Spatial and Temporal Analyses of the Variations in Aggressive Driving and Road Rage Behaviors Observed and Reported on San Diego Freeways

Sheila Sarkar, Ph.D., Director
California Institute of Transportation Safety
Project Director, Cool Operator Program
San Diego State University
5500 Campanile Drive
San Diego, CA 92182-1324
Phone: (619) 594 0164
Fax: (619) 594 0175
Email: msarkar@mail.sdsu.edu

Alanna Martineau, Graduate Research Assistant for Cool Operator Program
California Institute of Transportation Safety
San Diego State University
5500 Campanile Drive
San Diego, CA 92182-1324
Phone: (619) 594 0164
Fax: (619) 594 0175

Mohammad Emami, Statistical Analyst
California Institute of Transportation Safety
San Diego State University
5500 Campanile Drive
San Diego, CA 92182-1324
Phone: (619) 594 0164
Fax: (619) 594 0175

Mohammad Khatib, Undergraduate Student Intern, TMC, CalTrans
Department of Civil and Environmental Engineering
San Diego State University
5500 Campanile Drive
San Diego, CA 92182-1324
Phone: (619) 594 0164
Fax: (619) 594 0175

Karen Wallace, TMC, CalTrans
c/o California Institute of Transportation Safety
San Diego State University
5500 Campanile Drive
San Diego, CA 92182-1324
Phone: (619) 594 0164
Fax: (619) 594 0175

Abstract

California Highway Patrol (CHP) in San Diego County receives cell phone calls reporting unsafe driving. The content of the calls varies, with drivers complaining about speeding cars driving over 100 miles per hour (estimated speed), other drivers weaving and cutting off or tailgating. In some cases, the driving conditions were even more volatile with drivers describing harassment, assaults with a weapon, running other vehicles off the road and so on. There were about 1987 reported incidents from the freeways of San Diego for the months of April, June and September 1998. The information received by the dispatchers was tabulated as shown in Table 1 and then put into five different categories: *Aggressive Driving 1, 2, and 3*, *Speeding Alone* and *Road Rage* based on definitions developed by the authors. Analyses indicated that 24.6% of the calls were for *Aggressive Driving 1* (speeding and some other behavior); *Aggressive Driving 2* (weaving and cutting) was reported most frequently (27.1% of all the calls), about 12.5% of the calls were for *Aggressive Driving 3* (tailgating); *Speeding Alone* calls comprised 19.8% of the total, and the rest were for *Road Rage* (16.1%).

Of the 1987 calls, 33% were generated on Interstate 5, the busiest in the county, followed by Interstate 15 which accounted for 22% of the calls. The reason for the high number of calls can be attributed to high Average Daily Traffic volumes at each interchange (over 130,000 vehicles) and lengths (Interstate 5 with 72 miles and Interstate 15 with 77 miles within San Diego county). Likewise, Interstate 8 seemed to have a lower number of calls than expected because the urban portion of the freeway is less than 17 miles with volumes of 180,000 per day for each interchange while the remaining distance had less than 30,000 vehicles at each interchange. This was further corroborated and both volume, $r\ (10) = .69$, $p < .029$, and length, $r\ (10) = .77$, $p < .001$, were robustly correlated with the number of phone reports per freeway. Additionally, chi-square tests indicated that the time of the day and day of the week influenced the type and number of calls received.

Key words: freeway incidents, aggressive driving, road rage, speeding

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Introduction

This paper analyzes the data set that consists of reports made by drivers on their cellular phones. Often, drivers call in to report various types of transgressions that they observe on the San Diego freeways. These include traffic violations, excessive speeding, threats, verbal assaults, etc. Data were compiled for three months (April, June and September) of 1998 within San Diego County. This is with the exception of five consecutive days in April for which the data were unavailable (April 11-15).

All calls (1987 incidents) reporting perceived driving transgressions made to the California Highway Patrol (CHP) dispatchers were included in these analyses. Callers would report the driving behaviors that they felt were dangerous. The reported incidents were assigned a CAD (Computer Aided Dispatch) number (a reference number for CHP records); other information recorded were date, time, location, type of offense, and sometimes a description. The information provided in the CAD records was then classified for analyses under six categories: speeding, tailgating, running vehicles off the road, weaving, cutting vehicles off, and other. The applicable categories were checked off and if any additional information was provided above and beyond that accounted for by the categories, a description was also recorded. Please refer to Table 1 for an example of the compiled data.

CAD #	Date	Time	Location	Speeding	Tailgating	Running veh. off road	Weaving	Cutting vehicle off	Other	Description
111	6/1/98	0711	SB 805 JNO Palm Ave.	1			1			In and out of traffic
183	6/1/98	0831	NB 805 JNO EB 94						1	Throwing objects at vehicle
246	6/1/98	0950	SB 5 JSO Via De La Valle	1					1	Slamming brakes in front of vehicle
351	6/1/98	1218	SB 805 JSO Telegraph Canyon Rd		1		1			Unsafe lane changes
352	6/1/98	1215	SB 15 JSO Mission Rd				1			In and out of traffic

Table 1. Example of recorded information for five cellular phone reports for June 1, 1998. Note that the reported information was sometimes relevant to more than one category and in some cases a description was also provided. (JNO = Just North of; JSO = Just South of; EB = Eastbound)

This paper investigates both the frequency and patterns for *aggressive driving* and *road rage* on the freeways of San Diego County. The problem of aggressive drivers has

been around for a long time. In 1968, Parry **(1)** wrote an entire book on aggression on the road.

While the two terms aggressive driving and road rage have often been used interchangeably, the National Highway Traffic Safety Administration (NHTSA) has chosen to separate them into two disparate categories. There has been little consensus in the literature thus far as to an adequate definition of these terms. Connell and Joint (**2)** state that road rage can be used to refer to anything from roadside assault (including murder) to "any exhibition of driver aggression" (p. 27). In some cases, aggressive driving is seen as a traffic offense and road rage is seen as a criminal offense (**3**). Richard Compton in a presentation at the Aggressive Driving Conference (October 19, 1998, Los Angeles, California) gave a specific definition of aggressive driving as a combination of certain traffic offenses. Aggressive driving has been said generally to include excessive horn-honking, running red lights, traffic weaving, tailgating, headlight flashing, braking excessively, excessive speeding, profanity/obscene gestures, blocking the passing lane, etc. NHTSA describes road rage as the more extreme cases of aggressive driving (**3**). The types of behaviors included under these umbrella terms often vary and it is not necessarily useful to use a checklist approach. This is especially true in the case of road rage if it is to be considered a "criminal offense". Joint (**4**) has similarly referred to road rage in a broad sense as any display of aggression by a driver but also suggests that the term is often used to refer to the more extreme acts of aggression. The line between aggressive driving and road rage is even blurrier with Mizell's definition stating that aggressive driving is "an incident in which an angry or impatient motorist or passenger intentionally injures or kills another motorist, passenger, or pedestrian, or attempts to injure or kill another motorist, passenger, or pedestrian, in response to a traffic dispute, altercation, or grievance" (**5**, p. 5). Ellison-Potter et al. (**6**) indicate that aggressive driving is any driving behavior fueled by frustration and/or anger that psychologically and physically endangers others, while road rage refers to the more extreme and psychopathological cases of aggressive driving involving homicidal intent. Shinar **(7)** has used the frustration aggression model that was first proposed by Dollard et al. in 1939 **(8).** According to him, aggressive driving is a syndrome of frustration-driven behaviors enabled by driver's environment. These behaviors can either take the form of

Instrumental aggression: that allows the aggressive driver to move ahead at the cost of infringing on other road users' rights (weaving, cutting, running red lights) or **Hostile aggression** – which is directed towards the object of frustration. **(7, 9)**

Obviously, both aggressive driving and road rage need to be operationally defined in such a way that they can be used both for practical and legal purposes. From a legal perspective, *mens rea* or the state of mind at the time of an offense is an essential factor to consider for criminal prosecution (**6**). If the distinction between aggressive driving and road rage includes a traffic versus criminal offense differential, the definition of these terms should in some sense address the state of mind of the perpetrator. First and foremost, *road rage* as the term implies is associated with a state of anger or hostility directed at some driver. This may not necessarily be true of aggressive driving. This paper proposes that aggressive driving be described as driving that is intentionally inconsiderate of other drivers (i.e., negligent) as Shinar **(6)** describes intentionally infringing on the rights of others. This type of driving is not directed at any one individual, but rather toward other drivers in general. For example, this would include behaviors such as weaving and cutting, passing on shoulders, following too closely, etc. The intentional component of this definition precludes certain types of actions from being classified as aggressive driving. Thus if a driver makes a lane change and does not see a vehicle in the next lane, this driver may inadvertently cut someone off. This would not be considered aggressive. This driver is inattentive and would probably be apologetic for the action. Someone who is driving aggressively however, would not feel apologetic because he/she is intentionally ignoring the rights of others on the road. That is not to say that these actions differ in terms of dangerousness. If the victim in this scenario realizes that the act was unintentional however, he or she might be less likely retaliate against this inattentive driver. One of the most detrimental consequences of aggressive driving is that it may cause another driver to become angry and *retaliate*—a stage that would be considered road rage.

While aggressive driving is directed toward other drivers *in general*, road rage is considered to be directed toward a *specific driver.* The driver exhibiting road rage is also clearly, intentionally inconsiderate of other drivers' rights. However, the road rager—unlike the aggressive driver—is targeting a particular individual. As implied earlier,

aggressive driving may instigate retaliation and thus a state of road rage. Anger is a necessary condition of road rage but not of aggressive driving, and road rage further includes an intent to cause emotional or physical harm. Road rage would therefore include behaviors such as running a vehicle off the road, throwing objects at a vehicle, threatening another driver, assaulting another driver, using a vehicle as a weapon, and directing verbal threats or obscene language toward another driver. Note that behaviors such as tailgating or slamming brakes in front of another vehicle could be considered either road rage or aggressive driving, depending on the circumstances. For example, if a driver exhibits weaving, cutting, and tailgating as a pattern in general, then this would be considered aggressive driving. Conversely, if a driver is cut off by someone and retaliates by following this individual too closely (i.e., tailgating), this would be considered road rage. Similarly, if a driver frequently weaves in and out of traffic and slams on the brakes, the behavior would fall into the aggressive driving category. If however, a driver slams on the brakes to retaliate against someone following too closely, the behavior would be considered road rage. By this line of reasoning it can be seen that inattentive driving, aggressive driving, and road rage are each dangerous in their own right. However, it is especially important to note that aggressive driving can very easily result in anger and retaliation and thus escalate to road rage.

Because this paper discusses incidents of aggressive driving and road rage according to these definitions, the offense category information is used to form five new categories. In some cases, the information available for a particular call is not sufficient to determine whether the incident is aggressive driving or road rage. Furthermore, when the call is merely reporting something such as excessive speeding, by these definitions the incident can not necessarily be classified as aggressive driving. If someone is just speeding and there are no other drivers in their path, then the behavior is not necessarily inconsiderate of others. Of course, this is open to debate. It might be that someone speeding excessively is inconsiderate in the sense that even if traffic is minimal, the speeder is still putting others at risk and is therefore inconsiderate of others' rights on the road. Because of this ambiguity, isolated reports of speeding are put into their own category. This category is considered a type of aggressive driving because this reported speeding behavior was probably accompanied by some other aggressive act, although this

is not certain. The category was labeled *Speeding Alone* and there were 393 calls (19.7% of all calls) reporting incidents of this type for the months of April, June and September 1998.

On a related note, aggressive driving that involved speeding with any other type of transgression was labeled *Aggressive Driving 1*. This means that the report was speeding and one or more of the other categories (unsafe lane changes, unsafe passing). There were 489 such incidents (24.6%) reported by callers from the freeways of San Diego.

Another very frequent pattern of aggressive driving is drivers weaving and cutting through traffic. This type of incident likely occurs during times of major congestion and is therefore less likely to involve speeding. For this reason, a separate category labeled *Aggressive Driving 2* included incidents of reported weaving or cutting or both, without any mention of speeding. There were 537 calls (27%) reporting such incidents.

The final category for aggressive driving (*Aggressive Driving 3*) consists of incidents that reported tailgating. Tailgating is a more severe form of aggressive driving and in some cases these reports are probably referring to incidents of road rage, although this cannot be determined from the information available. There were 248 incidents (12.5%) of *Aggressive Driving 3*.

The last category is for incidents that could not be classified as aggressive driving, and are assumed to be primarily incidents of road rage. Any reported incidents of running vehicles off the road were included in this category as were any incidents that were only checked off as "other". Furthermore, some of the reports were not placed into any of the original offense categories (see Table 1) so are included in this final category as well. This category was labeled *Road Rage* and there were 320 incidents (16.0%) of this type.

The description data (see Table 1) were coded and aggregated into five content categories. The first pertains to unsafe lane changes and is labeled as such. It consists of reports such as "all over the road," "swerving," "using all lanes to pass," etc. This type of description was significantly correlated with incidents of *Aggressive Driving 1*, r (1987) = .33, $p < .001$, and with *Aggressive Driving 2*, r (1987) = .12, $p < .001$. This makes sense of course because both of these categories contain incidents related to unsafe

lane changes. The second content category pertains to inappropriate passing and contained statements such as "passing on the shoulder, center divide, turn lanes, and across double solid lines". This type of comment was also significantly correlated with *Aggressive Driving 1*, r (1987) = .12, $p < .001$, and *Aggressive Driving 2*, r (1987) = .12, $p < .001$. The third content category contains descriptions related to speeding, such as large vehicles speeding, or estimates of speed most of which were "90 +" (i.e., ninety miles per hour or more) or "100 +". This type of description was significantly correlated with *Aggressive Driving 1*, r (1987) = .14, $p < .001$, and intuitively, these descriptions were strongly correlated with the *Speeding Alone* category, r (1987) = .52, $p < .001$.

The fourth category contained descriptions that were incidents of road rage. These were: "harassing or threatening others verbally," "using rude language or gestures," "flashing high beams or headlights," "honking," "slamming on brakes in front," "preventing others from passing," "threatening others with a weapon" (e.g., knife, gun, throwing objects, etc.), "firing shots," "hitting vehicles with objects," "hitting other vehicles with vehicle," "chasing another vehicle," "trying to run someone down," and "trying to run someone off the road." It should be clear that all of these descriptions are considered road rage because they appear to be targeting a particular individual and are not incidents of aggressive driving in general. There was a robust correlation between these descriptions and the category *Road Rage*, r (1987) = .42, $p < .001$. *Road Rage* was originally just considered an "*other*" category but it was reclassified to *Road Rage* because most of the incidents in the category contained descriptions that were consistent with the stated definition of road rage. And finally, the last description category contained reports that were somewhat miscellaneous. These included "racing, playing chicken or other games," "motorcycles stunting," "trying to cause an accident," "almost hitting someone," "running red lights" and "hit and run" incidents. These descriptions were also significantly correlated with the *Road Rage* category because of the large proportion of road rage descriptions, r (1987) = .11, $p < .001$.

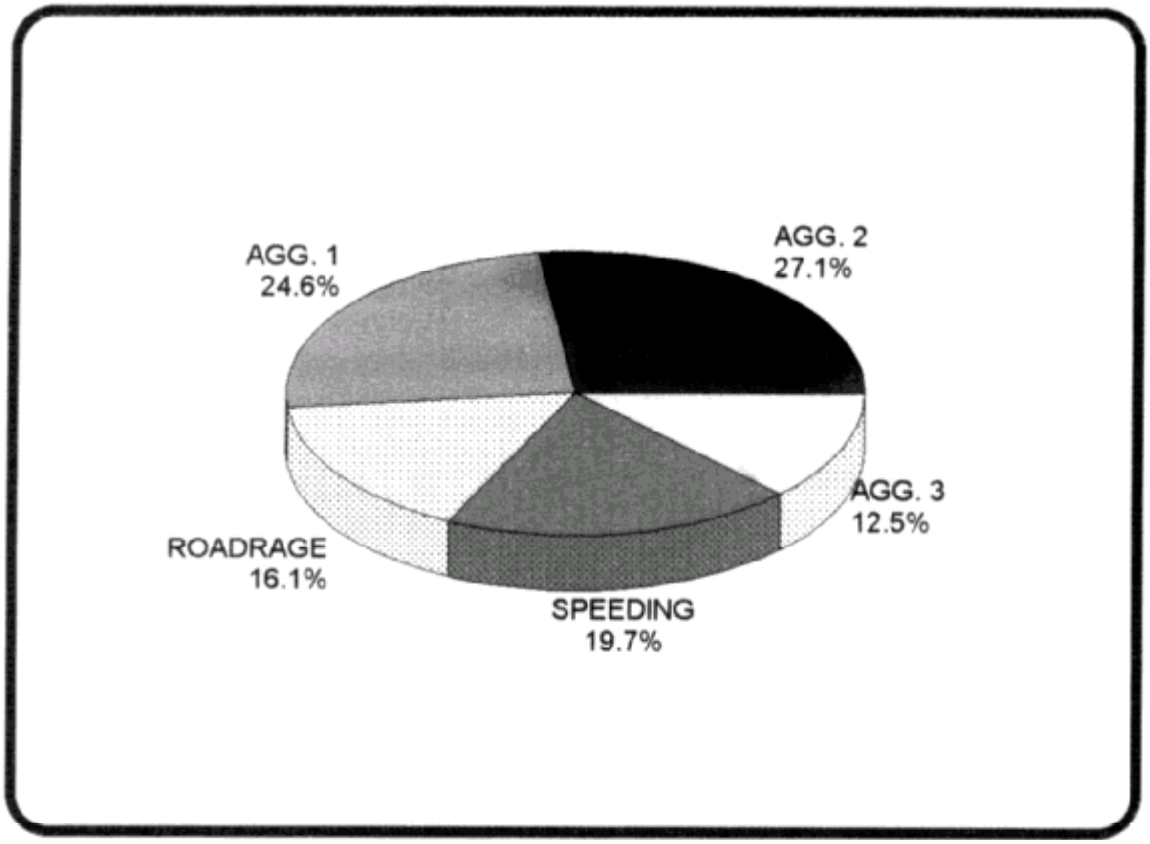

Figure 1. Percentage of cell phone calls reported for the five categories.

Spatial analyses of the cell phone calls

The spatial analyses of the calls show that 33% of the calls are reporting incidents on Interstate 5 (Figure 1), followed by Interstate 15, which generates about 22% of the calls, whereas Interstate 8 and Interstate 805 have about 12% and 10% respectively (Table 2). The fact that over 70% of the calls are generated by these four freeways is not surprising because they are the major freeways, particularly Interstate 5 which is the oldest and longest (79 miles) and with the heaviest volumes (average daily traffic of over 160,000 vehicles per day at each interchange). The remaining 30% of the calls come from all the other freeways and highways in San Diego County and most of them (except State Highway 78) report less than 5% of the total incidents.

Table 2. Spatial distribution of calls

Freeways	Frequency	Percent
5	655	33.0
15	448	22.5
8	241	12.1
805	213	10.7
78	121	6.1
163	68	3.4
94	57	2.9
not a freeway	43	2.2
52	40	2.0
215 *	37	1.9
67	27	1.4
74*	10	.5
125	9	.5
76	4	.2
54	4	.2
79	3	.2
56	2	.1
905	2	.1
165	1	.1
212	1	.1
70	1	.1
Total	1987	100.0

* not in San Diego County but the calls were received by San Diego CHP Dispatch Office

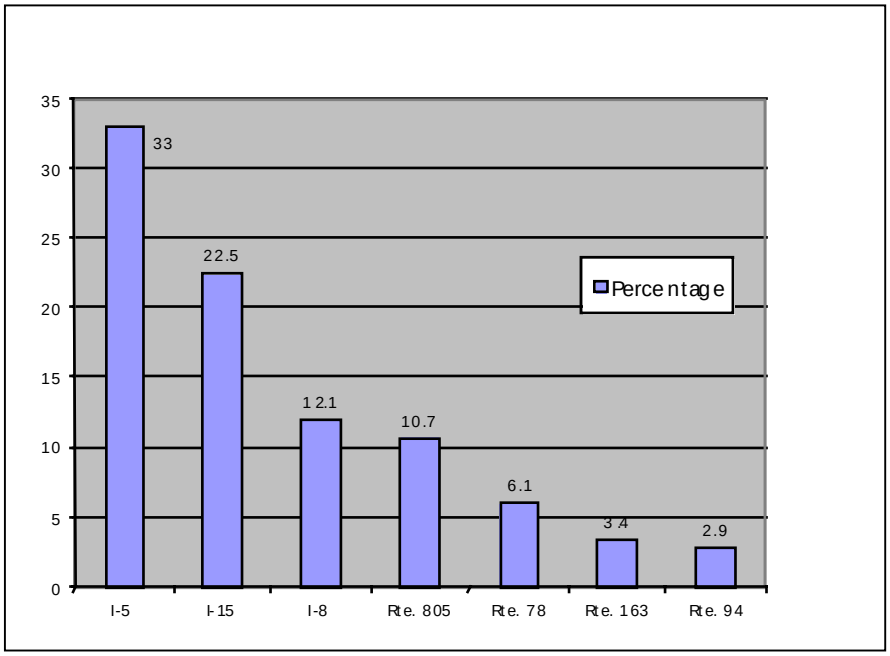

Figure 2. Frequency of calls by freeways.

Analyses of the aggressive driving behaviors reported by the callers

The purpose of this paper is to compare the frequency and patterns of aggressive driving behaviors reported by callers on the four major freeways (Interstates 5, 8, 805, and 15) that generate the highest number of calls (Figure 2). See Figure 3 for the freeway map. As mentioned, calls reported to CHP dispatchers for the months of April, June and September were aggregated under the following categories: *Aggressive Driving 1* (speeding and some other behaviors), *Aggressive Driving 2* (weaving and cutting), *Aggressive Driving 3* (tailgating), *Speeding Alone*, and *Road Rage* (Figure 2). In general, *Aggressive Driving 2* (weaving and cutting) and *Aggressive Driving 1* (speeding and some other offense) were the most frequently reported. *Speeding Alone* was reported about 20% of the time with the majority of the callers reporting estimated speeds of over 100 mph. But the fact that 12% and 16% of the calls were reporting some hostile behaviors (*Aggressive Driving 3* and *Road Rage* respectively) toward other drivers is important. Figure 4 provides a breakdown of the types of driving behaviors observed in the four main freeways (5, 15, 805 and 8). The percentage breakdowns for the freeways closely correspond to the overall percentages but there are some differences. Interstates 8 and 805 have fewer *Speeding Alone* incidents than either Interstate 5 or Interstate 15. There are however proportionately more *Road Rage* and tailgating (*Aggressive Driving 3*) reported on Interstate 8 compared to the other types of behaviors.

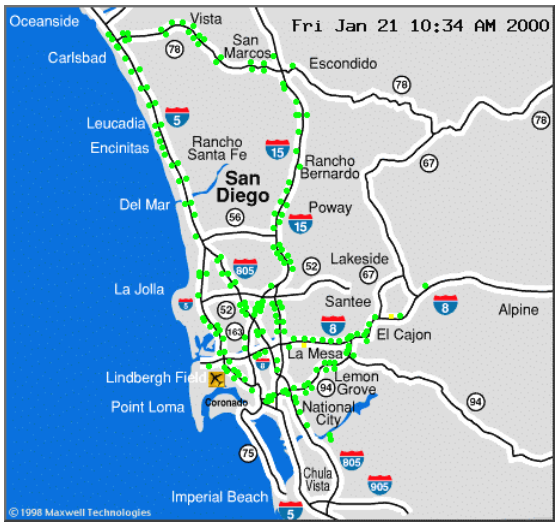

Figure 3. Freeway map of San Diego

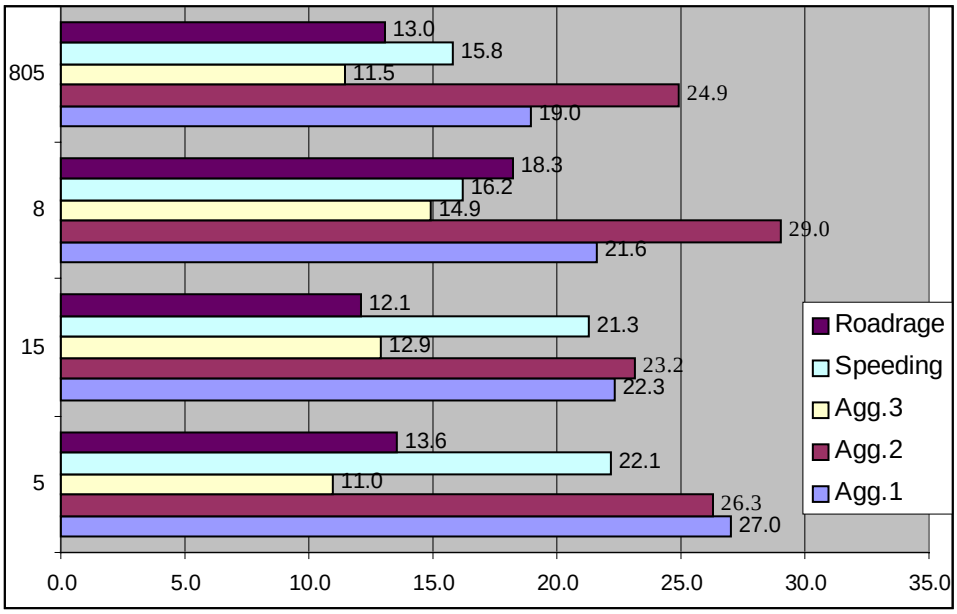

Figure 4. A breakdown of aggressive driving and road rage categories for Interstates 5, 15, 805 and 8.

Comparison of the expected and observed variations in the driving behaviors for the four freeways

Chi-square tests were done to estimate if the reported incidents for each of the five categories *Aggressive Driving 1, 2, 3*, *Speeding Only* and *Road Rage* would be equal to the expected number for each of the four freeways. The tests showed that *Aggressive Driving 1*- speeding and something else - were much higher in I-5 and I-15 $\chi 2(3)=82.8$, $p<.001$; *Aggressive Driving 2* - incidents of weaving and cutting - were much higher than expected in I-5, $\chi 2(3)=72.2$, $p<.001$, and for *Speeding Alone*, the chi-square was significant ($\chi 2(3)=98.4$, $p<.001$) because of disproportionately large number of reports for I-5. The other behaviors *Aggressive Driving 3* and *Road Rage* were either lower or almost equal to the expected number of calls.

***Expected* versus *Observed* number of incidents in the four freeways based on the lengths of the freeways**

There is significant variation in the lengths of the four freeways that are being analyzed within San Diego County. The longest freeway within the county is Interstate 8

(77 miles) followed by Interstate 5 (72 miles), Interstate 15 (54 miles) and Interstate 805 (29 miles). Typically, chi-square tests use expected values by dividing the total number of observations by the number of groups (e.g., 1987 observations by four groups). However, the length variation between the freeways of interest is an important factor when comparing these freeways. The disparities in length were taken in to account in the chi-square tests that were done to assess whether the observed and estimated number of incidents reported were proportional to the lengths of the freeways. To do this, percentage distribution for each of these freeways was derived. These percentages were used to arrive at the estimated number of incidents (for all incidents together) and for each category.

Variations in types of incidents by freeways

The chi-square test indicates that the number of incidents reported for each freeway differed significantly from the expected numbers even when length of the freeway was taken into account, $\chi 2(3)=280.6$, $p<.001$. Our analyses showed that Interstate 5 had considerably more incidents when the lengths were considered. Interstates 15 and 805 also had higher numbers when length was taken into account. Interstate 8 however had a lower number of incidents reported when length is taken into account.

For *Aggressive Driving 1* incidents, the chi-square test indicated that observed values differed significantly from expected values based on length, $\chi 2(3)=93.6$, $p<.001$. In particular, there were many more incidents reported for Interstate 5 than expected (O = 177, E = 114), slightly more for Interstate 15 (O = 109, E = 91), little difference for Interstate 805 (O = 29, E = 22) and less than expected for Interstate 8 (O = 36, E = 71).

This pattern of residuals was observed for all five classifications of driving and chi-square tests indicated that for *Aggressive Driving 2*, *Aggressive Driving 3*, *Speeding Alone*, and *Road Rage*, observed values were significantly different from expected values based on length. These data suggest that taking length into account does not ameliorate the discrepancies in proportion of total reported incidents for these four freeways.

It was felt that traffic volume on the freeway is an important factor to take into account when discussing the number of incidents reported. Therefore other freeway data is included to assess the relationship between incidents, length, and traffic volume. While the majority of this paper has focused on the four freeways, this analysis includes the cell phone reports from the ten most frequently reporting freeways in San Diego County (Table 2).

Average daily traffic data is available from California Department of Transportation (CalTrans) in San Diego County. Averages over a year are reported for each interchange on the freeways. This data was used to compute an overall average volume for each interchange for the ten freeways. Both volume, $r\ (10) = .69\ ,\ p < .029$, and length, $r\ (10) = .77,\ p < .001$, were robustly correlated with the number of phone reports per freeway.

The above analysis explains why Interstate 8 has lower than expected number of incidents. The urban section of Interstate 8, where the volumes at each interchange are over 183,000, is only 17 miles; another 7 miles has a volume of 60,000 vehicles per day for each interchange, and for the remaining length the volume drops sharply to 14,000 vehicles per day. For the same reason Interstate 5 has more than expected incidents as this long stretch of freeway has over 160,000 vehicles per interchange.

Variation in aggressive driving and road rage behaviors by time of year

To estimate if there were any differences in the types of behaviors reported by the time of the year, chi-square test was done for comparing June and September after combining *Aggressive Driving 1, 2, and 3*, and leaving *Speeding Alone* and *Road Rage* as separate categories (note: April was excluded because of the missing data). There were no differences in aggressive driving behaviors between June and September $\chi 2(1)=0.052$, ns**.** For *Speeding Alone*, the chi-square test is not significant ($\chi 2(1)=3.247$, p=0.072) and for *Road Rage* chi-square was significant ($\chi 2(1)=5.258$, p=0.022).

Variation in behaviors by time of day

To estimate whether the different types of aggressive behaviors categorized here varied by time of day, Chi-square tests were done to assess the variations. Calls for *Aggressive Driving 1* (speeding and some other behavior) were found to be higher between 9 am and 9 pm with the highest number of calls reporting such incidents being 12 pm to 3 pm (O=111, E=61.1) and 3 pm to 6 pm (O= 110; E=61.1) $\chi 2(7)=216$, $p<.001$. Reports of *Aggressive Driving 2* (weaving and cutting) were quite high between 9 am and 6 pm, and the 3 pm to 6 pm time (O=154; E=67.1) had the highest number of reported incidents which corresponds with the peak hours of travel $\chi 2(7)=260$, $p<.001$. *Aggressive Driving 3* (tailgating) was highest between 12 pm and 6 pm $\chi 2(7)=99.7$, $p<.001$. *Speeding Alone* incidents reported were higher than expected between 12 pm and 3 pm, followed by 3 pm to 6 pm and 9 am to 12 noon $\chi 2(7)=100.5$, $p<.001$. *Road Rage* incidents were reported more frequently during 3 pm to 6 pm (O=90; E=40); the number of reports was marginally greater between 12 - 3 pm and 6 - 9 pm $\chi 2(7)=143.6$, $p<.001$.

Chi-square tests were significant indicating that each freeway did exhibit differences in the driving behaviors based on time of day. **The time period when aggressive driving, speeding and road rage were reported most was 3 pm to 6 pm for all the four freeways.** Aggressive driving in general was reported more often between 9 am and 6 pm (for convenience all the three types of aggressive driving categories were combined for this analysis). Interstates 5 and 15 had significant variations for aggressive driving by time of the day $\chi 2(7)=192.3$, $p<.001$, $\chi 2(7)=111.1$, $p<.001$ respectively with the highest reported for 3 pm to 6 pm.

Variations in behaviors by day of week

The chi-square tests indicated that the number of calls varied by the day of the week for all incidents together and each category (Table 3). The number of calls was greater than expected on Fridays followed by Wednesdays. Sunday had lower than expected number of calls followed by Monday and Saturday. For each separate category the trends were similar to the overall pattern with minor differences. Thursday generated

a higher number of calls for *Aggressive Driving 1* (speeding and something else). *Aggressive Driving 2* (weaving and tailgating) was unusually high on Fridays.

Table 3. Residuals for Chi-square tests

Driving Category	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Expected
Aggressive 1	-13.9	.1	-10.9	16.1	21.1	-3.9	-8.9	**69.9**
Aggressive 2	-13.7	6.3	9.3	2.3	40.3	-7.7	-36.7	**76.7**
Aggressive 3	-2.4	3.6	-.4	7.6	8.6	-3.4	-13.4	**35.4**
Speeding Alone	-15.1	.9	14.9	-12.1	11.9	4.9	-5.1	**56.1**
Road Rage	-14.7	-.7	16.3	1.3	14.3	-5.7	-10.7	**45.7**
ALL INCIDENTS	-59.9	10.1	29.1	15.1	96.1	-15.9	-74.9	**283.9**

Conclusions

The paper offers a spatial analyses (by major freeways) of aggressive driving behavior patterns that drivers/callers report to CHP dispatchers. It also brings into focus that the perception of endangerment due to aggressive driving and speeding is high. The fact that at least 30 incidents are reported each day when only 10 percent of the people report such acts is significant. A separate study done by Sarkar using employees in San Diego found that 1 out 10 drivers called in aggressive behaviors.

Dollard et al.'s **(8)** discussion of the frustration-aggression model and Shinar's premise that congestion could be a contributing factor to aggression **(7)** can be partially proven by the authors' findings, that the type of behaviors that are reported vary and increase spatially and temporally. More research and study needs to be conducted on the same

It is important to note that the information offered by the callers to the dispatchers is voluntary making this data unique and useful. The fact that drivers define clearly when and where their driving conditions were being compromised by someone else can be very useful in defining aggressive driving and predicting the precursors to violent confrontations on freeways. The authors are planning to use the data to predict if certain sections of the freeways receive more calls than others.

Caller information used here to conduct the analyses exists in every city, and San Diego Transportation Management Center (TMC) should be commended for taking the leadership in tabulating this data and providing it to the California Institute of Transportation Safety (CITS) for analysis. Similar endeavors are encouraged at other TMC's. Data such as that used in this paper is valuable to researchers and law enforcement and could be used in many ways such as developing good public awareness and education campaigns. If similar data is compiled longitudinally for a certain number of years, then researchers and professionals could predict trends as well as determine spatial variations in unsafe driving patterns by time of day and day of week. Development of "smart highways" and efficient use of law enforcement depends on a strong information base. The authors urge TMC's to work closely with local transportation safety research institutes to develop a useful database that would make it

easier to understand, define, and predict spatial and temporal variations in aggressive driving.

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