Article

Assessment of Traffic Sign Comprehension Levels among Drivers in the Emirate of Abu Dhabi, UAE

Taleb M. Al-Rousan [1,*] and **Abdullahi A. Umar** [2]

1   Department of Civil Engineering, The Hashemite University, Zarqa 13133, Jordan
2   Department of Civil Engineering and Quantity Surveying, Military Technological College, Al Matart Street, Muscat 111, Oman; Abdullah.Umar@mtc.edu.om
*   Correspondence: taleb@hu.edu.jo; Tel.: +962-5-3903333 (ext. 4383); Fax: +962-5-3826348

Abstract: Road traffic signs are part of the road infrastructure components meant to ensure the safe use of roads by motorists and pedestrians alike. A good knowledge and comprehension of road signs helps ensure smooth flow of traffic, improves safety for other motorists and provides drivers with good reaction time to comply with the message dictated by the signs. Abu Dhabi, being the capital of the UAE, brings together people from all over the world for work, business or tourism. Abu Dhabi has quality roads and traffic signage together with an efficient police force that enforces adherence to traffic rules. Despite all these and the reduced fatalities in absolute terms, traffic violations have been increasing exponentially, resulting in five million traffic fines in 2019 for a population of about 2.9 million inhabitants. This study sought to assess motorists' comprehension of the various traffic signs used across the UAE. The results of the survey (N = 200) revealed that the drivers were able to correctly identify 77% of the road signs in the survey. It was also found that the respondents failed to correctly identify traffic signs within the specific category referred to as "advance warning signs". Respondents' education, nationality, gender, and marital status did not have any statistically significant effects on the results compared to earlier studies. It is recommended that more attention be focused on driver education and training.

Keywords: Abu Dhabi; comprehension; driving behaviors; traffic signs; traffic safety

1. Introduction

Road transport is the most common transportation form globally. Road transportation provides benefits both to nations and to individuals by facilitating the movement of goods and people. It enables increased access to jobs, economic markets, education, recreation, and health care, which in turn have direct and indirect positive impacts on the health of populations [1]. However, driving on roads is a complex task that involves extensive interactions between road users and the other components of the transport system, such as the driver, the vehicle, and the road traffic environment [2]. This interaction, if well-coordinated with appropriate road signs, effective drivers' road sign education and comprehension, can result in smooth flow of traffic, enhanced road safety and a general reduction in traffic violations and accidents [3]. However, it has been reported that over 1.2 million deaths and about 50 million non-fatal injuries result from road accidents globally on an annual basis [1]. The global cost of road accidents has been estimated to cost the world economy USD 1.8 trillion between 2015–2030 or 0.12% of global Gross Domestic Product [4]. In a bid to reduce this number of deaths, governments around the world are taking different measures depending on the local domestic characteristics and driving behaviors they wish to stop or encourage. Researchers have also undertaken assisting governments by assessing the relationships between various factors and driving safety on roads. Governments respond to bad driving behaviors mostly through punitive measures such as fines to curb bad driving practices. Others have suggested the standardization

of traffic signs internationally to enhance the ability of tourists to drive without further host-country training [5].

The roads in the United Arab Emirates (UAE) are some of the best in the world in terms of quality, as evidenced by their ranking in the road quality index. The UAE roads were ranked ahead of more developed countries such as Germany, USA, UK and France in the 2019 report of the World Economic Forum [6]. Oil wealth has led to the rapid growth and development of Abu Dhabi and its sister Emirates within the UAE arrangement. This rapid economic growth has attracted people from different regions of the world to the UAE with its attendant need for smooth and efficient means of transportation. A large volume of tourists also frequents the UAE annually, reaching over 15 million tourists in 2018 [7]. Some of these tourists prefer to rent cars and drive around on their own in order to get a better feel of the country. While the Emirate of Dubai has introduced the Dubai metro in addition to other modes of public transportation, the Emirate of Abu Dhabi only relies on public buses, taxis, rental cars and private cars for the movement of people. This has led to pressure on residents to own a personal car to ease movements from point to point. With so many drivers from diverse backgrounds and driving educations, the situation is ripe for traffic violations and accidents.

The police in Abu Dhabi issued five million fines against drivers in 2019 [8], with a population of about 2.9 million (2016 estimates from Statistics Centre of Abu Dhabi (SCAD)); this translates to 1.7 fines for every resident. Despite the increased volume of fines against drivers, it has been found that road traffic injuries in the UAE remained stable from 2012 to 2016 [9]. Another alarming factor in the road injuries and fatalities is the overrepresentation of UAE nationals among the fatalities and the injured [10]. One study of five countries within the Gulf Co-operation Council (GCC) found that the drivers correctly comprehended only 56% of the traffic signs they were presented [11]. The authors also found that for the UAE in particular, the respondents (N-861) correctly comprehend only 62% of the traffic signs presented to them. They attribute the poor performance to the manner in which drivers are licensed and the laxity of the assessments. Similar studies carried out in the United States by Ward et al. [12] also found that drivers could not comprehend a large percentage of the international road signs they were presented. In Turkey, Yakut [13] found that on average, participants correctly identified 81% of the signs presented. In Kano city, Nigeria, it was found that the average traffic sign comprehension level was as high as 79%, with the least comprehension being 54.7% on the "Park and Ride" sign. However, they found that truck drivers had a lower understanding level than all other classes of road users [14]. A study of drivers' sign comprehension across four countries (Poland, Finland, Canada and Israel) found that on average the drivers identified 58.5% of the signs correctly [5]. This goes to show that the problem is not limited to developing countries only, developed countries are also struggling.

A recent study of road crashes in Abu Dhabi between 2012 and 2017 revealed that there were 1.26 million crashes, 9327 injuries, and 1305 fatalities during the period covered. The study went on to reveal that the crashes tended to be fatal when collisions occurred between 22:00 and 5:59 o'clock, occurred under adverse weather conditions, involved pedestrians or drunk drivers, occurred on higher speed limit highways, as well as when drivers were male, minors and/or Emiratis [10]. The economic costs of these accidents to the GCC have been estimated to be around $7.5 billion annually [15]. While the police attempt to use fines to correct poor driving behaviors, governments, on the other hand, focus on road improvement projects. Little attention has been paid by governments in assessing drivers' knowledge and comprehension of traffic signs, which facilitates and enhances safety and better road use compliance. The situation is further compounded due to today's travel culture where people are often licensed in one country and then drive without any further training or assessments in another country [5]. This happens to be the case across the GCC where Americans and Europeans seldom undergo any assessments but are issued licenses upon presenting their home-country drivers' licenses. A good understanding of traffic signs assists drivers in proper use of roads, contributes to the

smooth flow of traffic and enhances safety. Therefore, this study seeks to assess the level of road traffic signs comprehension among drivers in the Emirate of Abu Dhabi.

2. Literature Review

Road traffic signs help regulate traffic, provide crucial visual guidance, can alert drivers to potential hazards on the road and give drivers important preview time during night-time conditions [16]. In addition, well placed and maintained traffic signs provide drivers with clear guidance that enables them to act in a timely manner in accordance with the displayed instruction. Poorly maintained and illegible road signs can cause travelling delays and increase the potential for accidents for road users, especially drivers using such roads for the first time. Poorly maintained road signs are a growing problem even in developed countries. For instance, European Union Road Federation (ERF) [16] reported that 33% of Germany's 25 million road signs are considered non-readable, while another 25% are older than 15 years. Traffic signs come in both text and symbols, while in some instances may be text alone or a symbol alone. Researchers have assessed which option is more effective in delivering the required message to drivers. While it was found that text signs were difficult to comprehend by tourist respondents in Thailand [17], in Israel, a combination of text and symbols was found to be more acceptable and reduced driver comprehension time [18].

Past studies have also found that personal and social factors significantly affect drivers' comprehension of road signs [5,11,17,19,20]. In the case of Al-Madani and Al-Janahi [11], in their comparison of the countries within the GCC, they found that the drivers' education level, income range and nationality affected their ability to correctly identify traffic signs. Interestingly, they also found that males had a better comprehension than females and western drivers performed better than their Arab counterparts did. In Thailand, Choocharukul and Sriroongvikrai [17] assessed tourists in the country and found that drivers' age, experience in a foreign land and their nationality had a significant impact on ability to comprehend and translate road traffic signs. In the case of Shinar et al. [5] who assessed comprehension across four countries (Canada, Finland, Israel and Poland), they found that the age, gender and country (nationality) all had a significant impact on the comprehension levels of the respondents.

Taamneh and Alkheder [20], in their study of Jordanian drivers, found that only 61% of the drivers comprehended regulatory signs, 66% of drivers comprehended warning signs and 75% of drivers comprehended guidance traffic signs. They also found higher comprehension levels among drivers holding a commercial driving license and drivers with driving experience of more than 11 years.

Kirmizioglu and Tuydes-Yaman [21], in their study in Ankara-Turkey, found that out of 39 signs, only 12 were recognized correctly by almost 70% of the participants. They further found that over 10% of the drivers comprehended five of the signs oppositely, and they argued that the implication of this was riskier than not knowing at all. In Iraq, Ismail [19] found that drivers' comprehension of traffic signs increased with increasing education levels, the urbanization level of his residence and daily driving practice. Males and private car drivers were found to have a higher comprehension than females and other driver categories, respectively. He also found that marital status had no significant effect on the comprehension level of drivers. Ou and Liu [3] studied the influence of sign design features and training on the comprehension of 65 selected Taiwanese traffic signs on Taiwanese and Vietnamese drivers. They found that training outcome was positive in both user groups. The average comprehension improved from 0.63 and 0.41 pre-training to 0.98 and 0.89 post-training for Taiwanese and Vietnamese drivers, respectively. More importantly, comprehension scores measured after one month remained higher than pre-training.

Traffic signs are a simple and cost-effective intervention that can yield impressive rates of return in terms of road safety, and thus reducing the socio-economic consequences [16]. The European Union Roads Federation's review revealed that having good signage reduced fatalities by up to 87% in the UK. In Norway, the value derived from improved traffic

signs was found to outweigh the costs by a factor of 3.5:1 [22]. While in Australia, its National Black Spot program was estimated to have reduced fatal and casualty crashes at the treated sites by 30%; the report went on to reveal that traffic sign interventions had the best cost-benefit ratio, ranging between 15:1 and 20:1 depending on the financial hypothesis made on the project [23].

3. Methodology

This study was conducted in the Emirate of Abu Dhabi in the United Arab Emirates (UAE). A review of relevant past literature was undertaken to understand the state of research in the area of traffic sign comprehension levels among motorists. Traffic comprehension studies at the global, regional and country level were explored. The UAE is a melting pot of people from across the globe working or visiting for tourism. Despite the efficient public transportation, residents often opt to own and drive their own cars, resulting in a highly diverse respondent population within the survey sample. A Likert-based questionnaire was designed based on similar ones used for past studies by Al-Madani and Al-Janahi [11]. The questionnaire was composed of two parts. Part one intended to collect information about drivers' age, gender, nationality, marital status, education level, number of years having a driving license and whether they have multiple ones, the number of fines and number of accidents they have had. Part two of the questionnaire was designed to present to the respondent a list of 18 traffic signs (including regulatory, warning, and guide sign types) with a multiple-choice query so they could pick the meaning of the traffic sign from the offered choices.

Purposive sampling technique [24] was adopted for the administration of the questionnaires. The respondents were chosen among visitors to three major shopping malls within Abu Dhabi, including Marina mall, Al Wahda mall and Abu Dhabi Mall. Due to the often high temperatures, these are the places many residents like to visit and stay during the day, engaging in shopping, dining and amusement activities for children. The parking managers at the three malls were used to distribute the questionnaires to drivers on their way in and they dropped off the questionnaires on their way out. About 203 questionnaires were returned out of the 300 that were distributed. However, only 200 were used for the analysis; three questionnaires were removed for incomplete information. The number of respondents was comparable with previous studies that reported 32 respondents, 59 respondents and 53 respondents used by Alnuaimi and Al Mohsin [25], Ruqaishi and Bashir [26] and Oyegoke and Al Kiyumi [27], respectively. The response rate of about 67% can be regarded as good considering the low responses to surveys within the GCC, knowing that the average response rate for survey data collection from organizations was 35.7% [28].

4. Results

The analyses involved 200 respondents who owned a UAE drivers' license as a minimum requirement to be eligible to complete the questionnaire. The respondent's educational profile showed that there were five respondents with a PhD., 10 respondents with a Master's degree, 85 respondents with a B.Sc. degree, 36 with a Diploma certificate and 64 respondents with a high school certificate. In terms of marriage status, there were 88 married and 112 single respondents within the sample. The respondents were a rich reflection of the basic profile of Abu Dhabi's residents, with 20 respondents from Europe, 10 Americans, 42 Asians, 19 Africans and 109 Middle Easterners, as shown in Table 1 below.

Table 1. Crosstab marital status vs. region of respondents.

Marital Status	European	American	Middle Eastern	Asian	African	Total
Married	10	8	42	22	6	88
Single	10	2	67	20	13	112
Total	20	10	109	42	19	200

A further analysis of the respondents' profile, shown in Table 2, revealed that respondents with only one country's drivers' license constituted 50.5%, while respondents with over three countries' drivers' license constituted only 4% of the total respondents. The respondents' profile also showed that 170 respondents drove their private cars, 12 were taxi drivers, 7 drove a bus or a lorry, while 11 rode motorcycles.

Table 2. Crosstab of vehicle type vs. number of drivers' licenses.

No. of Licenses	Private Car	Taxi	Bus or Truck	Motorcycle	Total
1	84	6	4	7	101
2	61	5	1	2	69
3	18	1	2	1	22
Over 3	7	0	0	1	8
Total	170	12	7	11	200

A normality test was conducted on the data to determine the distribution and decide whether parametric or non-parametric procedures would be used in the analysis. Both Kolmogorov-Smirnov and Shapiro-Wilk tests, presented in Table 3, revealed that the data violates normality assumptions, hence non-parametric procedures were employed in analyzing the data [29].

Table 3. Tests of normality.

	Kolmogorov-Smirnov [a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Mean18	0.159	200	0.000	0.973	200	0.001

[a] Lilliefors Significance Correction.

There are two variables within the data set that qualify for analysis using the Mann-Whitney U test for independent samples: they are the gender and marital status variables, while the Kruskal-Wallis H test was used for independent samples with more than two categories. The Mann-Whitney U test to determine whether there exists a statistically significant difference in responses between the genders (males and females) and respondents' marital status returned non-significant results, indicating that these independent variables did not affect road sign comprehension in any way, as shown in Table 4 below.

Table 4. Mann-Whitney U test.

Independent Variable		Median	N	Mann-Whitney U	Z	Assymp. Sig. (2-Tailed)
Gender (Male/Female)	M	2.0556	146	3400	−1.505	0.132
	F	2.0556	54			
Marriage Status (Married/Single)	M	2.0556	88	4221	−1.758	0.079
	S	2.0556	112			

Kruskal-Wallis H test was conducted on the independent variables of age, academic qualifications, type of vehicle driven, and the region of origin of the respondents. The results shown in Table 5 reveal that there was no statistically significant difference across the respondents based on age of respondents (*p*-value = 0.184); academic qualification (*p*-value = 0.217); type of vehicle driven (*p*-value = 0.541); and region of respondents (*p*-value = 0.390). The implication of this result is that road sign comprehension capacity is not affected by a driver's age, academic qualification, type of vehicle or the geographical region from which the driver originates. This last result is especially important given the fact that non-citizen residents in the UAE are treated based on their country of origin when seeking to convert their home-country drivers' licenses to a UAE drivers' license. However,

the test revealed that there was a statistically significant difference based on respondents' number of licenses.

Table 5. Kruskal Wallis H test results.

Independent Variable	Z-Score	df	Assymp. Sig.
Age of Respondents	4.834	3	0.184
Academic Qualification	5.775	4	0.217
Type of Vehicle	2.157	3	0.541
Number of Licenses	19.913	3	0.000
Nationality (Region)	4.122	4	0.390

To investigate further and determine which group was responsible for the difference, a Kruskal-Wallis one-way ANOVA was conducted, and the results are shown in Table 6 below. This test compares the median of the distribution to determine which group differs from the others [29]. The group with more than three licenses was responsible for the difference, even though the number of cases in this group was very small (8). However, due to their very small number, it would be unwise to generalize the results of this research endeavor.

Table 6. Kruskal-Wallis One-Way ANOVA test.

No. of Licenses	N	Median
One	101	2.0556
Two	69	2.1111
Three	22	2.0833
Over Three	8	1.9167
Total	200	2.0556

The overall average performance of the study sample was 77% across all 200 respondents in terms of their ability to correctly recognize the road traffic signs presented to them. This is an improvement on the earlier study which found a 56% average performance in the comprehension of traffic signs [11]. The performance of the sample is shown in Table 7. The performance of the respondents was below 90% on 8 out of the 18 road signs that were presented. Good comprehension of road signs reduces driving mistakes on the road, and consequently a reduction of accidents on the roads. However, the government relies on punitive measures such as fines to ensure adherence and compliance. As the results above reveal, there are a couple of areas where more sensitizations will be required, especially because all the signs used in the questionnaire were taken from the UAE's Emirates Driving Institutes' (EDI) Guidance chart for road signs, road markings and traffic signals.

A further breakdown of the performance of the respondents according to gender (see Table 8) reveals a very interesting trend. A higher percentage of males failed to correctly name each of the "advance warning signs" they were presented compared to their female counterparts. This finding is contrary to the earlier GCC-wide study by Al-Madani and Al-Janahi [11] who found that male drivers performed better than females.

Interestingly, all the road signs where the respondents failed to pick the correct answer were contained in the "advance warning signs" section of the EDI Guidance chart. Therefore, it has become pertinent that training instructors and police driving assessment officers pay more attention to these areas when training or assessing potential drivers, respectively. Furthermore, the government should consider a traffic sign retest exam for all drivers when they apply for their driving license renewal. While the importance of driver education is recommended [20] and aggressive campaigns have been suggested [21], it has also been empirically proven that driver training [3] holds the most potent potential for enhancing safety on our roads.

Table 7. Road sign comprehension performance.

S/No.	Road Signs		Sign Type	% Correct
1	Maximum Speed		Regulatory	92%
2	Petrol Filling Station		Guide	96%
3	Hospital		Guide	79%
4	Restaurants		Guide	89%
5	Parking		Guide	100%
6	One-Way Traffic		Regulatory	90%
7	Hazard Ahead		Warning	77%
8	Dual-Carriage Way Ends		Warning	17%
9	Traffic Merges From Left		Warning	18%
10	Pedestrian Crossing		Warning	95%
11	Children Crossing		Warning	75%
12	Hump		Warning	95%
13	Minimum Speed		Regulatory	33%
14	Left Only		Regulatory	93%
15	Turning Left Or Right		Regulatory	90%
16	U-Turn		Regulatory	90%
17	Round-About		Regulatory	95%
18	Shared Track For Pedestrians And Bicycles		Regulatory	67%

Table 8. Percentage of the seven road sign comprehension failures by gender.

Signs with Comprehension Issues	Males 146	Females 54
Hospital Sign	24%	15%
Hazard Ahead	27%	13%
Dual Carriage Ends	84%	80%
Traffic Merges From Left	84%	78%
Children Crossing	28%	19%
Minimum Speed	64%	78%
Shared Track for Pedestrians and Bicycles	39%	19%

5. Discussion

As indicated earlier, the respondents were a rich reflection of the basic profile of Abu Dhabi's residents, which makes the study results more realistic and reflects the real prevailing situation of sign comprehension of drivers in the Emirate of Abu Dhabi.

The results revealed that there was no statistically significant difference in responses between the genders (males and females) and respondents' marital status, indicating that these independent variables did not affect road sign comprehension in any way. Both results tend to be an improvement on an earlier study conducted by Al-Madani and Al-Janahi [11] across the GCC countries. However, the majority of earlier studies have consistently found that differences exist between the genders when it comes to traffic-related issues and accidents [30–33]. Cordellieri et al. [30] and McKenna et al. [32], however, found that these differences do not exist in terms of driving risk perception, while the SIRC [33] argued that these differences can best be explained by virtue of fundamental evolutionary differences in behavior and psychology rather than levels of competence and driving skills. In a related study, Massie and Campbell [31] found that the differences witnessed between male and female drivers disappear by the age of 60 and onwards. The results from this study may, however, have been impacted by the low number of female respondents, which was about 27%. Another possible explanation could be the large number of under 40 respondents (76%), since it has been found that age tends to mediate the observed difference [31,34].

Moreover, several earlier studies on gender revealed that males were in general better than females regarding traffic sign comprehension [19,35]. Al-Madani and Al-Janahi [36] indicated that posted signs were comprehended better by male drivers than females in Arab, European and American countries. Similarly, Hawkins Jr et al. [37] reported that men better recognized one fifth of the warning signs correctly. When education background is controlled for, the differences between males and females may become less remarkable [35]. Gender was found to have no statistically significant impact in a study that considered male and female European and American drivers having at least undergraduate degrees [11]. Likewise, Ng and Chan [38] indicated that there was no significant difference for traffic sign guessability between males and females of similar education levels. In regards to marital status, the findings of this study were in line with the finding of Ismail [19], who also found that marital status had no significant effect on the comprehension level of drivers.

The results revealed that there was no statistically significant difference across the respondents based on age, academic qualifications, type of vehicle driven and region of respondents. The implication of this result is that road sign comprehension capacity is not affected by a driver's age, academic qualification, type of vehicle and the geographical region from which the driver originates. These results disagree with Al-Madani and Al-Janahi [11], who found that the driver's education level, income range and nationality impacted ability to correctly identify traffic signs in countries within the GCC. However, this could be interpreted as an improvement in the training and testing methods in Abu Dhabi. Previous studies in general indicated that drivers' comprehension of traffic signs increased with increasing education levels [19,35,38].

As presented in the Results section, the overall average performance of the study sample was 77%, reflecting respondents' ability to correctly recognize the road traffic signs presented to them. This result can be considered as an improvement on the earlier study which found a 56% average performance in the comprehension of traffic signs, and 62% for the UAE in particular [11]. Similar studies showed that drivers could not comprehend a large percentage of the road signs presented to them [12]. In Turkey, participants correctly identified 81% of the signs presented [13]. In Kano city, Nigeria, it was found that the average traffic sign comprehension level was as high as 79% [14]. A study of drivers' sign comprehension across four countries (Poland, Finland, Canada and Israel) found that on average the drivers only identified 58.5% of the signs correctly [5]. This goes to show that the problem is not limited to developing countries only, as developed countries are also struggling.

The timeliness and the robustness of traffic sign comprehension while driving is very important to drivers. Safe driving and accident avoidance can be ensured when a timely visual recognition of traffic signs takes place [21,39,40]. Zhang et al. [41] clustered the factors that affect a traffic sign's visual recognizability into three groups: (1) geometric factors of traffic sign, such as sign's size, placement, mounting height, aim, depression angle, occlusion angle, curvature of road and changing road surface [41]; (2) movement factors of vehicle, such as speed, Geometric Field Of View (GFOV), which decreases with speed being increased [42], and height and direction of line of sight which governs whether the traffic sign is contained by the GFOV; and (3) other factors, for example, weather conditions [43], lighting conditions [44], drivers' view reaction time which is affected by drivers' age and sight capabilities [44], and traffic density cognitive burden [45]. Moreover, occlusion may cause interruptions to visual continuity, thus affecting the recognition of the traffic signs [46]. Considering the abovementioned factors that affect the recognizability of the traffic sign in real-life driving practice, it is expected that the level of comprehension of drivers will reduce to an extent that might be significant if the above factors are not considered in the design and placement of these signs.

Traffic Sign Recognition (TSR) systems have recently become common in car manufacturing industries. Road safety enhancement can be achieved using TSR technology by providing timely warnings and dynamically assisting drivers in adhering to posted speed limits [47]. The most basic TSR systems employ vehicle-mounted cameras for identification of traffic signs. Their main function is to notify the driver of near traffic signs in a process that starts with scanning the roadside for signs, then using real-time image processing software to identify and inform the driver by a sound or displaying a symbol on the vehicle's dashboard panel [48]. Zhang et al. [41] indicated that the most current traffic sign detection and classification methods are based on color and shape information within images or videos. These methods use color information to segment the sign candidate area, and then to extract the traffic sign. Challenges to the vision-based TSR systems include variations in lighting and weather conditions, occluded signs and image distortion due to vehicle motion [41,48]. Zhang et al. [41] pointed out that there are different methods for recognition evaluation (simulator and image methods and naturalistic driving experimentation), but each has its own limitations. As indicated earlier, deployment of TSR systems will bring great enhancement to road safety and reduce accident involvement. Meanwhile, limitations to TSR deployment should be addressed, which include fixing conflicts in signage design, cooperation between the vehicle industry and road operators to achieve reliability of the TSR system, and adaptation with continuous development of the TSR technology which is expected to become more accurate and more reliable [48].

The study outcomes clearly show that traffic safety can be enhanced by means of providing well maintained, readable and well-placed signs; driver education and training; inclusion of TSR technology into the transportation system; and consideration of traffic sign retest exams for all drivers when they apply for their driving license renewal.

6. Conclusions

Traffic signs are components of road infrastructures that are meant to assist road users in safely navigating to their destinations. This study sought to assess the comprehension level of drivers in the Emirate of Abu Dhabi (UAE). The respondents' overall performance was an improvement on earlier studies, however, there is still much to be improved upon. Although earlier studies found that driver's age, marital status, gender, nationality, level of education and type of vehicle all had a statistically significant impact on road sign comprehension, the data analysis for this study did not support such a conclusion. Furthermore, contrary to earlier studies, a higher percentage of males failed to correctly identify the "advance warning signs" compared to female respondents. One of the most critical findings from this study is the ability to identify the category of road signs that are problematic to drivers in Abu Dhabi. This finding should assist driving instructors and police driving assessment officers in redesigning their teaching materials and assessments, respectively. The fact that despite increased fines driving violations persist points to the need to shine a spotlight on the training of drivers and the assessment methods for issuing licenses, as well as requirements for license renewal.

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