THE DEVELOPMENT OF MOTORIZATION AND THE ROAD NETWORK IN EGYPT FROM 1950 TO 1980

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ABSTRACT

The aim of this paper is to study the development of both the traffic and the road network in Egypt from 1950 to 1980. Because of the lack of new date after 1980, the study is limited only to this period of time. A study has been made for the relation of the situation of motorization and the road network in Egypt and some developed countries.A mathematical model for the prediction of the motorization development is also presented.

INTRODUCTION

No doubt that the development of motorization (car ownership) reflects the standard of living of persons and can be considered as a measure for the progress of the countries. The increase in the motorization must be accompanied by improvement and development of the local road-network, otherwise this will bring out many problems, causing adverse effects upon the situation of urban and rural traffic.

The aim of this paper is to show the development of both motorization and road network in Egypt and to make a comparison with some cities in Europa, Asia and America and to find a mathematical model for forecasting the development of motorization in Egypt.

POPULATION DEVELOPMENT

It is essential to show the development of population, since the population represents a main factor which affects the development of motorization.

Figure (1) indicates the population development in Egypt, France, west Germany and Britian [1].

It is clear from Figure. (1) that, the rate of increase in population of Egypt is very high by comparison with these countries.

The rate of increase reached about 2.7 % in EGYPT for the period from 1966 to 1976, whereas in France it was 0.74 % only for the same period. In contrast, the population of west Germany and Britian can be considered constant, since the corresponding rate of increase in population was only 0.3 and 0.2 % respectively.

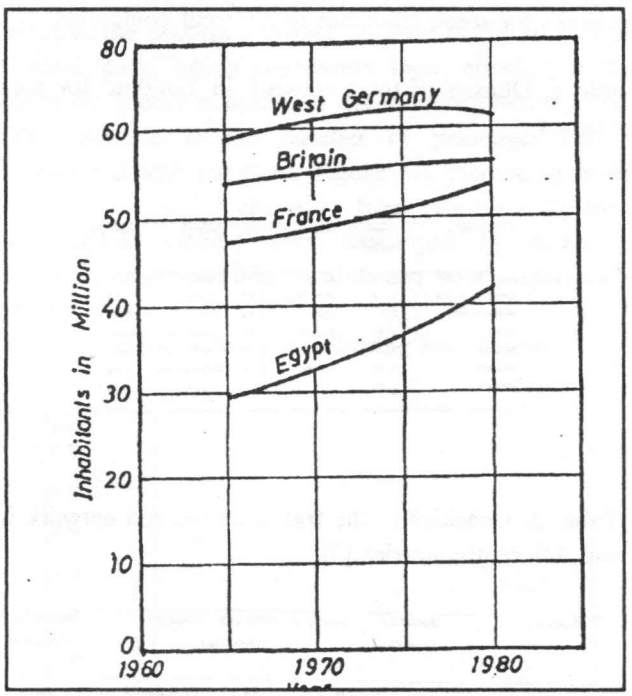

Figure 1. Population development for some countries.

DEVELOPMENT OF THE EGYPTIAN ROAD NETWORK

A graphical presentation of the lengths of both paved and unpaved road network is shown in Figure (2) for the period from 1940 to 1979 [2]. It is clear that length of unpaved roads is bigger than the length of paved roads, although the rate of increase in the length of paved roads is bigger than that of unpaved roads.

The ratio between the total network length in km and

the total area in sq. km. can be used as a measure to describe the situation of road network, and will be defined here as a density of road network.

Table (1) indicates the densities of total networks in km. per sq. km. for some countries in Africa, America, and Europe [3].

From this table it could be noticed that, the density of Egyptian network is 0.03 km/km^2, this value equals only 1.5 and 1 % of the values of the densities in West Germany and Japan respectively. The small value of the density of the Egyptian road network indicates that, the area of the existing road network is too small referring to the total area of the country.

Another measure for the traffic condition is the traffic density, which means the number of vehicles per unit length of the road network (veh./km).

Table (2) shows the densities of the traffic on road networks for some countries in different continents.

Table 1. Density of total network in kim/km^2 for some countries

Country	Density (Km/Km^2)	Country	Density	Country	Density (Km/Km^2)
West Germany	1.34	Egypt	0.03	Canda	0.03
Great Britain	1.53	Ethiopia	0.03	Brazil	0.16
Netherlands	2.2	Congo	0.02	USA	0.67
Italy	0.97	Sambia	0.05	Argentine	0.07
Greece	0.28	Zaire	0.06	Chili	0.1
Hungary	0.94	Uganda	0.11	Dominicon-Rep.	0.42
France	1.45			Japan	2.95

Table 2. Densities of the traffic on the rod network for some different countries [3].

Country	Density (Veh/Km)	Country	Density (Veh/Km)	Country	Density (Veh/Km)
West Germany	50	Egypt	14	Argentine	19
Britian	49				
		Ethiopia	2	Brazil	25
Italy	63				
Netherlands	50	Uganda	2	Canada	26
Greece	20			Colombia	7.0
		Zaire	1.0		
Luxembourg	30			Chile	6.0

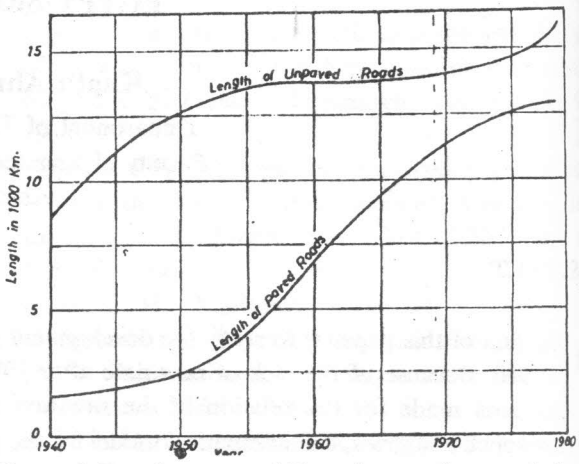

Figure 2. Development of Egyptian road network from 1950 to 1980.

Table (2) indicates that, the densities of traffic in developed countries are much greater than in the under developed countries which means that, first, the road networks with small densities are able to accommodate the future traffic increase,second the existing traffic in the under developed countries can be classified as free flow.

DEVELOPMENT OF MOTORIZATION IN EGYPT

Figure (3) indicates the increase of the degree of motorization in passenger cares per thousand inhabitants during the period from 1950 to 1980. This period can be clearly divided into two stages. The first stage is from 1950 to 1970 in which the car ownership can be assumed constant over this long period of time.

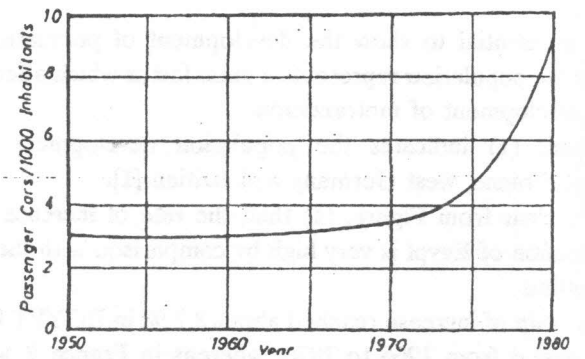

Figure 3. Development of motorization in Egypt from 1950 to 1980.

The second stage starts from 1970 to 1980 which is very interesting since the motorization was doubled in the last

five years only.

The motorization in Egypt is still very low in comparison with the developed countries, in spite of the enormous increase in car ownership in the last five years.

Table (3) shows a comparison between the motorization in Egypt and some other countries.

Table 3. Degree of motorization (Inhabitants/car) in some countries [1], 1979.

Country	Degree of Motorization (Person/Car)	Country	degree of Motorisation (Person/Car)	country	Degree o Motoriza (person/C
West Germany	2.8	Egypt	131	USA	1.9
France	3.0	Algeria	83	Argentine	10
Britain	3.9	Morocco	56	Brazil	17
Italy	3.3			Canada	2.4
Newseland	2.4	Madagasker	166	Australia	2.5
Netherlands	3.6			Mexico	24
Belgium	3.3			Japan	5.4

Table (3) indicates the following:

a) The motorization in Egypt was very low in comparison with the other countries which exist especially in Europe, North, south America and Japan.

b) The west european countries, Canada, USA, Australia, Newseland and Japan have reached nearly the saturation level, i.e. The degree of motorization will stay constant or the increase will be unremarkable, since it reached nearly its maximum value.

c) The average value of the degree of motorization for the west european countries was about 3.3 Inhabitants per passenger car, this value seems to be very high by comparison with the african countries, which reached only 90 Inhabitants per passenger car; i.e. the value of the european countries equals 27 times the corresponding value in the europan countries.

d) It is expected that, the degree of motorization in Egypt will increase continuously but it will not reach the saturation level in the near future.

e) The saturation value of the degree of motorization in Egypt will not reach the value of the west european countries in any case, and it is difficult to determine its exact value and the time of its occurrence. A value ranging from 10 to 15 Inhabitants/car can be given as a reasonable assumption [4].

MATHEMATICAL MODEL FOR PREDICTION OF THE NUMBER OF PASSENGER CARS IN EGYPT

The degree of motorization is affected by many factors such as:

a) Population or Inhabitants at the age from 18 to 65 years.

b) The national income or the standard of living for the Inhabitants.

c) The total cost of the car such as operation costs, repairs, maintenance and fees, etc.

d) The efficiency of public transport, and restrictions of the private transport traffic in the center and some zones in the cities.

e) Policy decisions which control the import of vehicles in order to protect the national industries.

It is very difficult to consider all the above mentioned factors in the proposed model, because of the lack of the required data, which represents their effect. For this reason the model is based on the following assumption:

The increase in the number of passenger cars is proportional with the time, Figure (4). According to the available data, which are taken from reference [2], three mathematical models were developed by means of regression analysis. These models can be summarized as follows:

The first model takes the following linear from:

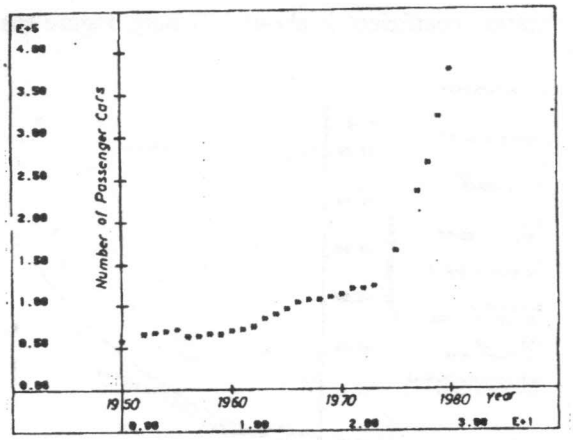

Figure 4. Development of passenger cars from 1950 to 1980.

$$Y = A + BX \quad (1)$$

where:

Y = the total number of passenger cars

A,B = constants

X = time under consideration in years

The values of A and B are shown in Figure (5). This model seems to be of low accuracy, since the correlation coefficient equals only 0.675.

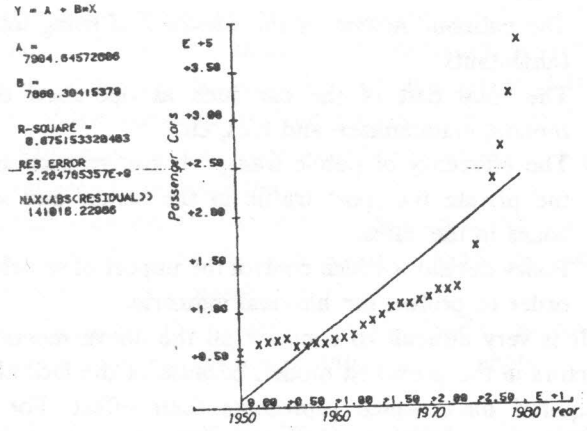

Figure 5. The constants of the straight line model.

The second model takes the following exponential from:

$$Y = Ae^{BX}$$

where A and B are constants.

This model seems to be of low accuracy too. The correlation coefficient is about 0.77 only, Figure (6)

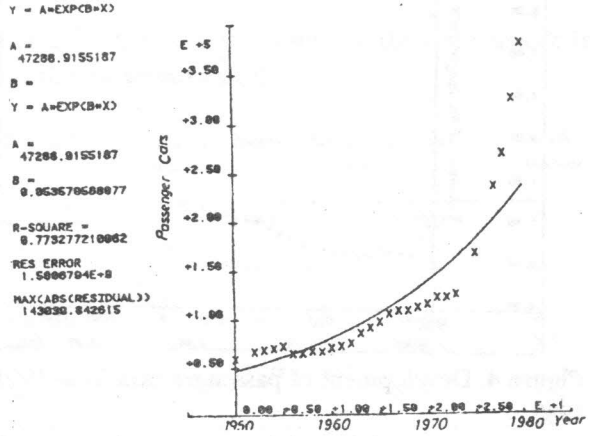

Figure 6. Thee exponential Model's constants.

The third model takes polynomial from. The general form of this model can be written as follows:

$$Y = A_nX^n \pm A_{n-1}X^{n-1} \pm A_{n-2}X^{n-2} \pm A_{n-3}X^{n-3} + \ldots \pm AX \pm A_o$$

where Y = total number of passenger cars

x = the time under considerations

n = the degree of the polynom.

Three different types of these models with different degrees (n = 3,5 and 10) were developed and presented in Figures (7) through (9) respectively. These Figures show the constant and the correlation coefficients for the three cases. These models seem to be very accurate and more suitable than the first and the second model, since the correlation coefficients in these cases are 0.973, 0.995 and 0.999 respectively.

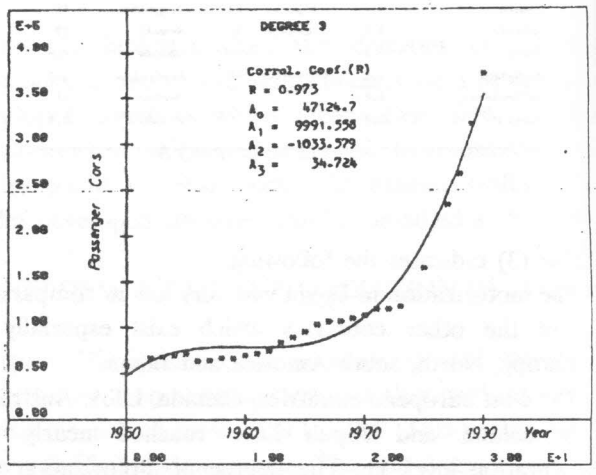

Figure 7. The polynomial model with degree of 3.

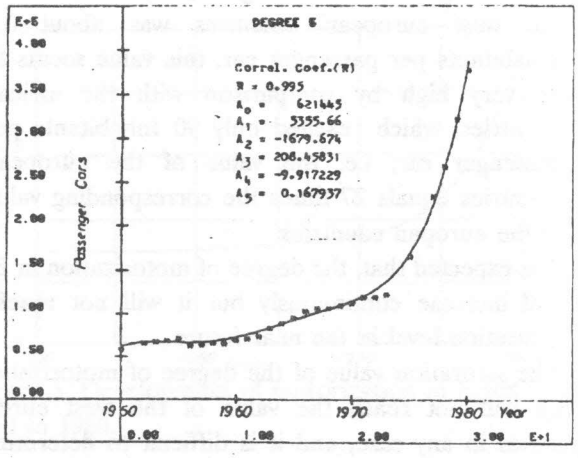

Figure 8. The polynomial model with degree of 5.

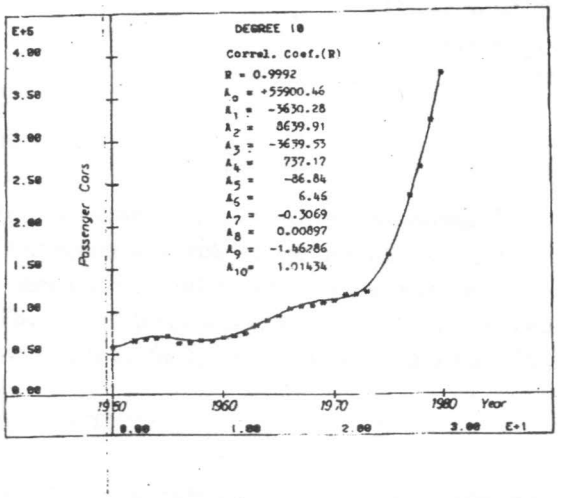

Figure 9.The polynomial model with degree of 10.

CONCLUSIONS

According to the investigated period of time the following are the main conclusions drawn from this course of investigation:

1) The density of the Egyptian road network is too small as compared to developed countries. For example, it reached only 1.5 and 1 % of the corresponding values in West Germany and Japan respectively.
2) The traffic density on the egyptian road network is still small in comparison with the developed countries, which means that, the Egyptian road network is able to accommodate the future increase in traffic.
3) The saturation value of the degree of motorization in Egypt is not expected to reach the value in the developed countries and it is difficult to expect its time of occurrence.
4) The study indicated that, mathematical models which take polynomial form with different degrees are more suitable than the other models such as the straight line and the exponent form.

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