CIVIL & ENVIRONMENTAL ENGINEERING | RESEARCH ARTICLE

Road traffic safety perception in Jordan

Lina I. Shbeeb¹ and Wa’el H. Awad²*

Abstract: In the past 20 years, several safety measures were taken in an attempt to reduce traffic-related fatalities. Although reduction in deaths was occasionally noticed, the sustainability of that trend has never achieved. This study explores Jordan safety profile trying to explain the traffic safety trend. It examines road traffic safety perception of both public community and road specialist. Main turning points that may have contributed in explaining prevailing traffic safety conditions have been collected. A questionnaire is administered to two distinct groups of the Jordanian society (general public and road specialist) with a total of 167 subjects. The subjects were asked to evaluate the effectiveness of a list of safety measures. Results showed that government took effective but not sustainable measures (mainly enforcement and legislative). Other ineffective measures (administrative and engineering) were taken but they were not target oriented. The main focus of interviewed subjects in order to improve traffic safety in Jordan is to establish sustainable engineering measures and improving the vehicle fleet, driver licensing, and testing procedures. As a surprising result, enforcement measures were not considered as desirable as other measures.

Keywords: road; safety; measure; profile; effectiveness

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Public Interest Statement

Several safety measures were taken in Jordan over the last 20 years that contribute in death reduction that was not sustainable. This study explores country safety profile and attempts to explain the trend. It examines road traffic safety measures perception of both community and road specialist. Main turning points that may have contributed in explaining prevailing traffic safety trend have been collected. A questionnaire is administered to two groups (general public and road specialist). A sample of 167 subjects was interviewed. A list of safety measures were provided and they were asked to rate their effectiveness. The study showed that government took measures (mainly enforcement and legislation) that were effective but not sustainable. Administration and engineering measures were taken but they were not target oriented. Interviewed subjects stressed on the needs for providing engineering measures and improving vehicle, driver licensing, and testing procedures. Enforcement measures were not desirable as other measures.
1. Introduction

Road traffic crashes are a global concern. It is estimated that more than 1.2 million people die worldwide as a result of road traffic crashes and some 50 million are injured per annum (Hughes, Newstead, Anund, Shu, & Falkmer, 2015). The world Bank reported that road traffic injuries ranked as the ninth leading cause of death in 2004 and expected to become the fifth leading cause of death in 2030 (Figure 1).

Road traffic injuries in Jordan caused 740 deaths in 2008 (on average two people are killed each day). Forty percent of these deaths were pedestrians, almost half of them children (less than 15-year old). The mortality rate from road traffic accidents is 12.6 deaths per 100,000 people in 2008 (Jordan Traffic Institute, 2010). A significant reduction in death rate is indicated in 2008 statistics compared to 2007, which showed a rate of 17.3 per 100,000 people (a reduction of 27%). The reduction came as a result of collective measures and initiatives that were taken at national level, which followed the occurrence of a tragic accident in the very beginning of 2008 that took a life of more than 30 persons. Private sector took some initiatives to contribute in reducing road traffic death toll. In general, the public awareness of road accidents has been raised significantly. This study document the traffic safety profile in Jordan during the past 20 years and discuss the major mile stones and turning points that had major impact on traffic safety. The study looks into the communal perception of road traffic safety.

The total length of the roadway network in Jordan increased from 6872 km (1996) to 7299 km (2013). Rural roads constitute 36.3% of the roadway network, while major roads comprise about 38%. Amman governorate, the capital of Jordan is covered by about 15% of total roadway network.

![Figure 1. Expected leading causes of death worldwide between 2004 and 2030.](http://www.who.int/whosis/whostat/2008/en/index.html)
in the kingdom. Surprisingly, more than 75% of vehicles in Jordan are registered in Amman, the capital. Due to economic situation in the past decades, overall pavement conditions are substandard and routine maintenance is passing critical boundaries, where public criticisms occasionally pronounced.

2. Road accident situation in Jordan

The total reported number of road traffic accidents in 2010, results is 17,403 injuries and 670 fatalities (Jordan Traffic Institute, 2010). On a fatality rate scale, Jordan is ranked relatively high (Figure 2). Fatality rate as expressed per inhabitant is higher than any other selected European country, but it is lower than many reported rate of selected Middle East countries (Australia Bureau of Infrastructure, Transport and Regional Economics, 2010). Referring to WHO global reports, Jordan ranked 154 out of 185 countries (83.24%) in road fatalities per inhabitants per year, and ranked 104

![Figure 2. Fatality rate per 100,000 population for a number of selected countries (2006).](image)

Source: International Road Safety Comparisons 2010 and National Data for Middle East countries (Australia Bureau of Infrastructure, Transport & Regional Economics, 2010).

<table>
<thead>
<tr>
<th>Country</th>
<th>Rank</th>
<th>Fatality rate</th>
<th>Country</th>
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<th>Fatality rate</th>
<th>Country</th>
<th>Rank</th>
<th>Fatality rate</th>
<th>Country</th>
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</thead>
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<td>Tanzania</td>
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<td>Brazil</td>
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<td>Malaysia</td>
<td>4</td>
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<td>Kenya</td>
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<td>7.71</td>
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<td>13.71</td>
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<td>30.71</td>
<td>Mexico</td>
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<td>Jamaica</td>
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<td></td>
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<td>United Kingdom</td>
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<td></td>
<td></td>
<td>Romania</td>
<td>10</td>
<td>12.65</td>
<td>Sweden</td>
<td>29</td>
<td>4.89</td>
</tr>
<tr>
<td>Libya</td>
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<td>34.71</td>
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out of 185 countries (56.22%) in road fatalities per motor vehicles per year according to 2010 statistics (Ministry of Tourism and Antiquities/Jordan (MOTA), 2000–2009; World Health Organization, 2013).

Road accidents are one of the leading causes of death. Worldwide, it is ranked as the ninth cause of death. It is not within the top 10 causes of death in high nor in low income countries, whereas it is on ranked as the sixth cause of death in middle income countries (World Health Organization, 2009a). In Jordan, road traffic fatalities are the fifth cause of death, while it is ranked as the twenty third cause of death around the globe (Table 1). Traffic fatalities are highly ranked as main cause of death in the Middle East Countries, which is not the case in Europe except in Greece, which has high fatality rate as shown in Figure 1. Still European countries explore different means to make road traffic safer. Road deaths in South America and Africa are ranked among the top 10 causes of death but at low rank, which might be due to the presence of other epidemics and diseases that took lives of many citizens (Organización Panamericana de la Salud, 2009; World Health Organization, 2009b, 2009c, 2009d, 2010).

3. Traffic safety profile
The progression of road accident problem over the last 20 years showed a continuous fluctuation over the years. The development of vehicle ownership showed similar trend, which explains the variation in fatalities per 100,000 people over the years (Figure 3).

As elsewhere in the world as vehicle ownership increases, fatalities per 10,000 vehicles decrease. However, the trend in Jordan is not clear as in other countries in the world. On average, for every 1% increase in number of vehicles in Sweden (Eurostat, 2012), fatality rate decreases by 3% (Figure 4). The corresponding reduction in fatalities in Jordan is almost 1%.

Fatality reduction in Jordan (Figure 3) is due to the implementation of remedial measures packages which goes in parallel to political and economic circumstances that can be summarized as follows:

Jordan passed through significant economic recession during 1988–1989. The government took several measures to recover, which includes tightening the import of vehicles to save hard currency. Fatality rate (per 100,000 inhabitants) declined at the same pace as the reported declination in number of vehicles. The cabinet in 1990 took a decision mandating two-day weekend instead of one-day weekend. This decision effectively contributed to exposure reduction, which helped also in reducing the fatality rate.
In 1991, the first gulf war was launched and resulted in the reflux of many Jordanians residing in Kuwait and other Gulf countries. This helped in the recovery of the economy, the number of vehicles started to increase with time and the fatalities went up, but at a higher rate. Driving culture of the returnees was different from Jordanian driving culture, which might be the cause of the further increase in fatalities. Driving in Gulf countries is often associated with speeding that is related to the infrastructure conditions (wide and open streets) that facilitate speed and encourage speeders, which is not the case in Jordan.

Jordan signed Wadi Araba peace treaty in 1994. Jordan economy relies to some extent on foreign aids. Consequently, Jordan was granted aids and loans that improved its budget during 1995–1999 (Figure 5). Further, Jordan Parliament issued investment promotion law (low number 16/95) in 1995 to encourage private sector to invest in the country, which involved transport sector, among other sectors. Tourism industry also flourished (Figure 6), new hotels were constructed and touristic transport was an area of investment that was given incentives by Jordan Investment Cooperation (Ministry of Tourism and Antiquities, 2000–2009). Overall, number of vehicles during this period increased rapidly at 6% annual rate, leading to a 9% increase in fatality rate. The government was seriously concerned with the increase in death toll. But the emphasis was given to enforcement. The violation point system was introduced in 1997, without parallel effort in other fields, such as education or awareness campaigns. Figure 3 showed slight decrease in the progression of fatalities in the following year.
Safety belt law is another measure to enforce, which introduced for the first time in 1984, but not fully implemented. Following the joint cooperation between Sweden and Jordan concerning traffic safety (1998–1999), the issue of enforcing safety belt use was considered as a primary mean to reduce the fatalities. Traffic police started stringent execution of safety belt law in 1998. Jordan Traffic Institute continuously evaluated the use of safety belt showing an improvement from 23% in 1999 to 50% in 2006 (Jordan Traffic Institute, 1999, 2006).

On the legislative and administrative side, the government in 1999 reduced the customs on imported vehicles (both new and used), in addition to permitting the registration of vehicles which is more than five-year old, which has not been allowed before that date. This resulted in adding 72,000 extra vehicles on Jordan’s road network in just fifteen months, without infrastructure upgrade to accommodate such an increase. Number of fatalities in 2000 increased by 13% compared to only 8% in 1999, the year that preceded the act. However, the fatality rate slightly decreased by 0.02 fatalities per 100,000 inhabitant (Jordanian Legislation System, 1988–2009).

Palestinian second uprising intifada was ignited in the fall of 2000, which negatively influenced tourism and level of investment attraction. Figure 4 showed slight budget reduction during 2000 and 2001, which affected the performance of most governmental agencies due to budgeting limitation. This implied shortage of funds to finance enforcement or engineering interventions, which may add to the severity of accident problem. The level of public frustration due to the political situation in Palestine might also have negatively contributed on driver’s behavior, which became more aggressive.

In 2000 and further, Greater Amman Municipality started an implementation plan for upgrading 20 at-grade intersections to grade separated junctions in an attempt to improve traffic circulation and reduce congestion. The new setups facilitated the speed on main roads and contribute to the severity of accident problem. Pedestrian needs were not fully addressed in the new setup.

The government as a response to emergent problem issued a new traffic law in 2001 that raised the fines related to violations associated with high risk driving violations. Figure 3 showed that fatality rate in the following year (2002) decreased despite the increase in number of registered vehicles. Short-term decrease was evident that did not last and the number of fatalities went up again. A series of enforcement measures were taken such as establishing the automated surveillance program in 2003, which started in Amman, the capital. Ten cameras were installed at 10 intersections. Both speed and red light crossing were monitored. The measures were effective in reducing violation at the selected intersections but it would be illogical to assume that the implementation of the measures on such limited number of sites will have a significant reduction of fatalities at national level.

A new legislation that updated and modified existing traffic rules was issued in 2004. Again short-term effect was observed that did not last and the fatality rate increased only one year after the implementation of the new legislation. The increase in fatalities amalgamated with the significant increase in tourists, which eventually means more vehicles entering the country. Which is in a way or another is related to the increase in government expenditures. In 2004 and beyond, the increase registered vehicles was related to Gulf second war, which also brought in large numbers of Iraqs immigrants. Driving skills and culture of the Iraqis are different form Jordanian, this might add to the severity of the safety problem.

The governmental response was mainly directed to apply more strict rules and enforcement. Two traffic laws were issued in two successive years (2007 and 2008). The first law (2007) was very strict. The violation penalties were significantly increased, leading the public to complain, and as a result the law was suspended and substituted by a new law in 2008. Early 2008, a dramatic single crash occurred that took lives of many passengers. The community was shocked with the losses, the political leaders in the country felt the need to take immediate action to absorb the general public
reaction to this crash. More policing and enforcement were first considered. New non-governmental agencies advocating for traffic safety were established. Their clear message was “the community can’t take these loses and there is a need to take immediate actions.” Since 2008, fatalities started to decrease.

4. Public perception of traffic safety measures

To examine the public perception, a questionnaire was designed and administrated. The sample consists of 167 observations. The sample includes two groups; the first group refers to general community perception hereinafter will be referred to as Public (152 subjects). The second group comprises only of 15 subjects that work in road industry sector; this group will be referred to as Road Specialist.

The characteristics of the sample are given in Table 2. Female present is higher in road specialist group (47%) when compared to general public. Half of the public group hold graduated degree compared to 40% for the second group. Two-thirds of general public group do not use transit in their travel whereas two-third of road specialist commute by transit. Less than half of road specialist group own a car compared to 85% for the public group. The majority of both groups, more than 80% have private driving license.

The subjects were requested to provide information about their life style, which include income, smoking habits, availability of health insurance and the associated cost. The subjects provide also same information on their safety record, which cover accident past experience and number of committed traffic violations during the last three years.

Table 2. Sample characteristics

<table>
<thead>
<tr>
<th></th>
<th>General public</th>
<th>Road specialist</th>
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<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>Female</td>
<td>14</td>
<td>9.2</td>
</tr>
<tr>
<td>Male</td>
<td>138</td>
<td>90.8</td>
</tr>
<tr>
<td>Less than high school</td>
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<td>7.2</td>
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<tr>
<td>High school</td>
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</tr>
<tr>
<td>Associate degree</td>
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<td>23.7</td>
</tr>
<tr>
<td>Graduated</td>
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<td>54.6</td>
</tr>
<tr>
<td>Transit user</td>
<td>55</td>
<td>36.2</td>
</tr>
<tr>
<td>Not transit user</td>
<td>97</td>
<td>63.8</td>
</tr>
<tr>
<td>Own a car</td>
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<td>85.5</td>
</tr>
<tr>
<td>Not own a car</td>
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<td>14.5</td>
</tr>
<tr>
<td>Hold license</td>
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<td>95.4</td>
</tr>
<tr>
<td>Does not hold license</td>
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<td>4.6</td>
</tr>
<tr>
<td>Private license</td>
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<td>80.3</td>
</tr>
<tr>
<td>Smoker</td>
<td>81</td>
<td>53.3</td>
</tr>
<tr>
<td>Not smoker</td>
<td>69</td>
<td>45.4</td>
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<tr>
<td>No answer</td>
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<td>1.3</td>
</tr>
<tr>
<td>Have health insurance</td>
<td>106</td>
<td>69.7</td>
</tr>
<tr>
<td>No health insurance</td>
<td>46</td>
<td>30.3</td>
</tr>
<tr>
<td>No Answer</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Total</td>
<td>152</td>
<td>91%</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average number of accidents</td>
<td>2.3</td>
<td>100%</td>
</tr>
<tr>
<td>Average number of violations</td>
<td>5</td>
<td>2.33</td>
</tr>
</tbody>
</table>
Table 2 showed that subjects in public group have higher involvement in accidents (on average, 2.3 accidents) compared to road specialist group (one accident on average). The average number of traffic violation committed of the first group (public) is twice the average reported for the second group (Road specialist).

A set of 18 remedial measures were presented to the subjects to assess their acceptance and how they perceive the effectiveness of such measures on traffic safety. The proposed measures can be grouped into five different categories of work (enforcement, engineering, education, driver/vehicle testing and licensing, administrative and rescue service). The remedial measures are briefly described as follows:

**Category I—Enforcement**

(1) Tightening traffic sanction: increase the presence of traffic police in the streets, whether temporarily or spatially, to monitor and ticket violators.
(2) Increasing electronic surveillance in urban areas: install more electronic surveillance equipment on key locations and black spots within urbanized jurisdictions.
(3) Increasing electronic surveillance in rural areas: install more electronic surveillance equipment on key locations and black spots within rural areas.
(4) Banning smoking and mobile use: ticketing violators.

**Category II—Engineering**

(1) Engineering and technical measures: improve planning; design; and construction practices for highways.
(2) Improving pedestrian facilities: channelize and identify pedestrians’ facilities to reduce conflict with motorized traffic.
(3) Improving public transportation means: provide competitive service with more coverage.
(4) Providing safety barriers, marking, signs: improve street furniture and traffic control devices.

**Category III—Education**

(1) Launching traffic safety campaigns: promote safe driving behavior in a series of scheduled and sustained program.

**Category IV—Driver/vehicle testing and licensing**

(1) Tightening vehicle licensing procedures: elevate the operating conditions of motor vehicle fleet.
(2) Increase driving practical training hours: improve the driving skills prior to licensing.
(3) Increase driving theoretical training hours: improve the driving knowledge of rules and regulation prior to licensing.
(4) Tightening driving test procedure: improve the competitiveness of licensed drivers.
(5) Improving the capacity of driving instructors: capacity building by certification and routine follow-up.
(6) Tightening driving license procedures: by increasing the standards and pushing up the passing thresholds.

**Category V—Administrative and rescue service**
(1) Establish specialized traffic courts: currently, traffic-related legal cases are referred to regular court system.

(2) Establish higher council for traffic safety: to be responsible for accomplishing the country strategy in traffic safety.

(3) Improving rescue and ambulance services: through management and coordination.

Although, the above categories are distinct theoretically, the interaction between and among each other is well investigated in the literature and beyond the scope of this paper. The infrastructure remedial measures related to geometry and pavement should be supported by traffic control remedial measures to come up with one integrated engineering perspective that can be supported by education and enforcement.

5. Data analysis
The selected analysis is aiming at testing the following hypothesis:

• General public have the same perception of traffic safety as road specialist.
• Road user involvement in traffic incidents is related to the seriousness of these events.
• People assess their experience in traffic in the same way they assess other people experience.
• The community desire to implement traffic safety measures is related to their effectiveness.

The variables included in the analysis are ordinal variables and the appropriate tests are based on cross tabulation analysis, which include both Chi Square, and Spearman correlation. Chi-Square test based on analyzing subject responses on a five-point scale whereas Spearman correlation analysis, which considers two categories which involves converting the five-scale to two categories (Frequency: Common and Less Common, Riskiness: Slight Risk and Risky). The first three-points on each scale form the first group and the remaining two-point scale forms the second group.

Road specialists believed that engineering measures are means to improve safety conditions, which is in good agreement with general publics’ believe. Running traffic safety campaigns and conduct traffic education programs are ranked high in both groups priority that deemed necessary to upgrade safety condition in the country. Improving vehicle and driving licensing procedures are ranked high by road specialist group but not by the general public group. Road specialists also believe that improving rescuing procedure would reduce the severity of traffic accidents, which is to some extent in agreement with general public group view. Although both general public and road specialist stress the need of providing safe pedestrian facilities but they did not rate their effectiveness as high as providing more signs as indicated by general public or stress the need to improve
driver instructor level as suggested by road specialists (Figure 7). Road specialists believe the improving rescue service would have the most effective measures to be taken; they think also that positive impact of up-grading of driving instructor capacity would be high on traffic safety. On the other hand, general public thinks that providing sign and marking would be the most effective means to improve road safety followed by improving the quality of pedestrian facility.

There is a significant difference in rating the needs or the desire of providing the proposed measures between both groups of subjects ($\rho = 0.661$, $p = 0.003$). However, they agree on their evaluation about the effectiveness of the presented remedial measures ($\rho = 0.313$, $p = 0.205$). There is a tremendous agreement on rating for the need of providing each measures and their effectiveness as indicated by Chi-square test (Figure 7) with a few exceptions reported for the following measures:

- The need and the effectiveness of providing more signs, marking and safety barriers
- The effectiveness of installing more cameras and other automated surveillance means

6. Discussions of results
The development of road traffic accidents in Jordan over the last 20 years showed a decrease in fatalities per 10,000 vehicles but not when considering fatalities per 100,000 people. Road accident is perceived as the main health concern for the community, which was also indicated by the results of the survey.

The measures that have been taken place over the past 20 years were always resulting in short-term effect that did not last for long or maintained continuity over the years. The measures were mostly related to enforcement and legislations aspect. Implementation of engineering measures was limited and if provided they were targeting capacity issues and localized in most cases without maintaining a systematic pattern that might support a positive behavioral pattern. Political situation in the region impose some impact on road safety, partially due to general attitude and social issues, but mainly due to financial difficulties.

The community stresses the need of considering infrastructure measures to improve safety as well as running traffic safety campaigns. Enforcement measures were not desirable as other
measures. There is a significant relation between the community desires of providing safety measures and their effectiveness.

The overall international vision towards improving road safety (Roles and responsibilities of different organisations in tackling road safety, XXXX) requires the participation of many different organizations and sectors. No one sector working alone can effectively reduce the number of road accidents and/or deaths. This international vision is not adopted in Jordan, although many non-governmental agencies were established after the 2008 single crash to commence individual safety initiatives. No plan of coordination took place, and the unsustainable “positive” impact remained minimal.

In Jordan, no leading institution is taking responsibility to coordinate and manage the effort to establish a practical strategic plan for the future with a balanced blend of safety countermeasures. The strategic plan should incorporate room for collective efforts from all organizations (private and public) to tackle the traffic safety problem in Jordan. The international success stories in Fiji; Australia; and many other countries are leading examples (Asian Development Bank, 1997) in developing effective strategic plans to improve traffic safety.

International research (Nordfjærn, Şimşekoğlu, & Rundmo, 2014; Nordfjærn et al., 2014) is focusing on the effect of human factors and road traffic culture to improve safety, some conclusions are directing the decision-makers towards this issue, to accommodate psychological cognitions and driver behavior jointly with investments in developing the road infrastructure.

A balanced blend of safety countermeasures must be well planned for the coming 10 years to improve traffic safety in Jordan. Such plan should be based on practical strategic planning. Future research will consider the assessment of accomplished safety countermeasures in Jordan during the past 20 years to examine if Jordan is maintaining balance in measures taken to improve safety, or more emphasis were given to one measure compared to others, such as enforcement, and paying less to psychological cognitions and driver behavior.
of road safety: The South-East Asia Region—A Call for policy direction.