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Driver Response to Right Turning Path Intrusions at Signalized Intersections

Erika Ziraldo University of Guelph

Shady Attalla and Sam Kodsi Kodsi Engineering

Michele Oliver University of Guelph

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Abstract

Previously researched path intrusion scenarios include left-turning hazard vehicles which intrude laterally across the path of the through driver. A right turning vehicle, however, creates a scenario where a hazard which was initially travelling perpendicular to the driver can intrude into the through driver's path without also occupying the adjacent through lanes. This hazard scenario has not been previously investigated. The purpose of this research was to determine driver response time (DRT) and response choice to a right turning vehicle that merges abruptly into the lane of the oncoming through driver.

Using an Oktal full car driving simulator, 107 licenced drivers (N_{Female} = 57, N_{Male} = 50) completed a five-minute practice drive followed by a ten-minute experimental drive containing two conditions of the right turn hazard, presented in a counterbalanced order. In one condition, the hazard vehicle was stopped with its front bumper at the stop bar before accelerating into the path of the participant driver. In the other condition, the hazard vehicle approached the intersection and turned at a constant speed. DRT was defined as the time between when the hazard vehicle crossed the stop bar and when the participant driver reacted by touching the brake pedal or swerving.

There was a significant difference in DRT ($p < 0.001$) between the two hazard conditions with drivers responding earlier to the right turning vehicle when it was initially in motion. In both scenarios, approximately half of the through drivers swerved in response to the hazard vehicle. Participants who chose to swerve were slower on average, although this response type did not result in significantly more collisions ($\chi^2(2) = 2.02$, $p = 0.14$).

Introduction

Urban and heavily trafficked roadways often use signalized intersections to minimize conflict between road users. With the purpose of improving safety and efficiency, traffic lights at busy intersections control when motor vehicles, pedestrians, and cyclists can cross. One exception is right turning which often does not have a controlled phase at signalized intersections. In most of Canada and the United States, right turns are allowed during all signal phases including on red. Before attempting a right turn on red, drivers are first expected to come to a full stop at the intersection and to yield to any through vehicles approaching from the left. However, given that successful navigation of signalized intersections includes anticipating and responding to the actions of road users travelling in multiple directions, drivers turning right on red often fail to recognize or appropriately yield to oncoming through drivers [1].

To investigate a crash involving a right turning vehicle, collision reconstructionists are often asked to determine whether the collision was avoidable by the through driver or a typical driver in their position. The investigator relies on the most applicable literature to estimate a range of driver response times (DRTs). DRT is defined as the time interval between the onset of a hazard and the first measurable response to the hazard vehicle. This differs from perception-response time which is defined in SAE Standard J2944 as the time interval between when the through driver can physically sense an initiating event and the first braking response [4]. Note that there are many terms (i.e., perception-response time, brake-response time, perception-reaction time, etc.) used in the literature. In the current study, DRT is used to refer to all possible response choices including braking, swerving, or a combination of these responses.

To determine a reasonable DRT, investigators interpret and compare the research methodology to the circumstances encountered by the incident through driver. In the case of drivers responding to right turning hazards, there is no available research that quantifies DRT. It is also unknown if the specific characteristics of a right turning vehicle affect the through driver's response. For example, it is unknown if the response of the through driver is affected by whether the hazard comes to a complete stop before entering the intersection. Therefore, the purpose of this study was to examine the DRT and response choices of drivers confronted with a right turning hazard at a signalized intersection. Both initially stopped and not stopped right turn hazard scenarios were considered. The results of this research provide DRT values that are applicable to collision reconstructionists and investigators when determining the avoidance potential for similar path intrusion collisions. The research can also be considered by roadway designers to ensure that current intersection safety measures are effective to mitigate collisions involving right turning vehicles and to evaluate the potential benefits of other geometric, operational, or regulatory improvements like right turn lanes or further restrictions on right turns on red.

Methods

Simulator

The experiment was conducted in the Driving in Virtual Environments (DRiVE) Laboratory at the University of Guelph using a full vehicle driving simulator. The Oktal© simulator is comprised of an instrumented Pontiac G6, six projectors, and wrap-around screens, as seen in Figure 1. The high-definition projectors and screens provide the driver with an immersive 300-degree field of view. The steering wheel was equipped with force feedback, and vibration was created in the car body through subwoofer speakers and two ButtKicker mini LFE units mounted to the vehicle frame. The simulation engine software was SCANeRstudio v.1.6 (Oktal Sydac, Paris). The simulator collected data on the position and speed of the vehicle, as well as the driver's brake and accelerator pedal application.

Virtual Environment

The roadway was modelled after two intersections in Mississauga, Ontario: Bristol Road and Kinglet Avenue, and Matheson Boulevard and McLaughlin Road. Both are busy suburban intersections located in a mixed commercial and residential area. The total route was a combination of 15 intersections joined by stretches of road for a total distance of eight kilometres. The road included two traffic lanes and one bicycle lane in each direction, and a lane in the middle that was not used for driving. Each traffic lane was 3.5 meters wide, while the bicycle lanes were 1.5 meters wide. The sidewalks were 2.3 meters wide. Roadway scenery, including trees, buildings, and sidewalks were also modelled after suburban Mississauga. There were no sightline obstructions between the through driver and any of the hazard vehicles A moderate level of vehicle, cyclist and pedestrian traffic was present on the road in every scenario. There was no vehicle traffic adjacent to or in front of the through driver. The speed limit was 60 kilometres per hour (km/h), which was indicated by signs lining the route. Lastly, road conditions were dry and skies were clear.

FIGURE 1 University of Guelph Driving Research in Virtual Environments (DRiVE) Lab full car Oktal driving simulator.

Hazard Scenarios

Two scenarios of a right turning vehicle hazard were presented once to each participant during the experiment. In both hazard scenarios, the intersection was signalized and controlled by stoplights. The participant drivers had the right-of-way. They were instructed to travel in the curb lane and to observe the 60 km/h posted speed limit.

The hazard scenarios were differentiated by the pre-impact motion of the hazard vehicles. In one hazard scenario, the right turning vehicle was initially stopped (RS) at a red light at the stop bar located ten meters from the intersection. As the through driver approached, the hazard vehicle accelerated into its right turn, intruding into their path. In the other hazard scenario, the right turning vehicle approached the intersection at a constant speed then made a right turn into the through driver's lane without stopping at the red light (RNS). The time-to-impact (the total time available for the participant driver to perceive, respond, and attempt to avoid the collision) and the eccentricity (the angle between the participant driver and the hazard vehicle) are discussed for each scenario below.

This work was part of a larger study where four different hazard scenarios were presented. The hazard scenarios were presented in a counterbalanced order such that every test participant experienced either the RS or RNS hazard early in the study and encountered each hazard scenario only once. There was a significant effect of hazard presentation order on DRT only for the RS scenario ($F(3) = 9.43$, $p < 0.001$). The results of a Tukey's HSD post hoc analysis found that the DRT values were not significantly different between the first and second ($p = 0.23$), first and third ($p = 0.06$), or second and third ($p = 0.94$) hazard presentations. The same analysis showed a significant difference between the first and fourth ($p < 0.001$) presentations. Statistical power was maximized by maintaining the largest possible sample size, and therefore the first, second, and third hazard presentations (i.e. those which were not statistically different from one another) were included in the data analysis.

Right Turning Hazard, Stopped (RS) In the initially stopped scenario, as the participant travelled straight in the curb lane of the main road, the hazard vehicle made a right turn into the through driver's path. When the hazard vehicle

FIGURE 2 Right turning hazard in the initially stopped scenario (RS) at its starting position.

came into view of the through driver, it was stopped with its front end at the stop bar (Figure 2). As the through driver proceeded through the intersection, the hazard vehicle accelerated into the driver's path at a rate of 0.15 g. This acceleration rate is consistent with previous studies of naturalistic driving at signalized intersections [2]. If the participant did not react, they collided with the hazard vehicle's left front door (Figure 3). This hazard occurred at a 4-way light controlled intersection and the participant driver had the right-of-way (i.e., was facing a green light). The time-to-impact for this scenario was 4.3 seconds. Time-to-impact was measured from the moment the front of the right turning hazard vehicle began to accelerate and simultaneously crossed the stop bar. Time-to-impact ended when the through vehicle would have struck the driver's door of the turning vehicle if the through driver did not respond. The eccentricity varied between 12-15 degrees at the time the hazard vehicle began to accelerate. The variation in eccentricity is due to the slight variation in speed of the through driver as they approached the intersection.

FIGURE 3 Position of the through and right turning hazard vehicles if the through driver did not respond to the hazard.

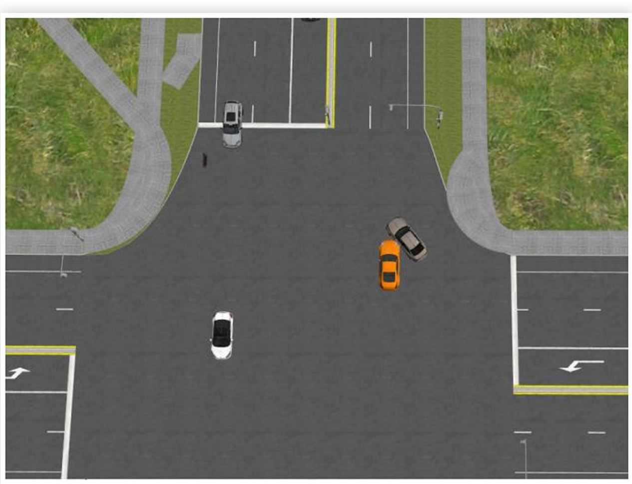
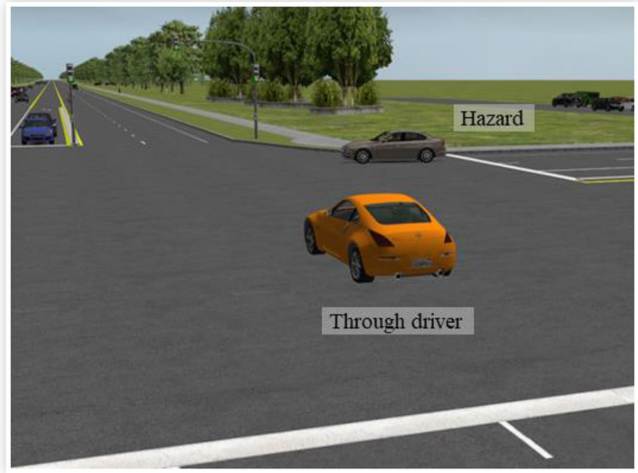


FIGURE 4 Right turning hazard vehicle and approaching through vehicle. The through vehicle is facing a green light.



Right Turning Hazard, Not Stopped (RNS) In the right turn, not stopped scenario (RNS), as the participant travelled straight in the curb lane of the main road, the hazard vehicle made a right-hand turn into the through driver's path. The hazard vehicle was travelling at a constant speed of 25 km/h and was already travelling at that speed as it came into view of the participant driver. If the participant did not react, they would have collided with the hazard vehicle's left front door (Figure 3). This hazard occurred at a 4-way light controlled intersection and the participant driver had the right-of-way (i.e. was facing a green light) (Figure 4). The time-to-impact for this scenario was 2 seconds. Time-to-impact was measured from the moment the front of the right turning hazard vehicle crossed the stop bar and ended when the through vehicle would have struck the turning vehicle if the through driver did not respond. The eccentricity was between 25 and 30 degrees.

Participants

107 participants, 57 female (Mean Age: 20.5 years, SD: 5.7 years) and 50 male (Mean Age: 21.3 years, SD: 6.7 years) completed the experiment. All participants held at least a G2 Ontario driver's licence or out of province equivalent.

Measures

The response times measured in this study were defined according to the SAE International J2944 [3] standards as follows:

Driver Reaction Time (DRT) is the time interval, measured in seconds, from the onset of the hazard to the first observable response to the hazard, as outlined in Table 1.

Braking Response Time (BRT) is the time interval between hazard onset and the driver's first contact with the brake pedal.

Steering Response Time (SRT) is the time interval between hazard onset and the first movement of the steering wheel in response to the hazard. SRT was only recorded if

TABLE 1 Descriptions of hazard onset and first observable response

Hazard	Hazard Onset	First Observable Response
Right turn, stopped (RS)	The stopped hazard vehicle accelerates to initiate a right turn into the path of the through driver.	Participant driver's first contact with the brake pedal or change in steering of at least 6 degrees.
Right turn, not stopped (RNS)	The hazard vehicle, travelling at 25 km/h, crosses the stop bar and begins its right turn into the path of the through driver.	

the steering response threshold of ±6 degrees was met or exceeded.

Brake and Steer Response time (BSRT) is the time interval between hazard onset and the first response by the driver in the case that they braked and swerved in response to the hazard. The first response was either the driver's first contact with the brake pedal or a steering response equal to or greater than ±6 degrees.

Statistical Analysis

Statistical analyses were conducted using R (R Foundation for Statistical Computing, Version 3.5.1, Vienna, Austria). First, the means, standard deviations, and 15th, 50th, and 85th percentile DRT scores for both scenarios were calculated. Mean DRTs were compared between RS and RNS using analysis of variance procedures ($\alpha \leq 0.05$). When appropriate, differences between means were assessed using a Tukey's HSD post hoc analysis. The effect of response type (brake, steer, or both) on DRT was similarly evaluated. Lastly, collision rates between the RS and RNS scenarios and the response types were compared using a Chi-square analysis ($\alpha \leq 0.05$).

Results

Descriptive statistics for both the RS and RNS scenarios are reported in Table 2, by response type. DRTs were significantly longer in the RS scenario than in the RNS scenario ($F(1) = 547.53$, $p < 0.001$). About 25% of the DRTs reported during the RNS scenario were "negative". In these cases, the participant drivers anticipated the imminent collision and began their responses prior to the hazard vehicle having crossed over the stop bar and entered the intersection. However, few of these negative responses occurred when RS or RNS was the first hazard scenario encountered by the participant driver. Specifically, when RNS was presented first, only two participant drivers began their avoidance response before the hazard vehicle had crossed over the stop bar. In other words, negative DRTs occurred overwhelmingly when RNS was presented as the 2nd or 3rd hazard scenario.

There were no significant differences in DRT between response types ($F(2)=2.03$, $p=0.14$), although in both scenarios steering responses were slower on average than braking and

TABLE 2 Descriptive statistics for the right turn, stopped and right turn, not stopped scenarios. The data is also reported by the response type.

Scenario	Response Type	N	Mean (s)	SD	Percentile (s) 15	50	85
Right turn, stopped	Brake	22	2.63	0.52	2.04	2.67	3.22
	Steer	41	2.92	0.51	2.35	2.92	3.46
	Brake and Steer	9	2.63	0.62	1.92	2.62	3.33
	Total	77[1]	2.80	0.54	2.20	2.76	3.38
Right turn, not stopped	Brake	28	0.26	0.73	-0.28	0.29	0.82
	Steer	35	0.47	0.70	-0.24	0.46	1.23
	Brake and Steer	8	0.33	0.44	-0.21	0.32	0.77
	Total	79[2]	0.37	0.69	-0.24	0.37	1.03

[1] There were 5 participants who did not respond to the right turning, stopped hazard

[2] There were 8 participants who did not respond to the right turning, not stopped hazard

combined responses. The comparison of DRTs by response type is displayed in Figure 5.

Steering was also the most common response type. Specifically, 53% of the participant drivers steered to avoid the hazard vehicle in the RS scenario, while 44% did so in the RNS scenario. Braking was also common, with 29% of drivers in the RS scenario and 35% of drivers in the RNS scenario responding by braking only. A small portion of the participants did not respond to the hazard. Frequencies for each response type are presented in Figure 6.

The scenario ($\chi^2(1) = 18.079$, $p < 0.001$) had a significant effect on the rate of collision. In the RS scenario, less than 3%

FIGURE 5 Driver response times by response type for both the stopped and not stopped right turning vehicle hazard.

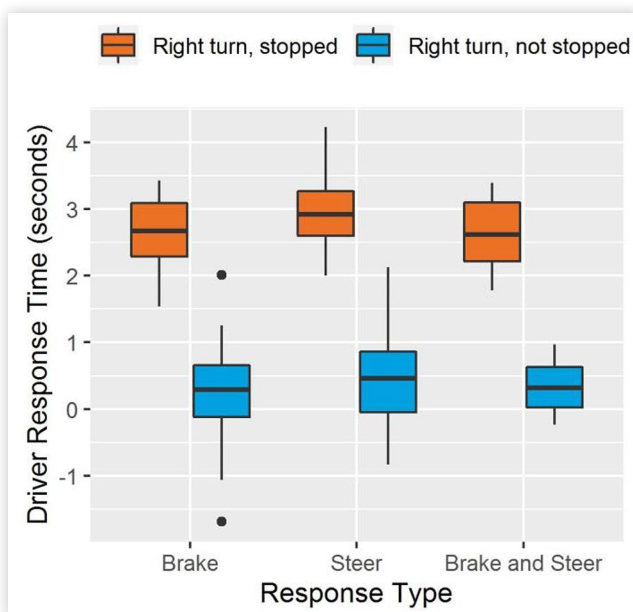


FIGURE 6 Response type rates for both right turn hazard scenarios.

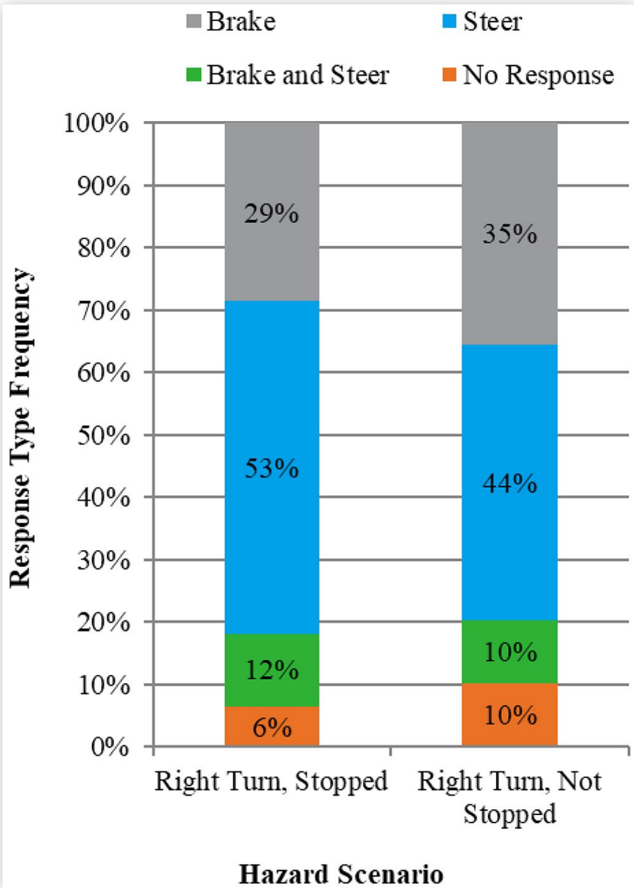
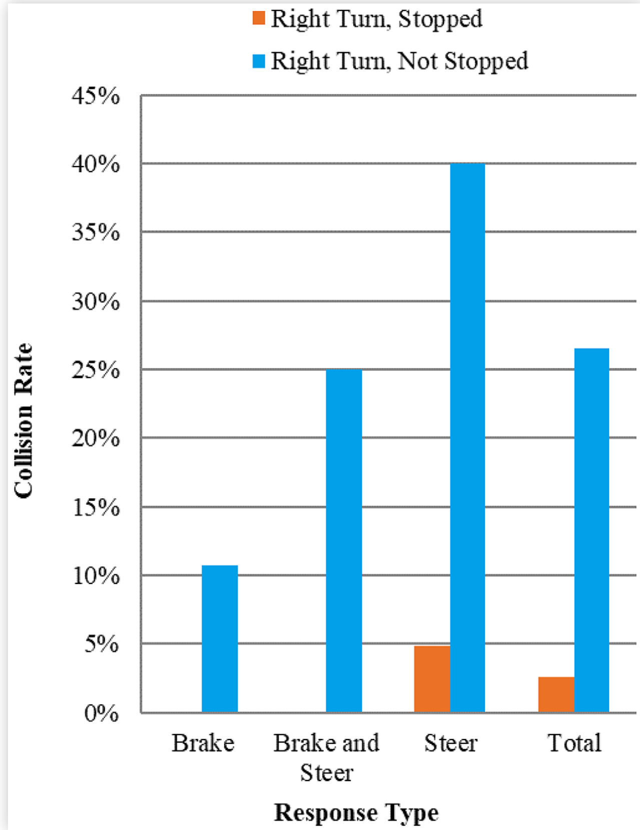


FIGURE 7 Collision rates for the right turn hazard scenarios.



of the participant drivers collided with the hazard vehicle, while in the RNS scenario 27% of participants crashed. Although the effect of the response type on collision status was not significant ($\chi^2(2) = 2.02$, $p = 0.14$), collisions did occur mostly during steering or combined responses to the right turning hazards. Figure 7 illustrates the collision rates during both scenarios, by response type.

Discussion

A driving simulator was used to investigate driver response time (DRT), response type, and collision rate for two scenarios of a right turning vehicle hazard. In one scenario, the hazard vehicle was moving at 25 km/h when it came into view of the through driver (RNS) and was stopped at the stop bar (RS) in the other. DRT in the RS scenario was significantly longer than DRT in the RNS scenario. While no previous research has focused on hazards turning right, this finding was consistent with studies on other vehicle hazard scenarios which found that drivers were more able to detect an initially moving vehicle than an initially stopped vehicle [4, 5]. For example, a review of 341 collisions involving a path intrusion hazard found that DRT was about 0.2 seconds faster when the hazard vehicle moved into the through driver's path without stopping [4]. Similarly, a driving simulator study found a 0.62 second difference between stopped and not stopped scenarios of a left turning vehicle hazard [5]. In the current study, however, there was an even greater difference (2.43 seconds) between the average DRT in the RS and RNS scenarios which may be related to the development of the hazards. The hazard avoidance framework proposed by Pradhan and Crundall [6] is used to categorize the development of the RS and RNS hazards. Under this framework, the RS scenario is an example of an abrupt onset hazard. It becomes a hazard for the through driver without first cueing the driver with evidence of a potential hazard called a behavioural precursor. Without a precursor there is a reduced chance for the through driver to predict the hazard before it has entered their path. Accordingly, hazard onset in the RS scenario occurred as the right turning vehicle began to accelerate from its stopped position. In contrast, the RNS scenario included a gradual onset hazard for which the hazard vehicle approaching the intersection provided an obvious precursor to the hazard. The hazard evidence was so apparent that about 25% of through drivers responded to the RNS hazard before it crossed the stop bar. These values were recorded as "negative" response times. For many participants, the approaching vehicle became a high priority precursor requiring a hazard avoidance response prior to the defined hazard onset. It follows that DRT was very short in the RNS scenario because many participants responded to the precursor, rather than the hazard (i.e. the hazard vehicle after crossing the stop bar).

Although the current study is the first to investigate right turning hazards, research on stopped, right incurring hazards has been conducted. The average DRT for the RS scenario was 2.80 seconds, which is longer than the average response times measured during comparable studies. For example, a simulator study that measured driver responses to right and left incurring vehicles found an average DRT of 0.96 seconds for a hazard with a time to intersection of 3.60 seconds [7]. A recent study found a brake response time (BRT) of 1.32 seconds for a right incursion hazard with a time to arrival of 3.5 seconds and eccentricity of 6.5 degrees [8]. One important reason for the increased DRT in the current study is that the virtual environment was modelled after a wide, suburban intersection, rather than a narrower urban or rural intersection like those used in both the aforementioned studies. In particular, there were about 10 meters between the stop bar and the edge of the roadway. At an intersection with sidewalks, bike lanes and extra clearance between the stop bar and the roadway, the hazard vehicle stopped at the stop bar is still far from the direct path of through driver. An attentive through driver could reasonably expect a turning driver to move forward to get a better look at oncoming traffic. However, in the RS scenario, the hazard vehicle does not stop again as the through driver would expect. It is at this point, about 2 seconds after hazard onset that most of the through drivers responded to the hazard.

While the right incursion experiments discussed above found similar DRTs, they disagreed about whether the most common response type to a right incurring hazard vehicle was braking or steering. In the current study, steering was the most common response in both scenarios. This was consistent with the findings from Hankey et al., which similarly measured SRT from the start of the hazard vehicle's acceleration until a steering input of 6 degrees or more [7]. When a hazard vehicle approaches from the right, through drivers are more likely to steer because they can increase the distance between themselves and the hazard vehicle using the lanes to the left. In hazards approaching from the left drivers typically resist steering [9], because there is no roadway on the right to move into and away from the hazard.

Collisions rates were very high for steering responses in the RNS scenario. Collisions were not more common when DRT was longer; rather collisions in this scenario were related to the lateral deviation of the through driver. Specifically, many of the through drivers steered early but moved only partially into the passing lane. In naturalistic driving, this would have given the hazard vehicle driver an opportunity to slow or stop their turn, but during the simulation, the hazard vehicle was programmed to complete the turn into the curb lane. Fewer drivers collided in the RS scenario because their responses were more aggressive; they braked harder and steered further than drivers in the RNS scenario. Future studies should investigate how the characteristics of a hazard scenario influence the through driver's steering and braking rates.

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Contact Information

Erika Ziraldo
eziraldo@uoguelph.ca

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Definitions/Abbreviations

RS - Right turn, stopped

RNS - Right turn, not stopped

BRT - Brake response time

BSRT - Brake and steer response time

SRT - Steer response time

DRT - Driver response time

Appendix

Raw Data

Legend	
Hazard Order	First Hazard = 1; Second Hazard = 2; Third Hazard = 3
Hazard Type	Right turn, stopped = RS; Right turn, not stopped = RNS
Reaction Type	Brake = B; Steer = S; Brake and Steer = BS; None = N
Driver Response Time (DRT)	Time (s)
Collision	No collision = 0; Collision = 1

Sample #	Hazard Order	Response Type	Hazard Scenario	DRT (s)	Collision
1	1	S	RS	3.71	0
2	1	S	RS	3.24	0
3	1	S	RS	3.10	0
4	1	S	RS	2.40	0
5	1	S	RS	3.27	0
6	1	S	RS	2.03	0
7	1	S	RS	2.98	0
8	1	S	RS	2.96	0
9	1	S	RS	3.10	0
10	1	BS	RS	3.39	0
11	1	B	RS	2.64	0
12	1	BS	RS	2.92	0
13	1	S	RS	3.38	0
14	1	S	RS	3.22	0
15	1	S	RS	2.37	0
16	1	B	RS	2.40	0
17	1	B	RS	3.11	0
18	1	S	RS	2.61	0
19	1	BS	RS	3.39	0
20	1	S	RS	3.55	0
21	1	B	RS	3.43	0
22	1	S	RS	3.69	0
23	1	S	RS	2.35	0
24	1	S	RS	3.14	0
25	1	S	RS	2.76	0
26	1	B	RNS	-0.45	0
27	1	N	RNS	-	0
28	1	B	RNS	1.25	0
29	1	B	RNS	0.64	1
30	1	N	RNS	-	1
31	1	S	RNS	0.83	1
32	1	B	RNS	0.16	0
33	1	S	RNS	1.43	1
34	1	S	RNS	0.52	1
35	1	B	RNS	0.76	1
36	1	B	RNS	0.37	0
37	1	S	RNS	0.45	1
38	1	B	RNS	0.40	0
39	1	S	RNS	2.13	1
40	1	S	RNS	1.24	1

(Continued)

Sample #	Hazard Order	Response Type	Hazard Scenario	DRT (s)	Collision
41	1	N	RNS	-	0
42	1	S	RNS	0.89	1
43	1	BS	RNS	0.97	1
44	1	S	RNS	0.30	0
45	1	S	RNS	-0.83	1
46	1	S	RNS	1.10	1
47	1	B	RNS	0.82	0
48	1	S	RNS	0.74	1
49	1	S	RNS	0.57	0
50	1	N	RNS	-	1
51	1	S	RNS	0.21	0
52	2	B	RS	2.42	0
53	2	B	RS	1.98	0
54	2	N	RS	-	0
55	2	S	RS	2.18	0
56	2	N	RS	-	0
57	2	S	RS	2.71	0
58	2	B	RS	3.26	0
59	2	N	RS	-	0
60	2	S	RS	2.60	0
61	2	S	RS	3.46	0
62	2	B	RS	1.54	0
63	2	BS	RS	2.40	0
64	2	BS	RS	2.62	0
65	2	S	RS	2.53	0
66	2	S	RS	3.34	0
67	2	S	RS	3.41	0
68	2	S	RS	2.20	0
69	2	S	RS	3.47	0
70	2	S	RS	2.65	0
71	2	N	RS	-	0
72	2	S	RS	3.20	0
73	2	BS	RS	3.10	0
74	2	B	RS	2.70	0
75	2	S	RS	2.85	0
76	2	BS	RS	2.22	0
77	2	B	RS	3.19	0
78	2	B	RNS	0.45	1
79	2	S	RNS	1.17	0
80	2	B	RNS	0.05	0
81	2	B	RNS	-1.06	0
82	2	S	RNS	0.47	1
83	2	S	RNS	-0.26	0
84	2	B	RNS	-0.28	0
85	2	BS	RNS	0.78	0
86	2	B	RNS	-0.64	0
87	2	S	RNS	0.47	0
88	2	B	RNS	-1.69	0
89	2	B	RNS	0.09	0
90	2	S	RNS	1.78	0
91	2	BS	RNS	0.42	1
92	2	B	RNS	0.27	0

(Continued)

Sample #	Hazard Order	Response Type	Hazard Scenario	DRT (s)	Collision
93	2	BS	RNS	0.23	0
94	2	BS	RNS	0.58	0
95	2	BS	RNS	-0.23	0
96	2	S	RNS	0.26	0
97	2	S	RNS	1.50	0
98	2	B	RNS	-0.23	0
99	2	S	RNS	0.62	1
100	2	S	RNS	1.51	0
101	2	B	RNS	0.47	0
102	2	B	RNS	0.32	0
103	2	B	RNS	0.12	0
104	2	B	RNS	-0.09	0
105	2	BS	RNS	0.11	0
106	3	B	RS	2.71	0
107	3	B	RS	2.68	0
108	3	B	RS	3.23	0
109	3	S	RS	2.92	1
110	3	B	RS	2.75	0
111	3	S	RS	4.23	1
112	3	B	RS	2.02	0
113	3	B	RS	2.66	0
114	3	S	RS	2.67	0
115	3	B	RS	2.35	0
116	3	B	RS	2.19	0
117	3	BS	RS	1.84	0
118	3	B	RS	3.38	0
119	3	N	RS	-	0
120	3	S	RS	3.12	0
121	3	B	RS	2.27	0
122	3	S	RS	2.31	0
123	3	B	RS	3.04	0
124	3	S	RS	2.18	0
125	3	BS	RS	1.78	0
126	3	S	RS	2.90	0
127	3	S	RS	3.47	0
128	3	S	RS	2.81	0
129	3	B	RS	1.88	0
130	3	S	RS	2.76	0
131	3	S	RS	2.00	0
132	3	S	RNS	0.02	1
133	3	S	RNS	-0.20	0
134	3	S	RNS	-0.80	0
135	3	S	RNS	0.46	0
136	3	S	RNS	-0.30	0
137	3	B	RNS	-0.22	0
138	3	B	RNS	0.59	0
139	3	S	RNS	0.15	0
140	3	N	RNS	-	0
141	3	S	RNS	-0.08	0
142	3	B	RNS	0.71	0
143	3	BS	RNS	-0.23	0
144	3	S	RNS	-0.25	1

(Continued)

Sample #	Hazard Order	Response Type	Hazard Scenario	DRT (s)	Collision
145	3	S	RNS	-0.24	0
146	3	S	RNS	0.33	0
147	3	N	RNS	-	0
148	3	N	RNS	-	0
149	3	B	RNS	0.96	0
150	3	N	RNS	-	0
151	3	S	RNS	-0.16	0
152	3	B	RNS	0.20	0
153	3	S	RNS	0.59	0
154	3	S	RNS	-0.01	0
155	3	B	RNS	1.19	0
156	3	B	RNS	2.01	0

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