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Research Article

ANALYSIS OF THE IMPACTS OF AUTOMATIC SECTION SPEED CONTROL ON A SAMPLE GROUP OF COMMUTER DRIVERS IN AN EDUCATIONAL CAMPUS

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Keywords

Automatic section speed controL
Average speed,
Before/after period,
Speed limit,
Driver opinions

Abstract

Automatic Section Speed Control that is one of the speed enforcement systems applied for solving high speed problem causing accidents in traffic is a new and advanced intelligent transportation system application that is gaining popularity all over the world in countries with high levels of motorization. The objective of this study was to examine the effects of this system installed as mobile at sections in a university campus with low speed limits on the before/after periods speeds and opinions of commuter drivers. A total of 729 driver surveys were accepted as valid. According to meticulous evaluations; it was determined that only 32 of the survey participants were among those for which average speeds were detected at least 8 times by the system during each of the before/after periods. Whereas the speed average during the before period was 38.73 km/h, the speeds decreased down to 35.13 km/h during the after period. When the opinions of the drivers regarding the speed limits enforced in the campus were asked, it was determined that 3.3% think that the speed limits are high, 56.7% think that they are low, whereas 36.7% think that they are sufficient. Independent Sample t test was used to determine the average speed differences for the before/after periods according to the "gender, age, duty, number of accidents, opinions on speed limit" variables of the drivers who participated in the survey and for whom the average speeds were detected, whereas Univariate Anova test was applied in order to determine the average speed differences for the "education level, years of driving experience, tendency to overtake other vehicles" variables during the before/after periods. The differences were not determined to be statistically significant according to the analyses. There was a statistically significant decrease in average speeds without any legal enforcement; however, a greater abidance by the speed limits may be attained via an enforcement. No statistically significant difference was observed between the accident histories of the drivers and the decreases in their average speeds.

OTOMATİK KORİDOR HIZ KONTROLÜ'NÜN BİR EĞİTİM YERLEŞKESİNDEKİ TEKRARLI SÜRÜCÜLERDEN OLUŞAN BİR ÖRNEKLEM ÜZERİNDEKİ GÖRÜŞLER VE HIZ ETKİLERİ ÜZERİNE ANALİZİ

Anahtar Kelimeler

Otomatik koridor hız kontrolü,
Ortalama hız,
Önce/sonra dönemi,
Hız limiti,
Sürücü görüşü.

Öz

Trafikte kazalara sebep olan yüksek hız problemini çözmek için uygulanan hız denetim sistemlerinden biri olan Otomatik Koridor Hız Kontrolü, dünya çapında son derece yüksek seviyede motorize olmuş ülkelerde popülerliği artan yeni ve gelişmiş bir akıllı ulaştırma sistemi uygulamasıdır. Bu makalede bir üniversite kampüsü içindeki düşük hız limitli güzergâhlara 2013 yılında mobil olarak kurulan bu sistemin, tekrarlı (her gün kampüse gidip gelen) sürücülerin önce/sonra dönemlerindeki hızlarına ve görüşlerine etkisini araştıran bir çalışma sunulmaktadır. Sürücülere yapılan anketlerden ise 729 adedi geçerli sayılmıştır. Titizlikle yapılan tespitlere göre; anket katılımcılarından sadece 32 adedinin önce/sonra dönemlerinin her birinde en az 8 kere sistem tarafından ortalama hızları tespit edilenler olduğu tespit edilmiştir. Önce dönemine ait hızların

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ortalaması 38.73 km/s iken, sonra döneminde hızlar 35.13 km/s'e düşmüştür. Sürücülerin kampüste uygulanan hız limitleri hakkındaki düşünceleri sorulduğunda ise, %3.3'ü hız limitlerinin yüksek olduğunu, %56.7'si düşük olduğunu, %36.7'si ise yeterli olduğunu belirtmiştir. Ankete katılan ve ortalama hızları tespit edilen sürücülerin "cinsiyet, yaş, görev, kaza sayısı, hız sınırı hakkında düşünceler" değişkenlerine göre önce/sonra dönemlerine ait ortalama hız farklılıklarını bulmak için Bağımsız iki örnek T testi kullanılmış "eğitim düzeyi, araç kullanma yılı, diğer aracı geçme eğilimi" değişkenlerinin önce/sonra dönemlerine ait ortalama hız farklılıklarını bulmak için ise Tek değişkenli varyans analizi yapılmıştır. Analize göre farklar anlamlı değildir. Cezai yaptırım olmaksızın ortalama hızlar anlamlı düşüş göstermiştir; fakat hız sınırlarına daha yüksek bir uyum, bir uygulama yaptırımı ile sağlanabilir. Sürücülerin kaza geçmişleri ile ortalama hızlarındaki düşüşler arasında anlamlı fark görülmemiştir.

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1. Introduction

One of the reasons of traffic accidents is speeding and risk of accidents along with accident severity increase with increasing speed; high speed is one of the fundamental causes of deaths and injuries (Aarts and van Schagen, 2006). One of the systems applied for solving the speed and accident problems in traffic is Automatic Section Speed Control (ASSC). This application is comprised of placing at least two cameras in many locations along a road section (Figure 1). Data for license plate and vehicle records are acquired for each vehicle as it enters the system from the first camera location followed by further data and images obtained from cameras at different locations after which the acquired data are uploaded and matched with previous data. Vehicle registration data are then matched via Optical Character Recognition and Automatic License Plate Recognition technologies (Malenstein, 2007; Cameron, 2008; Simcic, 2009; Soole et al., 2012; 2013; Gil and Montella et al., 2015; Ilgaz and Saltan, 2017a). Cross-section speed of vehicles as they pass between two cameras is used for calculating the average speed (Taylor et al., 2000; Ilgaz and Saltan, 2017a). The acquired images and traffic offence data (time, date, speed etc.) are transferred over a communication network from the local processing unit to a central processing unit when the average speed is above the legal speed limits for that section in order to issue a statement of violation for verified traffic offences (Figure 2). It is aimed by such traffic inspection methods not to punish the drivers but to decrease the traffic accident related death toll as well as the number of injuries (Gil and Malenstein, 2007; Soole et al., 2012; 2013; Ilgaz and Saltan, 2017a).

Meticulous before/after studies should be carried out in order to increase our knowledge on the effects of section safety precautions (Elvik, 2011). The advantage of ASSC is that it can record the average speed along a section which will result in high levels of compliance with speed limits and thereby decrease in the differences of vehicle speeds (speed variation among the vehicles also increases the risk of involvement in an accident), increase in distance between vehicles, a more homogeneous traffic flow and increased traffic capacities. Section control enables the better use of the current infrastructure while decreasing traffic emissions and traffic noise due to the approximation in traffic flow (Soole et al., 2012). The first ASSC in the United Kingdom was setup in 2000 on Nottingham M1 highway. Two average speed cameras were placed with distances of 0.5 kilometers along a 40 mile/s section after which the average speeds decreased below 40 mil/h following the application (Cameron, 2008) .In addition, it was put forth by other studies carried out that the decrease in the ratios of speeding vehicles decreased by about 90% (Schwab, 2006; Soole et al., 2012; Fleiter et al., 2013).

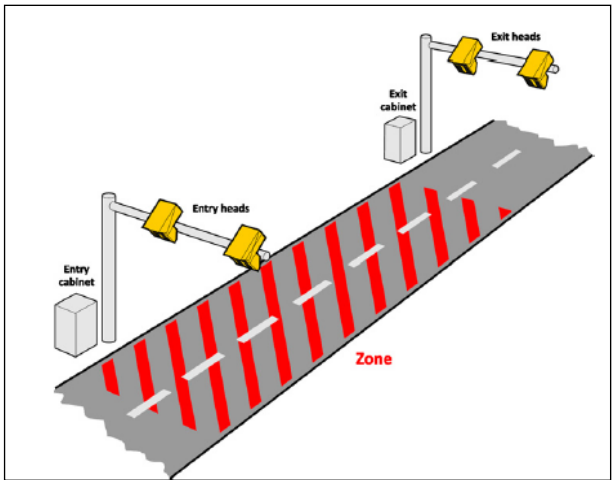

Figure 1. Average speed application (Soole et al., 2012)

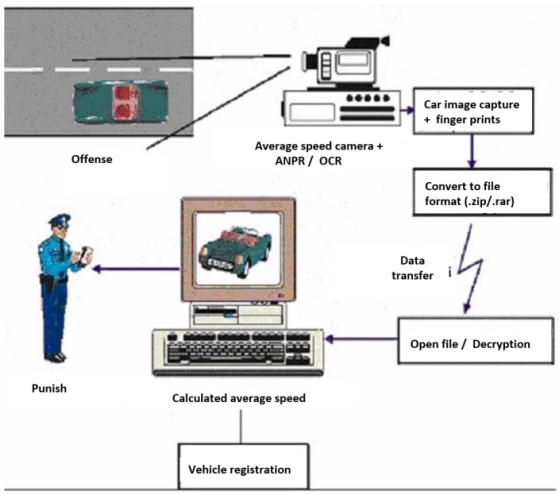

Figure 2. Average speed application (Organisation for Economic Co-Operation and Development, 2006)

Theoretically, ASSC contributes to traffic safety because a decrease in both the average speed and speed variance results in decreased risk of accident (Soole et al., 2012). In accordance with the decrease in the speeds of vehicles, current studies put forth that significant decreases have occurred in all accident types and especially those that result in deaths or serious injuries (KSI). These are the results of evaluation studies carried out in England, Italy, Austria and Holland and encompass both the permanent and temporary systems (Gil and Malenstein, 2007; Soole et al., 2012; 2013). Decreases up to 20% have been put forth in accidents with minor injuries and up to 65% in ASSC, KSI's especially in England (Soole et al., 2012; 2013).

The effectiveness of an ASSC application depends also on the policy adopted for determining the speed limits. Even though ASSC is being used by many countries, there is no agreed method for adjusting the proper speed limits for the sections of application. However, a single speed limit value should be chosen for the section between the two cameras. This value should reflect the mobility needs while also being sufficient for a safe drive even in the most constrained geometric components (Montella et al., 2015). A series of studies carried out in Australia put forth that speeding remains a popular behavior and that majority of the drivers prefer speeds that are 10 km/h above the speed limits (Walker et al., 2009; Soole et al., 2012). It was put forth by these studies that speeding behavior is accepted socially especially when it is not excessive (Hatfield and Job, 2006).

It is important that the drivers understand the technology provided to them on the road; because this will help them better their attitudes and behaviors. Drivers did not have sufficient information on this application until the acceptance of the ASSC sign in Europe in 2006. It could be seen that they were braking in front of the camera and many erroneous information was being shared online (Charlesworth, 2008). Whereas today, braking in front of the camera is rarely observed since they remain at a consistent speed along the section thanks to the placement of ASSC signs (Charlesworth, 2008; Høye, 2014). Drivers criticize the fact that spot speed precautions do not reflect the typical speeding behaviors (Soole et al., 2013), it was put forth by drivers that ASSC is more fair in comparison with spot speed application since speed is measured along a longer distance in ASSC applied sections (Simcic, 2009).

It was observed during the first use of ASSC in Holland that 75% of the drivers perceived this application to be more fair in comparison with other automated speed enforcement systems and that driver acceptance was high (Soole et al., 2012; 2013). A driver survey carried out in the United Kingdom put forth that 74% of the drivers comply with ASSC (Charlesworth, 2008). A total of 61% of the drivers indicated that they believe ASSC to be a good effort as a result of a survey carried out on more than 1000 drivers , that 73% stated a decrease in their selection of vehicle speeds and that 17% stated that the system generates road safety benefit (Schwab, 2006). A survey carried out in the New South Wales state of Australia on 315 drivers put forth that 63% of the participants support this application (Walker et al., 2009). Thus, a series of driver survey studies indicate a high level of driver acceptance regarding the application (Soole et al., 2013; Bates et al., 2016).

The fact that cameras did not have type approval for enforcing speeds of under 30 mil/h was an obstacle for ASSC to decrease the speed limits during the first years. Hence, speed bumps and sharp turns were used. However, even though such speed enforcement methods are effective, they were not approved by the drivers. There is a recent change in the trial of this system on sections with low speed limits. It was put forth that technology provides an effective alternative to speed enforcement methods that are expensive, that may increase emissions and that are unnecessary for emergency vehicles (e.g. speed bumps) (Townsend, 2006; Crawford and Council, 2007;

Simcic, 2009). A survey carried out on drivers in England put forth that 72% of the participants will support the use of ASSC on residential area roads with speed limits of 20 mil/h. Only 43% of the drivers support speed bumps as an alternative to ASSC (Crawford and Council, 2007). It was determined as a result of the surveys carried out by RACQ in Australia that 66% of the members support ASSC especially for low speed limit sections (Soole et al., 2013).
There are speed bump applications as a precaution to high speeds in Turkey for sections at areas such as university campuses with low speed limits, however, speed bumps have the aforementioned disadvantages. The objective of this study was to: (1) setup mobile ASSC and measure the average speed values of commuter drivers via speed etudes at 7 different sections with a speed limit of 30 km/s during 1 secret and 2 announced periods (2) carrying out a survey with these drivers for determining their opinions about the applied system and driver attributes, (3) meticulously determining the commuter drivers who have participated in the survey and for whom average speeds have been determined and to evaluate the effectiveness of this system at the end of the application by way of measuring the matched data via statistical methods.

ASSC has been in use recently in both urban and express ways in Turkey, however, there are no articles on this subject in peer reviewed journals. The difference of this system from the other applications in Turkey was that license plates can be acquired at any desired time and location since the cameras are placed not on a fixed spot but on mobile vehicles. Areas such as campuses are sections in which there are commuter drivers and hence the average speeds of the same vehicles can be measured more than once. This is important for attaining the continuity of the data acquired in the study. As of now, there are a limited number of studies published in peer-reviewed journals examining the effects of speed on ASSC's commuter drivers with their own views.

2. Mobile ASSC at The University Campus

Majority of the pedestrians and vehicles pass from the same locations in the Akdeniz University campus located in the city of Antalya, Turkey which increases the possibility of accidents involving vehicles and pedestrians. In addition, the number of accidents recorded per year is 10 (there are also unrecorded accidents) (Ilgaz and Saltan, 2017c). Even though there are speed-signs in the campus that indicate the speed limit of 30 km/s the most important issue is that speeding is very common in the campus. Figure 3 and Table 1 show 7 different sections along with their properties where the inclination to drive fast is high.

Figure 3. Sections (Ilgaz and Saltan, 2017b).

Table 1. Properties of the sections

Section	Length (m)	Number of pedestrian crossings	Number of speed bumps
A	908	5	3
B	717	4	3
E	425	2	2
H	615	3	1
I	594	3	-
J	695	3	-
K	695	3	-

2.1. Data Acquisition

Two mobile vehicles with ASSC installed (Figure 4) have been parked on these sections so that they can scan all lanes without interfering with the flow of traffic. Cameras recorded average speeds from 08:00 to 18:00 on 5 five week days at 7 different sections during February-March 2013 in the “before” period and during April-May 2013 in the “after” period. Uninterrupted video flow method is used in the system for detecting the vehicle license plates which are then uploaded to the central server along with the photographs taken. Wireless internet connection (3G Router) is used for uploading these analyzed license plates in both text and photograph format to the central server shown in Figure 5 (computer+main software) (Figure 6) (Ilgaz and Saltan, 2017a).

Figure4. Mobile ASSC Setup (Ilgaz and Saltan,

2017b).)

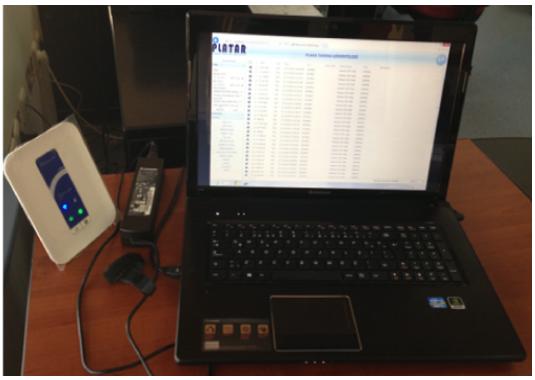

Figure 5. Central Server

Figure 6. A sample vehicle photo transferred via 3G Router

"Before" period measurements were carried out without prior information provided to the drivers. An e-mail was sent announcing the dates for the use of the system for the "after" period, billboards were placed at the entrance gates and leaflets were distributed. Surveys were distributed to 4000 drivers at the end of both the "before" and "after" periods. The number of vehicles for which average speed was determined was 16862 in the "before" period and 15186 in the "after" period; average speeds and number of those who committed speeding offence decreased in all sections. Only 734 surveys were filled out and returned by the drivers. It was meticulously determined that the average speeds were calculated during both the before/after periods for only 32 of the survey participants with 8 in each period (in order to increase reliability of the statistical analyses). Speed and survey data comprised of these 32 samples were uploaded to the SPSS software® and statistical analyses were carried out on these data in accordance with the objectives of the study. Statistical significance level for the study was selected as 0.05.

3. Results And Discussion

3.1. Surveys

Table 2 shows defining characteristics of the participant drivers, behaviors put forth by the drivers regarding their own speeding behaviors along with their opinions on the speed limit precaution. A total of 54.8% of the drivers indicated that they do not tend to overtake other vehicles. It was stated by 56.7% of the drivers that the speed limits in the campus are low. Of the drivers, 34.4% have not been involved in an accident, whereas 37.5% have been involved in 1 or more accidents.

Table2. Driver characteristic

Defining characteristics	**N**	**%**
Gender		
Male	24	75
Female	8	25
Age		
40 and below	18	56.3
41 and above	14	43.8
Graduation Status		
Undergraduate	10	31.3
Academy + Undergraduate	8	25
Graduate Study + Doctorate	14	43.8
Level of Responsibility in the University		
Academic	13	40.6
Non-Academic	19	59.4
Total Years of Driving Experience		
0-9	11	35.5
10-19	11	35.5
20 and above	9	29
Number of accidents involved as the vehicle driver		
0 accidents	11	34.4
1 or more accidents	12	37.5
Perceptions of the drivers regarding their own speeding behavior	**N**	**%**
Do you tend to overtake other vehicles at every opportunity?		
Yes	5	16.1
No	17	54.8
Sometimes	9	29.0
Opinions of the drivers on average speed limit precaution	**N**	**%**
What are your opinions regarding the speed limits enforced in the campus via ASSC?		
High	1	3.3
Low	17	56.7
Sufficient	11	36.7
No Idea	1	3.3

3.2. Analyses on driver characteristics and speeds

Normality hypothesis of the speed data distribution for 32 drivers who participated in the survey and for whom average speeds were determined was verified via Shapiro-Wilk test (Table 3). Shapiro-Wilk test is more sensitive in comparison with other tests and it is more suited for data sets with number of data less than 2000. It was determined as a result of the analysis that the speeds have a normal distribution for both the before/after periods. Hence, paired-samples t test which is a parametric test was used in order to understand whether the change in average speeds

during the before/after periods was statistically significant or not.

Table 3. Before/after speed normality test for drivers

Period	N	Average Speed (km/s)	Standard Deviation	Value	p
Before	32	38.73	5.671375	0.963	0.340
After	32	35.13	4.672501	0.966	0.402

*Significant at the 5% level.

Paired-samples t test was applied in order to compare the observed speed value averages for the drivers during the two different periods (Table 4). Whereas the average value for the speeds in the "before" period was 38.73 km/s, this value decreased down to 35.13 km/s in the "after" period. Paired-samples t test put forth that the differences were statistically significant.

Table 4. Before/after average speed Paired-samples t test for the drivers

Period	N	Average speed (km/s)	Standard Deviation	t	p
Before	32	38.73	5.671375	4.474	0.000
After	32	35.13	4.672501		

*Significant at the 5% level.

In this section, Independent Samples t-test was carried out in order to determine whether the variables of "gender, age, responsibility level, opinions on the enforced speed limits and drivers who were/were not involved in an accident"" affect the speed averages during the before/after periods (Table 5). The "before" period average speed of male drivers was 37.64 km/s, whereas that of female drivers was 42.00 km/s. These values decreased down to 34.43 km/s for male drivers during the "after" period and to 37.23 km/s for female drivers. The speed average for drivers with ages of 40 and below was 40.52 km/s during the "before" period, whereas it was 33.32 km/s for drivers aged 41 and above. These values decreased down to 36.53 km/s and to 33.32 km/s during the "after" period. The "before" period speed average for academics was 39.76 km/s, whereas it was 38.03 km/s for non-academics. These speed averages decreased down to 35.16 km/s and to 35.10 km/s during the "after" period. The "before" speed average of the drivers who indicated that the speed limit enforced via ASSC is low was determined as 39.07 km/s, whereas the average speed was determined as 37.87 km/s for those who think that the speed limit is sufficient. The "after" average speed was determined as 35.25 km/s for the drivers who stated that the speed limit is low, whereas it was determined as 33.63 km/s for the drivers who stated that the speed limit is sufficient. The speed average of the drivers who have not been involved in an accident was 41.43 km/h, whereas the speed average was 38.86 km/h for those who have been involved in an accident. The speed average for the drivers who have not been involved in an accident was 35.18 km/h, whereas the speed average for those who have been involved in an accident was 36.45 km/h. Even though there are numeric differences for both the "before" and "after" periods between the opinions on the enforced speed limit with regard to gender, age, responsibility level and accident status, the t-test put forth that there was no statistically significant difference in the average speeds of the drivers according to these variables. This indicates that differences in gender, age, responsibility level, opinions on speed limits and accident status do not affect the speed averages of the before/after periods.

Table 5. "Gender, age, responsibility, speed limit"&"before/after average speed" t test

Period		N	Average Speed (km/s)	Standard Deviation	t	p
	Gender					
Before	Male	24	37.64	6.030	-1.971	0.058
	Female	8	42.00	2.577		
After	Male	24	34.43	4.818	-1.497	0.145
	Female	8	37.23	3.701		
	Age					
Before	40 and below	18	40.52	5.350	2.130	0.042
	41 and above	14	36.44	5.404		
After	40 and below	18	36.53	4.713	2.023	0.052
	41 and above	14	33.32	4.095		
	Responsibility					
Before	Academic	13	39.76	4.687	0.846	0.404
	Non-academic	19	38.03	6.282		
After	Academic	13	35.16	3.305	0.033	0.974
	Non-academic	19	35.10	5.506		
	Opinions on speed limits					
Before	Low	17	39.07	4.564	0.556	0.583
	Sufficient	11	37.87	6.948		
After	Low	17	35.25	3.904	0.990	0.331
	Sufficient	11	33.63	4.681		
	Number of accidents					
Before	0 accidents	11	41.43	4.879		
	1 or more accidents	12	38.86	4.6186	1.298	0.208
After	0 accidents	11	35.18	4.264		
	1 or more accidents	12	36.45	4.307	-0.706	0.488

*Significant at the 5% level.

In this section, Univariate Anova test was carried out in order to put forth whether the variables of "education, years of driving experience, tendency to overtake other vehicles" affect the before/after speed averages or not (Table 6). It was determined that the speed averages of those that are not university graduates was 35.32 km/s during the "before" period, whereas the speed averages was determined as 40.76 km/s for university graduates and as 40.01 km/s for graduate study alumni; whereas these values were determined as 33.47 km/s, 36.47 km/s, 35.54 km/s respectively during the "after" period. The speed average for those who have been driving for0-9years, 10-19years and 20 years and above was determined

respectively as 39.40 km/s, 39.73 km/s, 36.81 km/s for the "before" period. Whereas these values were determined respectively as 36.71 km/s, 34.20 km/s, 34.30 km/s for the "after" period. It was examined whether the speed averages for drivers with a tendency to overtake other vehicles differ between the before/after periods and it was determined that the speed averages of drivers who responded as yes, no and maybe were 40.86 km/s, 38.09 km/s, 39.244km/s respectively during the "before" period. Whereas these values were determined as 37.91 km/s, 33.85 km/s, 35.78 km/s during the "after" period. T-test carried out in both periods for the average speed values analyzed for all 3 types of variables indicate that there is no statistically significant difference, meaning that the differences between education levels, total years of driving experience and tendencies to overtake other vehicles do not affect the speed averages in both periods.

Table 6. "Education, years of driving experience, tendency to overtake other vehicles"&"before/after period speed" Anova test

Periods		N	Average Speed (km/s)	Standard Deviation	F	P
	Graduation					
Before	Pre-University	10	35.317	6.476		
	College+Undergraduate	8	40.757	4.961	3.031	0.064
	Gradute+Doctorate	14	40.013	4.599		
After	Pre-University	10	33.469	6.064		
	College+Undergraduate	8	36.472	4.535	1.018	0.374
	Gradute+Doctorate	14	35.541	3.481		
	Years of Driving Experience					
Before	0-9	11	39.404	5.019		
	10-19	11	39.733	6.537	0.727	0.492
	20 and above	9	36.811	5.782		
After	0-9	11	36.711	4.852		
	10-19	11	34.201	4.895	0.955	0.397
	20 and above	9	34.298	4.452		
	Tendency to Overtake Other Vehicles					
Before	Yes	5	40.862	3.210		
	No	17	38.093	6.513	0.464	0.633
	Sometimes	9	39.244	5.311		
After	Yes	5	37.909	5.374		
	No	17	33.851	4.557	1.625	0.215
	Sometimes	9	35.778	4.408		

*Significant at the 5% level.

4. Conclusions And Future Research

Whereas the speed average during the before period was 38.73 km/h, the speeds decreased down to 35.13 km/h during the after period. Normality assumption of the speed data distribution for these drivers the average speed values and survey results of which are known was verified via Shapiro-Wilk test. Therefore, it was verified via the parametric test of Paired-samples t test that the decrease in the average speeds between the before/after periods was statistically significant. Of the drivers, 34.4% have never been involved in an accident, whereas 37.5% have been involved in 1 or more accidents. When the opinions of the drivers regarding the speed limits enforced in the campus were asked, it was determined that 3.3% think that the speed limits are high, 56.7% think that they are low, whereas 36.7% think that they are sufficient. Independent Sample t test was used to determine the average speed differences for the before/after periods according to the "gender, age, duty, number of accidents, opinions on speed limit" variables of the drivers who participated in the survey and for whom the average speeds were detected, whereas Univariate Anova test was applied in order to determine the average speed differences for the "education level, years of driving experience, tendency to overtake other vehicles" variables during the before/after periods. The differences were not determined to be statistically significant according to the analyses. The study was conducted in Akdeniz University campus. Therefore, most of the people who were measured were elite. This may have affected the statistical significance of the results.

In this system, average speeds decreased in the campus for the sample group comprised of 32 drivers without any penal sanctions and only by way of warnings and announcements; however, these average speed values are above the speed limit. A higher ratio for obeying the sped limits may be obtained by way of a better communication and

instruction strategy along with an enforcement sanction following any violation. No speed enforcement system is sufficiently effective when there is no enforcement sanction or when the level of sanction is not sufficient. Of the participants, 54.8% indicated that they do not tend to overtake other vehicles. Based on this sample group, it is thought that speeding behavior is not considered as an acceptable behavior by the majority. The results would be different if the number of samples was higher and an urban route with a higher speed limit was chosen for the study.

Of the drivers, 56.7% indicated that the speed limits enforced by ASSC are low. Based on this sample group, majority of the drivers are of the opinion that the imposed speed limits are not reasonable and that these limits will be neglected for the most part in future periods. In general, speed limit adjustment is a proper means for ensuring that the drivers respect the enforced speed limits, however it should be kept in mind that this study was carried out in a university campus. Excessive attention should be provided in order to prevent any risks involved for pedestrian safety due to the enforced speed limits (Ilgaz and Saltan, 2017a). It is planned and suggested to carry out similar studies on the greater number of commuter drivers on expressways.

Conflict of Interest / Çıkar Çatışması

No conflict of interest was declared by the authors.

Yazarlar tarafından herhangi bir çıkar çatışması beyan edilmemiştir

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