SURVEY OF DRIVER'S OPINION ABOUT WORK ZONE TRAFFIC CONTROL ON A RURAL HIGHWAY

By

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A Report of the findings of:
Investigation of speed control methods in work zones

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Survey of Driver's Opinion About Work Zone Traffic Control on a Rural Highway

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The responses of 441 drivers who traveled through a construction zone on I-57 were collected and analyzed. The drivers were surveyed for their understanding, interpretation, and reaction to work zone traffic control signs and messages. They were also asked for suggestions to improve work zone safety. The analysis indicated that 77% of the drivers paid more attention to work zone signs. About 83% said they saw the flagger and 88% of them correctly understood the flagger's message, while only 92% reduced their speed. Speed limit signs were noticed by 87%, but correctly remembered by only 90% of them. About 91% of the drivers reduced their speed after seeing speed limit signs, but 6% did not. One-third of the drivers reported their speed being greater than the speed limit. About 94% of the speeding drivers felt that their speed was safe enough for the work zone conditions. Over three-fourths of the drivers said the posted speed limit in the work zone was about right, but 17% said it was too low. Even though 79% of the drivers said the posted speed limit was about right, only 59% said they drove at or below this speed limit. The work zone signs conveyed a clear enough message such that a majority of the drivers were guided comfortably through the work zone. However, about 5% replied that one or more signs were confusing to them. While there was not an agreement of the "confusing" signs, the posted speed limit signs were cited by several drivers. The motorists did not perceive the driving conditions in the work zone to be hazardous; only 54% of the drivers said that going through the work zone was more hazardous than a non-work zone. The driving conditions in the work zone were described as comfortable by 3/4 of the drivers and uncomfortable by 22%. The report contains analysis of the responses and drivers' suggestions.
ACKNOWLEDGEMENT AND DISCLAIMER

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The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Illinois Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.
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I. INTRODUCTION

Motorists' understanding of traffic control plans (TCP) and their perception of problems in work zones may be different from that of an engineer who prepares the plans. Conveying an effective traffic control message to motorists will reduce confusion, noncompliance, or misinterpretation of TCP. Thus, it may increase the safety and efficiency of traffic in work zones. Understanding problems from drivers' perspective would be helpful in preparing more effective traffic control plans.

The objectives of this study were to collect and analyze information on:

1) Drivers' interpretation of work zone signs and messages,
2) Drivers' reaction to the conveyed messages,
3) Drivers' perception of problems in work zones, and
4) Drivers' suggestions for improving safety and efficiency.

A survey instrument was designed to solicit input from drivers' right after traveling through a work zone. The survey questionnaire was designed to analyze drivers' understanding of the work zone traffic control plans, interpretation of work zone messages, reaction to given messages, perception of problems, and their possible solutions.

This report discusses the results from the survey of over 400 drivers who had traveled through a construction zone approximately 10 miles long. The construction zone was located in a rural area on the southbound of Interstate 57, south of Champaign, Illinois.
II. STUDY PROCEDURES

II. A. Survey Instrument

A questionnaire was designed to understand drivers’ perception of problems in a work zone, and their assessments of the layout and signing of the work zone. Findings from studies by Owens (1), Ray et al (2), Pietrucha et al (3), Paniati (4), Hostetter et al (5) which had insight to driver surveys were used in the design of this questionnaire. An interim form of the questionnaire was given to graduate students and secretaries to fill in their responses. Then, they were interviewed to identify any unclear questions which may have been open to interpretation. Their inputs were used to revise the form and make the questionnaire as clear as possible.

The survey form had 30 questions. A copy of the survey instrument used in this study is given in Appendix A. The survey included questions about driver’s profile, assessment of comfort level, understanding and reaction to work zone signs, flagging, speed limit, and suggestions or comments to increase safety and traffic flow efficiency in work zones.

II. B. Study Site

The data was collected at the Illinois Prairie Rest Area located about 2 miles south of the construction zone as shown in Figure 1. The drivers stopped at the rest area after going through the construction zone on the southbound of I-57. The rest area was new, clean, park-like, and had benches inside and picnic tables outside of the building. Inside the building there were restrooms, public telephones, free brochures, and road maps. Most of the survey forms were collected when the drivers were inside the building.
Figure 1

TYPICAL CONSTRUCTION ZONE TRAFFIC CONTROL PLAN ON SB I-57 DURING SURVEY

- REST AREA
- WORKERS AHEAD
- SPEED LIMIT 45
- WHEN FLASHING
- END CONSTRUCTION
- TRUCKS LEAVING ON LEFT
- FLAGMAN AHEAD
- WORKERS AHEAD
- SPEED LIMIT 45
- WHEN FLASHING
- RIGHT LANE CLOSED AHEAD
- 45 M.P.H
- RIGHT LANE CLOSED 1/2 MILE
- ROAD CONSTRUCTION 1 MILE
- Give 'em a BRAKE Slow Down
The drivers went through several miles of one-lane construction zone before reaching the rest area. The speed limit on I-57 outside of the construction zone was 65 mph for cars and light trucks, and 55 mph for heavy trucks. The speed limit in the construction zone was 45 mph for all vehicles when work was in progress. A regulatory 45 mph speed limit sign, with two small flashing beacons mounted on the signs to indicate construction work in progress, was in effect during work hours. The type of construction occurring on the southbound lanes was asphalt overlay, with one of the lanes closed and the other lane open to traffic. The lane closure ended shortly before the rest area located near the south end of the zone. Plastic barrels were used to delineate the construction area during daytime. There was at least one flagger in the work zone using a STOP/SLOW paddle to slow down traffic. The construction zone began shortly after the interchange between I-57 and I-72, and ended approximately 2 miles before the rest area, which was before the interchange of I-57 and US Route 45. The terrain in the study site was level, and the roadway did not have sharp curves.

The traffic volume in the construction zone was light, being approximately 400 vehicles per hour. The Average Daily Traffic (ADT) in this section of I-57 is about 14,500, with 17% large trucks. There was one diamond interchange within the work zone. The entering and exiting volumes on the ramps were very light.

II. C. Opinion Solicitation

The data was collected on 11 weekdays between September 18 and October 4, 1989 when the construction crew was working on the road. The dates and times of data collection are listed in Table 1. A total of 441 motorists who had just driven through the construction zone were surveyed. Almost all of the participants were the driver of the vehicle. Inadvertently, only several passengers filled out the questionnaire either
Table 1. Time, Date, and Number of Surveys Collected

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Time</th>
<th>No. of Surveys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>9-18</td>
<td>12:00-2:00 PM</td>
<td>50</td>
</tr>
<tr>
<td>Tuesday</td>
<td>9-19</td>
<td>12:00-2:30 PM</td>
<td>48</td>
</tr>
<tr>
<td>Thursday</td>
<td>9-21</td>
<td>11:00-2:30 PM</td>
<td>52</td>
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<tr>
<td>Thursday</td>
<td>9-21</td>
<td>4:30-6:00 PM</td>
<td>13</td>
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<tr>
<td>Friday</td>
<td>9-22</td>
<td>10:00-4:30 PM</td>
<td>89</td>
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<td>Monday</td>
<td>9-25</td>
<td>12:30-4:00 PM</td>
<td>37</td>
</tr>
<tr>
<td>Tuesday</td>
<td>9-26</td>
<td>11:30-2:30 PM</td>
<td>22</td>
</tr>
<tr>
<td>Thursday</td>
<td>9-28</td>
<td>1:30-2:30 PM</td>
<td>11</td>
</tr>
<tr>
<td>Friday</td>
<td>9-29</td>
<td>12:30-4:30 PM</td>
<td>74</td>
</tr>
<tr>
<td>Tuesday</td>
<td>10-3</td>
<td>12:00-1:00 PM</td>
<td>10</td>
</tr>
<tr>
<td>Wednesday</td>
<td>10-4</td>
<td>12:00-2:00 PM</td>
<td>35</td>
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Total No. of Surveys Collected 441

alone or in consultation with the driver of the vehicle. It was decided not to use these questionnaires, but the survey crew could not identify the forms filled out by the passengers. Thus, it was assumed that the collected responses reflected the opinion of the driver of the vehicle.

Some drivers did not respond to all of the questions. It was decided to discard the survey forms with one third or more unanswered questions. Twenty surveys were deleted because of the above mentioned reason. Also, the 13 surveys conducted after 4:30 pm on Thursday 9/21/89 were deleted because no construction activities were going on during that time. The responses for 408 surveys were tabulated for further analysis.

Most of the questions were multiple choice type and the drivers selected the best answer. Some questions asked them to write a short response, such as number of years of driving experience. There were two open-ended questions asking them to write suggestions and comments. The survey form was filled out by the drivers either on their own or by a
student who read the questions to them and recorded their responses. About a dozen forms were read to the drivers by the student. The survey took 2-5 minutes to fill in depending on whether the driver supplied suggestions and comments.

The construction zone was video taped several times during the data collection period to record the actual field conditions. When there was a change in the layout of the construction zone, it was video taped again. The video taping was used to confirm or check drivers’ comments about the work zone’s traffic control plan.

II. D. Survey Team’s Field Observations

The survey staff approached the drivers and explained to them that they were students at the University of Illinois and they were working on a project for Illinois DOT to help make construction zones safer for highway travelers. Among all the drivers who were asked to fill out the survey form, about a 2/3 compliance rate was obtained. When more information was given about the purpose of the survey and the survey staff, drivers consented more often to fill in the survey.

Some people commented that the survey was too long. Perhaps some of the incomplete forms resulted from the lengthy form. Several of the questions hinged on one another. If one answered yes to one question, then he/she was asked a follow-up question. Some people, especially those who were rushing through the form to get back on the road quickly, did not like hinged questions.

II. E. Data Reduction

Four hundred and eight surveys were checked for inconsistency in the responses. An inconsistency occurred when the response to a follow-up question contradicted the response
to the previous question. For example, a response was considered inconsistent when a driver answered "NO" to question 9 ("Did you see a flagger in this work zone?"), but went ahead and responded to question 10 ("if you did see a flagger, what message was he or she conveying?").

The inconsistencies for 4 groups of responses were checked. These groups were questions 9, 10, and 11; questions 12 and 13; questions 14, 15, and 16; and questions 26, 27, and 28. The number of inconsistent answers were 6, 7, 10, and 14 for these groups, respectively. There were 37 inconsistent responses out of a total of 1632 (4*408), which is 2.3% of the responses for these 4 groups. A few forms had more than one inconsistency. When there was one or more inconsistent responses in a group, all of the questions in that group were coded as inconsistent.

This coding scheme prevented the use of inconsistent answers in further analysis. If the total number of inconsistent answers and unanswered questions was more than 10, the survey for that driver was discarded. Eight more forms were deleted because of inconsistent and unanswered questions. Therefore, 400 surveys were used in this study. For a given question the inconsistent answers were not used in further analysis of the responses for that question.
III. ANALYSIS OF SURVEY RESULTS

III. A. Driver Profile

For the 400 drivers, the distribution of the type of vehicles driven is given in Figure 2. There were 66% automobiles, 10% pick-up trucks, 15.5% large trucks, and 8.5% others (van, motor home, etc). Illinois DOT’s Average Daily Traffic (ADT) maps show that the large trucks constituted about 17% of ADT on this section of I-57. Thus, the survey represents very closely the large truck distribution on this section of I-57.

Demographic information about the drivers surveyed indicated that 81.5% of them were male, 18% female, and 0.5 did not answer the question, as shown in Figure 3. The drivers were grouped in age groups of less than 20, 21-30, 31-45, 46-65, and greater than 65 years old. The percentage of drivers in each age group is shown in Figure 4. There were 22% over 65 years of age, 37% in the age group of 46-65, and 25% between 31 and 45 years of age. The percentage of drivers 30 or younger was 16%, which is higher than what we were expecting to see in the rest area during working hours.

Overall, the distribution is shifted towards older age groups. According to the data published by the Office of Secretary of State, in 1987 the percentage of licensed drivers in Illinois by age group were: 7.43% less than 20 years old, 54.65% in the age group of 20 to 44, 25.58% in the age group of 45 to 64, and 12.31% 65 years or older. In comparison, the survey included more older drivers than the percentage shown by the licensing data. The distribution of driving experience of the participants is shown in Figure 5. The sample represents more experienced drivers. Only 6.5% had less than 5 years of experience, 13% had less than 10 years, and 30% less than 20 years of experience. About 70% of the drivers
Figure 2. Type of vehicles drivers used

Vehicle Type

Figure 3. Percentage of male and female drivers
Figure 4. Distribution of age of the drivers

Age group

Figure 5. Distribution of driving experience of the participants

Years of experience
had more than 20 years of experience. People with 50 or more years of experience constituted 10% of the sample. Almost half of the drivers were Illinois residents and the remaining were out of state drivers; see Figure 6.

Most of the drivers (61%) responded that they traveled on the studied section only occasionally, while 21% of them were traveling on the section for the first time. About 2% said they traveled on this section daily, 8% traveled weekly, and 9% monthly, see Figure 7. Most of the drivers were not very familiar with the work zone. About 37% said they were not familiar at all with the section of the freeway under construction. About 42% were reasonably familiar, and 21% said that they were familiar with the section under construction; see Figure 8.

III. B. Driver’s Assessment of Flagging

The amount of attention motorists pay to the driving task in a work zone is one of the important factors that affects the safety of travelers and the construction crew. Construction zones are more complex sections than regular freeway sections. Thus, they demand more attention from the drivers. Although it is very difficult to measure quantitatively how much more attention motorists pay to the driving task in construction zones, a question was asked to see if the drivers felt they became more attentive to the work zone signs. The majority of drivers (77.3%) said they paid more attention to the signs after entering the work zone, and 20% paid the same amount of attention; see Figure 9. It was surprising to see that 1.3% paid less attention and 1.3% did not remember whether they paid more or less attention.

Most of the drivers said that they saw the flagger in the work zone. Out of the 400 drivers, 82.7% (331 drivers) said "yes" they saw the flagger, 14.3% (57 drivers) said, "no" they did not see the flagger, 1% (4 drivers) did not remember whether they saw a flagger
Figure 6. Percentage of the drivers who are residents of Illinois

Residency of the drivers

Figure 7. Frequency of travel through the work zone

Travel
Figure 8. Familiarity with the section of highway under construction

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Very familiar</th>
<th>Reasonably familiar</th>
<th>Not familiar at all</th>
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<tr>
<td>21</td>
<td>42.5</td>
<td>36.5</td>
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Figure 9. Attention the drivers paid to signs after entering the work zone

<table>
<thead>
<tr>
<th>Percentage</th>
<th>More attention</th>
<th>Same attention</th>
<th>Less attention</th>
<th>Don't remember</th>
<th>No answer</th>
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<tr>
<td>77.25</td>
<td>20</td>
<td>1.25</td>
<td>1.25</td>
<td>0.25</td>
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or not, and 2% (8 drivers) provided inconsistent answers; see Chart 1.

Most of the drivers who saw the flagger said that the message conveyed by the flagger was to "Proceed with caution and slow down." This was the response of 87.9% of drivers to question 10 ("If you did see a flagger, what message was he or she conveying?"). About 3.3% said that the message was "Proceeded with caution but don’t slow down." 0% said they did not understand the message, 4.8% said "No message was given," 2.5% could not remember the message, 0.6% understood it as change your lane, and 0.9% did not reply; see Chart 2.

Among the drivers who interpreted the flagger’s message correctly as "Proceed with caution and slow down," 92.1% said they reduced their speed if the flagger was asking them to slow down; 6.2% did not decrease their speed; and 1.7% did not remember or did not reply.

A small group of drivers, 18 drivers (the 6.2%), who saw the flagger and interpreted the flagger’s message correctly did not slow down. Seven out of the 18 drivers, about 39% of the small group, knew that they were speeding in the work zone. None of the drivers were truck drivers. Only 12 drivers, about 66.7% of the small group of drivers, who did not slow down, but knew they were asked to, thought that their speed was safe enough for the conditions of the construction zone.

The drivers were not asked to specify the amount of speed reduction, but were asked to answer whether or not they decreased their speed. Among the drivers who saw the flagger, regardless of their interpretation of the flagger’s message, 89% decreased their speed, 7% did not reduce their speed, and the remaining 4% did not remember or did not reply to the question. The responses indicate that the drivers decreased their speed when they saw a flagger, regardless of their interpretation of the message. However,
CHART 1
RESPONSE TO QUESTIONS 9, 10, AND 11

DID YOU SEE A FLAGGER IN THIS WORK ZONE

YES
82.7% (331)
see details on a separate sheet.

NO
14.3% (57)

DON'T REMEMBER
1.0% (4)

NO REPLY
2.0% (8)

MESSAGE GIVEN

RNR
89.5% (51)

NO MESSAGE WAS GIVEN
10.5% (6)

DECREASED SPEED FOR FLAGGER

RNR
90.2% (46)

YES
7.8% (4)

NO
2.0% (1)

DECREASED SPEED FOR FLAGGER

YES
33.3% (2)

NO
16.7% (1)

DON'T REMEMBER
33.3% (2)

RNR
16.7% (1)

LEGEND:

PERCENT (NO. OF DRIVERS)
RNR = RESPONSE NOT REQUIRED
CHART 2
RESPONSE TO QUESTIONS 9, 10, AND 11 CONTINUED

DID YOU SEE A FLAGGER IN THIS WORK ZONE

YES
82.7% (331)

MESSAGE GIVEN

PROCEED W/ CAUTION BUT DON'T SLOW DOWN
3.3% (11)

PROCEED W/ CAUTION AND SLOW DOWN
87.9% (291)

DID NOT UNDERSTAND THE MESSAGE
0.0% (0)

SAW THE FLAGGER BUT CAN'T REMEMBER THE MESSAGE
2.5% (8)

CHANGE THE LANES
0.6% (2)

NO REPLY
0.9% (3)

NO MESSAGE WAS GIVEN
4.8% (16)

DECREASED SPEED FOR FLAGGER

YES
81.8% (9)

NO
18.2% (2)

DECREASED SPEED FOR FLAGGER

YES
50.0% (1)

NO
50.0% (1)

DECREASED SPEED FOR FLAGGER

YES
92.1% (226)

NO
6.2% (18)

DON'T REMEMBER
0.7% (2)

NO REPLY
1.0% (3)

DECREASED SPEED FOR FLAGGER

YES
62.5% (5)

NO
12.5% (1)

DON'T REMEMBER
12.5% (1)

RNR
12.5% (1)

DECREASED SPEED FOR FLAGGER

YES
66.7% (2)

NO REPLY
33.3% (1)

DECREASED SPEED FOR FLAGGER

YES
59.0% (8)

NO
6.2% (1)

DON'T REMEMBER
6.3% (1)

RNR
37.5% (6)

LEGEND:
PERCENT (NO. OF DRIVERS)
RNR = RESPONSE NOT REQUIRED
whether or not the reduction brought their speed to the posted speed limit remains to be determined.

Among the drivers who said the flagger was giving a message other than "Proceed with caution and slow down," most of them decreased their speed regardless. About 81.8% of those who said the flagger’s message was "Proceed with caution but do not slow down," decreased their speed, while 18.2% did not. Among the drivers who said "No message was given," 50% decreased their speed anyway. Among those drivers who could not remember the flagger’s message, 62.5% decreased their speed.

Among the drivers who replied they did not see the flagger, 10.5% (6 drivers) decreased their speed anyway. Most of the drivers who did not see the flagger did not reply to question 11 ("If the flagger was asking you to slow down, did you decrease your speed?"). Perhaps these drivers slowed down because of traveling in the construction zone. Out of 400 drivers, 3% did not reply or did not remember whether or not they saw the flagger.

III. C. Driver’s Reaction to Speed Limit Signs

More of the drivers surveyed were traveling on the closed lane rather than the open lane (shoulder lane was closed); as shown in Chart 3. When one of the two lanes was closed, about 57.5% (230 drivers) were required to change lanes, while 38.3% (135 drivers) were not; and 4.2% (17 drivers) did not reply or did not remember whether or not they changed lanes. Among those who changed lanes, 97.8% said they had enough time to move to the open lane. The remaining 2.2% either did not have time or did not remember whether they had enough time. One reason for the high percentage might have been the presence of two arrow boards before the taper. Another reason might be due to the lower traffic volume and larger
CHART 3
RESPONSE TO QUESTIONS 12 AND 13

WERE YOU REQUIRED TO CHANGE LANES IN THIS WORK ZONE

YES 57.5% (230)
NO 38.3% (153)
DON'T REMEMBER 0.7% (3)
NO REPLY 3.5% (14)

ENOUGH TIME TO MOVE TO OPEN LANE

YES 97.8% (225)
NO 1.3% (3)
DON'T REMEMBER 0.9% (2)

ENOUGH TIME TO MOVE TO OPEN LANE

RNR 94.1% (144)
YES 5.3% (8)
DON'T REMEMBER 0.6% (1)

RNR 100.0% (3)

ENOUGH TIME TO MOVE TO OPEN LANE

NO 85.7% (12)
YES 14.3% (2)

LEGEND:
PERCENT (NO. OF DRIVERS)
RNR = RESPONSE NOT REQUIRED
gaps in the traffic stream. It was observed that most of the drivers made the lane change after seeing the first arrow board.

The drivers were asked whether they saw the speed limit signs in the work zone, and what was the speed limit if they saw it. About 86.7% (347 drivers) said "yes" they saw the speed limit signs, 4.8% (19 drivers) said "no," and 8.5% (34 drivers) did not remember whether or not they saw the speed limit signs or did not reply; see Chart 4. This distribution indicated that 86.7% of the drivers were positive about seeing the signs, and the remaining 13.3% (53 drivers) were not positive whether they had seen the speed limit signs in this work zone.

It seems that even the flashing lights mounted on the speed limit signs did not get the attention of approximately 1/8 of the drivers (13.3%). Nineteen drivers (4.8% of the drivers) said they did not remember whether or not they saw the speed limit signs. Another 19 drivers (4.8% of drivers) said they did not see the speed limit signs. And, 15 drivers (3.7% of drivers) were put into a no reply category because their answers were inconsistent or they did not answer at all.

Most of the drivers who saw the speed limit signs remembered the speed limit correctly. In fact, 90.2% of the drivers (313 drivers) who saw the signs remembered the speed limit correctly. The speed limit in the work zone was 45 mph when the crew was working. Among those who saw the signs, 6.3% said it was, "40 mph or less," 90.2% said it was "45 mph," 0.9% said "55 mph," 0.6% said "65 mph," and 2% did not remember or did not reply. It was surprising to find out that 6.3% incorrectly remembered the speed limit as being lower than the posted speed limit. It is doubtful whether these drivers really saw the speed limit, and if so whether they paid enough attention to read and remember it correctly.
CHART 4
RESPONSE TO QUESTIONS 14 AND 15

DID YOU SEE THE SPEED LIMIT SIGN IN THIS WORK ZONE

YES
86.7% (347)

NO
4.8% (19)

DON'T REMEMBER
4.8% (19)

NO REPLY
3.7% (15)

WHAT WAS THE POSTED SPEED LIMIT

40 M.P.H OR LESS
6.3% (22)

45 M.P.H
90.2% (313)

55 M.P.H
0.9% (3)

65 M.P.H
0.6% (2)

DON'T REMEMBER
1.4% (5)

NO REPLY
0.6% (2)

WHAT WAS THE POSTED SPEED LIMIT

RNR
94.7% (18)

45 M.P.H
5.3% (1)

LEGEND:
PERCENT (NO. OF DRIVERS)
RNR = RESPONSE NOT REQUIRED
The responses for 55 and 65 mph could come from drivers who saw the freeway speed limit signs which said 55 for trucks and 65 for passenger cars.

The drivers were asked whether or not they slowed down after seeing the speed limit signs. About 91.4% of those who said they saw the speed limit signs, responded that they reduced their speed; see Chart 5. However, 6.1% said they did not reduce their speed even after seeing the speed limit signs. These people may have been traveling at the speed limit, so did not need to slow down, or did not want to reduce their speed. The remaining drivers did not reply or did not remember what they did.

The drivers were asked to judge their speed in relation to the posted speed limit in the work zone and to assess if their speed was safe enough for the conditions. Thirty four percent said their speed was greater than the speed limit, 59% said it was not, 5.3% did not remember, and 1.7% did not reply; see Chart 6.

It seems the trend of traveling faster than the speed limit on the regular sections of the freeways is carried into the construction zones. Considering that 87% of the drivers said they saw the sign and 90% of these correctly remembered the speed limit, about one third of the drivers knowingly traveled faster than the speed limit in the work zone. The majority of the drivers (94.2% or 128 drivers) who knew their speed was greater than the speed limit felt that their speed was safe enough for the conditions in the work zone. About 4.4% said they thought their speed was not safe enough for the conditions, but they drove at that speed anyway. About 1.4% did not remember or did not reply to this question.

The drivers were asked to judge whether the posted speed limit was too high, too low, or about right for the driving conditions in the work zone. About 17% said it was too low,
CHART 6
RESPONSE TO QUESTIONS 17 AND 18

WAS YOUR SPEED GREATER THAN THE SPEED LIMIT IN THIS WORK ZONE

- YES: 34.0% (136)
- NO: 59.0% (236)
- DON'T REMEMBER: 5.3% (21)
- NO REPLY: 1.7% (7)

SPEED SAFE ENOUGH FOR CONDITION

- YES: 94.2% (128)
- NO: 4.4% (6)
- DON'T REMEMBER: 0.7% (1)
- NO REPLY: 0.7% (1)

SPEED SAFE ENOUGH FOR CONDITION

- RNR: 71.6% (169)
- YES: 25.9% (61)
- NO: 2.1% (5)
- DON'T REMEMBER: 0.4% (1)

SPEED SAFE ENOUGH FOR CONDITION

- RNR: 57.1% (12)
- YES: 38.1% (8)
- DON'T REMEMBER: 4.8% (1)

SPEED SAFE ENOUGH FOR CONDITION

- RNR: 85.7% (6)
- YES: 14.3% (1)

LEGEND:
PERCENT (NO. OF DRIVERS)
RNR = RESPONSE NOT REQUIRED
3% said it was too high, 78.5% said it was about right, and 1.5% did not reply; see Figure 10. Although most of the drivers (78.5%) agreed that the speed limit was set about right, only 59% kept their speed at or below the posted speed level. Similarly, only 17% thought the speed was too low, but 34% drove faster than the speed limit. This seems to indicate that some drivers have little respect for the speed limit signs in the work zones.

III. D. Driver's Understanding of Work Zone Signs

Work zone signs seemed to convey a clear message to most of the motorists, and provide enough information to guide them comfortably through the work zone. About 93.5% of the drivers responded that the message conveyed by the work signs was clear to them; see Figure 11. However, 3.5% said that the message was not clear. The remaining 3% were split between those with no opinion and those who did not respond. It seems the information given by the signs was enough to guide 93.5% of the drivers comfortably through the work zone; see Figure 12. A small percentage of drivers (4.3%) responded that the signs did not provide enough information, and 2.2% had no opinion or did not reply. The drivers were asked whether any sign or signs were confusing to them. For 93% of the drivers the signs were not confusing; see Figure 13. However, 4.8% replied that a sign or some signs were confusing to them. There were 2.2% of the drivers who did not remember whether any sign was confusing or did not answer this question. The drivers who found some signs confusing were asked to describe the signs. The identified signs and their comments about the "confusing" signs are discussed in the following sub-section.

When the drivers were asked whether they were able to read all of the signs in the work zone, 95.5% responded "yes"; 2.3% said they were not able to read all of the signs in
Figure 10. Opinion about posted speed limit

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too low</td>
<td>17</td>
</tr>
<tr>
<td>Too high</td>
<td>3</td>
</tr>
<tr>
<td>About right</td>
<td>78.5</td>
</tr>
<tr>
<td>No answer</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Posted speed limit

Figure 11. Clarity of message given by work zone signs

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear</td>
<td>93.5</td>
</tr>
<tr>
<td>Not Clear</td>
<td>3.5</td>
</tr>
<tr>
<td>No Opinion</td>
<td>1.5</td>
</tr>
<tr>
<td>No Answer</td>
<td>1.5</td>
</tr>
</tbody>
</table>
Figure 12. Adequacy of signs to guide the drivers comfortably

Figure 13. Opinion about signs being confusing
the work zone; and 2.2% did not remember or did not reply; see Figure 14. When the drivers were asked whether there were too many signs in the work zone, 93% said no, 4.3% said yes, 2.7% did not know; see Figure 15. The drivers responses indicated that the number of signs used in the work zone was not excessive and most of the drivers were able to read all of the signs.

III. D. 1. Driver’s Description of “Confusing” Signs

In this section a summary of comments about question 22 - "Did you find any sign or signs confusing? If yes, please describe the sign or signs briefly."- is presented. Twenty eight drivers (21 auto, 4 truck, 1 pick-up, and 2 other) made comments, suggestions, or attempts to describe the "confusing" signs. The descriptions provided by the drivers are given in Appendix B. Three drivers made positive comments and rated the work zone signing okay, very good, and great. One driver commented that the flashing lights helped to give him extra warning (It should be mentioned that two arrow boards were used in the advance warning area of this construction zone). Three drivers could not remember what signs they felt were confusing. Two drivers felt that signs were needed further before the work zone to inform and give them enough time to prepare for construction zone travel. One driver commented that there were not enough signs, but did not elaborate further. Another driver wanted to know how many miles of road was being repaired on all construction zones. Presumably this driver was either making a general comment or he did not see the sign telling that this construction zone was 10 miles long. One driver said the presence of work zone signs while no work was going on confused him/her.
Figure 14. Ability to read work zone signs

![Bar chart showing ability to read work zone signs]

- Able: 95.5%
- Not able: 2.25%
- Don’t remember: 2%
- No reply: 0.25%

Figure 15. Opinion about number of signs in work zone areas

![Bar chart showing opinion about number of signs]

- Too many: 4.25%
- Not too many: 93%
- Don’t know: 2.75%
It seems that some drivers had difficulty in understanding the meaning of some signs. Five drivers described the "confusing" signs as: "Lighted signs or arrows to change speed or lanes," "Give them a break, Caution," "Orange with number on them," "Round sign hand held saying 'Slow,' "Change lanes." One driver commented that the exit layout was misleading, and another one said that the Right Lane Closed sign was confusing.

Several drivers wrote they were confused as to what the speed limit was. They commented that one sign said 45 mph while another sign showed a 65 mph speed limit (the freeway speed limit sign of 65 mph was not covered). Also, for some drivers the speed limit when the flagger shows the slow paddle or when the drivers see a "Give‘em a BRAKE slow down" sign was unclear. One driver wrote that it was difficult to tell if the flashing lights on the speed limit signs were on or off.

Some work zone characteristics need to be mentioned here. Illinois DOT uses work zone speed limit signs that have two small yellow flashing lights mounted on top. These flashing lights are turned on when construction activities are in progress. There was a newly placed "Give‘em a BRAKE slow down" sign at the beginning of the construction zone. This work zone also had flaggers with STOP/SLOW paddles. There also was an interchange in the middle of the construction zone.

In summary, the driver’s responses seem to indicate that the posted speed limit was unclear to at least several drivers. Confusion was attributed to the combination of a construction zone 45 mph speed limit sign, a conditional speed limit sign (45 mph when flashing), and the presence of the freeway 65 mph speed limit sign. Increasing the intensity or size of the flashing lights mounted on the speed limit signs may help the drivers to clearly discern whether the lights are on. Thus, it may increase the clarity and reduce the confusion about the speed limit. Drivers described the signs that had an unclear meaning, but there was
not an agreement among drivers about which individual sign was confusing. Some drivers suggested that signs were needed earlier to inform them there was a work zone ahead and requested further warning for lane closing. One driver commented that the flashing lights helped give him extra warning. Some drivers felt there was a need for better placement of the highway signs and the addition of a sign to tell how many miles remained in the construction zone.

III. E. Driver’s Assessment of “Hazard” And Comfort In Work Zones

The driver’s opinion about “hazard” and comfort level in the work zone, in general, was mixed. Over half of the drivers (54%) said they found going through work zones to be more hazardous than non-work zone areas; see Figure 16. On the other hand, 42.3% of the drivers did not find work zones more hazardous than non-work zones. About 3.7% had no opinion or did not reply. It is not known whether the perception of more hazardous condition translated to more cautious driving through the work zone. It is logical to assume that such perception might cause drivers to be more cautious or to be more alert to the situation at hand. This does not mean that more hazardous conditions will be safer because the driver would be more attentive. On the other hand, a large portion of drivers (42.3%) did not find going through the work zone more hazardous than a regular section of freeway. For this group the presence of traffic control devices, heavy equipment, construction crews, and the geometric design of the work zones do not seem to create more hazardous driving conditions.

It was attempted to see if driving conditions in the work zone, made the drivers uncomfortable. About 21.7% said it did, while 75.6% replied that driving conditions did not make them uncomfortable. About 2.7% did not know or did not reply; see Chart 7. The
Figure 16. Opinion about "hazard" of traveling through a work zone

Work zone area
CHART 7
RESPONSE TO QUESTION 26

DID DRIVING CONDITIONS IN THIS WORK ZONE MAKE YOU UNCOMFORTABLE

YES
21.7% (87)

NO
75.6% (302)

NO REPLY
2.0% (8)

DON'T KNOW
0.7% (3)

REASONS FOR COMFORT

TRAVELING SLOWER
* 37.4% (113)

ENOUGH INFO WAS GIVEN
* 42.7% (129)

NO WORK WAS GOING ON
* 6.0% (18)

LESS TRAFFIC
* 9.3% (28)

DON'T KNOW
* 6.6% (20)

OTHER
* 10.3% (31)

NO REPLY
* 9.3% (28)

REASONS FOR DISCOMFORT

TRAVELING TOO FAST
* 8.0% (7)

TOO MANY SIGNS
* 6.9% (6)

WORKERS ON FREEWAY
* 51.7% (45)

TOO MUCH TRAFFIC
* 24.1% (21)

DON'T KNOW
* 3.4% (3)

OTHER
* 39.1% (34)

NO REPLY
* 3.4% (3)

LEGEND:
PERCENT (NO. OF DRIVERS)
RNR = RESPONSE NOT REQUIRED

* NOTE THAT: Drivers selected more than one reason for comfort or discomfort. Thus, the sum of percentages is greater than 100%.
reasons for comfort or discomfort for different drivers were different, but there seems to be some consistency in the results.

Among the drivers who responded that driving conditions in the work zone made them uncomfortable, 51.7% (45 drivers) said that workers' presence on the freeway was the reason for discomfort. A large portion of the drivers, 39.1% (34 drivers), provided "other" reasons for discomfort; the "other" reasons will be discussed in a later section. Too much traffic was selected by 24.1% of drivers (21 drivers) as the reason for discomfort (the ADT for this section of I-57 is about 14500). The reason for discomfort for 8.0% of the drivers (7 drivers) was traveling too fast, and for 6.9% of the drivers (6 drivers) it was the presence of too many signs in the work zone. 7.2% (6 drivers) did not reply or did not know the reason for their discomfort.

Among the drivers who said that the driving conditions in the work zone did not make them uncomfortable, 37.4% (113 drivers) said that traveling slow was the factor that made them feel comfortable, and 42.7% (129 drivers) said the factor was that enough information was given to travel comfortably. For 6% of the drivers (18 drivers) the factor for comfort was "no work was going on", and for 9.3% (28 drivers) the factor was "less traffic in the work zone". About 6.6% of the drivers did not know, and 9.3% did not state the reason for comfort. 10.3% of the drivers (31 drivers) selected "other" reasons for comfort, which will be discussed in the following section.

III. F. Other Factors For Comfort or Discomfort

This section includes the "other" reasons the drivers mentioned for discomfort or "other" factors that made them feel comfortable when they traveled through the work zone. Appendix C contains the reasons given by the drivers. This part only analyzes the response
to part "f" of question numbers 27 and 28, which contains the "other" reasons for comfort or discomfort. The discussion about responses for part "a" through "e" of question numbers 28 and 29 was provided in the previous section.

Sixty five drivers (47 auto, 10 truck, 6 pick-up, 2 other) who responded about driving conditions in the work zone, wrote the following comments as "other" reasons for having either comfort or discomfort. Twelve drivers (10 of those drove automobiles) reported that barrels were placed too close to the traveled lane resulting in a narrow one-way lane, which made them uncomfortable. However, 4 drivers said that they were comfortable because of one-lane traffic, with enough lane and shoulder width. Twelve drivers mentioned that they are used to traveling through work zones so their experience allowed them to feel comfortable. Different drivers cited signing and marking of the construction zone as both causing comfort and discomfort. One driver requested advanced warning for the lane closing.

The action and presence of other drivers were also listed as reasons for comfort and discomfort. Some drivers felt comfortable due to smoothly flowing traffic, uniform speed, lack of congestion, and because of preceding drivers who were following road conditions and signs. Those drivers who felt uncomfortable listed the following reasons: slow moving trucks, tailgaters, construction trucks moving to the driving lane, and people driving too fast or changing lanes. The speed limit was listed as too slow by two drivers and caused discomfort for them. The presence of workers near the traveled lane made some people nervous.

It seems that the pavement and shoulder conditions greatly influenced the drivers’ comfort. Several drivers listed rough construction joints and bumps, along with edge drop off, and materials left on the shoulder as the reason for their discomfort. A few drivers commented about bumps on the road and soft shoulders, but were not uncomfortable because
of these. Four drivers stated that "nervousness", "too much orange" color, "too many things to see", and "more attention required" made them uncomfortable. On the other hand, light construction work and big barrels demanding attention were listed as reasons for comfort by drivers.

In summary, from this question it seems that signing, lane width, and pavement conditions affected the drivers' comfort level. The construction zone signing was listed as a positive influence on comfort but there was one driver who felt the signing was improper and therefore caused his discomfort. The impact of the lane width was unclear. Some drivers felt the driving lane was too narrow while some said the lane width provided was plenty. There were, however, three times more drivers who felt the lane width was too narrow.

It seems that the condition of the riding surface greatly influenced the driver's comfort, even with the reduced speed of the construction zone, the most often listed problems were bumps and rough construction joints. Some other reasons for comfort or discomfort were influenced by the actions of other drivers. If the traffic was flowing smoothly or slowly, a few drivers said they were comfortable.

Some drivers were uncomfortable because of tailgaters and others were uncomfortable because of the slow speed of the vehicles in front of them. The presence of workers near the traveled lane made some people nervous. Drivers listed experience and a well marked zone as being reasons for comfort.

III. G. Driver's Suggestions For Improving Safety in Work Zones

This section provides a summary of comments and suggestions about Question 29 - "Please describe any suggestions you have for improving safety in work zone areas". Appendix D contains the suggestions made by the drivers. The suggestions from 99 drivers
(61 auto, 25 truck, 8 pick-up, 5 other) were reviewed and grouped based on the subject they were directed to. The summary is given below:

III. G. 1. Signing And Marking

Drivers listed speed regulation, use of flaggers, advance warning of the work zone, and more information on the condition of the work zone to improve safety. Covering 65 mph Speed Limit signs in work zones and not placing 45 mph Speed Limit signs too far ahead of actual construction work was suggested. Drivers also suggested positioning the flagger not at the scene of activity but, further upstream of the construction crew. More publicity as to the hazards of work zone activities was recommended by one driver.

Six drivers complained that the lights on the flashing arrow board were too bright. All six drove large trucks. Apparently the lights were at the eye level of the truck drivers. On the other hand, the flashing lights on the Speed Limit (45 mph When Flashing) signs were too dim and some drivers could not see them very well. One suggested replacing the speed limit sign with Give’em a Brake sign, and another one suggested using more Give’em a Brake signs. However, there were comments that the flashing 45 mph sign was effective and more of them should be used to remind drivers to slow down. Several drivers requested bump signs, especially at night, for advance warning. Drivers also requested more up to date information on the construction zone, and higher speed limits if there is no work activity.

III. G. 2. Flagger And Construction Workers

Some drivers suggested brighter clothing be worn by the workers and flaggers to enhance their visibility. One advised that the message given by the flagger needed to be more clear because the flagger was asking for reduced speeds, but drivers were changing lanes
instead. One suggestion was to have two flaggers, one placed in advance of the work for warning and another to slow the cars right before the work. Other suggestions given were to have workers more informed about the danger of vehicles and have fewer workers in the actual travel lane. Some drivers suggested putting flaggers in the work zones even when the construction work has stopped.

A suggestion to finish quicker by having double shifts was given. Also to keep the traffic flowing smoothly, prompt help for stranded motorists was suggested. A few observed that better enforcement of the speed limit would decrease the difference in speeds through the zone and increase safety.

**III. G. 3. Lane Width And Length**

About a dozen drivers requested keeping the driving lane wider and not putting the barrels on the driving lane. They suggested leaving more room between the drivers and the workers. Some commented on proper channelization throughout the work zone. Six drivers complained that the length of the construction zone was too long. They recommended refraining from closing several miles when no work is being done. Instead, they suggested completing one section of a construction zone before starting another.

**III. G. 4. Pavement And Shoulder Conditions**

Some drivers felt there was a need for an improved riding surface through the construction zone. They mentioned that the approaches should be more graded to improve handling of vehicles, longitudinal edge of new asphalt be more gradual, pavement surface be smoother, loose gravel be removed, bumps at bridges be fixed, and drop off shoulders made safer.
III. G. 5. Other Suggestions

One driver commented that there is need for more lights at night. Another one suggested requesting drivers to turn on their headlights when in construction zones even during the day time. Some suggested enforcing not only the maximum speed limit, but also requesting vehicles to keep up with the posted speed limit. Some drivers seemed happy with what they saw. Some of their comments are: "Well done in this state," "Seemed safe to me," "Keep up the good work," "Good," "Safety okay now," "No improvement necessary," "It’s okay - we need better roads," "Get it done quicker," "Speed up construction time," "Let drivers think about others," "Keep workers off of traffic lane," and "Good enough."

III. H. Driver’s Comments About The Work Zone

Drivers provided the following additional comments or questions in response to question no. 30 - "Please list any additional comments or questions.": Thirty three drivers (19 auto, 7 truck, 3 pick-up, 4 other) provided the following additional comments and suggestions: Provide warning signs that there will be a slow down. Mark the amount of work zone ahead. Place a sign where there is a pavement drop off. Warning sign should be placed at bumps. Raise speed limit to the same speed for everyone. Place more state police patrol in 45 mph areas. Don’t slow down unless the men are working. Enforce the speed limit in the area. Reduce the length of the work zone.

The rate at which work is completed seems to be too slow for some drivers, and some suggested there be more shifts and work at night. One driver wrote this about reflectors: "Those splendid reflectors in the center of many Illinois roads have been really helpful when weather conditions are less than good. i.e. heavy rain, fog, heavy snow. Coming home from EIU evening class those nifty reflectors guided a couple of us teachers safely home. The
"barrel-like" markers are so much better than the cones. The courtesy of road worker and supervisory personnel is great!!" Another driver made this comment: "Construction signing is a lot better than it is in Georgia."
IV. SUMMARY AND CONCLUSIONS

A survey questionnaire was designed to collect information on drivers’ understanding of work zone traffic control signs and messages, interpretation of them, reaction to given messages, perceived problems, and possible solutions. The responses from over 400 drivers who traveled through a construction zone were collected and analyzed. The construction zone was approximately 10 miles long, and was located in a rural area on the southbound of Interstate 57, south of Champaign, Illinois. One of the two lanes on the southbound was closed for resurfacing or joint repair work. There was at least one flagger in the work zone requesting the traffic to slow down using a STOP/SLOW paddle.

The survey indicated that most of the drivers paid more attention to the messages given by the construction signs than the signs on the freeway. The majority of drivers, 77.3%, responded that they paid more attention to the work zone signs after entering the work zone. About 20% said that they paid the same amount of attention as before.

A large percentage of drivers saw the flagger and correctly understood the flagger’s message. About 82.7% of the survey participants replied that they saw the flagger in the work zone. However, 14.3% said they did not see a flagger in the work zone. Of the drivers who saw the flagger, 87.9%, correctly interpreted the flagger’s message. Zero percent of the drivers said they did not understand the message. However, 3.3% interpreted the message as "proceed with caution but do not slow down," and 2.5% did not remember what the message was. Among the drivers who saw the flagger and correctly interpreted the message, 92.1% reduced their speed if the flagger was asking them to do so. However, 6.2% (18 drivers) did not reduce their speed even though they knew the flagger was asking them to do so. None of these 18 drivers was driving a large truck. Seven out of these 18
drivers knew they were speeding. Twelve drivers out of the 18 drivers thought their speed was safe for the conditions.

The survey indicated that most of the drivers decreased their speed as they saw a flagger, regardless of interpretation of the flagger’s message. Eighty nine percent slowed down, 7% did not reduce their speed, and 4% did not remember or did not reply. However, it is not known whether or not the reduction brought their speed to the posted speed limit level.

The signs to move the drivers from the closed lane to the open lane seemed to be adequate. Almost all of the drivers had enough time to move to the open lane without making a late merge. It was observed that most of the drivers moved to the open lane closer to the first arrow board. Relatively low traffic volume and use of two arrow boards before the taper provided a smooth lane change and prevented the drivers from making a forced merge near the taper.

The survey indicated that the regulatory speed limit signs were noticed by most of the drivers. A large percentage of drivers, 86.7%, responded that they saw the speed limit signs, 4.8% did not see them, and 8.5% did not remember or did not reply. Even the flashing lights mounted on the speed limit signs did not get the attention of about 1/8 of the drivers. Most of the drivers, 90.2%, who saw the speed limit signs remembered the speed limit correctly. However, 7.8% of the drivers remembered the speed limit incorrectly, and 2% of them did not reply or did not remember it. About 6.3% incorrectly said that the speed limit was 40 mph or less.

The survey results indicated that the drivers waited to see the speed limit signs in the work zone before reducing their speed. About 91.4% of the drivers reduced their speed after seeing the speed limit signs. Only 6.1% did not reduce their speed after seeing the speed
limit signs. Those drivers were either traveling at the speed limit or did not feel they should
do so. About one-third of the drivers knew that their speeds were greater than the posted
speed limit and about 59% said their speed was not greater than the posted speed limit.
About 94.2% of the speeding drivers felt that their speed was safe enough for the conditions
in the work zone. However, 4.4% said their speed was not safe for the construction zone,
but continued to drive faster than the speed limit anyway.

The survey results indicated that a majority of the drivers were aware of the speed
limit in the work zone, but did not comply with it. Over three-fourths of the drivers said the
speed limit in the work zone was about right. About 17% said it was too low, and 3% said
it was too high. Even though 78.5% of the drivers said the posted speed limit was about
right, only 59% drove at or below this speed limit. Similarly, only 17% said the speed limit
was too low, but 34% drove faster than the speed limit. Considering that 87% of the drivers
saw the speed limit signs and 90% of them correctly remembered the speed limit, about one
third knowingly traveled faster than the speed limit.

The work zone signs seemed to convey a clear message to 93.5% of the motorists and
guide them comfortably through the work zone. About 3.5% said that the signs in the work
zone did not provide a clear message, and a small percentage of drivers, 4.3%, responded
that the signs did not provide enough information. About 93% of the drivers said that the
signs were not confusing, but 4.8% replied that one or more signs were confusing to them.

The driver's response seemed to indicate that the posted speed limit was unclear to
several drivers. The confusion, perhaps, was due to presence of the freeway 65 mph speed
limit sign which was not covered. There was not an agreement among the drivers on
description of the "confusing" signs.

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The survey indicated that the number of signs in the work zone was not excessive as indicated by 93% of the drivers. Only 4.3% of the drivers said that there were too many signs. Almost all of the drivers, 95.5%, were able to read all the signs in the work zone. Only 2.3% could not read all of the signs.

The drivers’ opinions about "hazard" and "comfort" in the work zone were mixed. Nearly half of the drivers (54%) said that they found going through the work zone to be more hazardous than non-work zones, but 42.3% disagreed with this group.

The driving conditions in the work zone were described as comfortable by three fourths of the drivers. However, about 21.7% said the driving conditions in the work zone made them uncomfortable. Nearly half of them said the reason for discomfort was the presence of workers on the freeway. Signing, lane width, and pavement surface conditions all affected drivers’ comfort level.

Drivers suggested that a wider driving lane and a shorter construction zone would increase safety. Some commented that with brighter clothing for workers and fewer workers in the travel lane, safety would be improved. Drivers also felt that either having the flagger further from the actual work area, or having two flaggers, one much before the actual work for warning and another just before the actual work to slow the vehicles would help more. They suggested that dimming the arrow board lights and installing brighter lights on the 45 mph When Flashing sign would improve their visibility. Bump signs were requested when pavement surface is too rough. There were complaints about inadequate lighting at night time, bumps on traveled lanes, rough shoulders, and rough construction joints. Drivers also wanted more up to date information on the construction zone. Some wanted to drive at a higher speed limit if there was no work activity, and some requested stricter enforcement of the speed limit.
To the best of our knowledge, this study is the first large scale survey of drivers’ opinion immediately after traveling though a construction zone. It has some limitations such as not matching the speed of the vehicle in the work zone to the response given by the driver. Its findings are limited by the scope of the questionnaire and the shortcomings of the study. Some of the shortcomings of this study may be addressed in future studies. It should be noted that the results discussed in this report are not classified by vehicle type.

REFERENCES


APPENDIX A
COPY OF THE QUESTIONNAIRE USED IN THIS STUDY
DRIVER’S SURVEY IN WORK ZONE AREAS

ANSWER THE FOLLOWING QUESTIONS AS WELL AS YOU CAN.
ALL RESPONSES WILL BE KEPT CONFIDENTIAL.
ANSWER BY CIRCLING THE APPROPRIATE RESPONSE.

1. What type of vehicle did you drive through the construction zone?
   a. Automobile
   b. Pick-up truck
   c. Large truck
   d. Motorcycle
   e. Other (van, motor home, etc.)

2. Are you:
   a. Male
   b. Female

3. Which category describes your age group?
   a. Less than 20 years old
   b. 21 to 30 years old
   c. 31–45 years old
   d. 46–65 years old
   e. Greater than 65 years old

4. How many years of driving experience do you have? ____________

5. Are you a resident of Illinois?
   a. Yes
   b. No

6. How often do you travel on this section of the road that is currently under construction?
   a. Daily
   b. Weekly
   c. Monthly
   d. Occasionally
   e. This is the first time

7. How familiar are you with this section of the freeway under construction?
   a. Very familiar
   b. Reasonably familiar
   c. Not familiar at all

8. After seeing the ROAD WORK AHEAD sign, did you pay more, the same, or less attention to the signs in the work zone area?
   a. Paid more attention
   b. Paid the same amount of attention
   c. Paid less attention
   d. Don't remember

9. Did you see a flagger in this work zone?
   a. Yes
   b. No
   c. Don't remember

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10. If you did see a flagger, what message was he or she conveying?
   a. Proceed with caution and slow down
   b. Proceed with caution but don't slow down
   c. Did not understand the message
   d. No message was given
   e. Saw the flagger, but can’t remember the message conveyed

11. If the flagger was asking you to slow down, did you decrease your speed?
   a. Yes
   b. No
   c. Don’t remember

12. Were you required to change lanes in the work zone area?
   a. Yes
   b. No

13. If you answered yes to the previous question (12), did you have enough time to move to an open lane?
   a. Yes
   b. No
   c. Don’t remember

14. Did you see the speed limit sign in the work zone area?
   a. Yes
   b. No
   c. Don’t remember

15. If you answered yes to the previous question (14), what was the posted speed limit?
   a. 40 mph or less
   b. 45 mph
   c. 50 mph
   d. 55 mph
   e. 60 mph
   f. 65 mph
   g. Saw the sign, but don’t remember the posted speed

16. Did you slow down after seeing the speed limit sign in the work zone area?
   a. Yes
   b. No
   c. Don’t remember

17. Was your speed greater than the posted speed limit in the work zone area?
   a. Yes
   b. No
   c. Don’t remember

18. If you answered yes to the previous question (17), do you think your speed was safe enough for the conditions in the work zone?
   a. Yes
   b. No
   c. Don’t remember

19. For the driving conditions in the work zone area, did you find the posted speed limit to be:
   a. Too low
   b. Too high
   c. About right

20. Was the message conveyed by the work zone signs clear to you?
   a. Yes
   b. No
   c. No opinion

21. Was the information given by the signs enough to guide you comfortably through the work zone?
   a. Yes
   b. No
   c. No opinion

22. Did you find any sign or signs confusing?
   a. Yes
   b. No
   c. Don’t remember
23. Were you able to read all of the work zone signs?
   a. Yes  
   b. No  
   c. Don’t remember

24. Do you think there were too many signs in the work zone area?
   a. Yes  
   b. No  
   c. Don’t know

25. Did you find going through the work zone area more hazardous than non-work zone areas?
   a. Yes  
   b. No  
   c. No opinion

26. Did the driving conditions in the work zone make you uncomfortable?
   a. Yes  
   b. No  
   c. Don’t know

27. If you answered yes to the previous question (26), what were the reasons for discomfort?
   a. Travelling too fast  
   b. Too many signs in the work zone area  
   c. Workers on the freeway  
   d. Too much traffic  
   e. Don’t know  
   f. Other __________________________

28. If you answered no to question (26), what were some of the factors that made you feel comfortable?
   a. Travelling slower  
   b. Enough information was given  
   c. No work was going on  
   d. Less traffic in the work zone  
   e. Don’t know  
   f. Other __________________________

29. Please describe any suggestions you have for improving safety in work zone areas:
   __________________________________________
   __________________________________________
   __________________________________________

30. Please list any additional comments or questions:
    __________________________________________
    __________________________________________
    __________________________________________
    __________________________________________
    __________________________________________

THANK YOU FOR FILLING OUT THIS SURVEY.
PLEASE RETURN TO THE BOX OR DISTRIBUTOR WHEN FINISHED.
APPENDIX B
DRIVER’S DESCRIPTION OF THE "CONFUSING" SIGNS
IN THE WORK ZONE
Responses to Question 22: "Did you find any sign or signs confusing? If yes, please describe the sign or signs briefly."

SURVEY
NUMBER THE ACTUAL RESPONSE GIVEN BY THE DRIVERS

2 -Don’t remember
14 -First sign - 45, 2nd sign - 45 when flashing - then a 65 mph sign and it was still in the construction.
24 -Exits could mislead
26 -The workers are doing a great job of keeping the work section safe.
28 -Don’t remember
42 -Don’t remember
47 -I like the extra warning of flashing lights.
61 -Give them a break, caution.
83 -Work zone signs but no work going on. This made it confusing.
90 -Not at this time okay.
101 -Some places I couldn’t find the highway sign.
106 -Change lanes.
125 -Very good
184 -Three different signs warning working ahead and then give them a brake slowdown, and then a flashing sign to slow to 45 miles an hour.
234 -I would like to know how many miles of road is being repaired. This information is not always given.
244 -Construction ahead - speed 45.
256 -Flashing speed limit. Hard to see the flashing light and therefore confused as to whether men working or not.
283 -Need signs located much before zone where work is done.
310 -Not sufficient time to prepare.
323 -But that was my own fault. I didn’t know I was past one of my check points 12-13 miles out of my way.
329 -A speed sign, a men working ahead sign, a slow, and flag man ahead.
331 -One sign said 65 mph and one said 45 mph.
363 -Lighted signs or arrows to change speed or lanes.
383 -Orange with number on them.
394 -Old speed limit sign (65 mph) not covered up.
406 -Mileage sign.
415 -Round sign hand held saying "slow".
424 -Right/left closing, slow, construction, Givem’ a brake.
APPENDIX C
OTHER REASONS FOR COMFORT OR DISCOMFORT IN TRAVELING THROUGH THE WORK ZONE
Response to Questions 26, 27, 28 - "Did the driving conditions in the work zone make you uncomfortable?" The followings are the responses from the drivers who said "Yes" or "No" to question 26 and described the "Other reason" for comfort or discomfort in Question 27 and 28.

<table>
<thead>
<tr>
<th>SURVEY NUMBER</th>
<th>THE ACTUAL RESPONSE GIVEN BY THE DRIVERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 -Yes</td>
<td>The pavement was not up to the bridge causing me to become airborne and fight to keep my rig under control. No reason for this roughness in the road. Poor management of the construction company.</td>
</tr>
<tr>
<td>24 -Yes</td>
<td>Sometimes barrels closer than necessary, one workman too close to lane especially as I (in camper) passed by! He had to move. Edge of new pavement dangerous. Other cars pushing for faster speed.</td>
</tr>
<tr>
<td>34 -No</td>
<td>Most other drivers followed road conditions and signs.</td>
</tr>
<tr>
<td>35 -Yes</td>
<td>One giant hole not marked. Lucky to have tires.</td>
</tr>
<tr>
<td>37 -No</td>
<td>Big bumps.</td>
</tr>
<tr>
<td>41 -Yes</td>
<td>Too slow</td>
</tr>
<tr>
<td>42 -Yes</td>
<td>Barrels left narrow passageway</td>
</tr>
<tr>
<td>47 -No</td>
<td>Except when clouds of cement dust made vision less than good. Near Kankakee I was blasted by some kind of black material being deposited on the road. As mentioned, dust and debris being blown in my path making vision less clear.</td>
</tr>
<tr>
<td>61 -No</td>
<td>((I was driving)) At posted speed.</td>
</tr>
<tr>
<td>62 -No</td>
<td>Unless at night.</td>
</tr>
<tr>
<td>69 -No</td>
<td>Drivers confused.</td>
</tr>
<tr>
<td>74 -Yes</td>
<td>Nervousness.</td>
</tr>
<tr>
<td>78 -No</td>
<td>Was handled well.</td>
</tr>
<tr>
<td>84 -Yes</td>
<td>Road block in only one lane blocking too much of lane.</td>
</tr>
<tr>
<td>93 -Yes</td>
<td>Not signed properly.</td>
</tr>
<tr>
<td>94 -Yes</td>
<td>Rough road</td>
</tr>
<tr>
<td>96 -Yes</td>
<td>Too much orange</td>
</tr>
<tr>
<td>98 -No</td>
<td>Bumpy highway - soft shoulder</td>
</tr>
<tr>
<td>108 -No</td>
<td>Used to it.</td>
</tr>
<tr>
<td>164 -No</td>
<td>Experienced</td>
</tr>
<tr>
<td>167 -No</td>
<td>Confident in ability</td>
</tr>
<tr>
<td>173 -Yes</td>
<td>Narrow lane and one lane construction</td>
</tr>
<tr>
<td>183 -No</td>
<td>Used to it</td>
</tr>
<tr>
<td>188 -Yes</td>
<td>One lane</td>
</tr>
<tr>
<td>197 -No</td>
<td>Experience</td>
</tr>
<tr>
<td>203 -Yes</td>
<td>Barricades too close</td>
</tr>
<tr>
<td>214 -No</td>
<td>Driving experience</td>
</tr>
<tr>
<td>216 -Yes</td>
<td>Lane too narrow for traffic flow</td>
</tr>
<tr>
<td>220 -Yes</td>
<td>Barrels were too close to my lane.</td>
</tr>
<tr>
<td>226 -No</td>
<td>Big barrels caught my eye and made me more cautious.</td>
</tr>
<tr>
<td>227 -No</td>
<td>Experienced</td>
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<tr>
<td>Number</td>
<td>Response</td>
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<td>--------</td>
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<tr>
<td>234</td>
<td>Yes</td>
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<tr>
<td>237</td>
<td>Yes</td>
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<td>250</td>
<td>No</td>
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<td>251</td>
<td>No</td>
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<td>252</td>
<td>No</td>
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<tr>
<td>256</td>
<td>Yes</td>
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<tr>
<td>265</td>
<td>No</td>
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<tr>
<td>267</td>
<td>No</td>
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<tr>
<td>269</td>
<td>No</td>
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<tr>
<td>293</td>
<td>Yes</td>
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<tr>
<td>294</td>
<td>No</td>
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<td>296</td>
<td>Yes</td>
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<td>298</td>
<td>Yes</td>
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<tr>
<td>305</td>
<td>No</td>
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<tr>
<td>306</td>
<td>Yes</td>
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<tr>
<td>310</td>
<td>Yes</td>
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<tr>
<td>323</td>
<td>Yes</td>
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<td>324</td>
<td>Yes</td>
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<td>327</td>
<td>Yes</td>
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<td>333</td>
<td>No</td>
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<tr>
<td>338</td>
<td>Yes</td>
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<tr>
<td>342</td>
<td>Yes</td>
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<tr>
<td>351</td>
<td>Yes</td>
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<td>362</td>
<td>No</td>
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<td>363</td>
<td>No</td>
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<td>366</td>
<td>No</td>
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<tr>
<td>372</td>
<td>Yes</td>
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<tr>
<td>377</td>
<td>No</td>
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<tr>
<td>391</td>
<td>Yes</td>
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<td>403</td>
<td>Yes</td>
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<td>406</td>
<td>Yes</td>
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<td>409</td>
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<td>413</td>
<td>No</td>
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<tr>
<td>428</td>
<td>No</td>
</tr>
</tbody>
</table>
APPENDIX D
DRIVERS' SUGGESTIONS TO IMPROVE SAFETY IN WORK ZONES
Response to Question 29 - "Please describe any suggestions you have for improving safety in work zone areas."

SURVEY NUMBER THE ACTUAL RESPONSE GIVEN BY THE DRIVERS

5 - Brighter clothing on workers.
6 - Looked fine to me.
8 - Flag people wave flags. Try to keep workers out of freeway as much as possible.
14 - Set the speed limit to 45 when flashing and either cover the old sign or remove them. I see no need to travel at this speed for 5 miles before there is any construction.
15 - Make the approaches more graded to improve handling of vehicles.
24 - Worker awareness! Slow all cars somehow. Barrels not closer than necessary. Edge of new asphalt more gradual.
26 - Seemed safe to me.
27 - Sometimes construction zones are too long.
28 - Have a traffic policeman policing the flow of cars.
35 - No time
37 - Zone way too long
39 - Keep up the good work
42 - Avoid unnecessary narrow driveway
51 - Hood yellow flashing arrows so you won’t blind trucks
62 - Nighttime flashing lights - eliminate
63 - Just have work area one lane not 4 and 5 miles before
66 - Barricade signs are too far from center line in some place.
68 - At night the lighted arrow to indicate what lane is open is too bright, it blinds you, especially if the road has poor markings.
69 - Improve pavement surface. Loose gravel. Increase the width of driving lane.
73 - The left lane needs to be wider. The lane is too narrow for a loaded truck.
79 - Widen the lanes
83 - Barricades too far in the driving lane.
84 - Make sure drivers are aware of road blocks which may be in driver’s lane for any reason.
94 - Why such a long area every time?
99 - More organization on new road paving construction.
100 - Complete work in a better manner the first time so it does not have to be redone.
101 - Please keep the highway signs where people can see them.
110 - Good
118 - Need signs for bumps.
125 - Use brighter colored vest.
126 - Work zone area is too long. Limited to the one lane in construction area even though no work is going on.
139 - There were some bumps in the roads that should have been marked.
150 - It was just fine to me. There are no suggestions.
- Need bump sign especially at night.
- Make sure the workers watch out for the automobiles, as well as the drivers looking out for the workers.
- Arrow lights were too bright.
- Safety okay now.
- Please describe bumps, such as bridges and overpasses.
- I would like to see more "Give'm Break" signs.
- Work double shifts
- The yellow flashers lighted arrows showing a closed lane all at the same height as a large truck windshield. They are too bright, especially at night. Either change the height or make them dimmer.
- No improvement necessary
- Extra helper for stranded driver.
- Signs ahead Off or far before work area.
- It's okay - we need better roads
- Fix bumps at bridges
- Get it done quicker
- Really I don't think there is much you could do to improve the signs or how you go through it that is safe now.
- Try to prevent gapers block
- More patrolling
- Replace core of speed limit signs with "give'm a brake" latter is more effective.
- Leave more room in available lane.
- More alert workers.
- Well done in this state.
- Bump sign
- Publicity of hazards - aware of workmen
- Bump sign at bridge
- Repair shorter sections of the road
- The only suggestion would be to try and give people driving a little more area to do it in.
- Flagging is confusing to some people. Flagger was asking to slow down but people were changing lanes instead.
- More flashing speed limit sign to remind drivers to slow down.
- All cars and trucks drive the posted limits don't drive under the posted limits.
- If no one is working, remove signs saying "men working" or related signs.
- Which lane is closed further ahead.
- An inordinate number of miles were closed due to construction with no signs of work being done. Probably shorter distances would be better.
- Put work signs up earlier before you get to work area. More signs.
- Flagmen even when work has stopped; except at night.
- If there is no work going on take the 45 mph signs down because traffic becomes congested.
- Put the flagger out - off the workers. Barrels on right position too far out.
- More margin between workers and traffic
- Should not leave more space before the actual work site. Have to go too long before you get to the work zone.
-Maybe two sign holders on one side one to make motorist more alert and - the second to demand directions for people to slow down from immediate work zone.

-Speed up construction time

-Not so long of a work area

-Lighted arrows at construction zones are directly in the eyes of large truck operators. This is very hazardous at night. Suggest dimmer lights or lower location.

-Move barrels so lane is not so narrow. Drop off shoulders unsafe.

-Use more of the flashing workers ahead sign speed 45 if flashing.

-All workers wear safety vest (day-glow orange). Flaggers have yellow/orange flag unrolled. Flashing lights on 45 mph signs were not very bright.

-Nothing except other drivers should be more cautious than they really are.

-One section of highway started out as one lane and then opened up to two lanes. But after about a mile or so closed back to one lane. It should have been closed to one lane all the way.

-So far so good

-Less work driving traveler's time. (Do during night time)

-Let drivers think about others

-Ought to have a cop out there. Place more effort to slowing 4 wheelers

-Flagger holding sign too close to work area. Should be back further (more upstream than he was - was right near workers)

-Use radar gun and display

-Keep workers off of traffic lane

-Too long of a stretch of work to be done. Should be reduced.

-Do not have the work zone too long.

-Indicate to what extent actual construction work is going on. Also give more warning to about where actual construction work sites are.

-Barrels preferred, concrete barrels.

-Every automobile should turn on the headlights

-Pretty flag ladies

-Use flagger. Reduce speed.

-Flagman was at scene of activity - he should be at least 200 yards before work activity zone.

-When starting a construction zone complete one section at a time before starting another. There is way too much construction on the interstate highway.

-Better lighting during night hours.

-Speed limit of 45 mph should be enforced more.

-Pretty good working crews out on the road.

-Good enough
Response to Question 30 - "Please list any additional comments or questions."

<table>
<thead>
<tr>
<th>SURVEY NUMBER</th>
<th>THE ACTUAL RESPONSE GIVEN BY THE DRIVERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>-Raise speed limit to the same speed for everyone.</td>
</tr>
<tr>
<td>26</td>
<td>-Illinois is a great state</td>
</tr>
<tr>
<td>40</td>
<td>-Several bad bumps were encountered with no warning.</td>
</tr>
<tr>
<td>42</td>
<td>-Less interference at night</td>
</tr>
<tr>
<td>44</td>
<td>-Place sign where pavement drops off</td>
</tr>
<tr>
<td>47</td>
<td>-Those splendid reflectors in the center of many Illinois roads have been really helpful when weather conditions are less than good. i.e. heavy rain, fog, heavy snow. Coming home from EIU evening class those nifty reflectors guided a couple of us teachers safely home. The &quot;barrel-like&quot; markers are so much better than the cones. The courtesy of road worker and supervisory personnel is great!!</td>
</tr>
<tr>
<td>63</td>
<td>-Work 24 hours</td>
</tr>
<tr>
<td>66</td>
<td>-Lot of standing and looking by workers</td>
</tr>
<tr>
<td>110</td>
<td>-No warning to slow down</td>
</tr>
<tr>
<td>113</td>
<td>-Raise the speed limit</td>
</tr>
<tr>
<td>120</td>
<td>-Traffic does not slow down to 45 mph. Must drive greater than 45 mph to keep up with traffic. Suggest more state police patrol in 45 mph areas.</td>
</tr>
<tr>
<td>122</td>
<td>-Work seems pretty good.</td>
</tr>
<tr>
<td>196</td>
<td>-Don’t slow down unless the mean are working.</td>
</tr>
<tr>
<td>199</td>
<td>-Length of work zone area is definitely extended far too far of a distance. There could be a shorter ready area instead of miles.</td>
</tr>
<tr>
<td>206</td>
<td>-Maybe do the work at night</td>
</tr>
<tr>
<td>212</td>
<td>-Saw one drunk driver</td>
</tr>
<tr>
<td>257</td>
<td>-Work zone area is too long</td>
</tr>
<tr>
<td>260</td>
<td>-Long stretch of work zone area even though actual work is confined to small area.</td>
</tr>
<tr>
<td>268</td>
<td>-Conditions were adequately controlled.</td>
</tr>
<tr>
<td>269</td>
<td>-Enjoy Interstate 57</td>
</tr>
<tr>
<td>286</td>
<td>-Generally most construction work is well marked (pre-warning) (speed limit and hazard protection)</td>
</tr>
<tr>
<td>310</td>
<td>-Very interesting</td>
</tr>
<tr>
<td>323</td>
<td>-Yeah, how much did this road work bid out at or cost.</td>
</tr>
<tr>
<td>325</td>
<td>-Need vending machines in Illini Prairie rest area</td>
</tr>
<tr>
<td>333</td>
<td>-Better than Michigan</td>
</tr>
<tr>
<td>337</td>
<td>-Overall speed limit for large trucks should be 60 mph. 55 mph poses a momentum, problem when lane changing as auto traffic is approaching behind us at least 10 mph faster.</td>
</tr>
<tr>
<td>352</td>
<td>-I work for the highway department in the section which actually has workers. I go slower but not the whole posted zone.</td>
</tr>
<tr>
<td>362</td>
<td>-Place an &quot;end construction&quot; sign</td>
</tr>
<tr>
<td>367</td>
<td>-How much more work zones ahead.</td>
</tr>
<tr>
<td>375</td>
<td>-Hurry and finish construction</td>
</tr>
<tr>
<td>417</td>
<td>-Just keep up the good work. Enforce the speed limit in the area.</td>
</tr>
</tbody>
</table>
- Why don't construction workers work 3 shifts to speed up the work area so they can finish it and start another. I feel they spend way too much time on one construction zone.

- Construction signing is lot better than it is in Georgia.