

ANALYSIS OF COMPREHENSION OF TRAFFIC SIGNS: A PILOT STUDY
IN ANKARA, TURKEY

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ABSTRACT

ANALYSIS OF COMPREHENSION OF TRAFFIC SIGNS: A PILOT STUDY IN ANKARA, TURKEY

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Traffic signs, which are extremely important for traffic safety, aims to regulate traffic by providing information about the characteristics of road and road environment for drivers. The success of traffic signs mainly rely on the easy comprehensibility of its meaning in a short time. Further more, today's global economies and transportation systems emphasize the need for more universal traffic signs which was the main motivation of two main treaties on traffic signs; Vienna Convention in 1968 and European Agreement Treaty in 1971, which are signed and followed by Turkey. For an effort to increase traffic safety, a Subcommittee of the Turkish Highway Traffic Safety (THTS) Council requested the determination of comprehensibility of critical signs with higher probability of impact on traffic safety selected by a group of experts from engineers and law enforcement agencies in a survey study. The survey questionnaire included 30 selected traffic signs (including two prohibition signs omitting oblique bar recently changed as a part of the European Union Participation Process) and 9 control group signs, a total of 39 traffic signs, and driver characteristic questions, such as gender, age, educational background, etc. to reveal insights about a) the level of comprehensibility of different groups of traffic signs and and b) driver characteristics that may affect the comprehensibility of these signs.

A pilot study in the city of Ankara is conducted over a sample of 1,478 surveys. Answers for the meaning of each sign are coded using a scale of five (opposite, wrong, no comment, partially correct and correct responses). The results showed that the control group signs have very high comprehensibility as expected, while some of the critical signs were not known much, or mistaken for others, even mistaken for opposite meanings. The certain loss of comprehensibility of the traffic signs changed recently is seen in the comparative analysis of the signs before and after the change, as well as significant shift towards an opposite meaning. The significance of driver characteristics (gender, education, occupation etc.) affecting the comprehensibility of the traffic signs varies among traffic signs and characteristics. As the result of this study, (THTS) Council decided to support traffic and driver education more and mass promotion of mis- or un-comprehended signs without searching for more local solutions or versions.

Keywords: Traffic Safety, Traffic Signs, Comprehension Level, European Agreement for Traffic Signs, Driver Characteristics, Survey Analysis

ÖZ

TRAFİK İŞARETLERİNİN BİLİNİRLİK ANALİZİ ANKARA İLİ PİLOT ÇALIŞMASI

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Trafik güvenliği açısından son derece önemli olan trafik işaretleri, yolu kullananlara yol ve çevresinin karakteristiği hakkında uyarı ve bilgi vererek trafiği düzenlemeyi amaçlamaktadır. Bir trafik işaretinin başarısı kısa zamanda anlamının bilinmesi olarak açıklanabilir. Küresel ekonominin ve ulaştırma sisteminin ortak trafik işaretleri kullanımındaki ihtiyacına paralel olarak, Türkiye tarafından da kabul edilen 1968 yılında Viyana Konvensiyonu, 1971 yılında da Avrupa Anlaşması (European Agreement) imzalanmıştır. Trafik güvenliğini artırmak amacıyla, Karayolu Trafik Güvenliği Kurulunun (KTGK) belirlediği bir alt komisyon, mühendis ve Emniyet yetkililerinden oluşan bir uzman grubun desteğiyle belirlediği trafik kazalarına etkisinin fazla olması beklenen trafik işaretlerinin bilinirlik seviyesinin ölçülmesi amacıyla bir anket çalışması yapılmasına karar vermiştir. Her bir anket formunda 30 trafik işareti sorusu bulunurken (Avrupa Birliği uyum sürecinde “çapraz kırmızı çizgilerin” kaldırılması ile değiştirilen 2 yasaklayıcı işaret ile 9 kontrol grubu trafik işaretini de içermektedir), toplamda 39 farklı trafik işareti ve cinsiyet, yaş, öğrenim seviyesi vb. sürücü karakteristiği bulgularının ışık tuttuğu a) trafik işaretlerinin bilinirlik seviyesi ve b) bilinirlik seviyesini etkileyen sürücü özelliklerinin

belirlenmesi çalışması yapılmıştır. Pilot çalışmanın uygulandığı Ankara ilinde toplam 1,478 katılımcıya anket uygulanmıştır. Trafik işaretlerinin anlamı sorusuna verilen yanıtlar beşli bir ölçek (tam tersi, yanlış, yorumsuz, kısmi doğru ve tam doğru) kullanılarak kodlanmıştır. Sonuçlar, kontrol grubu olarak belirlenen trafik işaretlerinin beklendiği gibi yüksek oranda bilindiğini; bazı işaretlerin yeterli seviyede bilinmediğini, bazılarının diğerleriyle karıştırıldığını, bazılarının da tam tersi şeklinde yanıtladığını göstermiştir. AB Uyum sürecinde değiştirilen trafik işaretlerinin yeni versiyonlarının bilinirliğinin azaldığı, hatta bu işaretlere verilen tam tersi yanıtların çok yüksek oranda olduğu görülmüştür. Farklı alt grupların (cinsiyet, öğrenim seviyesi, yaş vb.) trafik işaretlerinin bilinirliğine etkisi araştırılmıştır. Bu çalışma sonucunda, sürücülere daha fazla eğitim verilmesi kararına varılmış, yeterli seviyede bilinmeyen trafik işaretlerine açıklayıcı kelimelerin yazılmasının günümüzün global ekonomi ve ulaşım sistemindeki evrensel işaretlerin anlaşılmasını zorlaştıracak görüşü benimsenmiştir.

Anahtar Kelimeler: Trafik İşaretleri, Bilinirlik, Karşılaştırmalı Analizler, AB Uyum Sürecinde Değişen Trafik İşaretleri, Figür ve Renk Faktörü, Trafik İşaretlerinin Temel Özellikleri, Anket Çalışması, Anket Formu Tasarımı

To My Parents,

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CHAPTER 1

INTRODUCTION

By technological and economical developments in recent years, the number and quality of vehicles have increased. As a result, traffic has been one of the most important parts of our daily lives as people spend more time in traffic. Drivers have started to face a higher risk of traffic accidents, especially in Turkey, where advancing technology in vehicle safety systems has not been able to reduce property and psychological losses faced due to traffic accidents.

Number of lives lost in traffic accidents is higher than total life loss in all world wars. Worldwide, more than 1.25 million people lose their lives annually due to traffic crashes. Traffic accidents are the leading cause of death among people in ages between 15-19, second cause for 10-14 and 20-24 age groups. Every day, nearly 1,049 people under the age of 25 lose their lives in traffic accidents (WHO, 2004). Each year, an estimated 518 billion dollars is lost because of traffic accidents. If appropriate actions are not taken by 2020, traffic accident injuries are predicted to rank the third leading contributor to the global burden of disease and injury while it was ninth in 1998 (Murray and Lopez, 2004).

In our country, nearly 4,500 people lose their lives in traffic accidents each year. Bearing in mind that around 200,000 people suffer from injuries due to traffic accidents annually, the significance of the matter can be seen even better. When factors causing traffic accidents in Turkey are examined, it is seen that 98% of accidents occur due to driver faults while impact of road conditions or defects in vehicles is much more lower (SGD, 2010). In 2008, 30% of traffic accidents due to driver faults resulting in injury or life loss are primarily caused by the driver not being able to adjust vehicle speed to the current road conditions, air conditions or

traffic flow). In other words, excessive speed is the main factor that causes traffic accidents (GDS, 2010).

From a perspective that includes not only private car drivers, but also professional drivers who transport passengers and cargo, it is seen that traffic safety issue requires studies in many fields, such as infrastructure design and management, drivers education, supervision and training, etc. There are multiple domestic laws and legislations to regulate traffic in our country. First of all, “Road Traffic Law (2918)” aims to govern traffic safety and defines all precautions to be taken. This law includes traffic rules, occasions, rights and obligations, implementations and detections, related institutes and their authorization, responsibilities, working procedures and other articles (Official Journal of the Republic of Turkey, 1983).

Highway Traffic Safety High Committee (in Turkish *Karayolu Trafik Güvenliği Yüksek Kurulu*) is currently the highest authority on traffic safety, under the direction of Prime Minister with participation of 8 related Ministers, State Planning Organization Undersecretary, Director-General of Security General Directorate (SGD) (in Turkish *Emniyet Genel Müdürlüğü*), Gendarmerie General Commander and Director-General of General Directorate of Highways. A supported committee called Highway Traffic Safety Committee (HTSC) (in Turkish *Karayolu Trafik Güvenliği Kurulu*), under the direction of Head of Turkish SGD Traffic Service, includes participation of 24 at least top-level officers of public institutions. In metropolition regions, Transportation Coordination Centres, have authority in local issues, such as speed limit on arterials, signalization, etc.

To increase traffic safety Intelligent Transportation Systems, such as Advanced Traveler Information Systems and In-Vehicle Navigation Systems are being developed. However, a much more effective and more basic step is increasing driver’s skills and traffic knowledge, especially on the traffic signs used to guide them. To achieve traffic safety, drivers should understand traffic sign information and should have appropriate driving behavior as well as knowledge on traffic sign regulations and detection. Otherwise drivers will probably have dangerous driving behaviors and may create danger for other drivers or pedestrians since they cannot recognize the forward situation. But eventually, the success of traffic signs mainly

relies on the easy comprehensibility of their meanings in a short time. Another factor is using universal traffic signs instead of those regionally differ.

When history of traffic signs is reviewed, it is seen that first serious studies about design and usage of signs began with the invention and development of vehicles by 1900's. Traffic signs are used to regulate traffic, inform road users of prohibition and restrictions and guide drivers by drawing lines, arrows, text and symbol on the road surface. The traffic sign standards are accepted by many countries throughout the world and the standards used in our country have been laid out in the Vienna Convention on Road Signs and Signals (also known as the Vienna Convention or Vienna Protocol) signed on November 8, 1968 in Vienna. European countries, desiring to achieve greater uniformity in rules governing road signs, signals and symbols and road markings in Europe, have undersigned the European Agreement Supplementing the Convention on Road Signs and Signals of 1968 at Geneva on 1 May 1971 (UN, 2008).

In 1968, Turkey accepted and has become a party to -the “Vienna Convention” which determines international highway safety standards but the Convention was not adopted into legislation, as it has not been approved by the Grand National Assembly of Turkey, yet. General Directorate of Highways that determines standards of traffic signs and which installs required signs on highways, constructs, improves and repairs the roads and bridges, determines required intersections, stopping areas, illuminates parking places and other buildings to supply traffic safety and maintenance and sets speed limits with the approval of Ministry of Interior, adopted traffic sign and signal standards and put them into application according to the Vienna Convention since the day it was signed. Since Turkey is in accession period for the European Union (EU); General Directorate of Highway adapted some traffic signs at the end of 2004 according to the European Agreement by removing oblique red bars appropriate to the Vienna Convention.

HTSC in an effort to evaluate the comprehensibility of traffic signs, decided to make survey study to some of the traffic signs that recently changed due to EU process and critical ones that are expected to have high impact on traffic safety, such as speed limit, prohibitions on takeover, etc.

In the scope of the study, at first traffic signs which will be addressed in a survey study are determined and a questionnaire is designed by the help of experts. Survey study is applied in some public institutions and shopping centers that locate in center districts of Ankara (Cankaya, Yenimahalle). Kecioren and Mamak districts are chosen to reach drivers that have different social backgrounds, income and personal characteristics. 1,478 drivers participated in the survey study. At the end of the survey study, comprehension levels regarding 39 traffic signs are determined. Traffic signs known correctly, partially as well as those not known or with false comprehension have been determined. Change of comprehension level for the previous and new versions of the traffic signs that were changed during the EU accession period is determined.

The layout of this thesis is as follows: Next chapter includes general information and statistics about highway traffic safety. After that, necessary information about historical development and types of traffic signs are given. Chapter 4 presents the main steps and methodology of the study performed by Turkish HTSC and Chapter 5 includes statistical analysis results of the study. This chapter also includes information and comparison about traffic signs. To preserve fluency, summary of analysis results of traffic signs are given in the Appendix. After the relationship between drivers' characteristics and comprehension levels are given in Chapter 6, Chapter 7 includes conclusion and further recommendations.

CHAPTER 2

TRAFFIC SAFETY IN TURKEY

As a result of traffic accidents, each year ten thousands of people are killed, hundred thousands are injured and billions of dollars worth of property damage occurs in our economy (Turkish Security General Directorate, 2010). Everyone killed, injured or disabled in highway traffic accidents has a network including family and friends, who are deeply affected. It would be impossible to attach a value to each case of human fatality and suffering. In our country, material and psychological losses caused by traffic accidents are higher than losses incurred by earthquakes, floods, natural disasters and terrorist attacks etc. The economic cost of road crashes and injuries is estimated to account for 2.1 % of the gross national product (GNP) of our country (TURKSTAT, 2007). It is obvious that contributing to the solution of traffic safety problem will help many people at different aspects.

To improve traffic safety; highway infrastructure, engineering, education, supervision, emergency services should be maintained in a coordinated and consistent way. When factors that cause traffic accidents are examined, it is seen that traffic accidents mostly occur due to driver faults (98 %) and road or vehicle defects are at very low rates (See Table 2.1). By examining traffic accidents involving fatality or injury in 2008, it is seen that one-third of the accidents occurred because of excessive speeding (See Table 2.2). Excitement, courageousness of drivers, having high driving skills and the need for time saving etc. are shown as the main causes of excessive speeding (Cubuk, 2004).

Table 2.1 Faults Caused to Traffic Accident between 1995 and 2007 (GDS, 2010)

F a u l t s											
Years	Total	Driver faults	Ratio to total faults	Passengers faults	Ratio to total faults	Pedestrian faults	Ratio to total faults	Road defects	Ratio to total faults	Vehicle defects	Ratio to total faults
1995	382,480	356,707	93.26	507	0.13	16,559	4.33	5,759	1.51	2,948	0.77
1996	420,036	398,782	94.94	2,288	0.54	16,702	3.98	572	0.14	1,692	0.40
1997	667,899	649,955	97.31	894	0.13	14,297	2.14	28	0.00	2,725	0.41
1998	551,211	528,921	95.96	1,419	0.26	15,004	2.72	2,459	0.45	3,408	0.62
1999	562,104	539,563	95.99	1,279	0.23	15,133	2.69	3,148	0.56	2,981	0.53
2000	600,298	576,668	96.06	1,485	0.25	14,435	2.40	4,604	0.77	3,106	0.52
2001	565,682	546,233	96.56	1,738	0.31	13,105	2.32	2,457	0.43	2,149	0.38
2002	538,346	521,227	96.82	1,254	0.23	12,867	2.39	1,332	0.25	1,666	0.31
2003	568,364	551,467	97.03	882	0.16	13,208	2.32	1,255	0.22	1,552	0.27
2004	640,906	623,578	97.30	710	0.11	13,987	2.18	1,216	0.19	1,415	0.22
2005	730,623	711,572	97.39	769	0.11	14,882	2.04	1,603	0.22	1,797	0.25
2006	851,150	834,681	98.07	739	0.09	13,789	1.62	1,100	0.13	841	0.10
2007	922,004	903,860	98.03	795	0.09	15,086	1.64	994	0.11	1,269	0.14
Note. Road traffic accidents are include in responsibility area of traffic police and gendarmerie											

2.1 Transportation Systems in Turkey and in the World

Before focusing on traffic safety, it is necessary to overview features of highway transportation system and traffic structure in our country. In Turkey, highway has a market share of more than 90 % among all transportation systems for both passenger and freight (See Figure 2.1). Highway transportation system for passengers has around 90 % share, which is only 27 % in United States and 58 % in Germany (See Figure 2.2). In the United States rail transportation is used most widely and water transportation has almost one fourth ratio of all systems. In Germany, although highway transportation has a ratio more than half, also rail, water and air transportation systems have also significant shares. As it is seen, both passenger and goods are mostly transported by using highway system. However when road capacities are reviewed, it is seen that our country has much lower rates than developed countries (See Figure 2.3). This causes higher traffic density on our roads.

Table 2.2 Driver Faults Causing Traffic Accidents Involving Fatality or Injury in
2008 (GDS, 2010)

DRIVER FAULTS	URBAN	RURAL	TOTAL	%
Unable to adjust vehicle speed road due to road, air conditions or traffic flow	21,168	9,566	30,734	33.46
Failure to yield the right of way	12,682	1,311	13,993	15.24
Failure to turning regulations	9,797	1,740	11,537	12.56
Tailgating	6,209	2,842	9,051	9.85
Failure to other traffic safety regulations	4,323	2,018	6,341	6.90
Frequent or unsafe lane changes	3,349	1,591	4,940	5.38
Impaired driving	3,185	756	3,941	4.29
Failure to traffic signals	2,208	247	2,455	2.67
Entering to no entry roads	1,551	303	1,854	2.02
Excessive speed	929	467	1,396	1.52
Influence of alcohol	1,026	325	1,351	1.47
Collision to safely parked vehicles	1,012	57	1,069	1.16
Passing when it is restricted	668	219	887	0.97
Unsafe parking	379	134	513	0.56
Other	1,550	231	1,781	1.94
TOTAL	70,036	21,807	91,843	100

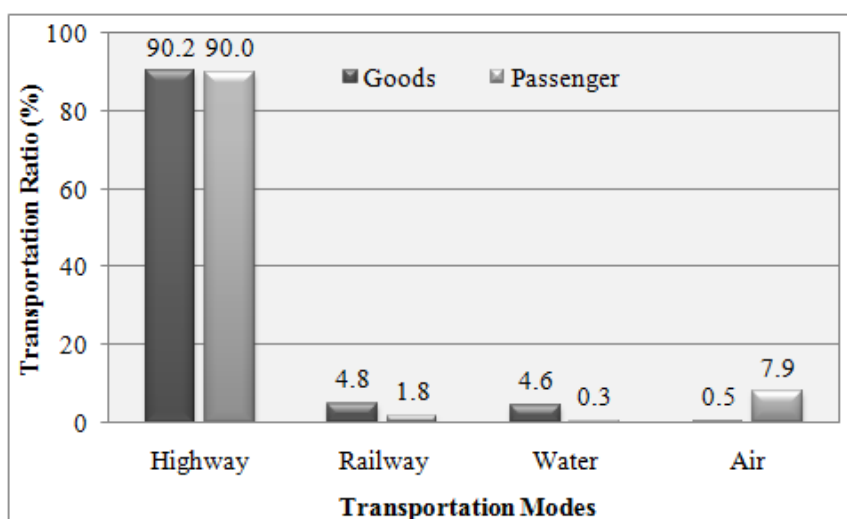


Figure 2.1 Transportation of Passengers and Goods per Mode in Turkey (%)
(TURKSTAT, 2008)

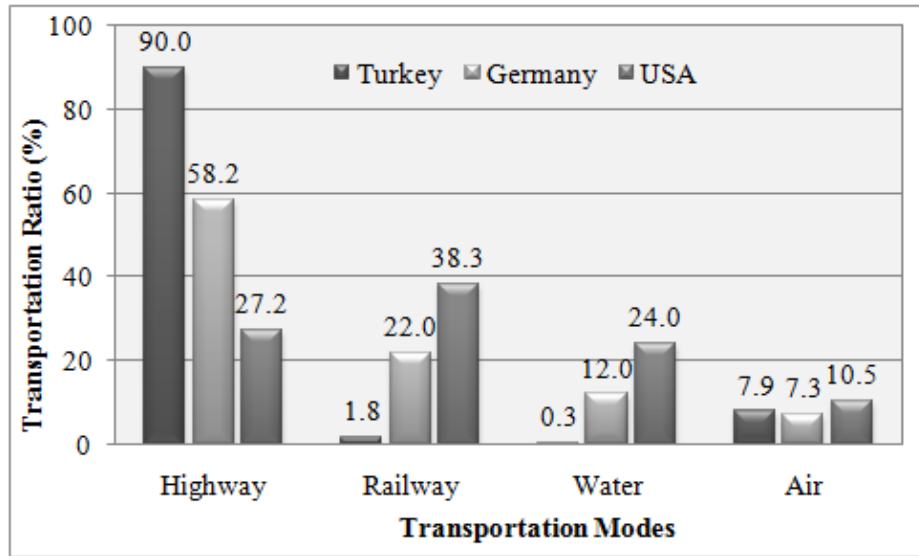


Figure 2.2 Transportation of Passengers per Mode (%) in Turkey, United States and Germany (UNECE Transport Division, 2006)

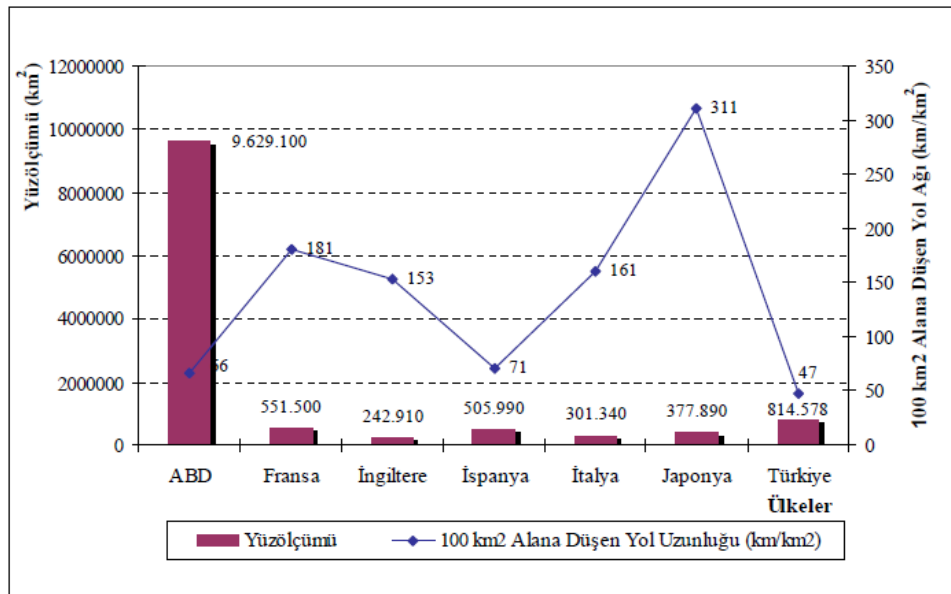


Figure 2.3 Length of Total Road Network in Some Countries per 100 km²

2.2 Traffic Statistics

There are lots of indicators defining relationship between traffic safety and density. To see the general picture and trend, it is necessary first to review general driver and vehicle statistics (number of drivers, number and type of vehicles, growth rates, etc.), and then traffic accidents (number of accidents, fatality or injury etc.).

a) Driver and Vehicle Statistics

Since driver faults are main causes of accidents, it is important to review changes in number of drivers. In the last ten years, number of drivers in Turkey increased 48.5% and rising from 13.8 million to 20.5 million drivers (See Table 2.3). Another important change in the trend is the increase in the number of female drivers, rising from 1.9 million (13.5%) to 3.6 million (17.5%) drivers, which shows almost a two-fold increase. In the same period, number of male drivers raised from 12 million to 16.9 million (82.5 %) drivers increasing 41%.

Table 2.3 Number of Male and Female Drivers between 2000 and 2009

Year	Total Drivers	Increase (%) *	Male	(%)	Female	(%)
2000	13,859,449		11,988,154	86.5	1,871,295	13.5
2001	14,491,332	4.6	12,473,155	86.1	2,018,177	13.9
2002	14,994,960	3.5	12,851,459	85.7	2,143,501	14.3
2003	15,488,493	3.3	13,205,913	85.3	2,282,580	14.7
2004	16,151,623	4.3	13,704,551	84.8	2,447,072	15.2
2005	16,958,895	5.0	14,289,647	84.3	2,669,248	15.7
2006	17,586,179	3.7	14,770,114	84.0	2,816,065	16.0
2007	18,422,958	4.8	15,424,427	83.7	2,998,531	16.3
2008	19,377,790	5.2	16,073,831	82.9	3,303,959	17.1
2009	20,460,739	5.6	16,871,100	82.5	3,589,639	17.5

(*) increase rate from previous year

With 2009 values, B Type (Car, Minibus or Small Truck), E Type (Bus) and C Type (Truck) driver license classes have the highest number of registered drivers, with approximately 14.8 million drivers, 3.5 million drivers, 1.4 million drivers, respectively (See Table 2.4). It should be noted that the difference between number of drivers and driver's licenses occurs when some drivers have more than one type driver's licenses. Also number of vehicles has increased from 8.8 million to 14.3 million with an increase of 38.6 % (See Table 2.5) in the last decade. Almost half of the total vehicles are privately owned vehicles and also number of heavy goods vehicles is very high in 2009.

Table 2.4 Number of Driver License Types between 2000 and 2009

Year	A1	A2	B	C	D	E	F	G	H	Total	Increase
2000	53,219	364,174	9,276,057	1,444,108	9,207	2,534,039	392,585	16,836	18,830	14,109,116	
2001	53,467	388,567	9,814,416	1,445,804	10,737	2,631,449	383,827	18,511	20,806	14,767,694	4.67%
2002	53,622	402,674	10,251,523	1,447,174	13,013	2,692,300	382,624	20,094	22,037	15,285,187	3.50%
2003	53,805	411,375	10,686,009	1,447,347	15,225	2,748,562	380,901	21,487	23,085	15,787,933	3.29%
2004	54,426	429,307	11,230,909	1,454,422	24,435	2,847,388	379,286	23,350	24,680	16,468,317	4.31%
2005	54,787	450,680	11,919,158	1,456,546	32,651	2,951,273	378,523	25,735	26,709	17,296,216	5.03%
2006	56,039	494,164	12,434,247	1,467,482	41,558	3,030,388	380,006	30,198	28,597	17,962,895	3.85%
2007	56,485	567,904	13,135,961	1,438,239	56,581	3,180,982	375,709	34,653	30,840	18,877,354	5.09%
2008	57,232	660,817	13,903,160	1,442,323	75,902	3,336,506	375,787	39,272	33,443	19,924,442	5.55%
2009	60,193	784,442	14,758,037	1,441,473	100,232	3,531,082	375,673	47,245	36,527	21,134,904	6.08%
A1:Moped; A2:Motorcycle; B:Car, Minibus or Small Truck; C:Truck; D:Towed Vehicle; E:Bus; F:Tractor; G:Construction Vehicle; H:Specially Designed for Disabled Persons											

Table 2.5 Number of Vehicles by Type between 2000 and 2009 (GDS, 2010)

Year	Car	Minibus	Bus	Small Truck	Truck	Motorcycle	Special Use	Tractor	Total	Increase (*)
2000	4,855,421	289,422	129,924	789,524	593,361	984,592	21,822	1,131,626	8,795,692	
2001	4,975,733	293,697	133,944	877,563	598,481	1,011,160	22,939	1,148,391	9,061,908	3.03%
2002	5,080,555	303,803	137,964	924,342	604,050	1,032,011	23,666	1,168,389	9,274,780	2.35%
2003	5,124,254	309,545	141,987	1,045,776	616,940	1,096,777	24,468	1,178,929	9,538,676	2.85%
2004	5,400,440	318,954	152,712	1,259,867	647,420	1,218,677	28,004	1,210,283	10,236,357	7.31%
2005	5,772,745	338,539	163,390	1,475,057	676,929	1,441,066	30,333	1,247,767	11,145,826	8.88%
2006	6,140,992	357,523	175,949	1,695,624	709,535	1,822,831	34,260	1,290,679	12,227,393	9.70%
2007	6,472,156	372,601	189,128	1,890,459	729,202	2,003,492	38,573	1,327,334	13,022,945	6.51%
2008	6,796,629	383,548	199,934	2,066,007	744,217	2,181,383	35,100	1,358,577	13,765,395	5.70%
2009	7,093,964	384,053	201,033	2,204,951	727,302	2,303,261	34,104	1,368,032	14,316,700	4.01%

(*) increase rate to previous year

When length of road network is checked, since 1960s, it has shown a slight increase from 61,542 km (1960) to 63,174 (2005). On the other hand, road use amount increased from 1.6 million (1960) to 61 million (2005) between same intervals (Figure 2.4). As it is seen, despite a small increase of total length of road network, road use increased 108 folds. Vehicle-km shows travelled distance of vehicles in traffic and is a good measure of transportation need and use of highway road network. When vehicle-km data and length of total road network is considered, it is possible to evaluate transportation supply and demand over time (See Figure 2.4). In 1950 length of total road network was 47 thousand km, ten years later it increased by 30% to 61 thousands km 45 years later, in 2005, it increased by 3% to 63 thousands km On the other hand, while the road network use was 558 million vehicle-km in 1950, in ten years period it reached to 1,600 million vehicle-km increased by 3 folds. After 45 years, in 2005, it reached 61,000 million vehicle-km and increased by 38 times. As it is seen, road network capacity could not follow transportation demand. When considered with the length of total road network in developed countries per 100 km² data; imbalance between supply and demand is clearly seen as one of the reasons for traffic congestion today.

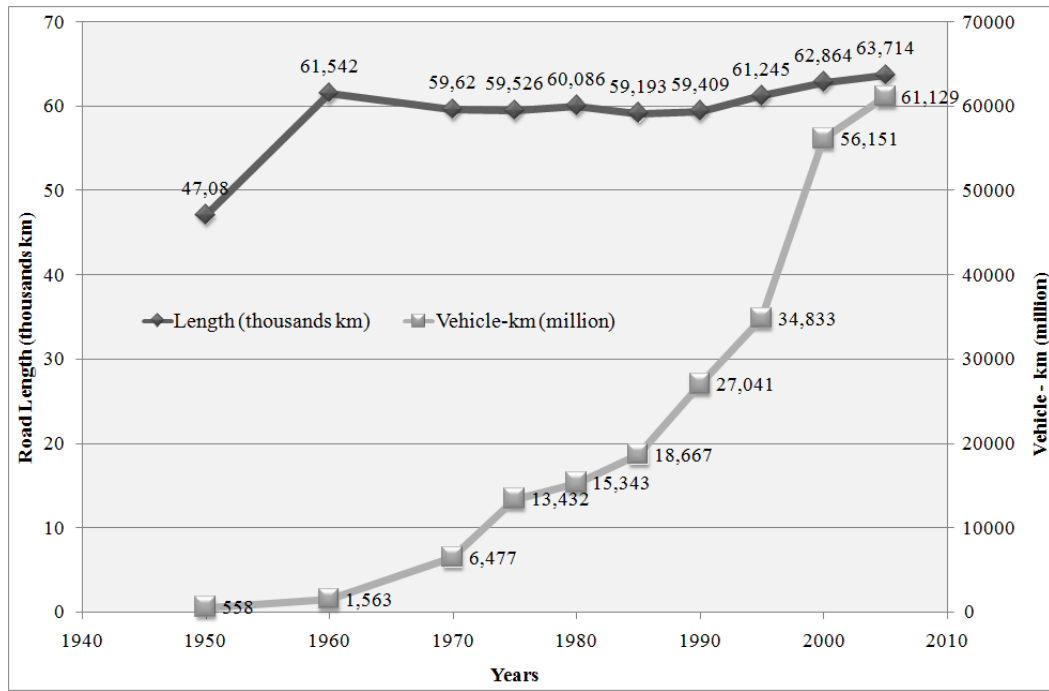


Figure 2.4 Length of Highway Road Network per Year (Motorways, Highways and State Roads) (GDH, 2004)

b) Statistics on Traffic Accidents

Traffic accidents are the primary safety problem in highway transportation. In Turkey 4,300 people lost their lives and 200,405 people were injured in 1,034,435 total traffic accidents occurred in year 2009. Between years 2000 and 2003, after an almost stable period around 450 thousands, number of accidents doubled in 2009 (according to 2000) with a rapid increase after 2004 (See Table 2.6). In this decade, number of drivers increased by 47 %, number of vehicles increased by 30 % however the number of traffic accidents increased more than 100 %. When number of vehicles involved in accidents between 2001 and 2008 is examined, it is seen that this figure has increased almost constantly at an average rate of 6.6 % annually (See Table 2.7). 10 % of total vehicles involved in accidents in 2007. 32 % of buses, 15 % of trucks or mini-trucks, % 21 of minibuses involved in accident in 2007. Regarding to high numbers, cars involved in 61 % of all accidents in same year (See Figure 2.5).

Table 2.6 2000-2009 Number of Traffic Accidents, Killed and Injured Person (GDS, 2010)

YEAR	ACCIDENTS INVOLVING			PEOPLE	
	TOTAL	FATALITY	INJURY	KILLED	INJURED
2000	500,664	2,994	62,295	5,566	136,406
2001	442,960	2,312	52,848	4,386	116,202
2002	439,958	2,221	52,525	4,169	116,045
2003	455,637	2,120	53,983	3,959	117,551
2004	537,352	2,354	61,239	4,427	136,437
2005	620,789	2,535	69,659	4,505	154,086
2006	728,755	2,586	76,591	4,633	169,080
2007	825,561	2,671	84,295	5,007	189,057
2008	950,120	2,258	82,361	4,236	184,468
2009	1,034,435	2,310	89,204	4,300	200,405

Number of accidents with fatality are generally 2-3 thousands with 4-5 thousand people killed annually at the crash site or on the way to hospitals (currently number of people killed in the following days are not recorded in traffic statistics yet, but is expected as much as one fold). In the last decade, number of accidents involving injuries increased from 63 thousands to 82 thousands; number of injuries reached from 110 thousands to 200 thousands at the same period. While fatality statistics in world literature includes deaths occurred within a month after accident; number of fatalities in these statistics only includes deaths occur at the same time with accidents. This number is estimated to be 4-5 thousands in our country. With technological and legal developments of Ministry of Health in recent years; number of killed people dataset will be expected to be given more confidential in future.

Table 2.7 Registered Motor Vehicles, Involved in Accidents by Type of the Vehicle
between 2001 and 2008 (GDS, 2009)

A. Number of registered vehicles			B. Number of vehicles involved in accidents					
	Total ⁽¹⁾		Car		Bus		Minibus	
	A	B	A	B	A	B	A	B
2001	8,521,956	767,358	4,534,803	518,225	119,306	32,440	239,381	46,892
2002	8,655,170	763,473	4,600,140	499,198	120,097	36,665	241,700	49,112
2003	8,903,843	795,260	4,700,343	514,148	123,500	37,916	245,394	51,870
2004	10,236,357	932,111	5,400,440	592,157	152,712	44,311	318,954	56,808
2005	11,145,826	1,055,113	5,772,745	672,866	163,390	49,010	338,539	57,670
2006	12,227,393	1,232,537	6,140,992	744,403	175,949	53,978	357,523	67,201
2007	13,022,945	1,395,997	6,472,156	847,270	189,128	56,040	372,601	74,362
2008	13,765,395	...	6,796,629	...	199,934	...	383,548	...
	Truck		Small truck		Motorcycle		Other ⁽¹⁾	
	A	B	A	B	A	B	A	B ⁽³⁾
2001	396,493	43,337	833,175	99,209	1,031,221	11,309	1,367,577	15,946
2002	399,025	43,924	875,381	103,536	1,046,907	10,838	1,371,920	20,200
2003	405,034	47,558	973,457	107,041	1,073,415	11,357	1,382,700	25,370
2004	⁽²⁾ 647,420	63,719	1,259,867	138,836	1,218,677	14,943	1,238,287	21,337
2005	⁽²⁾ 676,929	79,697	1,475,057	166,187	1,441,066	24,078	1,278,100	5,605
2006	⁽²⁾ 709,535	94,858	1,695,624	233,523	1,822,831	28,078	1,324,939	10,496
2007	⁽²⁾ 729,202	101,532	1,890,459	269,339	2,003,492	37,395	1,365,907	10,059
2008	⁽²⁾ 744,217	...	2,066,007	...	2,181,383	...	1,393,677	...

Note. Data does not cover the number of road traffic accidents in area of gendarmerie responsibility.

(2) Tractors is included.

(3) Tractor truck and tanker are included.

(4) Includes motor vehicles and non-motor vehicles.

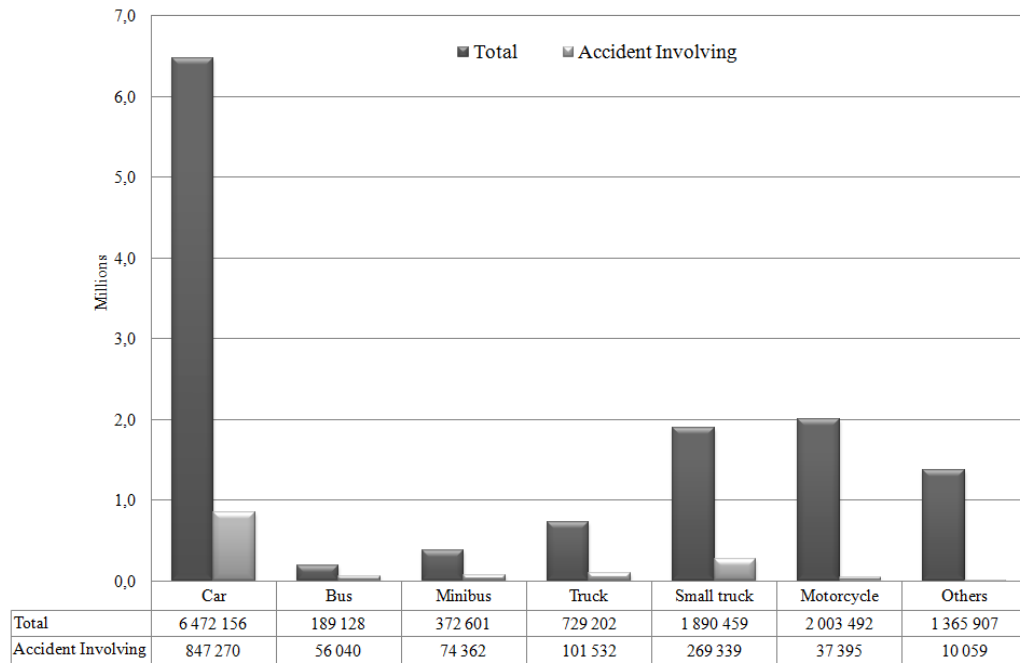


Figure 2.5 Number of Registered Vehicles and Number of Vehicles Involved in Accidents in 2007 (GDS, 2010)

2.3 Comparative Evaluation

By evaluating overall statistics, a general traffic safety idea may be gained. But to determine our position in the world in traffic safety and factors affecting it, comparative and normalized evaluations should be performed to minimize the impact of social and regional differences. This process is made generally by accidents per population, number of vehicles and number of accidents over vehicle-miles. Number and type of driving licenses, vehicle fleet and traffic accidents are important parameters for traffic safety but they are not enough to show the level of traffic safety directly in different areas.

When maps of traffic accidents, number of injuries and fatalities for every city/province are made out, most accidents seems to occur in Ankara and Istanbul, but it is not correct to declare “low traffic safety” in these cities as a result. Due to their high population, consequently high number of drivers and vehicles, the accidents statistics for such metropolitans should be normalized. Similarly, the least

number of injuries experienced in East and Southeast Anatolia regions is not enough to claim high traffic safety statement, since traffic density and number of vehicles are very also low in these areas. When traffic accidents are normalized to population, it is seen that most number of accidents involving fatality or injury occurred in Bolu with 232 of every 100 thousands accidents, Antalya and Çankırı following it with 224 accidents.

When it is considered that everyone in the city do not drive vehicle and do not use traffic equally, traffic safety can be evaluated according to vehicle-km data that shows traffic density instead of population or number of vehicles data. Since it is hard to obtain vehicle-km data in local traffic network, samples are determined by amount of fuel spent in related region.

Comparison of Other Country's Traffic Statistics with Turkey's

When world traffic statistics are reviewed in year 2006:

- a) Number of persons killed in road traffic accidents per 100 million vehicle-km in Turkey is 7.2, in Italy 6.9, in Japan 0.9, and in England 0.65 (See Figure 2.6).
- b) Number of persons killed in road traffic accidents per 100 thousand vehicles in Turkey is 42.5, in EU Countries 14.6 and in Japan 7.3 (See Figure 2.7).
- c) Number of persons killed in road traffic accidents per 100 thousand population in Turkey is 9.6, in Italy 8.7, in EU Countries 7.7, in France 6.4, in Germany 6.2, in England 5.5 and in Japan 5.0 (See Figure 2.8).

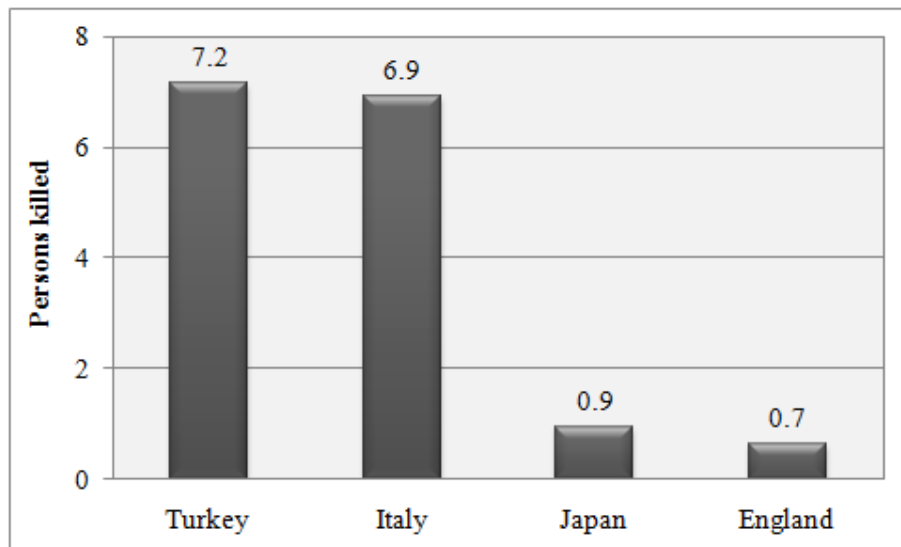


Figure 2.6 Persons Killed in Road Traffic Accidents per 100 Million vehicle-km in Some Countries in 2006 (GDS, 2008)

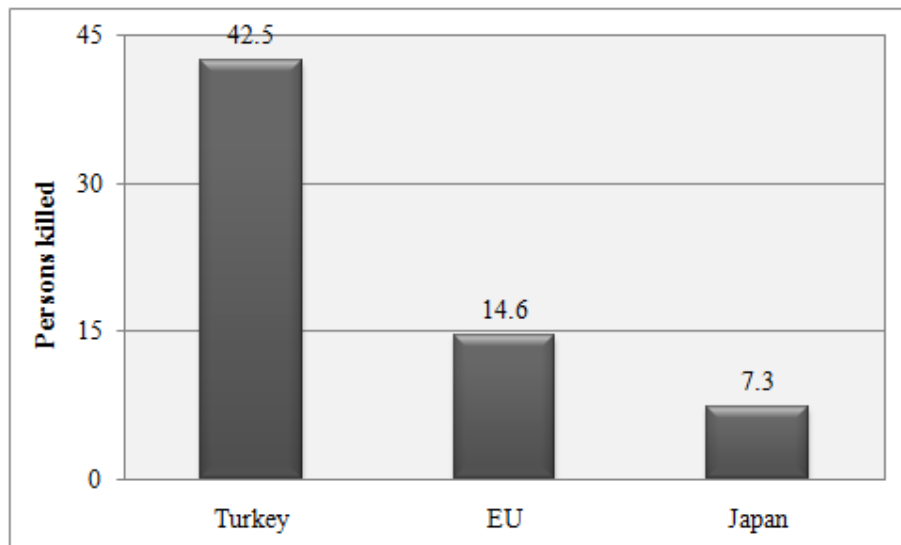


Figure 2.7 Number of Persons Killed in Road Traffic Accidents per 100 Thousand Vehicles in Some Countries in 2006 (GDS, 2008)

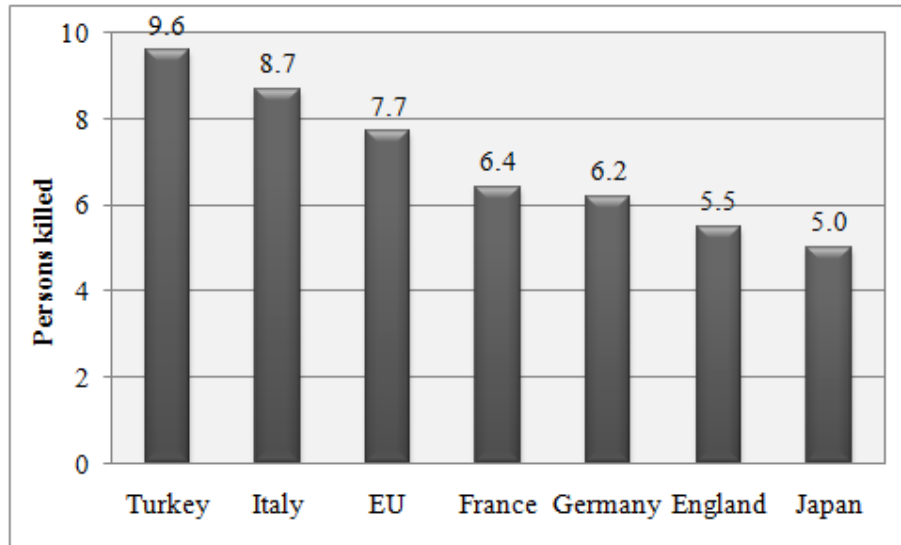


Figure 2.8 Number of persons killed in road traffic accidents per 100 thousand people in some countries in 2006 (GDS, 2010)

Information about Turkey and EU Countries' reported traffic accidents, ratio of fatalities and injuries, populations and surface areas in 2004 is given in Table 2.8. Turkey has the highest surface area between EU countries and second highest population after Germany. Turkey is in 6th place for number of total accidents and number of fatalities and 5th place for number of injured people within 29 EU countries. Unfortunately Turkey is in 1st place with 1,772 injuries per 1,000 accidents, and 14th place with 57 fatalities per 1,000 accidents. These clearly show that our country is beyond of developed countries for traffic safety.

2.4 Traffic Law and Legislation

There are more than one domestic legislations to regulate traffic in our country. First of all, “**Road Traffic Law (2918)**” aims to govern traffic safety and defines all considerations which need to be taken for that issue. This law includes traffic rules, occasions, rights and obligations, implementations and detections, related institutes and their authorization, responsibilities, working procedures and other articles

Table 2.8: Turkey and EU Countries Reported Traffic Accidents, Ratio of Fatalities and Injuries, Populations and Surface Area in 2004 (Statistics of Road Traffic Accidents in Europe and North America, 2007)

Country	Surface Area (km ²)	Population (thousands)	Number of Road Traffic Accidents	Killed Persons			Injured Persons		
				Number of Killed Person	Ratio to Population (‰)	Ratio to Number of Road Traffic Accidents (‰)	Number of Injured Person	Ratio to Population (‰)	Ratio to Number of Road Traffic Accidents (‰)
Austria	83,858	8,207	42,657	878	0.11	21	55,857	6.81	1309
Belgium	30,528	10,446	48,670	1,163	0.11	24	62,992	6.03	1294
Bulgaria	110,994	7,761	7,612	943	0.12	124	9,308	1.20	1223
Cyprus	9,251	749	2,080	117	0.16	56	3,176	4.24	1527
Czech Republic	78,866	10,221	26,516	1,382	0.14	52	34,254	3.35	1292
Denmark	43,094	5,411	6,209	369	0.07	59	7,546	1.39	1215
Estonia	45,227	1,348	2,244	170	0.13	76	2,875	2.13	1281
Finland	338,145	5,237	6,767	375	0.07	55	8,791	1.68	1299
France	551,50	60,340	85,396	5,232	0.09	61	108,727	1.80	1273
Germany	357,022	82,501	339,310	5,842	0.07	17	440,126	5.33	1297
Greece	131,957	11,062	15,547	1,670	0.15	107	20,179	1.82	1298
Hungary	93,030	10,098	20,957	1,296	0.13	62	28,054	2.78	1339
Ireland	70,273	4,044	5,781	374	0.09	65	7,867	1.95	1361
Italy	301,318	58,462	224,553	5,625	0.10	25	316,630	5.42	1410
Latvia	64,589	2,306	5,081	516	0.22	102	6,416	2.78	1263
Lithuania	65,30	3,425	6,357	752	0.22	118	7,862	2.30	1237
Luxembourg	2,586	455	692	49	0.11	71	1,079	2.37	1559
Malta	316	403	15,643	13	0.03	1	1,268	3.15	81
Netherlands	41,526	16,255	27,760	804	0.05	29	33,302	2.05	1200
Norway	323,758	4,577	8,425	257	0.06	31	12,121	2.65	1439
Poland	312,685	38,174	51,069	5,712	0.15	112	64,661	1.69	1266
Portugal	91,982	10,529	38,930	1,135	0.11	29	52,009	4.94	1336
Romania	238,391	21,70	6,860	2,418	0.11	352	5,594	0.26	815
Slovakia	49,036	5,385	8,443	603	0.11	71	11,190	2.08	1325
Slovenia	20,273	1,998	12,721	274	0.14	22	18,723	9.37	1472
Spain	505,992	43,198	94,009	4,741	0.11	50	138,383	3.20	1472
Sweden	449,964	9,011	18,029	480	0.05	27	26,582	2.95	1474
Turkey	774,815	71,794	77,008	4,427	0.06	57	136,437	1.90	1772
United Kingdom	242,90	59,834	207,410	3,221	0.05	16	277,619	4.64	1339

(Official Journal of the Republic of Turkey, 1983). **“Traffic Sign and Signals Regulation”** has a great impact on traffic safety. It determines standards, meaning, and qualification of traffic signs; warns drivers about prohibition and restrictions by informing road users about road environment and traffic situation (Official Journal of the Republic of Turkey, 1997). All construction works that will be done on highways by corporation, natural persons or public institutions and other works done on the edge or outside, inside of highway rather than traffic signs’ regulation are determined by **“Regulation for Signals and Illumination Standards on the Edge, Inside or Outside of the Road to Ensure Highway Traffic Safety, All Kinds of Cautions Conducted on Road Works and Other Signs”**.

In 1968, Turkey accepted and has become a party to “Vienna Convention on Road Signs and Signals” which determines traffic sign and signal standards, to adopt

international uniform traffic rules for international road safety. It has not became law because it is not approved by Grand National Assembly of Turkey (in Turkish *Türkiye Büyük Millet Meclisi*) but traffic sign and signals have been used according to this convention since it was signed.

Highway Traffic Safety High Committee is the highest authority on traffic safety, under the direction of Prime Minister with participation of Ministers of Justice, Interior, Finance , Education,, Public Works and Settlement, Health, Transport, Environment and Forest Ministries, Gendarmerie General Commander (in Turkish *Jandarma Genel Komutanlığı*), State Planning Organization Undersecretary (in Turkish *Devlet Planlama Teşkilatı Müsteşarlığı*), Director-General of Security General Directorate (in Turkish *Emniyet Genel Müdürlüğü*), Director-General of General Directorate of Highways (in Turkish *Karayolları Genel Müdürlüğü*). This commission evaluates and decides recommendations and offers prepared by Head of Traffic Service and approved by Highway Traffic Safety Committee and should meet twice in a year to implement decisions and coordination actions should be taken. This committee has been assembled twice since its establishment. Due to problems in regular meetings of the expected committee member, a restructuring of this high committee with more flexibility in meeting times or members is in proposal.

Highway Traffic Safety Committee (HTSC), under the direction of Turkish Security General Directorate Head of Traffic Service with participation at least Head level officers of public institutions participating Highway Safety High Committee; delegates of Gendarmerie General Command, Turkish Standards Institution (in Turkish *Türk Standartları Enstitüsü*), Turkish Drivers' and Vehicles Federation (in Turkish *Türkiye Şoförler ve Otomobilciler Federasyonu*), traffic related University approved by Ministry of Interior, Union of Chambers of Turkish Engineers and Architects (in Turkish *Türkiye Mühendis ve Mimarlar Odası*), Turkish Traffic Safety Association, Aid Foundation of Traffic Accidents (in Turkish *Trafik Kazalarını Önleme Vakfı*), Mayor of Greater Municipality of Ankara (in Turkish *Ankara Büyükşehir Belediyesi*). Committee evaluates and decides offers which were made to regulate traffic in a modern and safety way.

Transportation Coordination Centres (in Turkish *Ulaşım Koordinasyon Merkezleri*), structured within metropolitan municipalities, are in charge of all types of projects such as railway, highway and water transport, makes transportation plans, determines prices of public transportation tickets, detects plans of road and intersection signalization and coordinates with provincial traffic commissions.

Turkish Security General Directorate is another institution responsible from traffic. It directs traffic when necessary, detects whether documents and equipments are kept in vehicles, controls driver licenses, detects whether drivers and road users obey traffic rules, issues traffic tickets to punish drivers which have committed traffic violations whether some institutions related traffic are constructed satisfactorily. Another duty of Security General Directorate is to collect traffic accident statistics, to evaluate these statistics, to take action and inform other institutions about these actions. Gendarmerie General Command has similar duties as Security General Directorate but is responsible for rural roads. Gendarmerie General Command directs and manages traffic, detects whether documents and equipments are kept in vehicles, controls driver licenses, detects whether drivers and road users obey traffic rules, issues traffic tickets to traffic violations.

General Directorate of Highways, determines standards on traffic signs and installs required signs on highways, constructs, improves and repairs the roads and bridges, determines required intersections, stopping area, illuminates, parking places and other buildings to supply traffic safety and maintenance and sets speed limits with the approval of Ministry of Interior.

2.5 Drivers Education in Turkey

Transportation mostly takes place via highways in our country, creating a high risk of traffic accidents on highways. According to traffic statistics, these accidents mostly occur due to driver faults; thus, special attention should be given to driver education courses. Number of traffic accidents, especially heavy damaged, injury and fatality increased significantly since 1990, private driving schools are blamed for not educating new drivers well by public.

In Turkey, requirements to get a new driving license are determined as lower limit of age, education level, health, state of conviction and successful completion of a driver education course (See Table 2.9). There is no special application for new drivers like Graduated Driver Licensing, as it exists in some countries. New drivers are legally able to have all rights and obligations as experienced drivers in our country.

In Europe, new drivers are restricted from the first year of obtaining driving license. New drivers are called as “novice” drivers for the first two years of driving. Novice drivers are restricted to have traffic violation, excessive speed, passenger transport, drunk driving etc. Also in some countries as USA, they must take advanced driver training courses.

Table 2.9 Measures for Obtaining Driving License (MNE, 2010)

Driver License		Age	Education	Health	Course	Conviction
A1	Moped	17	To graduate from at least secondary school since 2000 ¹	Physical and mental status health report in terms of able to drive safe	Should successfully pass the license test and finish the driver education course	Not to be convicted from some crimes specified in Turkish Criminal Code and other laws
A2	Motorcycle	17				
B	Car, Minibus, Small Truck	18				
C	Truck	22				
D	Towed Vehicle	22				
E	Bus	22				
F	Tractor	17				
G	Construction Vehicles	18				
H	Disabled Person's Vehicle	17				

¹ Before 2000 learners should be graduated at least primary level.

In USA, training driver license is given to drivers under age 18. These drivers are restricted for solo driving and not to drive in certain times of day etc. These drivers keep on education in school and in driver courses. Novice drivers who complete training period successfully, older than minimum age and pass driving test will obtain full driving license.

a) Driving Schools

Driving schools, aim to educate, train and certificate drivers, were first established on February 1987 in Turkey. Now number of these schools reached to 2,997 throughout the country (MNE, 2010) and they are inspected by Ministry of National Education periodically once in a year.

In driving schools, education is given in theoretical and practical (car driving skills) lessons. Theory lessons include Traffic and Environmental Assessment, Emergency, Motor and Vehicle Equipment Information. Theoretical and practical class hours are different for each driver's license type (See Table 2.10). In practical lessons, candidates learn how to drive by using a special vehicle, designed for education with double brake and clutch pedals. These vehicles must include plate written "Driver Candidate" on it. Driving education is learnt in field of training and on roads determined by traffic commissions.

Table 2.10 Class Hours of Driving Schools (MNE, 2010)

Driver License Types and Vehicles	Class Hours			
	Traffic and Environmental Assessment	Emergency	Motor and Vehicle Equipment Information	Driving Education
A1 Moped	20	12	5	10
A2 Motorcycle				
B Car, Minibus, Mini Truck	35	12	16	20
C Truck				
D Towed Vehicle	35	12	20	45
E Bus				
F Tractor	20	12	10	10
G Construction Vehicles	20	12		
H Disabled Person's Vehicle	35	12		16

When duration of education in driver courses in our country is compared with other countries, it is seen that class hours differ (See Table 2.11). Other countries attach more importance to practical education than theoretical so more class hours were given to practical lessons. In European countries of Germany, Austria, Belgium, Bulgaria, Finland, France, Croatia, England, Sweden, Luxembourg, Hungary and Monaco, practical lesson hours are twice more than theoretical lessons. However in Turkey, theoretical lesson hours are three times more than practical lessons.

Table 2.11 Class Hours of Practical and Theoretical Lessons by Countries
(CEC,1998)

COUNTRY	Practical Lesson	Theoretical Lesson	Ratio of Practical/ Theoretical Lessons
Germany*	10 hours	24 hours	0.42
Austria *	20 hours	20 hours	0.5
Belgium	10 weeks	4 weeks	2.5
Bulgaria*	36 hours	25 hours	1.44
Algeria*	25 hours	12 hours	2.08
Estonia	30 hours	50 hours	0.6
Finland	30 hours	20 hours	1.5
France	20 hours	5 hours	4
Croatia	30 hours	30 hours	1
Netherlands	35 hours	-	-
England	30-35 hours	5-10 hours	4.33
Sweden	25-30 hours	20-25 hours	1.22
Latvia	16 hours	116 hours	0.14
Luxembourg	20 hours	12 hours	1.67
Hungary	25 hours	30 hours	0.83
Monaco	28 hours	6 hours	4.67
Norway	25 hours	-	-
Portugal*	30 hours	30 hours	1
Turkey*	20 hours	63 hours	0.3

* is valid for only B type driver education.

b) Problems of Driver Education:

There are lots of problems in driver education system in Turkey. In 1987 Ministry of National Education had firstly faced with some problems while educating learner drivers. Since educators were not expert and a certain period needed to specialize in this subject, difficulties and problems occurred in institutional structure for the creation of professional studies. At the same time, driver courses were established to educate and certificate drivers. Since attending a driver course has been a statutory obligation to obtain driver license, number of driver courses increased rapidly since 1987.

In 1998 Security General Directorate chose 200 participants within 2,085 drivers who successfully completed driver course education. These people were asked whether driver education was sufficient or not (GDS, 2001). 94 of 200 drivers told sufficiency of education given in courses but 106 (53 %) of 200 drivers told insufficiency of education given in courses. This group stated reasons about the insufficiency of education that driver courses act as a commercial institution, record too many learners and do not detect attendance. For these reasons, staff of driver courses should be expert in the field of training, so education will be provided in professional-level.

Aydın (2005) examines "National Traffic Safety" program in our country in a study on traffic safety and education. In this program, improvement the quality of traffic education at schools is aimed and new practical, risk based education program in primary and high schools is prepared for different age groups. Also determination of graduate level education programs and establishment of "Traffic Safety Research Center" were offered in the scope of the program which has not been realized yet.

In a study made by Defense Analysis Institute computer-based driver education is compared with traditional in-class lessons, it is observed that computer based education decreases course cost and duration by 1/3 level but increases efficiency in 1/3 level. In the study it is stated that technology should be subjected to learners correctly and technology-based education should provide a realistic and interactive driving experience (TRB, 2006).

2.6 Traffic Violations in Urban Regions

Demerit point system is applied with no time limit for all types of driving licenses in Turkey. If a driver has 100 penalty points in a year, his/her driving license will be withdrawn for 2 months and he/she will be educated. If a driver has 100 penalty points twice in a year, his/her driving license will be withdrawn for 4 months and he/she will be examined to a psycho-technical assessment by a psychiatrists. If a driver has 100 penalty point three times in a year, his/her driving license will be cancelled. If a driver's fault causes fatality, his/her driving license will be suspended for a year.

When number and types of traffic violations are reviewed, it is seen that drivers are mostly enforced because of excessive speed. Lack of letters, traffic light and traffic sign violations are other major faults (See Table 2.12). Traffic sign violation is not evaluated separately, it has been categorized together with traffic light violations by Security General Directorate, so it has not been able to review which traffic signs were mostly violated. Number of these types of violations is 561 thousands in 2007 and 597 thousands in 2008. Enforcement for this reason increased 6.4 % annually.

Number of traffic fines increased 21.4 % and amount increased 32.5 % between 2007 and 2008. Regarding to number of fines in 2008, use of mobile phones increased 248 %, not having tachograph increased 168 %, non-use of seat belt increased 131 % and pedestrian enforcement increased 125 % (See Table 2.13)

In 2001 GDS identified 10 traffic violations that mostly made in the City of Elazığ, determined that these violations are made lack of simple information and can easily be resolved through education. Year 2001 is accepted as Traffic Education Year in Elazığ. Firstly, coordination and contributions of institutions in traffic were determined. In Traffic Education Campaign, it is aimed to teach positive traffic behavior to target drivers through simple, understandable and thought provoking slogans. The target population was determined as students, official drivers, commercial vehicle drivers, learner drivers and "Pedestrian and Driver Training Seminar" program was performed. 5,335 students, 836 commercial vehicle drivers, 670 learner drivers and 190 official drivers were educated for 3 months. Number of

traffic accidents occurred, loss of life and property in year 2001 were decreased in 49 % level annually by education. Also a significant reduction occurred in the number of traffic violations at the same year (Arslan, 2001).

Table 2.12 Number of Traffic Violations in 2007 and 2008 (GDS, 2009)

VIOLATION TYPE		2007	2008	DIFFERENCE %
Fines Enforced by Stopping Vehicle	Alcohol	96,761	120,859	24.9
	Speed	943,775	1,375,614	45.8
	Overloading	46,246	43,201	-6.6
	Lack of Letters	653,698	831,917	27.3
	Lack of Equipment	53,753	95,235	77.2
	Use of Mobile Phone	55,425	192,832	247.9
	Seat Belt	235,565	544,572	131.2
	Too Many Passengers	153,465	145,681	-5.1
	Protective Heading / Glasses	36,956	60,172	62.8
	Tachograph	54,452	146,173	168.4
	Technical	183,394	196,042	6.9
	Traffic Sign/Light	561,175	597,058	6.4
	Other	883,667	686,810	-22.3
	TOTAL	3,958,332	5,036,166	27.2
Enforced to Vehicle Plate		2,674,878	3,009,497	12.5
Pedestrian		7,927	17,807	124.6
TOTAL		6,641,137	8,063,470	21.4

Table 2.13 Number and Amount (TL) of Traffic Fines between 2007 and 2008 (GDS, 2009)

YEARS	NUMBER			AMOUNT (TL)		
	CASH	INFORMED	TOTAL	CASH	INFORMED	TOTAL
2007	198,390	6,442,747	6,641,137	17,220,490	640,895,265	658,115,775
2008	174,443	7,889,047	8,063,470	18,135,143	853,566,832	871,701,975
DIFFERENCE (%)	-12.1	22.4	21.4	5.3	33.2	32.5

CHAPTER 3

TRAFFIC SIGNS

History of traffic signs begins with stone columns, giving distance in Rome and continues in middle ages with the use of stone slabs, directing settlements on multi-junction points. But mainly with the invention of the automobile, traffic sign usage and importance have increased (Hawkins, 1992). Evolution of traffic signs continued throughout the years, Stone or wood signposts have been replaced with aluminum plates ensuring adequate visibility at night. New generations of traffic signs based on big electronic displays can also change their symbols and provide intelligent behavior by means of sensors or by remote control.

3.1 History and Development of Traffic Signs

Before reviewing matters such as design of traffic signs and factor affecting comprehension, it will be useful to examine the history and development of traffic signs. One of the first modern-day road sign systems was developed by the Italian Touring Club in 1895. By 1900, a Congress of the International League of Touring Organizations in Paris was considering proposals for standardization of road signage. The origins of international legislation on road traffic may be traced back to the International Convention on Motor Traffic concluded in Paris on 11 October 1909. In 1909, nine European governments agreed on the use of four pictorial symbols, indicating "bump", "curve", "intersection", and "grade-level railroad crossing". Between 1926 and 1949, traffic signs were developed for the European road sign system and Inter-American Convention.

Recognizing that international uniformity of road signs, signals and symbols and of road markings is necessary in order to facilitate international road traffic and to increase road safety, Vienna Convention on Road Traffic was organized in Vienna on 8 November 1968, producing the well-known “the Vienna Convention on Road Signs and Signals” document. European countries, desiring to achieve greater uniformity in the rules governing road signs, signals and symbols and road markings in Europe, have signed the European Agreement Supplementing the Convention on Road Signs and Signals of 1968 in Geneva on 1 May 1971.

The two parts of Vienna Convention on Road Signs and Signals and on Road Traffic, which have a global scope, the European Agreements supplementing them, and the Protocol on Road Markings, additional to the European Agreement supplementing the Convention on Road Signs and Signals, are important legal tools enabling not only the facilitation of trade and transportation through harmonized rules, but also the development of road safety policies aiming reduction of the number of road crashes and victims.

3.2 Vienna Convention on Road Signs and Signals

This convention was agreed upon by the United Nations Economic and Social Council (UNESCO) at the UNESCO Conference on Road Traffic, held in Vienna on 8 November 1968. This conference also produced the Vienna Convention on Road Traffic which complements this legislation by standardizing international traffic laws. Since its entry into force on 6 June 1978, this Convention terminated and replaced previous road sign and signal conventions such as International Convention relating to Road Traffic and Motor Traffic signed on 24 April 1926, ii) Convention on the Regulation of Inter-American Automotive Traffic signed on 15 December 1943 in Washington, iii) Convention on Road Traffic signed on 19 September 1949 in Geneva.

The Contracting Parties, recognizing that international uniformity of road signs, signals and symbols and of road markings is necessary in order to facilitate international road traffic and to increase road safety, have agreed to apply Vienna

Convention in their territories as soon as possible. Where this Convention prescribes a sign, symbol or marking for signifying a certain rule or conveying certain information to road-users, the Contracting Parties undertake not to use any other sign, symbol or marking for signifying that rule or conveying that information.

The system of road signs and signals in the convention describes specific symbols instead of written explanations and colors for each category. When protocol offers different sign or symbol alternatives for the same rule, contracting parties shall use only one of them in their territories (See Figure 3.1). Contracting parties may have simple adaptations on the symbol by not changing basic characteristic.



Figure 3.1 Vienna Convention Alternatives a) “Overtaking Prohibited” and b) “Overtaking by Goods Vehicles Prohibited” traffic signs

European countries, desiring to achieve greater uniformity in the rules governing road signs, signals and symbols and road markings in Europe, have signed the European Agreement Supplementing the Convention on Road Signs and Signals of 1968 at Geneva on 1 May 1971. By this protocol, some additions or changes are made on Vienna Convention. European Agreement determines traffic signs through different alternatives. For example, Convention accepts both alternatives in Figure 3.1 but European Agreement is undertaken to use C13^{aa} and C13^{ba}. In convention, it

is stated that it shall be open to Contracting Parties to omit from No Entry for Goods Vehicles (C,3^e) sign, the red oblique bar joining the upper left quadrant and the lower right quadrant or provided that this does not make the symbol less easy to see and understand, not to interrupt the bar where it crosses the symbol. But in European Agreement, No Entry for Goods Vehicles (C,3^e) traffic sign mentioned under this item shall not incorporate an oblique red bar (See Figure 3.2).

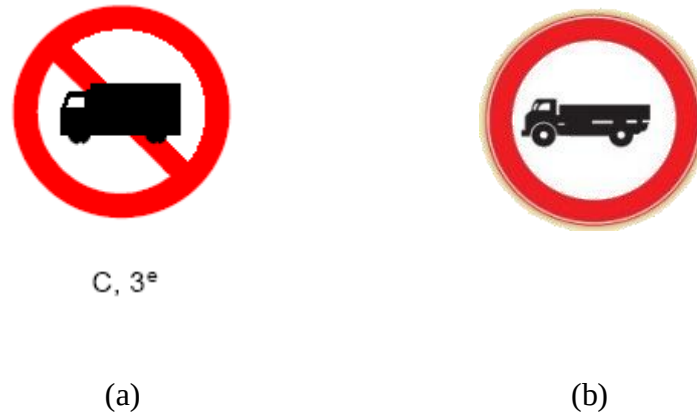


Figure 3.2 “No Entry for Goods Vehicles” Traffic Sign (a) Vienna Convention and
(b) European Agreement

In Vienna Convention different type of traffic signs are coded with letters, for example in code of No Entry for Goods Vehicles C,3^e, C refers to type of traffic sign (Prohibitory or Restrictive signs), 3 and e refers to placement of traffic sign in this type.

3.3 Turkey’s Adaptation to Vienna Convention

Economical and technological developments in the world increase the demand for transportation. Since Turkey has a close relationship in economical, cultural, social

and political areas with European countries and lays on both Europe and Asia, international highway transportation has always been very important. To increase international road traffic safety, international uniform traffic rules are accepted by Turkey after signing the Vienna Convention on Road Traffic in 1968. However, Turkey has not agreed on Article 52: “Any dispute between two or more Contracting Parties which relates to the interpretation or application of this Convention and which the Parties are unable to settle by negotiation or other means of settlement may be referred, at the request of any of the Contracting Parties concerned, to the International Court of Justice for decision”.

During the Turkey’s accession period for EU; at the end of 2004 General Directorate of Highway adapted some traffic signs according to European Agreement Annex:

“Traffic sign that prohibits entry for motorcycles, cycles, mopeds, goods vehicles, pedestrians, animal-drawn vehicles, handcarts, agricultural vehicles shall not incorporate an oblique red bar since symbol remains same as the old one”.

For example, instead of using traffic signs that prohibit overtaking with oblique red bar (C,13^{ab} and C,13^{bb}), traffic signs that does not incorporate oblique red bar (C,13^{aa} and C,13^{ba}) are accepted. “No Entry for Goods Vehicles” traffic sign was decided to use without oblique red bar as stated in European Agreement instead of traffic sign with oblique red bar in Vienna Convention (C,3^e) (See Figure 3.2).

It is told that previous traffic signs are not replaced with newer ones unless they finish their lifetime (GDH, 2004). This causes a concurrent use of new and old traffic signs in our roads together for approximately 5 years.

3.4 Traffic Sign Types Used in Turkey

There are two types of signing system in Turkey as vertical and horizontal. Horizontal traffic signs are used to regulate traffic, inform road users of prohibition and restrictions and guides drivers by drawing lines, arrows, text and symbol on the

road surface. Vertical traffic signs are traffic signpost and other traffic control elements mounted outside of the road (General Directorate of Highways, 2004).

There are three basic types of traffic sign: triangular signs warn drivers, circular signs give orders and rectangular signs give information. Each type has different shape. A further guide to the function of a sign is its color. All triangular signs are red. Blue circles generally give a mandatory instruction such as "turn left", or indicate a route available only to particular classes of traffic, e.g. buses and cycles only. Red rings or circles tell you what you must not do, e.g. you must not exceed 30 mph, and no vehicles over the height shown may proceed. Blue rectangles are used for information signs except on motorways where blue is used for direction signs. Green rectangles are used for direction signs on primary routes. White rectangles are used for direction signs on non-primary routes, or for plates used in combination with warning and regulatory signs (UK DfT, 2007). Figure 3.3 gives basic shape and color features of traffic signs.

The Traffic Signs Manual, published by GDH in 2004, provides detailed guidance for those responsible for designing and installing traffic signs. It is prepared according to Vienna Convention in 1968 and later revisions' articles and standards. In this manual, traffic signs are divided into five groups according to their basic characteristics (Sample traffic signs are given in Table 3.1):

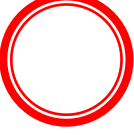
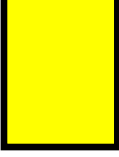
Triangle	Circle		Rectangle		
					
(warning)	(mandatory)	(order)	(information)	(motorway)	(road works)

Figure 3.3 Basic Shape and Color Features of Traffic Signs

a) Danger Warning Signs (T Group): These signs are intended to warn road-users of a danger on the road and to inform them of its nature. These traffic signs also warn drivers to reduce their speed and drive more carefully. In most countries, they usually take the shape of an equilateral triangle with white background, thick red border and black symbols.

b) Regulatory Signs (TT Group): These signs are intended to inform road-users of special obligations, restrictions or prohibitions with which they must comply. All regulatory signs are circular except “Stop” and “Give Way”.

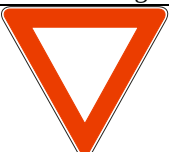
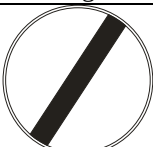
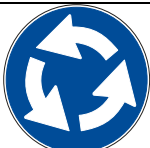
c) Informative Signs (B Group): These signs are intended to guide road-users while they are travelling or to provide them with other information which may be useful. These signs are generally used with white symbols on blue rectangular background except priority road traffic signs. Motorway signs are used on green background.

d) Standing and Parking Signs (P Group): These signs are intended to regulate traffic flow on the roads whether vehicles stand or park.

e) Road Works and Maintenance Signs (YB Group): Signs indicating temporary conditions such as road works, diversions or detours may have orange or yellow ground with original shape and color.

f) Additional Panels (PL Group): An additional panel may be placed below traffic sign and completes meaning of the sign.

Table 3.1 Samples of Different Types of Traffic Signs Used in Turkey

A- Danger Warning Signs				
		(a) Double curves, first to the right	(b) Risk of Ice	(c) Dangerous Bend of Route to the Left
B-Regulatory Signs	1- Priority Signs			
	2- Prohibitory or Restrictive Signs			
	3- Mandatory Signs			
		(a) Mandatory direction of travel	(b) Roundabout	(c) Minimum Speed Limit
C-Informative Signs				
		(a) End of Motorway	(b) Appropriate Traffic Lanes At Junction Ahead	(c) End of Priority Road
D- Standing and Parking Signs				
		(a) No Standing or Parking	(b) Parking Prohibited	(c) Parking
E- Construction and Maintenance Road Work Warning Signs				
		(a) Road Work	(b) Speed Limit	(c) Priority for Oncoming Traffic

3.5 Comprehension of Traffic Signs and Driver Characteristics

Since this study mainly focuses on comprehension level of drivers' on traffic signs, literature review done on similar issues will be briefly summarized below:

To improve traffic safety effectively, traffic signs should satisfy the requirements for many technical and design criteria as well, also being known and understood by drivers are needed to be. When domestic literature is reviewed with a focus on comprehension of traffic signs, it is seen that there is not much on this subject. In a graduate study conducted in Gazi University, the meanings of 20 different traffic signs were asked to drivers in a multiple-choice questionnaire. When survey is applied over a small sample of 210 persons, general average of those who correctly answered is found as % 81 (81.8% of male drivers, 73.2% of women drivers) (Yakut, 2006). In this study, the percentage of correct answers as found insufficient and intern driver applications and writing the meaning of traffic signs on or under the plates are proposed.

The colors and shapes of traffic signs are distinctive features of them. A study conducted on this area; images on traffic signs have been shown to drivers in a badly lit, shady manner using unfavorable features, different shapes and colors and drivers were requested to specify meaning of each image. As a result, it is observed that method based on the use of both shapes and colors, creates more effective results (Ulay, 2008).

Comprehension of traffic signs subject has taken more interest in international literature and have been working with different aspects. The relationship between drivers' personal characteristics and their comprehension of 28 posted signs is investigated in a study (Madani and Janahi, 2002). The characteristics considered in this study include: experience, accident per experience, ratio, age, marital status, sex type, nationality, educational background and monthly income. The populations sampled are from Bahrain, Kuwait, Oman, Qatar and United Arab Emirates. On an average, drivers comprehended only 56% of the posted signs. Education, monthly income and nationality were related to drivers' comprehension of traffic signs. Western drivers comprehend the signs better than other nationalities. Gulf

Cooperation Council States and Arab drivers comprehended the signs less well. Male drivers scored higher than female ones. Age, marital status, experience and accident rates had no effect on drivers comprehension of signs. The results indicate that drivers' personal characteristics are primarily associated with their understanding capabilities and not with their accident involvement rates. These findings are believed to be important for designers of traffic signs. They are also thought to be important for the decision makers for proper allocation of resources in the field of traffic education.

A similar study addresses the effects of driver factors and sign design features on the comprehensibility of traffic signs (Ng and Chan, 2008). A survey was designed to capture subjects' personal particulars, ratings on sign features, and comprehension scores, and then administered to 109 Hong Kong full driving license holders. It is stated that years with driving license and education level were significant predictors of sign comprehensibility. Contrary to expectation, the driver factors of age group, years of active driving, hours of driving, last time driving, driving frequency, and non-local driving experience had no effect on comprehension performance. Sign familiarity was correlated with comprehension score for licensed drivers, whereas sign concreteness, simplicity, and meaningfulness were not. The results of this study provide guidelines for designing more user-friendly traffic signs in the future. It identified particular driver groups who lacked good understanding of traffic signs, and this information may assist the relevant organizations to better allocate traffic training resources, and better target future studies of traffic sign comprehension.

An experiment investigated the relationships between the characteristics of prospective-users of traffic signs (people who will use the signs in the future) and the guessability of traffic signs, and also examined the effects of sign design features on the guessability of traffic signs (W.Y. Ng and Chan, 2007). Forty-one Hong Kong Chinese subjects guessed the meanings and rated the sign features of 120 Mainland Chinese signs. Males and females with similar education level had similar guessing performance. Previous experience of visiting Mainland China was a significant predictor of guessing performance. Family ownership of a vehicle was associated with guessing performance for subjects who intended to become a driver and for those with car game experience. Subjects who claimed to pay attention to traffic

signs in daily life performed better at sign guessing than those who did not. Traffic incident experience did not seem to enhance awareness of, or knowledge about, traffic signs. Guessability of a sign varied with the five design features of; familiarity, concreteness, simplicity, meaningfulness, and semantic closeness of the sign. Semantic closeness was the best predictor of guessability score, followed by familiarity, meaningfulness, concreteness, and simplicity. In order to design more user-friendly traffic signs and effective ways of using them, it is suggested that designers develop and evaluate signs according to the relative importance of the five sign features.

Current and revised versions of the Advance Flagger traffic sign were compared in a series of pilot studies (Purduski and Rys, 1998). Comprehension, reaction time, glance legibility and preference of each of the signs were tested through both field and laboratory tests. In field tests of Advance Flagger signs, approximately 86% of subjects gave construction-related responses to both new and current Advance Flagger signs. In lab tests, significant differences were found between the new and current signs in both glance legibility and reaction time. The findings suggest the new version to be an improvement over the current design.

A two-stage simulation experiment was conducted to investigate the effect of information volume on traffic regulatory/road direction signs, drivers' viewing strategies and sign familiarity on performance in visual search (Liu, 2005). In Stage I experiment, the amount of information on a total of 187 traffic regulatory and 1,272 road direction signs was calculated and divided into five information levels using cluster analysis. In Stage II experiment, 24 subjects participated in a 2 (familiarity), 5 (information volume level), 2 (viewing strategy) mixed factorial experiment. Each subject was required to perform a visual search task and a question-and-answer task. Visual search time and number of correct responses collected serve as the objective dependent variables. Subjective workload related to time stress and visual effort was gathered through a modified three-point rating. Results show that information volume on traffic signs had significant impact on drivers' visual search performance. Generally, the greater the amount of information, the slower the drivers in visual search is. However, while drivers had the highest accuracy rate in remembering purely pictorial traffic signs, these signs within the smallest information volume level

required a relatively longer search time. Different viewing strategies also led to different performances. The back-and-forth strategy yielded better search performance than the fixed strategy. Subjective workload evaluation indicates that drivers with less sign familiarity will be under greater time/visual pressures. Guidelines for designing for traffic signs or in-vehicle signing systems are provided.

When literature search is expanded on issues affecting the perception of traffic signs, the following studies are obtained. In a study, traffic sign information are converted to the driver, then the same traffic sign is displayed in written or symbolic form, it is observed that drivers reacted the symbols in a shorter period than written words (Dewar, Ellis, and Mundy, 1977). In a similar research in Turkey, traffic signs are arranged by using symbols, text and symbol + text and their effect of differentiation on the response time of 239 participants in different location, duration and speed has been tested. In the case of stimuli alone, symbol was found to have a shorter response time than text. The semantic preparation caused slower reaction time than repetitive, text+symbol stimulus created the best response time and the speed created a negative effect on response time (Koyuncu, 2005).

Other factors affecting the successful use of traffic signs (colors of signs, lighting criteria, appearance in the different times of day, sharpness, size, and location of installation, road environment, speed, intelligent vehicle systems) have been examined in more detail in literature (Kartal, 2007; Aydin, 2009; Borowsky, Shinar and Parmet, 2008; Martens and Fox, 2007) however not included here as they are not within the scope of this study.

CHAPTER 4

SURVEY STUDY

The suggestion of adding short texts on or under the traffic signs in Yakut (2006) is also brought to the Highway Traffic Safety Committee, and assigned to a sub-committee to be further investigated before final decision. In the coordination of General Directorate of Security (GDS) the sub-committee gathered with the participation of representatives from General Directorate of Highways (GDH), Middle East Technical University (METU), Gazi University (GU), Istanbul Technical University (ITU), Ufuk University (UU), Turkish Drivers and Vehicle Federation (TDVF), Turkey Traffic Safety Foundation (TTSF).

Sub-committee required a further study to evaluate the comprehensibility of traffic signs a) recently changed due to European Union process and b) which are expected to have high impact on traffic safety via a pilot study where the meanings of the signs are not offered in multiple choices. In a test conducted in METU, reaching a total of 61 drivers (31 university student's registered driving license recently), despite the 80% success in Yakut's multiple choice questionnaire (2006), the results indicated major problems with the comprehensions even among such highly and recently educated participants. Some signs were answered oppositely or falsely and some signs were left without any comment. As a result, sub-commission required a more comprehensive survey study in Ankara with a redesigned questionnaire content and layout, which is explained next. The following is the presentation of methodology of Ankara Pilot study.

4.1 Questionnaire Design

In the process of designing the questionnaire, with the contributions of the traffic psychologist of SGD and faculty of METU Psychology Department, a questionnaire with two sections – a driver's characteristics information part and traffic sign evaluation- is designed for Ankara pilot study. In order to study a total of 39 different traffic signs and not to include similar or new and old versions of the same signs in the same questionnaire, two versions are designed with 30 signs in each one, while the driver characteristics part kept the same. Traffic signs are not distributed randomly on A and B questionnaires, they are placed considering such cases being tired, comparison, fatigue etc.

1) Drivers' Characteristics Information Section

This part includes questions to evaluate drivers' personal, traffic and social characteristics. The characteristics considered here include: age, gender, educational background, occupation, driving license class, driving year, occupational driving requirement, the average inner-city and outer-city kilometers per year and the number of traffic fines taken in last five years (Figure 4.1). Drivers have not been requested to put their names on the questionnaires in order to maintain comfort in providing answers. Occupational driving requirement question is asked to capture professions requiring frequent travel separately, such as sales representative, carrier, delivery people etc.

2) Traffic Sign Evaluation Section

Each questionnaire includes 30 traffic signs. "Have you ever seen?" question is asked to indicate drivers' familiarity for each traffic sign by ticking "Yes" or "No" box (See Figure 4.1). "What is the meaning of the traffic sign?" question is the most important part of questionnaire and is not directed at multiple-choice on purpose; a relatively small blank space is left for participants to describe the meaning of the sign in their own words briefly. "What should be done when traffic sign is seen?" question is included upon persistent suggestions by the psychologist to determine participant's knowledge about what should be done when faced with the traffic sign in traffic, which is sometimes more important than describing the meaning of the sign itself.

▪ Age : ▪ Gender : ☐ Male ☐ Female ▪ Educational Level: ▪ Occupation : - Does your job require driving often? ☐ Yes ☐ No ▪ Driving License Class : ▪ How long have you been driving?	▪ How many kilometers do you drive per year? - Urban km - Rural km ▪ Have you had traffic ticket for 5 years? () No, never. () Yes,times. - If yes, please specify the reasons for punishment
---	--

(a)

Please tick Yes or No boxes whether you have ever seen following traffic signs in traffic, briefly describe the meaning and write what should be done when seen in traffic.

					
Have you ever seen in traffic?					
Yes ☐	No ☐	Yes ☐	No ☐	Yes ☐	No ☐
Meaning:		Meaning:		Meaning:	
What should be done when seen in traffic?					

(b)

Figure 4.1: Questionnaire Sections a) Drivers' Characteristics Information and b) Traffic Sign Information

4.2 Ankara Pilot Survey Study and Scope

In the survey study, a sample size of 1,478 participants among local drivers in Ankara is reached. As this represents about only 0.08% of the total number of drivers registered in Ankara, and furthermore the locations of the survey meetings are drawn from only 4 districts. In this case, the size and the drawing of the sample are not enough to draw conclusion for the whole city; thus, the study is defined as a “pilot” one that at least sheds some light to the topic. This should be considered while evaluating the analysis results, as well.

When 2009 traffic statistics are examined, it is seen that there are 1,816,434 drivers, 1,234,695 vehicles in Ankara while only 801 in Çankaya, 50 in Yenimahalle and 627 in Keçiören and Altındağ studied in these districts. In addition, the number of professional drivers (taxi, minibuses, service and bus etc.) is determined slightly more than the sampling ratio to have statistically more significant sub-samples. Since some sub-groups (truck, tractor, towing vehicle drivers etc.) do not use local traffic much, they are not included in this study. Number of existing drivers in the selected counties of Ankara and number of samples at the end of the survey study are given in Table 4.1.

Survey site studies are made in two stages. In 1st stage site studies, 851 surveys were conducted by METU Transportation Research Center to some staff of governmental offices/institutions, members of Highway Traffic Safety Committee (161 samples in Turkish Standards Institutions, 118 samples in Ministry of Environment and Forestry and 261 samples in METU to student’s parents) and others are applied by random sampling technique (122 samples by CEPA Shopping Center visitors, 189 samples by public and trader from Batıkent, Beşevler, Bahçelievler, Çankaya, Oran, Balgat, Çiğdem Mah. and 100. Yıl locations). After reviewing the participant profiles in the first stage, it is seen that population samples mainly consist of highly educated and high income drivers, so in the 2nd stage of the study, 627 surveys are made in various locations of Ankara to balance age, income and educational levels by a consultancy firm (See Table 4.2).

Table 4.1: Ankara Local Traffic Focused Survey Study Number of Existing and Reached Drivers (Turkish Security General Directorate, 2008)

			Ankara (2008/October)		SurveyStudy	
Driving License Type	VehicleConfigurati on	Profession	Male	Female	Male	Female
A1	Moped					
A2	Motorcycle				3	2
B	Automobile, Minibus, Pickup	Taxi	8,553		90	
		Minibus	2,784		50	
		Service Vehicle	6,549		74	
		Private Car	1,061,704	389,488	584	301
		Pick-up			21	
C	Truck		52,223		27	2
E	Bus	LocalPublicBus	1,790		36	
		PrivateBus	407			
		Other	175,193		225	2
Total			1,332,282	387,699	1,110	308

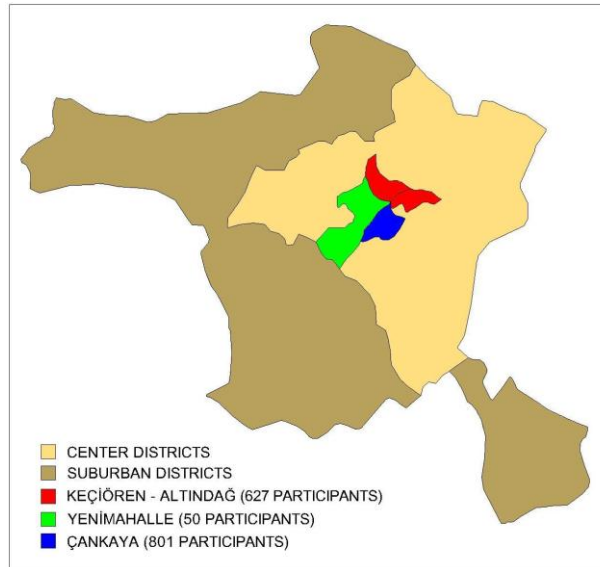


Figure 4.2 Number of Surveys Conducted in Center Districts of Ankara

During the surveys, it is told to drivers that this survey was not an exam, names or any other personal information were not taken and no legal action would be applied. By doing so, confidence is gained, number of samples is increased and proper responses were given. Drivers are emphasized that their knowledge level is important for the study rather than giving correct responses so adequate time is given for proper response. It is also told that the results would be kept confidential. The questionnaire was given to the participant in a place where the interviewer could see him/her or left for a short time unattended (up to 30 minutes in workplace surveys) to avoid copying and cheating or group process answers. When a driver preferred to answer verbally, interviewers simply wrote drivers' responses on questionnaire without interfering.

4.3 Data Entry and Assessment of Survey Responses

Each questionnaire is coded with an identification number indicating who conducted the survey, when and where. Drivers' personal and social characteristics information were coded as stated in the questionnaire "Have you ever seen the traffic sign?" question's dataset are coded with given "Yes" to 1 and "No" to 2.

Data entry of meaning of traffic signs is done by using a five part scale determined in METU pilot survey study. According to this scale, for the meaning of a sign:

- (-1) value; indicates the opposite answer,
- (-0.5) value; indicates wrong but not the opposite answer
- (0) value; indicates that no comment was made
- (+0.5) value; indicates partially correct answer
- (+1) value; indicates correct answer.

For example, responses such as "priority for going", "passing right" etc. are defined as opposite (-1) for "Give Way" traffic sign, because drivers who gave this type of responses will pass the road although they should give way. Responses such as "no parking", "attention", "roundabout" etc. are defined as wrong (-0.5) for "Closed to

All Vehicles in Both Directions” traffic sign, because drivers who gave this type of responses misunderstand sign information and will have faulty driving behavior in traffic. Responses such as “no parking”, “no standing”, “do not stop” etc. are defined as partially correct (+0.5) for “Standing and Parking Prohibited” traffic sign because drivers who gave this type of responses understood only one information within multiple. Responses such as “railway crossing”, “level crossing” etc. are defined as partially correct (+0.5) for “Level Crossing without Gates” traffic sign because drivers gave crossing information but not type of gate. Since sign information is a nominal data that does not include numerical value, frequency and percentage are used instead of mean and standard deviation, so the chosen scale values do not have any effect.

Questionnaires are controled, valued and coded for each sign by only one person, by doing so objectivity and standardization are gained and especially partially correct response difference is minimized. In some surveys, participants do not respond some parts of the questionnaire totally for some reasons, such as shortness of time, being busy etc. These partial surveys have not been totally excluded; instead answers for the not responded signs are considered as invalid and not included in sign evaluations. In the analysis results, it is seen that invalid answers for traffic signs do not exceed 5 % of all answers. “What should be done when the sign is seen?” section’s responses are not evaluated as it is not within the scope of this study, but answeres are coded as “filled” or “empty” during the data entry process to create an index for future analysis.

CHAPTER 5

COMPREHENSION ANALYSIS OF TRAFFIC SIGNS

As described before, main targets in the study are defined as:

- a) to determine comprehension level of 39 traffic signs and the role of drivers' characteristics on this level
- b) to identify traffic signs significantly having false or opposite responses
- c) to identify traffic signs that is not commented on much,
- d) to determine the change of comprehension level for the previous and current versions of traffic signs that were altered in EU accession period.

To reach these targets, a detailed analysis of each sign is prepared as well as some comparative analysis as described in the following sections.

5.1 Analysis of Comprehension Level of Traffic Signs

For this analysis, responses from all the participants for each traffic sign are performed separately to get the comprehensibility of each sign. Before grouping the signs based on the characteristics of the responses (such as well-known, etc.) a detailed report for each sign is prepared that includes sections of:

- a) Traffic sign's information and usage
- b) Comprehension level, response distribution and one page summary report
- c) Highly confused other traffic signs

d) Foreign Usage

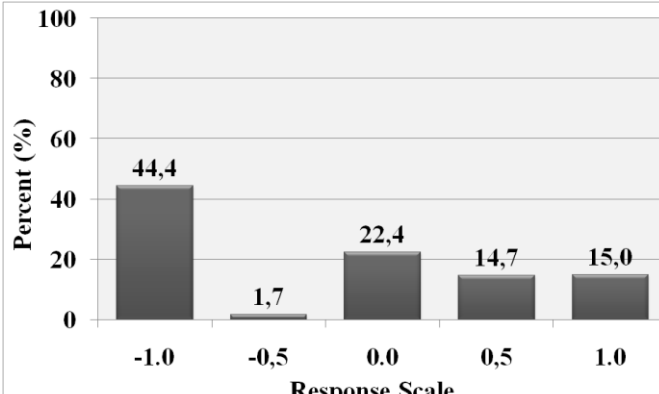
e) Personal and social characteristics that affect comprehension

While the detailed reports are submitted to GDS for further sharing with the relevant parties, such as driver schools, they are not included here to keep this thesis in a reasonable length, except for the parts needed for the analyses discussed in the next sections. However, one page summary report that shows all surveys' data and includes comprehension level by frequency and percent in both graphical and table form, is prepared for each sign and they can be found in the Appendix to supply reference for further research questions.

One page "Priority for Oncoming Traffic" signs' summary report is given below to show how informations are shown in the table (See Table 5.1):

All survey data, traffic sign's place in different questionnaires and number of questionnaire is given in a table. B,5 information given at the title indicates the code of "Priority for Oncoming Traffic" sign in Vienna Convention. Meaning section gives brief information about traffic sign's usage. Conclusion summary part gives brief information about survey result and response distribution. Comprehension level indicates rates of responses given in both graphical and table form. Sample responses highly used in questionnaire were given in this section to determine drivers' description for related traffic sign. Other Statistics part includes responses of "have you ever seen" and "what should be done" when it is seen" questions. "Have you ever seen" question is asked to determine traffic sign's familiarity. These statistics are obtained only with 1'st stage studies' data. Responses of "what should be done" question are not evaluated in content but identified to be filled or not.

Table 5.1: Priority for Oncoming Traffic Sign Conclusion Summary Report

Priority for Oncoming Vehicles (B,5)	Summary of Survey Study																																
		A		B		A+B																											
	Place	5		15																													
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2																											
	Valid	449	304	402	323	1478																											
	Total	753		725																													
Meaning: If, on a narrow section of road where passing is difficult or impossible, such regulation is carried out by giving priority to traffic moving in one direction and this sign shall be set up facing the traffic on the side which does not have priority.																																	
Conclusion Summary: 1/5 of drivers left without comment and wrong reponses are in a very low level. Partially or exact responses are both given by 1/6 of drivers. The most remarkable finding is that almost half of drivers gave opposite responses for the sign information and 2'nd traffic sign in this category.																																	
Comprehension Level  <table><tr><td></td><td>Size</td><td>%</td></tr><tr><td>Valid</td><td>1451</td><td>98.2</td></tr><tr><td colspan="3">Responses Scale (*)</td></tr><tr><td>-1.0</td><td>656</td><td>44.4</td></tr><tr><td>-0.5</td><td>25</td><td>1.7</td></tr><tr><td>0.0</td><td>331</td><td>22.4</td></tr><tr><td>0.5</td><td>217</td><td>14.7</td></tr><tr><td>1.0</td><td>221</td><td>15.0</td></tr><tr><td>Invalid</td><td>27</td><td>1.8</td></tr></table>								Size	%	Valid	1451	98.2	Responses Scale (*)			-1.0	656	44.4	-0.5	25	1.7	0.0	331	22.4	0.5	217	14.7	1.0	221	15.0	Invalid	27	1.8
	Size	%																															
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Responses Scale (*)																																	
-1.0	656	44.4																															
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0.0	331	22.4																															
0.5	217	14.7																															
1.0	221	15.0																															
Invalid	27	1.8																															
(*)	Sample Answers																																
-1.0	Two way traffic, Priority for going etc..																																
-0.5	Attention, Prohibition etc...																																
0.0	---Not commented---																																
0.5	Closed for going, One way trafficetc...																																
1.0	Give way to oncoming traffic etc.																																
Other Statistics																																	
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates																														
	Size	Percent		Size	Percent																												
Valid	802	94.2	Valid	1450	98.1																												
Not Filled	84	9.9																															
Yes	644	75.7	Not Filled	889	60.1																												
No	74	8.6	Filled	561	38.0																												
Invalid	49	5.8	Invalid	28	1.9																												

(1) This analysis was made with only controlled 1st stage data.

5.2 Comprehension Level of Traffic Signs

Traffic signs are grouped according to knowledge of drivers as follows:

- “Well” Known Signs
- Signs with high “No Comment” Level
- “Oppositely Associated” Signs
- “Partially” Known Signs
- Signs with “Mixed Comprehension” Level

5.2.1 “Well” Known Traffic Signs

By the analysis of survey data, it is seen that some traffic signs were highly comprehended correctly. This group involves 12 traffic signs that comprehended correctly (+1 values) by drivers of 70 % or higher (See Table 5.2). “Pedestrian Crossing Ahead” is the best known sign by 97.5 % of all drivers, “Maximum Speed Limit” and “Road Works” traffic signs are other well known signs with respectively 96.8 % and 96.7 %. Traffic signs that expected to be well known such as “Pedestrian Crossing Ahead” and “Road Works” are placed in questionnaire in order to control whether participants’ responses are subjective. As it was predicted, these signs take place in this group and this shows participants responded sincerely and seriously. Although being well known is the basic characteristic of this group, “Two Way Traffic” and “Risk of Ice” traffic signs were left without comment by more than 20 % of all participants.

5.2.2 “Oppositely” Associated Traffic Signs

By the analysis of survey data, it is seen that some traffic signs were comprehended oppositely at a significant level. Implementation of traffic rules in opposite way such as overtaking in a prohibited road, truck entrance to a prohibited road etc. will lead to great difficulties in traffic. In this group, there are 5 traffic signs comprehended oppositely by drivers of higher than 10 % (See Table 5.3).

Table 5.2 “Well” Known Traffic Signs

Traffic Sign		Comprehension Level (%)					Invalid %
Definition and Convention Code	Symbol	Opposite	Wrong	No Comment	Partially Correct	Correct	
Pedestrian Crossing Ahead (A,12 ^a)		0.14	0.00	0.97	0.00	97.52	1.24
Maximum Speed Limit (C,14)		0.40	0.00	0.93	0.13	96.81	1.73
Road Work (A,16)		0.00	0.00	1.79	0.00	96.69	1.52
No Trucks (Previous) (C,3 ^e)		0.13	2.12	3.19	1.20	90.84	2.52
School Crossing (A,13)		0.00	0.14	1.66	11.31	86.21	0.69
No Overtaking (Previous) (C,13 ^{aa})		0.28	5.10	4.69	3.72	84.97	1.24
Uneven Road (A,7 ^a)		0.00	3.31	9.38	3.45	83.17	0.69
Level Crossing Without Barrier (A,26 ^a)		0.13	0.80	9.03	4.12	82.47	3.45
Snow Chains Compulsory (D,9)		0.00	0.80	12.75	2.79	79.28	4.38
No Entry (C,1 ^a)		0.54	8.12	5.48	6.70	77.88	1.29
Two Way Traffic (A,23)		0.47	0.61	19.55	0.61	74.15	4.60
Risk of Ice (H,9)		0.00	1.35	20.57	2.84	71.72	3.52

“Minimum Speed Limit” is the traffic sign most often oppositely comprehended by 64.8 % of all participants. These participants responded not to drive faster than this speed limit instead of driving faster. Besides opposite responses, previous versions of “End of No Overtaking Zone for Trucks” and “No Overtaking” traffic signs’ meaning are left without comment more than 40 % of participants. Also 1/3 of participants gave correct responses to “No Overtaking” traffic sign.

Table 5.3 Oppositely Associated Traffic Signs

Traffic Sign		Comprehension Level (%)					
Definition and Convention Code	Symbol	Opposite	Wrong	Not Commented	Partially Correct	Correct	Invalid
Minimum Speed Limit (D,7)		64.82	0.95	10.96	0.54	19.96	2.77
Priority for Oncoming Vehicles (B,5)		44.38	1.69	22.40	14.68	14.95	1.83
End of No-Overtaking Zone for Trucks (C,17 ^d)		28.28	14.14	39.38	3.45	11.77	2.98
No Trucks (New)		27.72	6.34	36.00	3.17	21.79	4.83
No Overtaking (New) (C,13 ^{ab})		12.75	4.65	40.50	1.73	34.53	5.84

5.2.3 Signs with High “No Comment” Level

Some traffic signs were left without comment by more than half of the participants. These drivers told that they had no idea about the meaning of the traffic sign and could not give any answer. This group involves 10 traffic signs. “Obstruction Marker” traffic sign has the highest without comment level with 77.2 % of participants. “End of All Restrictions and Prohibitions” and “No Vehicles Carrying Explosives or Flammable Goods” traffic signs follow it with 69.8 and 68.4 % levels. Besides high level of without comment, “No Entry for Dangerous Goods Vehicles” traffic sign was given 27.1 % wrong responses; “Mandatory Direction for Vehicles Carrying Dangerous Goods” and “Single-Track Level Crossing Without Barrier” traffic signs are given partially correct responses by 1/3 of participants (See Table 5.4). In the subcommittee meeting, it is noted that although “Obstruction Marker” and “Distance to Level Crossing” traffic signs are installed separately at two sides of road in traffic, they were shown together on questionnaire. At the end, it is concluded that sign representation in the questionnaire might have caused confusion of the participants and may cause the high level of no comment responses.

It should be noted that some of the questions left unanswered due to tiredness or unwillingness of the participant after certain time, are coded “invalid” and are not included in “no comment” responses.

5.2.4 “Partially” Known Traffic Signs

Some traffic signs were known not fully but partially. This section includes 5 traffic signs that were partially known by higher than 45 % of participants (See Table 5.5). These responses are not exactly correct, but indicate that drivers know the meaning of sign partially or only one of multiple rules. “Compulsory Roundabout” traffic sign has the highest partially correct response level by 82.9 % of participants. “Double Curves First to the Right” traffic sign was responded correctly by 1/3 of drivers; “Standing or Parking Prohibited” and “Sharp Deviation of Route to the Left” traffic signs were comprehended correctly or left without comment by 1/5 of participants.

Table 5.4 Traffic Signs with High “No Comment” Level

Traffic Sign		Comprehension Level (%)					
Definition and Convention Code	Symbol	Opposite	Wrong	Not Commented	Partially Correct	Correct	Invalid
Obstruction Marker		0.00	16.58	77.20	0.14	0.88	5.21
End of All Restrictions and Prohibitions (C,17 ^a)		0.20	11.23	69.76	2.17	12.72	3.92
No Vehicles Carrying Explosives or Flammable Goods (C,3 ^m)		0.00	8.28	68.41	4.97	12.97	5.38
End of Priority Road (B,4)		3.65	4.13	67.86	3.45	17.93	2.98
Closed to All Vehicles in Both Directions (C,2)		0.41	6.43	63.53	4.47	23.21	1.96
Distance to Level Crossing (A,29 ^a)		0.00	14.88	62.31	12.52	6.36	3.92
No Entry for Dangerous Goods Vehicles (C,3 ^h)		0.13	27.09	56.31	9.03	2.79	4.65
Appropriate Traffic Lanes at Junction Ahead (E,4)		0.41	7.37	55.62	9.40	23.27	3.92
Mandatory Direction for Vehicles Carrying Dangerous Goods (D,10 ^c)		0.14	6.02	54.13	33.56	2.37	3.79
Single-Track Level Crossing (A,28 ^a)		0.00	5.79	50.21	29.38	10.07	4.55

Table 5.5 “Partially” Known Traffic Signs

Traffic Sign		Comprehension Level (%)					
Definition and Convention Code	Symbol	Opposite	Wrong	Not Commented	Partially Correct	Correct	Invalid
Roundabout (D,3)		0.00	0.40	6.64	82.87	4.78	5.31
Level Crossing with Barrier (A,25)		0.00	1.69	16.64	65.22	12.18	4.26
Double Curve First to the Right (A,1 ^d)		1.89	2.30	6.29	55.35	31.39	2.77
No Standing or Parking (C,19)		0.61	4.94	23.95	47.90	19.49	3.11
Sharp Deviation of Route to the Left		1.96	5.07	20.91	45.67	21.38	5.01

5.2.5 “Mixed” Traffic Signs

When response distribution is reviewed, it is seen that some traffic signs do not show any characteristic features indicating above groups. This group includes 7 traffic signs (See Table 5.6). Basic characteristics of these traffic signs are as follows:

“No Through Road in the Direction Indicated from Junction Ahead” traffic sign received 65.3 % correct, 11.8 % partially correct responses and 17.9 % of participants left without comment. “Road Narrows from Left” traffic sign is given correct responses more than half of drivers and 28.6 % partially correct responses. “Motor or Non-motorized Vehicles Prohibited” and “End of Motorway” traffic signs show similar characteristics. Also both traffic signs were comprehended correctly by almost half of the participants and left without comment by 1/3. “Crossroad with a

Non-priority Road” traffic sign is given partially correct responses by ¼ of drivers, correct by 44.2 % and left without comment by 22.5 % of drivers. “Dangerous Shoulder” and “Give Way” traffic signs were given wrong responses in high level. Almost half of drivers gave correct responses for “Dangerous Shoulder” and 1/3 of drivers gave correct responses or left without comment for “Give Way” traffic sign.

Table 5.6 Traffic Signs with Mixed Comprehension Level

Traffic Sign		Comprehension Level (%)					
Definition and Convention Code	Symbol	Opposite	Wrong	No Comment	Partially Correct	Correct	Invalid
No Through Road in the Direction Indicated from Junction Ahead (G,2 ^a)		0.80	0.93	17.93	11.82	65.34	3.19
Road Narrows from Left Side (A,4 ^b)		0.27	3.04	10.62	28.62	55.28	2.17
Motor or Non-Motorized Vehicles Prohibited (C,4 ^b)		0.41	2.90	31.72	9.10	51.31	4.55
End of Motorway (E,5 ^b)		1.06	10.36	31.87	1.20	50.86	4.65
Crossroad with a Non-Priority Road (A,19 ^a)		0.34	3.52	22.46	24.90	44.25	4.53
Dangerous Shoulder (A,8)		0.20	31.60	10.55	12.04	44.05	1.56
Give Way (B,1)		0.34	20.43	34.98	10.35	32.07	1.83

5.3 Comparative Analyses

In this section, the comprehensibility levels of similar signs or old and new versions of a sign will be compared to see the impact of different design features or recent changes in the signs.

a) Adopted Traffic Signs in Accession Period for the EU

As described in Section 3.3, during the current accession period for the European Union; some of the traffic signs have been changed to follow the European Agreement on the omission of the oblique bar on symbols. Due to the gradual change of signs on the roads over time, currently both new and old versions of these traffic signs are in use in our roads together. In this study, two of these recently changed signs are included with the older and newer versions asked in different questionnaire versions separately and the results are compared as follows:

“No Entry for Goods Vehicles” Traffic Sign

By removing oblique red bar from previously used “No Entry for Goods Vehicles” traffic sign, it is adopted to EU form. When comprehension levels of current and previous versions for the traffic sign are analyzed, it is seen that previous version comprehended correctly by 90.8 % of all drivers also opposite, wrong (false), not commented and partially correct response rates are very low; current version comprehended correctly by 21.8 % of all drivers, oppositely by 27.2 %, wrong (false) by 6.3 %, partially correct by 3.2 and not commented by 36 % (See Figure 5.1). While previous version is one of the best known traffic sign, current version is one of the most oppositely comprehended traffic sign. In other words drivers of 27.7 % described new version as “Entry for Goods Vehicles”. Dangerous accidents may probably occur, if drivers of goods vehicles enter a road that is prohibited. As a result it can be said that previous version is mostly comprehended correctly but new version is not learnt well, at least, not yet.

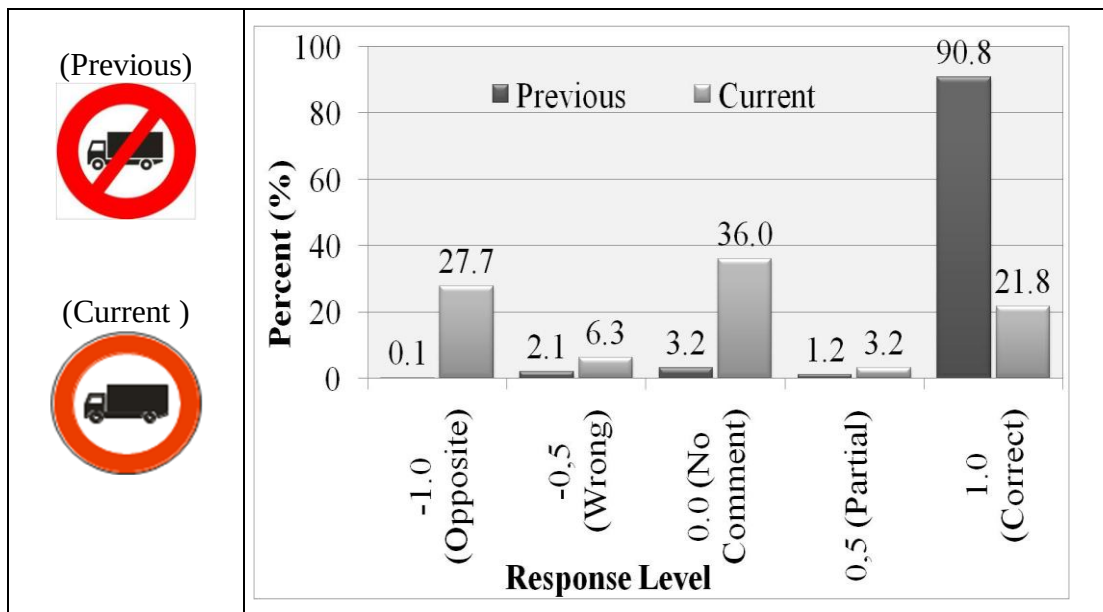


Figure 5.1: Comprehension Levels of Previous and Current Versions of “No Entry of Goods Vehicles” Traffic Sign

“No Overtaking” Traffic Sign

When comprehension levels of current and previous versions for “No Overtaking” traffic sign are analyzed, it is seen that while previous sign comprehended correctly by 85.0 % of all drivers; current version comprehended correctly by 34.5 % of all drivers, oppositely by 12.7 % and not commented by 40.5 % (See Figure 5.2). While previous version is known well, current version is comprehended oppositely or not commented in a high rate. In other words 12.7 % of drivers described new version as “Overtake” and 40.5 % could not make comment. Dangerous accidents may probably occur, if drivers do not understand no overtaking rule. As a result it can be said that previous version is mostly comprehended correctly, but current version is not learnt well, at least not yet.

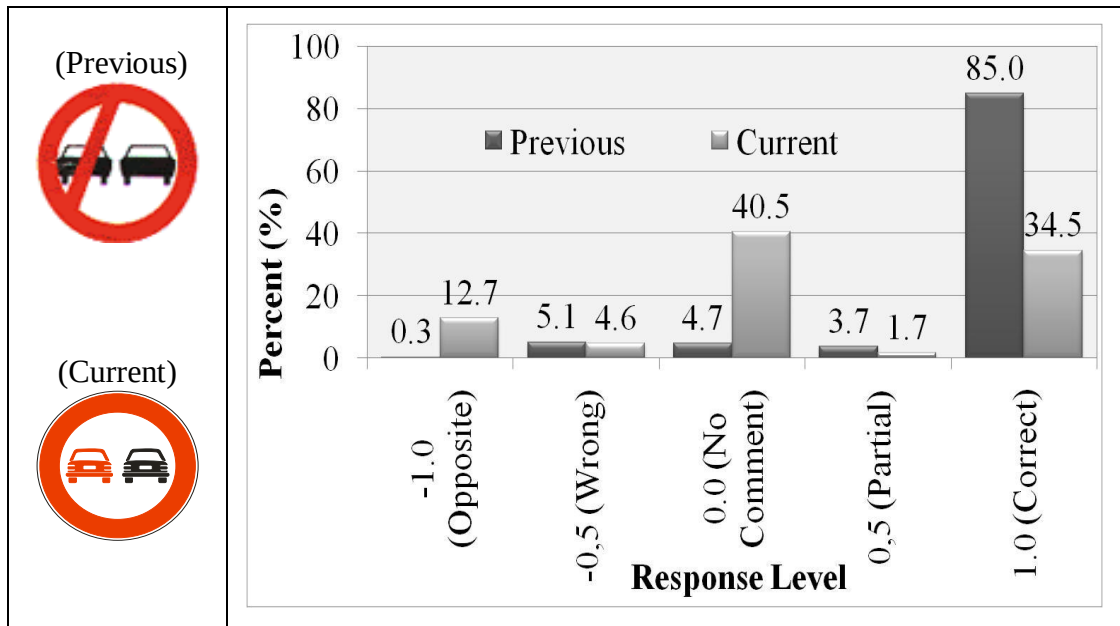


Figure 5.2: Previous and Current “No Overtaking” Traffic Signs’ Comprehension Levels

5.4 Color and Shape Detection

In addition to the signs with design changes, it is possible to compare similar signs with only a major color or shape difference to see, if drivers are aware of color or shape coding concepts in Vienna Convention system.

“Minimum Speed Limit” Sign versus “Maximum Speed Limit” Sign

These two regulatory traffic signs both show speed limits, but in an opposite way. Minimum speed limit sign is in blue color and warn drivers to drive faster than 30 km/hr. Maximum speed limit is in red and warn drivers not to drive faster than 50 km/hr (Figure 5.3). When responses of “Minimum Speed Limit” are analyzed, it is seen that 64.8 % of drivers gave opposite response and confused it with “maximum speed limit” traffic sign (See Table 5.7). It can be clearly seen that drivers do not know color of a sign guides its functions. Drivers should be informed that blue circle gives a mandatory instruction and red circle gives prohibitions.

Table 5.7 Comprehension Level of Minimum and Maximum Speed Traffic Signs

	 Minimum Speed Limit (C,14)	 Maximum Speed Limit (D,7)
Valid	97.23	98.27
<u>Opposite</u>	<u>64.82</u>	<u>0.40</u>
Wrong	0.95	0.00
Not Commented	10.96	0.93
Partially Correct	0.54	0.13
Correct	19.96	96.81
Invalid	2.77	1.73

“End of No Overtaking Zone for Trucks” Sign

When responses of “End of No Overtaking Zone for Trucks” are analyzed, it is seen that 28.3 % of drivers gave opposite response and confused with “No Overtaking for Trucks” traffic sign. “No Overtaking for Trucks” traffic sign prohibits overtaking for trucks, “End of No Overtaking Zone for Trucks” traffic sign allows this prohibition. Both traffic signs are circular, “No Overtaking for Trucks” traffic sign is in red color but “End of No Overtaking Zone for Trucks” traffic sign is in black and has an oblique bar (See Table 5.8). The reason of this confusing is thought to be drivers’ lack of knowledge that color of a sign guides its functions. Drivers should be informed that red color prohibits but black color ends this prohibition. Unfortunately, the no overtaking sign was not included in the survey design due to the limited number of signs asked in a reasonable survey time, so, there is no statistical data to comment on the comprehensibility of it independently.

Table 5.8 Comprehension Level of End of No Overtaking Zone for Trucks Traffic Sign

	 End of No Overtaking Zone for Trucks (C,17^d)”	 No Overtaking for Trucks (C,13^{ba})
Valid	97.02	Not included in the study
<u>Opposite</u>	<u>28.28</u>	
Wrong	14.14	
Not Commented	39.38	
Partially Correct	3.45	
Correct	11.77	
Invalid	2.98	

“Priority for Oncoming Traffic” Sign

“Priority for Oncoming Traffic” sign shall mean that entry into the narrow section is prohibited so long as it is not possible to pass through that section without obliging oncoming vehicles to stop. “Two Way Traffic” sign should be used where a one way street or part of a dual carriageway is converted to a two-way operation for the purpose of carrying out road works. 44.4 % of drivers gave opposite responses to “Priority for Oncoming Traffic” sign, two way traffic is the most given description in these responses (See Table 5.9). This fault occurs, since drivers cannot detect red arrow or do not know difference between black and red. Although two signs are in different shape and color, there are high opposite responses. Drivers should be informed that triangular is used to warn, red circle to give orders, red arrow to prohibit or warn drivers.

Table 5.9 Comprehension Level of Priority for Oncoming Traffic and Two Way Traffic Signs

	 Priority for Oncoming Traffic (A,23)	 Two Way Traffic (B,5)
<i>Valid</i>	98.17	95.40
<u>Opposite</u>	<u>44.38</u>	<u>0.47</u>
<i>Wrong</i>	1.69	0.61
<i>Not Commented</i>	22.40	19.55
<i>Partially Correct</i>	14.68	0.61
<i>Correct</i>	14.95	74.15
<i>Invalid</i>	1.83	4.60

CHAPTER 6

DRIVERS CHARACTERISTICS IMPACT ON COMPREHENSION OF TRAFFIC SIGNS

The comprehensibility of traffic signs depend not only the design of the sign, but also the driver's personal and social characteristics, such as gender, age, driving experience, occupation, etc. as well. That is why it is important to study a participant's profile characteristics in association with his/her responses to each sign. This section includes first a brief review of participant profile for the sample. In the analysis part first an overall analysis of driver characteristics on the comprehensibility levels of traffic signs is presented, followed by a sign-based analysis of significant driver's characteristics.

6.1 Participant Profiles

The study was performed over 1,134 male, 327 female with a total of 1,478 drivers (17 drivers left without comment for gender question). When drivers' educational background were examined, it is seen that highest rate of high school and university graduates were participated despite all the effort shown during sampling (See Table 6.1). Since survey was conducted to drivers that have high educational level, analysis results should be considered more optimistic than usual.

Table 6.1 Drivers' Educational Background

		Primary	Secondary	High	College	University	Master/ PhD	Total
Gender	Male	110	124	387	80	349	49	1,099
	Female	1	6	76	37	155	42	317
	Total	111	130	463	117	504	91	1,416

In the survey, both occupation of the participant and frequent driving requirement due to their occupation are asked. Further more, regardless of their reporting, a subset of 271 professional drivers is selected among taxi, bus and minibus drivers. While the number of professional and non-professional drivers is given in Table 6.2, their self-assessed driving due to job requirement is given in Table 6.3.

Table 6.2 Occupation Information for (a) Professional (b) Non-Professional Drivers

a)			(b)		
Professional Drivers	Size	Percent (%)	Occupation	Size	Percent (%)
Taxi	90	6.09	Student	148	10.01
Service	74	5.01	Engineer	147	9.95
Minibus	50	3.38	Officials*	146	9.88
Public Bus	36	2.44	Retired	68	4.60
Other	21	1.42	Teacher	34	2.30
			Worker	25	1.69
			Academician	24	1.62
			Accountant	22	1.49

(*) includes different occupations, but commonly called "official" due to their position in a government office.

Drivers are grouped according to their ages as: new (18-25 ages), young (26-35 ages), middle aged (36-45 ages), old (46-60 years) and retired (61 or more). Number of drivers have been nearly equal for each age group except 61 or more (average age is found as 35.8) (See Table 6.4). When we consider drivers above age of 61 do not use traffic so much, we can state that this low value does not affect analysis results.

Table 6.3 Information of Occupational Drivers

Occupation	Yes	No	Occupation	Yes	No
Taxi Driver	90	0	Student	21	118
Service Driver	74	0	Other Driver	21	0
Engineer	64	72	Teacher	12	21
Minibus Driver	50	0	Doctor	12	3
Official	37	105	Academician	12	12
Public Bus Driver	36	0	Technician	10	7
Self-Employment	35	13	Sales Consultant	10	5
Retired	25	36	Textile	9	4

Table 6.4 Breakdown of Participants' Age

		18-25	26-35	36-45	46-60	61 +	Total
Gender	Male	256	323	262	251	21	1,113
	Female	84	87	91	44	4	310
	Total	340	410	353	295	25	1,423

Drivers' experience was grouped as less than 5, 6-10 years, 11-15 years and more than 16 years. Drivers were grouped equally except 16 years or more experienced

(See Table 6.10). 139 drivers did not give information about traffic ticket they had for 5 years and 906 drivers (61.30 %) wrote they had not given any traffic ticket for 5 years. Numbers of 5 or more traffic tickets were grouped together. Drivers of 475 determined the reason of traffic ticket but 16 of them had not (See Table 6.5).

Table 6.5 Drivers' a) Driving Experience and b) Number of Traffic Tickets for 5 Years

(a)

Driving Experience	Size	Percent
Less than 5 years	498	33.7
6 -10 years	497	33.7
11 - 15 years	349	23.6
16 years or more	60	4.1
Invalid	74	4.9

(b)

Traffic Ticket	Size	Percent
Not Having	906	61.30
1	182	12.31
2	101	6.83
3	44	2.98
4	16	1.08
5 or More	90	6.09
Total	1,339	90.60

6.2 Overall Analysis of Driver Characteristics on Comprehensibility

Comprehension level difference between female and male drivers does not exceed 3 %. Female drivers gave more correct and less wrong or opposite responses than male drivers. Male drivers gave more partially correct responses and female drivers left not commented more (See Table 6.6). When drivers' comprehensibility is analyzed considering his/her education, it is seen that highly educated drivers gave more successful responses than other groups (See Table 6.7). But this may be partly due to the fact that they are more experienced in expressing themselves more or easily.

Table 6.6 Percentage of Drivers' Comprehension of Signs Based on Gender

	Male	Female
<i>Opposite</i>	5.07	4.70
<i>Wrong</i>	6.69	5.02
<i>Not Commented</i>	27.82	30.22
<i>Partially Correct</i>	15.26	12.14
<i>Correct</i>	42.65	44.35
<i>Invalid</i>	2.51	3.58

Table 6.7 Percentage of Drivers' Comprehension of Signs Based on Education

	Primary	Secondary	High	College	University	Master/ PhD
<i>Opposite</i>	5.7	6.0	5.3	4.5	4.6	4.4
<i>Wrong</i>	7.8	8.4	6.6	7.1	5.5	4.7
<i>Not Commented</i>	31.2	28.3	29.2	26.2	27.3	28.4
<i>Partially Correct</i>	16.3	17.0	14.9	14.0	13.7	13.6
<i>Correct</i>	37.4	38.8	41.5	44.2	46.0	45.4
<i>Invalid</i>	1.6	1.5	2.5	4.0	2.9	3.5

While more correct responses are given by non-professional drivers and more opposite and wrong (false) responses were given surprisingly by professional ones. (See Table 6.8) It should be noted that majority of the professional drivers does not have high education levels, which may affect their ability to express themselves easily or correctly, especially in written form. When professional drivers are compared among themselves, it is seen that correct response average is nearly equal except service drivers. Service drivers gave less correct but more partially correct responses and not commented on responses more than other professional driver

groups. Public bus drivers gave the highest wrong responses and service drivers gave least opposite and wrong responses. Taxi drivers gave most invalid responses since sometimes they had to leave the questionnaire (See Table 6.9).

Maximum average comprehension difference between age groups does not exceed 3 %. Drivers older than 46 aged comprehended the signs more correctly. There is no remarkable comprehension level difference in partially correct responses. Drivers aged between 18-25 gave more wrong and not commented, 26-35 aged drivers gave more opposite responses (See Table 6.10). Significant differences between ages were found for 20 traffic signs (See Table 6.15).

Table 6.8 Percentage of Drivers' Comprehension of Signs Based on Driving Reason

	Professional	Occupational	Personal
<i>Opposite</i>	6.38	5.13	4.41
<i>Wrong</i>	8.05	6.93	5.22
<i>Not Commented</i>	24.92	25.76	31.55
<i>Partially Correct</i>	17.40	14.93	13.26
<i>Correct</i>	40.40	45.20	42.47
<i>Invalid</i>	3.10	2.29	3.09

Table 6.9 Percentage of Professional Drivers' Comprehension of Signs

	Public Bus	Minibus	Service	Others	Taxi
<i>Opposite</i>	7.7	8.8	5.3	5.7	6.4
<i>Wrong</i>	10.5	9.9	6.9	8.7	7.7
<i>Not Commented</i>	22.2	22.1	32.7	25.1	21.4
<i>Partially Correct</i>	18.1	17.1	21.7	14.4	16.6
<i>Correct</i>	41.5	42.1	32.9	41.8	42.4
<i>Invalid</i>	0.0	0.0	0.5	4.3	5.5

Table 6.10 Percentage of Drivers' Comprehension of Signs Based on Age

	18-25	26-35	36-45	46 +
<i>Opposite</i>	5.1	5.3	4.3	4.8
<i>Wrong</i>	6.8	5.7	5.7	6.2
<i>Not Commented</i>	28.7	26.9	25.0	25.4
<i>Partially Correct</i>	14.2	15.3	14.1	14.1
<i>Correct</i>	42.9	42.0	44.9	45.5
<i>Invalid</i>	2.3	4.8	6.0	4.0

Maximum correct and partially correct comprehension difference between professional drivers does not exceed 3%. Drivers that have less than 5 years experience gave the most not commented responses. Drivers that have more than 16 years experience gave the most wrong responses. The most remarkable finding is that drivers' comprehension based on driving experience does not have much difference (Table 6.11). Significant differences between professional drivers were found for 16 traffic signs (See Table 6.15).

Table 6.11 Percentage of Drivers' Comprehension of Signs Based on Driving Experience

	< 5 Years	6-10 Years	11-15 Years	16 Years <
<i>Opposite</i>	4.9	5.1	5.5	5.4
<i>Wrong</i>	5.8	5.9	6.1	7.1
<i>Not Commented</i>	28.5	25.4	24.3	24.8
<i>Partially Correct</i>	13.5	14.6	15.3	15.7
<i>Correct</i>	43.9	43.2	44.6	42.5
<i>Invalid</i>	3.4	5.8	4.2	4.5

6.3 Driver's Characteristics Impact on Sign Comprehensibility

This section includes significant difference of drivers response to a traffic sign by their characteristics. To measure this, a two sample Kolmogorov Smirnov test is used by using SPSS software. The two-sample K-S test is one of the most useful and general nonparametric methods for comparing two samples, as it is sensitive to differences in both location and shape of the empirical cumulative distribution functions of the two samples (in this case two subset such as, male drivers versus female ones). Alfa value describes the response difference of different groups. Three different confidence limits are defined such as 1, 5 and 10 %.

As an example the significant impact of different driver's characteristics on the comprehensibility of "Compulsory Minimum Speed Traffic Sign" is discussed here, for which the response distribution of all subgroups of different characteristics is presented in Table 6.12. While there has not been any significant difference between male and female drivers for this sign at any confidence levels (See Table 6.13), there seems to be some difference between drivers that report regular driving due to occupational purposes at $\alpha = 1\%$. But with higher alpha levels, this difference cannot be regarded significant anymore. Similarly pattern exists for the impact of experience.

On the other hand, there is definitely a significant difference between different education level drivers and professional versus non-professional driver groups at all the confidence limits. However to see which subgroups have difference further analyses of comparisons have to be performed as shown in Table 6.14: Asymptotic significance (2-tailed) value is found 0.8 % between primary and university graduates, 2.3 % between primary and master/doctorate graduates, 8.4 % between secondary and college graduates, 0.0 % between secondary and university graduates, 0.4 % between secondary and master / doctorate graduates, 0.3 % between high school and university graduates, 5.7 % between high school and master / doctorate graduates. These values are lower than 10 %, so there are significance differences between responses of drivers that have these educational background levels.

Table 6.12 Response Levels by Driver Characteristics for“Compulsory Minimum Speed” Sign

		Compulsory Minimum Speed				
		Response Level (%)				
Educational Background	Primary School	Secondary School	High School	College (2year)	University (4 year)	MS/ PhD
Valid	99.10	98.46	98.27	95.73	98.02	96.70
Opposite	75.68	78.46	69.98	60.68	58.22	53.85
Wrong	1.80	1.54	0.00	2.56	1.19	1.10
Not Commented	7.21	8.46	10.37	10.26	11.88	15.38
Partially Correct	0.00	1.54	0.00	1.71	0.59	1.10
Correct	14.41	8.46	17.93	20.51	26.14	25.27
Invalid	0.90	1.54	1.73	4.27	1.98	3.30
Age	18-25	26-35	36-45	46-60		
Valid	99.12	98.78	96.32	97.63		
Opposite	65.88	64.39	62.32	69.49		
Wrong	0.29	0.98	1.13	1.69		
Not Commented	10.59	9.51	12.46	10.51		
Partially Correct	0.29	0.24	1.42	0.34		
Correct	22.06	23.66	18.98	15.59		
Invalid	0.88	1.22	3.68	2.37		
Professional Drivers	Public Bus	Minibus	Service	Other	Taxi	
Valid	100.00	100.00	100.00	95.24	100.00	
Opposite	86.11	98.00	52.70	61.90	86.11	
Wrong	2.78	0.00	0.00	0.00	2.78	
Not Commented	2.78	2.00	9.46	9.52	2.78	
Partially Correct	0.00	0.00	0.00	0.00	0.00	
Correct	8.33	0.00	37.84	23.81	8.33	
Invalid	0.00	0.00	0.00	4.76	0.00	
Driving Experience	<5 Years	6-10 Years	11-15 Years	16+ Years		
Valid	97.99	98.19	97.13	98.33		
Opposite	60.84	67.40	66.48	78.33		
Wrong	1.00	1.41	0.57	0.00		
Not Commented	13.65	8.65	11.46	6.67		
Partially Correct	0.20	0.40	1.15	1.67		
Correct	22.29	20.32	17.48	11.67		
Invalid	2.01	1.81	2.87	1.67		
Driving Need	Personal	Professional	Occupational			
Valid	96.95	97.79	99.14			
Opposite	58.06	76.38	68.68			
Wrong	1.16	0.37	1.08			
Not Commented	14.22	5.90	9.94			
Partially Correct	0.44	0.74	0.65			
Correct	23.08	14.39	18.79			
Invalid	3.05	2.21	0.86			
Gender	Male	Female				
Valid	98.06	96.94				
Opposite	66.14	61.77				
Wrong	1.15	0.31				
Not Commented	10.67	12.23				
Partially Correct	0.53	0.61				
Correct	19.58	22.02				
Invalid	1.94	3.06				

Table 6.13 Compulsory Minimum Speed Traffic Sign Significant Response
Difference in Sub-Groups

Compulsory Minimum Speed 		Sub-Groups Difference					
		Gender	Educational Background	Occupational Driving	Professional Drivers	Age	Experience
K-S Test Confidential Level	1 %	No	Yes	No	Yes	No	No
	5 %	No	Yes	Yes	Yes	No	No
	10%	No	Yes	Yes	Yes	No	Yes

Similarly the analysis of different groups of professional drivers are presented in the same table showing that minibus drivers are the most unsuccessful subgroup in Professional drivers.

A concise summary of the significant driver characteristics affecting sign comprehensibility is given in Table 6.15. The signs that are not included here are those that have not any significant difference based on the selected driver characteristics, regardless of their level of comprehensibility. For example “Maximum Speed Limit” is one of the best known traffic sign and does not have significant difference between driver’s characteristics. “Distance to Level Crossing” traffic sign is one of the highest wrongly responded and not commented traffic sign and does not have any significant difference between driver’s characteristics.

Table 6.14 “Compulsory Minimum Speed” Traffic Sign K-S Test Results by Educational Background and Professional Driving

 Compulsory Minimum Speed Traffic Sign						
Educational Background		Primary - Secondary	Primary - High School	Primary – College	Primary - University	Primary – Master/ Doctorate
Maximum Difference	Absolute	0.060	0.070	0.130	0.176	0.214
	Positive	0.060	0.000	0.000	0.000	0.214
	Negative	0.000	-0.070	-0.130	-0.176	0.000
Kolmogorov-Smirnov Z		0.458	0.656	0.966	1.667	1.494
Asymp. Sig. (2-tailed)		0.985	0.782	0.308	0.008	0.023
Educational Background		Secondary – High School	Secondary -College (2year)	Secondary-University (4 year)	Secondary – Master/ Doctorate	High School-College (2 year)
Maximum Difference	Absolute	0.100	0.163	0.206	0.244	0.078
	Positive	0.000	0.163	0.000	0.244	0.078
	Negative	-0.100	0.000	-0.206	0.000	0.000
Kolmogorov-Smirnov Z		1.004	1.259	2.082	1.764	0.741
Asymp. Sig. (2-tailed)		0.266	0.084	0.000	0.004	0.642
Educational Background		High School - University (4 year)	High School – Master/ Doctorate	College (2year)-University (4 year)	College (2 year) – Master/ Doctorate	University (4 year) – Master/ Doctorate
Maximum Difference	Absolute	0.118	0.155	0.055	0.093	0.038
	Positive	0.000	0.155	0.000	0.093	0.038
	Negative	-0.118	0.000	-0.055	0.000	-0.005
Kolmogorov-Smirnov Z		1.819	1.819	1.333	0.522	0.650
Asymp. Sig. (2-tailed)		0.003	0.003	0.057	0.948	0.793
Professional Drivers		Public Bus – Minibus	Public Bus – Service	Public Bus – Other	Public Bus – Taxi	Minibus – Service
Maximum Difference	Absolute	0.119	0.362	0.239	0.048	0.453
	Positive	0.119	0.000	0.239	0.048	0.000
	Negative	0.000	-0.362	0.000	-0.007	-0.453
Kolmogorov-Smirnov Z		0.544	1.781	0.857	0.242	2.474
Asymp. Sig. (2-tailed)		0.929	0.004	0.455	1.000	0.000
Professional Drivers		Minibus – Other	Minibus – Taxi	Service – Other	Service – Taxi	Taxi – Other
Maximum Difference	Absolute	0.330	0.098	0.128	0.355	0.232
	Positive	0.330	0.000	0.000	0.355	0.232
	Negative	0.000	-0.098	-0.128	0.000	0.000
Kolmogorov-Smirnov Z		1.247	0.548	0.509	2.235	0.935
Asymp. Sig. (2-tailed)		0.089	0.925	0.958	0.000	0.346

Table 6.15 Traffic Signs That Have Significant Comprehension Difference by Drivers' Traffic, Personal and Social Characteristics

		Gender	Educational Background	Occupational Driving	Professional Drivers	Age	Experience
	School Crossing			X	X		
	Level Crossing Without Gates			X	X		
	Snow Chains Compulsory			X			
	No Entry		X				
	Two Way Traffic				X	X	X
	Risk of Ice			X	X	X	
	Level Crossings with Gates		X				X
	Double Curve First to the Right				X		
	Standing and Parking Prohibited		X	X	X		
	Dangerous Bend of Route to the Left		X	X	X	X	
	Intersection with a Non-Priority Road		X	X	X		X
	No Through Road in the Direction Indicated			X	X		
	No Entry for Power Driven or Animal-Drawn Vehicles				X		

Table 6.15 Traffic Signs That Have Significant Comprehension Difference by Drivers' Traffic, Personal and Social Characteristics (continued)

		Gender	Educational Background	Occupational Driving	Professional Drivers	Age	Experience
	End of All Prohibition or Restriction		X	X	X		
	End of Priority Road				X	X	
	Closed to All Vehicles in Both Directions		X	X	X		
	Preselection at Intersections on Roads with Several Lanes				X	X	X
	Compulsory Direction for Vehicles Carrying Dangerous Goods			X	X		X
	Dangerous Shoulder		X	X			
	No Entry for Vehicles Carrying Dangerous Goods			X	X		
	Give Way		X		X		
	End of Motorway			X	X		
	Compulsory Minimum Speed		X		X		
	Priority for Oncoming Traffic	X		X		X	
	End Of Prohibition of Overtaking for Goods Vehicles		X	X	X	X	X

Table 6.15 Traffic Signs That Have Significant Comprehension Difference by Drivers' Traffic, Personal and Social Characteristics (continued)

		Gender	Educational Background	Occupational Driving	Professional Drivers	Age	Experience
	No Entry for Goods Vehicles (New)			X	X		X
	Overtaking Prohibited (New)				X		

CHAPTER 7

CONCLUSION AND RECOMMENDATIONS

The comprehension levels of 39 traffic signs, which are a) recently changed due to European Union process and b) expected to have high impact on traffic safety and c) are kept for control group, in a survey study of by a subcommission of the Highway Traffic Safety Committee, Turkey. The design of the questionnaire is done by contributions of experts and faculty members on traffic safety and psychology. Survey study is conducted to 1,478 drivers at different locations of Ankara to reach different personal, social and traffic characteristics. Due to the large number of drivers in the City of Ankara, the sample size is not enough to draw conclusions about the driver population in the whole city; thus, the study is defined as a “pilot” one that at least sheds some light to the topic. This point is considered while evaluating the analysis results, as well.

Answers for the meaning of each sign are coded using a scale of five (opposite, wrong, no comment, partially correct and correct responses). At the end of the study comprehension level of 39 traffic signs and role of drivers’ characteristics were determined. It is observed that some traffic signs, predicted high impact on traffic accidents, are not known or known oppositely or false at high rates even by drivers that have higher education level across the country. A detailed analysis of each sign is prepared as well as some comparative analysis. Traffic signs are grouped according to comprehension levels of drivers as:

- “Well” Known Signs
(*Maximum Speed Limit, No Trucks (Previous), No Overtaking (Previous), Two Way Traffic etc.*)

- Signs with High “No Comment” Level
(Obstruction Marker, End of All Restrictions and Prohibitions, Closed to All Vehicles in Both Directions, No Entry for Dangerous Goods Vehicles etc.)
- “Oppositely Associated” Signs
(Minimum Speed Limit, Priority for Oncoming Vehicles, End of No-Overtaking Zone for Trucks, New Version of No Trucks, New Version of No Overtaking)
- “Partially” Known Signs
(Roundabout, Level Crossing with Barrier, Double Curve First to the Right, No Standing or Parking, Sharp Deviation of Route to the Left)
- Signs with Mixed Comprehension Level
(Road Narrows from Left Side, End of Motorway, Crossroad with a Non-Priority Road, Dangerous Shoulder, Give Way etc.)

The certain loss of comprehensibility of new version of traffic signs is seen in the comparative analysis of the new and old version of recently changed signs. New versions were also given opposite responses at high levels. It is seen that previous version is mostly comprehended correctly but new version of traffic signs that changed during EU accession period is not learnt well, at least not yet. Also, comparative analyses of some signs suggest that drivers do not have knowledge that color and shape of a sign guides its functions. Among different subgroups (such as male versus female, education levels, age, driving experience etc.) impact of driver characteristics on the comprehensibility of traffic signs is detected and significant response difference is found by having K-S test.

Highway Traffic Safety Commission Decision

The result of this study led to a decision of focusing on more education and mass promotion of mis- or un-comprehended signs instead to adding verbal explanations based on the need to follow the universal signs in today’s global economies and transportation systems instead of creating local versions. The subcommission evaluated results of the study and determined that using traffic signs with their meanings written on or under the sign boards should not be used because:

a) as Turkey lies on international land transportation routes and has different education, age, cultural etc. driver profile on her highways

b) there is always a risk of distraction by the extra text, especially on roads that can be driven at high-speed,

c) especially in city center, it will create “sign pollution” problems while having a possibility of not creating expected effect,

Also, adding explanatory marking or texts on or under the sign boards are against idea of using internationally recognized symbols; also changing dimension is not accepted.

On the other hand, to improve the comprehension levels of traffic signs, a series of actions, in "education" and "control" is decided to be taken. In education actions, different target groups should be approached with different tools. For example, students should be taught in the courses or in other suitable places in the formal education system, hanging traffic signs on school yards, placement exams are given to questions related to traffic safety. Driver training courses should concentrate on this issue in education of driver candidates. Training programs organized by professional organizations should be informed by professional drivers such as taxi, service or truck drivers etc. Other road users, make up the majority, should be trained by media, symposia, competitions etc.

To achieve these goals in the short term news and interviews of related issues should be placed on written and visual media and results of the survey study should be shared on net,

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APPENDIX

SUMMARY REPORT OF TRAFFIC SIGNS

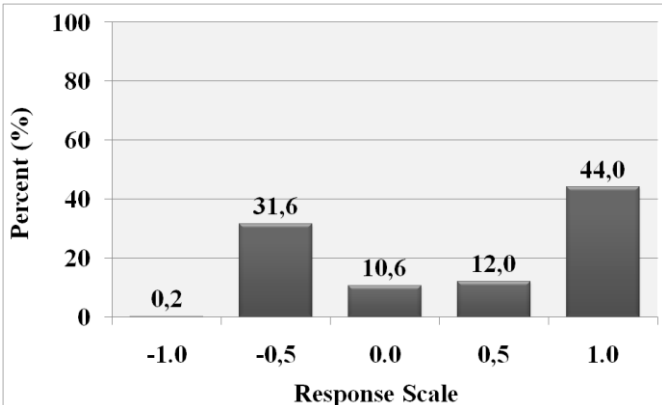
This section includes survey results of 39 traffic signs in one paged summary report forms.

Table A.1 “Dangerous Shoulders” Traffic Sign Summary Report

Dangerous Shoulders (A,8)		Summary of Survey Study					
		A		B		A+B	
	Place	1		7			
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2	
	Valid	449	304	402	323	1478	
	Total	753		725		1494	

Meaning: This sign shall be used to notify drivers about soft verges and distance between the shoulder and road.

Summary: Although the sign is comprehended correctly by almost half of the drivers and never comprehended oppositely, it has the highest wrong response level within all traffic signs.

Comprehension Level			
	Size	%	
	Valid	1455	98.4
	Responses Scale (*)		
	-1.0	3	0.2
	-0.5	467	31.6
	0.0	156	10.6
	0.5	178	12.0
	1.0	651	44.0
	Invalid	23	1.6

(*)	Sample Answers
-1.0	High shoulder etc.
-0.5	Slippery road, Rough surface, Falling rocks, Loose chippings etc.
0.0	---Not commented---
0.5	Steep ascent, Stockade, Cliff etc.
1.0	Dangerous shoulder, Soft verges etc.

Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	808	94.9	Valid	1455	98.4
Not Filled	42	5.0			
Yes	717	84.2	Not Filled	651	44.0
No	49	5.7	Filled	804	54.4
Invalid	43	5.0	Invalid	23	1.6

Table A.2 “Closed to All Vehicles in Both Directions” Traffic Sign Summary Report

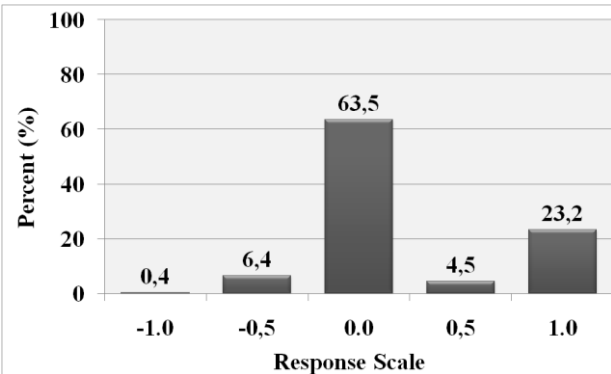
Closed to All Vehicles in Both Directions (C,2)		Summary of Survey Study																																											
		A		B		A+B																																							
	Place	3		13																																									
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2																																							
	Valid	449	304	402	323	1478																																							
	Total	753		725		1494																																							
Meaning: This sign shall be used to notify drivers that all vehicular traffic is prohibited in both directions. This sign post is used on roads available only to pedestrians.																																													
Summary: Level of opposite responses can be negligible, wrong and partially correct responses are in low level. Almost 1/4 of drivers gave correct responses. The most remarkable finding about the sign is that more than half of the drivers did not make comment about information of the sign.																																													
Comprehension Level <table><thead><tr><th></th><th>Size</th><th>%</th></tr></thead><tbody><tr><td>Valid</td><td>1455</td><td>98.0</td></tr><tr><td colspan="3">Responses Scale (*)</td></tr><tr><td>-1.0</td><td>6</td><td>0.4</td></tr><tr><td>-0.5</td><td>95</td><td>6.4</td></tr><tr><td>0.0</td><td>939</td><td>63.5</td></tr><tr><td>0.5</td><td>66</td><td>4.5</td></tr><tr><td>1.0</td><td>343</td><td>23.2</td></tr><tr><td>Invalid</td><td>29</td><td>2.0</td></tr></tbody></table> <table><thead><tr><th>(*)</th><th>Sample Answers</th></tr></thead><tbody><tr><td>-1.0</td><td>Open to traffic, Vehicle entry etc.</td></tr><tr><td>-0.5</td><td>No parking, Roundabout,Danger etc.</td></tr><tr><td>0.0</td><td>---Not commented---</td></tr><tr><td>0.5</td><td>No entry, End of road etc.</td></tr><tr><td>1.0</td><td>Closed to traffic etc.</td></tr></tbody></table>								Size	%	Valid	1455	98.0	Responses Scale (*)			-1.0	6	0.4	-0.5	95	6.4	0.0	939	63.5	0.5	66	4.5	1.0	343	23.2	Invalid	29	2.0	(*)	Sample Answers	-1.0	Open to traffic, Vehicle entry etc.	-0.5	No parking, Roundabout,Danger etc.	0.0	---Not commented---	0.5	No entry, End of road etc.	1.0	Closed to traffic etc.
	Size	%																																											
Valid	1455	98.0																																											
Responses Scale (*)																																													
-1.0	6	0.4																																											
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1.0	343	23.2																																											
Invalid	29	2.0																																											
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0.0	---Not commented---																																												
0.5	No entry, End of road etc.																																												
1.0	Closed to traffic etc.																																												
Other Statistics <table><thead><tr><th colspan="3">“Have you ever seen?” Response Rates ⁽¹⁾</th><th colspan="3">“What should be done?” Response Rates</th></tr><tr><th></th><th>Size</th><th>Percent</th><th></th><th>Size</th><th>Percent</th></tr></thead><tbody><tr><td>Valid</td><td>804</td><td>94.5</td><td rowspan="2">Valid</td><td rowspan="2">1450</td><td rowspan="2">98.1</td></tr><tr><td>Not Filled</td><td>168</td><td>19.7</td></tr><tr><td>Yes</td><td>360</td><td>42.4</td><td>Not Filled</td><td>1163</td><td>78.7</td></tr><tr><td>No</td><td>276</td><td>32.4</td><td>Filled</td><td>287</td><td>19.4</td></tr><tr><td>Invalid</td><td>47</td><td>5.5</td><td>Invalid</td><td>28</td><td>1.9</td></tr></tbody></table>							“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates				Size	Percent		Size	Percent	Valid	804	94.5	Valid	1450	98.1	Not Filled	168	19.7	Yes	360	42.4	Not Filled	1163	78.7	No	276	32.4	Filled	287	19.4	Invalid	47	5.5	Invalid	28	1.9
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates																																										
	Size	Percent		Size	Percent																																								
Valid	804	94.5	Valid	1450	98.1																																								
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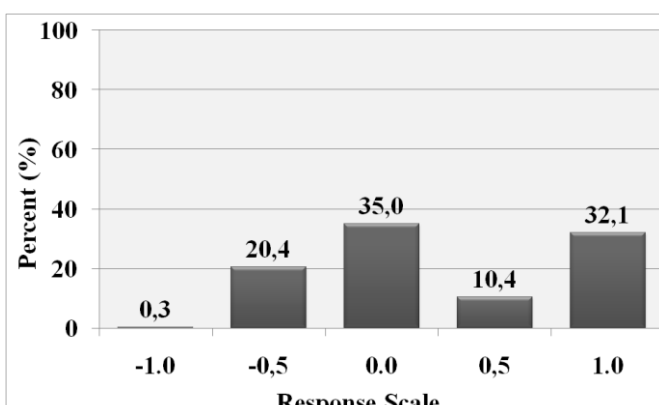
Table A.3 “Give Way” Traffic Sign Summary Report

Give Way (B,1)		Summary of Survey Study					
		A		B		A+B	
	Place	4		14			
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2	
	Valid	449	304	402	323	1478	
	Total	753		725			

Meaning: This sign shall be used to notify drivers that, at the intersection where the sign is placed, they must give way to vehicles on the road they are approaching.

Summary: Although opposite responses may be considered in negligible level, more than 1/5 of drivers gave wrong responses. 1/3 of drivers left without comment or comprehended correctly. Partially correct responses was given by 1/10 of drivers. The basic characteristic of sign is that responses are given in high level except opposites.

Comprehension Level



	Size	%
Valid	1451	98.2
Responses Scale (*)		
-1.0	5	0.3
-0.5	302	20.4
0.0	517	35.0
0.5	153	10.4
1.0	474	32.1
Invalid	27	1.8

(*)	Sample Answers
-1.0	Go, Priority for going etc.
-0.5	No parking, No entry, No way, Attention, Prohibition etc.
0.0	---Not commented---
0.5	Priority road, Vehicle zone, Crossroad etc.
1.0	Give way etc.

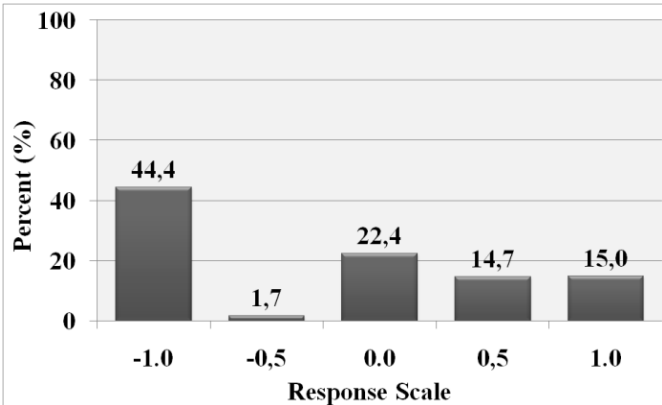
Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	803	94.4	Valid	1451	98.2
Not Filled	96	11.3			
Yes	621	73,0	Not Filled	959	64.9
No	86	10.1	Filled	492	33.3
Invalid	48	5.6	Invalid	27	1.8

Table A.4 “Priority for Oncoming Vehicles” Traffic Sign Summary Report

Priority for Oncoming Vehicles (B,5)	Summary of Survey Study					
		A		B		A+B
	Place	5		15		
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2
	Valid	449	304	402	323	1478
	Total	753		725		

Meaning: If, on a narrow section of road where passing is difficult or impossible, such regulation is carried out by giving priority to traffic moving in one direction and this sign shall be set up facing the traffic on the side which does not have priority.

Summary: 1/5 of drivers left without comment and wrong reponses are in a very low level. Partially or exact responses are both given by 1/6 of drivers. The most remarkable finding is that almost half of drivers gave opposite responses for the sign information and 2’nd traffic sign in this category.

Comprehension Level			
	Size	%	
	Valid	1451	98.2
	Responses Scale (*)		
	-1.0	656	44.4
	-0.5	25	1.7
	0.0	331	22.4
	0.5	217	14.7
	1.0	221	15.0
	Invalid	27	1.8

(*)	Sample Answers
-1.0	Two way traffic, Priority for going etc..
-0.5	Attention, Prohibition etc...
0.0	---Not commented---
0.5	Closed for going, One way trafficcetc...
1.0	Give way to oncoming traffic etc.

Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	802	94.2	Valid	1450	98.1
Not Filled	84	9.9			
Yes	644	75.7	Not Filled	889	60.1
No	74	8.6	Filled	561	38.0

Table A.5 “No Entry” Traffic Sign Summary Report

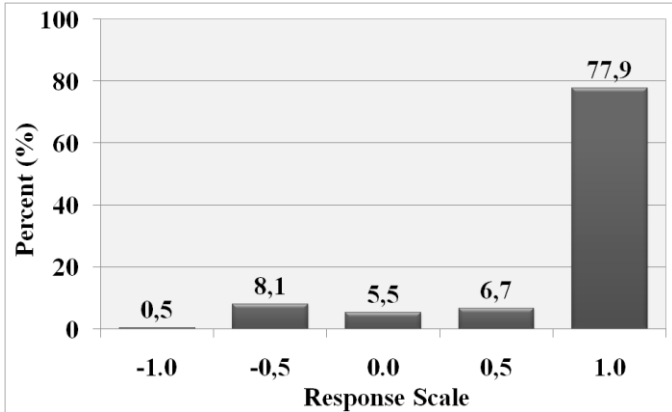
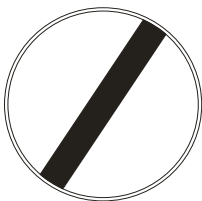
No Entry (C,1 ^a)		Summary of Survey Study																																	
				A		B		A+B																											
		Place		6		6		1+2																											
		Sample Size		1.Stage	2.Stage	1.Stage	2.Stage																												
		Valid		449	304	402	323	1478																											
		Total		753		725																													
Meaning: This sign is used to indicate to the driver of a vehicle that the entry of all vehicular traffic is prohibited and denote that the road is only for traffic coming in the opposite direction.																																			
Summary: Level of opposite responses is negligible, and almost 1 of every 15 drivers gave wrong, not commented or partially correct responses. One of the best known signs with 77,9 % correct response level.																																			
Comprehension Level  <table><tr><th></th><th>Size</th><th>%</th></tr><tr><td>Valid</td><td>1459</td><td>98.7</td></tr><tr><td colspan="3">Responses Scale (*)</td></tr><tr><td>-1.0</td><td>8</td><td>0.5</td></tr><tr><td>-0.5</td><td>120</td><td>8.1</td></tr><tr><td>0.0</td><td>81</td><td>5.5</td></tr><tr><td>0.5</td><td>99</td><td>6.7</td></tr><tr><td>1.0</td><td>1,151</td><td>77.9</td></tr><tr><td>Invalid</td><td>19</td><td>1.3</td></tr></table>										Size	%	Valid	1459	98.7	Responses Scale (*)			-1.0	8	0.5	-0.5	120	8.1	0.0	81	5.5	0.5	99	6.7	1.0	1,151	77.9	Invalid	19	1.3
	Size	%																																	
Valid	1459	98.7																																	
Responses Scale (*)																																			
-1.0	8	0.5																																	
-0.5	120	8.1																																	
0.0	81	5.5																																	
0.5	99	6.7																																	
1.0	1,151	77.9																																	
Invalid	19	1.3																																	
(*)	Sample Answers																																		
-1.0	Vehicle entry, Open to traffic etc..																																		
-0.5	Stop, Parking prohibited etc...																																		
0.0	---Not commented---																																		
0.5	Closed to traffic, One way traffic, No way etc...																																		
1.0	No entry etc.																																		
Other Statistics																																			
“Have you ever seen?” Response Rates ⁽¹⁾						“What should be done?” Response Rates																													
	Size	Percent		Size	Percent																														
Valid	811	95.3	Valid	1459	98.7																														
Not Filled	34	4.0																																	
Yes	763	89.7	Not Filled	644	43.6																														
No	14	1.6	Filled	815	55.1																														
Invalid	40	4.7	Invalid	19	1.3																														

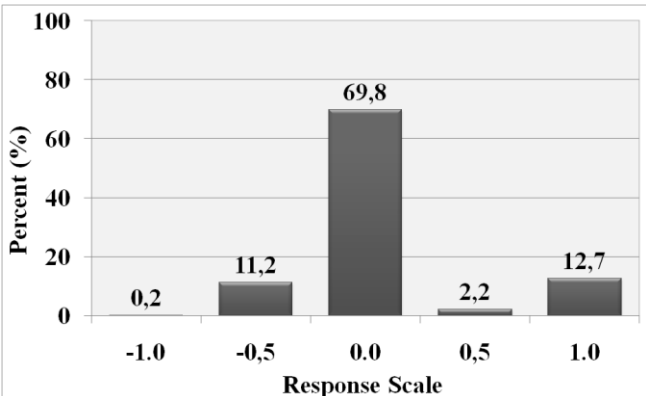
Table A.6 “End of All Prohibition or Restriction” Traffic Sign Summary Report

End of All Prohibition or Restriction (C,17 ^a)		Summary of Survey Study				
		A		B		A+B
	Place	8		20		1478
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	
	Valid	449	304	402	323	
	Total	753		725		

Meaning: The point at which all prohibitions notified by prohibitory signs for moving vehicles cease to apply, shall be indicated by sign C, 17a "End of All Prohibition or Restriction".

Summary: Opposite answers are negligible, partially correct answers are at low level. Almost 1/10 of drivers gave wrong or correct responses. 2nd not commented traffic sign with 69,8 % .

Comprehension Level



	Size	%
Valid	1420	96.1
Responses Scale (*)		
-1.0	3	0.2
-0.5	166	11.2
0.0	1,031	69.8
0.5	32	2.2
1.0	188	12.7
Invalid	58	3.9

(*)	Sample Answers
-1.0	Prohibition start etc.
-0.5	Do not stop, parking prohibited, End of road, No overtaking etc.
0.0	---Not commented---
0.5	End of parking prohibition, End of no vertaking zone etc.
1.0	End of all prohibition or restriction etc.

Other Statistics

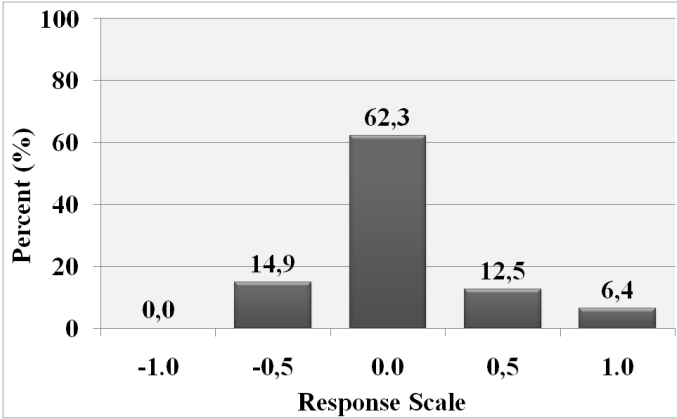
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	771	90.6	Valid	1420	96.1
Not Filled	172	20.2			
Yes	297	34.9	Not Filled	1262	85.4
No	302	35.5	Filled	158	10.7
Invalid	80	9.4	Invalid	58	3.9

Table A.7 “Distance to Level Crossing” Traffic Sign Summary Report

Distance to Level Crossing (A, 29 ^a)		Summary of Survey Study				
		A		B		A+B
	Place	10		22		
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2
	Valid	449	304	402	323	1478
	Total	753		725		

Meaning: Countdown markers may be used to emphasise the approach to a crossing.

Summary: Approximately 1 of every 10 driver comprehended wrong or partially correct. 6,4 % of drivers who gave correct responses. One of the most not commented sign with 6 of 10 ratio.

Comprehension Level			
		Size	%
	Valid	1420	96.1
	Responses Scale (*)		
	-1.0	0	0.0
	-0.5	220	14.9
	0.0	921	62.3
	0.5	185	12.5
	1.0	94	6.4
Invalid	58	3.9	

(*)	Sample Answers
-1.0	---Not Commented---
-0.5	Go ahead, Curve, Steep downhill etc...
0.0	---Not Commented---
0.5	Crossroad, Intersection, Turnout etc...
1.0	Distance to railroad crossing

Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	772	90.7	Valid	1421	96.1
Not Filled	188	22.1			
Yes	305	35.8	Not Filled	1155	78.1
No	279	32.8	Filled	266	18.0
Invalid	79	9.3	Invalid	57	3.9

Table A.8 “Risk of Ice or Snow” Traffic Sign Summary Report

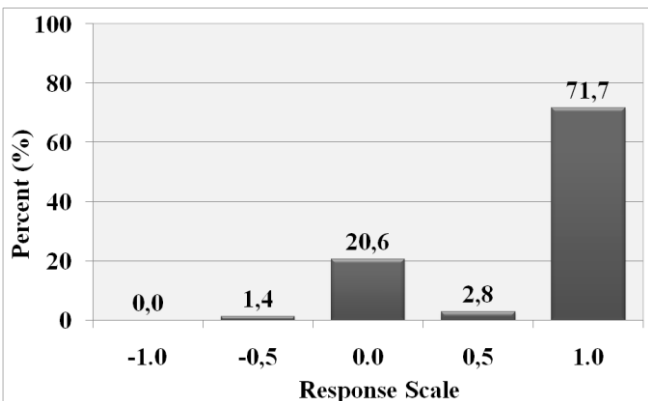
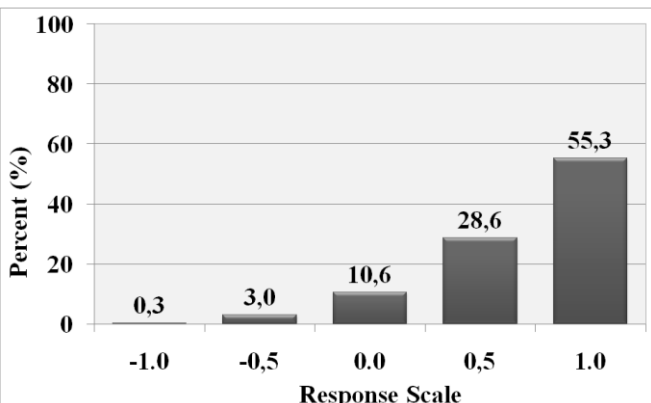
Risk of Ice or Snow (H,9)		Summary of Survey Study																																
		A		B		A+B																												
	Place	11		27																														
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2																												
	Valid	449	304	402	323	1478																												
	Total	753		725																														
Meaning: The “Risk of Ice or Snow” signs, are intended for use as temporary signs when a route is unusually dangerous as a result of extensive icing or heavy snowfalls. The signs must be removed when conditions return to normal.																																		
Summary: There is no driver who gave opposite response. Partially correct and wrong responses are in very low level. The basic characteristic of the sign is that 7 of every 10 drivers comprehended correctly and 1/5 of drivers did not make comment.																																		
Comprehension Level  <table><tr><th></th><th>Size</th><th>%</th></tr><tr><td>Valid</td><td>1426</td><td>96.5</td></tr><tr><td colspan="3">Responses Scale (*)</td></tr><tr><td>-1.0</td><td>0</td><td>0.0</td></tr><tr><td>-0.5</td><td>20</td><td>1.4</td></tr><tr><td>0.0</td><td>304</td><td>20.6</td></tr><tr><td>0.5</td><td>42</td><td>2.8</td></tr><tr><td>1.0</td><td>1,060</td><td>71.7</td></tr><tr><td>Invalid</td><td>52</td><td>3.5</td></tr></table>									Size	%	Valid	1426	96.5	Responses Scale (*)			-1.0	0	0.0	-0.5	20	1.4	0.0	304	20.6	0.5	42	2.8	1.0	1,060	71.7	Invalid	52	3.5
	Size	%																																
Valid	1426	96.5																																
Responses Scale (*)																																		
-1.0	0	0.0																																
-0.5	20	1.4																																
0.0	304	20.6																																
0.5	42	2.8																																
1.0	1,060	71.7																																
Invalid	52	3.5																																
(*)	Sample Answers																																	
-1.0	---No answer---																																	
-0.5	No entry when snowing, Forest, Tree, Cross wind etc.																																	
0.0	---Not commented---																																	
0.5	Snow chains compulsory, Rain etc.																																	
1.0	Risk of ice or snow etc.																																	
Other Statistics																																		
“Have you ever seen?” Response Rates ⁽¹⁾				“What should be done?” Response Rates																														
	Size	Percent		Size	Percent																													
Valid	773	90.8	Valid	1430	96.8																													
Not Filled	91	10.7																																
Yes	562	66.0	Not Filled	794	53.8																													
No	120	14.1	Filled	636	43.0																													
Invalid	78	9.2	Invalid	48	3.2																													

Table A.9 “Road Narrows from Left” Traffic Sign Summary Report

Road Narrows From Left (A,4 ^b)		Summary of Survey Study					
		A		B		A+B	
	Place	12		12			
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2	
	Valid	449	304	402	323	1478	
	Total	753		725			

Meaning: This sign should be used to depict roadworks on the left side of the carriageway on sections of two lane road where a sudden reduction in carriageway width creates a potential hazard.

Summary: The percentage of the drivers who gave opposite responses to the sign is negligible and also wrong response rate is low. Over half of the drivers gave correct, one fourth of drivers gave partially correct responses. 1 of every 10 drivers did not made comment about the meaning of the sign.

Comprehension Level			
	Size	%	
	Valid	1446	97.8
	Responses Scale (*)		
	-1.0	4	0.3
	-0.5	45	3.0
	0.0	157	10.6
	0.5	423	28.6
	1.0	817	55.3
	Invalid	32	2.2

(*)	Sample Answers
-1.0	Road narrows from right etc.
-0.5	Slippery road, Double curve first to the left, Curve, One way traffic etc.
0.0	---Not commented---
0.5	Road narrows etc.
1.0	Road narrows from left etc.

Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	792	93.1	Valid	1445	97.8
Not Filled	68	8,0			
Yes	713	83.8	Not Filled	738	49.9
No	11	1.3	Filled	707	47.9

Table A.10 “Obstruction Marker” Traffic Sign Summary Report

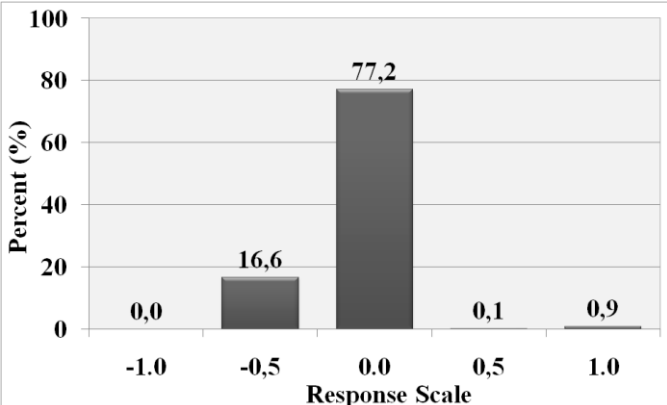
Obstruction Marker		Summary of Survey Study																															
		A		B		A+B																											
	Place	15		30																													
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2																											
	Valid	449	304	402	323	1478																											
	Total	753		725																													
Meaning: This sign is used to point out an obstruction on or above a road such as a road closure.																																	
Summary: There is no driver who gave opposite response to the information of the sign, also correct and partially correct responses given are in negligible level. 1 of every 6 driver gave wrong responses. The most remarkable finding about the sign is that it has the highest without comment level with 8 of every 10 drivers.																																	
Comprehension Level  <table><tr><td></td><td>Size</td><td>%</td></tr><tr><td>Valid</td><td>1401</td><td>94.8</td></tr><tr><td colspan="3">Responses Scale (*)</td></tr><tr><td>-1.0</td><td>0</td><td>0.0</td></tr><tr><td>-0.5</td><td>245</td><td>16.6</td></tr><tr><td>0.0</td><td>1,141</td><td>77.2</td></tr><tr><td>0.5</td><td>2</td><td>0.1</td></tr><tr><td>1.0</td><td>13</td><td>0.9</td></tr><tr><td>Invalid</td><td>77</td><td>5.2</td></tr></table>								Size	%	Valid	1401	94.8	Responses Scale (*)			-1.0	0	0.0	-0.5	245	16.6	0.0	1,141	77.2	0.5	2	0.1	1.0	13	0.9	Invalid	77	5.2
	Size	%																															
Valid	1401	94.8																															
Responses Scale (*)																																	
-1.0	0	0.0																															
-0.5	245	16.6																															
0.0	1,141	77.2																															
0.5	2	0.1																															
1.0	13	0.9																															
Invalid	77	5.2																															
(*)	Sample Answers																																
-1.0	---No response---																																
-0.5	Steep hill, Down hill, Curve, Crossroad etc...																																
0.0	---Not Commented---																																
0.5	Road work, Maintenance on road etc...																																
1.0	Obstruction markers etc...																																
Other Statistics																																	
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates																														
	Size	Percent		Size	Percent																												
Valid	753	88.5	Valid	1409	95.3																												
Not Filled	202	23.7																															
Yes	195	23,0	Not Filled	1271	86.0																												
No	356	41.8	Filled	138	9.3																												
Invalid	98	11.5	Invalid	69	4.7																												

Table A.11 “No Standing or Parking” Traffic Sign Summary Report

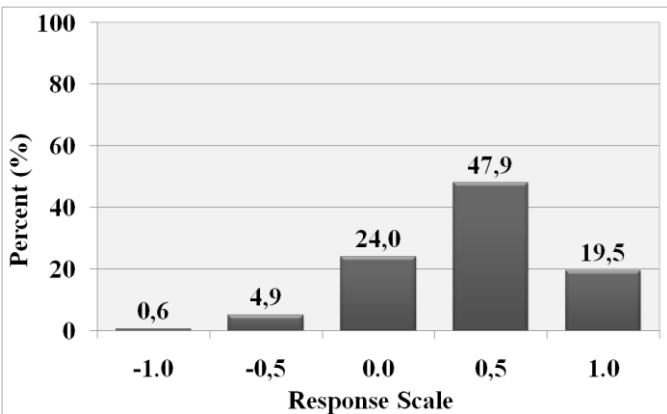
No Standing or Parking (C,19)		Summary of Survey Study																																
		A		B		A+B																												
	Place	16		16																														
		1.Stage	2.Stage	1.Stage	2.Stage	1+2																												
	Sample Size	449	304	402	323	1478																												
	Total	753		725																														
Meaning: This sign does not allow a private vehicle to stop for any purpose (except in an emergency or where exempted in the order), even to pick up and set down passengers.																																		
Summary: Level of opposite responses is negligible, also level of wrong responses is low. 1 of every 4 driver left without comment, 1 of every 5 driver gave correct response for information of the sign. The most remarkable finding is that it has the highest 4'th partially correct response level given by almost half of the drivers.																																		
Comprehension Level  <table><tr><td></td><td>Size</td><td>%</td></tr><tr><td>Valid</td><td>1432</td><td>96.9</td></tr><tr><td colspan="3">Responses Scale (*)</td></tr><tr><td>-1.0</td><td>9</td><td>0.6</td></tr><tr><td>-0.5</td><td>73</td><td>4.9</td></tr><tr><td>0.0</td><td>354</td><td>24.0</td></tr><tr><td>0.5</td><td>708</td><td>47.9</td></tr><tr><td>1.0</td><td>288</td><td>19.5</td></tr><tr><td>Invalid</td><td>46</td><td>3.1</td></tr></table>									Size	%	Valid	1432	96.9	Responses Scale (*)			-1.0	9	0.6	-0.5	73	4.9	0.0	354	24.0	0.5	708	47.9	1.0	288	19.5	Invalid	46	3.1
	Size	%																																
Valid	1432	96.9																																
Responses Scale (*)																																		
-1.0	9	0.6																																
-0.5	73	4.9																																
0.0	354	24.0																																
0.5	708	47.9																																
1.0	288	19.5																																
Invalid	46	3.1																																
(*)	Sample Answers																																	
-1.0	Standing or parking is allowed etc...																																	
-0.5	Prohibition, No entry, Crossroad etc...																																	
0.0	---Not commented---																																	
0.5	Parking prohibited, Standing prohibited etc...																																	
1.0	Standing or parking prohibition etc...																																	
Other Statistics																																		
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates																															
	Size	Percent		Size	Percent																													
Valid	776	91.2	Valid	1433	97.0																													
Not Filled	125	14.7																																
Yes	584	68.6	Not Filled	857	58.0																													
No	67	7.9	Filled	576	39.0																													
Invalid	75	8.8	Invalid	45	3.0																													

Table A.12 “Crossroad with a Non-Priority Road” Traffic Sign Summary Report

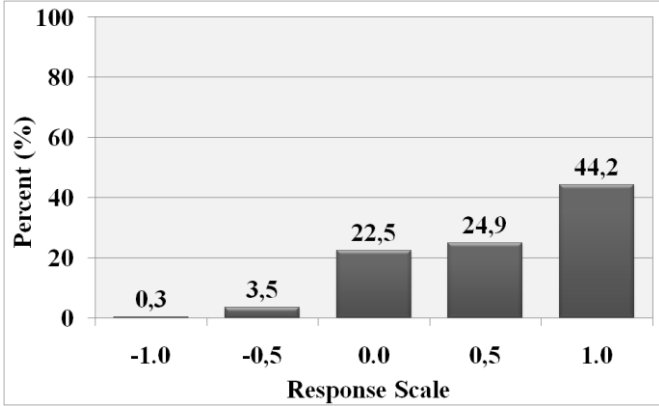
Crossroad with a Non-Priority Road (A,19 ^a)	Summary of Survey Study																																
		A		B		A+B																											
	Place	17		24																													
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2																											
	Valid	449	304	402	323	1478																											
	Total	753		725																													
Meaning: This sign indicates the presence of a junction. This is not a route of the same status. The priority route is indicated by the thicker route symbol.																																	
Summary: The rate of drivers who gave opposite response to the sign information is negligible, also wrong responses are in a low level. One fourth of drivers left without comment or gave partially correct responses. Almost half of drivers gave correct responses.																																	
Comprehension Level  <table><tr><td></td><td>Size</td><td>%</td></tr><tr><td>Valid</td><td>1411</td><td>95.5</td></tr><tr><td colspan="3">Responses Scale (*)</td></tr><tr><td>-1.0</td><td>5</td><td>0.4</td></tr><tr><td>-0.5</td><td>52</td><td>3.5</td></tr><tr><td>0.0</td><td>332</td><td>22.5</td></tr><tr><td>0.5</td><td>368</td><td>24.9</td></tr><tr><td>1.0</td><td>654</td><td>44.2</td></tr><tr><td>Invalid</td><td>67</td><td>4.5</td></tr></table>								Size	%	Valid	1411	95.5	Responses Scale (*)			-1.0	5	0.4	-0.5	52	3.5	0.0	332	22.5	0.5	368	24.9	1.0	654	44.2	Invalid	67	4.5
	Size	%																															
Valid	1411	95.5																															
Responses Scale (*)																																	
-1.0	5	0.4																															
-0.5	52	3.5																															
0.0	332	22.5																															
0.5	368	24.9																															
1.0	654	44.2																															
Invalid	67	4.5																															
(*)	Sample Answers																																
-1.0	Crossroad with a priority road etc...																																
-0.5	Railroad crossing, Low-flying aircraft, Traffic signal ahead etc...																																
0.0	---Not Commented---																																
0.5	Crossroad, Priority road, Non-priority road, sağa sola yol etc...																																
1.0	Crossroad with a non-priority road etc...																																
Other Statistics																																	
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates																														
	Size	Percent		Size	Percent																												
Valid	760	89.3	Valid	1414	95.7																												
Not Filled	87	10.2																															
Yes	598	70.3	Not Filled	851	57.6																												
No	75	8.8	Filled	563	38.1																												
Invalid	91	10.7	Invalid	64	4.3																												

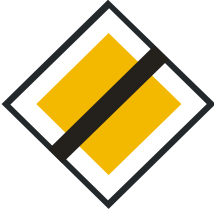
Table A.13 “Level Crossing with Barrier” Traffic Sign Summary Report

Level Crossing With Barrier (A,25)		Summary of Survey Study																															
		A		B		A+B																											
	Place	18		26																													
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2																											
	Valid	449	304	402	323	1478																											
	Total	753		725																													
Meaning: This sign is used on the approach to a railway level crossing which is equipped with gates or barriers.																																	
Summary: There is no driver who gave opposite responses to information of the sign, also wrong responses are in low level. 1 of every 6 driver did not make comment and 1 of every 8 driver gave correct responses to. The most remarkable finding is that it has the highest partially correct comprehension level with 7 of every 10 drivers.																																	
Comprehension Level																																	
					<table><tr><td></td><td>Size</td><td>%</td></tr><tr><td>Valid</td><td>1415</td><td>95.7</td></tr><tr><td colspan="3">Responses Scale (*)</td></tr><tr><td>-1.0</td><td>0</td><td>0.0</td></tr><tr><td>-0.5</td><td>25</td><td>1.7</td></tr><tr><td>0.0</td><td>246</td><td>16.6</td></tr><tr><td>0.5</td><td>964</td><td>65.2</td></tr><tr><td>1.0</td><td>180</td><td>12.2</td></tr><tr><td>Invalid</td><td>63</td><td>4.3</td></tr></table>			Size	%	Valid	1415	95.7	Responses Scale (*)			-1.0	0	0.0	-0.5	25	1.7	0.0	246	16.6	0.5	964	65.2	1.0	180	12.2	Invalid	63	4.3
	Size	%																															
Valid	1415	95.7																															
Responses Scale (*)																																	
-1.0	0	0.0																															
-0.5	25	1.7																															
0.0	246	16.6																															
0.5	964	65.2																															
1.0	180	12.2																															
Invalid	63	4.3																															
(*)	Sample Answers																																
-1.0	---No response---																																
-0.5	Fence, Garden, Wire fencing etc.																																
0.0	---Not Commented---																																
0.5	Railroad crossing, Level crossing, Barrier etc.																																
1.0	Level crossing with barrier etc.																																
Other Statistics																																	
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates																														
	Size	Percent		Size	Percent																												
Valid	762	89.5	Valid	1419	96.0																												
Not Filled	76	8.9																															
Yes	630	74.0	Not Filled	786	53.2																												
No	56	6.6	Filled	633	42.8																												
Invalid	89	10.5	Invalid	59	4.0																												

Table A.14 “Double Curve First to the Right” Traffic Sign Summary Report

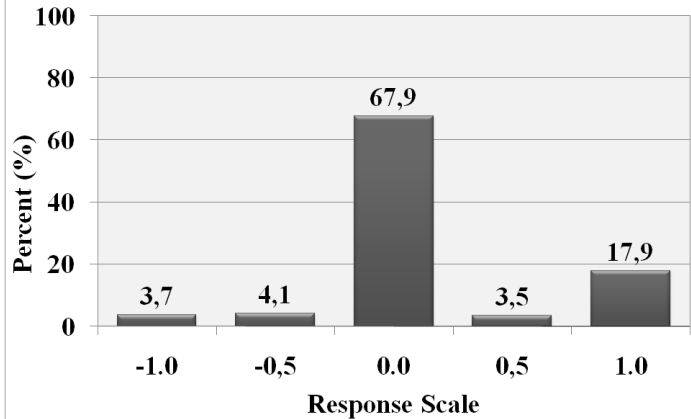
Double Curve First to the Right (A,1 ^d)	Summary of Survey Study																																												
		A		B		A+B																																							
	Place	18		19																																									
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2																																							
	Valid	449	304	402	323	1478																																							
	Total	753		725																																									
Meaning: This sign should be used to give advance warning of bends of similar severity follow in close proximity which a driver might find difficult to negotiate without slowing down and the severity of which cannot easily be seen either by day or by night.																																													
Summary: Opposite and wrong responses are given in a very low level also 1 of every 17 driver did not made comment about information of the sign. 1/3 of drivers gave correct and more than half of drivers gave partially correct responses. It is the 3 rd sign in partially correct response level.																																													
Comprehension Level <table><tr><th></th><th>Size</th><th>%</th></tr><tr><td>Valid</td><td>1411</td><td>97.2</td></tr><tr><td colspan="3">Responses Scale (*)</td></tr><tr><td>-1.0</td><td>28</td><td>1.9</td></tr><tr><td>-0.5</td><td>34</td><td>2.3</td></tr><tr><td>0.0</td><td>93</td><td>6.3</td></tr><tr><td>0.5</td><td>818</td><td>55.3</td></tr><tr><td>1.0</td><td>464</td><td>31.4</td></tr><tr><td>Invalid</td><td>41</td><td>2.8</td></tr></table> <table><tr><td>(*)</td><td>Sample Answers</td></tr><tr><td>-1.0</td><td>Double curve first to the left etc.</td></tr><tr><td>-0.5</td><td>Slippery road, Uneven road, Down hill etc.</td></tr><tr><td>0.0</td><td>---Not Commented---</td></tr><tr><td>0.5</td><td>Curve, Sharp deviation, Bend to right, Multiple curves etc.</td></tr><tr><td>1.0</td><td>Sharp curves first to the right etc.</td></tr></table>								Size	%	Valid	1411	97.2	Responses Scale (*)			-1.0	28	1.9	-0.5	34	2.3	0.0	93	6.3	0.5	818	55.3	1.0	464	31.4	Invalid	41	2.8	(*)	Sample Answers	-1.0	Double curve first to the left etc.	-0.5	Slippery road, Uneven road, Down hill etc.	0.0	---Not Commented---	0.5	Curve, Sharp deviation, Bend to right, Multiple curves etc.	1.0	Sharp curves first to the right etc.
	Size	%																																											
Valid	1411	97.2																																											
Responses Scale (*)																																													
-1.0	28	1.9																																											
-0.5	34	2.3																																											
0.0	93	6.3																																											
0.5	818	55.3																																											
1.0	464	31.4																																											
Invalid	41	2.8																																											
(*)	Sample Answers																																												
-1.0	Double curve first to the left etc.																																												
-0.5	Slippery road, Uneven road, Down hill etc.																																												
0.0	---Not Commented---																																												
0.5	Curve, Sharp deviation, Bend to right, Multiple curves etc.																																												
1.0	Sharp curves first to the right etc.																																												
Other Statistics																																													
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates																																										
	Size	Percent		Size	Percent																																								
Valid	778	91.4	Valid	1437	97.2																																								
Not Filled	52	6.1																																											
Yes	711	83.6	Not Filled	690	46.7																																								
No	15	1.7	Filled	747	50.5																																								

Table A.15 “End of Priority Road” Traffic Sign Summary Report

End of Priority Road (B,4)	Summary of Survey Study					
		A		B		A+B
	Place	22		2		
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2
	Valid	449	304	402	323	1478
	Total	753		725		

Meaning: This sign shall be placed at the approach to the point where the road ceases to have priority over other roads.

Summary: Levels of opposite, wrong and partially correct responses are low. 1 of every 5 drivers gave correct responses. It is the 4'th sign left without comment by 7 of every 10 drivers.

Comprehension Level			
	Size	%	
	Valid	1434	97.1
	Responses Scale (*)		
	-1.0	54	3.7
	-0.5	61	4.1
	0.0	1.003	67.9
	0.5	51	3.5
	1.0	265	17.9
	Invalid	44	2.9

(*)	Sample Answers
-1.0	Priority road starting etc...
-0.5	Priority road, No entry, No parking etc...
0.0	---Not Commented---
0.5	End of motorway, End of road etc...
1.0	End of priority road etc...

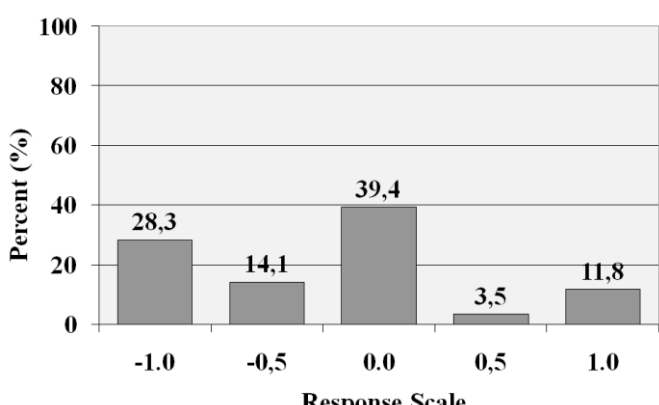
Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	782	91.89	Valid	1435	97.1
Not Filled	131	15.39			
Yes	284	33.37	Not Filled	1229	83.2
No	367	43.13	Filled	206	14.0
Invalid	69	8.11	Invalid	43	2.9

Table A.16 “End of No-Overtaking Zone for Trucks” Traffic Sign Summary Report

End of No-Overtaking Zone for Trucks (C,17 ^d)	Summary of Survey Study					
		A		B		A+B
	Place	23		3		
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2
	Valid	449	304	402	323	1478
	Total	753		725		

Meaning: This traffic sign indicates end of No-Overtaking Zone for trucks that previously prohibited.

Summary: Partially correct responses are few and 4 of every 10 drivers did not made comment. Wrong or correct response rates are a bit higher than 1/10. One of the most oppositely known sign with 1/3 of drivers.

Comprehension Level			
		Size	%
	Valid	1434	97.1
	Responses Scale (*)		
	-1.0	418	28.3
	-0.5	209	14.1
	0.0	582	39.4
	0.5	51	3.5
	1.0	174	11.8
	Invalid	44	2.9

(*)	Sample Answers
-1.0	No-overtaking for Trucks, No-overtaking etc.
-0.5	No entry for vehicles, Overtaking trucks is allowed, Divided road etc.
0.0	---Not Commented---
0.5	End of no-overtaking, End of prohibition etc.
1.0	End of no-overtaking zone for trucks etc.

Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	781	91.8	Valid	1436	97.2
Not Filled	96	11.3			
Yes	531	62.4	Not Filled	1039	70.3
No	154	18.1	Filled	397	26.9
Invalid	70	8.2	Invalid	42	2,8

Table A.17 “Minimum Speed Limit” Traffic Sign Summary Report

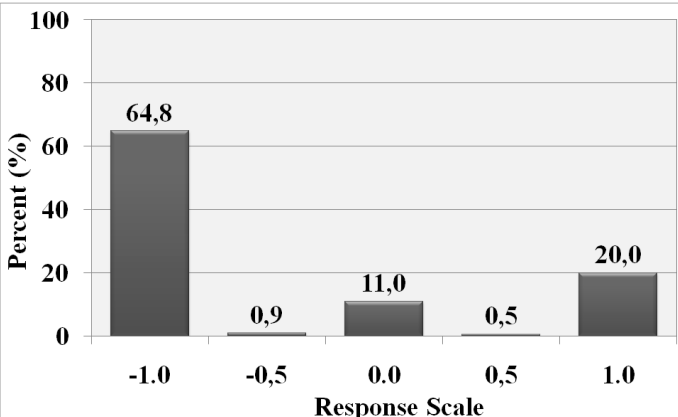
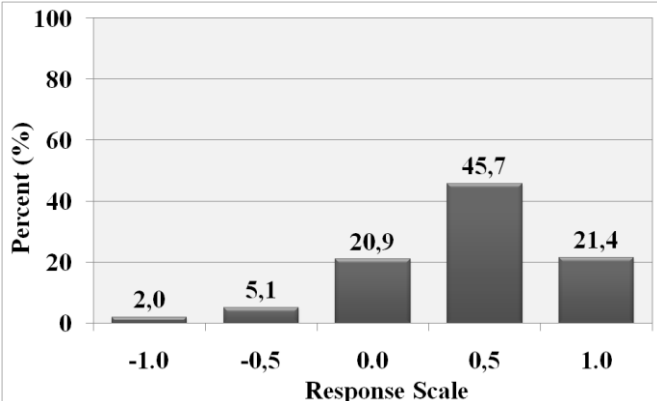
Minimum Speed Limit (C,7)	Summary of Survey Study																																												
		A		B		A+B																																							
	Place	24		4																																									
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2																																							
	Valid	449	304	402	323	1478																																							
	Total	753		725																																									
Meaning: This sign orders to drive faster than determined minimum speed limit indicated as 30 km/hr on motorways.																																													
Summary: It is the highest oppositely responded traffic sign by 64,8 % of all drivers. Level of opposite and partially correct responses are negligible. 1/5 of drivers gave correct responses and 1/10 of drivers did not make comment.																																													
Comprehension Level <table><tr><th></th><th>Size</th><th>%</th></tr><tr><td>Valid</td><td>1437</td><td>97.2</td></tr><tr><td colspan="3">Responses Scale (*)</td></tr><tr><td>-1.0</td><td>958</td><td>64.8</td></tr><tr><td>-0.5</td><td>14</td><td>0.9</td></tr><tr><td>0.0</td><td>162</td><td>11.0</td></tr><tr><td>0.5</td><td>8</td><td>0.5</td></tr><tr><td>1.0</td><td>295</td><td>20.0</td></tr><tr><td>Invalid</td><td>41</td><td>2.8</td></tr></table> (*) Sample Answers -1.0 Maximum allowable speed, No driving faster than 30 km/hr etc... -0.5 30 m ahead, Name of motorway etc... 0.0 ---Not Commented--- 0.5 End of speed limit etc... 1.0 Minimum speed limit etc...								Size	%	Valid	1437	97.2	Responses Scale (*)			-1.0	958	64.8	-0.5	14	0.9	0.0	162	11.0	0.5	8	0.5	1.0	295	20.0	Invalid	41	2.8												
	Size	%																																											
Valid	1437	97.2																																											
Responses Scale (*)																																													
-1.0	958	64.8																																											
-0.5	14	0.9																																											
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0.5	8	0.5																																											
1.0	295	20.0																																											
Invalid	41	2.8																																											
Other Statistics <table><tr><th colspan="3">“Have you ever seen?” Response Rates ⁽¹⁾</th><th colspan="3">“What should be done?” Response Rates</th></tr><tr><th></th><th>Size</th><th>Percent</th><th></th><th>Size</th><th>Percent</th></tr><tr><td>Valid</td><td>782</td><td>91.89</td><td rowspan="2">Valid</td><td rowspan="2">1438</td><td rowspan="2">97.3</td></tr><tr><td>Not Filled</td><td>66</td><td>7.76</td></tr><tr><td>Yes</td><td>649</td><td>76.26</td><td>Not Filled</td><td>687</td><td>46.5</td></tr><tr><td>No</td><td>67</td><td>7.87</td><td>Filled</td><td>751</td><td>50.8</td></tr><tr><td>Invalid</td><td>69</td><td>8.11</td><td>Invalid</td><td>40</td><td>2.7</td></tr></table>							“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates				Size	Percent		Size	Percent	Valid	782	91.89	Valid	1438	97.3	Not Filled	66	7.76	Yes	649	76.26	Not Filled	687	46.5	No	67	7.87	Filled	751	50.8	Invalid	69	8.11	Invalid	40	2.7
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates																																										
	Size	Percent		Size	Percent																																								
Valid	782	91.89	Valid	1438	97.3																																								
Not Filled	66	7.76																																											
Yes	649	76.26	Not Filled	687	46.5																																								
No	67	7.87	Filled	751	50.8																																								
Invalid	69	8.11	Invalid	40	2.7																																								

Table A.18 “Dangerous Bend of Route to the Left” Traffic Sign Summary Report

Dangerous Bend of Route to the Left		Summary of Survey Study					
		A		B		A+B	
	Place	25		19			
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2	
	Valid	449	304	402	323	1478	
	Total	753		725			

Meaning: The sign should be used on roundabouts to face traffic on each approach and elsewhere to denote sharp changes in the direction of a road where a “bend” sign alone would not be a sufficient warning.

Summary: Opposite or wrong response rates are very low, 1/5 of drivers gave correct responses or left without comment. Almost half of the drivers gave partially correct responses.

Comprehension Level			
	Size	%	
	Valid	1404	95.1
	Responses Scale (*)		
	-1.0	29	2.0
	-0.5	75	5.1
	0.0	309	20.9
	0.5	675	45.7
	1.0	316	21.4
	Invalid	74	4.9

(*)	Sample Answers
-1.0	Sharp deviation to the right etc...
-0.5	Mandatory direction, Down hill etc...
0.0	---Not Commented---
0.5	Sharp deviation, Double Curve, Route to the left etc...
1.0	Sharp deviation of route to the left etc...

Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	760	89.3	Valid	1404	95.0
Not Filled	83	9.8			
Yes	594	69.8	Not Filled	827	56.0
No	83	9.7	Filled	577	39.0
Invalid	91	10.7	Invalid	74	5.0

Table A.19 “Two Way Traffic” Traffic Sign Summary Report

Two Way Traffic (A,23)		Summary of Survey Study				
		A		B		A+B
	Place	26		25		
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	1+2
	Valid	449	304	402	323	1478
	Total	753		725		

Meaning: This sign should be used where a oneway street or part of a dual carriageway is converted to a two-way operation for the purpose of carrying out roadworks.

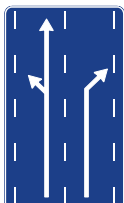
Summary: Opposite, wrong or partially correct responses levels are negligible. 1/5 of drivers left without comment of the traffic sign’s information. 7 of every 10 drivers gave correct responses to the meaning of the sign. Basic characteristic of the sign is that drivers gave correct responses or left without comment.

Comprehension Level			
	Size	%	
	Valid	1410	95.5
	Responses Scale (*)		
	-1.0	7	0.5
	-0.5	9	0.6
	0.0	289	19.6
	0.5	9	0.6
	1.0	1.096	74.2
	Invalid	68	4.5

(*)	Sample Answers
-1.0	One way traffic etc...
-0.5	Steep downhill, Down hill etc...
0.0	---Not Commented---
0.5	Two lanes etc...
1.0	Two way traffic etc...

Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	759	89.2	Valid	1413	95.6
Not Filled	71	8.4			
Yes	646	75.9	Not Filled	916	62.0
No	42	4.9	Filled	497	33.6
Invalid	92	10.8	Invalid	65	4.4

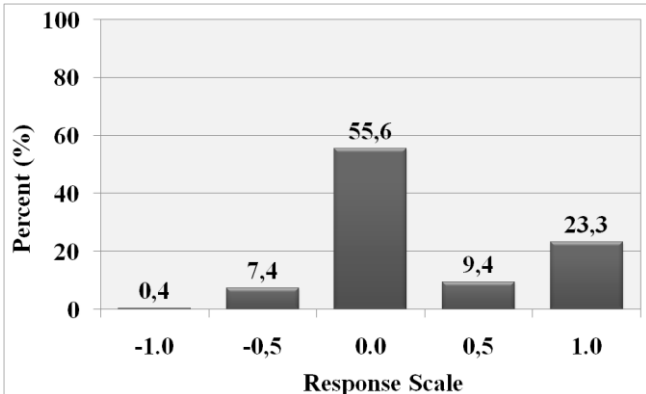
Table A.20 “Appropriate Traffic Lanes at Junction Ahead” Traffic Sign Summary Report

Appropriate Traffic Lanes at Junction Ahead (E,4)	Summary of Survey Study					
		A		B		A+B
	Place	28		10		1478
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage	
	Valid	449	304	402	323	
	Total	753		725		

Meaning: This sign is used to make appropriate lane selection within multiple lane roads at intersection approaches.

Summary: Opposite responses are negligible. 1 of every 10 driver gave wrong or partially correct responses. 1/4 of drivers gave correct responses and more than half of the participants did not made comment about the meaning of the sign.

Comprehension Level



Response Scale	Percent (%)
-1.0	0,4
-0,5	7,4
0.0	55,6
0,5	9,4
1.0	23,3

	Size	%
Valid	1420	96.1
Responses Scale (*)		
-1.0	6	0.4
-0.5	109	7.4
0.0	822	55.6
0.5	139	9.4
1.0	344	23.3
Invalid	58	3.9

(*)	Sample Answers
-1.0	Do not replace lane, Keep existing lane et etc...
-0.5	Multiple lanes, Overtaking is allowed etc...
0.0	---Not Commented---
0.5	Appropriate lanes, Turnout etc...
1.0	Appropriate lanes at intersection ahead etc...

Other Statistics

“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	770	90.5	Valid	1420	96.1
Not Filled	125	14.6			
Yes	391	46,0	Not Filled	1159	78.4
No	254	29.9	Filled	261	17.7
Invalid	81	9.5	Invalid	58	3.9

Table A.21 “Mandatory Direction for Vehicles Carrying Dangerous Goods” Traffic Sign Summary Report

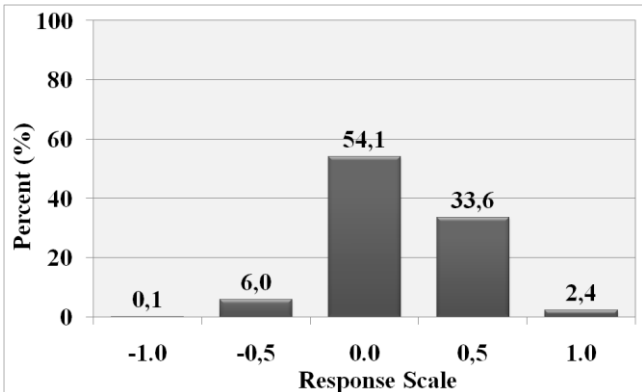
Mandatory Direction for Vehicles Carrying Dangerous Goods (D,10 ^c)		Summary of Survey Study																															
		A		B		A+B																											
	Place	29		11		1478																											
	Sample Size	1.Stage	2.Stage	1.Stage	2.Stage																												
	Valid	449	304	402	323																												
	Total	753		725																													
Meaning: This sign indicates that vehicles carrying dangerous goods must follow the route as indicated.																																	
Summary: Level of opposite responses is negligible and level of correct responses is very low. More than half of drivers did not make comment but 1/3 of drivers gave partially correct responses. Wrong responses are in almost 1/16 level.																																	
Comprehension Level  <table><tr><td></td><td>Size</td><td>%</td></tr><tr><td>Valid</td><td>1422</td><td>96.2</td></tr><tr><td colspan="3">Responses Scale (*)</td></tr><tr><td>-1.0</td><td>2</td><td>0.1</td></tr><tr><td>-0.5</td><td>89</td><td>6.0</td></tr><tr><td>0.0</td><td>800</td><td>54.1</td></tr><tr><td>0.5</td><td>496</td><td>33.6</td></tr><tr><td>1.0</td><td>35</td><td>2.4</td></tr><tr><td>Invalid</td><td>56</td><td>3.8</td></tr></table>								Size	%	Valid	1422	96.2	Responses Scale (*)			-1.0	2	0.1	-0.5	89	6.0	0.0	800	54.1	0.5	496	33.6	1.0	35	2.4	Invalid	56	3.8
	Size	%																															
Valid	1422	96.2																															
Responses Scale (*)																																	
-1.0	2	0.1																															
-0.5	89	6.0																															
0.0	800	54.1																															
0.5	496	33.6																															
1.0	35	2.4																															
Invalid	56	3.8																															
(*)	Sample Answers																																
-1.0	No entry for vehicles carrying dangerous goods to the right etc...																																
-0.5	Scale on right, Parking on right, Traffic control on right etc...																																
0.0	---Not Commented---																																
0.5	Mandatory direction, Trucks should go to right etc...																																
1.0	Mandatory direction for vehicles carrying dangerous goods etc...																																
Other Statistics																																	
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates																														
	Size	Percent		Size	Percent																												
Valid	771	90.6	Valid	1423	96.3																												
Not Filled	162	19.0																															
Yes	282	33.1	Not Filled	1140	77.1																												
No	327	38.3	Filled	283	19.2																												
Invalid	80	9.4	Invalid	55	3,7																												

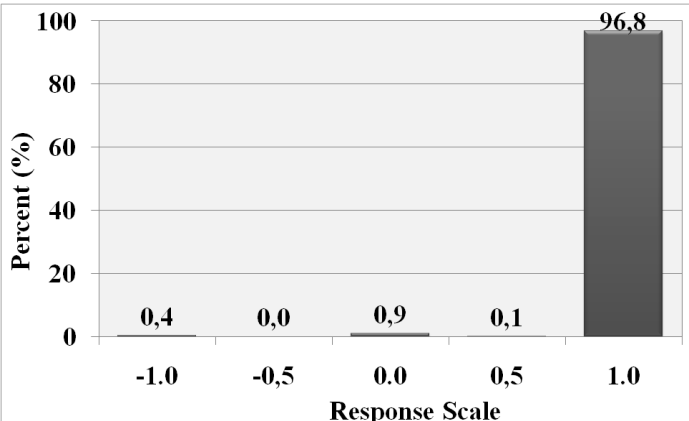
Table A.22 “Maximum Speed Limit” Traffic Sign Summary Report

Maximum Speed Limit (C,14)	Summary of Survey Study				
		A		B	A+B
	Place	2		-	
	Sample Size	1.Stage	2.Stage	-	1+2
	Valid	449	304	-	753
	Total	753		-	

Meaning: This sign is used to inform drivers about beginning of maximum speed limits and incidate 50 km/hr speed limit.

Summary: Opposite, wrong, without comment and partially correct comprehensions are negligible. It is the 2’nd best known traffic sign with 96,8 % correct response level.

Comprehension Level



	Size	%
Valid	740	98.2
Responses Scale (*)		
-1.0	3	0.4
-0.5	0	0.0
0.0	7	0.9
0.5	1	0.1
1.0	729	96.8
Invalid	13	1.8

(*)	Sample Answers
-1.0	Minimum speed limit, No driving faster than 50 km/hr speed etc...
-0.5	---No response---
0.0	---Not Commented---
0.5	50 km/hr speed etc...
1.0	Maximum allowable speed etc...

Other Statistics

“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	431	96.0	Valid	741	98.4
Not Filled	18	4.0			
Yes	411	91.5	Not Filled	310	41.2
No	2	0.5	Filled	431	57.2
Invalid	18	4.0	Invalid	12	1.6

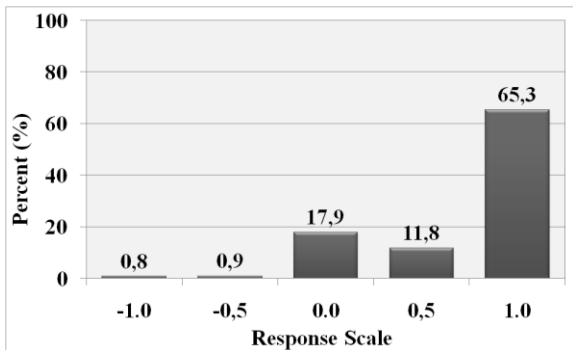
Table A.23 “No Through Road in the Direction Indicated From Junction Ahead”
Traffic Sign Summary Report

No Through Road in the Direction Indicated From Junction Ahead (G,2 ^a)		Summary of Survey Study			
		A		B	A+B
	Place	7		-	753
	Sample Size	1.Stage	2.Stage	-	
	Valid	449	304	-	
	Total	753		-	

Meaning: This sign is used to direct drivers for route to be followed in order to turn no through road from junction ahead.

Summary: Level of opposite and wrong responses are negligible. 1 of every 10 drivers gave partially correct responses and 1 of every 5 drivers did not make comment. 7 of every 10 drivers gave correct responses.

Comprehension Level



	Size	%
Valid	729	96.7
Responses Scale (*)		
-1.0	6	0.8
-0.5	7	0.9
0.0	135	17.9
0.5	89	11.8
1.0	492	65.3
Invalid	24	3.3

(*)	Sample Answers
-1.0	Right way is open, Following road is closed etc...
-0.5	Chose appropriate lane, Turnout etc...
0.0	---Not Commented---
0.5	Dead end, No way etc...
1.0	No through road to right from junction ahead etc...

Other Statistics

“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	415	92.4	Valid	729	96.8
Not Filled	30	6.7			
Yes	336	74.8	Not Filled	437	58.0
No	49	10.9	Filled	292	38.8

Table A.24 “End of Motorway” Traffic Sign Summary Report

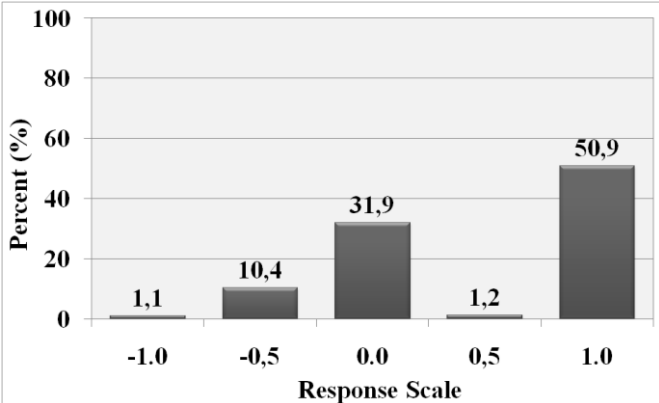
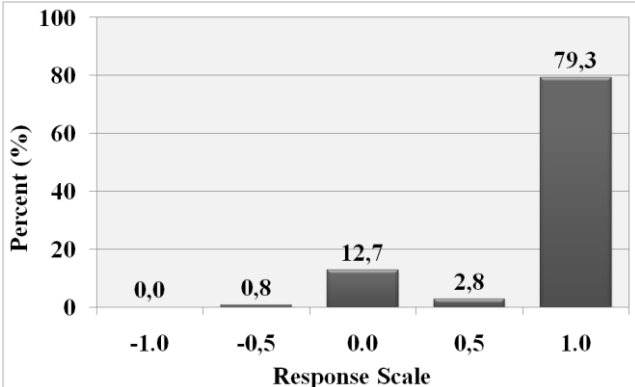
End of Motorway (E,5 ^b)	Summary of Survey Study																															
		A		B	A+B																											
	Place	20		-																												
	Sample Size	1.Stage	2.Stage	-	1+2																											
	Valid	449	304	-	753																											
	Total	753		-																												
Meaning: This sign is used to warn that the Motorway ends ahead and indicates that Motorway traffic regulations end.																																
Summary: Opposite or partially correct response rates are negligible. Half of the participants gave correct, 1 of every 10 driver gave wrong responses and 1 of every 3 driver did not made comment.																																
Comprehension Level  <table><tr><td></td><td>Size</td><td>%</td></tr><tr><td>Valid</td><td>718</td><td>95.5</td></tr><tr><td colspan="3">Responses Scale (*)</td></tr><tr><td>-1.0</td><td>8</td><td>1.1</td></tr><tr><td>-0.5</td><td>78</td><td>10.4</td></tr><tr><td>0.0</td><td>240</td><td>31.9</td></tr><tr><td>0.5</td><td>9</td><td>1.2</td></tr><tr><td>1.0</td><td>383</td><td>50.9</td></tr><tr><td>Invalid</td><td>35</td><td>4.5</td></tr></table>							Size	%	Valid	718	95.5	Responses Scale (*)			-1.0	8	1.1	-0.5	78	10.4	0.0	240	31.9	0.5	9	1.2	1.0	383	50.9	Invalid	35	4.5
	Size	%																														
Valid	718	95.5																														
Responses Scale (*)																																
-1.0	8	1.1																														
-0.5	78	10.4																														
0.0	240	31.9																														
0.5	9	1.2																														
1.0	383	50.9																														
Invalid	35	4.5																														
(*)	Sample Answers																															
-1.0	Motorway starts etc...																															
-0.5	No entry to motorway, End of two way traffic, Bridge etc...																															
0.0	---Not commented---																															
0.5	Dead end, End of priority road etc...																															
1.0	End of motorway etc...																															
Other Statistics																																
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates																													
	Size	Percent		Size	Percent																											
Valid	400	89.1	Valid	719	95.5																											
Not Filled	46	10.2																														
Yes	304	67.7	Not Filled	519	68.9																											
No	50	11.2	Filled	200	26.6																											
Invalid	49	10.9	Invalid	34	4.5																											

Table A.25 “Snow Chains Compulsory” Traffic Sign Summary Report

Snow Chains Compulsory (D,9)		Summary of Survey Study			
		A		B	A+B
	Place	21		-	
	Sample Size	1.Stage	2.Stage	-	1+2
	Valid	449	304	-	753
	Total	753		-	

Meaning: The sign is used to direct drivers installation of tire chains to both wheels as dictated by road conditions.

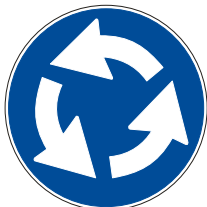
Summary: There is no driver who gave opposite response, also level of wrong responses is negligible and level of partially correct response is very low. 1 of every 7 driver did not make comment about the information of the sign. One of the best known sign with 79,3 % percent.

Comprehension Level			
	Size	%	
	Valid	720	95.6
	Responses Scale (*)		
	-1.0	0	0.0
	-0.5	6	0.8
	0.0	96	12.7
	0.5	21	2.8
	1.0	597	79.3
Invalid	33	4.4	

(*)	Sample Answers
-1.0	---No answer---
-0.5	Tire must be changed, Tire seller, Tire trouble etc...
0.0	---Not commented---
0.5	Risk of ice, Snowy road, Snowing, Slippery road etc...
1.0	Snow chains compulsory etc...

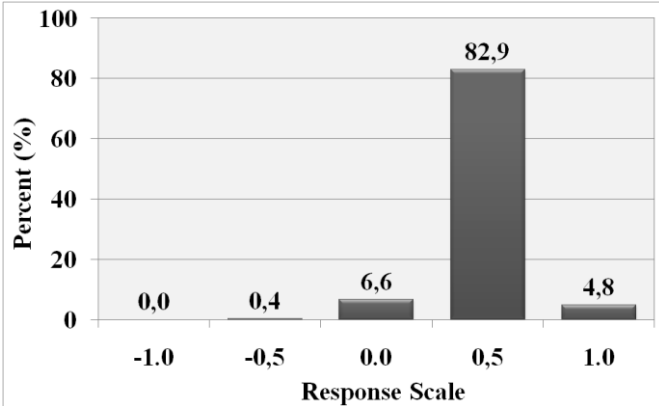
Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	402	89.5	Valid	721	95.8
Not Filled	35	7.8			
Yes	326	72.6	Not Filled	412	54.8
No	41	9.1	Filled	309	41.0
Invalid	47	10.5	Invalid	32	4.2

Table A.26 “Compulsory Roundabout” Traffic Sign Summary Report

Compulsory Roundabout (D,3)	Summary of Survey Study				
		A		B	A+B
	Place	30		-	
	Sample Size	1.Stage	2.Stage	-	1+2
	Valid	449	304	-	753
	Total	753		-	

Meaning: This sign is used at mini-roundabouts and requires that vehicles entering a junction must give priority to vehicles at the road junction

Summary: It is the highest partially correct responded traffic sign by 82,9 % of drivers. There is no driver who gave opposite response, also level of wrong responses are negligible. 1 of every 20 driver gave correct responses and 1 of every 15 driver did not make comment.

Comprehension Level			
	Size	%	
	Valid	713	94.7
	Responses Scale (*)		
	-1.0	0	0.0
	-0.5	3	0.4
	0.0	50	6.6
	0.5	624	82.9
1.0	36	4.8	
Invalid	40	5.3	

(*)	Sample Answers
-1.0	---No response---
-0.5	Curve to the left, Dangerous bend etc...
0.0	---Not Commented---
0.5	U turn is allowed, Crossroad, Intersection, Mandatory direction etc...
1.0	Traffic circle, roundabout etc...

Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	399	88.9	Valid	715	95.0
Not Filled	37	8.3			
Yes	352	78.4	Not Filled	408	54.2
No	10	2.2	Filled	307	40.8
Invalid	50	11.1	Invalid	38	5.0

Table A.27 “Uneven Road” Traffic Sign Summary Report

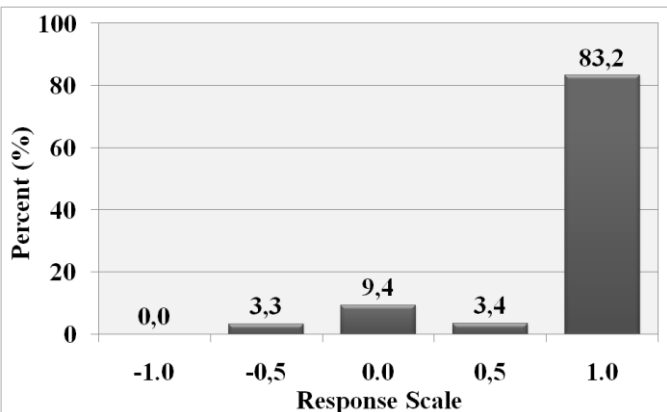
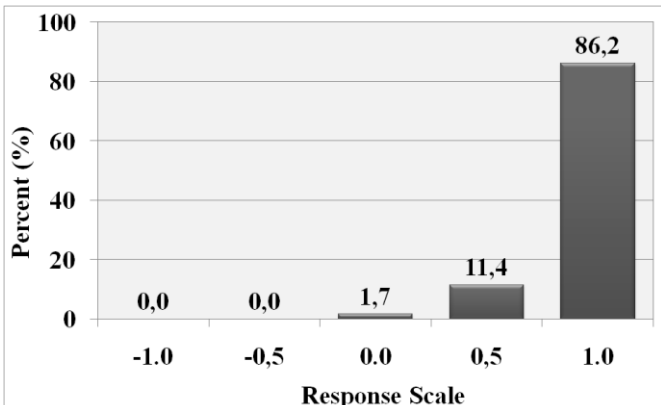
Uneven Road (A,7 ^a)	Summary of Survey Study																															
		A	B		A+B																											
	Place	-	1																													
	Sample Size		1.Stage	2.Stage	1+2																											
	Valid	-	402	323	725																											
	Total	-	725																													
Meaning: This sign is used to warn of danger arising from longitudinal or transverse irregularities in the road surface which at the normal speed of traffic might seriously impair control of a vehicle.																																
Summary: There is no driver who gave opposite response. 1 of every 30 driver similarly gave wrong or partially correct responses. 1/10 of drivers did not made comment. One of the best known sign by 83,2 % of drivers..																																
Comprehension Level  <table><tr><td></td><td>Size</td><td>%</td></tr><tr><td>Valid</td><td>720</td><td>99.3</td></tr><tr><td colspan="3">Responses Scale (*)</td></tr><tr><td>-1.0</td><td>0</td><td>0.0</td></tr><tr><td>-0.5</td><td>24</td><td>3.3</td></tr><tr><td>0.0</td><td>68</td><td>9.4</td></tr><tr><td>0.5</td><td>25</td><td>3.4</td></tr><tr><td>1.0</td><td>603</td><td>83.2</td></tr><tr><td>Invalid</td><td>5</td><td>0.7</td></tr></table>							Size	%	Valid	720	99.3	Responses Scale (*)			-1.0	0	0.0	-0.5	24	3.3	0.0	68	9.4	0.5	25	3.4	1.0	603	83.2	Invalid	5	0.7
	Size	%																														
Valid	720	99.3																														
Responses Scale (*)																																
-1.0	0	0.0																														
-0.5	24	3.3																														
0.0	68	9.4																														
0.5	25	3.4																														
1.0	603	83.2																														
Invalid	5	0.7																														
(*)	Sample Answers																															
-1.0	---No response---																															
-0.5	Tunnel, Curve etc...																															
0.0	---Not Commented---																															
0.5	Barrier, Hump, Defective road etc...																															
1.0	Uneven road etc...																															
Other Statistics																																
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates																													
	Size	Percent		Size	Percent																											
Valid	384	95.5	Valid	720	99.3																											
Not Filled	12	2.9																														
Yes	354	88.1	Not Filled	260	35.9																											
No	18	4.5	Filled	460	63.4																											
Invalid	18	4.5	Invalid	5	0.7																											

Table A.28 “School Children Crossing” Traffic Sign Summary Report

School Children Crossing (A,13)		Summary of Survey Study			
		A	B		A+B
	Place	-	5		
	Sample Size	-	1.Stage	2.Stage	1+2
	Valid	-	402	323	725
	Total	-	725		

Meaning: This sign is used to warn of the likelihood of encountering children in the road ahead, going to a school or playground

Summary: There is no driver who gave opposite responses, also level of wrong responses can be negligible and level of not commented responses are very low. 1 of every 9 driver gave partially and 9 of every 10 driver gave correct responses. It is the best known 5th traffic sign.

Comprehension Level			
	Size	%	
	Valid	720	99.3
	Responses Scale (*)		
	-1.0	0	0.0
	-0.5	0	0.0
	0.0	12	1.7
	0.5	83	11.4
	1.0	625	86.2
Invalid	5	0.7	

(*)	Sample Answers
-1.0	---No response---
-0.5	---No response---
0.0	---Not commented---
0.5	Pedestrian crossroad, Children playground etc...
1.0	School children crossing etc...

Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	382	95.0	Valid	720	99.3
Not Filled	15	3.7			
Yes	357	88.8	Not Filled	239	33.0
No	10	2.5	Filled	481	66.3
Invalid	20	5.0	Invalid	5	0.7

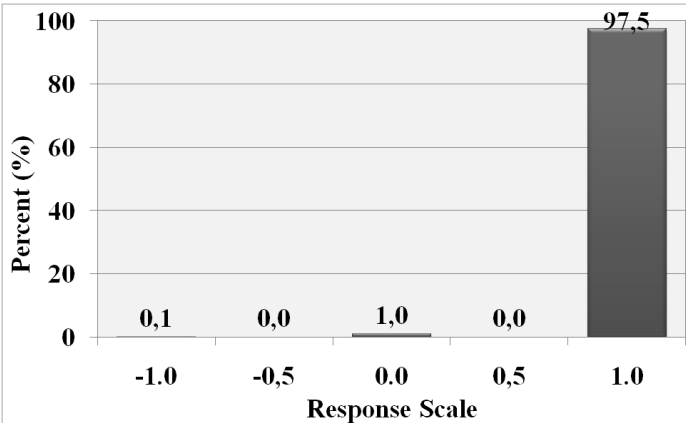
Table A.29 “Pedestrian Crossing Ahead” Traffic Sign Summary Report

Pedestrian Crossing Ahead (A,12 ^a)		Summary of Survey Study			
		A	B		A+B
	Place	-	8		
	Sample Size	-	1.Stage	2.Stage	1+2
	Valid	-	402	323	725
	Total	-	725		

Meaning: This sign is used to warn drivers about pedestrian crossing ahead.

Summary: There are no wrong or partially correct responses, also opposite and not commented responses are negligible. It is the best known traffic sign by 97,5 % of drivers within 39 different signs asked on questionnaires.

Comprehension Level



	Size	%
Valid	716	98.6
Responses Scale (*)		
-1.0	1	0.1
-0.5	0	0.0
0.0	7	1.0
0.5	0	0.0
1.0	707	97.5
Invalid	9	1.4

(*)	Sample Answers
-1.0	Pedestrians prohibited etc...
-0.5	---No response---
0.0	---Not Commented---
0.5	---No response---
1.0	Pedestrian Crossing etc...

Other Statistics

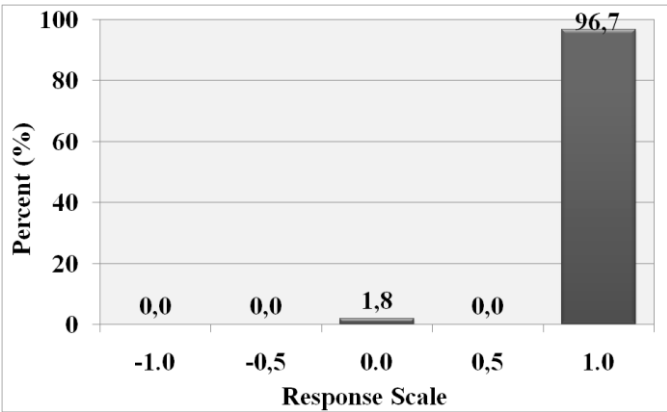
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	376	93.5	Valid	715	98.6
Not Filled	6	1.5			
Yes	366	91.0	Not Filled	260	35.8
No	4	1.0	Filled	455	62.8
Invalid	26	6.5	Invalid	10	1.4

Table A.30 “Road Works” Traffic Sign Summary Report

Road Works (A,16)		Summary of Survey Study			
		A	B		A+B
	Place	-	17		
	Sample Size	-	1.Stage	2.Stage	1+2
	Valid	-	402	323	725
	Total	-	725		

Meaning: This sign warns drivers that work is in progress on the section of the road ahead.

Summary: There are no opposite, wrong or partially correct responses given; also not commented response level is negligible. It is the 3. best known sign by 96,7 % of all drivers.

Comprehension Level			
	Size	%	
	Valid	714	98.5
	Responses Scale (*)		
	-1.0	0	0.0
	-0.5	0	0.0
	0.0	13	1.8
	0.5	0	0.0
	1.0	701	96.7
	Invalid	11	1.5

(*)	Sample Answers
-1.0	---No response---
-0.5	---No response---
0.0	---Not Commented---
0.5	---No response---
1.0	Road Work etc...

Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	375	93.3	Valid	713	98.3
Not Filled	19	4.7			
Yes	354	88.1	Not Filled	291	40.1
No	2	0.5	Filled	422	58.2
Invalid	27	6.7	Invalid	12	1.7

Table A.31 “Motor or Non-Motorized Vehicles Prohibited” Traffic Sign Summary
Report

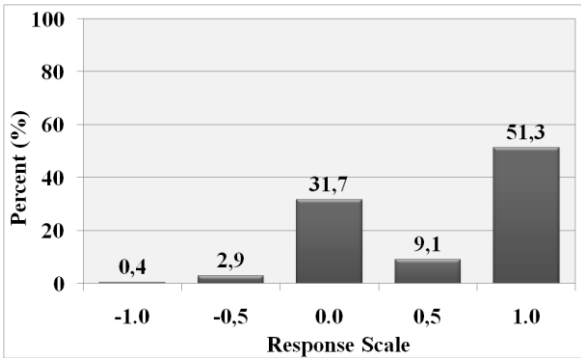
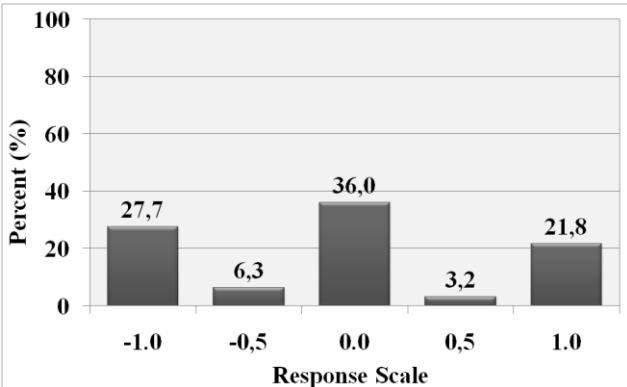
Motor or Non-Motorized Vehicles Prohibited (C,4 ^b)	Summary of Survey Study																															
		A	B		A+B																											
	Place	-	23																													
	Sample Size	-	1.Stage	2.Stage	1+2																											
	Valid	-	402	323	725																											
	Total	-	725																													
Meaning: The sign gives effect to an order which prohibits the use of a road by motor and non-motorized vehicles other than ridden bycles, solo motor cycles and hand power vehicles.																																
Summary: Level of opposite responses is negligible and wrong responses is low. 1/3 of drivers left without comment, 1/10 gave partially correct and almost half of drivers gave correct responses.																																
Comprehension Level  <table><tr><td></td><td>Size</td><td>%</td></tr><tr><td>Valid</td><td>692</td><td>95.4</td></tr><tr><td colspan="3">Responses Scale (*)</td></tr><tr><td>-1.0</td><td>3</td><td>0.4</td></tr><tr><td>-0.5</td><td>21</td><td>2.9</td></tr><tr><td>0.0</td><td>230</td><td>31.7</td></tr><tr><td>0.5</td><td>66</td><td>9.1</td></tr><tr><td>1.0</td><td>372</td><td>51.3</td></tr><tr><td>Invalid</td><td>33</td><td>4.6</td></tr></table>							Size	%	Valid	692	95.4	Responses Scale (*)			-1.0	3	0.4	-0.5	21	2.9	0.0	230	31.7	0.5	66	9.1	1.0	372	51.3	Invalid	33	4.6
	Size	%																														
Valid	692	95.4																														
Responses Scale (*)																																
-1.0	3	0.4																														
-0.5	21	2.9																														
0.0	230	31.7																														
0.5	66	9.1																														
1.0	372	51.3																														
Invalid	33	4.6																														
(*)	Sample Answers																															
-1.0	Vehicle entry etc...																															
-0.5	Truck road, Attention to the cart etc...																															
0.0	---Not Commented---																															
0.5	No vehicles, No motor vehicles, No cars, No bicycles etc...																															
1.0	Motor or non-motorized vehicles prohibited etc...																															
Other Statistics																																
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates																													
	Size	Percent		Size	Percent																											
Valid	355	88.3	Valid	693	95.6																											
Not Filled	52	12.9																														
Yes	235	58.5	Not Filled	467	64.4																											
No	68	16.9	Filled	226	31.2																											

Table A.32 “No Trucks (Current)” Traffic Sign Summary Report

No Trucks (Current) (C,3°)	Summary of Survey Study				
		A	B		A+B
	Place	-	21		725
	Sample Size	-	1.Stage	2.Stage	
	Valid	-	402	323	
	Total	-	725		

Meaning: The sign is used to give effect to an order prohibiting goods vehicles (with maximum gross weight exceeding 3,5 tonnes).

Summary: By removing oblique red bar from previously used “No Entry for Goods Vehicles” traffic sign, it is adopted to EU form. More than 1/4 of drivers gave opposite response, 1/3 left without comment and 1/5 gave correct responses for the sign information. Levels of partially correct or wrong responses are in low level.

Comprehension Level			
		Size	%
	Valid	690	95.0
	Responses Scale (*)		
	-1.0	201	27.7
	-0.5	46	6.3
	0.0	261	36.0
	0.5	23	3.2
	1.0	158	21.8
	Invalid	35	5.0

(*)	Sample Answers
-1.0	Trucks allowed, Open to lorries, Truck way etc...
-0.5	Attention to truck etc...
0.0	---Not Commented---
0.5	No minibus, No bus, No mini-truck etc...
1.0	No trucks etc...

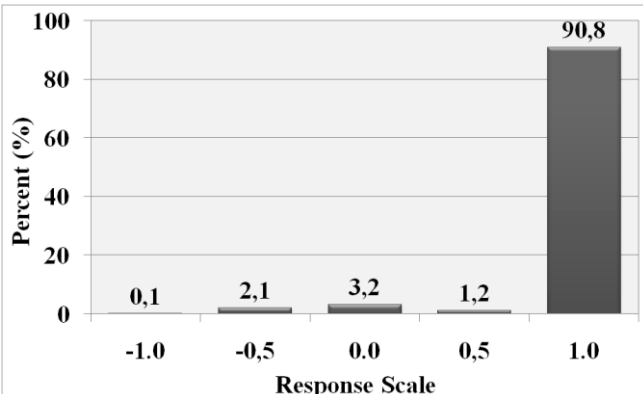
Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	356	88.6	Valid	690	95.2
Not Filled	62	15.4			
Yes	228	56.8	Not Filled	495	68.3
No	66	16.4	Filled	195	26.9
Invalid	46	11.4	Invalid	35	4.8

Table A.33 “No Trucks (Previous)” Traffic Sign Summary Report

No Trucks (Previous) (C,3 ^e)	Summary of Survey Study				
		A		B	A+B
	Place	9		-	
	Sample Size	1.Stage	2.Stage	-	1+2
	Valid	449	304	-	753
	Total	753		-	

Meaning: The sign is used to give effect to an order prohibiting goods vehicles (with maximum gross weight exceeding 3,5 tonnes).

Summary: By EU integration process this sign has been removed from use. This sign is placed on questionnaire to determine comprehension level of new sign by comparing the results of the previous. Opposite response level is negligible; wrong, not commented and partially correct response levels are very low but 9 of every 10 driver gave correct responses for information of the sign.

Comprehension Level			
		Size	%
	Valid	734	97.4
	Responses Scale (*)		
	-1.0	1	0.1
	-0.5	16	2.1
	0.0	24	3.2
	0.5	9	1.2
	1.0	684	90.8
	Invalid	19	2.6

(*)	Sample Answers
-1.0	Trucks allowed, Open to lorries, Truck way etc...
-0.5	Attention to truck etc...
0.0	---Not Commented---
0.5	No minibus, No bus, No mini-truck etc...
1.0	No trucks etc...

Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	417	92.9	Valid	733	97.3
Not Filled	28	6.2			
Yes	381	84.9	Not Filled	406	53.9
No	8	1.8	Filled	327	43.4

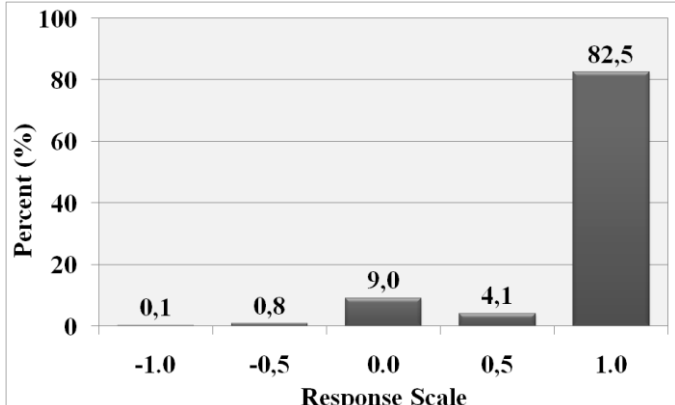
Table A.34 “Level Crossing without Barrier” Traffic Sign Summary Report

Level Crossing Without Barrier (A,26°)	Summary of Survey Study				
		A		B	A+B
	Place	13		-	
	Sample Size	1.Stage	2.Stage	-	1+2
	Valid	449	304	-	753
	Total	753		-	

Meaning: This sign is used in advance of open railway level crossings which have neither gates nor barriers.

Summary: Almost there is no opposite or wrong responses. Although there is a train symbol on the sign, 9% of drivers left without comment. Partially correct response rate is low but there is 82,5 % correct response rate.

Comprehension Level



	Size	%
Valid	727	96.5
Responses Scale (*)		
-1.0	1	0.1
-0.5	6	0.8
0.0	68	9.0
0.5	31	4.1
1.0	621	82.5
Invalid	26	3.5

(*)	Sample Answers
-1.0	No railroad crossroad etc...
-0.5	No trucks, Road works etc...
0.0	---Not Commented---
0.5	Railroad, Railroad crossing with barrier etc...
1.0	Level crossing without barrier etc...

Other Statistics

“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	413	92.0	Valid	726	96.4
Not Filled	28	6.2			
Yes	363	80.9	Not Filled	390	51.8
No	22	4.9	Filled	336	44.6
Invalid	36	8.0	Invalid	27	3.6

Table A.35 “Single-Track Level Crossing” Traffic Sign Summary Report

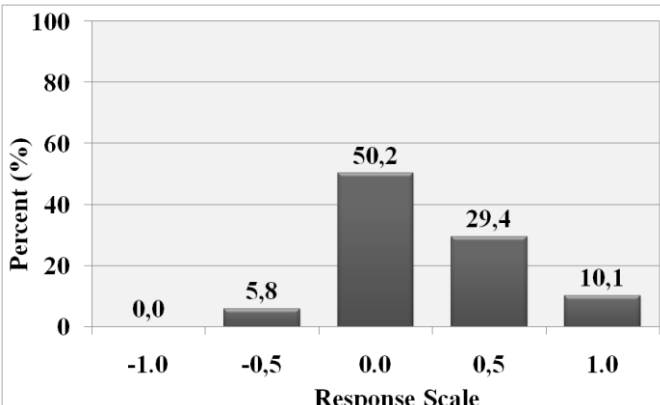
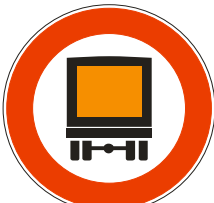
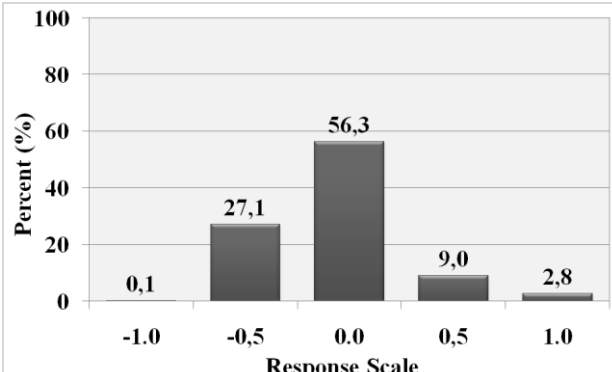
Single-Track Level Crossing (A,28 ^a)	Summary of Survey Study																															
		A	B		A+B																											
	Place	-	28																													
	Sample Size	-	1.Stage	2.Stage	1+2																											
	Valid	-	402	323	725																											
	Total	-	725																													
Meaning: This sign is used to indicate the location of a level crossing which has no gate or barrier.																																
Summary: There is no opposite response given and wrong response rate is low. Half of drivers did not made comment. 1/3 of drivers gave partially correct and 1/10 gave correct responses.																																
Comprehension Level  <table><thead><tr><th></th><th>Size</th><th>%</th></tr></thead><tbody><tr><td>Valid</td><td>692</td><td>95.5</td></tr><tr><td colspan="3">Responses Scale (*)</td></tr><tr><td>-1.0</td><td>0</td><td>0.0</td></tr><tr><td>-0.5</td><td>42</td><td>5.8</td></tr><tr><td>0.0</td><td>364</td><td>50.2</td></tr><tr><td>0.5</td><td>213</td><td>29.4</td></tr><tr><td>1.0</td><td>73</td><td>10.1</td></tr><tr><td>Invalid</td><td>33</td><td>4.5</td></tr></tbody></table>							Size	%	Valid	692	95.5	Responses Scale (*)			-1.0	0	0.0	-0.5	42	5.8	0.0	364	50.2	0.5	213	29.4	1.0	73	10.1	Invalid	33	4.5
	Size	%																														
Valid	692	95.5																														
Responses Scale (*)																																
-1.0	0	0.0																														
-0.5	42	5.8																														
0.0	364	50.2																														
0.5	213	29.4																														
1.0	73	10.1																														
Invalid	33	4.5																														
(*)	Sample Answers																															
-1.0	---No response---																															
-0.5	No entry, closed to vehicles, Barrier, Bridge etc...																															
0.0	---Not Commented---																															
0.5	Railroad ahead, Distance to railroad, Level crossing with barrier etc...																															
1.0	Single-track level crossing, Railroad crossing without barrier etc...																															
Other Statistics																																
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates																													
	Size	Percent		Size	Percent																											
Valid	353	87.8	Valid	696	96.0																											
Not Filled	47	11.7																														
Yes	209	52.0	Not Filled	548	75.6																											
No	97	24.1	Filled	148	20.4																											
Invalid	49	12.2	Invalid	29	4.0																											

Table A.36 “No Vehicles Carrying Dangerous Goods” Traffic Sign Summary Report

No Vehicles Carrying Dangerous Goods (C,3 ^h)		Summary of Survey Study			
		A		B	A+B
	Place	14		-	
	Sample Size	1.Stage	2.Stage	-	1+2
	Valid	449	304	-	753
	Total	753		-	

Meaning: It is used on roads to prohibit entry of vehicles carrying dangerous goods.

Summary: More than half of drivers left without comment and wrong responses level is very high by 27,1% of drivers. Only one driver gave opposite answer. Correct response level is very low and every 1 of 11 drivers gave partially correct responses.

Comprehension Level			
	Size	%	
	Valid	718	95,3
	Responses Scale (*)		
	-1.0	1	0,1
	-0.5	204	27,1
	0.0	424	56,3
	0.5	68	9,0
1.0	21	2,8	
Invalid	35	4,7	

(*)	Sample Answers
-1.0	Entry of vehicles carrying dangerous goods etc...
-0.5	Truck road, Tractor, Truck traffic congestion etc...
0.0	---Not Commented---
0.5	No heavy vehicles, No trucks etc...
1.0	No vehicles carrying dangerous goods etc...

Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	405	90.2	Valid	719	95.5
Not Filled	84	18.7			
Yes	121	270	Not Filled	575	76.4
No	200	44.5	Filled	144	19.1
Invalid	44	9.8	Invalid	34	4.5

Table A.37 “No Vehicles Carrying Explosives or Flammable Goods” Traffic Sign
Summary Report

No Vehicles Carrying Explosives or Flammable Goods (C,3 ^m)	Summary of Survey Study				
		A	B		A+B
	Place	-	29		
	Sample Size	-	1.Stage	2.Stage	1+2
	Valid	-	402	323	725
	Total	-	725		
Meaning: The sign is used to give effect to an order that prohibits vehicles carrying explosives from using a length of road.					
Summary: There is no driver who gave opposite response. 7/10 of drivers did not make comment, 1/12 gave wrong, 1/20 gave partially correct responses. 13 % of drivers gave correct responses.					
<					

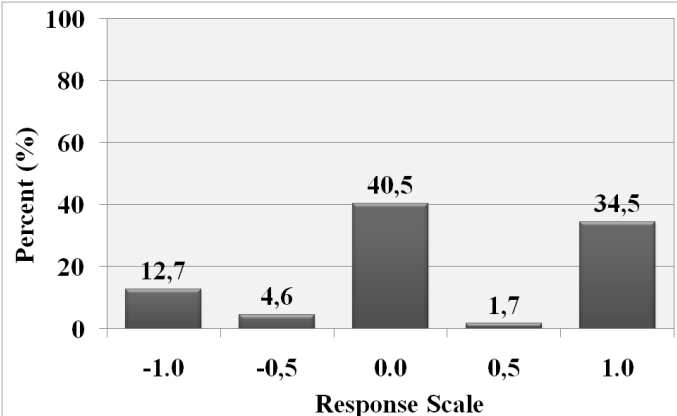
Table A.38 “No Overtaking (Current)” Traffic Sign Summary Report

No Overtaking (Current) (C,13 ^{ea})		Summary of Survey Study			
		A		B	A+B
	Place	27		-	
	Sample Size	1.Stage	2.Stage	-	1+2
	Valid	449	304	-	753
	Total	753		-	

Meaning: The sign is used to give effect to an order which prohibits overtaking.

Summary: 1/3 of drivers gave correct responses, but 40% of drivers left without comment, 13% of gave opposite and 5% gave wrong responses. Low wrong response rate shows that this sign is not much confused with others. Only 1/59 of drivers gave partially correct responses.

Comprehension Level



	Size	%
Valid	709	94.0
Responses Scale (*)		
-1.0	96	12.7
-0.5	35	4.6
0.0	305	40.5
0.5	13	1.7
1.0	260	34.5
Invalid	44	6.0

(*)	Sample Answers
-1.0	Overtaking is allowed, End of no overtaking zone etc...
-0.5	No vehicles, Two way traffic etc...
0.0	---Not Commented---
0.5	Do not keep on left lane, Related with overtaking etc...
1.0	No overtaking etc...

Other Statistics

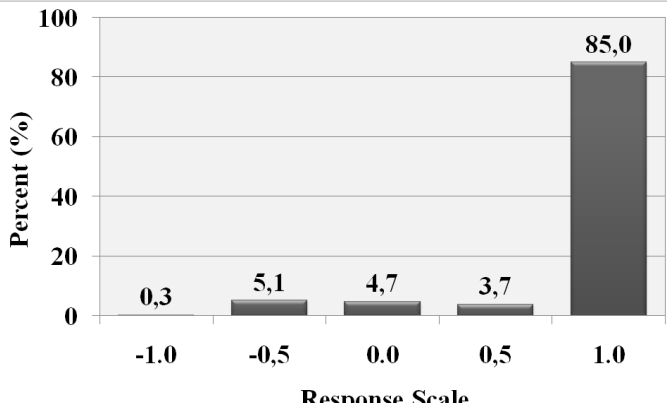
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	397	88.4	Valid	710	94.3
Not Filled	60	13.4			
Yes	278	61.9	Not Filled	541	71.9
No	59	13.1	Filled	169	22.4
Invalid	52	11.6	Invalid	43	5.7

Table A.39 “No Overtaking (Previous)” Traffic Sign Summary Report

No Overtaking (Previous) (C,13 ^{eb})	Summary of Survey Study				
		A	B		A+B
	Place	-	9		1+2
	Sample Size	-	1.Stage	2.Stage	
	Valid	-	402	323	725
	Total	-	725		

Meaning: The sign is used to give effect to an order which prohibits overtaking. AB Uyumu çerçevesinde bu işaret kullanımdan kaldırılmış bulunmaktadır.

Summary: Opposite responses are negligible, wrong, not commented and partially correct response rates are low. One of the best known sign with 85% correct response rate.

Comprehension Level			
	Size	%	
	Valid	716	98.8
	Responses Scale (*)		
	-1.0	2	0.3
	-0.5	37	5.1
	0.0	34	4.7
	0.5	27	3.7
	1.0	616	85.0
	Invalid	9	1.2

(*)	Sample Answers
-1.0	Overtaking is allowed, End of no overtaking zone etc...
-0.5	No vehicles, Two way traffic etc...
0.0	---Not Commented---
0.5	Do not keep on left lane, Related with overtaking etc...
1.0	No overtaking etc...

Other Statistics					
“Have you ever seen?” Response Rates ⁽¹⁾			“What should be done?” Response Rates		
	Size	Percent		Size	Percent
Valid	376	93.5	Valid	713	98.3
Not Filled	12	3.0			
Yes	362	90.0	Not Filled	307	42.3
No	2	0.5	Filled	406	56.0
Invalid	26	6.5	Invalid	12	1.7