TANTALA ASSOCIATES, LLC
CONSULTING ENGINEERS

AN UPDATE OF A STUDY OF THE RELATIONSHIP BETWEEN DIGITAL BILLBOARDS AND TRAFFIC SAFETY IN CUYAHOGA COUNTY, OHIO

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AN UPDATE OF A STUDY OF THE RELATIONSHIP BETWEEN DIGITAL BILLBOARDS AND TRAFFIC SAFETY IN CUYAHOGA COUNTY, OHIO

Key points:

- Eight years of accident data comparison
- Seven digital boards on Interstate Routes with eight second dwell times
- Data shows no statistically significant increase in accident rates
- Driver Age (young/elderly) is a neutral factor
- Time of day (daytime/nighttime) is a neutral factor

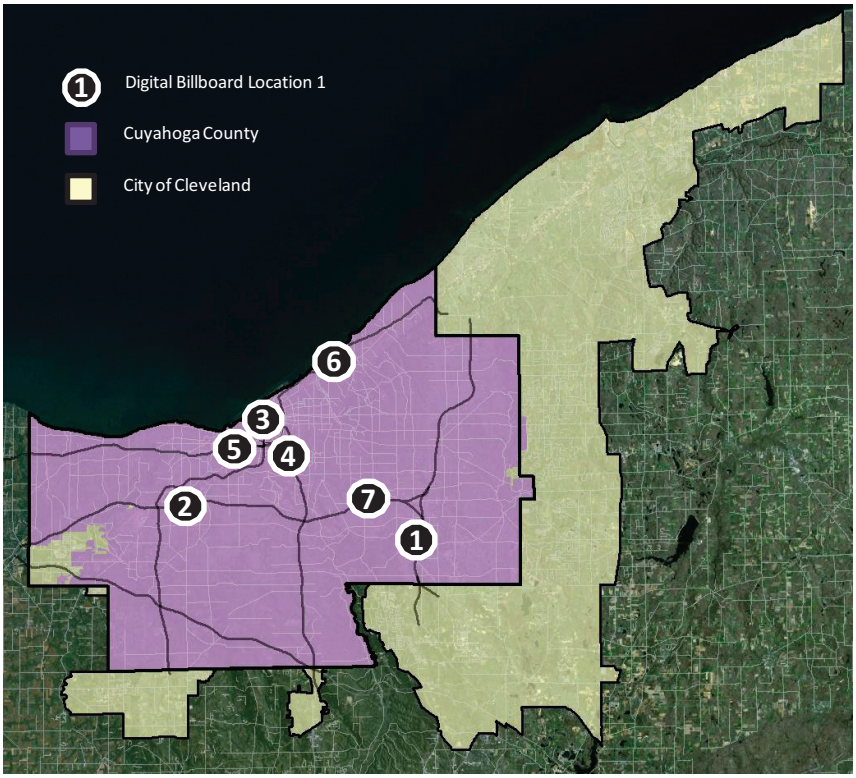

Figure 1.
Digital Billboard locations in Cuyahoga County, Ohio and within the City of Cleveland

Eight years of data …

… no statistically significant relationship with the occurrence of accidents …

… age of drivers and time of day are neutral factors.

OVERVIEW

This **2009 study** is an update of our 2007 study of the statistical relationship between digital billboards and traffic safety in Cuyahoga County, Ohio. This study revisits the same seven digital billboards in Ohio for longer periods of time and looks more closely at comparisons of specific attributes within accident reports, including comparisons of driver age (young/elderly) and time of day (daytime/nighttime).

This 2009 study examines and compares **eight years of traffic accident data** near seven digital billboards in Ohio. This eight-year comparison more than doubles the three-year study period in 2007. This study analyzed traffic and accident data along Interstate Routes I-77, I-90, I-271, and I-480 and near seven existing, digital billboards (see Figure 1). The seven billboards have eight-second dwell times, were converted to digital from conventional format in July 2005 and collectively have traffic volumes as much as 335 million vehicles per year. The study uses official data as collected, compiled and recorded independently by the Ohio Department of Transportation. Over eight years, this accident data represents approximately 46,000 accidents on Interstate Routes within the County and 360,000 accidents on all roads within the County.

Temporal (*when and how frequently*) and spatial (*where and how far*) statistics were summarized near billboards within multiple vicinity ranges within 0.2, 0.4, 0.6, 0.8, and 1.0 miles upstream and downstream of the billboards.

The overall conclusion of this study is that **digital billboards in Cuyahoga County have no statistically significant relationship with the occurrence of accidents**.

This study reinforces the findings of our original study for longer periods of time with a robust eight years of data. This study also finds that the **age of drivers (younger/elderly) and the time of day (daytime/nighttime) are neutral factors** which show no increase in accident rates near the digital billboards in Cuyahoga County.

This conclusion is based on the Ohio Department of Transportation's own data and an objective statistical analysis; **the data shows no increase in accident rates**.

STUDY REGION

Cuyahoga County was revisited as a study region, because the County has multiple digital billboards in close proximity which were in service for extended periods of time (five percent of the Interstate billboards in Cuyahoga County are digital), and the Interstate Routes adjacent to these billboards are heavily traveled with approximately 12.6 million vehicle-miles traveled per day on these Interstate Routes.

Cuyahoga County is the most populous County in Ohio with 1.4 million people, with a population density of 3,040 people per land-square-mile, and with a median age of 37. The County is south of Lake Erie, and is contiguous with six other counties in Ohio.

Cuyahoga County's seat is the City of Cleveland, and is part of the Greater Cleveland metropolitan area. Cuyahoga County has 571,000 households with an average household size of 2.39 people. In Cuyahoga County, approximately 623,000 workers commute, with a mean travel time of 24.4 minutes.

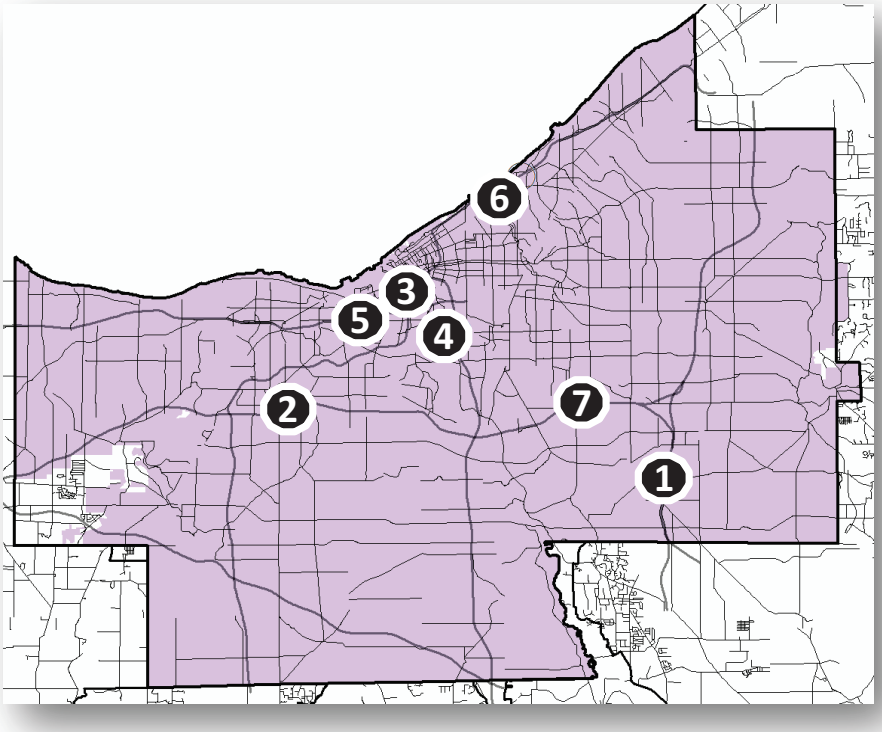

Figure 2.
Digital Billboard locations in Cuyahoga County, Ohio

Cuyahoga County is served by three primary (two-digit) Interstate Routes (I-71, I-77, and I-90) and three (three-digit) auxiliary Interstate Routes (I-271, I-480, and I-490). Cuyahoga County's transportation infrastructure serves 1.2-million registered, motor vehicles of which 82% are passenger vehicles. The County has 132.07 Interstate-highway miles, 18.90 turnpike miles, 107.21 U.S.-highway miles and 232.56 State-highway miles. In 2005, the estimated daily vehicle miles traveled (DVMT) was 28.3 million, of which 12.6 million (44.5%) was on Interstate Routes. In 2005, the number of reported traffic accidents was 37,039, of which 5,400 (14.6%) were on Interstate Routes.

BILLBOARD CHARACTERISTICS

Digital billboards display static messages which, when viewed, resemble conventional painted or printed billboards. With digital technology, a static copy "dwells" and includes no animation, flashing lights, scrolling, or full-motion video. The static display on each of these digital billboards has a "dwell time" of eight seconds.

The digital billboards were designed and manufactured by *Daktronics*, and use red, green, and blue light-emitting-diode (LED) technology to present text and graphics. The digital billboards compensate for varying light levels, including day and night viewing, by automatically monitoring and adjusting overall display brightness levels. A photocell is mounted on each digital billboard to measure ambient light. All seven digital billboards are owned and operated by *Clear Channel Outdoor*.

BILLBOARD No.	ROUTE	LOCATION	SIGN CONFIG	DIGITAL FACE ADVERTISES TO DIRECTION	FACE SIZE (FEET)	READ
1	INTERSTATE 271	West side of I-271 (125 feet South of Solon Road)	Free Standing, Vee Flag Double Faced	Southbound	14x48	Right Hand Reader
2	INTERSTATE 480	South side of I-480 (2 miles East of I-71)	Free Standing, Parallel Faced Double Faced	Westbound	14x48	Cross Reader
3	INTERSTATE 90	South side of Innerbelt Freeway (100 feet East of West 3rd Street)	Free Standing, Parallel Faced Double Faced	Eastbound	14x48	Right Hand Reader
4	INTERSTATE 77	West side of I-77 (0.3 miles South of Pershing Avenue)	Free Standing, Parallel Faced Double Faced	Southbound	14x48	Right Hand Reader
5	INTERSTATE 90	South side of I-90 (70 feet East of West 55th Street)	Free Standing, Vee Flag Double Faced	Eastbound	14x48	Right Hand Reader
6	INTERSTATE 90	South side of I-90 (0.5 miles West of Eddy Street)	Free Standing, Vee Flag Double Faced	Westbound	14x48	Cross Reader
7	INTERSTATE 480	North side of I-480 (0.5 miles East of Broadway Avenue)	Free Standing, Vee Flag Double Faced	Westbound	14x48	Right Hand Reader

Figure 3.
Digital Billboard locations, configuration, sizes and other characteristics

The static display on each of these digital billboards has a "dwell time" of eight seconds.

Each of the seven digital billboards is a freestanding, single-pole, double-faced structure with one digital face that measures 14-feet high and 48-feet wide (a face area of 672 square feet). The digital billboards are numbered 1 to 7 and are located along major Interstate Routes (I-77, I-90, I-271, and I-480). The locations of the seven billboards in Cuyahoga County are shown in Figures 2 and 3 which summarize location, configurations, sizes and other characteristics. These are the only digital billboards in Cuyahoga County. The digital billboards and their surroundings were observed during day and night conditions.

Figure 4 summarizes conversion dates and compares the timelines of comparison of the 2007 study (three-year period) with this study (eight-year period). The billboards were converted from conventional to digital format in July 2005. This allows for before/after comparisons in excess of eight years individually with a cumulative of 56 years. Additional billboard-location photos, aerials, and map references for each billboard number are included within this report.

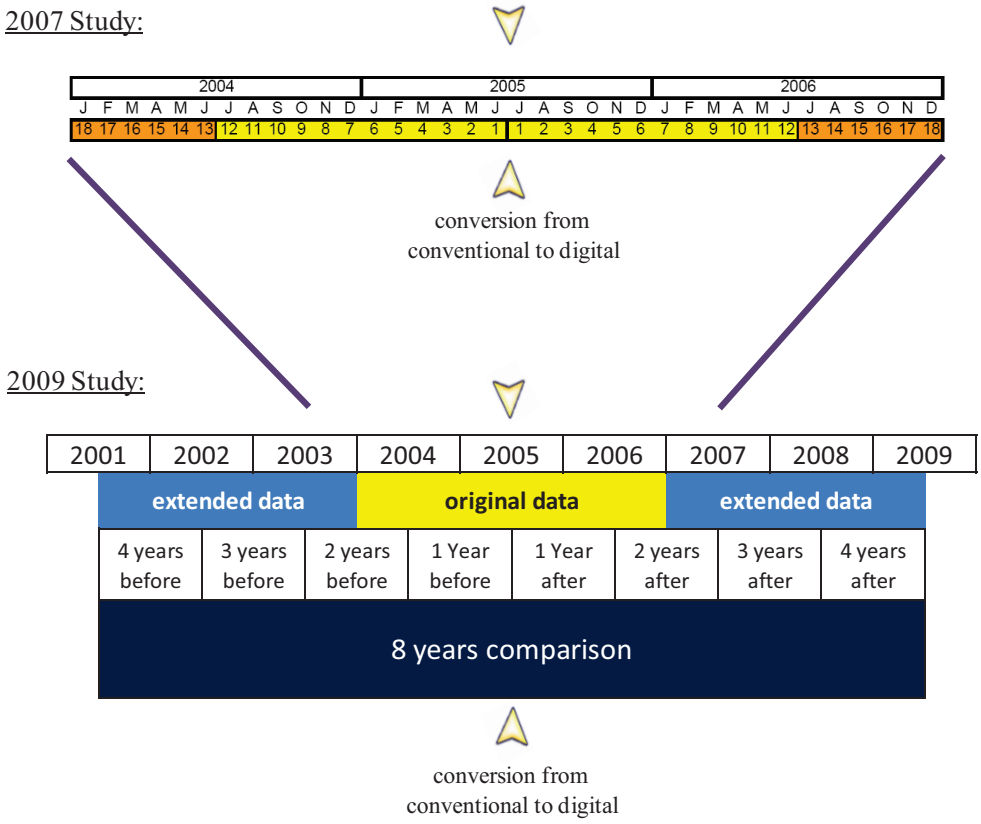

Figure 4.
Digital Billboard Conversion Dates and period of study in 2007 study compared with this 2009 study

Figure 5 summarizes characteristics of the digital billboards and the Interstate Routes to which they advertise. This includes the Route's lanes and geometry and the billboard's overall height, hagl, distance to nearest advertising and opposite lanes.

Billboard No.	Interstate Route No.	Number of Lanes	Interstate Breakdown Widths (Feet)	Overall Height	HAGL Height Above Grade Line	Distance from Upright to Nearest Lane	Distance from Upright to Nearest Lane in Opposite Direction
				(All dimensions in feet ±)			
1		6 total 3 NB 3 SB	10-36-4 181 4-36-10	97	83	88.0	304.4
2		8 total 4 WB 4 EB	10-48-11 4 11-48-10	50	36	106.1	178.7
3		8 total 4 NB 4 SB	0-52-6 4 6-52-0	180	166	55.4	111.5
4		6 total 3 NB 3 SB	10-36-4 2 4-36-10	83	69	80.4	126.0
5		10 total 5 WB 5 EB	10-60-3 70 3-60-10	115	101	144.4	315.0
6		8 total 4 WB 4 EB	10-48-3 3 3-48-10	65	51	136.1	195.6
7		8 total 4 WB 4 EB	10-48-6 26 6-48-10	87	73	174.6	246.0

Figure 5.
Interstate Route Characteristics near digital billboards including number of lanes, widths, sign height, height above grade line, and distances to lanes

Billboard No. 1 advertises to traffic on the southbound lanes of Interstate Route 271 south of the Solon Road overpass. The digital face is a right-hand reader and a vee, flag configuration with an overall height of 66 feet and an offset distance of 85 feet to the nearest lane to which it advertises. Figure 6 is a photo of the digital face. Figure 9 shows the location in an oblique aerial. The digital face was converted from a conventional face on the existing structure in July 2005.

Figure 6. Digital Billboard 1 on I-271

Billboard No. 2 advertises to traffic on the westbound lanes of Interstate Route 480 about two miles east of I-271. The digital face is a left-hand cross-reader and has a parallel-faced configuration with an overall height of 50± feet and an offset distance of 178.7 feet to the nearest lane to which it advertises. Figure 7 is a photo of the digital face. Figure 10 shows the location in an oblique aerial. The digital face was converted from a conventional face on the existing structure in July 2005.

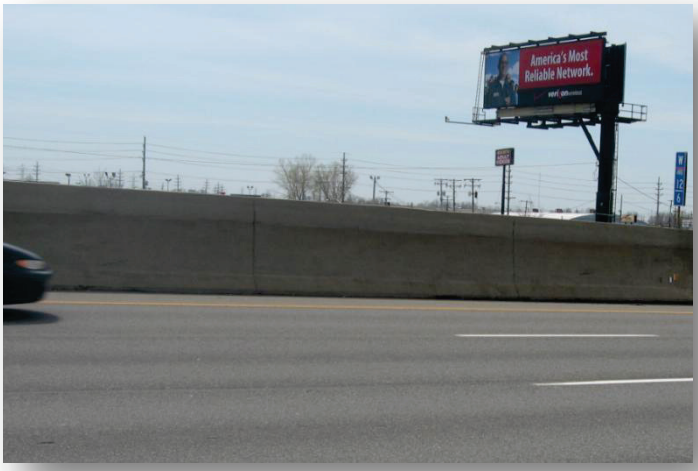

Figure 7. Digital Billboard 2 on I-480

Billboard No. 3 advertises to traffic on the eastbound lanes of Interstate Route 90, east of West 3rd Street. The digital face is a right-hand reader and has a parallel-faced configuration with an overall height of 180± feet and an offset distance of 55.4 feet to the nearest lane to which it advertises. Figure 8 is a photo of the digital face. Figure 11 shows the location in an oblique aerial. The digital face was converted from a conventional face on the existing structure in July 2005.

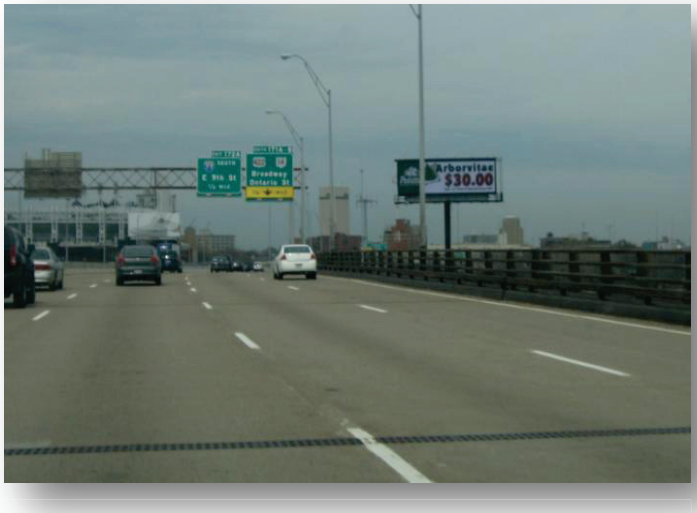

Figure 8. Digital Billboard 3 on I-90

Figure 9. Oblique Aerial of Digital Billboard 1 on I-271

Figure 10. Oblique Aerial of Digital Billboard 2 on I-480

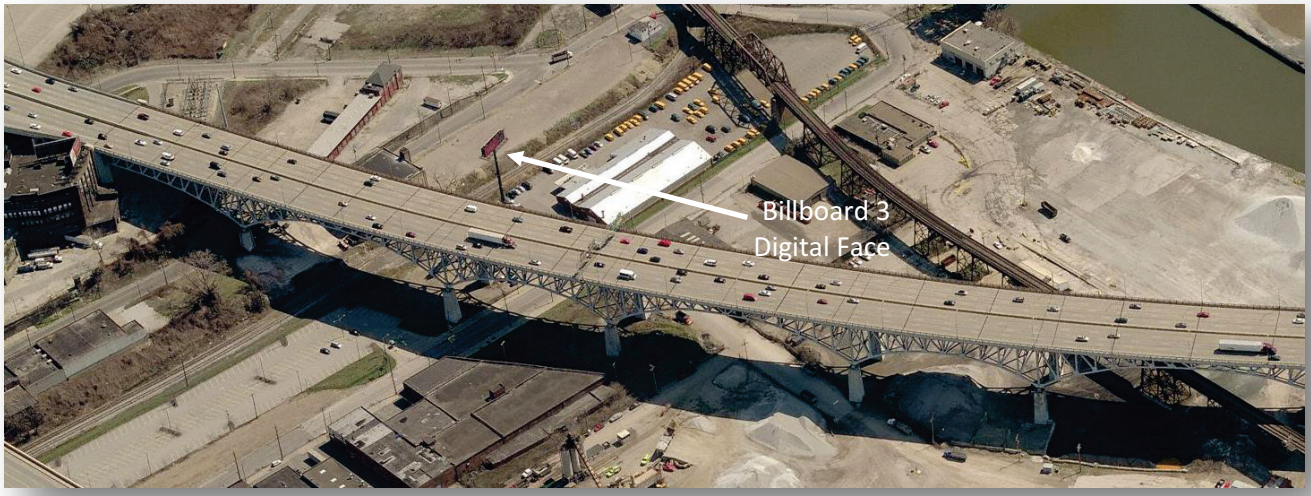

Figure 11. Oblique Aerial of Digital Billboard 3 on I-90

Billboard No. 4 advertises to the traffic on southbound lanes of Interstate Route 77, south of Pershing Avenue. The digital face is a right-hand reader and has a parallel-faced configuration with an overall height of 83± feet and an offset distance of 80.4 feet to the nearest lane to which it advertises. Figure 12 is a photo of the digital face. Figure 14 shows the location in an oblique aerial. The digital face was converted from a conventional face on the existing structure in July 2005.

Figure 12. Digital Billboard 4 on I-77

Billboard No. 5 advertises to traffic on the eastbound lanes of Interstate Route 90, east of West 55th Street. The digital face is a right-hand reader and has a vee, flag configuration with an overall height of 115± feet and an offset distance of 144.4 feet to the nearest lane to which it advertises. Figure 13 is a photo of the digital face. Figure 15 shows the location in an oblique aerial. The digital face was converted from a conventional face on the existing structure in July 2005.

Figure 13. Digital Billboard 5 on I-90

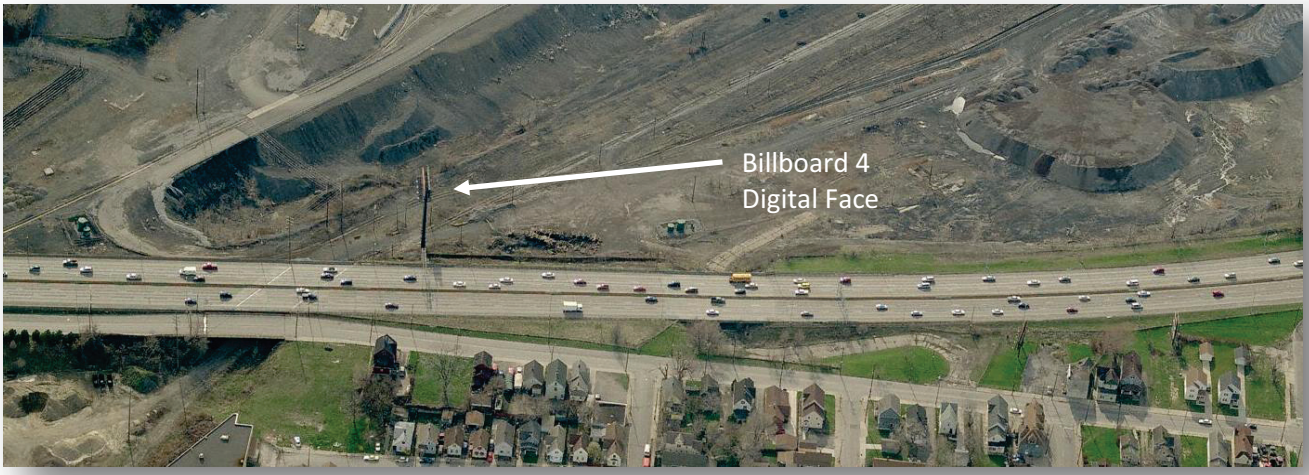

Figure 14. Oblique Aerial of Digital Billboard 4 on I-77

Figure 15. Oblique Aerial of Digital Billboard 5 on I-90

Billboard No. 6 advertises to traffic on the westbound lanes of Interstate Route 90, west of Eddy Street. The digital face is a left-hand cross-reader and has a vee, flag configuration with an overall height of 65± feet and an offset distance of 195.6 feet to the nearest lane to which it advertises. Figure 16 is a photo of the digital face. Figure 18 shows the location in an oblique aerial. The digital face was converted from a conventional face on the existing structure in July 2005.

Figure 16. Digital Billboard 6 on I-90

Billboard No. 7 advertises to traffic on the westbound lanes of Interstate Route 480, east of Broadway Avenue (Route 14). The digital face is a right-hand reader and has a vee, flag configuration with an overall height of 87± feet and an offset distance of 174.6 feet to the nearest lane to which it advertises. Figure 17 is a photo of the digital face. Figure 19 shows the location in an oblique aerial. The digital face was converted from a conventional face on the existing structure in July 2005.

Figure 17. Digital Billboard 7 on I-480

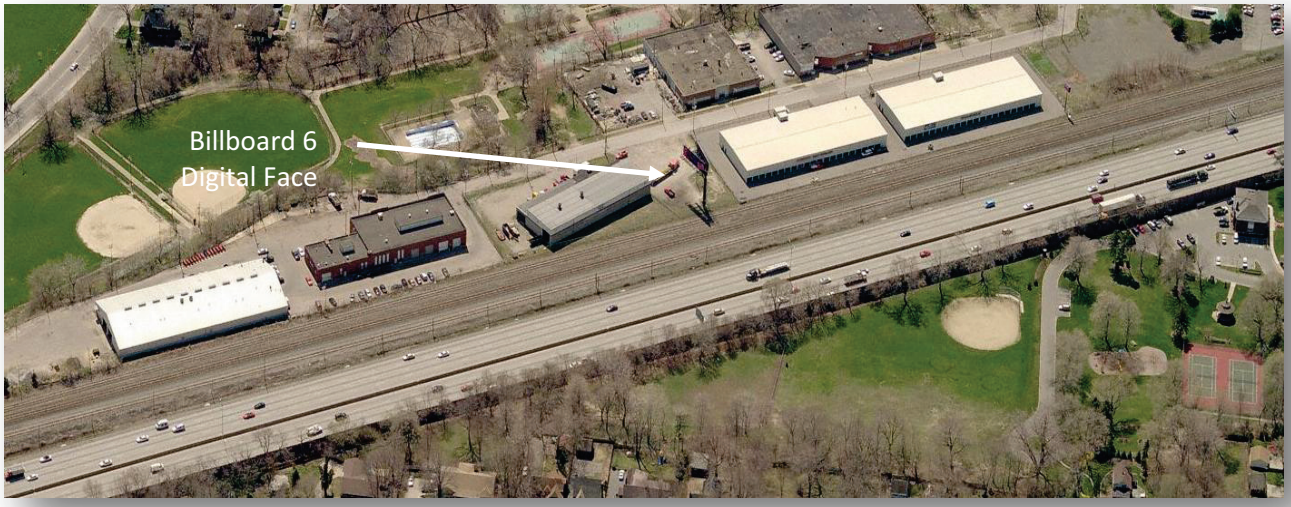

Figure 18. Oblique Aerial of Digital Billboard 6 on I-90

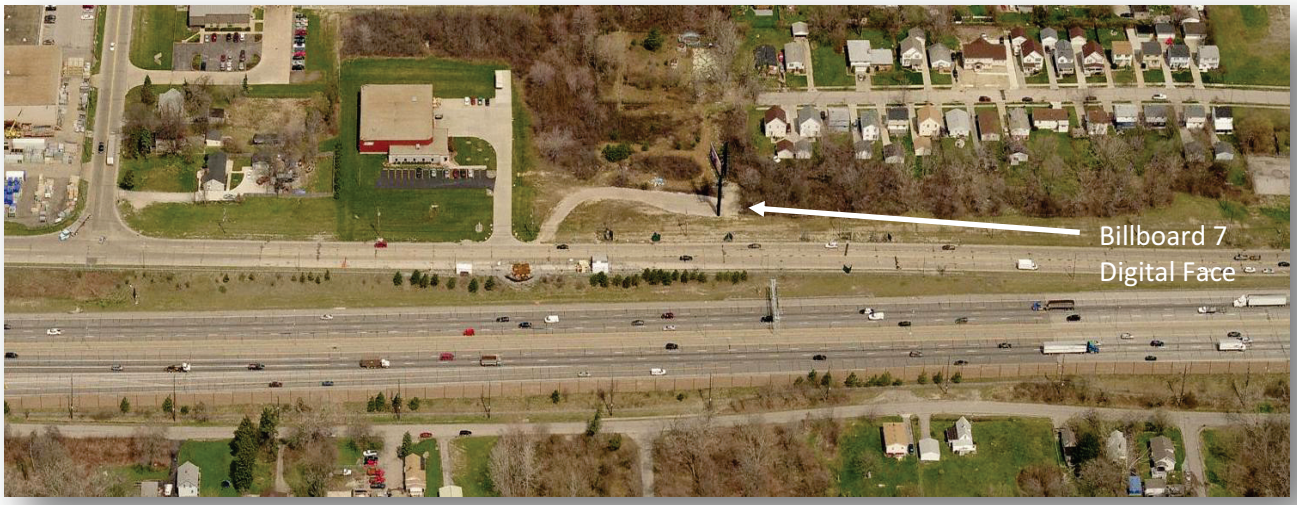

Figure 19. Oblique Aerial of Digital Billboard 7 on I-480

AADT ranges individually near the seven billboards from 118,000 to 160,000 vehicles per day, or equivalently 43 to 58 million vehicles per year.

TRAFFIC VOLUME DATA

Traffic volume data for the Cuyahoga County was obtained from the *Ohio Department of Transportation* (ODOT) and the County Engineer's Office. Traffic-monitoring data includes vehicle volume, vehicle classification, and weigh-in-motion data. The metrics of traffic flow provided by ODOT include short-term (hourly) traffic counts, annual average daily traffic (AADT), and daily vehicle miles traveled (DVMT). This includes the annual average daily traffic (AADT), which is the average of 24-hour counts collected every day in the year. AADT Traffic volumes were recorded in Cuyahoga County between 2000 and 2009.

A sample of the AADT values is summarized in Figure 20. AADT ranges individually near the seven billboards from 118,000 to 160,000 vehicles per day, or equivalently 43 to 58 million vehicles per year. For all seven billboards, this collectively represents 915 thousand vehicles per day or 335 million vehicles per year.

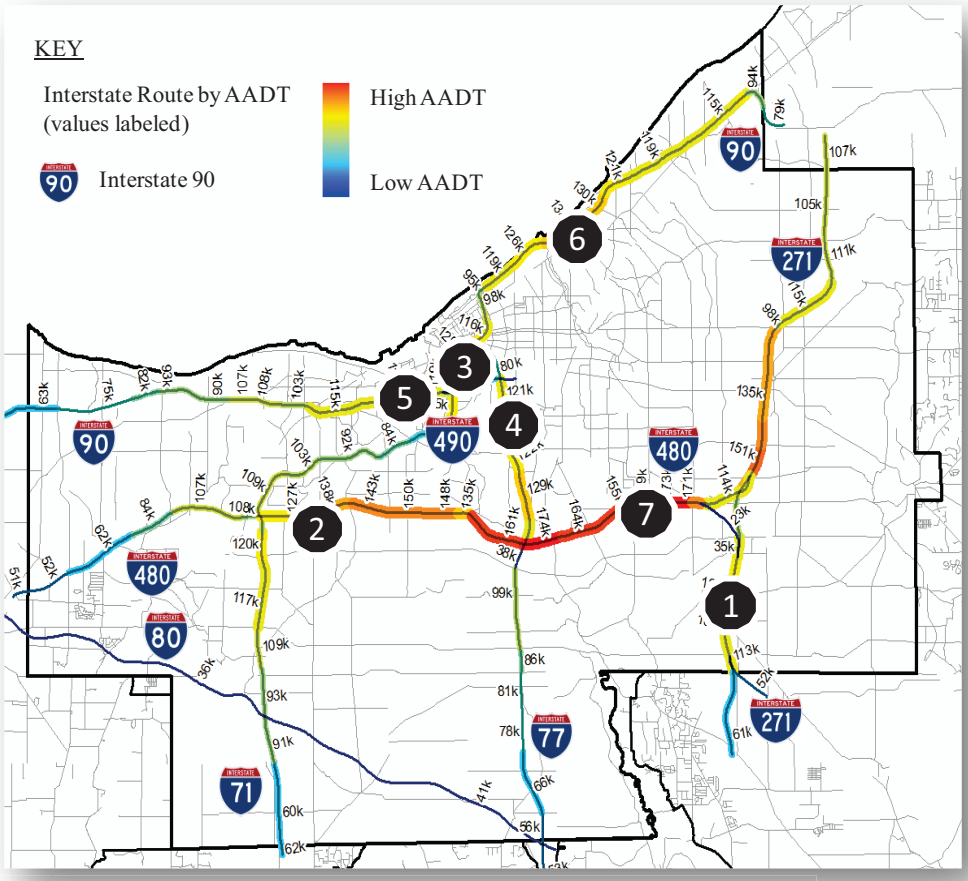

Figure 20. AADT Traffic Volume Data in Cuyahoga County

ACCIDENT DATA

In Ohio, the majority of Interstate accident reports and crash photos are investigated, recorded, and maintained by the *Ohio State Highway Patrol*. Ohio uses the *American National Standards Institute*'s (ANSI) Standard D16.1 – 1996, Manual on Classification of Motor Vehicle Traffic Accidents. The reports also provide annually to the *Ohio Department of Public Safety*, which compiles statistical data on crashes that occur on roads and highways.

Figure 21 summarizes the traffic accident data of the past eight years in Cuyahoga County on the Interstate Routes I-71, I-77 and I-90, I-271, I-480, and I-490.

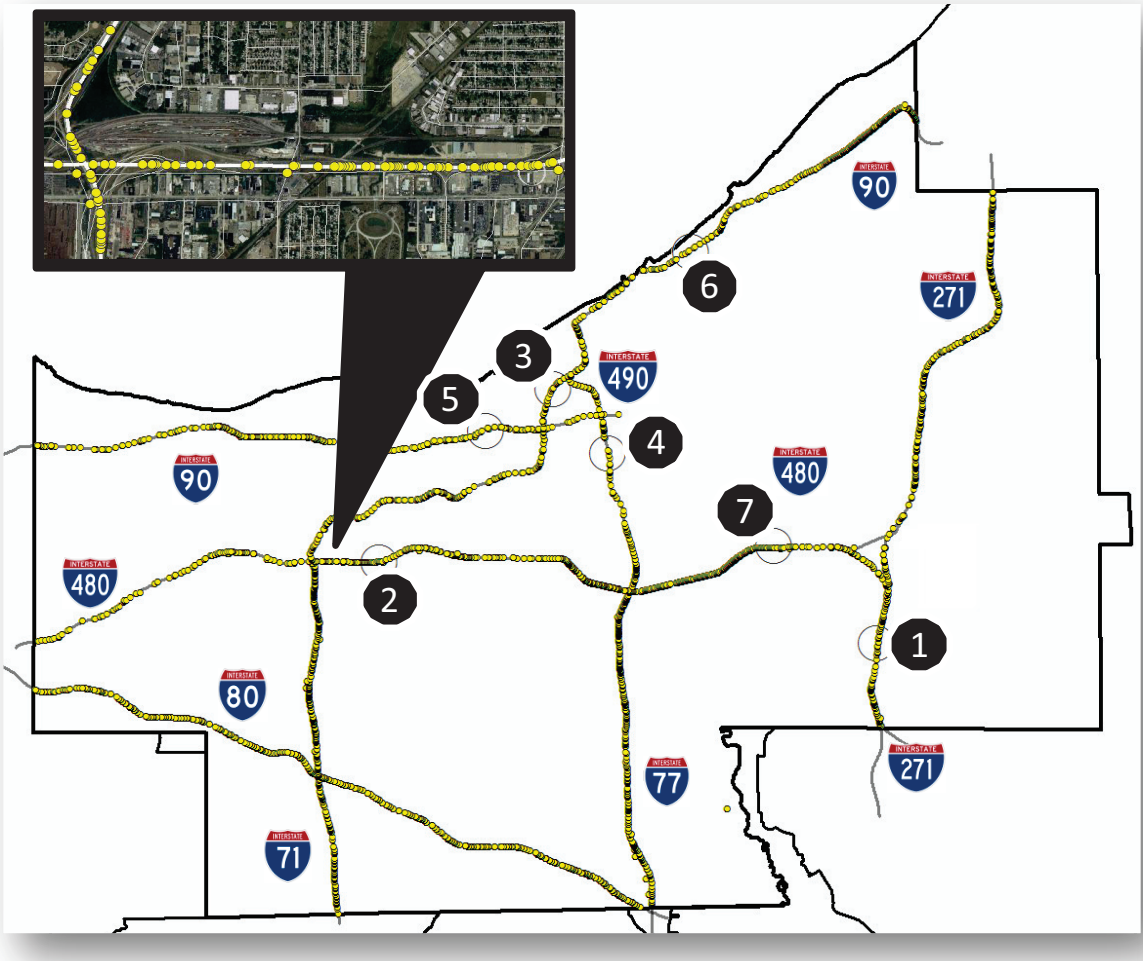

Figure 21. Traffic Accidents (yellow dots) in Cuyahoga County along Interstate Routes, 2001-2009

Figure 22 summarizes the traffic accident data of the past eight years in Cuyahoga County and shows the distribution of accidents by year, month, day of week and time of day. This represents a consistent pattern of data and illustrates that more accidents occur on weekdays and at rush hour (before and after work), during winter months, and during weekdays.

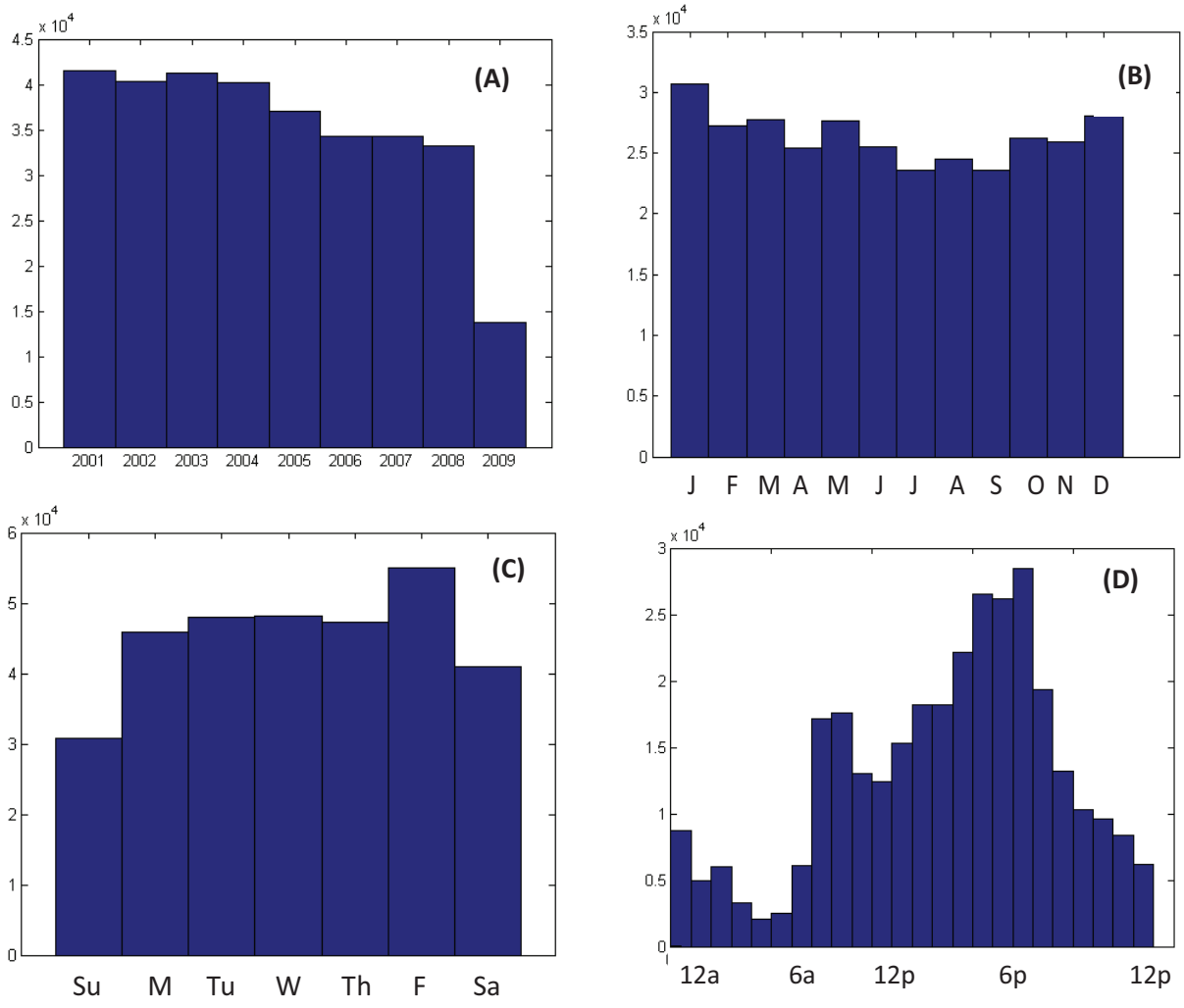

Figure 22. Histogram of traffic accident data of the past eight years in Cuyahoga County for all roads by (A) year, (B) month, (C) day of week and (D) time of day. Note that these figures and related data represent data from 2001 to 2009 and accident reports in 2009 were only available for January to July. This is reflected in Figure 22(A) in the 2009 bar.