Abrams Associates
TRAFFIC ENGINEERING, INC.

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Assistant City Planner
City of Santa Clara
1500 Warburton Avenue
Santa Clara, CA 95050

Re: Review of the Potential Effects of Digital Billboards on U.S. 101 Freeway Accident Rates in the City of Santa Clara

Dear Ms. Patel,

The purpose of this letter is to summarize the results of my review of the accident history before and after installation of digital billboards along U.S. 101 in the City of Santa Clara. Outfront Media asked me to conduct this review based on comments it apparently received from the Planning Commission regarding a digital billboard it is proposing.

By way of background, I am a licensed professional traffic engineer. I have had my professional engineering license for over 30 years. I am also president and owner of Abrams Associates Traffic Engineering, which has been in business for over 40 years. I have successfully provided traffic and transportation analyses for hundreds of projects throughout the Bay Area. I also previously served for five years as the contract City Traffic Engineer for the City of El Cerrito.

Summary

The primary basis for this analysis was a detailed review of the California Highway Patrol (CHP) accident records for U.S. 101. Of the three dual-direction digital billboards along U.S. 101 in Santa Clara, only one was installed during a time period where the standard five years of accident data was available both before and after the installation. At this digital billboard location (941 Laurelwood Road) there was actually a decrease in accidents in the five years after the installation of the sign along the adjacent segment of U.S. 101 (which was 1,000 feet in both directions, for the purposes of this analysis).

To put the data we collected on the effect of digital billboard displays on accident rate into context, we also analyzed two “control” segments to determine the

baseline trends in accidents on segments where no digital displays exist. Unfortunately, the lack of long-term data for the two control segments means one cannot draw any conclusions of any import. Analysis of these segments also yielded inconsistent data, with accidents slightly increasing along one control segment and more than doubling on the other control segment.

Even where five years of data exists before and after the placement of a digital display, our analysis also indicated that the CHP freeway accident data cannot be used to make any statistically reliable conclusions about the effects of local digital billboards on freeway accident rates. There are simply too many variables at play that affect the analysis. Below is a list of the variables/factors that, taken all together, essentially make it impossible to make any solid conclusions about the effects of digital billboard installations on the small sample size of signs that exist along U.S. 101 within Santa Clara:

- The random nature of the number of accidents per year (this can vary by 15% per year or more on a freeway segment, even with no obvious changes).

- Inconsistency in the locations of individual accidents in the database (Freeway accidents are unfortunately only reported to the nearest 10^{th} of a mile, or 528 feet; therefore, in most cases meaning the actual location of various accidents cannot be precisely determined).

- Mistakes with data entry are a significant problem with the CHP database (There are typically many spelling mistakes in the names of roadways which makes it challenging to locate all the accidents in an area, and the extent of this problem seems to vary by year).

- Changes in police enforcement have been proven to affect accident rates, making it more difficult to filter out the effects of digital billboard installations. For example, during the same years where there have been reduced enforcement there have also been significant increases in accidents with fatalities.

- The increasing use of cellphones (without hands free devices) has been increasing and has been proven to increase accidents.

- Freeway construction can also result in increases in accidents, even if this construction is minor, and these accidents may not always be properly logged as being caused by construction.

While the overall data collection effort did not provide reliable data on which to base general conclusions, the 941 Laurelwood Road sign site provided the best data set for analysis, as we could review five years of accident data before and after the sign installation. Although the most comprehensive data was available at 941 Laurelwood Road, the decrease in accidents (about 12%) does not statistically exceed the random yearly fluctuations in accidents (15%). As a result, the decrease is not nearly enough to make any solid conclusions about the effects of the digital billboard installation given it is probably not possible to filter out the effects all of the other variables listed above. The inconsistencies with the control segments, combined with the factors listed above, lead to the conclusion that it is simply not possible reliably filter out the effects of the digital billboard installation. In general, there are so many other factors that potentially affect the accident analysis results (as described below) that it's not possible to make any solid conclusions about the effects of the digital billboards using the CHP accident data.

Methodology

In order to address the questions raised by the Santa Clara Planning Commission on correlation between digital display billboards and traffic accidents, we endeavored to collect and study traffic accident data from the CHP database for the three digital display billboards along U.S. 101 within Santa Clara and determine if a reliable trend could be established with the accident rates. However, two of the segments installed at times where there was insufficient data to analyze the conditions before and after the installation. The digital billboard at the intersection of Duane Avenue with Raymond Street was installed in 2011. Unfortunately, the SWITRS database only goes back to 2010, so it was not possible to conduct an adequate analysis of the conditions before the installation at this location. Conversely, the digital billboard at 630 Laurelwood Road was installed in 2022 so, at that location, it was not possible to conduct an adequate analysis of the conditions *after* the installation. As a result, the only digital billboard location in Santa Clara that could be analyzed was the one at 941 Laurelwood Road, which was installed in 2015. For this location (and for two control segments on either side) the accidents were reviewed for 1,000 feet in each direction for the five-year period preceding the installation year, and also for

the five-year period after the installation. Accidents involving driving under the influence and accidents in construction work zones were eliminated from the analysis. The raw accident analysis results are available upon request.
As part of this exercise, we also examined nearby comparable segments where no digital displays had been constructed in order to establish any baseline accident trends due to other factors such as cellphone use, enforcement changes, driver behavior changes, road construction, etc. One of the two control segments was located immediately west of the segment for 941 Laurelwood Road and the other one was located 3,000 feet to the east of it.

Accident Data Analysis Results

There were three large commercial digital billboard installations identified along U.S. 101 in the City of Santa Clara. However, as noted above, the only digital billboard location in Santa Clara that could be adequately analyzed with the CHP accident data was the one at 941 Laurelwood Road, which was installed in 2015. The results of the accident analysis for 941 Laurelwood Road were generally inconclusive. However, there was no evidence identified that would indicate the installation of the digital billboard at 941 Laurelwood Road resulted in decreased safety in the area. In fact, the accident analysis indicated there was a reduction in accidents after the digital billboard installation. During the five-year period before the installation, there were 66 reported accidents on the two 1,000-foot segments of U.S. 101 approaching the billboard at 941 Laurelwood Road (in both directions). In the five-year period after the installation there were 59 reported accidents in the same two segments (a 12% reduction).

As noted above, 2,000-foot control segments (without digital billboards) on either side of this segment were also analyzed for comparison. As noted previously, one of the two control segments was located immediately west of the analysis segment for 941 Laurelwood Road and the other one was located 3,000 feet to the east of it. Unfortunately, the two control segments did not provide much clarity on accident trends in the area. The control segment located to the west of the 941 Laurelwood Road segment had a minor increase in accidents (48 accidents in the five-year period before the installation and 53 accidents in the five-year period after the installation). The control segment located to the east had a much larger increase in accidents. On this adjacent segment to the east the accidents more than doubled in the period from 2016 to 2020 (41 accidents in the five-year period before the installation and 110 accidents in the five-year period after the installation).

In summary, there was no increase in accidents recorded after the installation of the digital billboard at 941 Laurelwood Road. Unfortunately, there was also no consistency with the data for the two control segments that were analyzed. These inconsistencies, combined with the factors described below, lead to the conclusion that it is simply not possible reliably filter out the effects of the digital billboard installation using the CHP accident data in a localized manner using limited samples. In our opinion there are so many other factors that potentially affect the accident analysis (as described below) that it's not possible to make any solid conclusions about the effects of the digital billboards using the CHP accident data.

Variables Affecting the Reliability of the CHP Accident Data

Presenting an accident analysis of a digital billboard installation would be misleading without disclosing the other important variables/factors that could be affecting the accident rates reported in the CHP database. Taken all together, the logical conclusion is that there are simply too many factors that would need to be somehow filtered out to make any conclusions about the safety effects of a digital billboard installation. Below is a more detailed description of the various factors that may also be influencing the accident rates in the area.

The Random Nature of Accidents – Accidents may be more or less frequent on different freeway segments, but the annual variability of accidents on each segment is affected by the random nature of accidents. Studies on the variability of accidents and unobserved factors influencing the frequency of crashes indicate the number of accidents per year can vary by 15% per year (or more) on any given freeway segment, even with no obvious changes that would affect the accident rates.[1]

Inconsistency in the locations of individual accidents in the database - Freeway accidents are unfortunately often only reported to the nearest 10th of a mile (528 feet) meaning the actual location of various accidents cannot be precisely determined. This is especially true in the new CHP's new California Crash Reporting System (CCRS), where over a third of the accidents on U.S. 101 are reported in tenths of a mile. This is another factor that reduces the statistical reliability of the CHP data for use in accident analysis of specific freeway segments.

[1] *Safety Analysis of Freeway Segments with Random Parameters*, Transportation Research Record: Journal of the Transportation Research Board, Washington D.C., January 1, 2015.

There are significant amounts of data entry mistakes in the CHP Database – In our experience, mistakes with data entry are a significant problem with the CHP database. This may be, in part, due to the fact that approximately 43 percent of manual crash reporting in the state has now become automated.[2] Whenever we conduct accident queries, we always end up finding numerous street names that were incorrectly entered. The data entry problem is so pervasive that our company has had to develop proprietary software to help reduce the time it takes to search the records for all the minute differences in spelling and punctuation.

The individual accident records are often especially inconsistent when it comes to abbreviations on things like St. or Blvd. There are typically enough spelling mistakes in the names of reference roadways that its very challenging to be sure we have located all the accidents in a segment. These data entry problems also appear to vary from year to year, and seem to have become worse in recent years. In general, the inconsistency in the data entry for individual accidents appears to be another factor that reduces the statistical reliability of the CHP data for use in accident analysis of specific freeway segments.

Pandemic Effects and Changes in Police Enforcement – During the pandemic, traffic stops by the police plummeted around the country as agencies instructed officers to avoid nonessential contact with the public. But in the months and years that followed, the traffic came back in full force, but the traffic enforcement did not. For example, by the end of 2023, the police in San Francisco were making less than half the traffic stops they did pre-pandemic. Ironically, even with the overall number of traffic accidents being down (by about 20% on U.S. 101 from 2019 to 2022), there has still been a significant rise in road fatalities during this same period. In general, changes to the nature of police enforcement appear to be another factor that reduces the statistical reliability of the accident data when it comes to comparing different time periods.[3]

Accident effects from the increasing handheld use of cell phones - The visible manipulation of hand-held devices has been rising steadily during the time period

[2] *Allied Agency Reporting Service to SWITRS*, California Highway Patrol, Sacramento, CA, April, 2019.
[3] *Traffic Enforcement Dwindled During the Pandemic*, New York Times, New York, NY, July 29, 2024.

being analyzed for this analysis (2010-2020).[4] The increasing use of cellphones (without hands free devices) has been proven to increase accidents. As an example, a study in the State of New York found that during the period from 2009 to 2018, the number of tickets issues for hand held cell phone use or texting plummeted by over 40%. During this same period the number of accidents with distracted driving as a contributing factor nearly doubled.[5] These effects are another factor that substantially reduces the statistical reliability of the accident data when it comes to comparing different time periods.

Freeway construction also results in increases in accidents - Freeway construction can result in increases in accidents, and these accidents may not always be properly logged as being caused by construction. A study of rear-end collisions in work zones from 2020 to 2022 found that on urban interstates there was a 60% higher chance of fatal accidents in work zones than there was on segments without construction.[6] Based on our review it appears there was no significant construction in the study area during the analysis period. However, it is entirely possible some occurred that we are not aware of, and therefore this is another factor that could reduce the statistical reliability of the accident data when it comes to comparing different time periods.

Please don't hesitate to contact me if you have questions or require any additional information to resolve these issues to your satisfaction.

Sincerely,

Stephen C. Abrams
President
Abrams Associates
T.E. License No. 1852

[4] *How Cellphone Use While Driving Has Changed in America Since 2004*, Jared Staver & Morgan Mullings, Staver Accident Injury Lawyers, Chicago, IL, 2020.
[5] *Cell Phone and Texting Accidents Continue to Rise*, Adam H. Rosenblum Esq., Rosenblum Law, Clifton, NJ, November 4, 2019.
[6] *Work Zone Traffic Crash Trends and Statistics*, American Road & Transportation Builders Association., Based on Data from the Fatality Analysis Reporting System, National Highway Traffic Safety Administration, U.S. Department of Transportation, Washington, D.C., 2025.