

# The effect of public transportation modes on traffic accidents in Jordan

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Road accidents have, become one of the greatest problems in Jordan. The number of traffic accidents has increased continuously in the last decade. The total number of accidents has jumped from 17,838 in 1990 to 50,330 accidents in 1999 with an increase of 182 % in only ten years. The annual direct cost of traffic accidents in Jordan during this period is estimated about 150 million dollars. Jordan is one of developing countries with high traffic accident rates related to population and number of vehicles. It is, therefore, necessary to investigate all the transportation modes in order to stop the growing accident rates and promote road safety either by reducing the number of accidents or/and reducing this severity. This paper examined the share of public transportation modes in traffic accidents. It was concluded that the contribution of public transportation to traffic accidents is much higher than their ratio to total traffic. It was also found that passengers are at much higher risk of involvement in accidents when using public transportation. The paper examined the reasons behind the unsafe public transportation and recommended solutions to reduce traffic accidents resulted from public transportation.

لقد أصبحت حوادث المرور في الأردن من المشاكل المعقدة . لقد ازدادت حوادث المرور بشكل مستمر في العقد الماضي . فقد زاد عدد الحوادث من ١٧٨٣٨ عام ١٩٩٠ إلى ٥٠٣٣٠ حادثاً عام ١٩٩٩ وبزيادة مقدارها ١٨٢% خلال عشر سنوات فقط . علماً أن التكلفة المباشرة لهذه الحوادث تقدر بمائة وخمسين مليون دولار سنوياً . تعتبر الأردن من الدول ذات النسب العالية في معدلات حوادث المرور بالنسبة لأعداد السكان والمركبات . ولذلك أصبح من الضروري القيام بدراسة جميع وسائل النقل لإيقاف الزيادة المضطردة بالحوادث ورفع نسب الأمان أما بتقليل عدد الحوادث أو انقاص حدتها . تبحث هذه الورقة في تأثير وسائل النقل العام على الحوادث . ولقد تبين أن مساهمة وسائل النقل العام بنسبة حوادث المرور أعلى من نسبتها في مجموع المركبات . ولقد تبين أيضاً أن درجة تعرض المسافرين بوسائل النقل العام للحوادث أعلى منها بوسائل النقل الخاصة . ولقد تمت دراسة الأسباب الكامنة وراء عدم الأمان في استخدام وسائل النقل العامة وأوصت بحلول معينة لانقاص الحوادث الناتجة عنها .

**Keywords :** Public transportation, Traffic accidents, Risk index, Severity index.

## 1. Introduction

The growth of population and the expansion of urban areas have resulted in increasing travel demand by public transportation, and consequently in increasing the number of traffic accidents, especially those related to public transportation. The share of public transportation in daily trips in Greater Amman Area (GAA), as table 1 shows, is only 42 % of total daily trips, while the share of private cars and buses is 58 % [1]. Although these figures describe the share of daily trips among the different modes of transportation in GAA, they represent to a large extent the whole country since a great percentage of population and vehicles are concentrated in GAA [2]. In addition there are no available

data or studies about the travel behavior in the rest of the country.

The purpose of this paper is to examine the contribution of the public transportation in Jordan traffic accidents. It also investigates the reasons of high public transportation accidents and recommends a lot of abatement actions.

## 2. Public transportation accidents

According to the available data, the contribution of public transportation to traffic accidents is analyzed through dividing the public transportation modes into three categories. These categories are:

1. Large buses
2. Mini buses
3. Small passengers cars (Jitneys)

Table 1  
Daily Modal Split in Greater Amman Area

Mode	Share(percentage)
Private cars	51
Large & Mini buses (private)	7
Large & Mini Buses (public)	14
Taxis	12
Small passenger cars (jitneys)	16

### 2.1. Large buses

This category includes public large buses with an average capacity of 50 passengers with the ability to operate on nearly all streets, arterials, and freeways. More than 95 % of these buses are operated on fixed routes without fixed schedule. They pick up and drop off passengers along their routes by request and in most cases anywhere.

Table 2 shows a comparison between total number of large buses and their accidents as well as the total registered vehicles and their accidents for the years 1995-1999 [3]. The Table shows that the ratio of total number of large buses to total registered vehicles ranges from 0.0023 to 0.0031, while their ratio of total traffic accidents ranges from 0.0062 to 0.0085. These ratios are also presented in fig. 1. The ratios in table 2 and fig. 1 highlight the fact that the large buses contribute much more accidents than the total registered vehicles. Table 2 also presents the Risk Indices (RI<sub>s</sub>) for large buses. The Risk Index (RI) is defined as the ratio of percentage accident involvements in-group divided by the percentage population in-group [4]. Table 2 also shows that the RI<sub>s</sub> range from 2.48 to 3.81. This indicates that people using large buses in their travel are involved in a disproportionate number of accidents relative to the portion of large buses in total traffic.

For example, people who used buses in their travel in 1999 were exposed to accidents 3.8 times the people who used other transportation transportation modes.

Table 3 presents a comparison of the Severity Indices (SI<sub>s</sub>) of large buses and total traffic. These indices are based on fatalities and injuries. The Severity Index is defined as the number of fatality or injury per accident [4]. The table shows that the severity indices of the total traffic based on fatalities range from 0.013 to 0.16 fatalities per accident

while they range from 0.013 to 0.056 fatality per accident for large buses. Moreover, the Table shows also that the severity indices for total traffic based on injuries range from 0.38 to 0.46 injury per accident while they range from 0.26 to 0.71 injury per accident for large buses. These figures indicate that people using large buses are at higher risk of being injured or killed than by using other transportation modes.

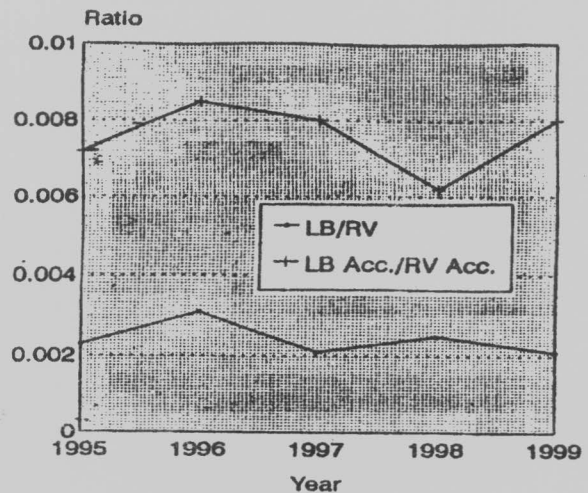


Fig. 1. The ratio of no. vehicles to the no. of accidents for large buses & total registered vehicles in GAA (1995-1999).

### 2.2 Mini buses

This category includes public buses with their average capacity of 20-25 passengers. All these buses operate on fixed routes without fixed schedule. As in large buses they pick up and drop off passengers along their routes.

Table 4 exhibits the ratio of total mini buses to total registered vehicles. It also shows the ratio of total mini buses accidents to total traffic accidents [3]. The Table highlights that the mini buses are involved in accidents in much higher ratios than those of the total registered vehicles. It shows that while the ratios of total mini buses to total registered vehicles ranges from 0.0101 to 0.0144, their ratio from total traffic accidents ranges from 0.0605 to 0.0814. These ratios are also presented in fig.2.

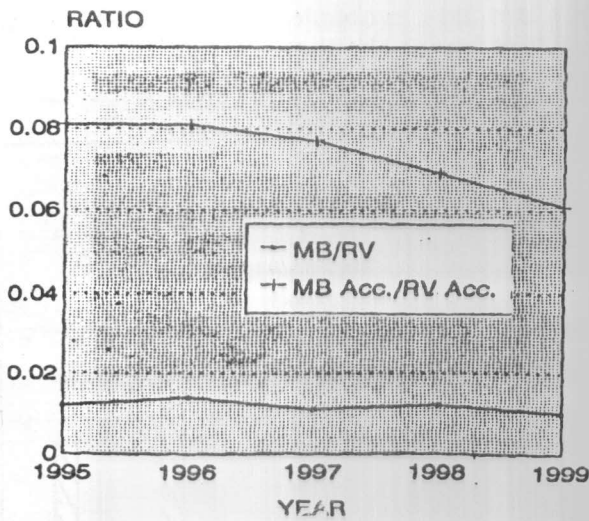


Fig. 2. Comparison between the ratios of total mini buses (MB) & total registered vehicles (RV) with their accidents.

Table 4 also presents the Risk Indices ( $RI_s$ ) for mini buses. Risk Indices range from 5.75 to 7.0. Again as in large buses, these figures indicate that people using mini buses in their daily trips are involved in higher number accidents if compared to the total registered vehicles. It is obvious that risk indices for mini buses are much higher than those of large buses.

Table 5 presents a comparison of severity indices based on both fatalities and injuries between mini buses and total traffic. These numbers show that the severity indices based on injuries for mini buses are in general higher than those of large buses. However, the severity indices based on fatalities are higher in case of large buses, and the contribution of buses (large & mini) to traffic accidents and their risk indices are very high.

During the last decade, The Public Transport Corporation (PTC), a public sector body, which owns and operates transportation service mainly inside Greater Amman Area, has failed to meet the travel demand and has faced a continuous deficit in its budgets. As a result, the Jordanian government decided in 1992 to privatize a part of the PTC [5]. The second phase of privatization was implemented in 1998.

The privatization of the PTC was conducted by leasing the lines to individuals who established new transportation

companies to cover some of the PTC lines. As a result, the new companies purchased many buses mostly mini buses. As the new investors had no experience in operating public transportation, they started to lease the buses to drivers so as to guarantee good service and profit. This type of operation had resulted in frequent violation of traffic laws by drivers so as to assure the required profit set by the investors. In the rest of the country, the bus operation is worse. The buses are owned and operated by individuals who lease the buses to drivers. The previous analyses explain the reasons behind the high accidents, high risk indices, and the high severity indices for both type of buses (large & mini).

### 2.1. Small passenger cars (Jitneys)

This category includes small passenger cars with an average capacity of 507 passengers. They are privately owned and operated generally on a fixed route without fixed schedule. This type of jitney is called in Jordan (serveese). They usually operate inside major cities carrying passengers from down towns to different parts of the city. Few numbers of small passenger cars are used to carry passengers between cities.

Table 6 shows the proportion of small passenger cars to total traffic and it also presents the ratio of total small passenger car accidents to total traffic accidents [3]. These ratios are presented in fig. 3. The table highlights that the small passenger cars are involved in accidents in much higher ratio than the ratio of total traffic. The Risk Indices for small passenger cars, which range from 7.34 to 10.0 as shows also in table 6, are much higher than those of large and mini buses. Table 7 exhibits the severity indices for small passenger cars based on fatalities and injuries. A study of the numbers in table 7 shows that the severity indices for small public transportation modes (large buses, mini buses, and small passenger cars). The figure shows that the risk indices for small passenger cars are the highest followed by mini buses and large buses which means that small passenger cars are involved and contribute to accidents in much higher ratio

than the other two categories because of their large numbers and the fact that they mainly operate inside the major cities.

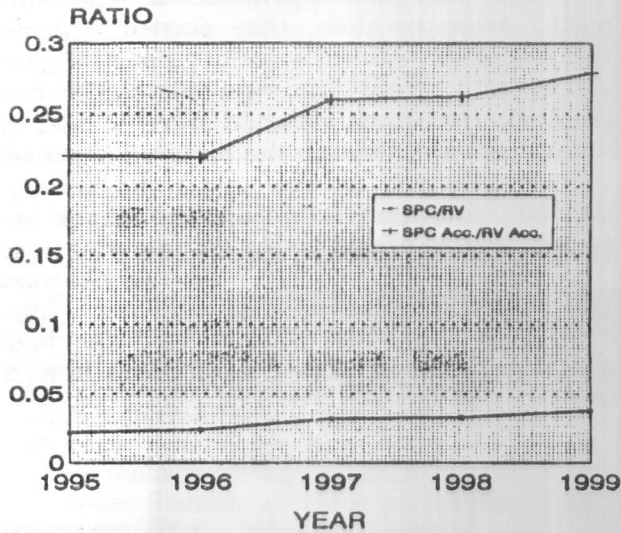


Fig. 3. Comparison between the ratios of total small passenger cars (SPC) & total registered vehicles (RV) with their accidents.

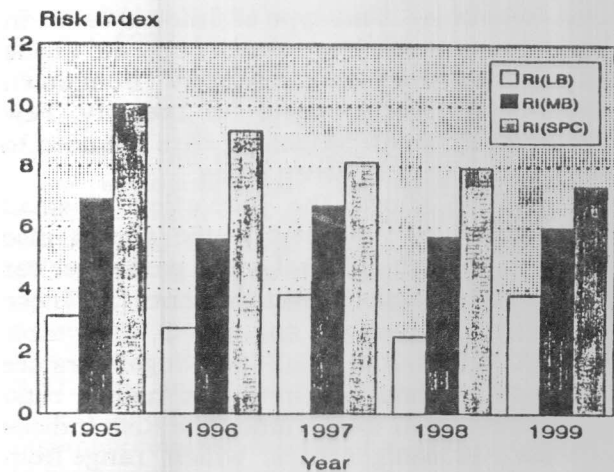


Fig. 4. Comparison between the risk indices of different modes of public transportation.

Fig. 5 presents a comparison for the severity indices based on fatality per accident between the same three categories and the total traffic. The Figure shows also that the probabilities of people being killed in traffic accident by using small passenger cars in their trips are less than those using the other two types (large & mini buses). Fig. 6 presents a comparison between the three categories based on severity index (injury/accident). It also shows that people using small passenger

cars are less probable to be injured by an accident among the three categories.

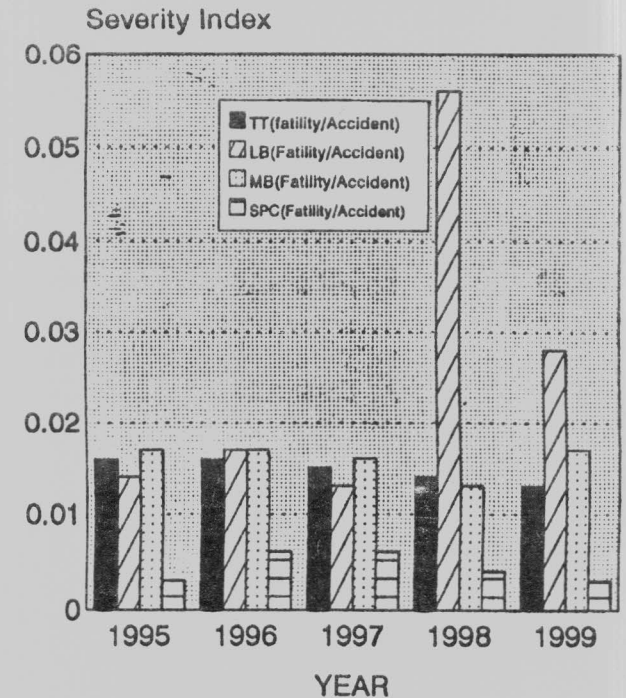


Fig. 5. A comparison between the severity indices (fatality/Accident) of different modes of public transportation.

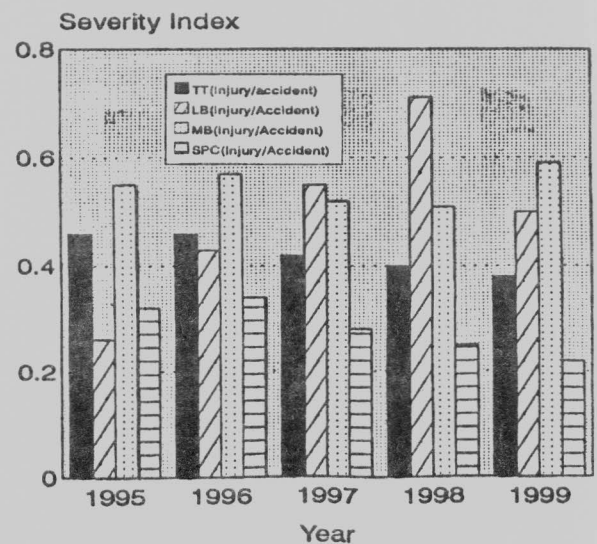


Fig. 6. Comparison between the severity indices (Injury/Accident) of different modes of public transportation.

Table 2

A comparison between large buses and registered vehicles in terms of vehicles and accidents in GAA (1995-1999)

Year	total large buses (LB)	Total registered vehicles (RV)	(total LB/(total registered vehicles)	total LB acc.	total RV accidents	( LB acc.)/ ( RV acc.)	Risk Indices For LB (RI <sub>s</sub> )
1995	733	321373	0.0023	209	28970	0.0072	3.13
1996	1062	342337	0.0031	289	33784	0.0085	2.74
1997	807	362811	0.0021	309	39005	0.0080	3.81
1998	957	389196	0.0025	270	43343	0.0062	2.48
1999	889	418433	0.0021	397	50330	0.0080	3.81

Table 3

A comparison of severity indices between large buses and total registered vehicles in the GAA

Year	Total registered vehicles (RV)		Total Large buses (LB)		Severity Index based on fatalities (fatality/accident)		Severity Index based on injuries (injury/accident)	
	Fatality	Injury	Fatality	Injury	RV	LB	RV	LB
1995	469	13184	3	54	0.016	0.014	0.46	0.26
1996	552	15375	5	124	0.016	0.017	0.46	0.43
1997	577	16259	4	171	0.015	0.013	0.42	0.55
1998	612	17177	15	193	0.014	0.056	0.40	0.71
1999	676	19015	11	199	0.013	0.028	0.38	0.50

Table 4

A comparison between total mini buses and total registered vehicles with their accidents

Year	Total Mini Buses (MB)	Total registered vehicles (RV)	(Total MB/(total registered vehicles)	Total MB Acc.	Total traffic acc.	(MB accid.)/ ( RV acc.)	Risk indices For MB (RI <sub>s</sub> )
1995	3785	321373	0.012	2358	28970	0.081	6.90
1996	4935	342337	0.014	2722	33784	0.081	5.60
1997	4135	362811	0.011	2989	39005	0.077	6.70
1998	4672	389196	0.012	2971	43343	0.069	5.70
1999	4208	418433	0.010	3045	50330	0.061	6.00

Table 5  
A comparison of severity indices between mini buses and registered

Year	total registered vehicles		total Mb		severity index based on fatalities (fatality/accident)		Severity index based on injuries (injury/accident)	
	Fatality	injury	fatality	Injury	RV	MB	RV	MB
1995	469	13184	39	1287	0.016	0.017	0.46	0.55
1996	552	15375	46	1550	0.016	0.017	0.46	0.57
1997	577	16259	49	1557	0.015	0.016	0.42	0.52
1998	612	17177	39	1508	0.014	0.013	0.40	0.51
1999	676	19015	52	1782	0.013	0.017	0.38	0.59

Table 6  
A comparison between small passenger cars (SPC) and total registered vehicles (RV) with their accidents

Year	Total SPC	total registered vehicles	(total SPC/(total registered vehicles)	total SPC Acc.	total RV acc.	(SPC acc.)/ (RV acc.)	Risk indices For SPC (RI <sub>s</sub> )
1995	7064	321373	0.022	6411	28970	0.221	10.04
1996	8199	342337	0.024	7410	33784	0.220	9.17
1997	11433	362811	0.032	10135	39005	0.260	8.13
1998	12872	389196	0.033	11375	43343	0.262	7.94
1999	15999	418433	0.038	14048	50330	0.279	7.34

Table 7  
A comparison between small passenger cars (SPC) and total registered vehicles (RV) with their accidents

Year	Total Registered Vehicles		Total SPC		Severity Index based on fatalities (fatality/accident)		Severity Index based on injuries (injury/accident)	
	Fatality	Injury	Fatality	Injury	RV	SPC	RV	SPC
1995	469	13184	19	2072	0.016	0.003	0.46	0.32
1996	552	15375	43	2483	0.016	0.006	0.46	0.34
1997	577	16259	58	2807	0.015	0.006	0.42	0.28
1998	612	17177	47	2860	0.014	0.004	0.40	0.25
1999	676	19015	47	3046	0.013	0.003	0.38	0.22

### 3. Conclusions

Based on the discussion and the previous study, the following conclusions can be drawn:

1. Public transportation modes in Jordan are contributed to total accidents in much higher ratio than their portion of total traffic.
2. The risk indices for small passenger cars are the highest among three categories.
3. The severity indices based on fatalities for small passenger cars are the lowest among the three categories.
4. In general, the severity indices based on injuries are the highest for mini buses among the three categories.

### 4. Recommendations

1. A thorough investigation of public transportation accidents is needed to examine all the factors which may affect their accidents, such as driver's age, weather, etc.
2. Re-evaluation of the privatization of Public Transport Association. Grouping the individual owned buses in large companies so as to make it easy to control and monitor through well-defined performance measurements. It is also recommended not to give permission for operating bus lines for individuals.
3. A stronger law enforcement by the traffic police department on the operation of public transportation modes.

4. Establishment of National Transportation Council (NTC) to regulate, set policies, and control the transportation system as the existing transportation system in Jordan is divided among many public and private agents with limited coordination between them.

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