

Lines, Signs, Signals...

What Do People Really Know and Do

**An Informational Report of the Institute of
Transportation Engineers (ITE)**



Prepared by the ITE Traffic Engineering Council Committee 111-03
Chair: Leon Goodman, P.E., PTOE
Vice Chair: Mark Kulewicz



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The Institute of Transportation Engineers is an international educational and scientific association of transportation professionals who are responsible for meeting mobility and safety needs. ITE facilitates the application of technology and scientific principles to research, planning, functional design, implementation, operation, policy development, and management for any mode of ground transportation. Through its products and services, ITE promotes professional development of its members, supports and encourages education, stimulates research, develops public awareness programs, and serves as a conduit for the exchange of professional information.

Founded in 1930, ITE is a community of transportation professionals including, but not limited to transportation engineers, transportation planners, consultants, educators, and researchers. Through meetings, seminars, publications, and a network of nearly 15,000 members in more than 90 countries, ITE is your source for expertise, knowledge, and ideas.



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PREFACE AND ACKNOWLEDGMENTS

This is an informational report of the Institute of Transportation Engineers (ITE). The information in this report has been obtained from experiences of transportation engineering professionals and research. ITE informational reports are prepared for informational purposes only and do not include ITE recommendations on the best course of action of the preferred application of data.

ITE Traffic Engineering Council Committee 111-03, Lines, Signs, Signals...What Do People Really Know and Do, was established with the purpose of 1) identifying examples of where the *Manual on Uniform Traffic Control Devices* (MUTCD)-intended meaning of a traffic control device; is not correctly conveyed by state motor vehicle manuals; is not really understood by drivers; and/or is not consistently applied by enforcement agencies, and 2) developing an informational report documenting identified problem areas which can be reviewed with relevant agencies towards achieving improved highway safety.

The committee established a work scope that included a literature review, an Internet search, a survey of ITE public sector members, and reviewing and categorizing the collected information. The results of this study are presented in this report.

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Cover Photo: Courtesy of Leon Goodman

1. INTRODUCTION

Background

While traffic engineers carefully apply technically correct traffic control devices, drivers, pedestrians, bicyclists, and some traffic engineers often don't know or are quite confused as to the meaning of these devices. Police sometimes are inconsistently enforcing these devices. We should be concerned because, per the *Manual on Uniform Traffic Control Devices* (MUTCD) "traffic control devices should fill a need, command attention, convey a clear and simple meaning." That is critical if users are to fully realize the potential safety benefits of the devices.

"Lines on the Pavement/Drivers Don't Know," a paper presented at the 2010 ITE Northeastern District Annual Meeting, presented examples of these confusing, misleading, or actually incorrect situations, regarding pavement markings. The confused or inaccurate reactions of attendees, including many "new" (and experienced) traffic engineers, led to the idea that this subject needs focus from our profession, not just for markings but for other traffic control devices. As a result, a committee was established to study this question and prepare a report.

In preparing this report, the committee has been aware that in addition to the MUTCD the design, intent, and meaning of traffic control devices derive from: state statutes, the *Uniform Vehicle Code*, state driver's manuals, and law enforcement interpretations.

As a note, the approaching introduction of autonomous vehicles poses significant issues as to the future role of the type of traffic control devices covered in this report. In the long term, if and when all vehicles are autonomous, fewer or none of these devices may be needed. Regulatory and warning devices may be unnecessary, but roadway markings may be needed for optical guidance and informational signs may still be helpful. During the transition period, when autonomous vehicles are being operated along with semi-autonomous vehicles, the devices discussed here (or variations of them) will still be needed. How long will this transition last? What new or different traffic control devices will be appropriate? Only time will tell.

One perspective on this transition was advanced by Princeton University professor Alain Kornhauser in his October 2014 *ITE Journal* article on Smart Driving Cars, "This suggests that making signs, lane markings, etc. easier for humans to recognize, read, and understand, the easier it will be for image processing software to recognize, read and understand what needs to be done. Investments in better lane markings, intersection markings and channelization, easier to see signals, and more consistent design and positioning, etc. and the performance of a conventional driver will also be a valued investment for smart driving cars."

This informational report is intended to:

- 1) Identify examples of where the MUTCD-intended meaning of a traffic control device: is not correctly conveyed by state motor vehicle manuals and/or is confounded by state motor vehicle laws that do not conform to the *Uniform Vehicle Code* meanings; is not really understood by road users; is not correctly applied by traffic engineering agencies;

and/or is not consistently enforced by police. Examples include: edge lines (when can they be crossed); lane lines (meaning and difference of single solid white line or double solid white lines); pedestrian crosswalk signs (protection or lack thereof provided to pedestrians) and directional signs ("EXIT ¼ MI" legend, which usually indicates an upcoming right hand exit, used on advance sign for a left-hand exit).

- 2) Develop documentation of identified problem areas and suggested changes designed to address these situations. This documentation, i.e., the informational report, would be published by ITE and also would be intended for review with relevant organizations towards improved highway safety. These organizations could include motor vehicle departments through the American Association of Motor Vehicle Administrators (AAMVA), police organizations through the International Association of Chiefs of Police (IACP) and, possibly, driver education/training groups such as the American Automobile Association (AAA) or the American Association of Retired Persons (AARP).

This review, aimed at mutual understanding of traffic control devices, would be a follow up to this project. The committee sought input on these types of situations in local areas, for pavement markings, and other traffic control devices.

Committee, Methodology, and Scope

Committee members included ITE members with extensive traffic engineering experience in the public and private sector, as well as representatives of other relevant groups, such as AAA, AAMVA, and IACP.

This report draws on the knowledge and field experience of committee members, their further research of state drivers' manuals and vehicle codes, a literature search and questionnaires to transportation professionals, police, and drivers. Questionnaires were sent to: members of ITE Councils (Traffic Engineering, Transportation Safety, and Public Agency), members of the IACP, and two AAA auto clubs in New York state.

Some of the key findings from the literature search and from the questionnaires are included in the text of this report. Additional summary points from the questionnaires are in the report appendix.

As to scope, the information herein is the product of the volunteer committee, with assistance from ITE staff. The committee's research and observations, directly addressed 21 states. While it is not a "scan" of all fifty states, the report does provide a relevant sample of some of the concerns. The states examined in this report include: Alaska, California, Delaware, the District of Columbia, Florida, Georgia, Hawaii, Illinois, Kansas, Maryland, Massachusetts, Minnesota, Missouri, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Utah, Virginia, and Washington state. The observations within a state are also a sample, a note on some of the concerns, certainly not a complete scan.

2. OBSERVATIONS OF “INCONSISTENCIES”

Observations noted in this section of the report are organized as follows:

- Passing
- Shoulders
- Turns
- Intersections
- Traffic Signals
- Pedestrians
- Bicycles
- Special Zones
- Other Issues

Included here are some apparent inconsistencies between the MUTCD and a state driver’s manual, vehicle code, vehicle law, or other driver guidance information. This chapter provides insights from a review of state driver’s manuals, vehicle codes and/or vehicle laws, and the results of the questionnaire. Some of these points may be considered relatively minor, such as a needed update for the latest color of flaggers vests in work zones. More concern is noted where a state’s guidance language implies that motorists may drive “at will,” for long distances in a shoulder.

Passing

One-Way Roadways

For single-solid and double-solid white lane lines, and associated signs, the MUTCD says:

Except as provided in Paragraph 6, where crossing the lane line markings with care is permitted, the lane line markings shall consist of a normal broken white line.

Where crossing the lane line markings is discouraged, the lane line markings shall consist of a normal or wide solid white line.

Where crossing the lane line markings is prohibited, the lane line markings shall consist of a double solid white line.

The MUTCD further notes use of a “STAY IN LANE” sign where lane changing is prohibited, stating: “If a STAY IN LANE sign is used it should be accompanied by a double solid white lane line(s) to prohibit lane changing.” While the MUTCD says “should” rather than the stronger “shall,” the committee believes that use of the STAY IN LANE sign with less restrictive lane lines, i.e., broken white line or solid white line, greatly dilutes this sign’s effectiveness.

State Drivers Manuals, Vehicle Codes, or Vehicle Laws

Florida

The Florida driver's manual states: "Solid White Line, a solid white line marks the right edge of the roadway or separates lanes of traffic moving in the same direction. One may travel in the same direction on both sides of this line, but you should not cross the line unless you must do so to avoid a hazard."

The basic problem is that the manual uses one text for two entirely different applications, i.e., right edge line and lane line. With regard to the right edge line, taken literally, does it mean one could legally drive in the paved shoulder for as long as desired?

On the other hand for a lane line, does it mean that one can't cross a single solid white line to follow guidance from lane placement direction signs, such as at intersection approaches, at toll plazas, at exits from major bridges, etc.? For this pavement marking, the MUTCD states that it is only to "discourage" lane changing.

Hawaii

The official Hawaii driver's manual is not available at the department of motor vehicles (DMV) licensing offices, but can be purchased at local stores and is available online. Another reference for drivers is *Hawaii Revised Statutes* (HRS).

HRS states that double solid white lines indicate a "maximum" restriction while the driver's manual states that they indicate that crossing (meaning lane changing?) is prohibited. There is some question as to which wording is to be followed, "maximum restriction" or "prohibited?"

Page 39 of the driver's manual states, "You may cross a (single) solid white line only in unusual circumstances and then only with great care." Does this mean that one can't cross a single solid white line to comply with lane placement directional signs, such as at intersection approaches, at toll plazas, at exits from major bridges, etc.

Illinois

The *Illinois Vehicle Code* refers to a "manual" that is maintained by Illinois DOT. That "manual" appears to be the MUTCD, possibly with Illinois specific amendments. The Illinois Secretary of State publishes *The Rules of the Road*, which appears to generally follow the MUTCD.

Section 4 of *The Rules of the Road* deals with passing markings for two-way roadways, but is silent on lane lines for one-way roadways. So there essentially is no guidance provided to drivers regarding dashed white lane lines, single solid white lane lines, or double white lane lines.

Massachusetts (same as Florida)

Massachusetts driver's manual states, "Solid White Line. A solid white line marks the right edge of the roadway or separates lanes of traffic moving in the same direction. You may travel in the same direction on both sides of this line, but you should not cross the

line unless you must do so to avoid a hazard.” This is the same text as in the Florida driver’s manual.

As with Florida, the basic problem is that the manual uses one text for two entirely different applications, i.e., right edge line and lane line. Taken literally does the text mean with respect to right edge line that one could legally drive in the paved shoulder for as long as desired?

Alternatively for a lane line, does it mean that one can’t cross a single solid white line to follow guidance from lane placement direction signs, such as at intersection approaches, at toll plazas, at exits from major bridges, etc.? As noted previously for this pavement marking, the MUTCD states that it is only to “discourage” lane changing.

Minnesota

The Minnesota driver’s manual essentially matches the MUTCD regarding lane lines, i.e., “A line composed of white dashes indicates that drivers can change lanes...”, “A solid white line indicates that lane changes are discouraged...,” and “Double solid white lines indicate that lane changes are prohibited...”

New Jersey

Surprisingly, in a state with many multilane highways, the New Jersey driver’s manual section on passing deals only with passing across yellow center line markings. There is no narrative description of white lane markings, either single solid white line or double solid white lines.

New York

The New York state driver’s manual, under “Edge and Lane Lines” says, “Lines separating lanes of traffic moving in the same direction are white. Lines separating traffic moving in opposite directions are yellow.”

This manual section further states, “Double Solid Lines; you may not pass, or change lanes. Single Solid Line; you may pass other vehicles or change lanes, but you should do so only if obstructions in the road make it necessary or traffic conditions require it.”

The language is not as clear as it should be since nowhere is there a direct meaning shown for double solid white lane line marking or for a single solid white lane line marking.

Further, even when the reader interprets and integrates the intent of this language, there is an inconsistency with the MUTCD regarding a single solid white lane line. The New York manual states, “Only if obstructions in the road make it necessary,” “or traffic conditions require it...” These descriptions are not in keeping with situations in New York state where that lane marking is frequently placed, such as on intersection approaches or where motorists are directed to follow guidance from advance lane placement directional signs. The Brooklyn exit of New York City’s Manhattan Bridge, shown in Figure 1, is a “lane placement” example.

**Figure 1: Example of Lane Placement Directional Signs
Brooklyn Exit of Manhattan Bridge, New York**



Source: Leon Goodman

North Carolina

The North Carolina driver's handbook states, "Single, solid white lines are used as right-edge lines along the roadway and for guiding traffic traveling in the same direction." There is no mention of the use of single solid white line or double solid white lines markings as lane lines. The "STAY IN LANE" sign is not shown in the regulatory signs section of the manual.

Pennsylvania

The Pennsylvania driver's manual states, "As a general rule, broken traffic lines can be crossed and solid lines cannot, except when making a turn." The manual does not appear to describe situations where a single solid white lane may need to be crossed to follow directional signs. The manual also states, "Do not cross a solid white line in the center of the road in a work zone." This leads to the question, why would there be a solid white line in the center of the road? Shouldn't a line in the center of the road be yellow, i.e., to separate two-way traffic?

Texas

The Texas driver's handbook states, "solid white lines are used for...lane use control. Crossing a solid white line should be avoided if possible." The "avoided" language is

similar to the “discouraged” wording in the MUTCD, but it may be confusing to motorists who need to cross a solid white line when following lane placement directional signs.

Utah

The Utah driver’s handbook’s section on pavement markings does not cover single solid white lane lines or double solid white lane line markings.

Virginia

There is no mention of the double solid white lane line marking in the Virginia driver’s manual.

The single solid white line, according to the Virginia manual, is used to “discourage” lane changes near intersections and at other locations where lane changes might be dangerous. “The “discourage” wording is consistent with the MUTCD but the “dangerous” terminology implies that it is dangerous for motorists to cross this type of lane line when following guidance from lane placement directional signs.

Various States

This discussion is based on the committee’s field observations in several states in the northeast.

As noted earlier in this section, the MUTCD says that the most restrictive lane sign, “STAY IN LANE,” should be used with the double solid white line lane marking. Some jurisdictions have used other, even more explicit signs for this situation such as “DO NOT CROSS DOUBLE WHITE LINES” or “CROSSING DOUBLE WHITE LINES IS PROHIBITED.” All of these signs clearly convey the intended strong “don’t” meaning.

In order to elicit and maintain the desired motorist action, or non-action, it is important that there be a consistent match between signs and markings especially for this type of potentially hazardous situation. Committee members have observed uses of the “STAY IN LANE” sign with single solid white lane lines (not appropriate) or even with broken white lane lines (very inappropriate). Such inappropriate applications of the sign create several potential problems.

Of most immediate concern, the motorist may be getting a mixed message. Should he or she follow the generally understood meaning of the marking, or follow the more restrictive meaning of the sign? And use of a “strong” sign with a single solid white or broken white lane line may weaken the impact of the sign when it is used properly, i.e., with a double solid white lane line marking.

The committee did find that at least one jurisdiction recognized the need to differentiate the black on white STAY IN LANE sign when used with a less restrictive marking, i.e., not a double solid white lane line. In work zones in Washington, DC, an orange “NOTICE” placard is mounted above the standard STAY IN LANE sign.

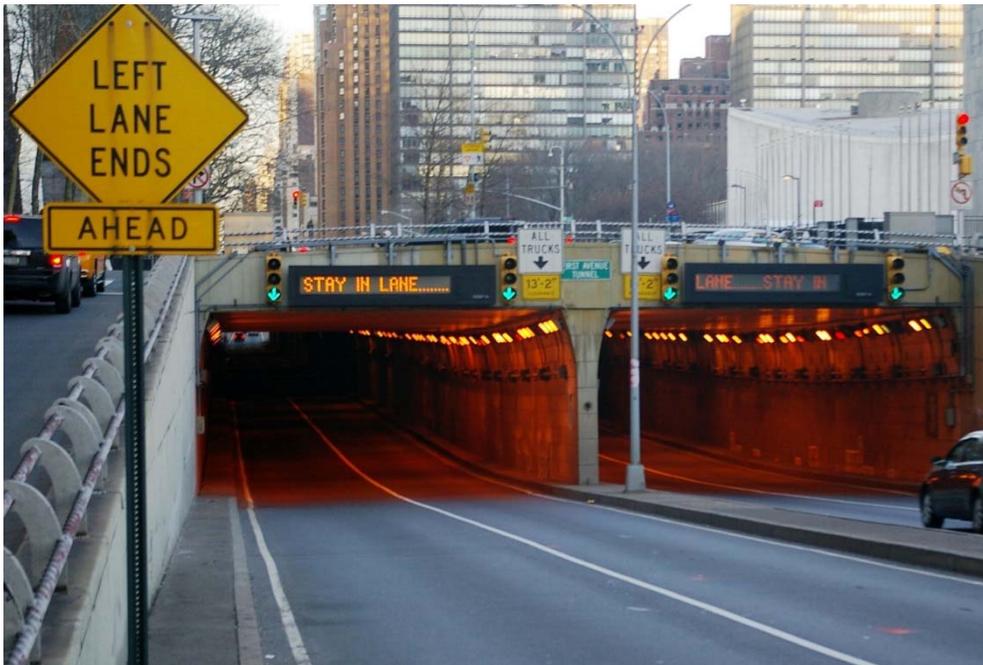
Some examples of inappropriate and appropriate STAY IN LANE sign applications are shown in Figures 2 through 5.

Figure 2: Inappropriate Use of Stay In Lane Signs, Wilbur Cross Parkway Tunnel, Connecticut (single solid white line)



Source: Leon Goodman

Figure 3: Inappropriate Use of Stay In Lane Sign, First Avenue Tunnel, New York (single solid white line)



Source: Leon Goodman

Figure 4: Appropriate Use of Stay In Lane Sign, Holland Tunnel. New Jersey (double solid white line)



Source: Leon Goodman

**Figure 5: Inappropriate Use of Stay In Lane Sign, Bronx River Parkway, New York
(broken white line)**



Source: Leon Goodman

Questionnaire

Single Solid White Lane Line: Perhaps related to the varying practices of the states regarding the “meaning” of markings and signs for single solid white lane lines on one-way roadways, there was a wide range of responses from questionnaire participants. Only 42 percent of transportation professionals gave a response consistent with the MUTCD, “Change lanes with caution.” Among drivers and police the correct response was even less, about 24 percent were aware of the meaning consistent with the MUTCD.

Table 1: Survey Responses on Meaning of Single Solid White Lane Line

Response	ITE members (Transportation Professionals)	AAA (drivers)	IACP (police)
Not change lane	39.1%	45.2%	58.8%
Change lanes with caution	41.8%	24.4%	23.5%
Not change lanes if a STAY IN LANE sign was present	17.0%	28.3%	17.6%

Double Solid White Lane Line: Again, these results may be due to the variations among the states regarding the “meaning” of markings and signs for double solid white lane lines on one-way roadways, there was a wide range of responses from questionnaire participants. The 13 percent response of “Don’t know” among ITE members was somewhat surprising. More drivers (82 percent) than transportation professionals (79 percent) gave the correct response to “Not change lanes.” Among police only 56 percent selected “Not change lanes” and, surprisingly, almost 19 percent chose “Change lanes with caution.”

Table 2: Survey Responses on Meaning of Double Solid White Lane Line

	ITE members (Transportation Professionals)	AAA (drivers)	IACP (police)
Not change lane	79.1%	82.4%	56.3%
Change lanes with caution	2.3%	3.1%	18.8%
Not change lanes if a STAY IN LANE sign was present	4.6%	5.6%	6.3%
Don’t know	13.1%	8.6%	18.8%

STAY IN LANE Sign: The ITE responses illustrate the varied applications of the STAY IN LANE sign, some of which appear inconsistent with the intent of the MUTCD.

Table 3: Survey Responses on Meaning of STAY IN LANE Sign

Response	ITE members (Transportation Professionals)	AAA (drivers)	IACP (police)
Only with double solid white line	20.4%	.3%	21.1%
In some cases with single solid white line	52.3%	32.3%	31.6%
In some cases with single dashed white line	1.7%	4.5%	5.3%
With any type of lane marking, if in a work zone	22.7%	49.8%	26.3%
Don't know	0%	5.1%	15.8%

Two-Way Roadways

For two-lane, two-way roadways, some of the applications for yellow center line marking applications in the MUTCD are:

- Two-direction passing zone markings consisting of a normal broken yellow line where crossing the center line markings for passing with care is permitted for traffic traveling in either direction;
- One-direction, no-passing zone markings consisting of a double yellow line, one of which is a normal broken yellow line and the other is a normal solid yellow line, where crossing the center line markings for passing with care is permitted for the traffic traveling adjacent to the broken line, but is prohibited for traffic traveling adjacent to the solid line; or
- Two-direction no-passing zone markings consisting of two normal solid yellow lines where crossing the center line markings for passing is prohibited for traffic traveling in either direction.

For these conditions, there appears to be a general agreement between the MUTCD and state driver's manuals. There were, however, a few inconsistencies worth noting:

New Jersey

The New Jersey driver's manual correctly shows a double solid yellow center line marking for "NO PASSING" conditions.

For the center marking of the typical two-way roadway where passing is permitted, the MUTCD calls for a single broken yellow line. The New Jersey manual's accompanying

narrative says that when "both center lines are broken: passing is allowed on both sides." Does this imply that the center marking for this situation should be a double broken yellow line? (There is a special condition, reversible lanes, where a double broken yellow line is specified in the MUTCD).

Vermont

Regarding center lines on two-way roadways, the Vermont driver's manual says, "Major highways are marked with yellow center lines..." The manual further states, "The lines show if you may or may not pass, if there is a solid line or two solid lines, it is recommended that you do not pass."

In a situation where a double solid yellow center line is warranted, due to sight distance, roadside development or other factors, it seems highly unusual for the State Transportation Agency to only be "recommending" that you do not pass." The language in the MUTCD is much stronger and definitive in direction, saying that the double solid yellow center line is to be used where "passing is prohibited."

Shoulders

Shoulders are typically marked with a single solid white edge line.

State Drivers Manuals, Vehicle Codes, or Vehicle Laws

Florida and Massachusetts

The driver's manuals in both states use this language, "A solid white line marks the right edge of the roadway or separates lanes of traffic going (moving) in the same direction. You may travel in the same direction on both sides of this line but you should not cross the line unless you must do so to avoid a hazard." So when a solid white line is a right edge line, i.e. delineates the road shoulder, taken literally does the manual mean that you could legally drive in the paved shoulder for as long as desired?

The committee does not believe that these two states intend to have motorists driving long distances in the shoulder, but the present language in their driver's manuals could be misinterpreted.

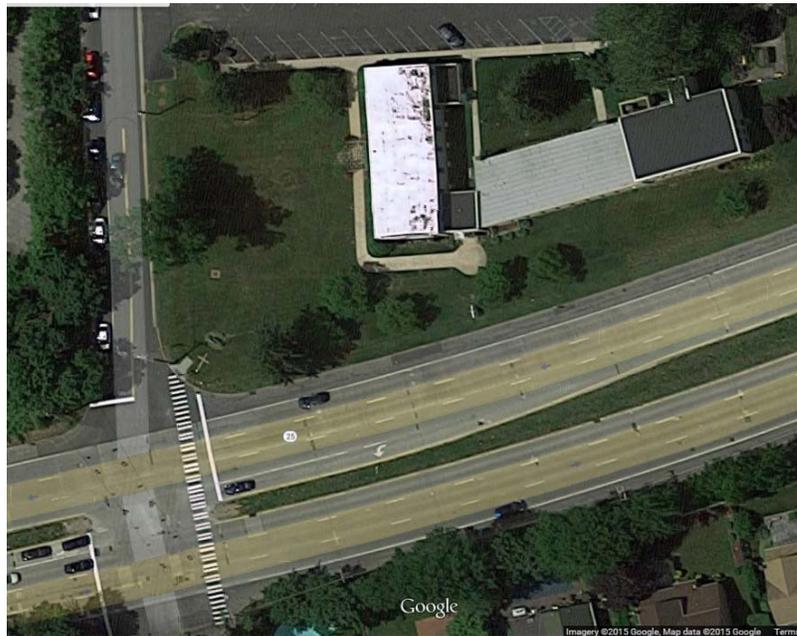
New York

The New York state driver's manual says that "solid lines along the side of the road tell you where the edge is—where the travel lane ends and the road shoulder begins. It is illegal to drive across the edge line, except when directed to do so by a police officer or other authorized official or when allowed by an official posted sign."

This language makes no provision for accepted shoulder uses such as vehicle breakdown and permitted parking. It also does not recognize common safe driving techniques on high speed suburban arterials or rural roadways, i.e. using the shoulder to decelerate and/or accelerate into or out of driveways, or for short use to slow for a right turn at an intersection.

An example in New York state demonstrates that this “slowing and/or accelerating” function is not only not tolerated by police, but is subject to ticketing and fines. In 2008, in Long Island, New York, a motorist was issued a \$150 traffic ticket for using the shoulder on a high-speed, suburban arterial to slow for a right turn at a signalized intersection. (Another Long Island intersection/shoulder situation, similar to the one at the ticket location is shown in Figure 6.) The motorist successfully appealed the ticket noting that many right turning drivers at that intersection use the shoulder as she did since the alternative, turning directly from the right lane, could lead to “rear-end” crashes. In other words, she was making the turn in the safest possible fashion. In this case, according to the driver’s manual, the police officer was technically correct in issuing a ticket. This leads to the question of whether the officer should be able to exercise judgment to differentiate “riding the shoulder” for a significant distance from short use for acceleration or deceleration.”

Figure 6: Example of Slowing/Accelerating Use of Shoulder with Single Solid White Edge Line, Jericho, New York



Source: Imagery ©2015 Google, map data ©2015 Google

Utah

The Utah manual does not explicitly explain solid white line edge lines. Following some diagrams of typical two-way roadway markings, however, it says, “In the above three illustrations, there is a white line painted on each side of the road. The area to the right of these lines is not meant for normal traffic use.”

The Utah language indicates what the shoulder “is not meant for” but is silent on permitted uses of the shoulder.

Questionnaire

Shoulders (white edge lines): The examples of guidance in driver’s manuals reveal significant variations among the states and when compared with the perceptions of questionnaire respondents. Those responses regarding potential uses of the shoulder though not mentioned in the driver’s manuals are noted in Table 4.

Table 4: Survey Responses on Meaning of Shoulder Edge Lines

Response	ITE members (Transportation Professionals)	AAA (drivers)	IACP (police)
Slow down to turn right or into driveway	9.9%	11.4%	9.3%
Speed up from driveway or right turn	0.2%	2.5%	7.0%
Pass a left turning vehicle	3.5%	5.7%	4.7%
Stop a disabled vehicle	68.5%	43.8%	30.2%
Ride a bicycle	13.5%	18.9%	25.6%
Walk in the shoulder	3.6%	15.8%	23.3%

Turns

Left Turns

State Drivers Manuals, Vehicle Codes, or Vehicle Laws

California

The California driver’s handbook states “Two sets of solid double yellow lines spaced 2 feet or more apart are considered a barrier. Do not drive on or over this barrier or make a left turn or a U-turn across it except at designated openings.” This is a very explicit prohibition against crossing this marking, for example to enter or leave a driveway, as California says is acceptable across a double solid yellow line. It also is a marked departure from the comparable situation in British Columbia, Canada where a “painted traffic island” is considered a “special case of a double solid line” (see below).

Massachusetts

For double yellow solid lines, the driver’s manual states, “You may not cross these lines unless turning left when it is safe to do so.” From this language is the motorist to conclude that it is acceptable to cross double solid yellow lines when making a legal U-turn or when entering or exiting a driveway? Anecdotally, many motorists are unclear. They believe that one can never legally cross double solid yellow lines.

New Jersey

The New Jersey driver's manual has no discussion of left turns, or U-turns, across double solid yellow lines or painted medians. In some states, such as Massachusetts, there is at least some language that indicates such maneuvers may be okay ("when it is safe to do so"). So, the New Jersey motorist receives no guidance on this frequently unclear point.

Utah

The Painted Islands section of their driver's manual refers to a "solid double yellow median" as a marking showing a painted island. The diagram shows a median delineated by two separated double solid yellow line markings. The manual states further, 'DO NOT DRIVE OR STOP IN THIS AREA FOR ANY REASON.' Taken literally, does this mean that it is not legal to ever go across this type of median as, for example, to enter or exit a driveway or to make a legal U-Turn?

British Columbia

(Quoted from the *DriveSmartBC* website which is included for comparison with U.S. driver's manuals)

"Chapter 3 of the British Columbia (BC) driver's manual, *Road Sense for Drivers*, presents a graphic of a painted traffic island and tells drivers that they must keep to the right and not drive on or over it. A painted traffic island is really a special case of a double solid line. In British Columbia a double solid line means that you must drive to the right of it only, except when entering or leaving the highway as long as other drivers are not unreasonably affected by the movement."

So, while not conclusive, a reasonable person could feel that a BC motorist should be able to legally cross a painted island, at least to enter into or exit from a driveway, i.e. "entering or leaving the highway."

Questionnaire

For the question on mid-block left turns into and out of a driveway across a double solid yellow line, and left turns from a wide, yellow striped median, there were reasonably consistent responses among transportation professionals, drivers, and police. For left turns into a driveway from a yellow striped median, yes/no responses were split about 50/50 from all three groups. This would indicate that the acceptability of this maneuver may not be clearly understood by any of the groups.

Table 5: Survey Responses on Mid-Block Left Turns

Response	ITE members (Transportation Professionals)	AAA (drivers)	IACP (police)
For mid-block left turns into a driveway, across a double solid yellow line			
Yes	80.6%	72.4%	86.7%
No	18.2%	25.5%	13.3%
For mid-block left turns out of a driveway, across a double solid yellow line			
Yes	83.7%	67.5%	80.0%
No	14.6%	30.0%	20.0%
There is a wide, yellow striped median. Can pull into the median and turn left into a driveway on the opposite side?			
Yes	47.6%	50.2%	60.0%
No	51.6%	43.5%	40.0%

U-Turns

State Drivers Manuals, Vehicle Codes, or Vehicle Laws

California

In summary, the California driver’s handbook says that under favorable conditions, which they describe, the motorist may make a legal U-turn:

- Across a double yellow line;
- In a residential district;
- At an intersection on a green light or green arrow; or
- On a divided highway.

California’s relatively numerous locations for legal U-turns contrasts with the laws in Virginia (U-turns only at intersections, in business districts) and the District of Columbia (no U-turns at intersections with traffic lights), see below.

Massachusetts

The driver’s manual says that you can make a U-Turn from the lane closest to the center line “if your path is clear and it is safe to do so. You cannot make a U-Turn if a No U-Turn sign is posted.” It also says to avoid U-Turns at the crest of a hill, near a curve, or if you lack a 500-foot view of oncoming traffic.

A *Boston Globe* article in December 2011 illustrates the typical lack of clarity about U-Turns, among motorists and among the police and transportation departments. A taxi driver was cited for a U-Turn in Boston, at a location with no signs regarding U-Turns and where he had been making that turn (without incident or citation) for the past 40 years. The *Globe* reporter asked about this case at the Boston Transportation Department and was referred to the Police Department, who gave a general response but not about this specific case.

The registry of motor vehicles department (RMV) said that “a U-Turn over a double yellow is legal if there is no oncoming traffic and no sign prohibiting it.” But other sources, law enforcement and driver’s education groups, gave varying answers.

New York

The New York driver’s manual is specific as to where U-Turns are prohibited, i.e., “near the crest of a hill, a curve or any other place with less than 500 feet of sight distance, in either direction”. The manual further states, “U-Turns are also illegal in business districts of New York City and where no U-Turn signs are posted.”

The New York state manual does clarify when you can cross a double solid yellow line marking, i.e., when turning left to enter or leave the highway (to or from a driveway or to perform a U-Turn).

Virginia and the District of Columbia

(Note: these two are discussed together because of “adjacency” and difference regarding U-Turns). The state Motor Vehicle laws for these jurisdictions appear to differ significantly regarding U-Turns.

Virginia’s law says, “The driver...within cities, towns or business districts of counties shall not turn his vehicle so as to proceed in the opposite direction except at an intersection.”

DC’s law says “No vehicle shall make a U-turn so as to proceed in the opposite direction at any intersection controlled by traffic lights or police officer...” Aside from the difference from the Virginia law, does the DC law mean that the typical U-turn on the left turn green arrow signal (traffic light) is illegal there?

Questionnaire

U-turns: There is a great disparity between transportation professionals (96.4 percent) and police (33.3 percent) regarding the response of “Only at intersections.” Police (60.0 percent) are much more accepting of “Anywhere driver feels they are safe” than are transportation professionals (1.5 percent). The response of “Don’t know” from 10 percent of drivers is troubling.

Table 6: Survey Responses on Meaning of NO U-TURN Signs

Response	ITE members (Transportation Professionals)	AAA (drivers)	IACP (police)
Only at intersections	96.4%	64.1%	33.3%
Anywhere driver feels they are safe	1.5%	23.0%	60.0%
Mid-block across double yellow line	0.5%	1.9%	0%
Don't know	0%	10.0%	6.7%

Intersections

Roundabouts

State Drivers Manuals, Vehicle Codes, or Vehicle Laws

Georgia

The Georgia driver's manual may be inaccurate, or at least incomplete, regarding roundabouts. It says "Roundabouts are sometimes used at intersections instead of stop signs." It might be more appropriate to say, "Roundabouts are sometimes used at intersections instead of stop signs or traffic signals."

Advance Directional Signs

State Drivers Manuals, Vehicle Codes, or Vehicle Laws

New York

Per the MUTCD, directional signs in advance of a right-hand exit typically indicate the intersecting roadway (route number and/or name) and a legend like "Exit ¼ MI" or simply "¼ MI." For a left-hand exit, the words LEFT or LEFT EXIT are added.

The following example shows that this common sense convention is not always followed, resulting in confusion and possibly undesirable last-minute lane changes. It is related here in the hope that this situation, which has also been observed sometimes in other states, can be avoided in the future.

An overhead directional sign, installed several years ago in New York City on a one way, three-lane urban arterial roadway, gives advance notice for two closely-spaced upcoming exits (Figure 7). First (northbound) exit is right-hand. Second (southbound) exit, only 800 ft. beyond the first, is left-hand. The names for both exits are on this one advance sign, with "1/4 MI" shown at the bottom of the sign. The sign is essentially advising drivers looking for either exit to get into the right lane...good for the first exit, not good for the second exit. The committee is aware, anecdotally from local drivers that unnecessary and potentially hazardous lane changes do occur at this location.

Figure 7: Example of Confusing Advance Directional Signing, New York, New York



Source: Leon Goodman

Left Turns at Signalized Intersections

Questionnaire

Responses among the three groups appear reasonably consistent. Observations in everyday driving seem to confirm these percentages, i.e., many drivers go to the center of the intersection to wait for a gap, but some hold back...they wait at the stop line. The practice of moving into the intersection or holding at the stop line varies across different regions of the country.

Table 7: Survey Responses to Question - Preparing to make a left turn, is driver permitted to enter intersection to wait for a gap?

Response	ITE members (Transportation Professionals)	AAA (drivers)	IACP (police)
Yes	72.7%	73.3%	66.7%
No	26.1%	21.2%	26.7%
Don't know	1.2%	5.3%	6.7%

Traffic Signals

RIGHT TURN SIGNAL Sign

Questionnaire

It was surprising to learn that more than half of the ITE member responses were not correct. Also of concern, only about 57 percent of drivers and police got this right. Of the choices given, “turn right only when right green arrow appears” is generally the most correct response. However there are some states where, after stopping, a right turn may also be made on a right red arrow.

Table 8: Survey Responses on Meaning of RIGHT TURN SIGNAL Sign

Response	ITE members (Transportation Professionals)	AAA (drivers)	IACP (police)
No turn on red	3.6%	1.5%	6.3%
Right turn permitted after full stop	12.6%	18.3%	5.0%
Turn right only when right green arrow appears	49.8%	57.8%	56.3%
Turn right any time when opposing traffic or pedestrians are not present	7.9%	12.9%	6.3%
Don't know	8.2%	9.1%	6.3%
Other	16.6%	-	-

Flashing Yellow Left Turn Arrow

Questionnaire

While the majority of respondents understood the meaning of the flashing left turn arrow to be, “turn after yielding...”, a few ITE members and police did not; neither did 34 percent of drivers.

Table 9: Survey Responses on the Meaning of the Flashing Yellow Left-Turn Arrow

Response	ITE members (Transportation Professionals)	AAA (drivers)	IACP (police)
Turn after yielding to other traffic and pedestrians	86.3%	65.9%	81.3%
Wait for change in signal indication before turn	1.0%	7.1%	6.3%
Opposing traffic about to start up	7.9%	16.7%	6.3%
Don't know	4.1%	9.9%	6.3%

Pedestrians

A look is needed at the “Stop for Pedestrians within Crosswalk” sign (R1-6 sign in the MUTCD). It has been observed that, on some college campuses in the Northeast, students do not even look or break cadence when they come to a crosswalk and merely walk in front of cars. The signing gives a false sense of right-of-way and may contradict the motor vehicle codes. In any case, it appears to be taken out of context. The police also often ignore the code, tending to ticket the motorist when the pedestrian is at fault by just walking in front of a vehicle that clearly has already entered the intersection. Motorists are also confused or, out of fear of being cited, they will sometimes stop suddenly even if the person is on the curb or walking toward the crosswalk, all of this even though the sign uses the term ‘WITHIN Crosswalk.

Maybe more education is needed to inform road users and police about the intent of the R1-6 sign, as part of safe street crossing practices. Such educational activities would, of course, need to be keyed to the codes and/or laws in each state. In California, for example, the law is that the motorist has to stop when a pedestrian is on the curb at a crosswalk. Anecdotally, it has been observed that, unlike the situations noted in the Northeast, pedestrians in California do seem to stop first before crossing.

Questionnaire

Pedestrians: Transportation professionals, drivers, and police all recognized that motorists should stop/yield to pedestrians in marked crosswalks and, to a lesser extent, standing at the curb.

Table 10: Survey Responses on the Meaning of the “Stop/Yield for Pedestrian in Crosswalk” Sign

Response	ITE members (Transportation Professionals)	AAA (drivers)	IACP (police)
Motorists must stop/yield for pedestrian on curb and about to enter marked crosswalk	83.6%	68.9%	93.8%
Motorists must stop for pedestrian standing at curb	3.9%	10.4%	6.3%
Bicyclists can ride in crosswalk and motorists must stop/yield to them	1.1%	6.0%	0%
Pedestrians can enter crosswalk regardless of proximity of oncoming vehicles	1.8%	8.2%	0%
Motorists must stop/yield to pedestrians or bicyclists crossing in an unmarked crosswalk or midblock	7.0%	5.7%	0%
No Answer	2.6%	1.1%	0%

Bicycles

State Drivers Manuals, Vehicle Codes, or Vehicle Laws

Hawaii

The *Hawaii Revised Statutes* define mopeds as vehicles possessing less than 2 horsepower and unlawful to operate in excess of 35 mph, and not required to be plated, although they must be registered. Further, that **mopeds may operate in bicycle lanes** and on multi-use paths unless otherwise posted.

For motorists this seems rather unusual and contrary to their expectations, considering that all signing for bicycle lanes in the state displays the word and symbol legends clearly conveying that the lanes are restricted to bicycles only.

Regarding multi-use paths, it also seems unusual to allow operation of vehicles with 30 to 35 mph capability where recreational bicyclists and pedestrians are also using the same path. Massachusetts, for example, does not allow mopeds on multi-use (pedestrian/bicycle) paths.

Special Zones

Work Zones

State Drivers Manuals, Vehicle Codes, or Vehicle Laws

Florida

As of March 2012, the work zone section of the Florida Driver's Manual has an outdated reference to apparel worn by flaggers...referring to orange vest or jackets. Per the MUTCD, high-visibility yellow apparel has taken the place of orange-colored clothing in work zones.

School Vehicles

State Drivers Manuals, Vehicle Codes or Vehicle Laws

Massachusetts

The Massachusetts driver's manual instructs that drivers in both directions must stop for school buses loading or discharging pupils, except that "on the other side of a divided highway with a barrier between travel directions...you do not have to stop." No guidance or rule is given for a situation where there is a wide median with no barrier.

New York

New York's driver's manual says that you must stop for a school bus (loading or unloading passengers) even if it is on the opposite side of a divided highway. Presumably this rule applies on roadways with or without a median barrier.

The Massachusetts rule allows for situations where a barrier precludes the need for both directions to stop for a school bus. New York’s rule likely may result in unnecessary stops in the “other direction,” i.e., where a barrier (or wide median) limits potential pupil roadway presence to the direction where the school bus is stopped.

Questionnaire

School Vehicles: Differing responses from ITE members may reflect differences between state laws. The mixed responses from drivers and police may also reflect variations among state laws.

Table 11: Survey Responses on the Motorist Requirement to Stop for School Vehicles with Red Lights Flashing

Response	ITE members (Transportation Professionals)	AAA (drivers)	IACP (police)
on non-divided highway only	77.3%		
in either direction on a divided highway	18.2%		
in both directions, on a non-divided roadway only		16.5%	6.3%
in both directions, on a non-divided roadway or when traveling in either direction, on a divided highway		37.5%	25.0%
in both directions, on a non-divided roadway or when traveling in the same direction as the school vehicle, on a divided highway		46.0%	68.8%

NOTE: The questions to ITE members had different wording than those to drivers and police.

Other Issues

White/yellow marking system

State Drivers Manuals, Vehicle Codes, or Vehicle Laws

The driver’s manuals for several states refer to the underlying concept of the white/yellow pavement marking system, as noted below.

Minnesota

White lines separate lanes of traffic traveling in the same direction... Yellow lines separate traffic moving in opposite directions.

New York

Lines separating lanes of traffic moving in the same direction are white. Lines separating traffic moving in opposite directions are yellow.

Pennsylvania

Yellow lines divide traffic traveling in opposite directions...white lines divide lanes of traffic traveling in the same direction.

Discussion

In recent years doubts have been expressed as to the need for the higher cost white/yellow system as compared to an all-white system. These concerns rest on some key questions: do drivers really know why some markings are white and some are yellow? Does the white/yellow system materially enhance traffic safety?

Contrary to anecdotal, conventional belief, our literature search indicates that drivers may be more informed on the white/yellow concept than generally believed.

Hawkins, et. al. (2002) conducted a driver understanding survey of the North American system of yellow-white pavement markings. The survey evaluated drivers' ability to describe the pavement marking color code, drivers' reliance on pavement marking patterns when interpreting marking messages, and drivers' reliance on pavement marking color when interpreting marking messages. The survey included 851 drivers in 5 states representing 47 states, the District of Columbia, and Puerto Rico. The survey results indicated that:

Drivers tend to use signs and other traffic as the primary cue to determine if a road is one-way or two-way. A substantial proportion of respondents had an understanding of the use of marking color to differentiate between one-way and two-way roads. About one-fourth of the respondents mentioned markings as one of their responses. Furthermore, when shown a graphic indicating the lanes, and direction of travel and asked what color the line in the middle of the street should be, about 70 percent of the respondents indicated that yellow markings are used for a two-way street, and about 80 percent indicated white markings are used for a one-way street.

This is just one study, but it does show some evidence that the yellow-white system is of use to drivers and is contributing to traffic safety improvement.

Traffic Control Devices in Private Commercial Areas

Committee members have observed instances in large commercial developments, such as office, parks, and shopping centers, where the traffic control devices do not conform to the MUTCD.

In one case, the pavement markings for a long, wide four lane roadway were all-white, including the double solid center line marking. In other cases, markings were all-yellow.

It's recognized that these privately-owned areas are not legally required to follow the MUTCD. But since these activity centers are regularly used by the public, and are typically adjacent to MUTCD-compliant roadways, should states and local governments strengthen efforts for voluntary compliance with the MUTCD?

3. DRIVER TRAINING, FURTHER THOUGHTS

MUTCD and Driver's Manuals

In trying to achieve more consistency between the MUTCD and driver's manuals (and vehicle codes), we need to recognize that each of these "books" is written from a different point of view. The engineering document—the MUTCD—generally lays out what devices are to be used for a given situation. By comparison, a driver's manual describes what a driver should do (or not do) when specific devices are present.

For example, the MUTCD specifies a single white edge line on the right side of a roadway which essentially marks the beginning of the shoulder. It is left to the driver's manual in each state to indicate under what circumstances the driver may cross this right hand edge line and/or for what purpose the driver can use the shoulder area. As noted in the "shoulder" section of this report, driver's manuals may be incomplete (no mention of shoulder use for breakdowns), may be silent on permitted uses, and do vary considerably from state to state.

Some committee members have suggested that perhaps, for some key traffic control devices, the MUTCD could include the response that engineers expect when drivers encounter that device. Alternatively, these "expected responses" could be in an MUTCD supplement. These expected responses could then be provided to state DMVs and to police agencies, for consideration in drafting new or revised sections of driver's manuals and for training of police.

Driver Training Programs

Getting state driver's manuals and police enforcement more aligned with the intended purpose of traffic control devices is clearly desirable.

As part of this initiative, it would be important to assure that driver training curriculum materials are updated, as necessary. Driver training instructors would then have available the latest driver "rules and regulations," and would be well coordinated with the MUTCD.

Driver Testing

Regarding the process for new driver's licenses, testing the applicant's knowledge of traffic control devices should remain included...and possibly be strengthened.

Some retesting about traffic control devices, for example, every ten years as part of license renewal, might also be considered.

4. CONCLUSIONS

In summary the technical committee reached the following conclusions from the review of state driver's manuals, vehicle codes, and/or vehicle laws, and the questionnaire responses from transportation professionals, drivers, and members of law enforcement:

1. Potential changes toward more consistency among MUTCD, state driver's manuals, and state vehicle codes
2. Possible text in MUTCD, or in an MUTCD supplement, to indicate how drivers are expected to react to traffic control devices
3. Further coordination by ITE with state DMVs (potentially through AAMVA)
4. Further coordination by ITE with police departments (potentially through IACP)
5. Further coordination by ITE with driver training providers (potentially through AAA, AARP, and others)

5. END NOTES

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**6. APPENDIX A: SUMMARY POINTS REGARDING
AGENCY QUESTIONNAIRE**

Lines, Signs, Signals...What Do People Really Know and Do

There were 941 ITE member responses to the questionnaire. Summary points regarding individual questions are noted below.

Question No.	Summary Information
1.	N/A
2.	<ul style="list-style-type: none"> • 90 percent from United States. • 7 percent from Canada. • All U.S. states represented though not evenly distributed.
3.	90 percent of respondents were transportation professionals
4.	N/A
5.	50 percent of respondents were licensed professionals
6.	<p>If single solid white line separating right lane and shoulder, in shoulder could:</p> <ul style="list-style-type: none"> • Slow down to turn right (9.9%) • Pass a left turning vehicle (3.5%) • Stop a disabled vehicle (68.5%) • Ride a bicycle (13.5%)
7.	<p>If single solid white line between traffic lanes, same direction, could:</p> <ul style="list-style-type: none"> • Not change lanes (39.1%) • Change lanes with caution (41.8%) • Not change lanes if a STAY IN LANE sign was present (17.0%)
8.	<p>If double solid white line between traffic lanes, same direction, could:</p> <ul style="list-style-type: none"> • Not change lanes (79.1%) • Change lanes with caution (2.3%) • Not change lanes if STAY IN LANE sign was present (4.6%) • Don't know (13.1%)
9.	<p>Can cross double solid yellow line to turn left into a driveway?</p> <ul style="list-style-type: none"> • Yes (80.6%) • No (18.2%)
10.	<p>From a driveway, can cross double solid yellow line to enter other side of roadway?</p> <ul style="list-style-type: none"> • Yes (83.7%) • No (14.9%)
11.	<p>There is a wide, yellow striped median. Can pull into the median and cross into a driveway on the opposite side?</p> <ul style="list-style-type: none"> • Yes (47.6%) • No (51.6%)
12.	N/A

Lines, Signs, Signals...What Do People Really Know and Do

13.	<p>The STAY IN LANE sign is used:</p> <ul style="list-style-type: none"> • Only with double solid white line (20.4%) • In some cases with single solid white line (52.3%) • In some cases with single dashed white line (1.7%) • With any type of lane marking, if in a work zone (22.7%)
14.	<p>Black-on-white RIGHT TURN SIGNAL sign mounted on a traffic signal pole means?</p> <ul style="list-style-type: none"> • No turn on red (3.6%) • Right turn permitted after full stop (12.6%) • Turn right only when right green arrow appears (49.8%) • Turn right any time when opposing traffic or pedestrians are not present (7.9%) • Don't know (8.2%) • Other (16.6%)
15.	<p>Does your state permit left turns on red at the intersection of two one-way streets?</p> <ul style="list-style-type: none"> • Yes (69.5%) • No (29.2%)
16.	<p>The sign STOP/YIELD TO PEDESTRIAN IN CROSSWALK means:</p> <ul style="list-style-type: none"> • Motorist must stop/yield for pedestrian on curb and about to enter marked crosswalk (83.6%) • Motorist must stop for pedestrian standing at the curb (3.9%) • Motorist must stop or yield to pedestrians and bicyclists crossing in an unmarked crossing or mid-block (7.0%)
17.	<p>Meaning of a flashing yellow turn arrow?</p> <ul style="list-style-type: none"> • Turn with caution (86.3%) • Opposing traffic about to start up (7.9%)
18.	<p>Preparing to make a left turn, is driver permitted to enter intersection to wait for a gap?</p> <ul style="list-style-type: none"> • Yes (72.7%) • No (26.1%)
19.	N/A
20.	<p>Unless NO-U-TURN signs are posted, U-turns are permitted:</p> <ul style="list-style-type: none"> • Only at intersections (96.4%) • Anywhere driver feels they are safe (1.5%) • Mid-block across double line (0.5%)
21.	<p>Motorists required to stop for school vehicle with red lights flashing:</p> <ul style="list-style-type: none"> • On non-divided highway only (77.3%) • In either direction on a divided highway (18.2%)