

**IMPACTS OF USING DYNAMIC FEATURES
ON CHANGEABLE MESSAGE SIGNS**

Technical Memorandum 7510-1

**Task 3 Experimental Designs for
Human Factors Laptop Studies**

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INTRODUCTION

Background

Dudek et al. (2000) and Dudek and Ullman (2002) reported on single-task human factors laboratory studies that were conducted in Dallas, El Paso, Fort Worth, Houston, and San Antonio to initially examine the effects of the practice of the following dynamic features when displaying messages on changeable message signs (CMSs): 1) flashing a one-phase message, 2) flashing one line in a one-phase, three-line message, and 3) alternating text on one line of a three-line CMS while keeping the other two lines of text constant on the second phase. A total of 260 drivers participated—52 from each city. The results of the single-task study showed that in a laboratory setting, flashing a one-phase message did not adversely affect driver recall and comprehension to a significant degree in comparison to when the message was not flashed. However, the average reading times were significantly higher when the message was flashed. The implication of these results is that if it takes drivers longer to read a message, then the number of informational units in the message displayed with flashing features may have to be reduced.

The results further revealed that flashing one line of a three-line message appears to have an adverse effect on recall of parts of the message. In addition, average reading times were significantly higher for the flashing line message. Additional multi-task laboratory studies, controlled field studies, and field studies, however, need to be conducted to more fully understand the effects of flashing a message or a line of a message.

The results also revealed that alternating one line of a three-line CMS while keeping the other two lines constant on the second phase did not reduce the ability of the subjects to remember parts of the message. However, total message reading times were significantly increased.

The above reported studies were single-task human factors laboratory studies, and as such the subjects were not placed under any work load similar to what they would encounter during normal driving situations. There is a need to evaluate the effects of these dynamic features of CMS message display while the driver is under heavier work load situations that simulate typical driving conditions. Whether these dynamic features of messages improve the effectiveness of the communication or detract from it is not fully understood. Research was needed to determine the full effects of the dynamic features of messages and to provide guidance to state, regional, and local department of transportation agencies.

Objectives

The objectives of the current study are to conduct driver simulator studies and human factors laboratory studies using laptop computers to determine the effects of the following dynamic features of displaying messages on CMSs:

- Flashing a one-phase message,
- Flashing one line in a one-phase, three-line message, and
- Alternating text on one line of a three-line changeable message sign (CMS) while keeping the other two lines of text constant on the second phase.

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This Technical Memorandum addresses the laptop computer studies

General Study Approach

Upon the recommendation of the FHWA Contract Officer's Technical Manager (COTM), the Texas Transportation Institute (TTI) will conduct human factors laboratory studies in College Station and one other city in the United States using laptop computers. The other city will be determined at a later date in concert with the COTM.

Laboratory Instrument

The three CMS dynamic display research issues were developed as independent studies and are shown in the subsequent major sections in the Technical Memorandum. The primary messages (see Appendix A) for each of the three issues, however, will be presented within an overall session for each subject. Furthermore, the subject pool in each city will be divided into two groups and the order of the primary messages displayed will be counterbalanced to avoid the occurrence of primacy bias. Because it will be necessary for a subject to view each message twice, a large set of other messages (not shown in this document) that are not related to the specific objectives of the current study will be intermixed with the primary messages and questions will be asked of the subjects as a means of separating the primary messages in time and to avoid subjects from concentrating only on the dynamic messages.

Each subject will be placed in a "driving" workload situation. TTI researchers as part of a separate study are currently evaluating two approaches for introducing driver work load into a laptop-based experiment as part of a separate study. The results of laptop studies with the two workload approaches will be compared with results obtained from TTI's driver simulator. The recommended workload approach will thus be based on the equivalency of results from driver simulator studies. The final selection will be made in concert with the COTM.

Pilot Study

After the preliminary laboratory instrument is developed, a pilot study will be conducted with about five to eight individuals from the College Station area. The purpose of the pilot study is to assess the administration procedures, determine the length of time needed for each subject to complete the laboratory instrument, and to identify any question deficiencies. The preliminary laboratory instrument will be modified based on the results of the pilot study.

Participant Recruitment

The laboratory instrument will be administered to 52 individuals in both College Station and the other city that will be determined later. Because the dynamic features of CMSs that will be evaluated will be primarily used on freeways and highways, all subjects will be required to have a current state driver's license, drive at least 8000 miles per year, and travel on a freeway or highway at least 12 times per year.

The 52 subjects who participate in the studies in College Station will also participate in the driver simulator studies that are described in Technical Memorandum 7510-2. Half of the subjects will

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participate in the laboratory studies before the driver simulator studies and half will participate in the driver simulator studies before they participate in the laboratory studies. One of the reasons why the same subjects will be used in both the laboratory and drive simulator studies is to determine whether the results of the two study techniques are comparable. If so, then better informed decisions can be made regarding the relative usefulness of laboratory studies using laptop computers and driver simulator studies for future studies.

Demographics

The demographic sample of drivers will be based on age, gender, and education for that specific state in which the study will be conducted.

Laboratory Session Protocol

Although the laboratory sessions will be conducted using laptop computers, it will not be necessary for the participants to have any computer experience. The only capability required of the subjects will be to press the space bar within certain points in the session and to manipulate a computer mouse for the secondary loading task. Each subject will undergo a short session to get familiar with procedures and equipment. Instructions and stimulus material will then be displayed on the computer screen. After reading the instructions and viewing a message, the subject will write answers to specific open-ended questions on a study form. Each time the subject presses the space bar, the program will advance to the next message.

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EXPERIMENTAL DESIGN FOR TASK 3 LABORATORY STUDIES USING LAPTOP COMPUTERS

STUDY 1: EVALUATE FLASHING AN ENTIRE ONE-PHASE MESSAGE VS NON-FLASHING ONE-PHASE MESSAGE

Objectives

The objectives of this study are to conduct human factors studies under driver work load conditions to:

1. Compare comprehension of a one-phase flashing message with a non-flashing message;
2. Compare the perception of the importance of the information on a non-flashing one-phase message with a flashing message.
3. Determine driver preferences for each of the two message styles; and
4. Determine driver reading times for each of the two message styles.

Background

It is not clear how comprehension and the amount of time it takes to read a CMS message will be affected by a flashing one-phase message versus a non-flashing message when a driver is under work loads. Also, it is not clear if drivers perceive a degree of importance or urgency of information on a flashing message versus a non-flashing message.

Method

The characteristics of the study design are shown in Table 1. The study will be counterbalanced by dividing the subjects into two groups. Group A consisting of 50 percent of the subjects will view Part 1 and Part 2 of the study that involve comprehension of messages. This will be followed with Part 3 and Part 4 to obtain driver preferences. Group B, the other 50 percent, will view Part 5 and Part 6 for message comprehension measurements followed by Part 7 and Part 8 for driver preferences information.

In Part 1 and Part 2 (Group A) and Part 5 and Part 6 (Group B) of the study, two one-phase messages will be displayed on a computer screen one at a time. The messages will be shown at different points within a larger study. The text will be the same with the exception that one message will flash and the other will not flash. Each message will be displayed for a total of 8 seconds. The flashing message will be displayed alternately 2 seconds on and a half-second off, which is comparable to flash rates used by some state DOTs. This process will continue automatically for a total of 8 seconds. The non-flashing message will be displayed continuously for a total of 8 seconds. The time of eight seconds was chosen because it is equivalent to the available reading time of typical CMSs while drivers are traveling at 90 km/h (55 mi/h).

The subjects will be asked questions to evaluate their comprehension of the message content for each message style. In addition, they will give their preferences for the message styles.

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Table 1. Characteristics of Study Design

Study Part	Group	Message Type	Message Text	Output
Group A: 50% of Subjects				
Part 1	Group A	Flash message	1	Comprehension
Part 2	Group A	Static message	2	Comprehension
Part 3	50 % of Group A	Flash message seen last	1	Preference
Part 4	50% of Group A	Static message seen last	2	Preference
Group B: 50% of Subjects				
Part 5	Group B	Static message	1	Comprehension
Part 6	Group B	Flash message	2	Comprehension
Part 7	50 % of Group B	Static message seen last	1	Preference
Part 8	50% of Group B	Flash message seen last	2	Preference
Group A and Group B: 100% of Subjects				
Part 9	Group A and Group B	Flash message	1	Reading time
Part 10	Group A and Group B	Flash message	2	Reading time
Part 11	Group A and Group B	Static message	1	Reading time
Part 12	Group A and Group B	Static message	2	Reading time
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; text-align: center;"> MAJOR ACCIDENT AT LITTLE YORK 3 LANES CLOSED </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> FREEWAY BLOCKED AT TIDWELL USE OTHER ROUTES </div> </div> <p style="text-align: center; margin-top: 10px;"><i>Message 1</i> <i>Message 2</i></p>				

Experimental Protocol for Subjects in Group A

PART 1

Instructions Shown on Screen to Subject (Group A, Part 1)

When you press the space bar you will be shown a message that will flash on and off for a few seconds. Then it will turn off. You will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 1. (1-1F)

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Message on screen: *flashing message for Group A:*

<p>MAJOR ACCIDENT AT LITTLE YORK 3 LANES CLOSED</p>
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Questions on Screen

Answer the following questions on the Form for SIGN 1. (1-1F)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. What was told about the lanes?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 2

Instructions Shown on Screen to Subject (Group A, Part 2)

When you press the space bar you will be shown a message that will remain on the screen for a few seconds. Then it will turn off. You will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 2. (1-2N)

Message on screen: *non-flashing message for Group A*

<p>FREEWAY BLOCKED AT TIDWELL USE OTHER ROUTES</p>

Questions on Screen

Answer the following questions on the Form for SIGN 2. (1-2N)

1. What is the traffic problem?
2. Where is the traffic problem located?

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3. What are you to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 3

This part of the study is for subjects who view the flashing message after they view the message that does not flash. After viewing the flashing message, subjects will view the following.

Instructions Shown on Screen to Subject (Group A, Part 3)

In the next part of the study, you will see two ways of displaying the same message. After you view both message styles, you will be asked to let us know which style you like the best.

The first message style is identical to the message you just saw. The message will flash on and off a few seconds. Then the message will turn off.

Press the space bar when you are ready to view the first message – SIGN 3. (1-1F)

Message on screen: *flashing message for Group A*

<p>MAJOR ACCIDENT AT LITTLE YORK 3 LANES CLOSED</p>
--

The second message style will have the same message as the first, but it will not flash on and off. The message will stay on for a few seconds. Then it will turn off.

Press the space bar when you are ready to view the second message style - SIGN 4. (1-1N)

Message on screen: *non-flashing message for Group A*

<p>MAJOR ACCIDENT AT LITTLE YORK 3 LANES CLOSED</p>
--

Questions on Screen

Answer the following questions on the Form for SIGNS 3 and 4.

1. Which message style do you prefer?
 The first message style (shown previously)
 The second message style (shown last)

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2. Why do you prefer the message style that you selected?

Answer _____

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 4

This part of the study is for subjects who view the non-flashing message after they view the flashing message. After viewing the non-flashing message, subjects will view the following.

Instructions Shown on Screen to Subject (Group A, Part 4)

In the next part of the study, you will see two ways of displaying the same message. After you view both message styles, you will be asked to let us know which style you like best.

The first message is identical to the message you just saw. The message will remain on the screen for a few seconds. Then it will turn off.

Press the space bar when you are ready to view the first message style - SIGN 5. (1-2N)

Message on screen: *non-flashing message for Group A*

<p>FREEWAY BLOCKED AT TIDWELL USE OTHER ROUTES</p>

The second message style has the same message as the first, but it will flash on and off for a few seconds. Then the message will turn off.

Press the space bar when you are ready to view the second message style - SIGN 6. (1-2F)

Message on screen: *flashing message for Group A*

<p>FREEWAY BLOCKED AT TIDWELL USE OTHER ROUTES</p>

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Questions on Screen

Answer the following questions on the Form for SIGNS 5 and 6.

1. Which message style do you prefer?
 The first message style (shown previously)
 The second message style (shown last)

2. Why do you prefer the message style that you selected?
Answer _____

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

Experimental Protocol for Subjects in Group B

PART 5

Instructions Shown on Screen to Subject (Group B, Part 5)

When you press the space bar you will be shown a message that will remain on the screen for a few seconds. Then it will turn off. You will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 7. (1-1N)

Message on screen: *non-flashing message for Group B*

<p>MAJOR ACCIDENT AT LITTLE YORK 3 LANES CLOSED</p>
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Questions on Screen

Answer the following questions on the Form for SIGN 7.

1. What is the traffic problem?
2. Where is the traffic problem located?
3. What is told about the lanes?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 6Instructions Shown on Screen to Subject (Group B, Part 6)

When you press the space bar you will be shown a message that will flash on and off for a few seconds. Then it will turn off. You will be asked questions about the information in the message. So try to remember the information in the message. (Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 8. (1-2F)

Message on screen: *flashing message for Group B*

<p>FREEWAY BLOCKED AT TIDWELL USE OTHER ROUTES</p>

Questions on Screen

Answer the following questions on the Form for SIGN 8. (1-2F)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. What are you to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

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PART 7

This part of the study is for subjects who view the non-flashing message after they view the flashing message. After viewing the non-flashing message, subjects will view the following.

Instructions Shown on Screen to Subject (Group B, Part 7)

In the next part of the study, you will see two ways of displaying the same message. After you view both message styles, you will be asked to let us know which style you like best.

The first message is identical to the message you just saw. The message will stay on for a few seconds. Then it will turn off.

Press the space bar when you are ready to view the first message style - SIGN 9. (1-1N)

Message on screen: *non-flashing message for Group B*

<p>MAJOR ACCIDENT AT LITTLE YORK 3 LANES CLOSED</p>
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The second message style will have the same message as the first, but it will flash on and off. The message will stay on for a few seconds. Then it will turn off.

Press the space bar when you are ready to view the second message style - SIGN 10. (1-1F)

Message on screen: *flashing message for Group B*

<p>MAJOR ACCIDENT AT LITTLE YORK 3 LANES CLOSED</p>
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Questions on screen:

Answer the following questions on the Form for SIGNS 9 and 10.

- Which message style do you prefer?
 The first message style (shown previously)
 The second message style (shown last)
- Why do you prefer the message style that you selected?

Answer _____

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 8

This part of the study is for subjects who view the flashing message after they view the non-flashing message. After viewing the flashing message, subjects will view the following.

Instructions Shown on Screen to Subject (Group B, Part 8)

In the next part of the study, you will see two ways of displaying the same message. After you view both message styles, you will be asked to let us know which style you like best.

The first message is identical to the message you just saw. The message will flash on and off for a few seconds. Then the message will turn off.

Press the space bar when you are ready to view the first message style. - SIGN 11. (1-2F)

Message on screen: *flashing message for Group B*

<p>FREEWAY BLOCKED AT TIDWELL USE OTHER ROUTES</p>

The second message style will have the same message as the first, but it will not flash on and off. The message will stay on for a few seconds. Then it will turn off.

Press the space bar when you are ready to view the first message style. - SIGN 12. (1-2N)

Message on screen: *non-flashing message for Group B*

<p>FREEWAY BLOCKED AT TIDWELL USE OTHER ROUTES</p>

Questions on screen:

Answer the following questions on the Form for SIGNS 11 and 12.

1. Which message style do you prefer?
____ *The first message style (shown previously)*
____ *The second message style (shown last)*

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2. Why do you prefer the message style that you selected?

Answer _____

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

Experimental Protocol for Subjects in Groups A and B

PART 9

This part of the study is designed to determine reading times. Subjects will view one of two flashing messages. Half the subjects will view Message 1 (Part 9) and the other half will view Message 2 (Part 10).

Instructions Shown on Screen to Subject (Group A & B, Part 9)

When you press the space bar you will be shown a message on the screen. The instant you have read the message, press the space bar to turn the message off. Then you will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 13. (1-1F)

Message 1 on screen: *flashing message for Group A & B*

<p>MAJOR ACCIDENT AT LITTLE YORK 3 LANES CLOSED</p>
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Questions on Screen

Answer the following questions on the Form for SIGN 13. (1-1F)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. What is told about the lanes?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 10

This part of the study is designed to determine reading times. Subjects will view one of two flashing messages. Half the subjects will view Message 1 (Part 9) and the other half will view Message 2 (Part 10).

Instructions Shown on Screen to Subject (Group A & B, Part 10)

When you press the space bar you will be shown a message on the screen. The instant you have read the message, press the space to turn the message off. Then you will be asked questions about the information in the message. So try to remember the information in the message. (Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTL.)

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 14. (1-2F)

Message 2 on screen: *flashing message for Group A & B*

<p>FREEWAY BLOCKED AT TIDWELL USE OTHER ROUTES</p>

Questions on Screen

Answer the following questions on the Form for SIGN 14. (1-2F)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. What are you to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

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PART 11

This part of the study is designed to determine reading times. Subjects will view one of two non-flashing messages. Half the subjects will view Message 1 (Part 11) and the other half will view Message 2 (Part 12).

Instructions Shown on Screen to Subject (Group A & B, Part 11)

When you press the space bar you will be shown a message on the screen. The instant you have read the message, press the space bar to turn the message off. Then you will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 15. (1-1N)

Message 1 on screen: *non-flashing message for Group A & B*

<p>MAJOR ACCIDENT AT LITTLE YORK 3 LANES CLOSED</p>
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Questions on Screen

Answer the following questions on the Form for SIGN 15. (1-1N)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. What is told about the lanes?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 12

This part of the study is designed to determine reading times. Subjects will view one of two non-flashing messages. Half the subjects will view Message 1 (Part 11) and the other half will view Message 2 (Part 12).

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Instructions Shown on Screen to Subject (Group A & B, Part 12)

When you press the space bar you will be shown a message on the screen. The instant you have read the message, press the space bar to turn the message off. Then you will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 16. (1-2N)

Message 2 on screen: *non-flashing message for Group A & B*

<p>FREEWAY BLOCKED AT TIDWELL USE OTHER ROUTES</p>

Questions on Screen

Answer the following questions on the Form for SIGN 16. (1-2N)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. What are you to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

Data Analysis

1. Number and percent of subjects that correctly identify the traffic problem.
2. Number and percent of subjects that correctly identify where the traffic problem is located.
3. Number and percent of subjects that correctly identify what they are to do.
4. Number and percent preference for each message style.
5. Appropriate statistical comparisons of reading times for each message style.

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STUDY 2: EVALUATE FLASHING ONE LINE OF A ONE-PHASE MESSAGE VS A NON-FLASHING ONE-PHASE MESSAGE

Objectives

The objectives of this study are to:

1. Determine motorist comprehension of a one-phase message when the top line (problem statement) flashes versus a message with no flashing lines;
2. Determine motorist preferences for each of the two message styles; and
3. Determine motorist reading times for each of the two message styles.

Background

There is a perception by some TMC managers that flashing the top line (problem statement) of a one-phase message will attract the attention of the motorists to the sign. However, it is not clear what effect flashing a single line has on driver comprehension and reading times of the entire message. For example, does the flashing line cause drivers to concentrate more on that line than the remainder of the message?

Method

The study method will be identical to Study 1 with the exception that only the top line will flash. The characteristics of the study are shown in Table 2.

Experimental Protocol for Subjects in Group A

PART 1

Instructions Shown on Screen to Subject (Group A, Part 1)

When you press the space bar you will be shown a message that will remain on the screen for a few seconds. Then it will turn off. You will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 17. (2-1F)

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Table 2. Characteristics of Study Design for Flashing One Line

Study Part	Group	Message Type	Message Text	Output
Group A: 50% of Subjects				
Part 1	Group A	Flash message line	1	Comprehension
Part 2	Group A	Static message	2	Comprehension
Part 3	50 % of Group A	Flash line message seen last	1	Preference
Part 4	50% of Group A	Static message seen last	2	Preference
Group B: 50% of Subjects				
Part 5	Group B	Static message	1	Comprehension
Part 6	Group B	Flash message line	2	Comprehension
Part 7	50 % of Group B	Static message seen last	1	Preference
Part 8	50% of Group B	Flash message seen last	2	Preference
Group A and Group B: 100% of Subjects				
Part 9	Group A and Group B	Flash message line	1	Reading time
Part 10	Group A and Group B	Flash message line	2	Reading time
Part 11	Group A and Group B	Static message line	1	Reading time
Part 12	Group A and Group B	Static message line	2	Reading time
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>FREEWAY CLOSED AT COLLEGE ST FOLLOW DETOUR</p> <p><i>Message 1</i></p> </div> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>TRUCK ACCIDENT AT AIRPORT RD USE SERVICE ROAD</p> <p><i>Message 2</i></p> </div> </div>				

Message on screen: *message with flashing top line for Group A*

**FREEWAY CLOSED
AT COLLEGE ST
FOLLOW DETOUR**

Questions on screen:

Answer the following questions on the Form for SIGN 17. (2-1F)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. What are you to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 2**Instructions Shown on Screen to Subject (Group A, Part 2)**

When you press the space bar you will be shown a message that will remain on the screen for a few seconds. Then it will turn off. You will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 18. (2-2N)

Message on screen: *non-flashing line message for Group A*

<p>TRUCK ACCIDENT AT AIRPORT RD USE SERVICE ROAD</p>

Questions on Screen

Answer the following questions on the Form for SIGN 18. (2-2N)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. What are you to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 3

This part of the study is for subjects who view the message with the flashing line after they view the message that does not flash. After viewing the flashing message, subjects will view the following.

Instructions Shown on Screen to Subject (Group A, Part 3)

In the next part of the study, you will see two ways of displaying the same message. After you view both message styles, you will be asked to let us know which style you like best.

Draft

The first message is identical to the message you just saw. The message will remain on the screen for a few seconds. Then it will turn off.

Press the space bar when you are ready to view the first message style - SIGN 19. (2-1F)

Message on screen: *message with flashing top line for Group A*

<p>FREEWAY CLOSED AT COLLEGE ST FOLLOW DETOUR</p>
--

The second message style will have the same message as the first but the top line will not be flashing. The message will stay on the screen for a few seconds. Then it will turn off.

Press the space bar when you are ready to view the second message style - SIGN 20. (2-1N)

Message on screen: *non-flashing line message for Group A*

<p>FREEWAY CLOSED AT COLLEGE ST FOLLOW DETOUR</p>
--

Questions on Screen

Answer the following questions on the Form for SIGNS 19 and 20. (2-1F and 2-1N)

- Which message style do you prefer?
 The first message style (shown previously)
 The second message style (shown last)
- Why do you prefer the message style that you selected?
Answer _____

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 4

This part of the study is for subjects who view the message without the flashing line after they view the message with the flashing line. After viewing the message without the flashing line, subjects will view the following.

Draft

Instructions Shown on Screen to Subject (Group A, Part 4)

In the next part of the study, you will see two ways to displaying the same message. After you view both message styles, you will be asked to let us know which style you like best.

The first message is identical to the message you just saw. The message will remain on the screen for a few seconds. Then the message will turn off.

Press the space bar when you are ready to view the first message style - SIGN 21. (2-2N)

Message on screen: *non-flashing top line message for Group A*

<p>TRUCK ACCIDENT AT AIRPORT ROAD USE SERVICE ROAD</p>
--

The second message style will have the same message as the first but the top line will be flashing. The message will stay on the screen for a few seconds. Then it will turn off.

Press the space bar when you are ready to view the second message style - SIGN 22. (2-2F)

Message on screen: *message with flashing top line for Group A*

<p>TRUCK ACCIDENT AT AIRPORT ROAD USE SERVICE ROAD</p>
--

Questions on Screen

Answer the following questions on the Form for SIGNS 21 and 22. (2-2N and 2-2F)

- Which message style do you prefer?
 The first message style (shown previously)
 The second message style (shown last)
- Why do you prefer the message style that you selected?

Answer _____

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

Experimental Protocol for Subjects in Group B

PART 5

Instructions Shown on Screen to Subject (Group B, Part 5)

When you press the space bar you will be shown a message that will remain on the screen for a few seconds. Then it will turn off. You will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 23. (2-1N)

Message on screen: *non-flashing message for Group B*

<p>FREEWAY CLOSED AT COLLEGE ST FOLLOW DETOUR</p>
--

Questions on screen:

Answer the following questions on the Form for SIGN 23. (2-1N)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. What are you to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 6

Instructions Shown on Screen to Subject (Group B, Part 6)

When you press the space bar you will be shown a message that will remain on the screen for a few seconds. Then it will turn off. You will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Draft

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 24. (2-2F)

Message on screen: *message with flashing top line for Group B*

<p>TRUCK ACCIDENT AT AIRPORT RD USE SERVICE ROAD</p>

Questions on Screen

Answer the following questions on the Form for SIGN 24. (2-2F)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. What are you to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 7

This part of the study is for subjects who view the message without the flashing line after they view the message with the flashing top line. After viewing the flashing message, subjects will view the following.

Instructions Shown on Screen to Subject (Group B, Part 7)

In the next part of the study, you will see two ways of displaying the same message. After you view both message styles, you will be asked to let us know which style you like best.

The first message is identical to the message you just saw. The message will remain on the screen for a few seconds. Then it will turn off.

Press the space bar when you are ready to view the first message style - SIGN 25. (2-1N)

Message on screen: *non-flashing message for Group B*

<p>FREEWAY CLOSED AT COLLEGE ST FELLOW DETOUR</p>
--

Draft

The second message style will have the same message as the first but the top line will flash on and off. The message will stay on the screen for a few seconds. Then it will turn off.

Press the space bar when you are ready to view the second message style - SIGN 26. (2-1F)

Message on screen: *non-flashing line message for Group A*

<p>FREEWAY CLOSED AT COLLEGE ST FELLOW DETOUR</p>
--

Questions on Screen

Answer the following questions on the Form for SIGNS 25 and 26. (2-1N) and 2-1F)

1. Which message style do you prefer?
 The first message style (shown previously)
 The second message style (shown last)

2. Why do you prefer the message style that you selected?

Answer _____

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 8

This part of the study is for subjects who view the message with the flashing line after they view the message that does not flash. After viewing the flashing message, subjects will view the following.

Instructions Shown on Screen to Subject (Group B, Part 8)

In the next part of the study, you will see two ways of displaying the same message. After you view both message styles, you will be asked to let us know which style you like best.

The first message is identical to the message you just saw. The top line of the message will flash on and off. The message will remain on the screen for a few seconds. Then the message will turn off.

Press the space bar when you are ready to view the first message style - SIGN 27. (2-2F)

Message on screen: *message with flashing top line for Group B*

<p style="text-align: center;">TRUCK ACCIDENT AT AIRPORT RD USE SERVICE ROAD</p>

The second message style will have the same message as the first but the top line will not be flashing. The message will stay on the screen for a few seconds. Then it will turn off.

Press the space bar when you are ready to view the second message style - SIGN 28. (2-2N)

Message on screen: non-flashing line message for Group B

<p style="text-align: center;">TRUCK ACCIDENT AT AIRPORT RD USE SERVICE ROAD</p>

Questions on Screen

Answer the following questions on the Form for SIGNS 27 and 28. (2-2F) and 2-2N)

1. Which message style do you prefer?
 The first message style (shown previously)
 The second message style (shown last)

4. Why do you prefer the message style that you selected?
Answer _____

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

Experimental Protocol for Subjects in Groups A and B

PART 9

This part of the study is designed to determine reading times. Subjects will view one of two messages with the top line flashing. Half the subjects will view Message 1 (Part 9) and the other half will view Message 2 (Part 10).

Instructions Shown on Screen to Subject (Group A & B, Part 9)

When you press the space bar you will be shown a message on the screen. The instant you have read the message, press the space bar to turn the message off. Then you will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 29. (2-1F)

Message 1 on screen: *message with flashing top line for Group A & B*

<p>FREEWAY CLOSED AT COLLEGE ST FOLLOW DETOUR</p>
--

Questions on Screen***Answer the following questions on the Form for SIGN 29. (2-1F)***

1. What is the traffic problem?
2. Where is the traffic problem located?
3. What are you to do?

When you are finished, press the space bar to continue. *(The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)*

PART 10

This part of the study is designed to determine reading times. Subjects will view one of two messages with the top line flashing. Half the subjects will view Message 1 (Part 9) and the other half will view Message 2 (Part 10).

Instructions Shown on Screen to Subject (Group A & B, Part 10)

When you press the space bar you will be shown a message on the screen. The instant you have read the message, press the space bar to turn the message off. Then you will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Draft

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 30. (2-2F)

Message 2 on screen: *message with flashing top line for Group A & B*

<p>TRUCK ACCIDENT AT AIRPORT RD USE SERVICE ROAD</p>

Questions on Screen

Answer the following questions on the Form for SIGN 30. (2-2F)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. What are you to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 11

This part of the study is designed to determine reading times. Subjects will view one of two non-flashing line messages. Half the subjects will view Message 1 (Part 11) and the other half will view Message 2 (Part 12).

Instructions Shown on Screen to Subject (Group A & B, Part 11)

When you press the space bar you will be shown a message on the screen. The instant you have read the message, press the space bar to turn the message off. Then you will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 31. (2-1N)

Draft

Message 1 on screen: *non-flashing line message for Group A & B*

<p>FREEWAY CLOSED AT COLLEGE ST FOLLOW DETOUR</p>
--

Questions on Screen

Answer the following questions on the Form for SIGN 31. (2-1N)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. What are you to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 12

This part of the study is designed to determine reading times. Subjects will view one of two non-flashing line messages. Half the subjects will view Message 1 (Part 11) and the other half will view Message 2 (Part 12).

Instructions Shown on Screen to Subject (Group A & B, Part 11)

When you press the space bar you will be shown a message on the screen. The instant you have read the message, press the space bar to turn the message off. Then you will be asked questions about the information in the message. So try to remember the information in the message.

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the message – SIGN 32. (2-2N)

Message 2 on screen: *non-flashing line message for Group A & B*

<p>TRUCK ACCIDENT AT AIRPORT RD USE SERVICE ROAD</p>

Draft

Questions on Screen

Answer the following questions on the Form for SIGN 32. (2-2N)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. What are you to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

Data Analysis

1. Number and percent of subjects that correctly identify the traffic problem.
2. Number and percent of subjects that correctly identify where the traffic problem is located.
3. Number and percent of subjects that correctly identify what they are to do.
4. Number and percent preference for each message style.
5. Appropriate statistical comparisons of reading times for each message style.

Draft

STUDY 3: EVALUATE THE EFFECT OF ALTERNATING TEXT ON ONE LINE OF A THREE-LINE CMS WHILE KEEPING THE OTHER TWO LINES OF TEXT CONSTANT ON THE SECOND PHASE

Objectives

The objectives of this study are to:

1. Determine motorist comprehension of redundancy in the form of repetition in a two-phase message when the bottom line changes while the other two lines remain the same versus a two-phase message without redundancy;
2. Determine motorist preferences for each of the two message styles; and
3. Determine motorist reading times for each of the two message styles.

Background

Some transportation agencies incorporate redundancy in the form of repetition of lines of text in two-phase messages. Generally, the two top lines remain the same while the bottom line changes text. It is not clear what effect the redundancy has on motorist comprehension and reading times of the entire message. For example, do the repetitive lines cause motorists to read these lines more than once thus increasing reading times? Also, there is uncertainty whether motorists actually notice that the bottom line changes.

Method

The study method will be identical to Study 1 with the exception that message styles will be different. For this study, two alternative two-phase messages will be compared. The top two lines for one message will remain the same (repetitive) while the bottom line will change. The second message will contain the same information with the redundancy removed. The characteristics of the study are shown in Table 3.

Experimental Protocol for Subjects in Group A

PART 1

Instructions Shown on Screen to Subject (Group A, Part 1)

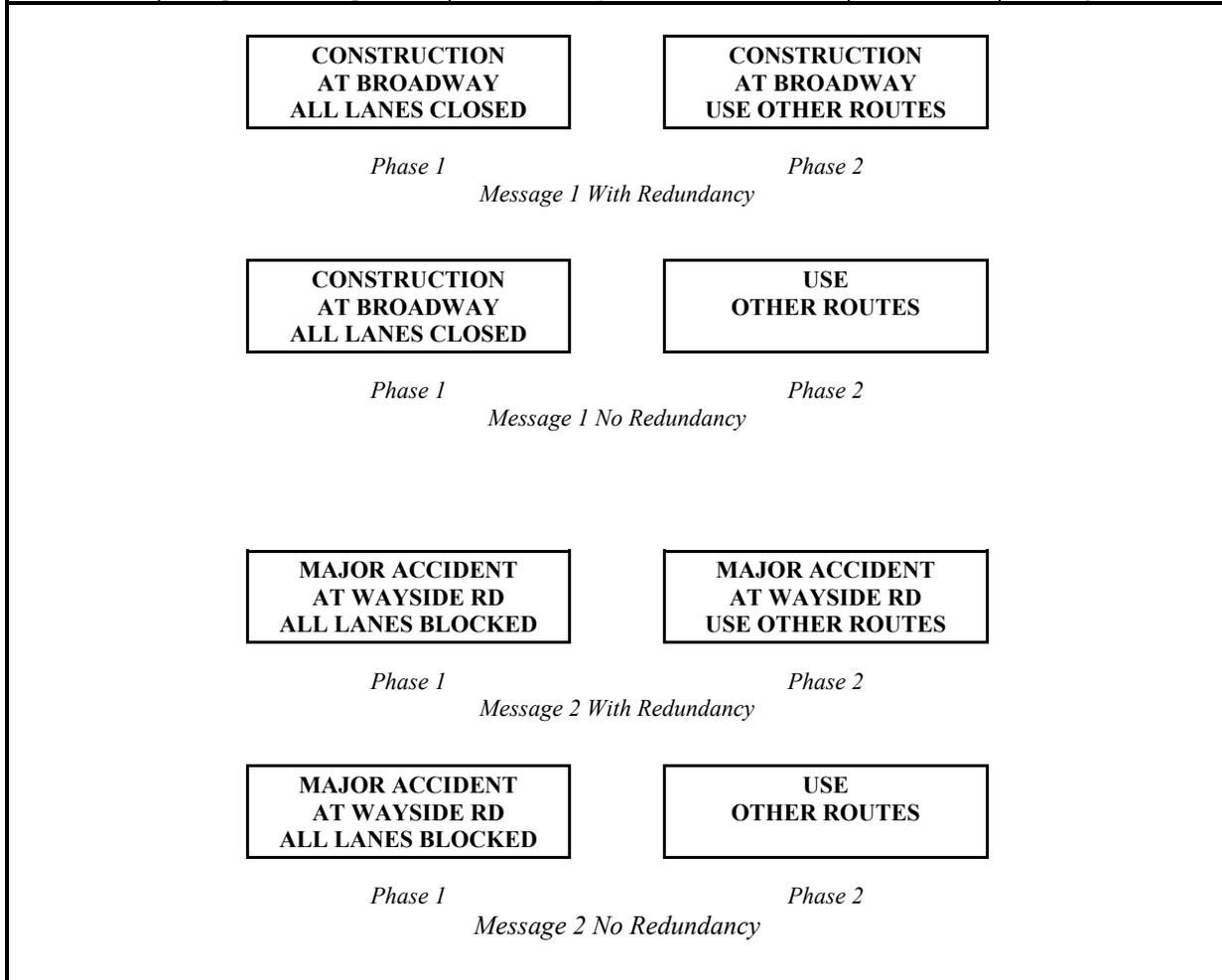
When you press the space bar you will be shown a message with TWO parts. Then it will turn off. You will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Draft

Table 3. Characteristics of Study Design for Redundancy in a Two-Phase Message

Study Part	Group	Message Type	Message Text	Output
Group A: 50% of Subjects				
Part 1	Group A	Redundancy with alternating line	1	Comprehension
Part 2	Group A	No redundancy	2	Comprehension
Part 3	50 % of Group A	Redundancy with alternating line message seen last	1	Preference
Part 4	50% of Group A	No redundancy message seen last	2	Preference
Group B: 50% of Subjects				
Part 5	Group B	No redundancy	1	Comprehension
Part 6	Group B	Redundancy with alternating line	2	Comprehension
Part 7	50 % of Group B	No redundancy message seen last	1	Preference
Part 8	50% of Group B	Redundancy with alternating line message seen last	2	Preference
Group A and Group B: 100% of Subjects				
Part 9	Group A and Group B	Redundancy with alternating line	1	Reading time
Part 10	Group A and Group B	Redundancy with alternating line	2	Reading time
Part 11	Group A and Group B	No redundancy	1	Reading time
Part 12	Group A and Group B	No redundancy	2	Reading time



Press the space bar to view the TWO- part message – SIGN 33. (3-1F)

Message on screen: *alternating third line message for Group A*

**CONSTRUCTION
AT BROADWAY RD
ALL LANES CLOSED**

1st Phase

**CONSTRUCTION
AT BROADWAY RD
USE OTHER ROUTES**

2nd Phase

Questions on Screen

Answer the following questions on the Form for SIGN 33. (3-1F)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. How many lanes are blocked?
4. What are you told to do?

When you are finished, press the space bar to continue. *(The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)*

PART 2

Instructions Shown on Screen to Subject (Group A, Part 2)

When you press the space bar you will be shown a message with TWO parts. Then it will turn off. You will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view TWO- part the message – SIGN 34. (3-2N)

Message on screen: *shorter message for Group A*

**MAJOR ACCIDENT
AT WAYSIDE RD
ALL LANES BLOCKED**

1st Phase

**USE
OTHER ROUTES**

2nd Phase

Draft

Questions on Screen:

Answer the following questions on the Form for SIGN 34. (3-2N)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. How many lanes are blocked?
4. What are you told to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 3

This study is for subjects who view the alternating third line message after they view the shorter version of the same message. After viewing the alternating third line message, subjects will view the following.

Instructions Shown on Screen to Subject (Group A, Part 3)

In the next part of the study, you will see two ways of displaying the same message. After you view both styles, you will be asked to let us know which style you like best.

The first message style is identical to the message you just saw. The message will be in TWO parts. Then it will turn off.

Press the space bar when you are ready to view the first message style - SIGN 35. (3-1F)

Message on screen: *alternating third line message for Group A*

<p>CONSTRUCTION AT BROADWAY RD ALL LANES CLOSED</p>
--

1st Phase

<p>CONSTRUCTION AT BROADWAY RD USE OTHER ROUTES</p>
--

2nd Phase

The second message style has the same message as the first, and will be shown in TWO parts. Then it will turn off.

Press the space bar when you are ready to view the second message style - SIGN 36. (3-1N)

Draft

Message on screen: *shorter message for Group A*

**CONSTRUCTION
AT BROADWAY RD
ALL LANES CLOSED**

1st Phase

**USE
OTHER ROUTES**

2nd Phase

Questions on Screen

Answer the following questions on the Form for SIGNS 35 and 36.

1. Which message style do you prefer?
 The first message style (shown previously)
 The second message style (shown last)

2. Why do you prefer the message style that you selected?

Answer _____

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 4

This study is for subjects who view the shorter message after they view the alternating third line message. After viewing the shorter message, subjects will view the following.

Instructions Shown on Screen to Subject (Group A, Part 4)

In the next part of the study, you will see two ways of displaying the same message. After you view both styles, you will be asked to let us know which style you like best.

The first message style is identical to the message you just saw. The message will be in TWO parts. Then it will turn off.

Press the space bar when you are ready to view the first message style - SIGN 37. (3-2N)

Message on screen: *shorter message for Group A*

**MAJOR ACCIDENT
AT WAYSIDE RD
ALL LANES BLOCKED**

1st Phase

**USE
OTHER ROUTES**

2nd Phase

The second message style has the same message as the first, and will be shown in TWO parts. Then it will turn off.

Press the space bar when you are ready to view the second message style- SIGN 38. (3-2F)

Message on screen: *alternating third line message for Group A*

**MAJOR ACCIDENT
AT WAYSIDE RD
ALL LANES BLOCKED**

1st Phase

**MAJOR ACCIDENT
AT WAYSIDE RD
USE OTHER ROUTES**

2nd Phase

Questions on Screen

Answer the following questions on the Form for SIGNS 37 and 38. (3-2N and 3-2F)

1. Which message style do you prefer?
 The first message style (shown previously)
 The second message style (shown last)

2. Why do you prefer the message style that you selected?

Answer _____

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

Experimental Protocol for Subjects in Group B

PART 5

Instructions Shown on Screen to Subject (Group B, Part 5)

When you press the space bar you will be shown a message with TWO parts. Then it will turn off. You will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do*

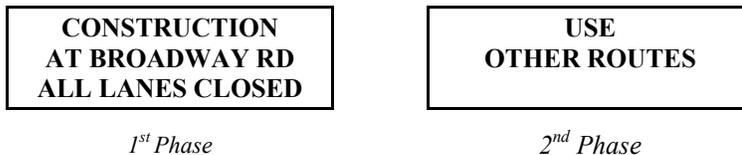
Draft

the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the TWO- part message – SIGN 39. (3-1N)

Message on screen: *shorter message for Group B*



Questions on Screen

Answer the following questions on the Form for SIGN 39. (3-1N)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. How many lanes are blocked?
4. What are you told to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 6

Instructions Shown on Screen to Subject (Group B, Part 6)

When you press the space bar you will be shown a message with TWO parts. Then it will turn off. You will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the TWO- part message – SIGN 40. (3-2F)

Draft

Message on screen: *alternating third line message for Group B*

**MAJOR ACCIDENT
AT WAYSIDE RD
ALL LANES BLOCKED**

1st Phase

**MAJOR ACCIDENT
AT WAYSIDE RD
USE OTHER ROUTES**

2nd Phase

Questions on Screen:

Answer the following questions on the Form for SIGN 40. (3-2F)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. How many lanes are blocked?
4. What are you told to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 7

This study is for subjects who view the shorter message after they view the alternating third line message. After viewing the shorter message, subjects will view the following.

Instructions Shown on Screen to Subject (Group B, Part 7)

In the next part of the study, you will see two ways of displaying the same message. After you view both message styles, you will be asked to let us know which style you like best.

The first message style is identical to the message you just saw. The message will be in TWO parts. Then it will turn off.

Press the space bar when you are ready to view the first message style - SIGN 41. (3-1N)

Message on screen: *shorter message for Group B*

**CONSTRUCTION
AT BROADWAY RD
ALL LANES CLOSED**

1st Phase

**USE
OTHER ROUTES**

2nd Phase

The second message style has the same message as the first, and will be shown in TWO parts. Then it will turn off.

Press the space bar when you are ready to view the second message style - SIGN 42. (3-1F)

Draft

Message on screen: *alternating third line message for Group B*

**CONSTRUCTION
 AT BROADWAY RD
 ALL LANES CLOSED**

1st Phase

**CONSTRUCTION
 AT BROADWAY RD
 USE OTHER ROUTES**

2nd Phase

Questions on Screen

Answer the following questions on the Form for SIGNS 41 and 42. (3-1N and 3-1F)

1. Which message style do you prefer?
 _____ ***The first message style (shown previously)***
 _____ ***The second message style (shown last)***

2. Why do you prefer the message style that you selected?

Answer _____

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 8

This study is for subjects who view the alternating third line message (Message 1) after they view the shorter message (Message 2). After viewing the shorter message, subjects will view the following.

Instructions Shown on Screen to Subject (Group B, Part 8)

In the next part of the study, you will see two ways of displaying the same message. After you view both message styles, you will be asked to let us know which style you like best.

The first message is identical to the message you just saw. The message will stay on for a few seconds. Then it will turn off.

Press the space bar when you are ready to view the first message style - SIGN 43. (3-2F)

Message on screen: *alternating third line message for Group B*

**MAJOR ACCIDENT
 AT WAYSIDE RD
 ALL LANES BLOCKED**

1st Phase

**MAJOR ACCIDENT
 AT WAYSIDE RD
 USE OTHER ROUTES**

2nd Phase

The second message style has the same message as the first, and will be shown in TWO parts. Then it will turn off.

Press the space bar when you are ready to view the second message style - SIGN 44. (3-2N)

Message on screen: *shorter message for Group B*

**MAJOR ACCIDENT
 AT WAYSIDE RD
 ALL LANES BLOCKED**

1st Phase

**USE
 OTHER ROUTES**

2nd Phase

Questions on Screen

Answer the following questions on the Form for SIGNS 43 and 44. (3-2F and 3-2N)

1. Which message style do you prefer?
 The first message style (shown previously)
 The second message style (shown last)
2. Why do you prefer the message style that you selected?

Answer _____

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

Experimental Protocol for Subjects in Groups A and B

PART 9

This part of the study is designed to determine reading times. Subjects will view one of two messages. Half the subjects will view Message 1 (Part 9) and the other half will view Message 2 (Part 10).

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Instructions Shown on Screen to Subject (Group A & B, Part 9)

When you press the space bar you will be shown a message on the screen with TWO parts. The instant you have read the first part of the message, press the space bar to see the second part of the message. The instant you have read the second part of the message, press the space bar again to turn the message off. Then you will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the TWO- part message – SIGN 45. (3-1F)

Message 1 on screen: *alternating third line message for Group A & B*

<p>CONSTRUCTION AT BROADWAY RD ALL LANES CLOSED</p>
--

1st Phase

<p>CONSTRUCTION AT BROADWAY RD USE OTHER ROUTES</p>
--

2nd Phase

Questions on Screen

Answer the following questions on the Form for SIGN 45. (3-1F)

1. What is the traffic problem?
5. Where is the traffic problem located?
3. How many lanes are blocked?
4. What are you told to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 10

This part of the study is designed to determine reading times. Subjects will view one of two messages. Half the subjects will view Message 1 (Part 9) and the other half will view Message 2 (Part 10).

Instructions Shown on Screen to Subject (Group A & B, Part 10)

When you press the space bar you will be shown a message on the screen with TWO parts. The instant you have read the first part of the message, press the space bar to see the second part

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of the message. The instant you have read the second part of the message, press the space bar again to turn the message off. Then you will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the TWO- part message – SIGN 46. (3-2F)

Message 2 on screen: *alternating third line message for Group A & B*

MAJOR ACCIDENT
AT WAYSIDE RD
ALL LANES BLOCKED

1st Phase

MAJOR ACCIDENT
AT WAYSIDE RD
USE OTHER ROUTES

2nd Phase

Questions on Screen

Answer the following questions on the Form for SIGN 46. (3-2F)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. How many lanes are blocked?
4. What are you told to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 11

This part of the study is designed to determine reading times. Subjects will view one of two messages. Half the subjects will view Message 1 (Part 11) and the other half will view Message 2 (Part 12).

Instructions Shown on Screen to Subject (Group A & B, Part 11)

When you press the space bar you will be shown a message on the screen with TWO parts. The instant you have read the first part of the message, press the space bar to see the second part of the message. The instant you have read the second part of the message, press the space bar again to turn the message off. Then you will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse.*

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The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)

Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the TWO- part message – SIGN 47. (3-1N)

Message 1 on screen: *shorter message for Group A & B*

**CONSTRUCTION
AT BROADWAY RD
ALL LANES CLOSED**

1st Phase

**USE
OTHER ROUTES**

2nd Phase

Questions on Screen

Answer the following questions on the Form for SIGN 47. (3-1N)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. How many lanes are blocked?
4. What are you told to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

PART 12

This part of the study is designed to determine reading times. Subjects will view one of two messages. Half the subjects will view Message 1 (Part 11) and the other half will view Message 2 (Part 12).

Instructions Shown on Screen to Subject (Group A & B, Part 12)

When you press the space bar you will be shown a message on the screen with TWO parts. The instant you have read the first part of the message, press the space bar to see the second part of the message. The instant you have read the second part of the message, press the space bar again to turn the message off. Then you will be asked questions about the information in the message. So try to remember the information in the message. *(Instructions will also be given to the subjects about how to do the secondary task loading by manipulating the computer mouse. The specific instructions will be prepared as soon as the secondary task activity is determined via the separate study being conducted by TTI.)*

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Assume that you are driving on southbound Interstate 45 and you see the message that will be shown on the screen.

Press the space bar to view the TWO- part message – SIGN 48. (3-2N)

Message 2 on screen: *shorter message for Group A & B*

**MAJOR ACCIDENT
AT WAYSIDE RD
ALL LANES BLOCKED**

1st Phase

**USE
OTHER ROUTES**

2nd Phase

Questions on Screen

Answer the following questions on the Form for SIGN 48. (3-2N)

1. What is the traffic problem?
2. Where is the traffic problem located?
3. How many lanes are blocked?
4. What are you told to do?

When you are finished, press the space bar to continue. (The specific part/section that the subject will be directed to will be determined when the experimental parts are packaged for each subject group.)

Data Analysis

1. Number and percent of subjects that correctly identify the traffic problem.
2. Number and percent of subjects that correctly identify where the traffic problem is located.
3. Number and percent of subjects that correctly identify the number of lanes affected.
4. Number and percent of subjects that correctly identify what the sign tells them to do.
5. Number and percent preference for each message style.
6. Appropriate statistical comparisons of reading times for each message style.

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**APPENDIX A
MESSAGES FOR HUMAN FACTORS STUDIES: LAPTOP**

Message 1-1F	Message 1-1N	Message 1-2F	Message 1-2N
MAJOR ACCIDENT AT LITTLE YORK 3 LANES CLOSED	MAJOR ACCIDENT AT LITTLE YORK 3 LANES CLOSED	FREEWAY BLOCKED AT TIDWELL USE OTHER ROUTES	FREEWAY BLOCKED AT TIDWELL USE OTHER ROUTES

Message 2-1F	Message 2-1N	Message 2-2F	Message 2-2N
FREEWAY CLOSED AT COLLEGE ST FOLLOW DETOUR	FREEWAY CLOSED AT COLLEGE ST FOLLOW DETOUR	TRUCK ACCIDENT AT AIRPORT RD USE SERVICE ROAD	TRUCK ACCIDENT AT AIRPORT RD USE SERVICE ROAD

Message 3-1F	Message 3-1N	Message 3-2F	Message 3-2N
CONSTRUCTION AT BROADWAY RD ALL LANES CLOSED	CONSTRUCTION AT BROADWAY RD ALL LANES CLOSED	MAJOR ACCIDENT AT WAYSIDE RD ALL LANES BLOCKED	MAJOR ACCIDENT AT WAYSIDE RD ALL LANES BLOCKED
CONSTRUCTION AT BROADWAY RD USE OTHER ROUTES	USE OTHER ROUTES	MAJOR ACCIDENT AT WAYSIDE RD USE OTHER ROUTES	USE OTHER ROUTES

Note: F = Flashing or alternating line; N = Non flashing or alternating line. Bold indicates the portion of the message that flashes or alternates