

**EVALUATION OF THE ROLE OF DRIVER'S KNOWLEDGE OF WHO
HAS THE RIGHT-OF-WAY CONTRIBUTES TO INTERSTATE ON-
RAMP CRASHES**

Prepared for

MACK BLACKWELL RURAL TRANSPORTATION CENTER

Project No. MBTC - 2100

Contract No.

Award No. DTRS99-G-0025

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NOVEMBER 2007

Acknowledgements

This project was funded jointly by Mack Blackwell Transportation Center (MBTC) with matching funds from the University of Dayton.

Disclaimer

The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the views or the policies of Mack Blackwell Transportation Center or the University of Dayton.

Abstract

The knowledge of drivers on who has the right-of-way between the one on mainline lanes of a freeway and the one entering the freeway through on-ramp junction lane was evaluated. In addition, drivers' opinions on how to make the on-ramp junctions safer were collected. A survey instrument with 21 items requesting drivers' information in regard with demographics, freeway driving experience, knowledge of right-of-way and merging practices was used for data collection. The results show that crashes are relatively rare events and for some reasons, most of them never happen but result into near misses, which can not be reported and documented. Most drivers act correctly when driving on freeway mainlines when they see a vehicle trying to merge from an entrance ramp but act improperly when merging into freeways from on-ramp lanes. Some drivers cannot identify which driver has the right-of-way at the merge area between the mainline and the on-ramp drivers. Yielding problems due to bad drivers' attitudes have been identified by drivers as the leading cause of freeway-ramp merge area crashes, followed by lack of attention and drivers entering the freeway at low speeds. Most of the drivers believe that they need longer acceleration lanes, better ramp signing and better driver's education especially in terms of sign meaning and entrance ramp safety in order to make freeway-ramp merge areas safer. Due to sampling problems encountered in this study, one has to be careful when interpreting these results because the sample completely missed teenage drivers and over-sampled older drivers.

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CHAPTER 1 - INTRODUCTION

Background

The characteristics and circumstances of interstate ramp crashes have been sparingly studied although entrance and exit ramps are one of the locations of highest crashes per mile driven of any segment of the interstate system. For ramp related crashes, studies have shown that about 50 percent of all crashes occur on exit ramps and about 36 percent occur on entrance ramps. For exit ramps, the most common type of crash is run-off-road whereby speeding was found to be often a major factor. However, for entrance ramp the most common crash type is rear-end and sideswipe or cutoff. These frequently involve at-fault drivers merging from entrance ramps into the sides of other vehicles and mostly trucks already on the freeway mainline lanes.

While speeding and ramp geometric design related factors have been studied extensively, however, very little has been researched on the factors that contribute to on-ramp merging drivers not yielding the right-of-way to freeway mainline-through traffic. Some states' driver's testing license booklets inform new drivers of accelerating at on-ramp to attain the freeway mainline speed. This is also in accordance with AASHTO Policy on Geometric Design of Highways and Streets whereby auxiliary (acceleration) lanes are provided in order to minimally affect the through traffic operations. Normally no yield sign is needed for ramps having standard acceleration lanes. The foregoing reasons may lead some on-ramp merging drivers to think that they share equally the right-of-way with the mainline-through traffic and hence become one of the major causes of on-ramp area collisions.

Research Objectives

The aim of this study is to quantify the knowledge of drivers on who has the right-of-way between the one on mainline lanes of a freeway or the one entering the freeway through on-ramp junction lane. Furthermore, investigate other factors that may lead merging drivers not yielding the right-of-way and collect any opinions drivers may have to make the on-ramp junctions safer.

Specifically, this study hypothesizes that:

1. Some drivers think that since they are supposed to accelerate on entering the freeway via on-ramp junctions, they have the right-of-way similar to that of traffic already traveling on freeway mainlines.
2. Since freeway on-ramp junctions with standard acceleration lanes don't have yield signs installed, some drivers think that they don't have to yield the right-of-way and wait for acceptable gaps in the mainline traffic stream to merge.

Organization of Report

Chapter 2 summarizes the literature review on various past studies and discusses a procedure used by most states in testing the knowledge and licensing of new drivers. Chapter 3 discusses the study methodology, survey instrument, data sources, and data collection. Chapter 4 presents and discusses the study results. Chapter 5 presents the study conclusions.

CHAPTER 2 - LITERATURE REVIEW

Introduction

The characteristics and circumstances that cause freeway ramp crashes have not been adequately studied although freeway-ramp areas have been identified as locations highly prone to crashes as compared to other segments of freeways. Most previous research efforts that studied the interchange ramp traffic crashes have concentrated in developing and calibrating relationships between traffic crashes and highway geometry, traffic volumes, types of crashes, frequency, and location (1, 2, 3, 4, 5). Ahammed et al. (6) studied the effect of geometry of entrance terminals on freeway merging behavior during off-peak periods. Their study aimed at developing an understanding of appropriate geometry of entrance ramps for safe and efficient operation of freeways at the merge areas.

A study by McCartt et al. (7) highlighted types and characteristics of ramp-related traffic crashes on urban interstate roadways in Northern Virginia by examining a sample of 1,150 crashes that occurred on heavily trafficked urban interstate ramps. Their results showed that about fifty percent of all crashes occurred when at-fault drivers were in the process of exiting the interstates, thirty six percent of at-fault drivers were entering the interstates, and sixteen percent occurred when at-fault drivers were at the midpoints of access roads or on ramps connecting two interstate mainlines. They concluded that run-off-road crashes were the most frequent type of crashes associated with exiting traffic (off-ramp) and speeding was a major factor; for merging (on-ramp) traffic, the sideswipe/cut-off type of crashes were the most frequent ones and lack of yielding of right-of-way involving passenger car drivers merging from entrance ramps. Rear-end

crashes were most frequent on access roads where traffic congestion was concluded to be a factor. They even proposed possible countermeasures to remedy the problems identified in their study. Some suggestions were given: geometric design changes to increase ramp design speed such as increasing curve radii to counteract run-off-road crashes for off-ramps; extending the length of acceleration lanes for on-ramp merging crashes; and using surveillance systems that detect congestion and variable message signs to alert drivers about congestion ahead and hence deter rear-end type of crashes on access roads (7).

Although it is known that on-ramp merging drivers are the major causes of crashes on entrance ramps, no effort has been done to determine why on-ramp merging drivers don't yield the right-of-way to mainline traffic and hence get involved in sideswipe/cut-off crashes. For example, McCartt et al. (7) note that for the sideswipe/cutoff crashes, "76% of them occurred when at-fault drivers were in the process of entering mainlines". It may be hypothesized that most of these at-fault drivers thought that they had a right-of-way over drivers already on main lanes.

Besides other factors that have been identified to contribute to the crashes at the freeway-ramp merge area (I-4), however, the contribution of driver's knowledge of which driver was supposed to legally yield the right-of-way to another driver before causing a potential crash has not been addressed.

Olsen and Hostetter (8) studied behaviors of freeway merging drivers and suggested ways of shaping their behaviors, i.e., specific behaviors to promote as well as those to be discouraged. They studied different entrance ramp configurations by observing merging behaviors and noted some behaviors to be discouraged such as merging earlier by using less of the available acceleration area, unnecessary hesitation before merging, and slowing unnecessarily.

While speeding and ramp geometric design related factors have been studied extensively, however, very little has been researched on the factors that contribute to on-ramp merging drivers not yielding the right-of-way to freeway mainline-through traffic. Some states' driver's testing license handbooks inform new drivers of accelerating at on-ramp to attain the freeway mainline speed. This is also in accordance with AASHTO Policy on Geometric Design of Highways and Streets whereby auxiliary (acceleration) lanes are provided in order to minimally affect the through traffic operations (9). Normally no yield sign is needed for ramps having standard acceleration lanes. The foregoing reasons may lead some on-ramp merging drivers to think that they share equally the right-of-way with the mainline-through traffic and hence become one of the major causes of on-ramp area collisions.

The purpose of this study is to quantify the knowledge of drivers on who has the right-of-way between the one on mainline lanes of a freeway or the one entering the freeway through on-ramp junction lane. In addition, investigate other factors that may lead merging drivers not yielding the right-of-way and collect any opinions drivers may have to make the on-ramp junctions safer.

Knowledge Testing and Licensing for New Drivers

In the U.S., individual states are responsible in issuing driver's licenses in their jurisdictions. Each state requires a driver's license applicant to take and pass a written test as one of the requirements before the license is issued. For most states the Department of Motor Vehicles (DMV) or Bureau of Motor Vehicle (BMV) is the state agency authorized by law to oversee the process of driver testing and license issuance. The driver's test normally examines the applicant's knowledge and understanding of issues such as road signs, rules of the road, vehicle operation (safe driving), etc. The state agency develops a driver's license testing

handbook, which becomes the main source of driving-related knowledge for most drivers. The license applicant is expected to review the handbook before taking the written test.

The state driver's licensing handbooks for Ohio, Florida, Kentucky, West Virginia, Michigan, and Indiana were reviewed. Each handbook has a section that advises drivers how to enter a freeway (10-14). Although the detail and clarity differs somewhat, however, most of them advise the drivers to do the following for entering the freeway safely:

- On the entrance ramp, begin checking for an opening in traffic and signal for your turn.
- Use the acceleration lane to speed up to the freeway speed. Try to adjust your speed so that you can move into the traffic when you reach the end of the acceleration lane.
- Merge into traffic when you can do so safely. You must yield the right-of-way to traffic on the expressway. You can't always count on other drivers moving over to give you room, but do not stop on an acceleration lane unless traffic is too heavy and there is no space for you to enter safely.

Some of the handbooks include figures that show the proper way of merging into the freeway (11-14). Only the state of Michigan includes the merge sign information in the freeway driving section. In the road signs section, most states don't include sufficient information and guidance about their use and meaning. For example, the states of Kentucky and Indiana, in the warning signs section, simply list sign symbols and short messages only, e.g., "merging traffic" (12, 14).

CHAPTER 3 - SURVEY DESIGN AND DATA COLLECTION

Survey Instrument Development

The researchers developed a questionnaire with survey items that cover needed information such as driver's demographics, driving experience on freeways, experience with on-ramp crashes, merging behaviors, and knowledge. The survey instrument consisted of 21 items, which constituted of multiple choice and open-ended questions where appropriate. The first 2 items were demographic questions to categorize respondents by age group and gender. Items 3 and 4 asked the respondents to estimate on average how often they drive on freeways (in this report, freeways include Interstate highways) and the average trip lengths for their freeway trips. The next 8 items asked respondents to recall for the past one year if they witnessed or were involved in either traffic crashes or in "near misses", i.e., situations that nearly developed into crashes in the vicinity of on-ramp merge areas. Items 13 through 16 consisted of three open-ended questions that asked respondents to give their driving behaviors when they are on the freeway main lanes and see a vehicle trying to merge from the entrance ramp and when they are driving on the entrance ramp ready to merge into the freeway; and one multiple-choice item that asked the meaning of a merge sign (W4-1) (16). Items 17 through 19 asked respondents about the right-of-way and proper freeway merging via on-ramp junctions. The last two (20 and 21) items were open-ended questions; the first one asked the respondents to give any reason(s) they think may be the cause of freeway-ramp merge area crashes and the other requested them to give suggestion(s) that may make freeway-ramp merge area safer.

The number of items was kept to 21 and fitted on two pages to encourage the respondents to respond. A cover letter was included stating the intent of the survey and respondents were assured that the responses will be kept anonymous as no names or any individual identifying information was required to be included on the questionnaire. The open-ended questions were intended for the respondents to give their understanding or what they normally do, not to guess the correct responses from possible choices.

Since this study was designed to use human subjects as a source of data collection, therefore, the human subjects' approval was sought and received from the University of Dayton Institutional Review Board (IRB) prior conducting preliminary data collection. The IRB request and approval letters are shown in Appendix A. The cover later and the survey questionnaire used to collect the research data are included in Appendix B.

Data Source

The original plan was to survey a representative sample of licensed drivers in western Ohio and eastern Indiana. The research team expected to work with the Ohio Bureau of Motor Vehicles and Indiana Bureau of Motor Vehicles in obtaining names and addresses of registered drivers in the states of Ohio and Indiana. In addition, the research team was expecting to work with the American Transportation Research Institute (ATRI), which is part of the American Trucking Association (ATA) in obtaining data from professional truck drivers. The sample of drivers to be mailed the questionnaire was to be randomly selected, stratified by age and gender, from the lists in order to reduce biases in the survey data.

Unfortunately, both Bureaus of Motor Vehicles refused to honor the requests citing their driver privacy protection laws that prohibit giving information of their drivers and then they be contacted by using that information. The letters requesting drivers' data sent to both state

agencies are included in Appendix C. Also, the refusal letter from Indiana Bureau of Motor Vehicles signed by the Public Records Request Coordinator, Mr. Brad Folck is included in Appendix C. The refusal note from Ohio Department of Public Safety was delivered via a phone call by Mr. John. R. Guldin, the Associate Legal Counsel.

Also, ATRI's response was not positive. Through email communication with Mr. Jeffrey Short, the Senior Research Associate said that they normally don't release such information but requested the research team leader to give him a call. Through the telephone conversation, Mr. Short said that they can only give data if they get incorporated into the research project as research partners and be paid as a result. Due to lack of funding, the research team could not honor the ATRI's request. The email communication with ATRI is included in Appendix D.

The research team then decided to use local published telephone books from Greater Dayton area and the Greater Metropolitan Cincinnati, including the City of Mason for names and addresses. A sample of 1500 names, that included 750 males and 750 female names were randomly selected from alphabetical listings in the phone books. Unfortunately, this procedure could not determine the age group of the respondent when the sampling was being undertaken.

Prior to mailing the surveys, the questionnaire was internally tested by distributing it to randomly selected University of Dayton community drivers. The results from this pilot data collection was instrumental in helping the research team in determining whether the questionnaire required refinement and whether the questions were well understood by the targeted respondents. After successful implementation of the pilot data collection, the surveys were mailed out. The mailed envelopes included the two-page questionnaire, a cover letter, and a stamped-self addressed envelop for mailing back the surveys.

CHAPTER 4 - ANALYSIS AND DISCUSSION OF RESULTS

Data were analyzed by using SPSS computer statistical software. A total of 376 completed surveys were received representing a response rate of 25 percent. This is a typical response rate as compared to other mail-out surveys (17, 18). Although the most current telephone books were used to extract names and addresses, however, 79 surveys (about 5.3%) could not be delivered because the addressees had already moved and could not be forwarded to their new addresses.

Data Summaries

Demographic Items

Item 1 asked the age group of respondents. The distribution of age groups is shown in Table 4.1 and is compared with those of licensed drivers in the state of Ohio and the U.S. in 2005 (19). The results show that this study over sampled mid-age and older drivers and completely missed the teenage drivers. The reason for under presentation of ages under 25 may be due to the fact that most of them do not live independently or don't head a household and hence not listed in the telephone books.

Item 2 asked the gender of respondents. Females constituted 52.0 percent of the respondents and 48.0 percent were males. Table 4.2 compares the gender splits for the sample with those of the U.S. and Ohio licensed drivers (19). The gender split for this study is very close to that of the state of Ohio. Although females are normally over sampled in studies where participation is voluntary (20), but it does not seem to be the case in this study.

Table 4.1 Comparison of Driver's Age Groups Distribution

Age Group	Percent of total drivers		
	This Study	Ohio	United States
≤ 19	0	5.0	4.7
20-25	2.4	9.6	10.2
26-44	22.4	33.5	36.2
45-54	29.1	20.5	19.9
55-64	27.7	14.9	14.4
≥ 65	18.4	16.5	14.6

Table 4.2 Comparison of Driver's Gender Splits

Gender	This Study	Ohio	United States
Male	48.0	48.4	50.0
Female	52.0	51.6	50.0

Item 3 asked how often on average, the respondent drives on the freeways. Table 4.3 summarizes the results of item 3. With 90.7% of the respondents saying that they at least drive on freeways once a week, the researchers were satisfied that the sample was qualified enough to answer freeway-related questions.

Table 4.3 How Often the Respondent Drives on Freeways

Average Driving Frequency	Number of Responses	Percent
Never	5	1.3
Rarely (two time a month or less)	30	8.0
Sometimes (once a week or less)	74	19.7
Regularly (two to five times a week)	144	38.3
Almost daily (six to seven days a week)	123	32.7
Total	376	100.0

Item 4 asked on average, how far the respondent drives on freeways. Table 4.4 summarizes the results of item 4. More than 89% of respondents reported that they drive at least six miles on the freeways.

Table 4.4 How Far the Respondent Drives on Freeways

Average Driving Distance	Number of Responses	Percent
Never	5	1.3
One to two miles	4	1.1
Three to five miles	31	8.2
Six to ten miles	108	28.7
Over ten miles	228	60.6
Total	376	100.0

Data was checked for consistency and was found that the respondents who chose “Never” in Table 4.3 were the same respondents who said “Never” in Table 4.4. Also, the same respondents were checked for their age groups and all reported to be in the 65 and above age group and commented that they either no longer drive at all or they don’t drive on freeways any more.

Personal Experience of Being Involved or Seeing Crashes and Near Misses

Items 5 and 6 were related and asked the respondents to recall for the past one year if they saw an on-ramp related accident(s) (Yes/No) and recall the number of such accidents seen, respectively. Data were checked for consistence to make sure there was no contradiction, e.g., if item 5’s answer was No, then item 6’s answer should be “None”. For item 5, 268 respondents checked “No” while 108 checked a “Yes”. The results of item 6 are shown in Table 4.5. Almost 29% of respondents reported seeing related crashes and mostly (21.6%) recalled seeing between one and three crashes.

Table 4.5 For the Past One Year, the Number of On-ramp Related Crashes Seen

Number of Accidents	Number of Responses	Percent
None	268	71.3
One	39	10.4
Two to three	42	11.2
Four to five	12	3.2
More than five	15	4.0
Total	376	100.0

Items 7 and 8 were related and asked the respondents to recall for the past one year if they saw on-ramp near misses i.e., situations that nearly resulted into crashes (Yes/No) and recall the number of such incidents seen, respectively. For item 7, 93 respondents checked “No” and 283 checked “Yes”. Again, data were checked for consistence. The results of item 8 are shown in Table 4.6. While 29% saw actual crashes on the freeway-entrance ramp merge areas, more than 75% saw near misses on the freeway-entrance ramp merge areas (with over 63% seeing more than 2 near misses in the past twelve months), which means that for some reasons, many potential crashes are more likely to end up into near misses.

Table 4.6 For the Past One Year, the Number of On-ramp Related Near Misses Seen

Number of Near Misses	Number of Responses	Percent
None	93	24.7
One	43	11.4
Two to three	130	34.6
Four to five	43	11.4
More than five	67	17.8
Total	376	100.0

Items 9 and 10 were related and asked the respondents to recall for the past one year if they were involved in on-ramp related crashes (Yes/No) and recall the number of such crashes they were involved, respectively. Data were checked for consistence. A total of 363 respondents reported not involved in such crashes and only 13 recalled being involved in crashes. The results of item 10 are shown in Table 4.7. This means that about 3.5% (about 1 out of 29 sampled

drivers) reported being involved in on-ramp-related crashes. This is a little higher than the 2005 national average of reported driver's crash involvement of about 3.1% (about 1 crash for every 33 licensed drivers in the U.S. in 2005) (21) Although some studies have found self-reporting bias where respondents are more likely to underreport their socially inappropriate behaviors (17, 22, 23, 24), however, it does not seem to be a problem in this case.

Table 4.7 For the Past One Year, the Number of On-ramp Related Crashes Involved You

Number of Accidents	Number of Responses	Percent
None	363	96.5
One	9	2.4
Two to three	0	0.0
Four to five	2	0.5
More than five	2	0.5
Total	376	100.0

Items 11 and 12 were related and they asked the respondents to recall for the past one year if they were involved in on-ramp near misses (Yes/No) and recall the number of such incidents they were involved, respectively. Data were checked for consistence. A total of 188 respondents (50.1 %) survived situation(s) where accidents almost happened while 187 respondents did not recall being involved in such situations. Similarly, while about 3.5% reported being involved in on-ramp related crashes, more than 50% of them survived situation(s) were crashes almost happened. Again, we can see that crashes are relatively rare events as

compared to the prevalence of potential near misses, which can not be reported or documented in the police reports. The results of item 12 are shown in Table 4.8.

Table 4.8 For the Past One Year, the Number of On-ramp Related Near Missed Involved You

Number of Near Misses	Number of Responses	Percent
None	187	49.9
One	68	18.1
Two to three	89	23.7
Four to five	16	4.3
More than five	15	4.0
Total	375*	100.0

*One person did not respond to this question.

Driving Behavior at Merging Area and Meaning of a Merge Sign Items

Item 13 was an open-ended question that asked respondents to explain what they normally do before entering a freeway at an on-ramp. The research team did not want to influence drivers by providing them with multiple choice answers when responding to their driving behaviors. Since this was an open-ended question, responses were read carefully and coded into major categories. Table 4.9 shows the coded response categories. It seems 29% of the respondents were likely to enter the freeway without extra caution by thinking that speeding to the freeway speed is the only requirement for proper entrance. About 4% did not respond to this question.

Table 4.9 What Do You Normally Do Before Entering the Freeway

Response Category	No. of Responses	Percent
Speed up	109	29.0
Caution for safe or smooth merge by adjusting speed	183	48.7
Look in side mirror/behind to check for on-coming traffic in near lane	55	14.6
Get to speed of traffic and look in side mirror/behind for on-coming traffic in near lane	4	1.1
Caution for safe speed or smooth merge, look in side mirror/behind to check for on-coming traffic in near lane, and put on turn signal	8	2.1
Pray and watch out	1	0.3
No response	16	4.3
Total	376	100.0

Item 14 was similar to item 13 except that the respondents were asked when driving on the freeway main lanes and see a vehicle entering via an on-ramp what do they normally do. The responses are given in Table 4.10. While most of the respondents showed some courtesy (93.7%) to entering drivers, 4.5% did not respond to the question and only 1.6% of them don't care about entering drivers. It is interesting to note that while 93.7% report to act properly when approaching the merge area when driving on freeway main lanes; only 66% (refer to Table 4.9) seem to act correctly when entering the freeway from entrance ramps. This can partly explain why some studies had found out that entering drivers are most of the time at fault for crashes that

occur at freeway-entrance ramp areas (7). A knowledge deficiency can be one of the contributing factors.

Table 4.10 What Do You Normally Do When You See a Vehicle Entering the Freeway

Response Category	No. of Responses	Percent
Switch lanes and try to merge on the left	142	37.8
Slow down or speed up to give space for merging vehicles	47	12.5
Try to merge to left or slow down/speed up to give space for merging vehicles	162	43.1
Continue at normal speed/maintain speed and lane	6	1.6
Switch lanes if possible and keep constant speed	1	0.3
Pray and watch out	1	0.3
No response	17	4.5
Total	376	100.0

Item 15 showed a merge warning sign symbol, which is Sign W4-1 from the Manual on Uniform Traffic Control Devices (16), depicted in Figure 4.1, and requested the respondents to choose the correct answer from the multiple-choices provided. The number of responses and their percentages are shown in Table 4.11.

Figure 4.1 Merge Warning Sign Symbol (Sign W4-1) asked in Item 15



Table 4.11 Response Results for the Meaning of a Merge Warning Sign

Response Category	No. of Responses	Percent
A highway point where entering vehicles have no dedicated acceleration lane and you should exercise caution	1	0.3
A highway point where entering vehicles have a dedicated acceleration lane and no need for you to do anything	196	52.1
A highway point where entering vehicles have a dedicated acceleration lane and no need for you to do anything	3	0.8
A highway point where entering vehicles have a dedicated acceleration lane and you should pay close attention to entering traffic	163	43.4
I am not sure	13	3.5
Total	376	100.0

According to the definition of merge sign given in the Manual on Uniform Traffic Control Devices (16), choices B and D are correct answers because the MUTCD does not

mention whether the acceleration lane is provided or not. Therefore, only about 4.6% of the respondents did not understand the meaning of the symbol.

Item 16 almost has the same meaning as item 13 except that respondents were asked what action they normally take before entering a freeway when driving on a single-lane ramp with a yield sign. The responses were coded and are summarized in Table 4.12. When comparing with item 13, the drivers who reported that they “just speed up” drops from 29.0% to 7.4% when the yield sign is posted on the entrance ramp.

Table 4.12 What Do You Normally Do When Entering the Freeway Via a Yield-Signed Ramp

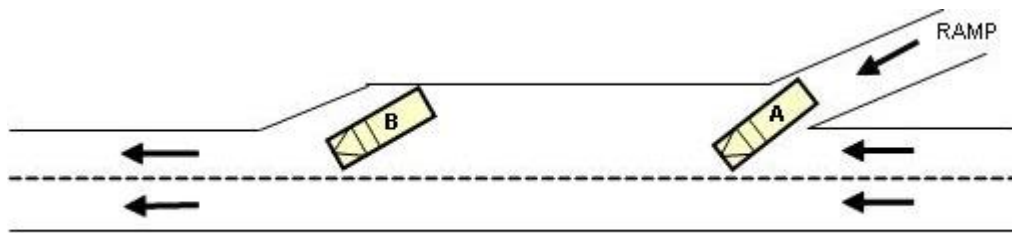
Response Category	No. of Responses	Percent
Slow down and watch traffic to enter safely and be able to stop if necessary	262	69.7
Yield to vehicles on the highway/check over my shoulder	57	15.2
Speed up	28	7.4
Slow down and watch traffic on main lanes, yield to vehicles on the highway, and put on turn signal	4	1.1
Look for gap in traffic and try to enter at freeway speed	2	0.5
Pray and watch out	1	0.3
No response	22	5.9
Total	376	100.0

The results of Table 4.9 and Table 4.12 indicate that there is a higher chance that most drivers act correctly when entering a freeway via a yield-signed entrance ramp as compared to the normal entrance ramp with a standard length of acceleration lane (where normally no yield sign is posted).

Knowledge and Right-of-Way Items

Item 17 was a freeway entrance knowledge question that included a picture depicted in Figure 4.2 showing two vehicles A and B entering the freeway from an on-ramp and requested the respondents to tell which vehicle is entering the freeway correctly. Five choices were given and the respondents were supposed to select only one correct choice. The responses to this item are summarized in Table 4.13.

Figure 4.2 Identify Which Vehicle is Entering the Freeway Correctly



Although most states' driving handbooks include a figure almost similar to Figure 4.2 advising proper freeway entrance (11-14), only 68.1% of respondents chose a correct answer. The reason for lower than expected understanding of proper on-ramp merge driving behaviors may be due to Ohio's handbook not including the figure which shows the proper location on the merging area (10).

Table 4.13 Responses to Item 17 on Which Vehicle is Entering Freeway Correctly

Response Category	No. of Responses	Percent
Vehicle A	19	5.1
Vehicle B*	256	68.1
Both of them	65	17.3
None of them	22	5.9
I am not sure	13	3.5
No response	1	0.3
Total	376	100.0

* The correct response.

Items 18 and 19 were right-of-way knowledge questions that showed two vehicles, one on a freeway main lane and the other entering the freeway and respondents were asked to identify which vehicle was supposed to yield the right-of-way to the other. In item 18 the vehicle on the ramp is entering directly into the freeway without speeding up through the acceleration lane and is on the course to collide with the other vehicle traveling on the freeway main lane. Figure 4.3 depicts the picture used for item 18. The responses to this item are summarized in Table 4.14.

Figure 4.3 Identify Which Vehicle has to Yield the Right-of-Way in Item 18

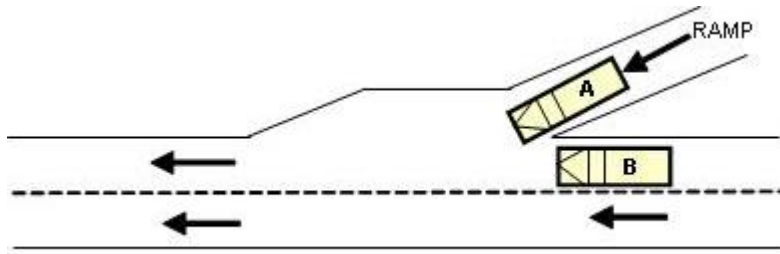


Table 4.14 Responses to Item 18 on Which Vehicle Has to Yield the Right-of-Way

Response Category	No. of Respondents	Percent
Vehicle A*	327	87.0
Vehicle B	30	8.0
The first vehicle to reach there has the right of way	3	0.8
None of them	5	1.3
I am not sure	11	2.9
Total	376	100.0

* The correct response.

The difference between items 18 and 19 was the location of the entering vehicles on the acceleration lane. In item 19 the vehicle on the ramp is entering correctly after speeding up on acceleration lane but it is on the collision course with another vehicle traveling on the freeway main lane. Figure 4.4 depicts the graphic that was used for item 19 and the responses for this item are summarized in Table 4.15.

Figure 4.4 Identify Which Vehicle has to Yield the Right-of-Way in Item 19

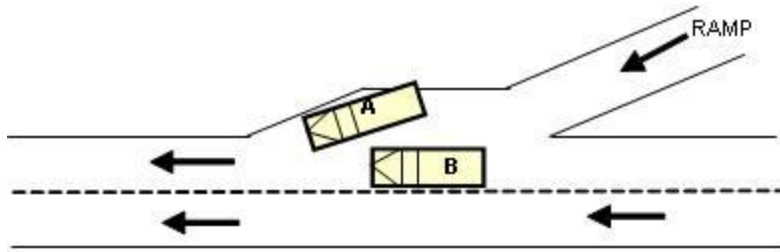


Table 4.15 Responses to Item 19 on Which Vehicle Has to Yield the Right-of-Way

Response Category	No. of Respondents	Percent
Vehicle A*	264	70.2
Vehicle B	87	23.1
The first vehicle to reach there has the right of way	4	1.1
None of them	8	2.1
I am not sure	13	3.5
Total	376	100.0

* The correct response.

The results of items 18 and 19 are very interesting. When vehicle A is entering improperly (Figure 4.3), most respondents, over 87% chose a correct answer, but when the same vehicle is entering properly (Figure 4.4), correct responses drop to about 70%. This may be a serious issue of right of way knowledge when drivers are entering and merging into a freeway. The results of items 18 and 19 (Tables 4.14 and 4.15) just complement the results of item 13 (Table 4.9) in confirming that there is a knowledge problem among drivers in regard with proper driving in the vicinity of freeway-entrance ramp areas.

Drivers' Opinions on Reasons that Cause Freeway-Ramp Merge Area Crashes

Item 20 consisted of an open-ended question inquiring the respondents to provide any reason(s) they think may be the cause of vehicle crashes at the freeway-ramp merge area. Some respondents mentioned several reasons and that is why the sum of the number of responses in Table 4.16 is higher than the number of respondents. The reasons given by drivers were coded and categorized as shown in Table 4.16.

Table 4.16 Reasons that Cause Crashes at the Freeway-Ramp Merge Area

Reason Category	No. of Responses	Percent*
Speed – drivers don't adjust speed to another driver's speed (too slow when entering)	82	19.8
Lack of attention/talking on cell phone	94	22.7
Yielding problem/drivers' bad attitudes (not courteous)	156	37.6
Some drivers don't know who has the right of way on the freeway	43	10.4
Lack of knowledgeable drivers	27	6.5
Heavy traffic	12	2.9
Acceleration lanes too short, difficult to speed up so quickly	1	0.2
No response	58	

* Values shown are percentages of total valid reasons only (excluding no responses).

Although a no response category to this question was relatively high (15.4% of respondents), however, for those who responded gave very important reasons, which are not

surprises to traffic engineers, but it was pleasing to note that even drivers know the root causes of some specific types of highway crashes. Interestingly, most of the respondents did not mention heavy traffic/congestion as a major problem, with only 2.9% of them mentioning it as one of the causes of freeway-entrance merge area crashes, while ranking highest the lack of yielding/bad attitudes as the main cause followed by lack of attention/talking on cell phone. The major reasons given can be grouped into two main categories: lack of knowledge and bad behavior. About 60% of the drivers who responded to the question believe that the freeway-entrance ramp crashes are due to bad driver behaviors (attention and yielding problems) while almost 37% of them point out the lack of knowledge (speed choice, about the right of way, and general knowledge problems). Hence, driver's behavior and lack of knowledge together have been blamed as the main causes of the freeway-entrance ramp merge area crashes by a total of about 97% of the drivers who responded to the question. The drivers' beliefs are in agreement with a study by GMAC Insurance (25), which suggests that many U.S. drivers find basic practices, such as merging and interpreting road signs difficult. In addition, the GMAC study reports that drivers not only lack basic road knowledge, but exhibit dangerous driving as well. Drivers in the Northwest and Mid-Atlantic states did worst in the GMAC study.

Drivers' Suggestions to Make the Freeway-Ramp Merge Areas Safer

Item 21 was the last question, which asked the respondents to give suggestion(s) that may make the freeway-ramp merge areas safer. Some respondents mentioned several reasons as well. The suggestions given by drivers were coded and categorized as shown in Table 4.17.

Table 4.17 Suggestions to Make the Freeway-Ramp Merge Areas Safer

Suggestion Category	No. of Responses	Percent*
Need longer acceleration lanes (redesigning the ramps)	170	54.3
Better ramp signing required	76	24.3
Need more safe drivers (teach driver what signs mean, entrance ramp safety)	57	18.2
Need more cops on the highway	8	2.6
Flashing lights when vehicles are merging to alert highway drivers of merging traffic	1	0.3
Fines for failure to allow entering drivers to merge	1	0.3
No response	103	

* Values shown are percentages of total valid suggestions only (excluding no responses).

More than half of the responses (54.3%) suggested that longer acceleration lanes are required to reduce crashes at the entrance ramp merging areas, which agrees with McCatt et al. study findings (3). More than 18% believe that most drivers need more driving education, especially meaning of signs and entrance ramp safety issues, agreeing with GMAC Insurance study findings (25). A surprising suggestion is the need to have better ramp signing (about 24%). This shows that there is a need for further investigation to figure out why some drivers think that the current level of signing at entrance ramps is not adequate for safety purposes. Some of the signage suggested by drivers on the entrance ramp includes:

- Merging traffic ahead
- Yield signs

- Yield to freeway traffic
- Get up to highway speed quickly

Analysis of Drivers' Knowledge

Further analysis was performed to find out about the respondents who knew correct merging behaviors versus those who did not. The responses of the knowledge questions (items 13, 14, 17, 18, and 19) were decoded into “correct” and “wrong” responses and the responses were statistically tested by using χ^2 (chi-square test of independence) at $\alpha = 0.05$ based on each of the following groups:

- Age (age groups: 20-25, 26-44, 45-54, 55-64, and 65+): knowledge questions' results were statistically tested to determine whether there were significant differences in responses given by different age groups.
- Gender (male/female): knowledge questions' results were statistically tested to determine whether there was a significant difference between male's and female's responses.
- Driving frequency (frequent driver/infrequent driver): knowledge responses' results were statistically tested to determine whether there was a significant difference between the responses given by frequent freeway drivers and infrequent freeway drivers. Frequent drivers were defined as those who were categorized as “regularly” and “almost daily” drivers and infrequent drivers constituted the “never”, “rarely”, and “sometimes” categorized drivers (refer to Table 4.3).
- Seen crashes (Yes/No): knowledge responses' results were statistically tested to determine whether there was a significant difference between the responses given by drivers who recalled seeing on-ramp related crashes the past one year and those drivers who could not recall seeing any such crashes.

- Seen near misses (Yes/No): knowledge responses' results were statistically tested to determine whether there was a significant difference between the responses given by drivers who recalled seeing on-ramp related near misses the past one year and those drivers who could not recall seeing any such near misses.
- Involved in crashes (Yes/No): knowledge responses' results were statistically tested to determine whether there was a significant difference between the responses given by drivers who recalled being involved in on-ramp related crashes the past one year and those drivers who could not recall being involved in such crashes.
- Involved in near misses (Yes/No): knowledge responses' results were statistically tested to determine whether there was a significant difference between the responses given by drivers who recalled being involved in on-ramp related near misses the past one year and those drivers who could not recall being involved in such near misses.

Table 4.18 summarizes the χ^2 significance testing results of the driver groups' on knowledge questions. From Table 4.18, it is only being "involved in crashes" group that the responses to all knowledge questions were not significantly different between those who said "Yes" and "No" to the item question. For age, where the differences were significant, it is the 20-25 and 65+ age groups whose knowledge was significantly lower than the other age groups. Interestingly, for gender, females showed significantly higher knowledge on item 14 while males were higher for item 17. Also, for driving frequency group, frequent freeway drivers exhibited significantly higher knowledge than their infrequent counterparts on items 14, 18, and 19). Besides these, no clear picture of other group attributes that can help to identify the differences in knowledge as far as the freeway-merge area safety is concerned (based on data collected in this study).

Table 4.18 Drivers' Knowledge χ^2 Significance Testing Results

Knowledge Question	Group of Responses						
	Age	Gender	Driving frequency	Seen crashes	Seen near misses	Involved in crashes	Involved in near misses
Your actions when entering a freeway (item 13)	2.00	0.00	0.03	3.66*	0.28	1.94	1.46
Your actions when driving on a freeway (item 14)	9.13*	6.59*	4.22*	1.54	13.30*	0.06	7.16*
Which vehicle is entering correctly (item 17)	1.63	7.06*	0.12	1.54	1.34	1.29	1.79
Entering wrongly, which vehicle has to yield (item 18)	9.63*	0.60	5.26*	4.03*	3.00*	0.34	2.07
Entering correctly, which vehicle has to yield (item 19)	4.33	0.54	3.50*	0.62	0.36	0.48	0.11

* $p < 0.05$

Limitations of the Study Method

There are several limitations associated with the study method used in this study that should be kept in mind when interpreting the results. First, the survey sample could not reach the younger drivers, mostly under 25 years old, and over represented older drivers. Second, the mail surveys tend to have relatively lower responses (in this case 25%) and thus prone to higher non-response biases. Third, self-reporting bias on some questions that ask to report their driving

behaviors are more likely to report better behaviors than otherwise. Fourth, some people may have difficulty to recall correctly the number of incidences encountered on highways for the past 12 months.

CHAPTER 5 - Conclusions

Besides the study limitations given, the authors believe that the responses given by sampled drivers in this study provide important insights to regard with drivers' knowledge of right-of-way issues at the freeway on-ramp merge area. This study has shown that even though crashes have been rare events, however, there is a higher chance most potential crashes never happen, for some reasons, result into near misses, which can not be reported and documented.

Although most drivers indicated that they act correctly when driving on freeway mainlines when they see a vehicle trying to merge from an entrance ramp, the same drivers seem to act improperly when merging into freeway from on-ramp lanes. This may be a reason why some research efforts have found that the on-ramp merging vehicles have been at-fault when such collisions happen. This problem is amplified when noting that some drivers could not identify which driver has the right-of-way at the merge area between the mainline and the on-ramp drivers. The main causes of crashes occurring at freeway-entrance merging areas may be grouped into two categories: (1) knowledge problems: drivers' lack of knowledge of right-of-way and proper emerging, and (2) behavioral problems: lack of attention when driving and bad attitudes (lack of courtesy) to others.

It is equally surprising that almost 32% of the sampled drivers could not identify the proper way of merging into the freeway. Younger (20-25) and older (65+) drivers showed significantly lower knowledge for most of the items asked compared to other age groups. Also, the infrequent freeway drivers showed the same problems when compared to frequent drivers.

Drivers identified that lack of yielding/bad attitudes is a leading cause of freeway-ramp merge areas followed by lack of attention/talking on cell phone and drivers entering the freeway at low speeds thus affecting the rest of the traffic.

Most of the drivers believe that they need longer acceleration lanes, better ramp signing and better driver's education especially in terms of sign meaning and entrance ramp safety in order to make freeway-ramp merge areas safer. There is a serious need for the driver licensing agencies to improve freeway related information in their driver's licensing manuals.

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Appendix A - Approval Letters to Use Human Subjects

This appendix includes a letter submitted to the Institutional Review Board (IRB) seeking permission to collect data from human subjects and the corresponding permission letter from IRB.

Application letter Requesting Approval to Use Human Subjects



INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN SUBJECTS IN RESEARCH

Application for IRB Review

The federal government and University policy require that the involvement of human participants in research be monitored by an Institutional Review Board (IRB). The University of Dayton's IRB works to ensure that appropriate ethical standards and statutory requirements governing the protection of human participants are followed by all researchers affiliated with the University of Dayton and/or those researchers who wish to conduct research on the University of Dayton campus or among University of Dayton students.

The information requested must be provided when humans are to be involved in research studies, whether these studies are internally funded, externally funded, or unfunded (e.g., student research projects, dissertations, theses, scholarly papers). Research involving animals should be submitted to the Animal Use Committee (IACUC).

One hard copy with original signatures and one electronic copy (CD, disk, or email attachment) of the complete application must be submitted to:

Jon Nieberding
Chair, University of Dayton IRB
300 College Park
Dayton, OH 45469-0104

A complete application includes the following:

1. Copies of all instruments and consent/assent forms to be used, and
2. Answers to all of the questions on pages 2-4 of this application form.

This cover sheet need not be included in the application. It is for informational purposes only.

For those of you on the UD campus, the IRB office is located in Room 542, Kettering Laboratories. Email submissions should be directed to jon.nieberding@udri.udayton.edu.

Research projects on which data collection has already begun cannot be reviewed or approved by the IRB.

The maximum time period between the date of receipt of your application and the approval/denial/request for revision or clarification letter is three (3) weeks. **Please consider this timeline when planning your application.**

All student submissions (papers, dissertations, theses) must have faculty sponsorship.

Researcher(s): Deogratias Eustace

Date of Submission: March 29, 2007

Project Title: Evaluation of the Role of Driver's Knowledge of Who Has the Right-of-Way
Contributes to Interstate On-Ramp Crashes

Position in the University (faculty, student, etc.). If student, please indicate faculty sponsor:
Faculty

Department: Civil and Environmental Engineering and Engineering Mechanics

Telephone: 9-2984

Email address:
Deo.Eustace@udayton.edu

Mailing address: +0243

Project is for (*please check all that apply*): scholarly research _____ dissertation _____
Thesis _____ class project _____ funded project X other (*specify*): _____

Project is: _____ unfunded X funded (if funded, please complete the following)

Funding agency (actual/potential): U.S. Department of Transportation

Contract/Grant No. (if applicable): SA0710213

For evaluation of your project, please check any of the following that apply.

<input type="checkbox"/>	Mentally or physically challenged participants	<input type="checkbox"/>	Participants studied at UD
<input type="checkbox"/>	Children or minor participants (under 18)	<input checked="" type="checkbox"/>	Subjects at non-UD locations
<input type="checkbox"/>	Prisoners, parolees, or incarcerated subjects	<input checked="" type="checkbox"/>	Students as subjects
<input type="checkbox"/>	Filming, video or audio recording of subjects	<input checked="" type="checkbox"/>	Employees as subjects
<input checked="" type="checkbox"/>	Questionnaires or surveys to be administered	<input type="checkbox"/>	Pregnant subjects
<input type="checkbox"/>	Use of data banks, archives or other records	<input type="checkbox"/>	Involves blood samples
<input type="checkbox"/>	Subjects major language is not English	<input type="checkbox"/>	Subjects to be paid
<input type="checkbox"/>	Exclusion of women or children subjects	<input type="checkbox"/>	Oral history project
<input type="checkbox"/>	Involves deception	<input type="checkbox"/>	Sexual content

Check the applicable category.

- Research on normal educational practices in commonly accepted educational settings (if yes, please justify below*)
- Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement)
- Research involving survey or interview procedures (if yes, please see below**)
- Research involving the collection or study of existing data, documents, or records.
- None of the above are applicable to my project.

*If you think your research employs “normal education practices” occurring in common educational settings, please justify below or on another clearly labeled sheet of paper.

**If your research involves use of survey or interview procedures, please indicate:

1. Response will be records in such a manner that human subjects cannot be identified (by anyone other than the researcher) either directly or through identifiers linked to the subject yes no. If yes, please specify your method (e.g., pseudonym, code numbers, etc.)
2. Would subjects’ responses, if they became known outside the research, reasonably place the subject at risk of criminal or civil liability or be damaging to the subject’s financial standing or employability?
 yes no.
3. The research deals with sensitive aspects of the subject’s own behavior, including but not limited to illegal drug use, sexual behavior, or use of alcohol
 yes no.

UDRI

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of DAYTON
RESEARCH
INSTITUTE**

Approval Letter to Use Human Subjects

27 April 2007

Dr. Deogratias Eustace
University of Dayton
Civil Engineering
Dayton, OH 45469

SUBJECT: “ Evaluation of the Role of Driver’s Knowledge of Who
has Right-of-Way Contributes to Interstate On-Ramp
Crashes”

Dear Dr. Eustace:

The Institutional Review Board for the Protection of Human Subjects in Research has reviewed the subject proposal. The proposed research protocol is exempt from human subject regulations as described in 45 CFR 46.101(b) (2). The procedures you have designed to protect participant confidentiality and to secure informed consent are adequate and conform to accepted ethical standards for this type of research.

Therefore, you have approval to proceed with the study. The Committee expects that the appropriate subject protection measures will be followed, as outlined in your proposal.

Please note that in Appendix A, Letter to the Parents, the phone number for IRB issues should read, (937) 229-4053.

Please inform the Committee of any ethical issues that may arise in your study. Please feel free to contact me should you encounter other issues relevant to the protection of human subjects. Good luck with your research.



Jon Nieberding Chair

jn:lky

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Appendix B - Cover Letter and the Survey Instrument

This appendix consists of the cover letter and the survey instrument (questionnaire) that were sent to selected drivers.

Cover Letter



May 9, 2007

SURVEY OF DRIVER'S KNOWLEDGE AND EXPERIENCE WITH INTERSTATE ON-RAMP ACCIDENTS

The Department of Civil and Environmental Engineering at University of Dayton is conducting a study for the United States Department of Transportation (USDOT) through the Mack-Blackwell Transportation Center to assess how well the public understands various safety issues relevant to freeway's entrance ramps. The survey has been developed so that you can tell us your experience and knowledge related with freeway entrance ramp safety. The information you give us will be used to develop a better understanding of freeway accident-related issues and how the driver's knowledge contributes towards these types of accidents.

Do not write your name on this survey questionnaire. All answers will be kept in strictest confidence. Answer the questions based on the best of your knowledge. Completing the survey is voluntary.

When you are finished, please return the questionnaire in the enclosed, addressed, stamped envelope.

Thank you very much for your help

Survey Instrument

1. What is your age? Under 20 20-25 26-44 45-54 55-64 Over 64

2. What is your gender? Male Female

3. How often do you drive on freeways (including Interstate highways)?
 - A) Never
 - B) Rarely (two times a month or less)
 - C) Sometimes (once a week or less)
 - D) Regularly (two to five times a week)
 - E) Almost daily (six or seven days a week, generally)

4. On an average, how far do you drive on the freeway highways?
 - A) Never
 - B) One to two miles
 - C) Three to four miles
 - D) Five to ten miles
 - E) Over ten miles

5. In the past one year, can you recall seeing an accident at a freeway entrance ramp that involved at least two vehicles, between a vehicle in the main lanes crashing with one that was entering through the on-ramp? Yes No

6. How many such accidents do you think you saw in the past one year?
 - A) None
 - B) One
 - C) Two to three
 - D) Four to five
 - E) More than five

7. In the past one year, can you recall seeing *near misses* at a freeway entrance ramp that involved at least two vehicles, between a vehicle in the main lanes that *almost crashed* with one that was entering through the on-ramp? Yes No

8. How many such incidents mentioned in item 7 above do you think you saw in the past one year?
 - A) None
 - B) One
 - C) Two to three
 - D) Four to five
 - E) More than five

9. In the past one year, can you recall yourself being involved in an accident at the entrance ramp that involved at least two vehicles, between you or the other vehicle being in the main lanes crashing with the other vehicle or you entering through the on-ramp? Yes No

10. How many such incidents mentioned in item 9 above do you recall you were involved in the past one year?
- A) None
 - B) One
 - C) Two to three
 - D) Four to five
 - E) More than five

11. In the past one year, can you recall being involved in a situation that can be termed as a “near miss” (nearly developed into an accident) in the vicinity of entrance ramps (either you or the other vehicle was in the main lanes and the other vehicle or you was entering through the on-ramp)? Yes No

12. How many such incidents mentioned in item 11 above do you recall you were involved in the past one year?
- A) None
 - B) One
 - C) Two to three
 - D) Four to five
 - E) More than five

13. When approaching a freeway from an on-ramp, what do you normally do before entering the highway?

.....

.....

.....

.....

14. When driving on a freeway and you see a vehicle entering from a ramp, what do you normally do?

.....

.....

.....

.....

15. What is the meaning of this sign?



- A) That you are approaching a highway point where vehicles can turn
- B) That you are approaching a highway point where entering vehicles have no dedicated acceleration lane to speed up to the highway speed and you should exercise caution
- C) That you are approaching a highway point where entering vehicles can accelerate to the highway speed in a dedicated acceleration lane and there is no need for you to do anything
- D) That you are approaching a highway point where entering vehicles can accelerate to the highway speed in a dedicated acceleration lane and you should pay close attention to entering traffic
- E) I am not sure

16. When approaching a freeway on a single-lane ramp with a YIELD sign, what action do you normally take before joining the highway?

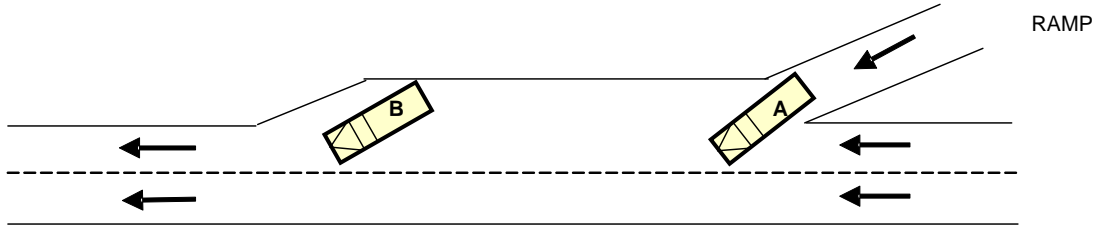
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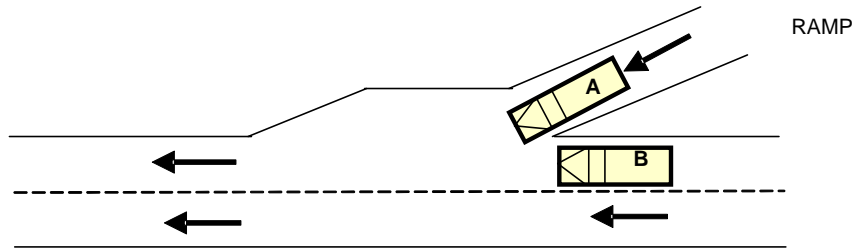
17. Which vehicle in the figure below is entering the freeway correctly?

- A) Vehicle A
- B) Vehicle B
- C) Both of them
- D) None of them
- E) I am not sure



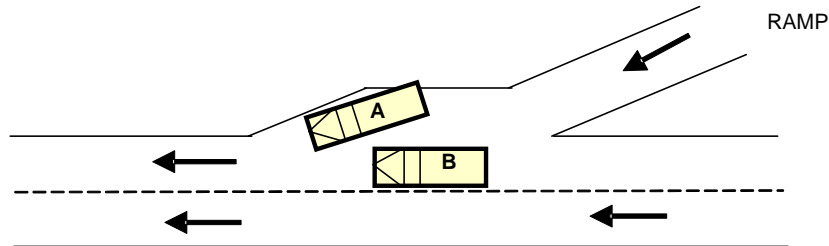
18. Which vehicle in the figure below has to yield the right-of-way to the other?

- A) Vehicle A
- B) Vehicle B
- C) The first vehicle to reach there has the right of way
- D) None of them has more right than the other
- E) I am not sure



19. Which vehicle in the figure below has to yield the right-of-way to the other?

- A) Vehicle A
- B) Vehicle B
- C) The first vehicle to reach there has the right of way
- D) None of them has more right than the other
- E) I am not sure



20. Any reason(s) do you think may be the cause of the accidents at the freeway-ramp merge area?

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21. Do you have any suggestion(s) that may make the freeway-ramp merge areas safer?

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Appendix C - Letters Requesting Data Sent to Ohio BMV and Indiana BMV

This appendix consists of letters sent to the Ohio and Indiana Bureaus of Motor Vehicles requesting drivers' data. Also, included is an official denial letter from Indiana BMV office.



April 5, 2007

The Registrar
Ohio Bureau of Motor Vehicles
P. O. Box 16520
Columbus, OH 43216-6520

SUBJECT: Request for information from Ohio BMV relating to a U.S. Department of Transportation-funded research study

Dear Sir/Madam:

I am an Assistant Professor at the University of Dayton, Ohio. I am currently conducting research sponsored by the U.S. Department of Transportation via the Mack Blackwell Transportation Center at the University of Arkansas. The topic is "Evaluation of how drivers' understanding of who has the right-of-way contributes to interstate on-ramp crashes."

As part of this research, I have developed and hope to disseminate a questionnaire targeting registered drivers in western Ohio and eastern Indiana. This questionnaire is designed to assess their level of understanding of various safety issues relevant to my research.

I write to you with a request for help in creating a representative, randomly-based list of drivers in Ohio. This would, I assume, include names and addresses. I would like a list of about 1500 from which to create my participant pool.

The proposed research protocol has been reviewed by my institution's Institutional Review Board for the Protection of Human Subjects in Research (UD IRB). Regarding assurance of confidentiality to project participants, I will be employing a three-tiered system for protecting confidentiality:

- (1) Once the randomly-generated list is provided by your office, I will assign each person a code number. This master list with names will only be seen by myself, and will be stored in a locked filing cabinet when not in use.
- (2) Once the dissemination and any follow-up are complete, the master list will be destroyed via shredding. From that point on, only the list with the code number will be used.
- (3) When reporting the results, only summary data will be made public. Any identifiers will be removed. We will include a statement to this effect in the mailing and will include contact information for participants who may have questions about their rights as a research participant.

Thank you very much for your consideration of my request. Please feel free to contact me at eustacde@udayton.edu or 937-229-2984 should you have any questions.

Sincerely,

Deogratias Eustace, Ph.D., P.E., PTOE



April 5, 2007

Mr. Brad Folck
Senior Information Specialist
Indiana BMV
Indiana Government Center North
100 N. Senate Avenue, Room N440
Indianapolis, IN 46204

SUBJECT: Formal request for information from Indiana BMV relating to a U.S. Department of Transportation-funded research study

Dear Mr. Folck:

I am an Assistant Professor at the University of Dayton, Ohio. I am currently conducting research sponsored by the U.S. Department of Transportation via the Mack Blackwell Transportation Center at the University of Arkansas. The topic is "Evaluation of how drivers' understanding of who has the right-of-way contributes to interstate on-ramp crashes."

As part of this research, I have developed and hope to disseminate a questionnaire targeting registered drivers in western Ohio and eastern Indiana. This questionnaire is designed to assess their level of understanding of various safety issues relevant to my research.

I write to you with a request for help in creating a representative, randomly-based list of drivers in Indiana. This would, I assume, include names and addresses. Per Section 5-14-3 of the Indiana Code, I am making this formal request in writing. I would like a list of about 1500 from which to create my participant pool.

The proposed research protocol has been reviewed by my institution's Institutional Review Board for the Protection of Human Subjects in Research (UD IRB). Regarding assurance of confidentiality to project participants, I will be employing a three-tiered system for protecting confidentiality:

- (1) Once the randomly-generated list is provided by your office, I will assign each person a code number. This master list with names will only be seen by myself, and will be stored in a locked filing cabinet when not in use.
- (2) Once the dissemination and any follow-up are complete, the master list will be destroyed via shredding. From that point on, only the list with the code number will be used.
- (3) When reporting the results, only summary data will be made public. Any identifiers will be removed. We will include a statement to this effect in the mailing and will include contact information for participants who may have questions about their rights as a research participant.

Thank you very much for your consideration of my request. Please feel free to contact me at eustacde@udayton.edu should you have any questions.

Sincerely,

Deogratias Eustace, Ph.D., P.E., PTOE



STATE OF INDIANA

Mitchell E. Daniels, Jr., Governor

Ronald L. Stiver, Commissioner
BUREAU OF MOTOR VEHICLES
100 North Senate Avenue
Indianapolis, Indiana 46204
Telephone: (317) 233-2521

May 7, 2007

Mr. Deogratias Eustace
University of Dayton—Dept. of Civil & Environmental Engineering
300 College Park
Dayton, OH 45469-0243

Re: Indiana Public Records Request

Dear Mr. Eustace:

Thank you for your public records request relating to the **“creating of a representative, randomly-based list of drivers in Indiana in order to “disseminate a questionnaire targeting registered drivers”** for the purposes of a research study in regard to the **“Evaluation of how drivers’ understanding of who has the right-of-way contributes to interstate on-ramp crashes.”**

IC 9-14-3 authorizes the release of public records, except those declared confidential by law. Unfortunately, we are unable to fulfill your request.

IC 9-14-3.5-10 - states that the Bureau may disclose personal information to a person if the person provides proof of identity and represents that the use of the personal information will be strictly limited to at least one (1) of the following:

.... (5) For use in research activities and for use in producing statistical reports, as long as the personal information is not published, re-disclosed, or used to contact the individuals who are the subject of the personal information.

Thank you again for your inquiry. Should you have any further questions or concerns regarding this request, please do not hesitate to contact me at (317) 233-2521.

Sincerely,

Brad Folck
Public Records Request Coordinator
Indiana Bureau of Motor Vehicles Communications Dept.

BF:bf

An Equal Opportunity Employer

Appendix D - Communication with ATRI

This appendix consists of email communication with the American Transportation Research Institute (ATRI) official.



"Jeffrey Short"
 <jshort@trucking.org>
 04/02/2007 10:41 AM

To "Diana Krajewski" <dkrajewski@trucking.org>,
 <eustacde@notes.udayton.edu>

cc
 bcc

Subject RE: Administering a Research Project Questionnaire

History: This message has been replied to.

Deo,
 We do not release that type of information but may be able to work with you to get this survey to the specific population. Please give me a call to discuss this matter further.
 Thank you,
 Jeff

Jeffrey Short: Senior Research Associate
 American Transportation Research Institute (ATRI)
 Atlanta Office: 1850 Lake Park Drive, Suite 123, Smyrna, GA 30080

tel: 770.432.0628
 fax: 770.432.0638
 www.atri-online.org <<http://www.atri-online.org/>>

From: eustacde@notes.udayton.edu [mailto:eustacde@notes.udayton.edu]
 Sent: Monday, April 02, 2007 10:18 AM
 To: ATRI
 Subject: Fw: Administering a Research Project Questionnaire

Dear Sir/Madam,

I am forwarding an email request I first sent on March 19, 2007 requesting assistance from your organization for my research project. Please let me know if you are able to help. Thanks very much.

Sincerely,

Deo Eustace.
 ----- Forwarded by Deogratias Eustace/ENGR/FacStaff/UDayton on 04/02/2007 10:16 AM -----

Deogratias Eustace/ENGR/FacStaff/UDayton

03/19/2007 04:52 PM

To

atri@trucking.org

cc

Subject

To whom it may concern:

I am an Assistant Professor at the University of Dayton. I am doing a research sponsored by the U.S. Department of Transportation through Mack-Blackwell Transportation Center housed at the University of Arkansas-Fayetteville. The research topic is "Evaluation of Driver's Understanding of Who has the Right-of-way Contributes To Interstate's On-ramp Crashes". In this research project I have prepared a questionnaire I would like to distribute to registered drivers in western Ohio, eastern Indiana, and professional truck drivers. I want to ask them safety- and understanding-related questions through the questionnaire to answer my research topic objectives. My request to your office is how I can get the names and addresses and an unbiased sample of professional truck drivers that will be representative of the professional-drivers community. Thanks in advance.

Sincerely yours,

Deo Eustace

Deogratias Eustace, Ph.D., P.E., PTOE
Assistant Professor
Director, Transportation Engineering Lab (TEL)
Department of Civil Engineering
University of Dayton
300 College Park Drive
Dayton, OH 45469-0243
PH: 937-229-2984, FX: 937-229-3491
Email: Deo.Eustace@udayton.edu

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