THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Digital Billboards and Traffic Safety Risks

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THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

NCTSPM
NATIONAL CENTER FOR TRANSPORTATION SYSTEMS PRODUCTIVITY AND MANAGEMENT

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RESEARCH SCOPE

- Investigate links between Digital Advertising Billboards-Distraction-Traffic Safety Risk

- Multi-state and multi-facet approach
  1. State-of-Practice-Synthesis
  2. Survey of Road Users
  3. Driving Simulator Study
  4. Epidemiological Study

DIGITAL BILLBOARDS UNIQUE FEATURES

- Brightness and contrast with surroundings
- Messages changing suddenly
- Realistic imagery
- No acclimation with message
- Potential for message sequencing
- Potential for interactivity with driver

1. STATE-OF-PRACTICE SYNTHESIS
Approach

- Meta-analysis studies
- Crash studies of historical trends
- Laboratory studies
- Naturalistic studies of driving behavior

STATE-OF-PRACTICE SYNTHESIS
Findings

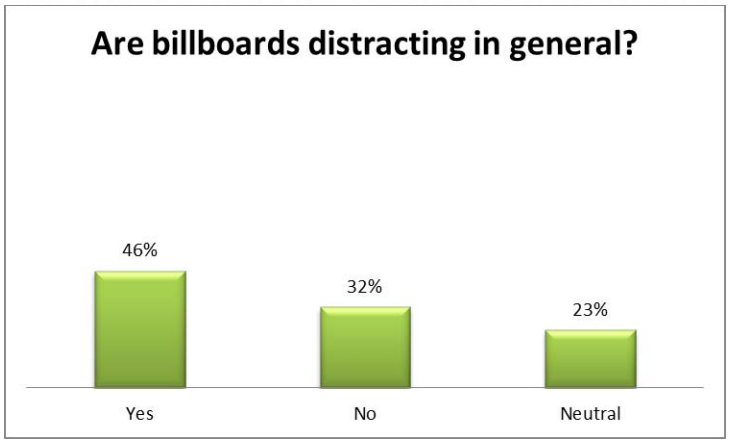
- Overall, the state-of-practice synthesis suggests that there is evidence of correlation between digital advertising billboards and increased driver distraction.

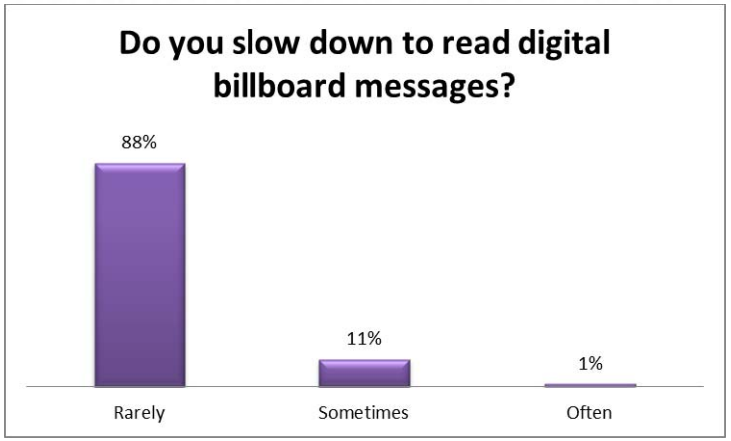
- However, local conditions, experimental settings, and other factors may play a role in the actual impact that digital advertising billboards have on traffic safety

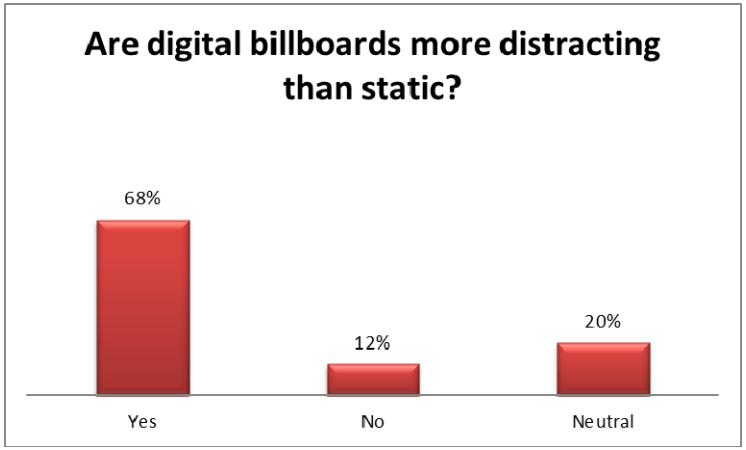
2. SURVEY OF ROAD USERS
Approach

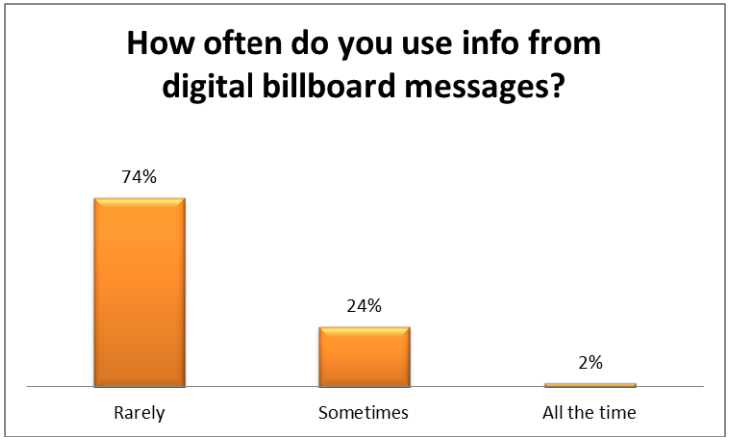
- Goal: Survey of driver's perceptions and attitudes toward digital advertising billboards
  - Demographics/Exposure
  - Perceived safety and efficiency
  - Regulations
- Method:
  - Online
- Response:
  - 295 AL; 429 FL

SURVEY OF ROAD USERS
Sample Findings- Alabama Drivers

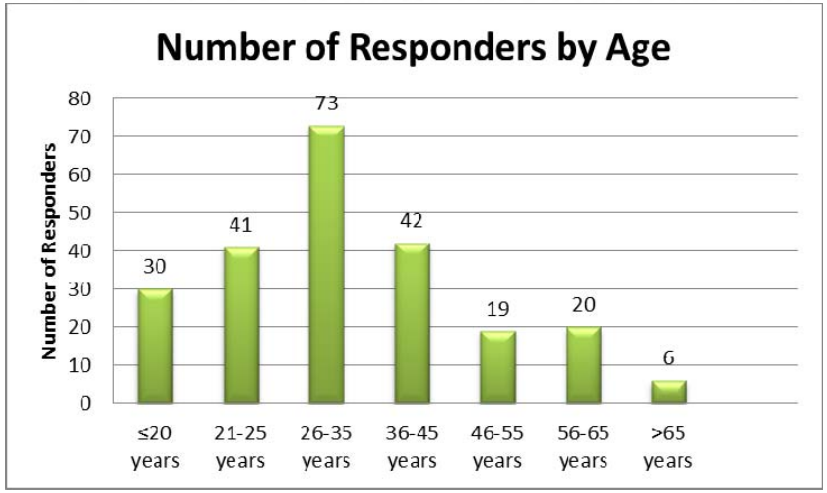


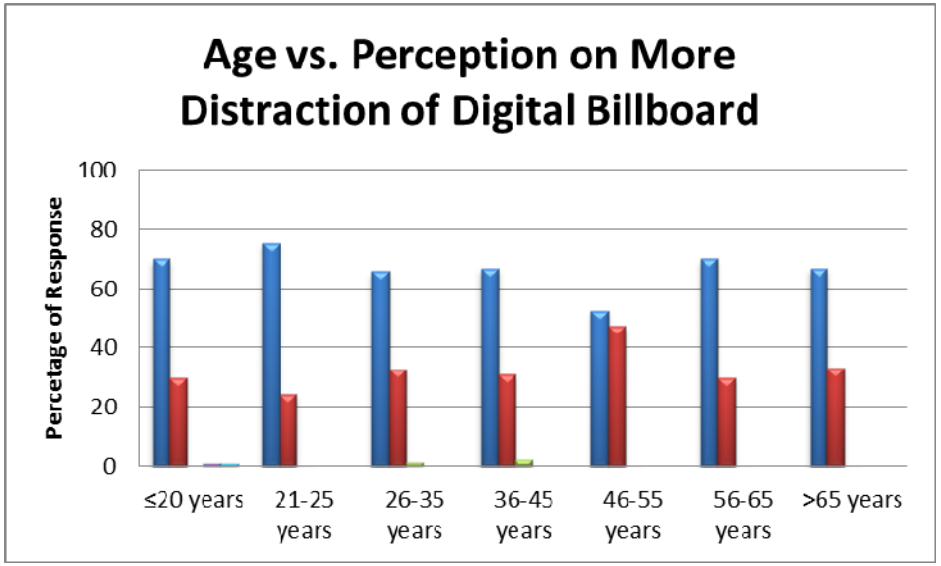




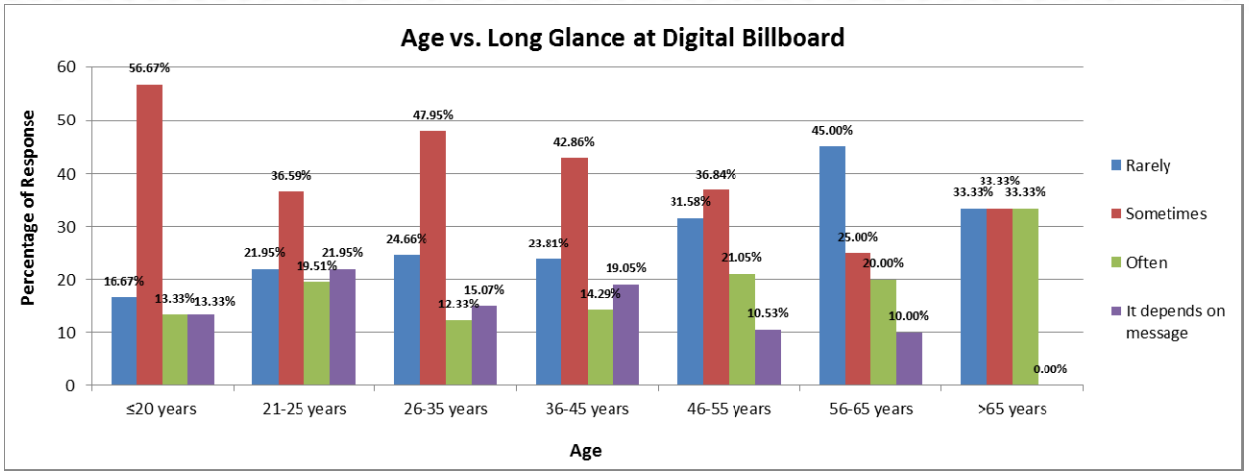


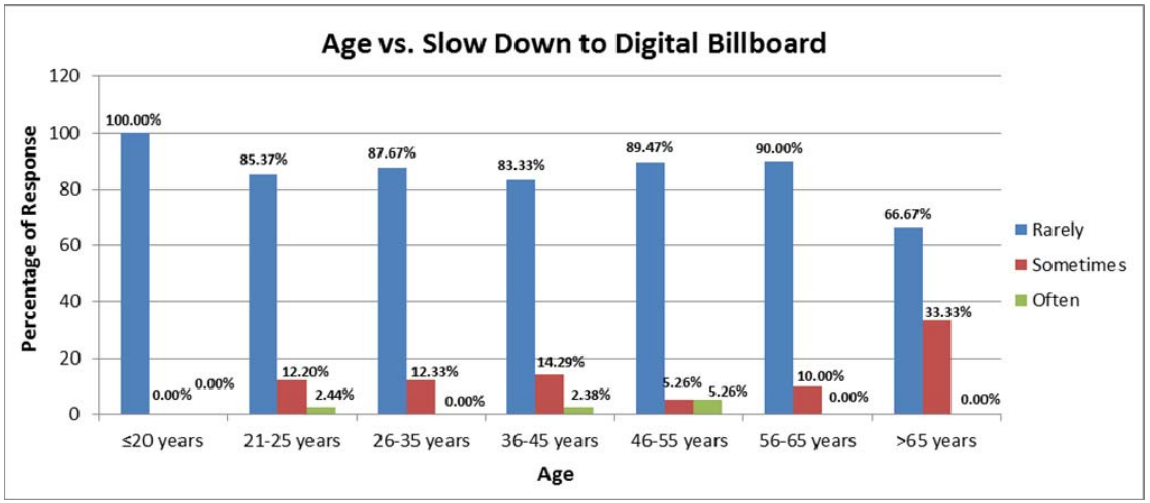
SURVEY OF ROAD USERS
Sample Findings- Alabama Drivers





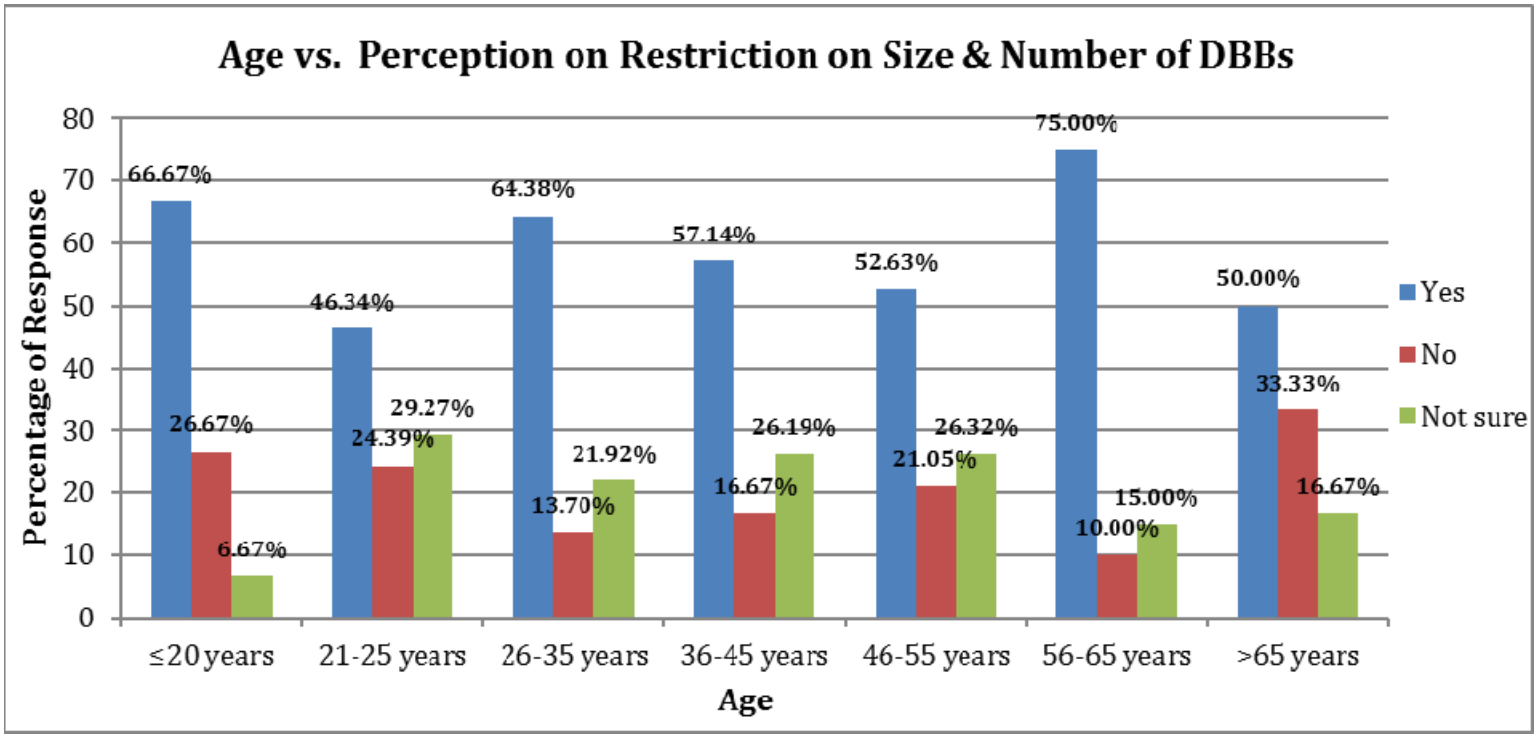
SURVEY OF ROAD USERS
Sample Findings- Alabama Drivers





SURVEY OF ROAD USERS
Sample Findings- Alabama Drivers

Q: Should there be restrictions on the size and number of digital billboards for traffic safety?



SURVEY OF ROAD USERS
Findings Summary- Alabama Drivers

- Road users perceive digital billboards as more dangerous than static
- Younger drivers admit staring at digital billboards longer without adjusting their speeds
- Responders overwhelmingly agree on the need for stricter regulations of billboards (related to the location of billboards, size and number of DBBs)

3. DRIVING SIMULATION STUDY
Approach

- Goal: Evaluate the distractive effects of roadside billboards through the use of the UAB driving simulator
- Approach:
  - Developed driving simulator data collection protocol
  - Developed driving simulator scenarios
    - 16 mile simulated highway driving scenario, with a mixture of digital and static billboards
  - Recruit participants (57)
  - Data collection and analysis

DRIVING SIMULATION STUDY
Analysis

- Length of Eye Gaze

  Percent of time participants spent looking at billboards while driving

- Memory Recall and Recognition

  Post-drive memory recall of information presented on billboards.

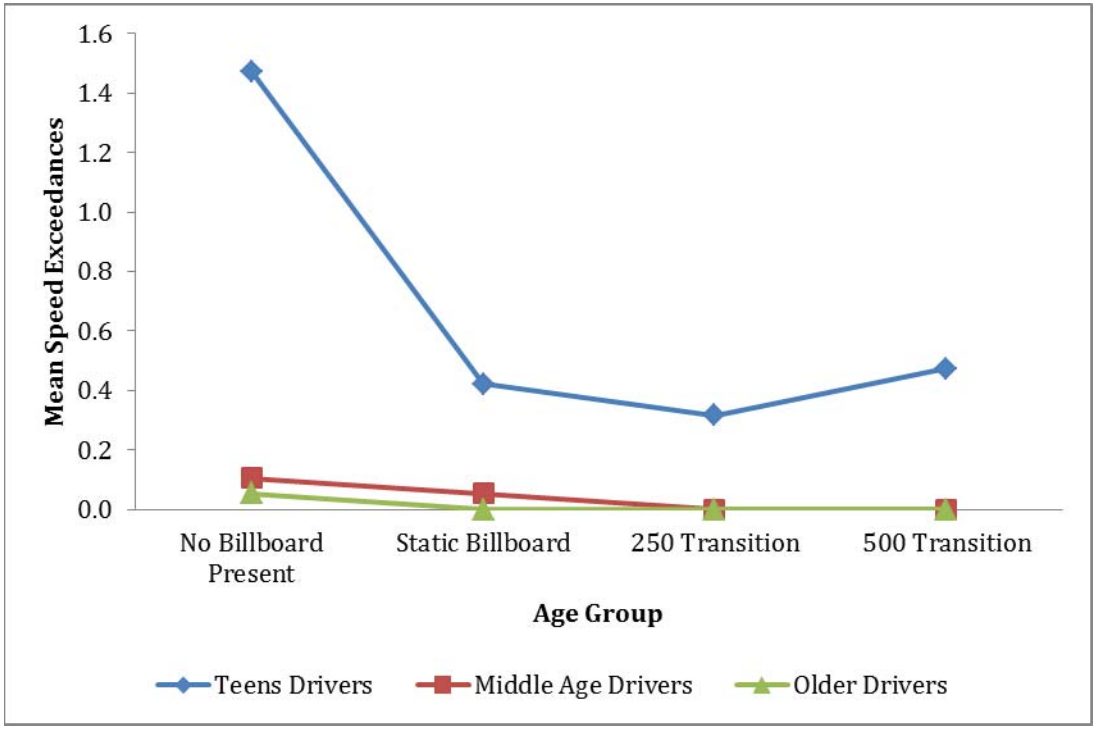
- Driving Performance

  a) the number of speed limit exceedances, v>69 (mph)

  b) the number of road edge excursions, and

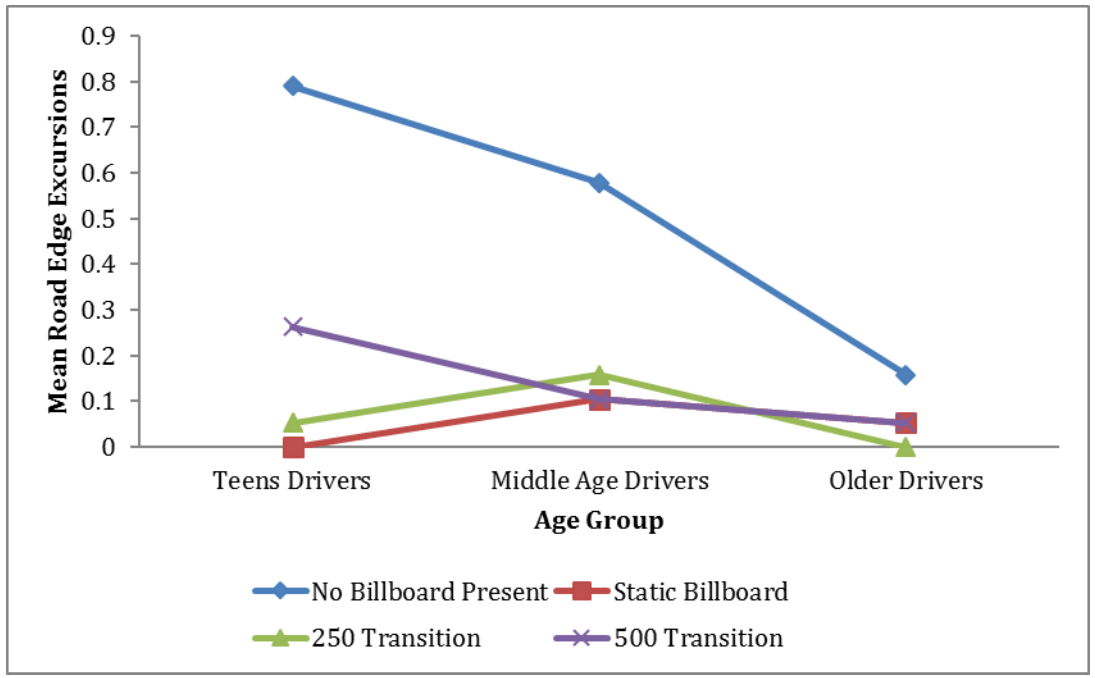
  c) the total number of motor vehicle collisions

DRIVING SIMULATION STUDY
Sample Findings



- Participants had fewer speed exceedances when there was a billboard present
- Teens, as expected, had more speed exceedances than middle aged and older drivers

DRIVING SIMULATION STUDY
Sample Findings



DRIVING SIMULATION STUDY
Conclusions

- Significant main effects of age group and billboard type were found
- Billboards drew the visual attention of teen drivers significantly more than that of drivers in the other age groups
- Digital billboards, particularly those transitioning at 500 ft, evoked significantly more attention than static billboards
- Teens had more speed exceedances than middle aged and older drivers
- Older drivers had poorer performance in the recognition and recall tests compared to middle aged drivers

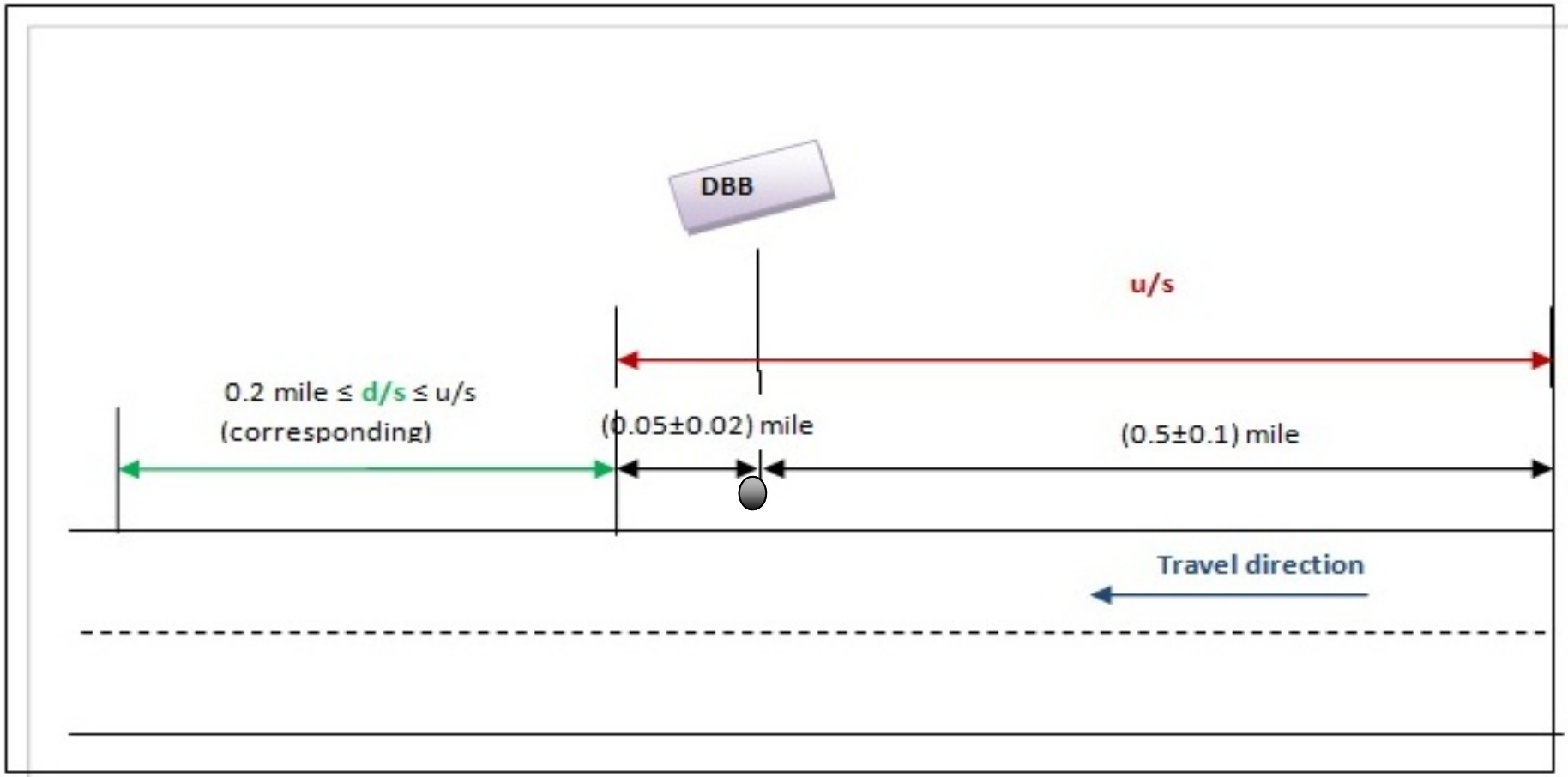
4. CRASH ANALYSIS
Approach

- Goal: Analysis of historical crash records in the vicinity of digital billboards
- Approach:
  - Identification of digital billboards
  - Select study segments (0.5 mile u/s + 0.02 mile d/s of DBBs) and control segments (farther d/s from DBBs)
  - Obtain historical crash data from reliable sources
  - Perform spatial analysis of crash data (where and how far from DBBs) to find statistical relationships between crash rate and digital billboard presence.

CRASH ANALYSIS
Study site selection criteria

- Long, straight section of road
- No billboard inside the influence and non-influence zones
- Good visibility
- Uniform traffic flow (AADT)
- Similar roadway geometry (e.g. lane number, lane width etc.)

CRASH ANALYSIS
Typical layout of study location



Schematic diagram of a typical study location (u/s and d/s)

CRASH ANALYSIS
Approach- Specifics-1

- ✓ Identification of sites
  - o AL: I-65; I-20/59, I-459; I-565; I-85; I-10
  - o FL: SR 826, SR 408, and SR 528. I-95, I-395, and I-4
- ✓ The impact of digital advertising billboard on traffic safety has been analyzed at 8 and 10 DBB locations on limited access facilities in AL and FL respectively
- ✓ 377 crashes in FL and 77 crashes in AL were used for analysis
- ✓ Crash data analysis

$$CR = \frac{Crash\ Count\ * 10^6}{0.5 * AADT * 365 * L * N}$$

Example of study site;
Location ID 19 on I-4 WB in Tampa

4. CRASH ANALYSIS
Crash Rates by Location– Alabama Sites

Summary Crash Statistics at the AL Digital Billboard Locations

Loc	City	DBB Influence Zone (U/S)				DBB Non-Influence Zone (D/S)				% Change in Crash Rate
		Len. (mi)	Total Crash Count	AADT	Crash Rate*	Len. (mi)	Total Crash Count	AADT	Crash Rate*	
1	Mobile	0.453	6	368990	0.197	0.453	7	368990	0.229	16.67
2	Mobile	0.467	15	470500	0.374	0.237	9	470500	0.442	18.23
3	Mont-gomery	0.396	5	228640	0.303	0.396	2	228640	0.121	-60.00
4	Madison	0.373	4	291580	0.202	0.373	1	291580	0.050	-75.00
5	Huntsville	0.353	3	453160	0.103	0.353	4	453160	0.137	33.33
6	Huntsville	0.486	3	453160	0.075	0.207	0	453160	0.000	-100.00
7	Bessemer	0.505	4	249850	0.174	0.505	5	249850	0.217	25.00
8	Bessemer	0.497	9	248480	0.399	0.497	0	248480	0.000	-100.00
Total crashes		3.53	49	344489	0.221	3.021	28	324859	0.156	**-29.19**

4. CRASH ANALYSIS
Crash Rates by Location– Florida Sites

Summary Crash Statistics at the FL Digital Billboard Locations

Loc.	City	DBB Influence Zone (U/S)				DBB Non-Influence Zone (D/S)				% Change in Crash Rate
		Len. (mi)	Total Crash Count	AADT	Crash Rate*	Len. (mi)	Total Crash Count	AADT	Crash Rate*	
1	Delray Beach	0.23	1	195,000	0.041	0.54	14	193,250	0.245	501.70
2	Miami	0.39	13	123,808	0.492	0.21	9	143,333	0.546	11.06
3	Doral	0.40	21	210,000	0.457	0.35	36	211,667	0.888	94.38
4	Miami	0.20	15	162,900	0.841	0.20	41	160,720	2.330	177.04
5	Miami	0.19	97	245,000	3.806	0.26	35	251,543	0.977	-74.32
6	Hallandale Beach	0.28	54	232,389	1.516	0.24	15	238,253	0.479	-68.39
7	Eatonville	0.40	3	160,000	0.086	0.40	3	151,500	0.090	5.61
8	Orlovista	0.36	1	60,000	0.085	0.17	2	60,000	0.358	323.53
9	Orlando	0.40	2	42,750	0.214	0.17	0	---	0.000	-100.00
10	Tampa	0.40	8	153,750	0.238	0.34	7	153,929	0.244	2.82
Total Crashes		3.25	215	---	0.809	2.88	162	---	0.608	**-24.79**

CRASH ANALYSIS SUMMARY FINDINGS
Crash rates by location

- From the analysis on crash rates by location it is found that:
  - Crash rate is 29% higher at DBB influence zones in Alabama, compared to non-influence zones
  - Crash rate is 25% higher at DBB influence zones in Florida, compared to non-influence zones

CRASH ANALYSIS
Crash type– Alabama Sites

Summary Statistics by Crash Type- AL

Crash Type	Upstream		Downstream		%Change in Crash Rate
	Crash Count	Crash Rate[1]	Crash Count	Crash Rate[1]	
Non-collision	1	0.005	0	0	-100.00
Single Vehicle Crash	7	0.032	8	0.045	40.63
Angle (front to side) Same Direction	1	0.005	0	0	-100.00
Rear End	11	0.050	7	0.039	-22.00
Side Impact (90 degrees)	1	0.005	0	0	-100.00
Sideswipe – Same Direction	6	0.027	0	0	-100.00
Record from Paper System	22	0.099	13	0.072	-27.27
Total Crashes	49	0.221	28	0.156	**-29.19**

CRASH ANALYSIS
Crash Type– Florida Sites

Summary Statistics by Crash Type- FL

Crash Type	Upstream		Downstream		Percent Change in Crash Rate
	Crash Count	Crash Rate[2]	Crash Count	Crash Rate[2]	
Rear-end	82	0.373	99	0.373	-0.12
Sideswipe	88	0.346	40	0.187	-45.74
Collision with Fixed Objects[1]	43	0.222	21	0.098	-55.84
Median Crossover	1	0.041	2	0.063	54.27
Tractor/Trailer Jackknifed	1	0.028	0	0.000	-100.00
Total Crashes	215	0.809	162	0.608	**-24.79**

CRASH ANALYSIS SUMMARY FINDINGS
Crash rates by location

- From the analysis on crash type it is found that:
  - In Alabama, out of 7 crash types, the number of crashes for all crash types except single vehicle crashes is higher at DBB influence zones
  - In Florida, out of 5 crash types, all crash types except median crossover type are over-represented at DBB influence zones

CRASH ANALYSIS
Crash severity– Alabama Sites

Summary Statistics by Crash Severity- AL

Crash Severity	Upstream		Downstream		Percent Change in Crash Rate
	Crash Count	Crash Rate[1]	Crash Count	Crash Rate[1]	
Fatal Injury	2	0.009	1	0.006	-33.33
Incapacitating Injury	6	0.027	1	0.006	-77.78
Non-incapacitating Injury	0	0	2	0.011	---
Possible Injury	4	0.018	1	0.006	-66.67
Property Damage Only (PDO)	35	0.158	22	0.123	-22.15
Unknown	2	0.009	1	0.006	-33.33
Total Crashes	49	0.221	28	0.156	**-29.19**

CRASH ANALYSIS
Crash severity– Florida Sites

Summary Statistics by Crash Severity- FL

Crash Severity	Upstream		Downstream		Percent Change in Crash Rate
	Crash Count	Crash Rate[1]	Crash Count	Crash Rate[1]	
Fatal	0	0.000	1	0.026	---
Injury	98	0.478	72	0.274	-42.63
Property Damage Only (PDO)	117	0.476	89	0.328	-31.03
Total Crashes	215	0.809	162	0.608	**-24.79**

CRASH ANALYSIS SUMMARY FINDINGS
Crash severity

- The analysis on crash injury severity reveals:
  - Higher number of more severe crashes at DBB influence zones in Alabama and Florida, although the overall number of severe accidents is small
  - Property damage only (PDO) type crashes comprises a large portion of all crashes occurred in both Alabama and Florida

CRASH ANALYSIS DISCUSSION

- Summary conclusions:
  - While variations were observed from site to site, the overall results were consistent between the two states and showed higher crash rates at DBB influence study sites.
- Recommendations:
  - It is recommended to validate the results using more sites, longer study segments and larger sample of crash data
  - Future study may incorporate the comparison of findings from AL and FL with other states
  - Study of the impact of DBB placement (right vs. left side of the road; on premises and off premises digital billboards) is also recommended
  - Study of the driver distraction level based on type of message and delivery method

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- Contributors to the study include:
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Thank You