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REVIEW ARTICLE

Current Traffic Safety Issues in Saudi Arabia

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Abstract. Transportation sector in Saudi Arabia has witnessed progressive growth over the last two decades. While the country's population has doubled during this period, total length of roads has increased 10 times, and number of registered vehicles was multiplied 34 times. During the period from 1975 to 1980, the intercity travel has shown an annual growth rate of 27%.

As a result of the dynamic growth there was an increase in the number and severity of road traffic accidents. The number of accidents, fatalitis, and injuries has increased 8.6, 4.7, and 4.1 times respectively between 1971 and 1990. The purpose of this paper is to present the magnitude of traffic accidents in Saudi Arabia and to discuss different traffic safety measures which were implemented to face this dilemma.

Introduction

The Kingdom of Saudi Arabia (KSA) has experienced a tremendous growth in the last two decades, including changes in socio-economic activities, life style, and mobility. Transportation sector in particular has gained the lead in this growth. For example, the total length of roads in the Kingdom has jumped from 12,000 Km in 1970 to 120,000 Km in 1990. The number of registered vehicles has increased 34 times between 1971 and 1990 with an average annual growth rate of 20%. Table 1 shows the growth of road length by category and registered motor vehicles in KSA.

Intercity travel growth which can be used as an indicator to mobility level shows that there was an annual growth rate of 27% in the period 1975-1980. This increase in mobility occurred as a result of combined factors which include [1]: (a) the increase

in vehicle ownership, (b) high rate of road infrastructure development, (c) introduction of public transit system, (d) growth of limousine companies and car rental services, (e) rapid expansion of cities, (f) economic growth rate, and (g) increase of per capita income.

The aforementioned growth is accompanied by an equally staggering increase in the number and severity of Road Traffic Accidents (RTA's). During the period from 1971 to 1990 the number of accidents increased from 4147 to 35799; the road accident fatalities registered a rise from 570 to 2697; and the injury victims increased from 5483 to 22526 [2].

The above discussion presents the magnitude of traffic accidents facing the authorities in Saudi Arabia. The aim of this paper is to present the dimensions of this problem and the different reduction measures which were adopted by various government ministries and agencies.

Characteristics of Vehicular Traffic in Saudi Arabia

KSA is located in the south western part of Asia and occupies approximately 2.25 million square kilometers. According to World Health Organization (WHO), the population of the country is growing at an annual rate of about 4.5% and had reached about 14.74 million people by the year 1990. Table 2 presents the change in population figures and the number of registered motor vehicles in the past twenty years, from 1971 to 1990.

The number of registered motor vehicles rose from 0.145 million in 1971 to 4.95 million in 1990. The classification of vehicles indicates that passenger cars comprise about 54%, light trucks 37.5%, heavy trucks 6.70%, taxis 0.70%, buses (including light buses) 0.70%, and motorcycles 0.4% of the total registered vehicle population [3, pp. 31-43].

The level of motorization has increased from 22 vehicles per 1000 persons in 1971 to 335 in 1990. The high increase in vehicle ownership is due to the drastic growth in the total number of registered motor vehicles. The data in Table 2 indicates that it took 7 years, between 1971 and 1978, for the total number of registered motor vehicles to be multiplied 10 times. By the year 1982 the total number has reached 20 times that of 1971.

Table 1. Growth of road length by category and registered motor vehicles in Saudi Arabia for the period of 1971 through 1990

Year	Paved roads (Kms)			Total paved roads	Unpaved roads (kms)	Total length of roads (a) (kms)	Registered vehicles (b)
	Primary	Secondary	Feeder				
1971	5000	2700	600	8300	3200	11500	144,768
1975	7000	3800	1200	12000	8700	20700	515,361
1980	11000	5500	3800	20300	25200	45500	2,069,479
1985	13000	7000	5300	25300	55000	80300	4,144,248
1990	13215	7600	12850	33665	87835	121500	4,950,466

(a) Source [1]
(b) Source [2]

Table 2. Population and registered motor vehicles growth in Saudi Arabia for the period of 1971 through 1990

Year	Population (Millions)	Reg. motor vehicles (Thousands)
1971	6.52	144.8
1972	6.82	180.2
1973	7.13	243.0
1974	7.46	355.0
1975	7.80	515.4
1976	8.16	774.4
1977	8.54	1113.0
1978	8.93	1433.0
1979	9.34	1723.0
1980	9.77	2069.5
1981	10.18	2467.9
1982	10.61	3018.8
1983	11.05	3569.0
1984	11.52	3920.9
1985	12.00	4144.3
1986	12.50	4281.0
1987	13.03	4428.0
1988	13.58	4574.0
1989	14.15	4768.0
1990	14.74	4950.0

Accident pattern

Table 3 shows the motor vehicle RTA's in KSA between 1971 and 1990. The data in this table and that of Table 2 indicates that accidents have increased at a faster rate than population but at a slower rate than registered motorized vehicles. In relation to values in 1971, the indices of growth of accidents, population and motor vehicles in 1990 were 8.60, 2.26 and 33.80, respectively.

Data in Table 3 show that, although there was an increasing trend in the total number of accidents and injuries during the study period, total number of fatalities has reached its peak during the 1980's with a total death of 3499 during the year 1983. The number of fatalities started to show a declining tend since then.

In terms of accident occurrence, available statistical data shows the drastic change in the last two decades. During the year 1971, one road accident occurred in the country every 130 minutes, resulting in an accident fatality every 925 minutes, and one accident injury every 96 minutes. After twenty years and during the year 1990, one road accident occurred in the country every 15 minutes, resulting in an accident fatility every 195 minutes and one accident injury every 23 minutes.

Severity indices

Severity index is a term that can be used as an indicator of the level of traffic safety. It can be obtained as the ratio of two different variables. The five indices used in this paper are:

(1) Fatalities per Accident:

$$\text{FPA} = \frac{\text{Total number of fatalities}}{\text{Total number of accidents}}$$

(2) Fatalities per Injury:

$$\text{FPI} = \frac{\text{Total number of fatalities}}{\text{Total number of injuries.}}$$

Table 3. Accident rates and pattern during the period from 1971 through 1990

Year	Total accidents	Total fatalities	Fat. per 100,000 pop.	Fat. per 10,000 reg. motor veh.	Total injuries	Inj. per 100,000 pop.	Inj. per 10,000 reg. motor veh.
1971	4147	570	8.74	39.40	5483	84.10	378.7
1975	13475	1594	20.4	30.93	10532	135.0	204.3
1980	18758	2731	28.0	13.20	16218	166.0	78.4
1985	29052	3277	27.3	7.90	22630	188.6	54.6
1990	35799	2697	18.3	5.45	22526	152.8	45.5

(3) Injuries per Accident:

$$\text{IPA} = \frac{\text{Total number of injuries}}{\text{Total number of accidents}}$$

(4) Fatalities plus Injuries per Accident:

$$\text{FIPA} = \frac{\text{Total number of fatalities and injuries}}{\text{Total number of accidents}}$$

(5) Fatalities per Fatalities plus Injuries:

$$\text{FPFI} = \frac{\text{Total number of fatalities}}{\text{Total number of fatalities and injuries}}$$

Figure 1 shows the five different indices for the traffic accidents data for the period 1971 through 1990. The following observations can be withdrawn from this figure:

(a) Starting from 1975, severity indices were the highest during the year 1980, after which they showed a declining trend.

(b) The two indices IPA and FIPA were following exactly the same pattern during all the study period. A similar pattern can be noticed for the two indices FPI and FPFI.

(c) The traffic safety level has shown an improvement trend over the years from 1980 through 1990. This is measured by the decline in the values of the five indices.

Road Safety Measures

The experience of industrialized countries indicate that there are several different ways in which improvement in traffic safety can be achieved. The main improvement programs include [4]:

a. Reducing accident occurrence.

b. Reducing the severity of accidents (*e.g.* proper use of guardrails, median barriers, impact attenuators, and breakaway sign posts and light standards).

c. Improving crash survivability.

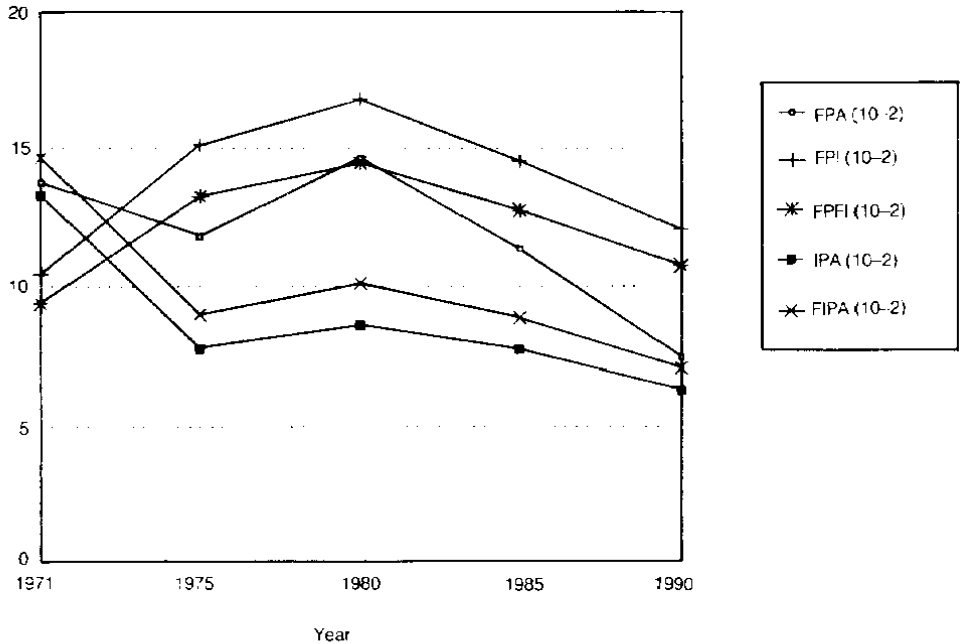

Fig. 1. Severity indices of traffic accidents in Saudi Arabia for the period from 1971 through 1990.

d. Programmatic safety efforts (*e.g.* vehicle inspection program).

e. Design aspects of safety (*e.g.* horizontal and vertical alignment, road side design, median barriers, and gore areas).

The government authorities of KSA have put special emphasis on traffic safety issues which is stressed in the fourth and fifth national development plans. Traffic safety programs included several measures which were implemented by various government ministries and agencies. The following are the most successful programs which took place in this regard:

1. Improving road safety facilities.
2. Establishing National Traffic Safety Committee (NTSC).
3. Commencement of Motor Vehicle Periodic Inspection (MVPI) program.
4. National road safety campaigns through all media means.
5. Traffic departments' efforts through enforcement of traffic regulations.
6. Health care and emergency services.

The following sections of this paper are highlights to some of these programs.

I. Improving Road Safety Facilities

The Ministry of Communications (MOC) is the government agency responsible for design, construction, maintenance and operation of road network in the KSA. Improving safety for road users by MOC was implemented through several measures which include [5]:

- Paving road shoulders.
- Improving side slopes.
- Wide bridges to match the road width and shoulders.
- Construct laybays and metal fencing alongside and on the centerline of expressways.
- Pavement markings of the centers and edges of the highways and the extensive use of raised markers.
- Provide roads with barriers, guard rails, signals, along with kilometer markers warning and directional signs.

II. National Traffic Safety Committee (NTSC) [6]

This committee is one of the national committees which belongs to King Abdulaziz City for Science and Technology (KACST), a research center that pays much attention to scientific aspects of the overwhelming progress in the Kingdom, and follow-up of development in all areas.

The responsibility of the NTSC covers all aspects of traffic safety in the Kingdom, thus its members are representing all government ministries and agencies which have connections with traffic safety.

The committee performs its functions through specialized study groups, both from its membership and from other specialists and researchers interested in this subject who have good experience in traffic problems and who are willing to share the committee's activities and to support the scientific aspects of the committee's work.

The working groups of the committee are shown in Table 4. The achievements of the committee in terms of applied research and technical studies are also shown in the table. Total funds allocated for the committee during the last ten years were in excess of 12 million Saudi Riyals.

The committee work has helped the traffic safety executive agencies to improve on the level of traffic safety. Table 4 shows typical NTSC studies which were applied or in the process of application.

III. Motor Vehicle Periodic Inspection (MVPI) Program

This program was initiated as a result of a research study sponsored by NTSC conducted during the year 1983 [6]. The results and recommendations of this study were adopted by the General Directorate of Traffic and the program was transferred to the private sector for establishing the inspection stations. By the end of year 1986, the MVPI program was in effect in the capital city of Riyadh and gradually it was introduced to other urban areas all over the Kingdom.

The aim of the program is to achieve several goals which include [7]:

1. Enhancing the traffic safety progress by reducing the number and severity of traffic accidents.
2. Improving vehicles condition, and

Table 4. NTSC working groups and corresponding studies conducted during the period from 1982 through 1990

Achievement year	WORKING GROUPS				Total
	Traffic engineering and information system	Medical and emergency services	Education, training & traffic awareness	Organization, administration & operation	
1982	2	–	1	–	3
1983	2	–	–	–	2
1984	2	1	–	2	5
1985	3	1	1	1	6
1986	5	1	1	–	7
1987	–	–	1	1	2
1988	–	3	4	–	7
1989	4	–		3	7
1990	2	–	–	1	3
Total	20	6	8	8	42
An example of each group studies	Setting a program for periodical motor vehicle inspection	Development of emergency medical services (three stages)	A study on sociological and psychological characteristics related to behavior of driving	Alternative system for the design of license plates	

Source [6]

3. Improving urban areas environment by reducing the level of air pollution as a result of decreasing the amount and concentration of pollutants.

Since the starting date, the number of stations and inspection lanes has grown from one station, 10 lanes in 1986 to 13 stations and 51 lanes by 1990. Total number of tested vehicles during this period was more than three million vehicles [8]. The data collected during the last five years has shown a decreasing trend in the ratio of defected vehicles to the total inspected vehicles which is an obvious sign of an improvement in vehicles condition.

Conclusion

The development and growth which took place in Saudi Arabia during the last two decades has covered all aspects of life. Transportation sector in particular has

gained good portion of this growth. As a result of this growth the mobility level has increased and consequently road traffic accidents have witnessed staggering increase. This study, however, has shown that despite the large increase in the number of vehicles, there seems to be a decline in fatality rates and severity indices. The decline trend came as a result of new traffic safety measures which were implemented recently all over the Kingdom.

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واقع السلامة المرورية في المملكة العربية السعودية

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ملخص البحث. شهد قطاع النقل في المملكة العربية السعودية خلال العقدين الماضيين فترة تنمويّة كبيرة. ذلك أنّه في حين تضاعف عدد السكان مرتين فإن إجمالي أطوال الطرق قد تضاعف عشر مرات كما أن عدد المركبات قد تضاعف ٣٤ مرة خلال الفترة نفسها. وخلال الفترة من ١٩٧٥ إلى ١٩٨٠م كان معدّل الزيادة السنويّة في كمية السفر بين المدن قد وصل إلى حوالي ٢٧٪.

وكنتيجة لهذا النمو كان هناك زيادة في أعداد وحدة الحوادث المرورية، فقد تضاعفت أعداد الحوادث، الوفيات والإصابات ٦,٨، ٧,٤ و١,٤ مرات على التوالي خلال الفترة بين ١٩٧١ و١٩٩٠م.

تهدف هذه الورقة إلى إبراز حجم الحوادث المرورية في المملكة ومن ثم مناقشة بعض الأساليب المختلفة للحد من الحوادث المرورية التي تم تطبيقها لمواجهة هذه المشكلة.