot car at a slow rate of speed over the newly seal coated pavement.

Once rock chips are applied to the liquid asphalt they are rolled in with rubber-tired rollers

Resources

1. Labi, S. and K.C. Sinha. Effectiveness of Highway Pavement Seal CoatingTreatments. In Journal Transportation Engineering, Vol. 130, No.1, American Society of Civil Engineers, pp. 14-23, New York 2004.
2. Pavement Distress and Rehabilitation Manual. MassHighway, Boston, Mass. 1993. Available as hard copy from Baystate Roads Program's Library -- MAN 20. Available as electronic copy from: David.Blei@MHD.state.ma.us
3. King, Kevin. " ChipSeal/ Best Practices," presented at the Texas Pavement Preservation Semnar, Austin, Texas, October 2005.
4. Technical Information Sheet #131, Pennsylvania DOT/LTAP, Summer 2007.

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TALK TO TTAP

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2. Please list any additional training workshops you would be interested in attending.

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3. Please list topics for videos you would like TTAP to obtain.

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4. Please list any other ideas or suggestions on how TTAP could assist you.

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