

A study into Pedestrian Safety Problem in Jordan

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Introduction

A Road traffic accident is a serious problem in Jordan. Road accident fatalities and injuries are increasing with no sign of being under control. Fatalities increased by 14% compared to 2000 (PSD, 2002). Injuries dropped 0.05% for the same period. On average, fatalities are increased by 7% per year. Fatality rate was 151 fatalities per million inhabitants in 2001. Pedestrians in Jordan suffer the most with a fatality rate of 61 pedestrians per million inhabitants. This fatality rate is high when compared to international statistics. The rate in Europe is 14 pedestrians per million inhabitants; it is the lowest in the world (Berg, 2002). Forty per cent of all traffic fatalities in Jordan are pedestrians and half of it is among children under the age of 15 years.

Other countries experience the same problem. Over 50,000 children are injured as pedestrians in the USA, with 1,800 deaths (children's hospital of Wisconsin, 1998 cited in Macgregor et al). A study in USA showed that children between the ages of 5-9 are involved in accidents within a 100 yards (90m) of their homes, while 10 – 16 year old are more likely to be involved in accidents as part of their journey to or from school (Preston, 1994). Jordan (1998) analysed 2,167 pedestrian accidents in Philadelphia. He found that more children are injured in route to or from school, but not near the school. A greater number are injured while playing after returning home from school rather than during the trips to or from school. In The Netherlands 90% of accidents occurred in children on foot or on bicycles within built-up areas. Although parents transport their children to and from their destinations in cars; still 50 children [up to 14 years of age] die in The Netherlands in traffic accidents each year (Westdijk, 2001)

A study in Montreal, Canada revealed that accidents among children pedestrians occur more frequently on weekday afternoons during summer months. They are more likely to happen at mid-block in residential areas. Male children between the ages 5 to 8 are the main victims (David and Rice, 1994). Cheng (1991) investigated the trend of Utah's pedestrian accident rate and discussed factors involved. His study produced similar results to David and Rice (1994). He showed that a) pedestrians of age group 5-10 are the major group involved in Utah's pedestrian accidents; b) most pedestrian accidents occurred in daytime and the peak time was 3:00 p.m. to 7:00 p.m.; c) more pedestrian accidents occurred between intersections than at intersections; and men and boys are involved in more than twice as many pedestrian accidents as are women and girls d) traffic-control devices do not guarantee a safety zone for pedestrians.

General accident statistics in Jordan do not provide such level of details to make any comparison. However, still it is possible to indicate that pedestrian accidents, regardless of age groups, occur more frequent on the afternoon, on daytime and in dry weather conditions (PSD, 2002)

Generally, children are considered a high risk pedestrian group. This may be due to. Children conception and perception of traffic situations is not always well developed (Gibby and Ferrara,

2001). They have problems perceiving direction of moving traffic or estimating the speed of oncoming vehicles. Their perception of the direction and meaning of sounds is not matured. Children are small to be seen clearly by drivers. In addition children have poor understanding of the use of the roadway and the installed traffic control devices.

It is easy to say that we need a better education for children. MacGregor et al (1999) found that there was a gap between what children are taught to do and what they are actually do. They made interviews with children parents. They carried out field observations of children crossing signalised and non-signalised intersections in the same area where interviews took place. Parents were asked about road crossing training that they taught their children. All parents reported that they taught their children safe crossing rules in steps. Observations showed that 33 percent of unaccompanied children performed no visual search before crossing at non-signalised junctions. It increased to 48 percent at signalised junctions.

A research into the significant factors affecting school children traffic behaviour and their high vulnerability towards road accidents was carried out in the Czech Republic (El-Araby and et al., 1996). It was found that socioeconomic background is the leading factor affecting children's behaviour followed by type and stage of school. Children' gender was found to affect only traffic perception and attitude. No significant difference was found between boys and girls in traffic knowledge and skills.

In Jordan, children pedestrian accidents and behaviour have not been investigated. It is believed that children perception would not differ geographically. It is true that driving cultures are different. The implications of different driving cultures on children may influence their behaviour and attitude to traffic. For example, In Jordan the existing road infrastructure is of modest standards. Pedestrian facilities are lacking and they are not used to pedestrian crossing. These crossings are a few in numbers and if they are provided, pedestrians are rarely given priority. Traffic safety awareness may be a contributing factor influencing both pedestrians and driver behaviour. This would affect road accident numbers and their consequences.

This paper addresses pedestrian safety problems in Jordan with particular emphasis on children.

Research objectives

Pedestrians under the age of 15 years are at a high risk of being either killed or injured in traffic. In an attempt to explore the various aspects of this problem, the following objectives are formulated.

- Analyze accident data to identify the nature and size of pedestrian accident problem with emphasis on children.
- Examine children risk of being involved in accidents
- Explore children walking activities particularly on their school trips.
- Evaluate children attitude towards traffic safety issues.
- Assess pedestrian knowledge of traffic rules and compare their knowledge with their parents' instructions.
- Appraise school route environment from pedestrian children safety perspective.

Methodology

Accident data at national level were reviewed and analysed. Children activities and attitude towards traffic and their knowledge of traffic safety rules were examined. Three questionnaires were designed. The first questionnaire was for children, the second was for their parents, and the third was distributed to their schools. Observations of children behaviour while walking and crossing roads were analysed to assess their actual behaviour. Finally, observations on routes leading to school were made to assess how walker friendly their environments are.

Ten schools were selected in the Greater Amman area. Amman is the capital of Jordan with a population of 1.87 millions and area of 8,231 km². Education in Jordan is provided by public or private sector. The United Nation also provides education to the Palestinian refugees but they were excluded from the study. Seven out of the ten selected schools were public schools. This selection reflects the number of public to private schools in the study area.

The school principle was asked to fill in school questionnaire. The questions were designed to examine school's role in providing a safe environment and its responsibility to increase traffic safety awareness for its students.

One student in each class in each school was selected. A total of 198 students participated in this survey. He/ she were asked to fill in the children questionnaire. A number of questions were included to examine children mode of transport to and from school. Other questions dealt with their other walking activities, route selection criteria, experience of danger in traffic. They were also asked if they have been involved in accidents during the last three years. If they were involved, further questions were put forward to examine the accident conditions and its consequences. The final part of student questionnaire was aimed to explore their knowledge of traffic safety rules. They were asked to report who taught them these rules.

The parents of the selected child were asked to fill questionnaire designed to explore the family walking habits including their selection of the mean of transport to school. A question on children involvement in accidents was included together with a set of questions that explore how the accident/accidents happened. Parents were asked if they feel that their children were safe in traffic. The final part was designed to explore parents' role in educating their children on traffic safety issues. They were asked to list traffic safety rules that they taught their children. The number of families included in the survey was 197. By coincidence two brothers from the same school, but at different class levels were selected. This resulted in 198 students from 197 families.

Observations on the routes within an area of 1-2km radius were completed by examining the following:

- Route pavement conditions: The pavements were assessed in terms of width, maintenance conditions, continuity, slipperiness, use for other purposes [vendors, parked cars] and the existing of light and advertisements poles.
- Pedestrian crossing: Observations included, was the pedestrian crossing marked and were appropriate road signs provided. Road environment in the crossing vicinity was assessed [wide road, high speed traffic; parked vehicle or trees that obscured the view]. Observations include checking if traffic calming devices ahead of the crossing were installed.

- Driver behaviour on pedestrian crossing [if available]. Driver speed at crossing was monitored.
- Did the driver comply with the rule that pedestrians have the priority on the crossing?
- Pedestrian ability to comply with traffic rules: Answers to questions like can pedestrian stop safely at the pavement adjacent to the crossing? Is the pedestrian visible to the driver? Are crossings designed in such a way allows pedestrians to visually search before crossing?
- The attractiveness of the routes for walking: Questions like is the road lit? Are plants grown on road side? Have benches been provided? Are shops available on road sides? Are roads and pavements clean?
- School location: Questions like is the school located on a main road with high speeds; is its main entrance on a minor road? Has its site been provided with the necessary marking and signing and are speed humps present?

Observations included monitoring pedestrian behaviour in traffic. Two pedestrians from each school were followed from the moment they left the school until they arrived home. Information on the time required to complete their trip is recorded. Their crossing behaviour was closely observed. The proportion of time spent while walking on the pavement or on the road was reported. Traffic conflict involvement was also included as part of the observation process.

Method of analysis

Descriptive statistics were used to analyse the data. Chi-square and Cramer's tests were carried out when examining the relationships between categorical variables. T-test was performed to investigate mean differences of interval variables.

Results

Accident analysis

Police reported accidents showed that the total number of fatalities in 2001 was 783 compared to 686 in 2000. The population of Jordan for the same period was 5,182,000. The registered vehicles were 509,832 vehicles. Pedestrian fatalities were 316. Number of fatalities for age group under 15 years was 154.. Accident data for the period (1996-2001) indicates that the number of pedestrian fatalities is on the increase while injuries started to decline since 1999 (Figure 1)

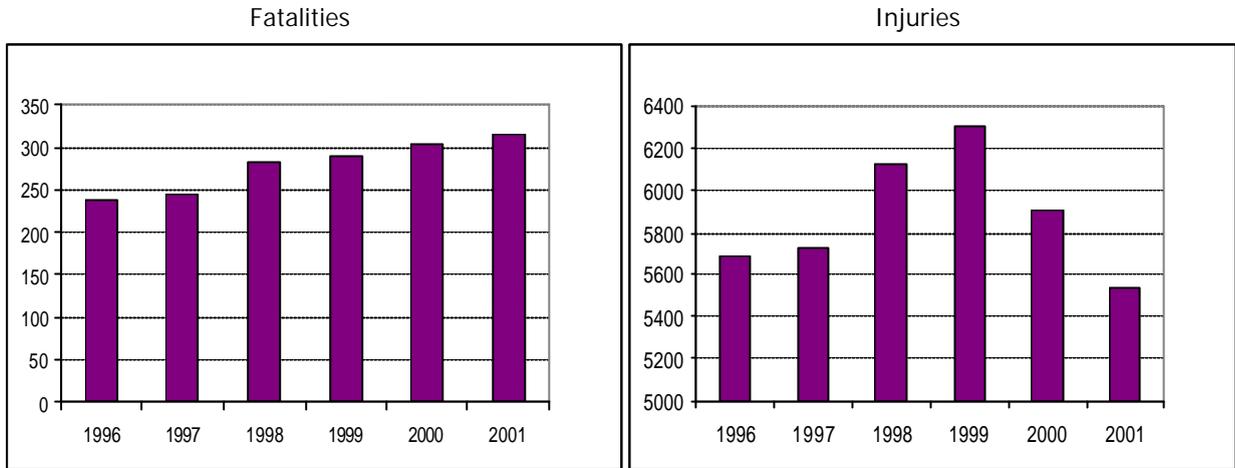


Figure 1 Pedestrian fatalities and injuries in Jordan, 1996-2001 (PSD, 2002)

Comparing the road fatalities in Jordan with other countries indicated that fatality rate for the age group 0-15 is three or four times as high as in the industrialised countries. The elderly are at high risk as well (Figure 2).

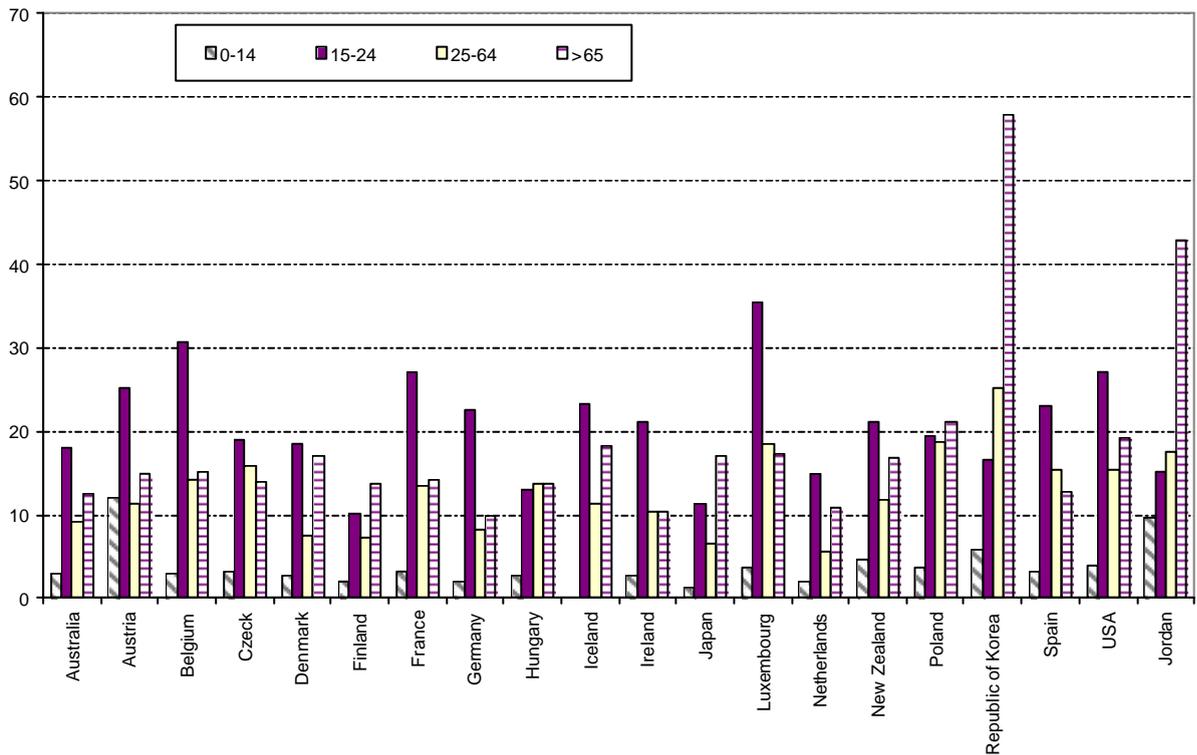


Figure 2 Road fatalities by age group for a number of countries (IRTAD, 1999 statistics, PSD, 2001 statistics)

Pedestrian accidents comprise around 11% of all reported accidents. Pedestrian accidents share of all fatal accidents in 2000 was 49%. They resulted in 43% of all fatalities in traffic accidents. It dropped in 2001 to 40% of all traffic fatalities. The number of injured pedestrians showed a similar drop between 2000 and 2001. Forty-seven percent of all accidents resulted in injuries in 2000 [they produced 31% of all injuries in traffic]. It was reduced in 2001 to 29% of all injuries in traffic.

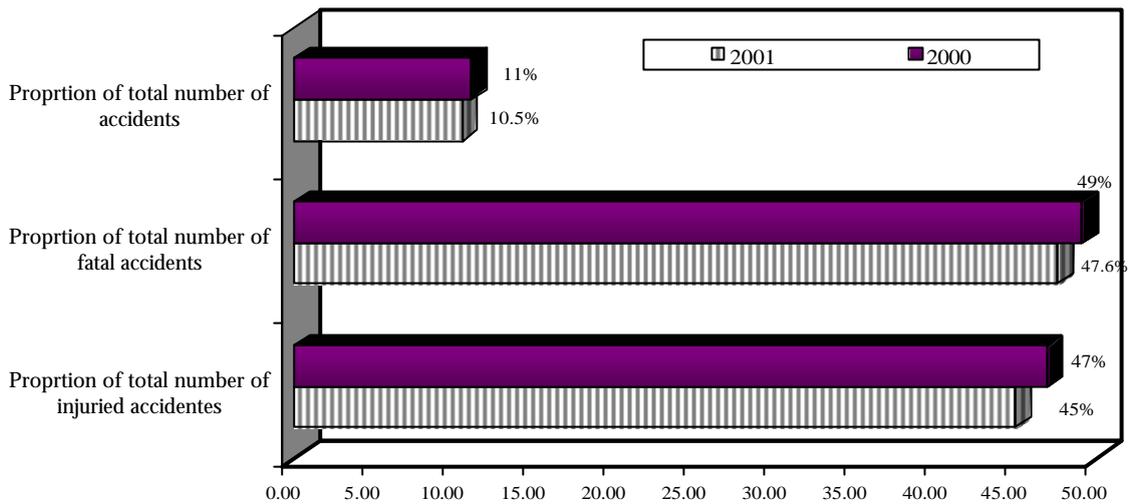


Figure 3 Pedestrian accidents proportion of all accident-fatal accidents and injury accident (PSD, 2001; 2002)

Most of pedestrian accidents occurred on roads with a speed limit 40 km/h. Sixty five percent of all pedestrian accidents occurred on road with speed limit of 40km/h in 2001 compared to 52% in 2000. Roads with speed limit of 50km/h came second, with 17% of reported pedestrian accidents in 2001 compared to 23% in 2000. Only five percent of all pedestrian accidents were on roads with a speed limit above 60 km/h (Figure 4). This implies that most of pedestrian accidents are in urban areas.

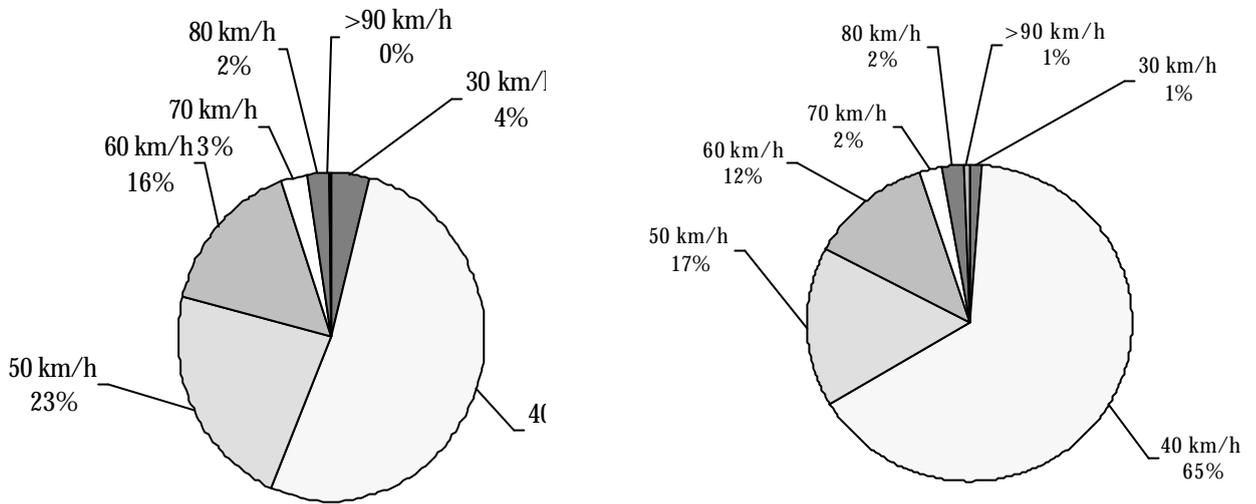


Figure 4 Pedestrian accidents by speed limit (PSD, 2001; 2002)

Thirty eight percent of pedestrian fatalities involve passenger car. Passenger cars comprise 65% of all registered vehicles in Jordan. This is proportional to the percentage of passenger cars in the traffic (Figure 5).

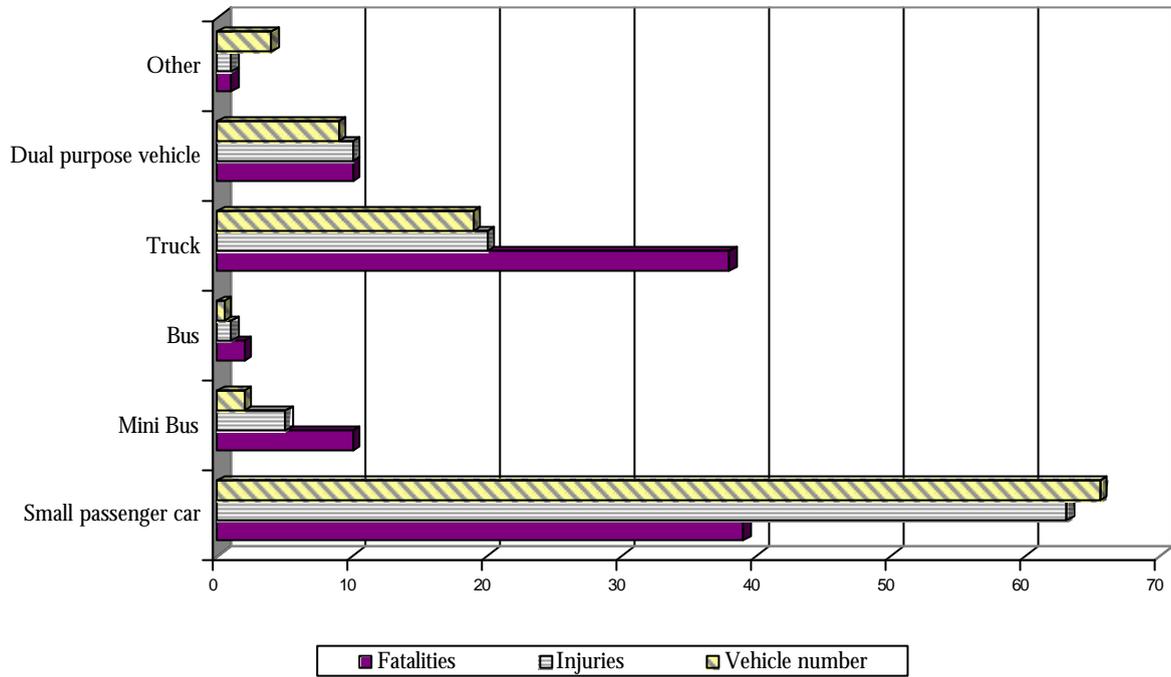


Figure 5 Proportion of pedestrian fatalities and injuries by vehicle type and proportion of each type of vehicle out of all registered vehicles in Jordanian fleet (PSD, 2001)

Heavy good vehicles caused 38% of pedestrian fatalities while they represented 20% of all registered vehicles. Mini-buses are more used than buses. They caused 9% of pedestrian fatalities and they represented 2.2% of all vehicles. Buses represent only 0.5% of all registered vehicles.

Child pedestrian accidents

For the purpose of this study, children were defined as those under the age of 15 years. They were further subdivided into three groups. Children under the age of 5 years form the first group. The other age groups are 6-10 years and 11-15 years. Children were 49% of all pedestrian fatalities in 2001 in Jordan. Females constitute only 27% of all fatalities. This low proportion is may be due to the fact that females are not equally represented in traffic as males (Wallberg and Wisenborn, 2000).

If we relate all fatalities or injuries of each age group to its population; we found the highest fatality rate is among children under the age of 5 years. The highest injury rate is among children of the age group 6-10 years (Figure 6). Fatality and injury rate was the lowest for the third age group. High fatality rate for the under 5 years indicates this is a serious problem and it needs to be addressed. Why such a group is at a high risk of being killed in traffic? The answer to this question may be that they might have been left unaccompanied in traffic! They are the most vulnerable group as pedestrians. If they are involved an accident, the consequences are more serious.

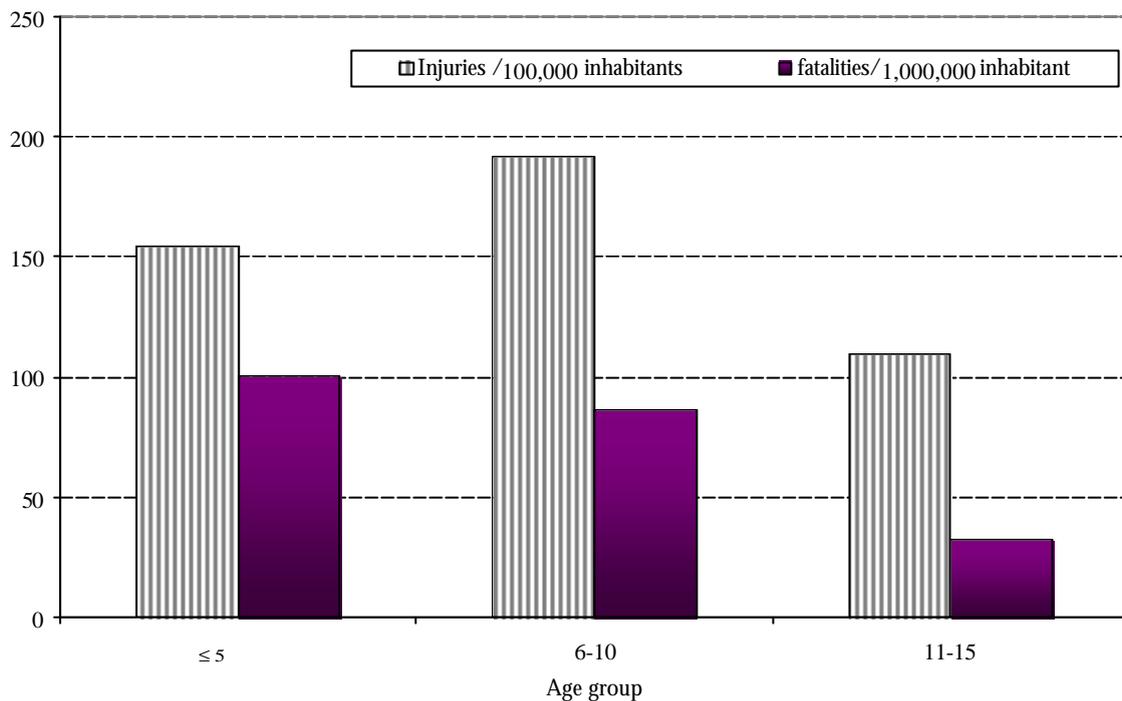


Figure 6 Child pedestrian injury/ fatality rate by age group (PSD, 2002)

Pedestrian fatalities among children dropped in 2001 when compared to 2000. In contrast, overall pedestrian fatalities increased. While Injuries for all age groups dropped (Figure 7).

According to police statistics, eighty five percent of pedestrian accidents occurred while crossing. Eleven percent of pedestrian accidents occurred while walking along the road. No details are available for each child age group.

The majority of children under age of 15 years go to school on foot. In a country with a low vehicle ownership level{which does not exceed 98 vehicles per 1000 inhabitants}, it is expected that walking is a common means of transport particularly among children.

We need to investigate children attitude and behaviour in traffic, to define the extent of traffic safety problems amongst this group. We decided to use children's' school trips as the means to provide us with an insight into children's' behaviour in traffic.

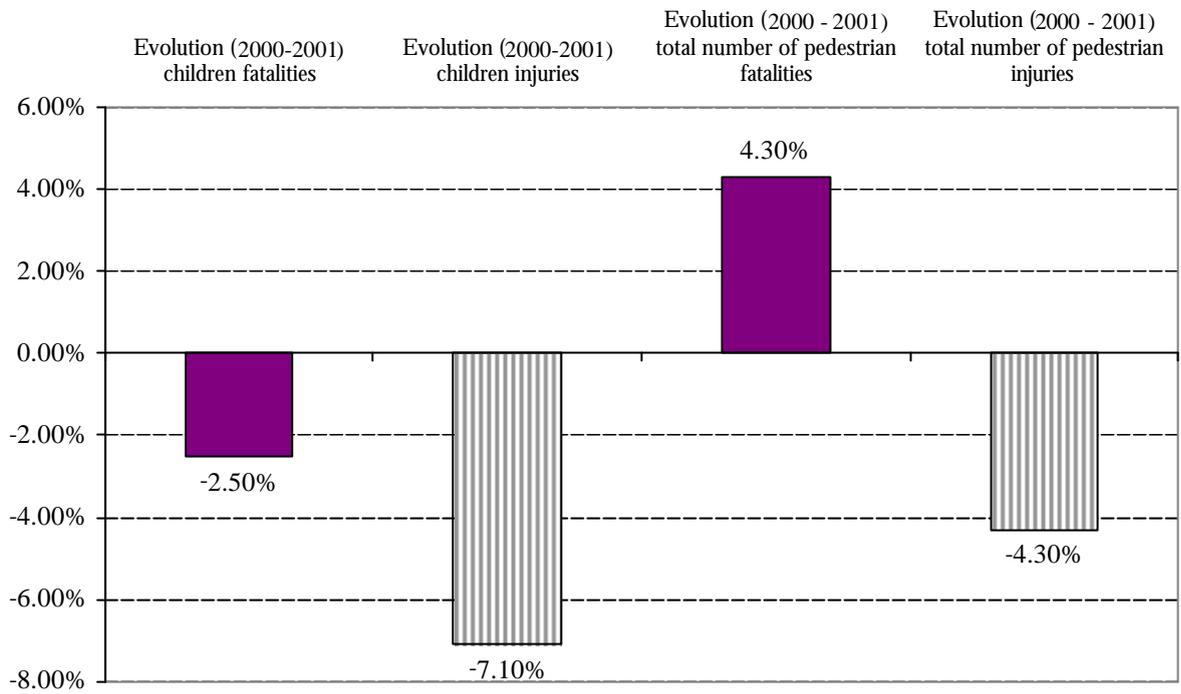


Figure 7 Evolution in number of pedestrian fatalities and injuries compared to child fatalities (PSD, 2000; 2001)

Survey of Children

Children's answers to the questionnaire were analysed and cross examined with their parents' answers where necessary. The results are as follows:

Mode of transport to and from school

Forty nine percent of children participating in the survey walk to school while fifty-seven walk home. Many children are driven to school by their parents' car but some who are driven return home walking (Figure 8). There is significant difference between mode of transport used and type of school (Figure 9). Fewer students walk to private school. A higher proportion of private school students go to school by bus. Chi-square test indicates that there is difference between the mode of transport used by children and type of school (tested at 5% level of confidence). Private schools provide a school bus service. This was the main cause of the significant difference. Car ownership level is another factor that might contribute to the difference in mode selection. In general, a high proportion of families included in the survey own a car. Sixty three percent of all families in the sample own a car. The proportion is higher among families with children in private schools [87% in private schools and 53% in public schools].

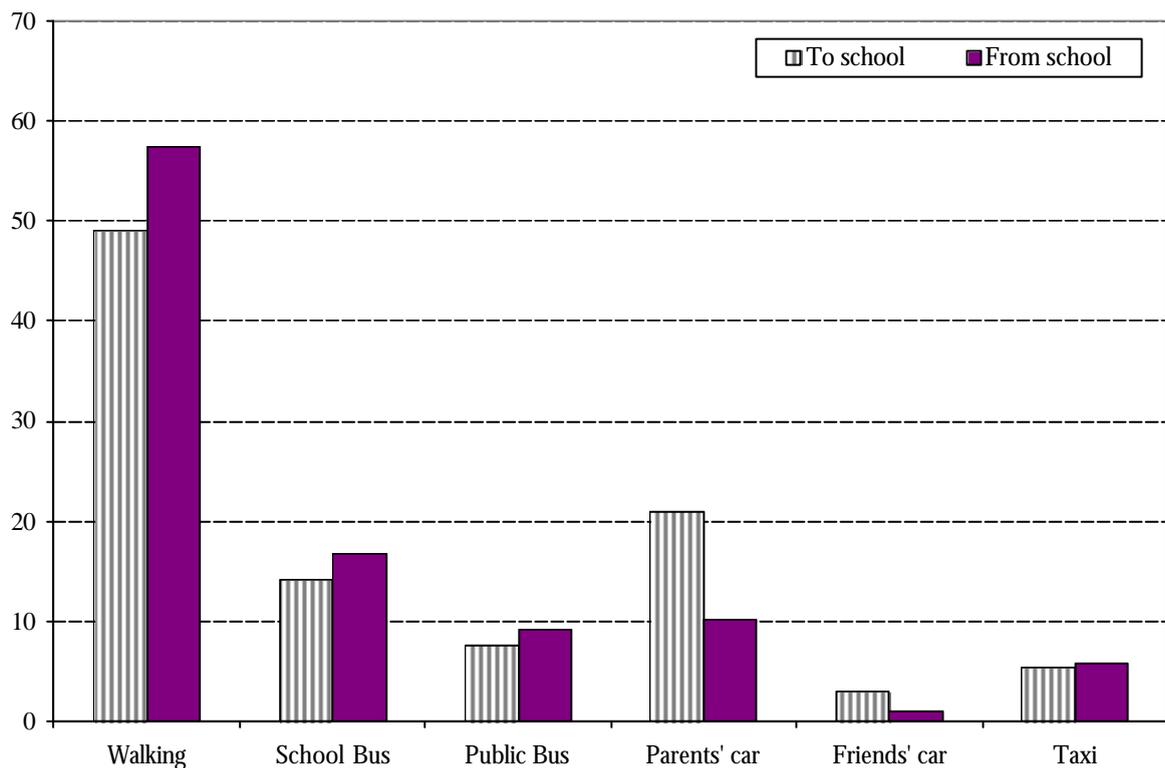


Figure 8 School trips by mode of transport (private and public schools' students)

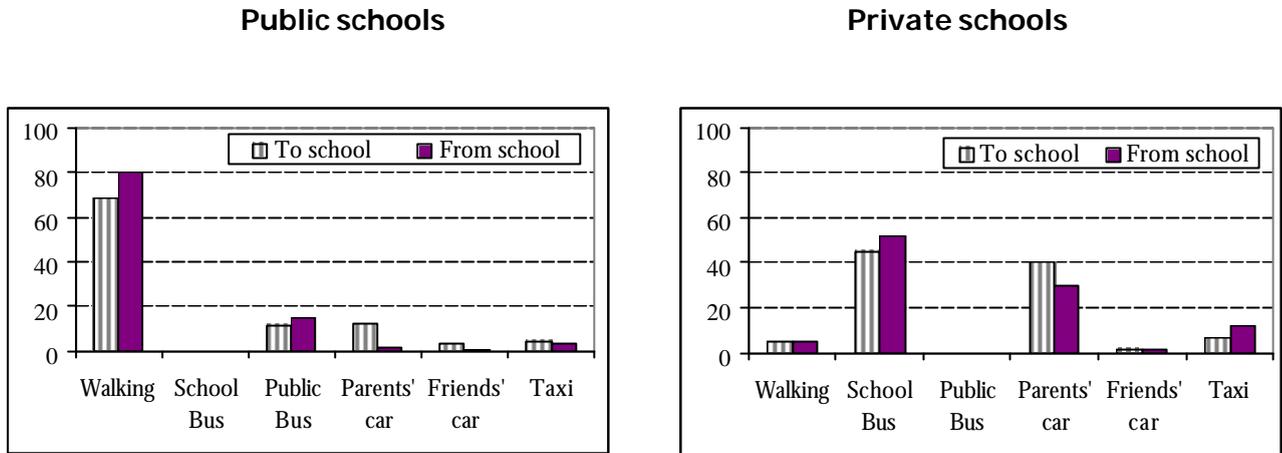


Figure 9 School trips by mode of transport by school administrative type

Data collected from the parents' questionnaire showed that 50% of all children in families participated in the survey are walking to school (Figure 10). Children driven by their parents constitute 21%. These results are in good agreement with the results obtained from children who were interviewed.

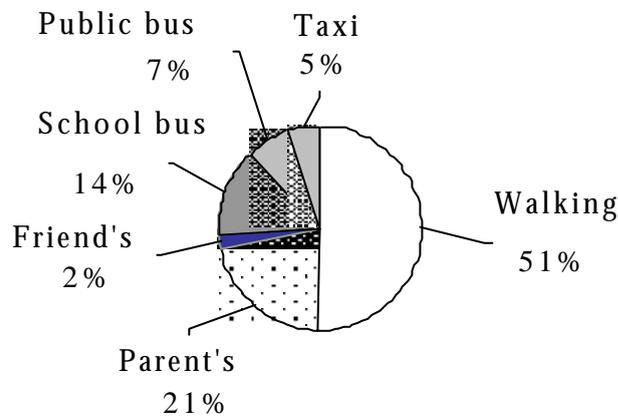


Figure 10 All families' children mode of transport to school

Children were asked if they had any preference regarding mode of transport to and from school (Figure 11). Their answers indicated that many of those walking prefer either going by school bus or by car. Many of those who go by bus prefer go with their parents. Chi-square test indicates that there is significant difference at 5% level of confidence between the present choice of student and their preferred choice. The difference between what they prefer and what they do is more pronounced for back home trips. This maybe attribute to weather conditions. Temperature at noon is high and children do not like to walk.

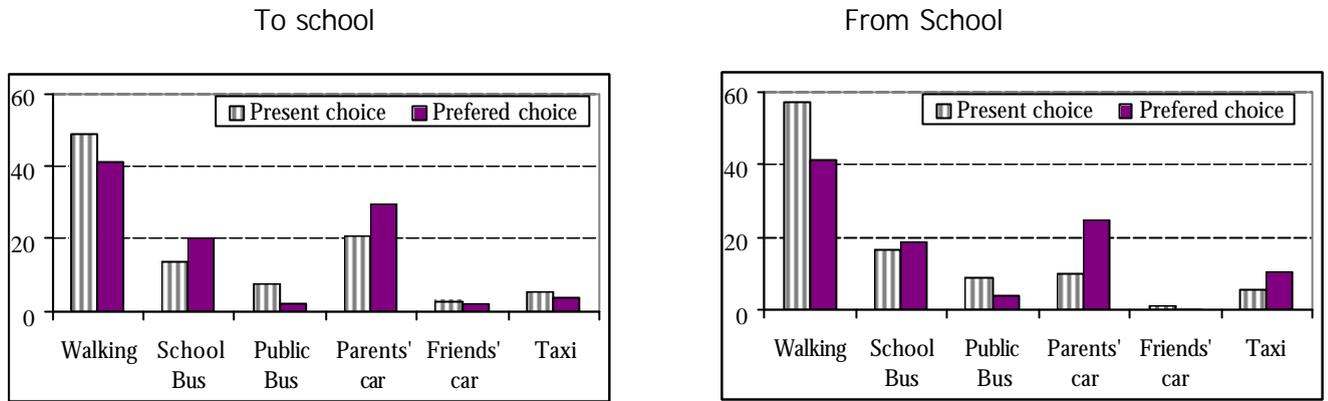


Figure 11 Comparison between the selection of mode of transport at the present time to and from school and what is the preferred choice.

If the students were walking to school, they were asked to give information about style of walking. Most of children are walking with friend of same age. A high proportion of male children are going to school alone compared to female children (Figure 12). Chi-square test that there is no significant difference between walking styles of children due to gender for going to school trips. There is a significant difference between walking styles of children due to gender for returning home. All tests are made at level of confidence of 5%.

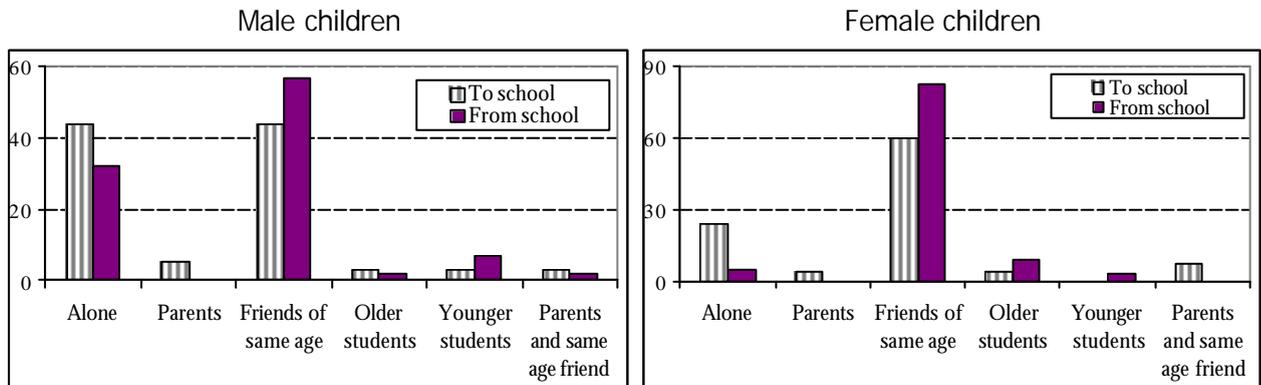


Figure 12 Walking style by gender

The average time of walking is 13 minutes (from home to school and almost the same time vice versa). There is no difference between times spent on walking due to gender. Female average walking time is 12.6 minutes compared to 13.7 minutes for male. Average time of travelling by car to school is 10.6 minutes (11.1 minutes for males and 9.5 minutes for female). Walking to or from school composes 47% of all time that females spend walking every day. The corresponding value for male children is 45%. Children were asked if they do other activities that require them to walk without being accompanied by adults. Seventy percent of all interviewed pedestrians

indicate that they do such activities. Parents' responses on a similar question showed a good agreement with the children's response. Seventy six percent of all interviewed families indicate that their children do other activities that require them to walk without being accompanied by an adult.

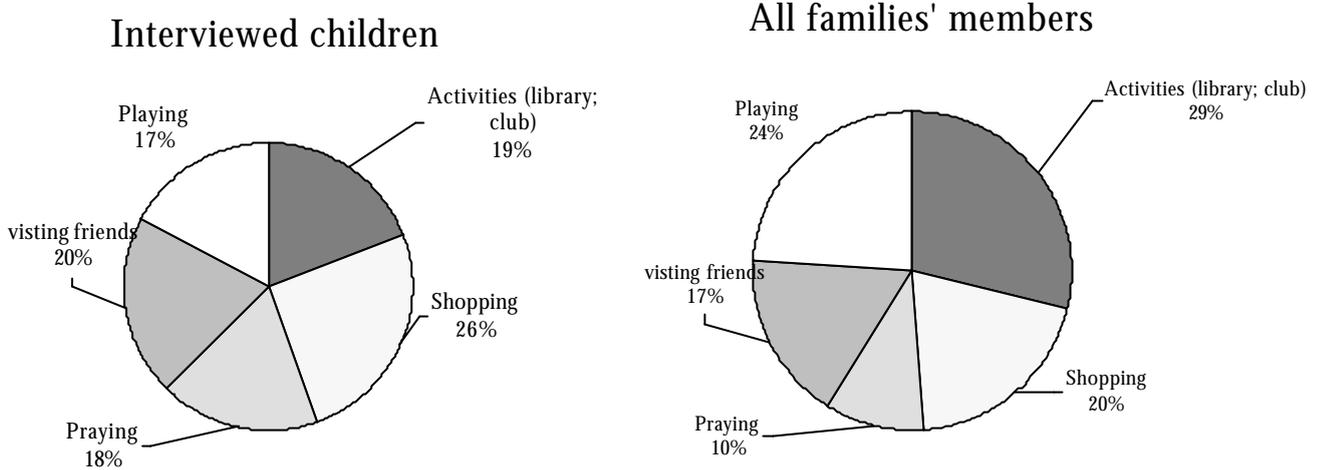


Figure 13 Activities performed by children after school hours

Activities that are performed vary from playing to shopping. A high proportion of interviewed children stated that they do some shopping for the family. Parents indicated that many of their children are doing shopping for the family (Figure 13). One suggestion might be that it is advisable for parents or an adult to do such activities.. Eighteen percent of interviewed children reported that they go alone to pray, a slight proportion was indicated by their parents. Since praying is a collective activity children can be accompanied by one of his parents or an adult person in the family. To secure a safe environments children should not be on their own while performing some of these activities. Good planning is also needed to provide safe environments for children to play whilst adults attend such activities. Interviewed children were asked to state the time they spend walking per day (Figure 14). The results show that, on average, their daily walk is one hour. There was no significant difference between time spent on walking by children due to gender (time spent was categorised into four groups and chi-square was used to test for differences due to gender at level on confidence of 5%)

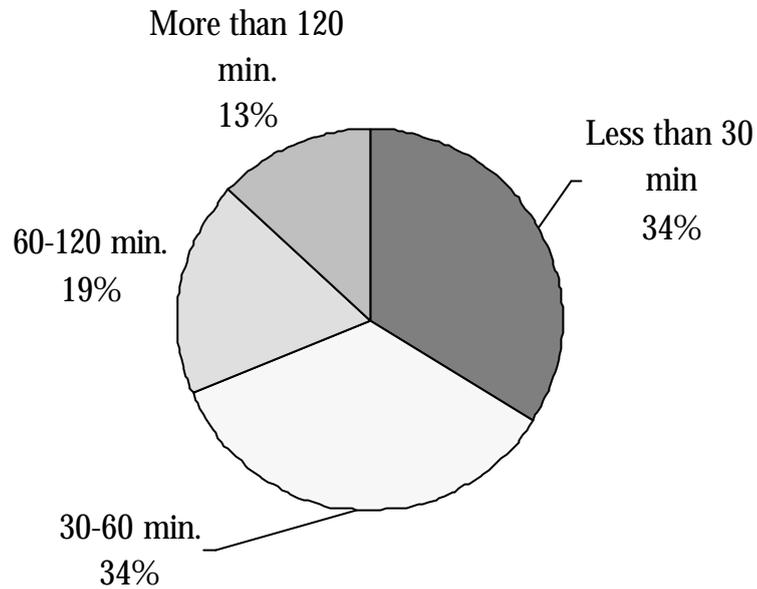


Figure 14 Daily walking times for children

Data collected on all family members (questionnaire filled in by the child's parents) shows that the father of family spends 69 ± 46 minutes walking each day. Mother of family spends 62 ± 38 minutes. Children in all families participating in the survey walk for 73 ± 43 minutes. It is clearly shown that children are walking for longer periods than parents. This exposes them to a higher risk of being involved in pedestrian accidents (Figure 15)



Figure 15 Comparison between time spend walking by family member

Children walking experience

Children were asked to state why they walk. They were also asked to state reasons that discourage them from walking. They were given a list of possible answers and were asked to choose up to three choices for each question. Answers were analysed due to gender (Figure 16). The results show that a high proportion of female and male children stated that they walk because they can go with their friends (22%). The enjoyment of walking was the second in rank for males, while it ranked first for females. The proportion of females selecting this answer among their choices was slightly higher with 22%, while it was 17% for male children. Results indicate that female feeling of freedom was ranked high in their answers (15%). Male children indicate that they walk since they are able to do other things as well (17%). A very small proportion of children walk because they see it as a form of sport. There was no statistical difference between children answers due to gender.

Children's answer to the question "What are the reasons that discourage you from walking?" indicate that reason like 'getting wet on rainy days' or 'heavy school bag' were ranked very high on the children's answers. Eighteen percent of all interviewed children included "afraid of being wet in rainy days" as one choice when they answered this question. A higher proportion of males selected this answer (20%) compared to 17% for females (Figure 17). Answers like "afraid of being involved in accidents" was not as high as the previous stated answers (9%). A slightly higher proportion was reported for males (11%) compared to 8% for females. Speed is a concern to students. Thirteen percent of all students mentioned high speed as an issue that discourages them from walking. This was higher in females; 14% for females versus 12% for males. There was no significant difference between males and females answers when tested by Ch-square test at 5% level of confidence.

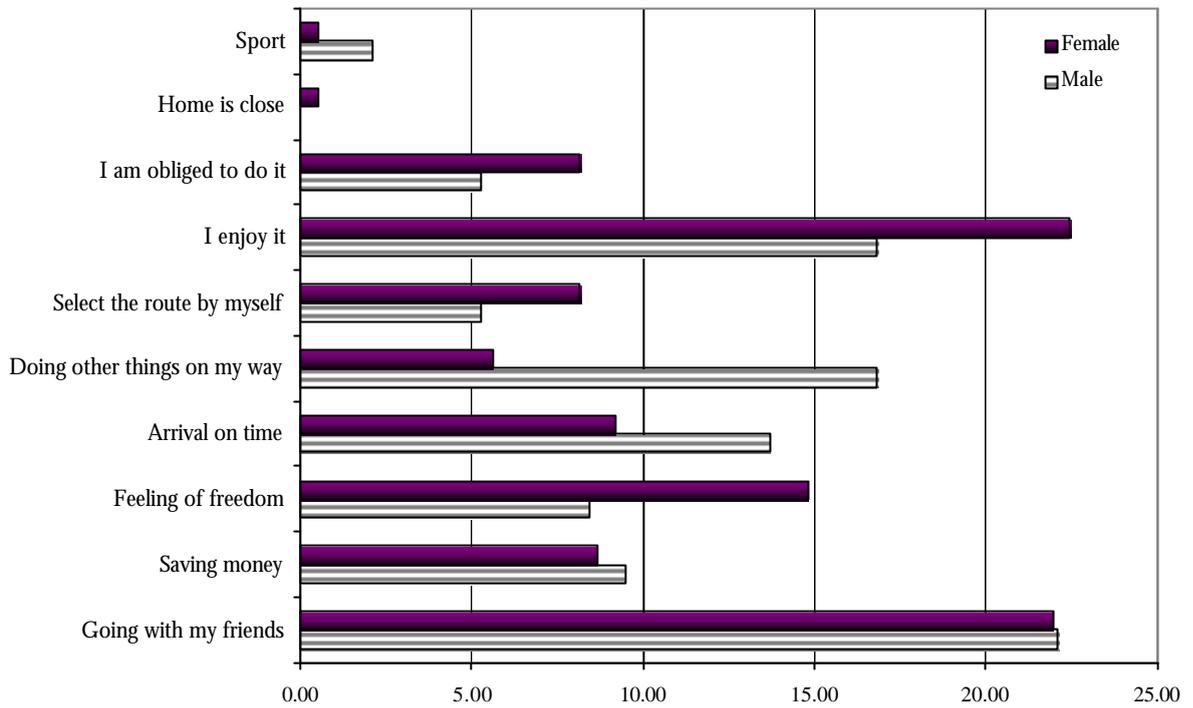


Figure 16 Children answers for “What are the reasons that make you walk to school?” expressed as percentage of each choice out of all answers received.

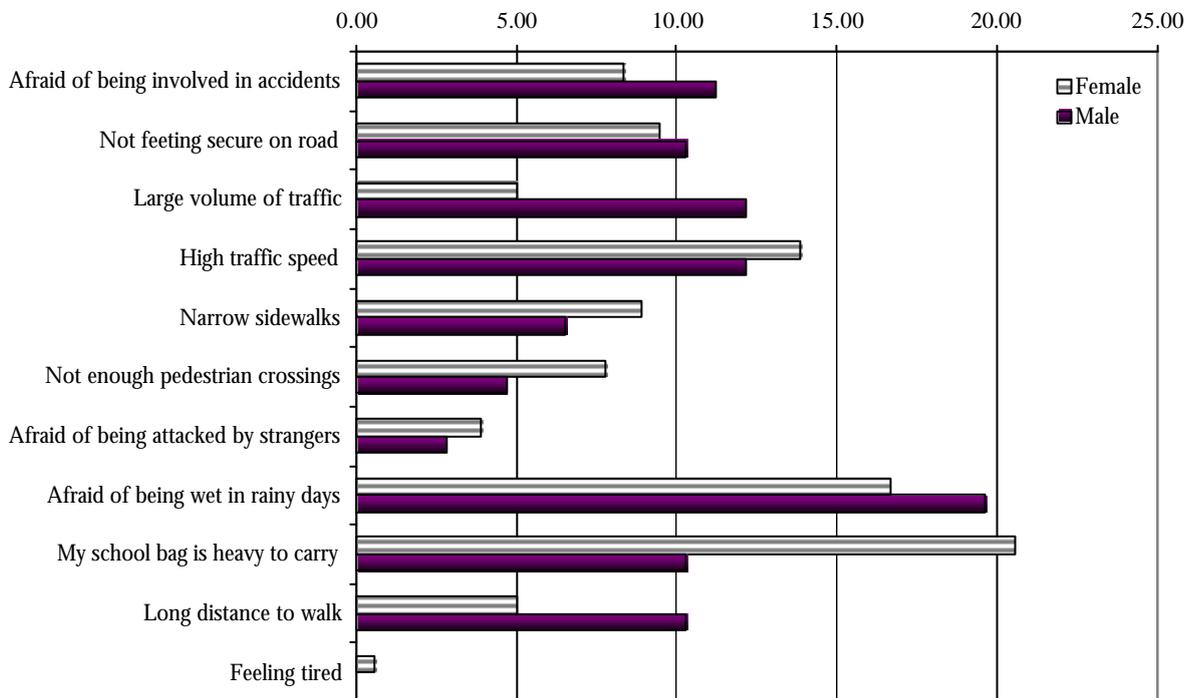


Figure 17 Children answers for “What are the reasons that make you not to walk to school?” expressed as percentage of each choice out of all answers received.

Children were also asked “The route you select to your school is characterised by” A list of nine characteristics were put forward. Students were asked to choose up to three characteristics. Most of the children asked stated that they chose the shortest route to school (Figure 18). Male children with a proportion of 33% select this choice among their answers while the corresponding female proportion is only 23%.

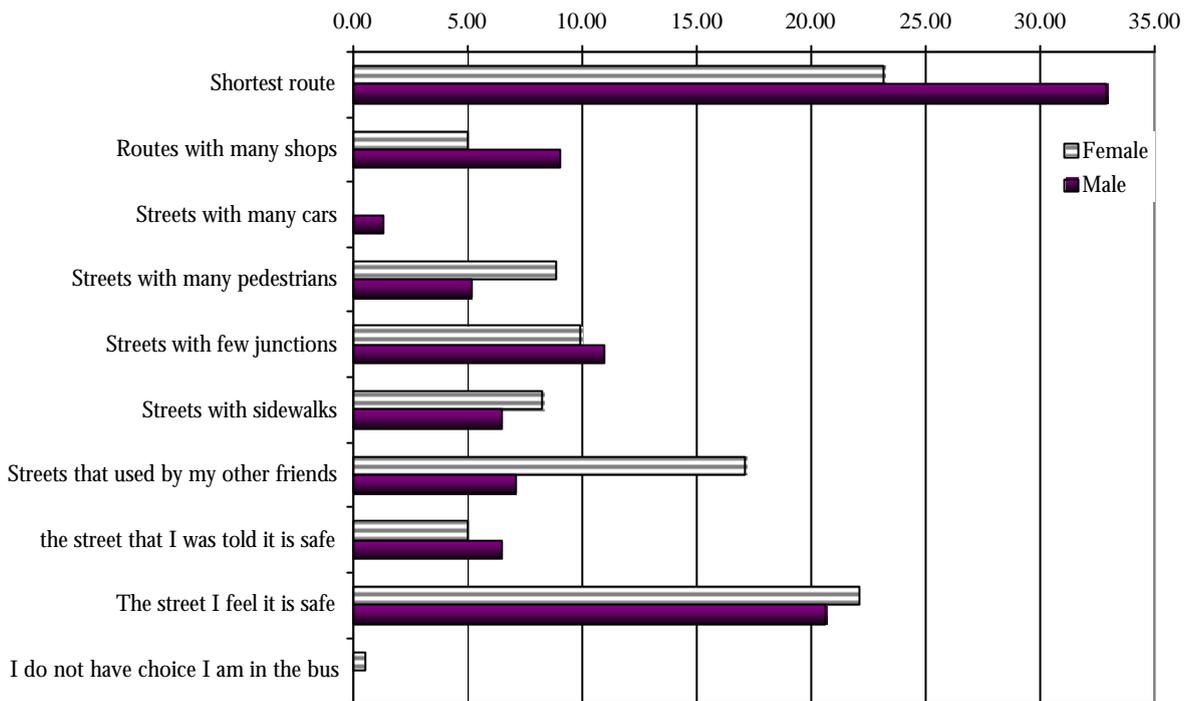


Figure 18 Children answers for “The route you select to your school is characterised by” expressed as percentage of each choice out of all answers received.

The second rank characteristic is “the safest street”. Females select this answer more frequent than males. Interestingly, seventeen percent of female answers indicated that they take the route that is selected by their friends. This should be read together with their answer to “What are the reasons that make you walk to school”. A high proportion of their answers were given to “Going with my friends” There is statistical difference between female and male responses to this question.

Children were also asked to give recommendations on how to make walking more convenient, particularly walking to school (Figure 19). Children stated that they need wider and clean pavements with no obstacles. Reduced traffic speed and the provision of safer crossings were highlighted in students’ answers. School location and their entrance are not among answers that ranked highly in the students’ responses. There was no statistical difference between the answers that could be attributed to gender (Chi –square test at 5% level of confidence).

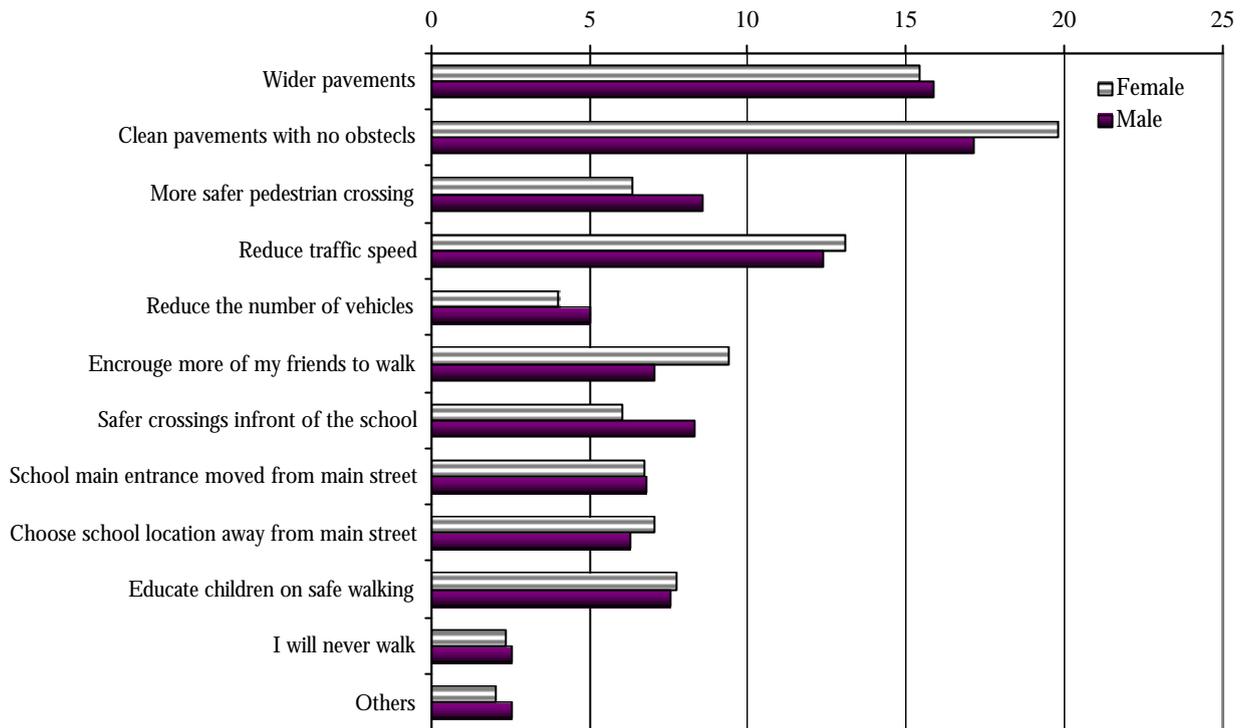


Figure 19 Children answers for “What are your recommendations to make walking more convenient?” expressed as percentage of each choice out of all answers received.

Children were also asked if they experience any hazard while walking to school. Seventy percent of interviewed children answered “Yes” This percentage was higher when parents were asked if they feel that their children are subjected to a high risk of being involved in accidents (78%). Children were asked to describe the hazard they are subjected to in their own words. Their answers were categorised in five groups (Figure 20). Each group was divided into a number of sub-categories (Table 1)

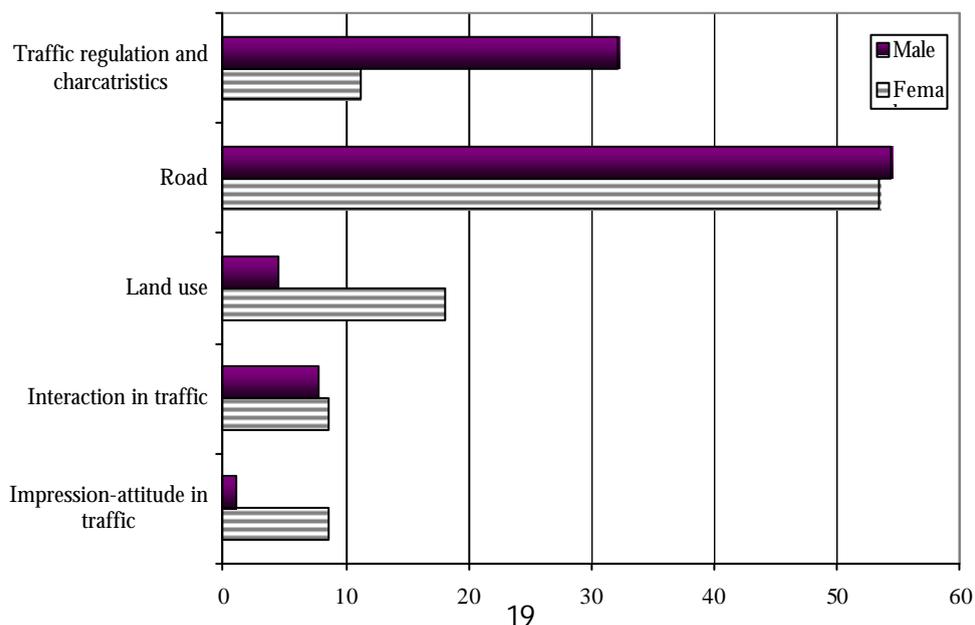


Figure 20 Children perception of hazard on roads

Table 1 Children experience of hazard in traffic

Category	Sub-category	Children statements	Female		Male	
			No	%	No	%
Attitude	Other pedestrian behaviour	Bad gays	2	2	1	1
	Special group of drivers	Young driver	7	6		
	Special group of drivers	Rent car drivers	1	1		
Interaction in traffic	Failed to interact safely	Afraid of being run-over	9	8	6	7
	Not given priority for pedestrian	Drivers do not cooperate	1	1		
	Unsafe interactions in traffic	Traffic conflicts			1	1
Land use	School location	In front of school	14	12	1	1
	Shop location	Shops	4	3	3	3
	Workshop location	Dangerous shops like car service workshops	3	3		
Road	Carriageway Cross section	Narrow street	3	3	3	3
	Hazard locations	Specific location (state name of hazardous location)	17	15	16	18
	Junction design	Dangerous junctions	11	9	8	9
	Junction design	No clear sight			1	1
	Maintenance	Pots on the road	3	3	1	1
	Maintenance	Slippery roads in winter			1	1
	Pedestrian facilities	Unsafe pedestrian crossing	1	1		
	Pedestrian facilities	No pedestrian crossing			1	1
	Road alignment	Sharp and hidden curve	4	3		
	Road alignment	Descending slope	2	2	3	3
	Road side devices	No guard rail	1	1		
	Sidewalks	Trees and other obstacles	1	1	2	2
	Sidewalks	Street without sidewalks	8	7	6	7
	Traffic claming measures	No hump in front of school			1	1
	Traffic control devices	Lack of signs	1	1	3	3
	Traffic control devices	Traffic light signal	9	8	2	2
	Traffic control devices	Lack of traffic light signal	1	1		
Traffic control devices	Wrong signs			1	1	
Traffic	Traffic volume	Main streets	2	2	7	8
	Speed	High speed car	5	4	10	11
	Speed	Fast trucks			2	2
	Traffic regulations	Mixed use of pedestrian and vehicle			1	1
	Traffic regulations	Parked trucks, vehicles	1	1		
	Traffic regulations	Pavement is used for parking vehicle			1	1
	Traffic volume	Heavy traffic roads	5	4	8	9

More than fifty percent of all statements referred to road characteristics (alignment, traffic control device; pedestrian facilities; calming measures, etc) Traffic characteristics were mentioned more frequently in male statements. Females were referring to land use issues and their impressions about certain groups of drivers. Both females and males referred specifically to locations on the network that they believe are hazardous (15% of female respondents; 18% of male's respondents). Pedestrian facilities have not been emphasized in the children responses.

Parents were also asked to define location on the road network where they believe that their children are at a high risk of being involved in accidents. They are asked to select more than one choice out of seven listed in front of them. They were asked to choose the most hazardous locations and they were not restricted to one answer. Junctions are ranked as the most hazardous locations. The second rank was given to crossing the road at any location without a pedestrian crossing (Figure 21). Walking along the road is also believed to be a hazardous activity.

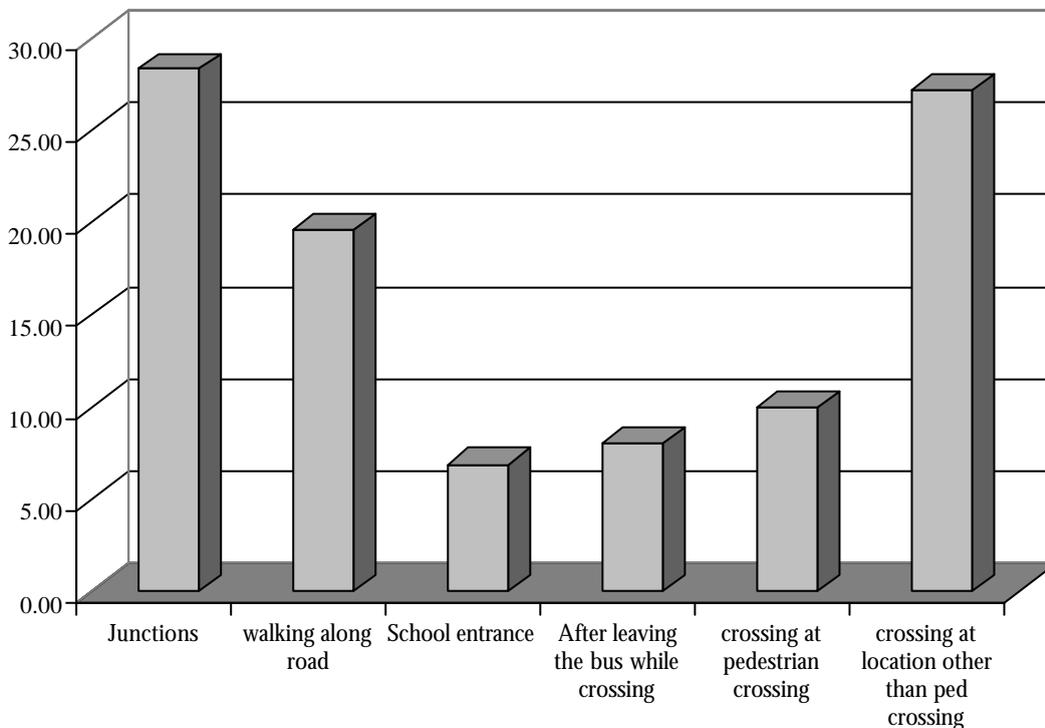


Figure 21 Parent responses on the most hazardous locations for their children

Children involved in accidents.

Children were asked if they have been involved in accidents during the last three years. Results showed that around 20 percent of all interviewed pedestrians were involved in accidents. The percentage was lower when data on all members of the interviewed family were included (6.5%). A database of 720 students in all families is considered. Average number of children per family is 5.33 with an average of 4.3 children per family going to school. The percentage is slightly lower when only children under age of 15 years are considered (6.1%)

Forty-nine percent of all interviewed children who were involved in accidents were walking (Figure 22). It is important to note that 19% of all child accidents involved school buses. Information on all family members indicates that sixty eight percent of all children of (Under age of 15 years) involved in accidents were walking prior to the accident. If all family children are included (under age of 18 years) then the proportion of students who were walking to school and involved in accidents is 63%.

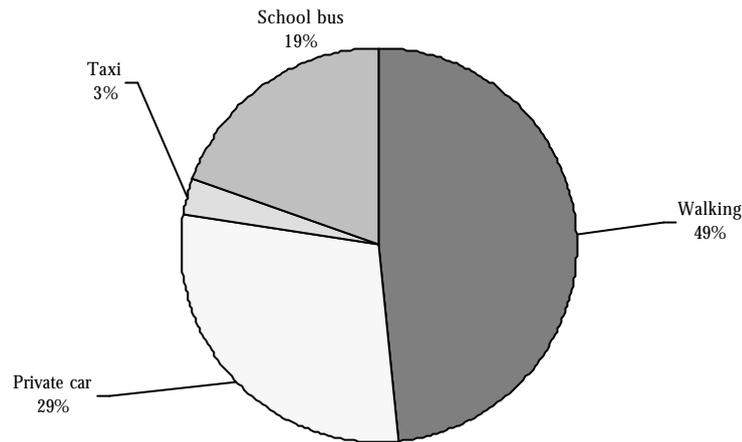


Figure 22 Child accident involvements by mode of transport

Forty-seven percent of the interviewed children who were involved in accidents had been injured. They were absent for an average of one week from school as a result of their injuries.

Children knowledge of road traffic safety

The results shown above indicate that children are subjected to a high risk of being involved in accidents, but they do not appreciate how much they are at risk. On their route selection criteria, accidents were not ranked as high as the distance to school. This might be attributed to poor traffic safety education. In the following section, children's level of traffic awareness is examined and compared to what parents are teaching their children on traffic safety issues. Children were asked to write down traffic rules that they know. Children were asked to state who taught them these rules. Parents were also asked to write down what did they taught their children concerning traffic rules. School principles were also asked to explain their role in increasing students' level of awareness and how they approach this subject.

Children listed 806 traffic rule combinations that included 116 traffic rules. Parents listed only 635 rule combinations that include 64 traffic rules. Stated traffic rules were categorized into 26 categories for children answers and 17 for the parents answers (Appendix A). Traffic rules that were frequently mentioned by children and their parents are shown in Table 2. Looking left and right before crossing is the most mentioned rules by both groups. Walking on the pavement was mentioned by children more than their parents. Crossing at pedestrian facilities and use the safety belts were equally mentioned by both groups.

Table 2 Most frequent mentioned traffic rules

Rule	children		Parents	
	Number mentioned	%	Number mentioned	%
Look left and right	130	16.1	100	16.3
Respect traffic light signal	125	15.5	44	7.2
Walk on the pavement	92	11.4	84	13.7
Cross only at pedestrian facilities	69	8.5	64	10.4
Use safety belt	57	7.1	46	7.5
Crossing behaviour	28	3.5	14	2.3
Use foot bridge if exist	28	3.5	22	3.6
Do not play on street	27	3.3	32	5.2
Speed is dangerous	22	2.7	26	4.2
Respect sign	21	2.6	16	2.6
Use traffic signal for crossing	0	0.0	17	2.8
Do not through rubbish from window	12	1.5	0	0.0
Do not sit on the front seat	9	1.1	8	1.3
Do not run at street	8	1.0	11	1.8

Children and parents statements' were examined to investigate if there is an agreement between what parents teach their children and what children state that they know. The same rules were stated by both the parents and the children in only 78 statements; which constitutes 5% of all traffic rule combinations. The agreements reported for rules presented in Table 3. Walking on the pavement reported the highest agreement followed by looking left and right before crossing "visual search"

To facilitate the comparison between children and parents statements, the categories of traffic rules for both of them (26 for children and 17 for parents) were aggregated in only 15 categories (Figure 23). Crossing rules were mentioned very often in both the parents and children's statements. Walking was also mentioned but to a lesser extent.

Table 3 List of rules that both parents and children have stated in their answers

Rules	No. of cases	%
Crossing "general statement"	4	5.13
Walk on the pavement	28	35.90
Respect sign	1	1.28
Respect traffic light signal	9	11.54
Look left and right	17	21.79
Use foot bridge if exist	5	6.41
Do not play on street	2	2.56
Help elderly, children	1	1.28
Cross only at pedestrian facilities	7	8.97
Use safety belt	2	2.56
Do not sit in the car front seat	1	1.28
Do not throw rubbish from window	1	1.28
Total	78	100

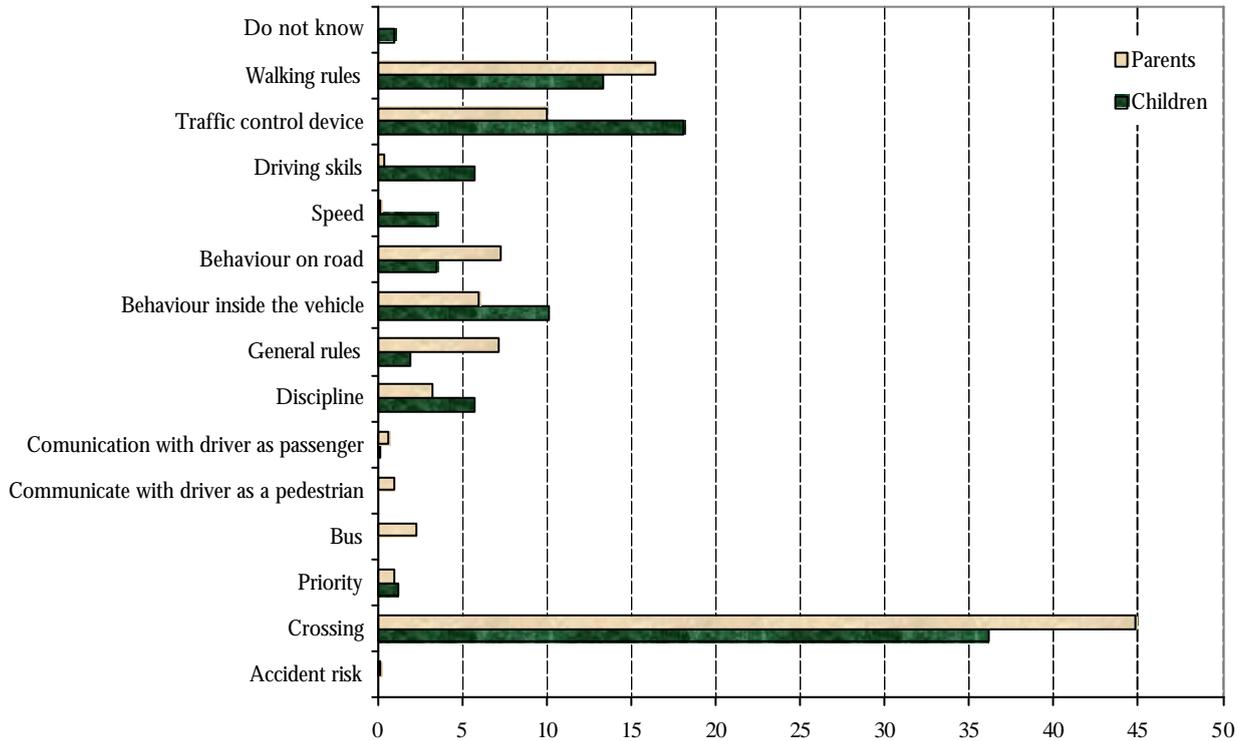


Figure 23 Traffic rules categories as stated by children included in the sample survey and their parents

Figure 23 shows that children mentioned rules that are relevant for drivers rather pedestrians. For example, children referred to overtaking, parking and congestion. These terms were not mentioned in their parents' statements. Parents emphasized skills that are needed for their children to walk safely. While children were referring to correct behavior inside the vehicle, parents highlight correct behavior on the road. Traffic control devices, particularly traffic light signals, have been frequently mentioned by children. For most of them, traffic rules are walk on green and stop on red. Speed and its associated terms, like speed limit, were not mentioned in the parents' statements. Children statements include these concepts. For instance; they gave statements like "Keep the speed limit" or "Do not speed in a residential area".

One statement given by the parents indicates that pedestrians should give priority to the vehicle. This could be explained by either lack of knowledge by the parents or overprotection of their children. They would like their children to be alert and not trust that they have priority in traffic. Some of the statements mentioned by the children were not correct. For example, walking in the direction of traffic (two-way traffic streets) is a statement that was given by some children. Others mentioned, cross wherever you want.

Who educates children in traffic rules?

Due to the differences in the statements made by children and their parents, it is of interest to try to find who educates the children in road safety. The following question was formulated and put forward to children "who taught you the traffic rules that you know". Prior to this question, children were asked to list traffic rules that they know. Their responds are summarized in Figure 24

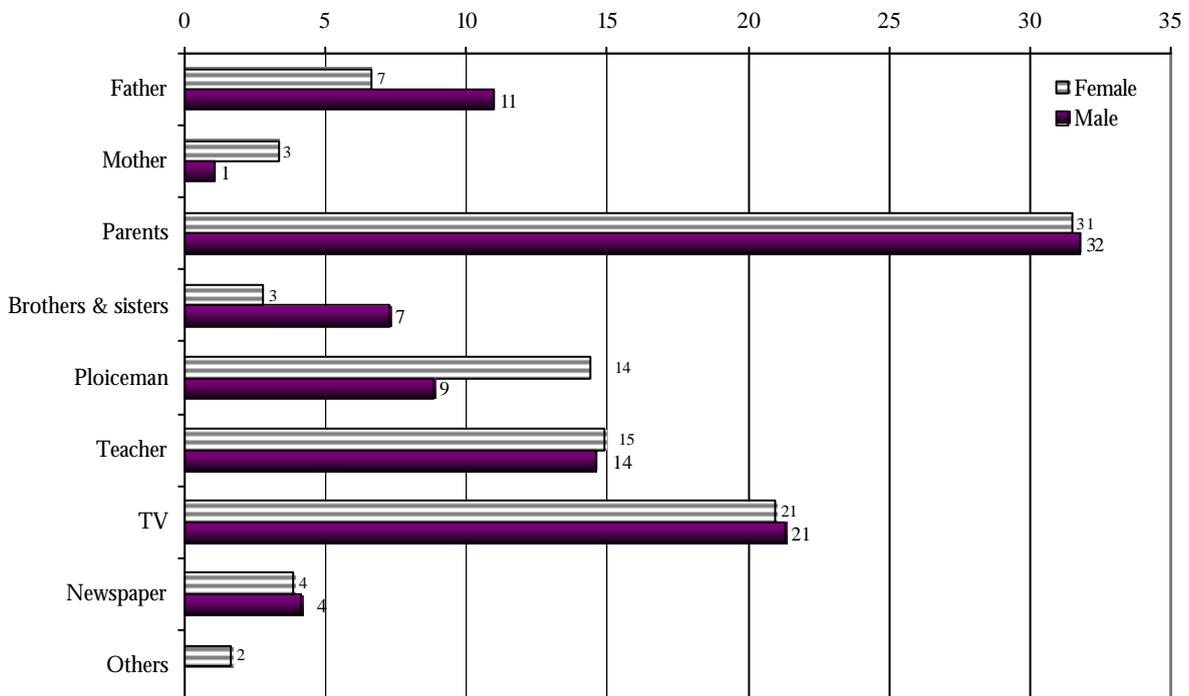


Figure 24 Children answers for "who taught you the traffic rules that you know?" expressed as percentage of each choice out of all answers received.

Parents (both the mother and the father) are the main source of information of traffic rules for their children (31, 32% for female and male respectively). The father alone was mentioned more often than mother alone as source of information. Male children rely on their father or older brothers and females are more reliant on their mother. This might be due to the fact that not many of the mothers in the sample are driving; only 38% of all mothers in the selected sample have a driving license, this does not necessarily mean that they are driving. . The father is the person who drives; thus the children interpret that he is the reliable source of information.

TV programs are the second source of information for children. Twenty-one percent of students mentioned TV programs, while only 15% mentioned their teacher. However, when school principles were asked if they teach children traffic rules, all of them answered "yes". They also stated that they carry out in and outdoor training.

School environment and location

Principles in the selected schools were asked to fill in the questionnaire that was formulated to investigate safety conditions in the school area. The surroundings were also assessed by a qualified person who was asked to check the routes that lead to each school. A surrounding area with a radius of 1-2km was considered for this purpose.

The survey showed that 50% of the schools' entrances are directly on main roads. Only forty percent of principles stated that their schools are on streets that have high speed traffic. The observations made showed that there are some differences between what the principles said and the actual conditions. Sixty percent (six schools) of schools are on main roads, two schools have their entrance directly on main roads. Humps have been installed nearby one school out of these six schools, while signs have been provided at roads leading to only three schools. Traffic light signals have been installed at two sites.

Humps have been installed in the neighborhood of 3 schools out of the ten selected that are not located on main roads. Signs have also been provided for three schools. Signs were installed probably due to the presence of humps. There are no street markings to indicate the presence of a school.

The assessment of the suitability of the streets for walking to school includes five aspects:

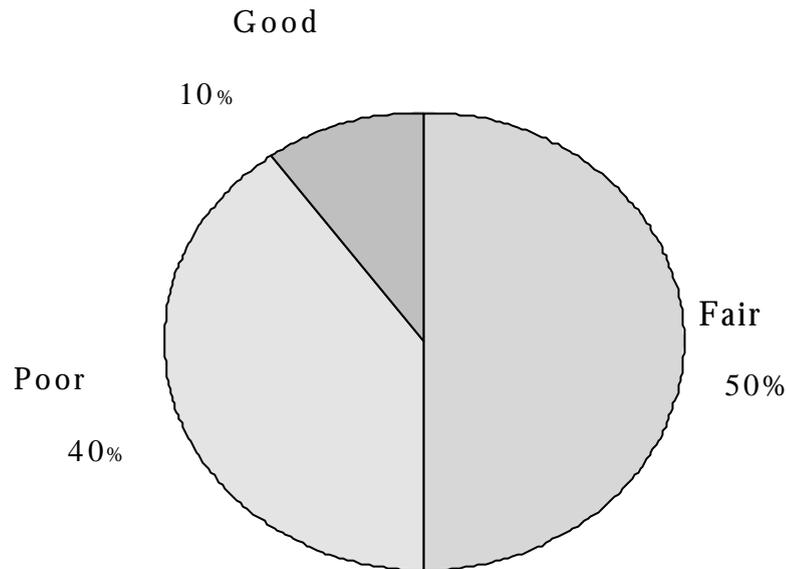
- Sidewalk conditions
- Pedestrian crossing conditions
- Driver behaviour at pedestrian crossing
- Pedestrian ability to comply with traffic rules
- The attractiveness of streets for walking

Streets have been appraised from these perspectives. Each has been given points if the existing conditions contribute positively to safety. No points were given if conditions contribute negatively to safety. A scale has been introduced to rate sight conditions from a safety perspective. The maximum point on the scale is 31. Sidewalk conditions have been assigned 8 points on this scale. Same points were given to crossing conditions. Six points were allocated to attractiveness. Driver behavior at crossing was given 5 points while pedestrian compliance with the rules received 4 points. Five categories were introduced using this scale to classify the suitability of the school surroundings for walking (Table 4).

Table 4 Categories used to rate the suitability of school surroundings for walking

Excellent atmosphere	Good atmosphere	Fair atmosphere	Poor atmosphere	Very poor atmosphere
31-25	24-20	19-15	14-11	<10

When we adopted this categorization; 4 school locations were rated poor; 5 locations were rated fair with only one location was rated high (Figure 25). This is presented in Table 5.

**Figure 26** School surrounding walk ability conditions**Table 5** The rating of the suitability of school environments for walking based on the five components of the scale adopted in this study

Name of school	Pavement	Crossing	Driver behaviour	Pedestrian Behaviour	Attractiveness	Overall rate
Al-Kendi	5	5	2	3	1	16
Islamic collage	6	4	2	2	3	17
IettehadSB	6	6	5	2	0	19
Sami_refaiB	4	4	2	2	2	12
Amira Basma	5	6	2	2	2	17
Am-Imara	3	6	4	2	1	16
IettehasSG	5	7	4	2	2	20
Ali Rda R	3	2	2	1	3	11
Samir_RefaiS	4	4	2	2	2	14
SweliehSB	3	2	2	1	3	11

Table 5 suggests both driver behavior and pedestrian compliance with rules do not add to the scale as the other components.

These conditions were further examined by observing pedestrian behavior on some of these routes. Pedestrians were followed from when they left school until they reached home. The time they spent walking on the pavement or the road was recorded. Their crossing behavior was closely observed. On average, children cross two junctions during their trips. The mean time spent by the twenty pedestrians walking was 30.1 ± 12.53 minutes. The pedestrians spent 58% of their time walking on the pavement, 21% along the road, and 21% of their time crossing. This clearly shows that they are over exposed to traffic increasing the likelihood of being involved in an accident. Five percent of the observed children were involved in serious traffic conflicts. Twenty percent of the observed children were running while crossing the road. Only 73% of these children performed a visual search before crossing. There was no significant difference between average times of trips or crossing times due to gender (t-test at 5% level of confidence). However, there was a significant difference in time spent on walking on the pavements due to gender. [Female children walk along the road longer than male children. In general, male walk longer with an average of 34 minutes while female walk for 25 minutes. Children tend to walk in-groups (Figure 26). This observation is in a good agreement with children stated preferences in their responds to the questionnaire.

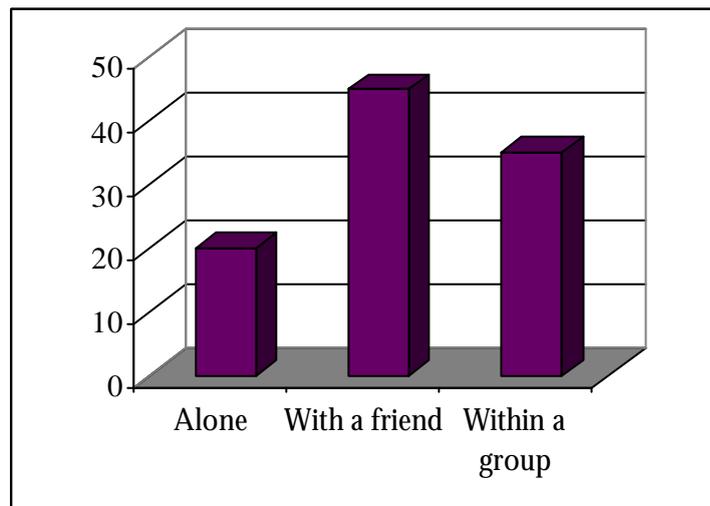


Figure 26 Children's' walking style

Discussion of results

The study indicated that pedestrians in Jordan are at a high risk of being involved in traffic accidents. Children under the age 15 years [40% of Jordan's population] suffer the most. The fatality rate for this group is three to four times higher than the corresponding rate in Europe. Questionnaire analysis showed that 19% of the participating children were involved in accidents. Around half of them were involved while they were walking. Children's' involvement in accidents was lower when the database was widened to include all the family members of the participating children (6.5%). The result of pedestrian monitoring while walking indicated that 2

out of 40 crossings made resulted in serious conflicts. This shows that child pedestrians are subjected to a high risk in traffic. This risk varies from serious conflict to accidents.

Walking is the only available means of transport for the majority of children in Jordan. There are two main reasons for this. First, Jordan is a country of a low level of motorization (98 vehicles per 1000 inhabitants). Second, poor public transport means that the only option for many groups is walking. Children often walk daily for more than one hour (73 minutes); two third of this time is spent to and from school. This high demand on walking was not met by the planners. Poor pavement conditions make it impossible for pedestrians to use them. They walk along the road instead; thus, being exposed to higher risk of being involved in accidents (21% of time spent on walking is done along the roads). Pedestrians indicated that to promote safe walking wider and clean pavements are required.

Safe pedestrian crossings are lacking. Many interviewed children mentioned that they would like to use pedestrian facilities if available. Parents mentioned that they teach their children to use pedestrian facilities. High traffic speed is an issue that children raised. However, they did not associate high speed with an increased risk of accidents.

Children's perception of accident risk is not high when we observed their behavior. For example, their school route selection is based mainly on the distance walked rather than route safety. Walking for many of children is a social activity. They like to walk with their friends. Children, particularly female, prefer to walk in groups. This may make it more difficult for planners. They need to satisfy group demand of pavement space and not individual pedestrians.

Children in Jordan seem to be educated to be drivers rather than pedestrians. When they have been asked to list traffic rules that they know, their answers clearly reflect this. For example, terms like overtaking and how to deal with congestion were mentioned. Speed limit, which was not mentioned by parents, was repeatedly mentioned by children. They seem to envisage themselves as drivers and forget their current needs of being a pedestrian. According to the survey, the source of traffic information is the parents, mainly the father. The children try to learn from their father, who is more often the driver in the family. It is expected that they will pick up driving rules rather than walking rules. In the absence of proper traffic education at school, children are not oriented to learn the basic skills that are needed for their safety. Coordination between schools and parents is very important. Only nineteen percent of all participating parents in the survey indicated that they have had discussions with school staff about road safety issues. When the same question was given to the school principles; 90% of the participants stated that they have meetings to discuss transport issues, including safety. Their concern is the children's late arrival at school and how to avoid it.

Although both parents and children frequently mentioned the visual search rule (look left and right) only 73% of all observed pedestrian do the search. This indicated that children do not adhere to what they have been taught. The assessment of school environment indicated that it did not provide pedestrians the means to comply with traffic rules.

Naturally children's activities expose them to the risks of traffic conflicts and accidents. For example, shopping is an activity that children have to do it with an adult. The survey indicated that children are walking far more than their parents are.

Conclusions

- Children in Jordan are at a high risk of being injured in traffic. Fatality rate of this group is 3 or four times higher than in the industrialized countries.
- Pedestrian accidents composed only 10-11% of all reported accident but resulted in 47% of fatalities.
- More than 50% of pedestrian accidents occur on streets a speed limit of 40 km/h speed.
- Pedestrian accidents normally involve passenger cars. However, considerable numbers of accidents involved heavy goods vehicles.
- Twenty percent of the participating children in the survey were involved in accidents. Half of these accidents were pedestrian accidents.
- Approximately 50% of children walk to school. They walk in groups with their friends (40-55% of male children walk in groups compared to 60-80% for female).
- Average time of one-way walking trip to school is 13 min. walking to and from school constitutes 46% of time children spent walking. However, our observation showed a longer time of 30 minutes
- Males tend to walk longer distances than female but there was no significant difference between the sexes.
- Children do not perceive hazards in traffic.
- Children recommend widening and cleaning the pavement to encourage walking as a mean of transport. Children reasons for not walking did not highlight accident risks. Children were worried about rain, school bag more than their concern about safety. They prefer the shortest route to school rather than the safest one.
- Children knowledge of traffic rules reflects their desire to be a driver. They were able to detect hazards to vehicles rather than to pedestrians.
- Parents are the first source of traffic education to children followed by television.
- School environment in Jordan is not walking friendly. The majority of streets included in this survey were rated as fair or poor.
- Forty percent of children walking time are on the road and not on the pavement. On average they need to cross two junctions. They tend to walk in-groups and are at a high risk of being involved in traffic conflicts.

Recommendations:

- Traffic safety education in Jordan is in urgent need of proper attention. The role of the school should be over emphasized. Parents are currently the main source of information for their children. These Parents should be educated in traffic safety issues to relay the right message to their children.
- Planners should be aware of pedestrian needs and behavior in traffic. This knowledge will guide them to provide safe pedestrian facilities.
- Pedestrian road infrastructure in Jordan is in need of modernization to provide a safe traffic environment to the young generation.

References

Berg, F. A. and et al. (2002) "Pedestrian Protection in Europe: The Potential of Car Design and Impact Testing" DEKRA Automobil GmbH, Accident Research and DaimlerChrysler AG, Accident Research

<http://www.unece.org/trans/doc/2002/wp29grsp/inf-gr-ps-13e.pdf>

Chitah, M. B. and et al (2002) "A HISTORICAL PERSPECTIVE OF ROAD TRAFFIC INJURIES AND THE CURRENT STATUS OF THE ZAMBIAN EXPERIENCE" Road Traffic Injuries and Health Equity Conference, Massachusetts, USA

<http://www.hsph.harvard.edu/traffic/papers/Zambia.pdf>

Hijar, M. and et al (2002) "Pedestrian traffic injuries in Mexico" Road Traffic Injuries and Health Equity Conference, Massachusetts, USA

<http://www.hsph.harvard.edu/traffic/papers/Mexico.pdf>

Macgregor, C. et al (1999) "Identifying Gaps in child pedestrian safety: comparing what children do with what parents teach" Transportation research Record 1674, PP 32-40

Preston, B. "Child pedestrian fatalities: the size of the problem and some suggested countermeasures" Journal of advanced transportation, Vol. 28, No.2 1994, pp. 129-140

David, N. K-B and Rice, R. G. " The role of the physical Environment in child pedestrian accidents" Journal of advanced transportation, Vol. 28, No.2 1994, pp. 171-187

Gibby, A. R. and Ferrara, T. C., (2001) "**Evaluation of Pedestrian Safety Policies and Practices on California State Highways: Final report**" The California Public Works Studies Program, Department of Civil Engineering, California State University, pp 8

Jordan, G (1998) "Child pedestrian-car crash near school are small percentage of total child pedestrian crashes in Philadelphia" Transportation Research Record 1636, pp 132-137

Cheng, EY-C (1991) "Pedestrian accidents in Utah" Transportation Research Board, Transportation Research Record 1325, pp 69-74

Westdijk, EC (2001) "Designing a safe residential environment for children." International Conference: Traffic Safety on Three Continents, Moscow, Russia

El-Araby and et al. (1996) "Traffic perception attitude and skills of school children: assessment of contributing elements" Proceedings of the Conference: Road Safety in Europe and Strategic Highway Research Program (SHRP). Report No: No. 4A, Part 2, pp 194-210

PSD: Public security Directorate (2000; 2001) Jordan traffic institute "Traffic accidents in Jordan"

Wallberg, S. and Wisenborn, P. (2000) " Pedestrian safety at zebra crossings in Amman" Bulletin 108, Department of Technology and society, Lund Institute of technology.

Appendix A-1 Categorization of parents' statements on traffic rules that they teach their children

Stated rules	Category	Stated rules	Category
Accident is a serious problem	Acc.	Patient	G
Get off the bus	B	General rules	G
Do not stand in the bus	B	Consider weather condition	G
Crossing behaviour	C	Do not step out of car until it complete stop	IN
Look left and right	C	Do not open the window and leave part of your body out of the windows	IN
If little, ask old person to help you for crossing	C	Use safety belt	IN
Use foot bridge if exists	C	How to behave in car	IN
Cross only at pedestrian facilities	C	Step out from pavement side	IN
Do not cross at curve	C	Do not open the car when it is still moving	IN
Use traffic signal for crossing	C	Do not sit on the front seat	IN
Child should not cross the street on his own	C	Do not open the vehicle's car until you make sure that there are no car on	IN
Do not cross at heavy traffic location	C	Baby should not be on the driver lap	IN
Do not cross at junction	C	Do not play on streets	RB
Pedestrian has priority	C-P	Do not run on streets	RB
Pedestrian should give priority for cars	C-P	Do not ride bicycle on streets	RB
Cross in front of bus	C-B	Do not fight on streets	RB
Avoid young drivers	C-DR_Ped	Avoid speeding car	S
Be far from vars	C-DR_Ped	Wrong overtaking is forbidden	SK
Never trust red signal for car	C-TC	Never drive without license	SK
Walk and cross quickly	C-W	Respect traffic signs	TC
Do not squeeze yourself between cars	C-W	Respect traffic light signals	TC
Do not talk to the taxi driver	DR_Pas	Use handy stop sign when crossing	TC
Do not talk to the driver	DR_Pas	Walking on the pavement	W
Pay attention from elderly driver	DR_Ped	Walking opposite to traffic	W
Listen to bus instructor instruction	DR_Pas-B	Walk in groups	W
Help elderly, younger	D	Do not walk between cars	W
Behave yourself on street	D	Do not walk with older students	W
Keep street clean	D	Walk only on safe streets	W
Do not through rubbish from window	D	Walk straight	W
Respect police officer	D	Do not walk in narrow street	W
Do not sabotage signs	D-TC	Do not walk on main street	W
Pay attention	G	Do not talk while walking quickly	W

Acc.: Accident risk **B:** Bus rules **C:** Crossing **C-B:** Crossing- bus rules
C-DR_ped: Crossing-Communication with driver as pedestrians **C-P** Crossing-priority
C-TC: Crossing-traffic control device **C-W:** Crossing-walking **D:** Discipline
DR_Pas: Communicate with driver as passenger **DR_Ped:** Communicate with driver as pedestrians
DR_Pas-B: Communicate with driver as passenger-bus rules **D-TC:** Discipline-Traffic control device
G: General rules **In:** behaviour inside the vehicle **RB:** Pedestrian behaviour on road behaviour
S: Speed **SK:** Driving skills and rules **TC:** Traffic control devices **W:** walking

Appendix A-2 Categorization of parents' statements on traffic rules that they teach their children

Stated rules	Category	Stated rules	Category
Accident is a serious problem	ACC	Maintain safety equipment	IN
Walk as a group	B	Children should not be sit in the loading part of truck	IN
Do not stand in the bus	B	Get into the car from the right side	IN
Bus should only stop at bus stop	B-G	Baby should be seated in child seat	IN
Crossing behaviour	C	Do not step out of car until it complete stop	IN
Look left and right	C	I do not know	KN
If little, ask old person to help you for crossing	C	Give priority for cars	P
Use foot bridge if exists	C	Disable should be given priority	P
Get off the bus	C	Priority for cars on main roads	P-SK
Do not run on the streets	C	Do not play on streets	RB
Use traffic signal for crossing	C	Cross only at pedestrian facilities	RB
Child should not cross the street on his own	C	Do not ride bicycle on roads	RB
Do not cross at heavy traffic location	C	Do not fight on streets	RB
Do not cross at junctions	C	Do not run nor walk slowly	RB-W
Do not cross in front of tunnels	C	Avoid speeding cars	S
Cross where ever I want	C	Do not speed in residential areas	S
Cross at any location where there are no cars	C	Keep speed limit	S
I cross the road and I do not care about cars	C	Reduce speed at humps	S
I like to cross at pedestrian facilities but there is none in my area	C	Wrong overtaking is forbidden	SK
Cross at safe locations	C	Never drive without license	SK
Do not cross road assigned for traffic	C	Driver should leave enough space between cars	SK
Do not cross main streets used footbridge instead	C	Driver should not park their car on pedestrian crossing	SK
I should be visible to the drivers	C	You have to get driver licence to drive	SK
Police should help is in crossing	C	Avoid wrong overtaking	SK
Cross in front of bus	C-B	Use signal to inform other driver	SK
Be far from cars	C-DR_Ped	Do not blow horns	SK
Pedestrian has priority	C-P	Cars should not stop at pedestrian crossing	SK
Pedestrian should give priority for cars	C-P	Avoid conflicts with other road users (cars, pedestrians)	SK
never trust red signal for cars	C-TC	Stop and wait when there is congestion	SK
Walk and cross quickly	C-W	Car must stop at junctions	SK
Do not squeeze yourself between cars	C-W	Car should stop at pedestrian crossings	SK
Help elderly, younger	D	No overtaking is allowed on main roads	SK

Behave yourself on street	D	Use car headlight at night and fog conditions	SK
Keep street clean	D	Do not leave the car on main roads	SK
Do not through rubbish from window	D	There should no congestion	SK
Respect police officer	D	Car should stops by the pavement the road edge	SK
Speed is dangerous	D	Do not park on no park zone	SK-G

../ Appendix A-2 Categorization of children' statements on traffic rules that they have been taught

Stated rules	Category	Stated rules	Category
Talk to stranger	D	Do not eat & drink while driving	SK-G
do not damage the trees on the pavements	D	Do not use mobile phone while driving	SK-G
Be polite and do not laugh or talk in loud voice	D	Cars should not stop at pavement	SK-G
Do not talk to the taxi driver	DR_Pas	Respect traffic signs	TC
Do not talk to driver	DR_Pas	Respect traffic light signals	TC
Listen to bus instructor instructions	DR_Pas-B	Use handy stop sign when crossing	TC
Pay attention from elderly driver	DR_Ped	Driver should stop at traffic light signal	TC-SK
Do not sabotage sign	D-TC	Walking in the pavement	W
Pay attention	G	Walking opposite to traffic	W
Patient	G	Avoid young drivers	W
General rules	G	Do not walk between cars	W
Consider weather condition	G	Do not walk with older students	W
Do not cross at curves	IN	Walk only on safe streets	W
Do not open the window and leave part of your body out of the windows	IN	Walk straight	W
Use safety belt	IN	Do not walk in narrow streets	W
How to behave in car	IN	Do not walk on main streets	W
Step out from pavement side	IN	Do not talk while walking quickly	W
Do not open the car when it is still moving	IN	Do walk on a street that I do know	W
Do not sit on the front seat	IN	Walk in the traffic direction	W
Do not open the vehicle's car until you make sure that there are no car on that side	IN	Use light colours at night when walking	W
Baby should not be on the driver lap	IN	Avoid streets with many junctions	W-C

Acc.: Accident risk **B:** Bus rules **B-G:** Bus-General rule **C:** crossing **C-B:** Crossing- bus rules

C-DR_ped: Crossing-Communication with driver as pedestrians **C-P** Crossing-priority

C-TC: Crossing-traffic control device **C-W:** Crossing-walking **D:** Discipline

DR_Pas: Communicate with driver as passenger **DR_Ped:** Communicate with driver as pedestrians **DR_Pas-B:** Communicate with driver as passenger-bus rules **D-TC:** Discipline-Traffic control device

G: General rules

KN: Do not know:

P-SK: Priority: driving skills and rules

RB: Pedestrian behaviour on road

RB-W: Pedestrian behaviour on road –Walking

In: behaviour inside the vehicle **S:** Speed

SK: Driving skills and rules

SK-G: Driving skills and rules& general rules

TC: Traffic control devices

TC-SK: traffic control device- Driving skills and rules& general rules

W: walking