ATTITUDES OF GREEK DRIVERS TOWARDS POSTED SPEED LIMITS

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ABSTRACT

One of the fundamental means for controlling speeds on a roadway is the presence of speed limits. A common practice has been to set speed limits at the 85th percentile of operating speeds (V85). There is a suspicion however that operating speeds and design speeds are often not in agreement. Moreover, posting of speed limits based on operating speeds that are inconsistent with design speed can create potential safety problems. Posted speed limits that are higher than the design speed of the roadway may also have a safety impact. The establishment of a proper methodology for determining the appropriate speed limits is therefore imperative in improving both operations and safety of a roadway segment. A first step in this direction is an understanding of the drivers' attitude and behavior towards posted speed limits. To accomplish this, an opinion survey of drivers of passenger cars and trucks was undertaken to determine their attitudes and behavior toward existing speed limits as well as indication of any crash involvement. The results indicate that a significant number of drivers exceed the current posted speeds, there were no differences among the various age groups of drivers, and few drivers have been involved in a crash. The major reason for not obeying speed limits is that the limits are not reflective of the roadway conditions and most drivers feel that they are lower than what the roadway can accommodate. The results were similar for drivers of both passenger cars and trucks. However, comparisons between local drivers and non-local drivers showed that local drivers are often those who violate the existing speeds. A review of practices in the United Kingdom and United States was also undertaken to supplement the efforts to develop a set of guidelines

Keywords: speed limits, methodology, opinion survey, Greek roadways

1. INTRODUCTION

Excessive speeds are often cited as the fundamental contributing factor for crashes, especially those resulting in fatalities or serious injuries. However, the reasons for the presence of such excessive speeds can be attributed to willfully exceeding posted speed limits or driving in a roadway environment that does not clearly communicate to the driver its proper speed. It is widely known that there are typically several contributing factors to the occurrence of a crash pointing to the significance of correctly selecting the appropriate operating speed in a roadway. Therefore, the selection of the proper operating speed based on existing posted speed limits should be viewed as a major component in addressing roadway safety. Setting posted speed limits should also be based on the roadway features and environment. Changing posted speed limits to address safety considerations should be the last resort after all other prudent measures, such as evaluation of existing signing, appropriate geometry features, and proper roadway maintenance, have been tried with no results.

The fundamental principle for selecting an operating speed is based on the assumption that reasonable drivers can select and modify their driving behavior in a manner that is reflective of the roadway environment. This implicitly implies that any changes in the operating speed should be timely communicated to the drivers. The establishment of a posted speed limit based on this principle is often viewed by several countries as a "prima facie" legal measure. This approach entails the concept that a posted speed limit is a numeric value of the operating speed of a vehicle that is reasonable and therefore prudent choice of a driver for the given roadway environment and conditions. It is apparent that a single posted speed limit cannot address all conditions and scenarios that a driver has to deal with while moving through a roadway section.

It is therefore reasonable to assume that a posted speed limit will have a limited influence on the real operating speeds that typically drivers will select to use while traversing a roadway segment. An underlying assumption here is that if posted speed limits are set in a way that are widely accepted by the users, such as the 85^{th} percentile speed, then such speeds should result in a proper driver behavior. At the same time, speed enforcement should be possible and there should be no need for continuous police presence to enforce the posted speed limits. It is therefore imperative that posted speed limits should be set in a technically and scientific sound manner. Such an approach should result in a roadway environment that will not rely on posted speed limit signs to enforce arbitrary chosen speeds but on posted speed limit signs that will make sense and are in agreement with the roadway environment.

A first step in this direction is an understanding of how drivers view posted speed limits and a documentation of their perceptions towards posted speed limits. The objective of this work was to complete such an effort by collecting speed data in three roadway environments in Greece and interview drivers on their perceptions and attitudes towards several aspects of posted speed limits.

2. OPINION SURVEY

The Greek Ministry of Environment and Public Works assigned to the Laboratory of Transportation Engineering (Faculty of Rural and Surveying Engineering / N.T.U.A) a study to develop a system for speed management in Greek roads. The project included an opinion survey of drivers of passenger cars and trucks. The opinion survey was undertaken to determine their attitudes and behavior toward existing speed limits as well as any crash involvement.

A total of 402 driver surveys were completed (294 passenger cars and 108 trucks) at various locations of the Greek national highway system. The surveys completed for freeways were conducted at toll booths and were completed as the drivers stopped to pay the toll. Speed measurements were not taken at these locations due to the influence of the toll collection stations but at other representative locations. A summary of the speeds for these roadways is presented in the following section.

2.1 Freeways

2.1.1 Passenger Cars with general speed limit 120km/h

The first group of speeds analyzed dealt with passenger cars. The results indicate the average speed of drivers was 131 km/h and only 43% of the drivers did not exceed the posted speed limit. The speed data indicated that the 85th percentile speed is 145 km/h, only a third of the drivers travel at the posted speed limit of 120 km/h, and 40% of the drivers travel at speeds equal to or greater than 140 km/h.

The data of the surveys indicate that drivers who are familiar with the roadway have a tendency to drive at higher speeds (average speeds of 137 km/h) while those who travel less frequent had lower average speeds (118 km/h). As a percentage, 62% of the driver familiar with the roadway exceeded the posted speed limit while only 12% of those unfamiliar traveled at speeds greater than 120 km/h (the posted speed limit).

Regarding speed enforcement, approximately one third of drivers have received a citation for speeding and they had an average speed of 139 km/h. On the contrary, those who exceed the posted speed but not received a citation had a lower overall average speed (127 km/h) possibly indicating a tolerance of the police to issue citations for smaller infractions.

Safety was cited as the major reason for complying to posted speed limits while legal implications and risk for citations received lower scores in preference survey. A large percentage of drivers indicated that safety is the main reason for not speeding and their speeds reflected this: their average speeds was 124 km/h. Two thirds of the drivers consider the existing posted speed limit of 120 km/h as low and cited a necessity to increase it. The mean speed of those drivers is 138 km/h. Those drivers who consider that the current posted speed limit is about correct (31% of the drivers) traveled at a mean speed of 120 km/h. Only 5% of the drivers believe that the speed limit is very high and needs to be decreased.

One half of the drivers interviewed believe that the posted speed limit should not be exceeded even though most of them drive at higher speeds. A surprising answer was the notion that two thirds of the drivers believe that the posted speed limit can be exceeded

at certain situations and that speeds can be safe within a 10 km/h range of the posted speed limit. Another unanticipated answer was that one third of drivers believe that the current posted speed limits are lower than a perceived safety speed and they can exceed it by more than 10 km/h. One fifth of drivers consider that the current posted speed limits are incorrect since they believe that they should be able to decide to drive faster or slower. Those drivers exceed the existent speed limit by an average of 15 km/h. More that two thirds (68%) of the drivers disagree with the above aspect and drive with a mean speed of 129 km/h.

2.1.2 Trucks with general speed limit 80km/h

The second group of drivers dealt with trucks. More than one half (58%) of truck drivers did not exceed the posted speed limit of 80 km/h, they have an average speed of 84 km/h, and their 85th percentile speed is 90 km/h. Only a small portion (10%) travel at speeds higher than 90 km/h.

The frequency of driving on freeways does not have any significant impact on truck drivers' speed as was noted for passenger car drivers. They also agree with passenger cars drivers (85% of truck drivers) on the aspect of safety for complying with posted speed limits. Those drivers exceed the speed limit by 4 km/h and their speed is equal with the mean speed of the drivers that do not consider safety as an important reason for complying with speed limits. A small fraction of drivers (31%) have received speeding citations and their speeds are slightly higher (84.8 km/h) than those who have not received a citation (84.0 km/h).

Almost two thirds of truck drivers consider that the speed limit (80 km/h) is very low and must be increased. The mean speed for those drivers is 86 km/h. The remaining (38%) drivers consider that the existent speed limit is about correct and they drive with a mean speed of 81 km/h. None of the drivers interviewed believes that the speed limit is very high and needs to be decreased.

A large portion (60%) of truck drivers also consider that the speed limit on freeways must not be exceeded although a high percentage of them drive little faster than 80 km/h. There is again a large portion (58%) of the drivers who consider that the speed limit can be exceeded only on certain situations and they drive with average speed of 86 km/h. An even larger percentage (74%) of drivers agrees with the aspect that the speed limit of 80 km/h is lower than a safety speed and it can be exceeded up to 10 km/h. The mean speed for those drivers is 86 km/h. Almost one fifth (17%) of drivers consider that speed limit of 80 km/h is lower than the safety limit of driving and can be exceeded more than 10 km/h. The mean speed for those drivers is 89 km/h.

2.2 Rural Roads without central median

2.2.1 Passenger cars with general speed limit 90km/h

Almost two-thirds (65%) of the drives exceeded the posted speed limit, their average speed was 103 km/h, and the 85th percentile speed was 120 km/h. A large portion (35%) of the drivers travel at speeds equal to or greater than 110 km/h.

The frequency of driving on such roads had little effect on the drivers' speed choice. Those who use them on a daily basis recorded an average speed of 110 km/h

while those who use them less frequently had a speed of 100 km/h. The mean speed of drivers that have received a speeding citation is higher than the speed of drivers that have not cited for speeding. However, speeding citations are not a significant deterrent mainly due to the spotty and inconsistent speed enforcement

Drivers again noted that the most important reason for complying with posted speed limits is safety. For these roads almost one half (46%) of the drivers stated that the posted speed limit is very low and must be increased. The mean speed for those drivers is 110 km/h. Almost an equal percentage (48%) consider that the existent posted speed limit is about correct and they drive on average with 98 km/h. Only 6% of the drivers believe that the speed limit is high and must be decreased. The mean speed for those drivers is 88 km/h.

The concept of exceeding the posted speed limit on certain situations was also prominent on these roadways. Almost two thirds (63%) of the drives believe this to be the case. The relationship of the posted speed limit to a safety speed was also investigated indicating that 65% of the drivers consider the 90 km/h speed limit low and that it could be safely exceeded up to 10 km/h. The mean speed for those drivers is 100 km/h. A large percentage (38%) of drivers also believe that the posted speed limit is lower than the safety speed and exceeding the speed limit by more than 10km/h is acceptable.

2.2.2 Trucks with general speed limit 80km/h

A very large (87%) percentage of drivers did not exceed the posted speed limit. The speed data indicate an average speed of 76.6 km/h and an 85th percentile speed of 80 km/h: at the posted speed limit for trucks.

Safety was cited again as the primary reason for complying with the posted speed limits. A small portion (19%) of the drivers considers that the safety limit for driving is higher than 80 km/h and they drive on average with 78 km/h. Most drivers (81%) consider that the current posted speed limit is about correct and they drive on average with 76 km/h. Of the remaining drives, 13% consider that the speed limit is very low and must be increased and they travel at an average speed of 84 km/h. The remaining 6% consider that the speed limit is very high and must be decreased and their mean speed is 74 km/h.

Almost 60% of the drivers consider that the speed limit must not be exceeded and that it can be exceeded in certain occasions. Three fourths of the drivers consider that the speed limit is lower than the safety speed and can be exceeded up to 10 km/h. The mean speed for those drivers is about 77 km/h. Of the remaining drivers, 17% believe that the speed limit is lower than the safety speed and can be exceeded by more than 10 km/h. The mean speed for those drivers is about 75 km/h.

2.3 Urban Through Roads

2.3.1 Passenger cars with general speed limit 50km/h

Even though only a small percentage (28%) of drivers did not exceed the posted speed limit, the average speed is 68 km/h and the 85th percentile speed is 85 km/h. Both these speed metrics indicate a high speed increase over the posted speed limit.

The average speed of the drivers that have received a speeding citation is higher than the speed of the drivers that have not. This is the same trend as the one observed for the other roadways. It is apparent that speeding citations are not a significant deterrent because the drivers that have already received such a citation still continue to exceed the posted speed limit.

Safety was one more time the perceived reason for complying wit posted speed limits. For these roads however, 50% of the drivers consider that the posted speed limit is very low and must be increased. The mean speed for those drivers is 76 km/h. Almost all remaining drivers (48%) consider that the existent speed limit is rather correct and travel with average speed of 60 km/h. Only 3% consider that the speed limit is very high and must be decreased although they travel with mean speed that exceeds the limit by 5 km/h.

Even though 40% of the drivers believe that the speed limit must not be exceeded, they continue to drive at high speeds (average speed of 65 km/h). Again a large percentage (71%) of the drivers consider that speed limit can be exceeded only on certain situations and there is a large percentage (68%) that agrees that the speed limit is lower than the safety speed. Finally, a small portion (22%) of the drivers considers that the speed limits are incorrect and they should be able to decide if they drive faster or slower than the posted speed limit. Those drivers exceed the limit by at least 20 km/h.

2.3.2 Trucks with general speed limit 50km/h

A large portion (41%) of truck drivers did not exceed the posted limit, their average speed was 55 km/h and their 85th percentile speed is 65 km/h.

The effect of speeding citations was the same as for the other drivers and the previously discussed roadways. A large portion of them (75%) considers that the current posted speed limit is about correct and they drive on average with 52 km/h. Of the remaining drivers, 23% consider that the speed limit is very low and must be increased and their average speed is 65 km/h.

Approximately two thirds (63%) consider that the speed limit must not be exceeded although a high percentage of them exceed the posted speed limit. Again a large portion (71%) indicated that the posted speed limit can be exceeded on certain situations. Most truck drives (80%) agree with the concept that the posted speed limit is lower than the safety speed and that the posted speed limit can be safely exceeded up to 10 km/h. Of the remaining drivers, 16% consider that the posted speed limit is lower than the safety speed and it can be safely exceeded by more than 10 km/h. Finally, 73% of the truck drivers interviewed agree that the posted speed limits are about right and drive at an average speed of 54 km/h.

2.4 Speed Measurements

As noted above, speeds were collected at various locations representing the speeds for the roadway segments where drivers were interviewed. Such speed measurements could be used as an indicator of the drivers' compliance with the posted speed limits. These measurements also present a fundamental relationship between operating speeds and the various elements of the roadway geometry, such as vertical and horizontal curves, roadside environment, and cross section elements. Various locations were

selected for these sped measurements at different spots of the Greek National Highway System. These sites were selected based on the roadway geometry, the cross section elements, the roadway environment, and the existing posted speed limits. A summary of the measurements is presented in Table 1.

Table 1: Spot Speed Measurements on Specific Locations of the Greek Road Network

Road class	Horizontal curve (m)	Grade %	Local speed limit (km/h)	V85, Vm passenger cars (km/h)	V85, Vm, V15 trucks (km/h)	V85, Vm,V15 buses (km/h)
2 lane rural road	450	0.5	60	100, 87	78,71, 61	-
2 lane rural road	415	1.0	80	100, 87	78,71, 64	82,75 66
2 lane rural road	1025	0.5	110	130, 115	82,80, 68	94,-, 79
2 lane rural road	Tangent	0.5	50	77, 68	67,59, 51	-
2 lane rural road	Tangent	2.5	50	116, 101	86,73, 62	-
Freeway	Tangent	2.0	120	144, 132	89,84, 78	98

Notes: V85: the 85th percentile speed; Vm: the average speed; V15: the 15th percentile speed

3. INTERNATIONAL COMPARISONS

In 2006 the British Department of Transportation published statistics relate to the speeds at which drivers travel in free-flow conditions across the road network (DfT, 2006). The level of cars exceeding the speed limit varies considerably between road types. The results indicate the highest level of cars traveling over the speed limit (70 mph—110 km/h) occurred on motorways (54%) and the average speed recorded for car drivers was 70 mph. The lowest level was on single carriageway roads, with a speed limit of 60 mph (96.6 km/h), where 11% of cars were driven over the speed limit.

As a percentage, 49% of all car drivers on 30 mph (48.3 km/h) built-up roads exceeded the speed limit and the average speed recorded for car drivers was 30 mph. 26% of buses drivers exceed the speed limit of 30 mph. The survey also reveals a high incidence of speeding by rigid heavy goods vehicles (HGVs): 44% of 2 axle - HGVs exceeded their 30 mph limit. The average speed recorded for rigid HGVs on these roads was 29 mph.

Various studies have been also conducted in the US to gauge the drivers' attitudes towards posted speed limits on various roadway classes. In the US, usually the posted speed limit is taken as the 85th percentile of the operating speeds. Fitzpatrick et al. (2003) found that 85th percentile operating speeds are higher than the posted speed limits and 50th percentile operating speeds are close to the posted speed limit. The study has noted that a large portion of free flow vehicles (37 to 64 percent on rural and 23 to 52 percent on suburban or urban roadway) traveled at speeds no higher than the posted speed limit. The data used in this study clearly indicates that at most sites the 85th percentile speeds exceeded the posted speed limit.

A recent review (Stamatiadis and Gong, 2007) found that in reality, the speed limit of a roadway should be set at the 85th percentile speeds. Most of the studies reviewed used 85th percentile speed as the best indicator of operating speeds on any roadway section for a given set of roadway conditions. Hence, by posting speed limits within a range of 5 mph of the 85th percentile speeds, potential discrepancies between operating speeds and posted speed limits are minimized. This also ensures a lesser dispersion of speeds. The result of this, as reported by some studies, is a reduced occurrence of crashes.

The surveys indicate that Greek drivers behave in a similar fashion to other drivers around the world and they exceed the posted speed limits. The percentage of speeding and the mean speed for the Greek car drivers both on motorways and built –up roads are higher than those noted for British drivers. The mean speed of British car drivers is about the same with the speed limit for both motorways and built – up roads. The mean speed of the Greek car drivers is higher than the speed limit both on motorways and built – up roads. The US studies indicate that for freeways and 2-lane rural roads, the Greek and US drivers exhibit similar speed behavior (Fitzpatrick et al 2003). It should be noted though that the US studies did not differentiate between passenger car and truck drivers; a factor that may influence overall 85th percentile speeds.

The mean speed for Greek and British truck drivers on motorways is about the same with the speed limit while they exceed the speed limit. The mean speed of Greek truck drivers is higher than the speed limit on built – up roads whereas the British car drivers travel with mean speed very closed to the speed limit for the same road type. Both Greek and British truck drivers exceed the speed limit on built up roads. Based on these comparisons it was determined to raise the posted speed limit for Greek freeways to 130 km/h for passenger cars and to 85 km/h for trucks effective June 2007.

4. CONCLUSIONS

Drivers select their operating speeds based on a variety of stimuli including roadway geometry, environmental conditions, and legal speed limits. The basic principle to be followed in roadway design is to establish a roadway environment that will dictate its operating speed and provide drivers with adequate clues as to when changes are needed in their operating speeds. The use of posted speed limits signs is usually a means for facilitating this by alerting the driver of such impending changes in roadway geometry. However, speed limits are often ignored and drivers tend to travel at operating speeds that seem appropriate to them based on the roadway environment. To determine the attitudes of drivers towards speed limits and understand their behavior, a survey of Greek drivers was undertaken in three roadway environments.

Overall, very similar attitudes were observed for drivers on freeways, rural roads, and urban roads. For all three environments, drivers of passenger cars and trucks exceed the posted speed limit by various magnitudes. All feel that the posted speed limit could be safely exceeded and all believe that posted speed limits are set to improve safety. Even though most drivers agree with the notion that the posted speed limits should be obeyed, they tend to drive at speeds greater than the posted speed limits.

The 85th percentile (V85) speeds for all three roadway environments were at least 25 km/h above the posted speed limits. Considering that typically the 85th percentile speed is the speed used for setting the speed limits, all roadway environments indicate that the speed limits are lower than what they should be. An examination of these differences as a percentage of the posted speed limit indicates that the greater problem is for urban roadways where the 50 km/h speed limit was exceed by 70%. This is somewhat disturbing considering the fact that urban environments are the most demanding conditions due to the presence of other vehicles and pedestrians. It is apparent that speed limits in urban roadways are not observed and different means are needed to enforce such speeds if this is desired.

Overall, truck drivers have a more appropriate attitude towards speed limits. More of them tend to drive closer to the speed limits and their 85th percentile speeds tend to remain close (both in numbers and percentages) the posted speed limits.

The new guidelines will be based on the findings of this study (Ministry of Environment, Physical Planning and Public Works 2006). For example, the fact that drivers typically exceed the posted speed limits and this violation varies among the different roadway types resulted in specific speed limits for each roadway class. The posted speed limits are set based on the assumption that they have to be similar to the operating speed (V85) and should not significantly exceed it. Finally, for new roads no posted speed limits will be placed once the roadway is opened to traffic and speed limits will be set once a traffic study is completed to determine the V85 speeds.

The findings from this survey indicate that, in general, drivers do not observe the posted speed limits and feel that they can determine when they can travel at higher or lower speeds. Drivers also feel that the posted speed limits can be exceeded at certain situations and they believe that a range of 10 km/h is an acceptable value. The results of the survey indicate that the roadway environment plays a more important role than the posted speed limit in selecting the appropriate operating speed. This leads to the basic conclusion that often times posted speed limits are placed without the proper considerations and are implemented due to a variety of reasons often unrelated to the roadway environment (statutory speed limits on freeways is such an example). It is therefore imperative that a more systematic approach is needed to establish speed limits that are reflective of the roadway geometry and produce operating speeds that are in harmony with the roadway environment.

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