Movement and transport of pilgrims in the Hajj Region, Saudi Arabia : a geographical study.

Al-Rakeiba, Abdullah S.

Movement and Transport of Pilgrims in the Hajj Region, Saudi Arabia:

A Geographical Study

by

Abdullah S. Al-Rakeiba

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Department of Geography
The University of Durham, England
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In the name of Allah
The Compassionate
The Merciful

To my parents, my wife and children,

Asma and Mshal

Abstract

Over the past ten years the movement and transport of pilgrims to and within Makkah, involving some 1.5 million Muslims annually from around the world who come to perform the Hajj (pilgrimage), has become the most complex aspect of the entire event, owing to the fact that the Hajj is carried out within a limited space at specific times and involves huge and annually increasing numbers of pilgrims and vehicles. Such increases have adversely affected the Hajj, which ought to run smoothly and easily for the benefit of pilgrims.

This study has concentrated on three points: 1) a discussion and analysis of the most important factors affecting the transport of pilgrims, such as transport facilities and increased numbers of pilgrims, and so on; 2) the determination and breakdown of the movement patterns of pilgrims, either between the cities of the Hajj region or between the Holy Places in Makkah, with the aim of evaluating such patterns according to the Hajj objective and pilgrimage instructions; 3) identification and discussion of the major transport problems which pilgrims face in the Hajj region, and suggestions for their solution.

The study has found that traffic congestion, overcrowding and delay are fundamental problems of the Hajj movement, particularly in Makkah. Such problems cannot be solved exclusively by building more roads and providing more vehicles. It has been found that Hajj movement in Makkah is subject to a series of time-space constraints. This limitation of time-space on an increasing number of pilgrims and vehicles involved in the Hajj were essential elements in the creation of traffic congestion.

In order to relieve these problems faced by pilgrims, an attempt to find a possible alternative transport system for the Hajj movement has been developed, in terms both of regional movement (between Jeddah, Madinah and Makkah) and of local movement in Makkah.

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1.1 Significance of the Study

The pilgrimage to Makkah, in which over 2.2 million Muslims from different countries and places come to perform their Hajj duty, can be considered the most important geographical phenomenon in the Middle East. This remarkable phenomenon has several characteristics which need to be examined and analysed in order to understand the problems that may be facing the pilgrims and the authorities responsible for the movement of pilgrims during the Hajj period. This is necessary if we are to provide appropriate solutions and planning in the future.

This vast number of pilgrims move between cities and through urban areas in a limited region during a specific period of time. Almost a month before the beginning of the Hajj rites period, Jeddah airport and harbour start to receive the earlier pilgrims arriving by plane or ship. At the same time or slightly later, Madinah and Makkah normally entertain the pilgrims who come by car and some of them also arrive at Madinah airport by plane. On arrival at Jeddah, some of the pilgrims make a short visit to Madinah before going to Makkah. Others simply travel directly to Makkah and pay the visit later on. However, by the eighth day of Dhul-Hijja (the last month of the Islam lunar calendar) almost all pilgrims are in Makkah or its environs to perform the Hajj rites which take between four and five days. After that, the transport of pilgrims begins back to their homes. All pilgrims who have travelled by air or sea must return to Jeddah, but some of them must first travel to Madinah for further prayers.

The movement and transport of pilgrims during the Hajj should be considered the most complex aspect of the pilgrimage due to the following considerations.

1. Transport of pilgrims takes place within a specific area, the Hajj region inter-city (Jeddah, Madinah, Makkah), and in particular at those sites which are the Holy Places in Makkah, to perform the Hajj rites.
2. There is a practical and limited period to carry out the Hajj duty which is four or five days. Thus all pilgrims must be in Makkah throughout this period.
3. The number of pilgrims generally is increasing yearly, for example, it had not exceeded 350,000 in 1960, while in 1979 it reached 2,080,000 (see chapter 5).
4. The available system, to transport the pilgrims from the airport or harbour to Makkah, is only by road, using public or private vehicles.

From this, it should be clear that the Hajj movement has characteristics that are reflected in its influence upon the transportation of pilgrims. In addition, the Hajj region has many factors, the study of which will help to identify the problems of Hajj transport and planning requirements. Therefore the success of the Hajj is associated with success in the transport arrangements of the pilgrims.

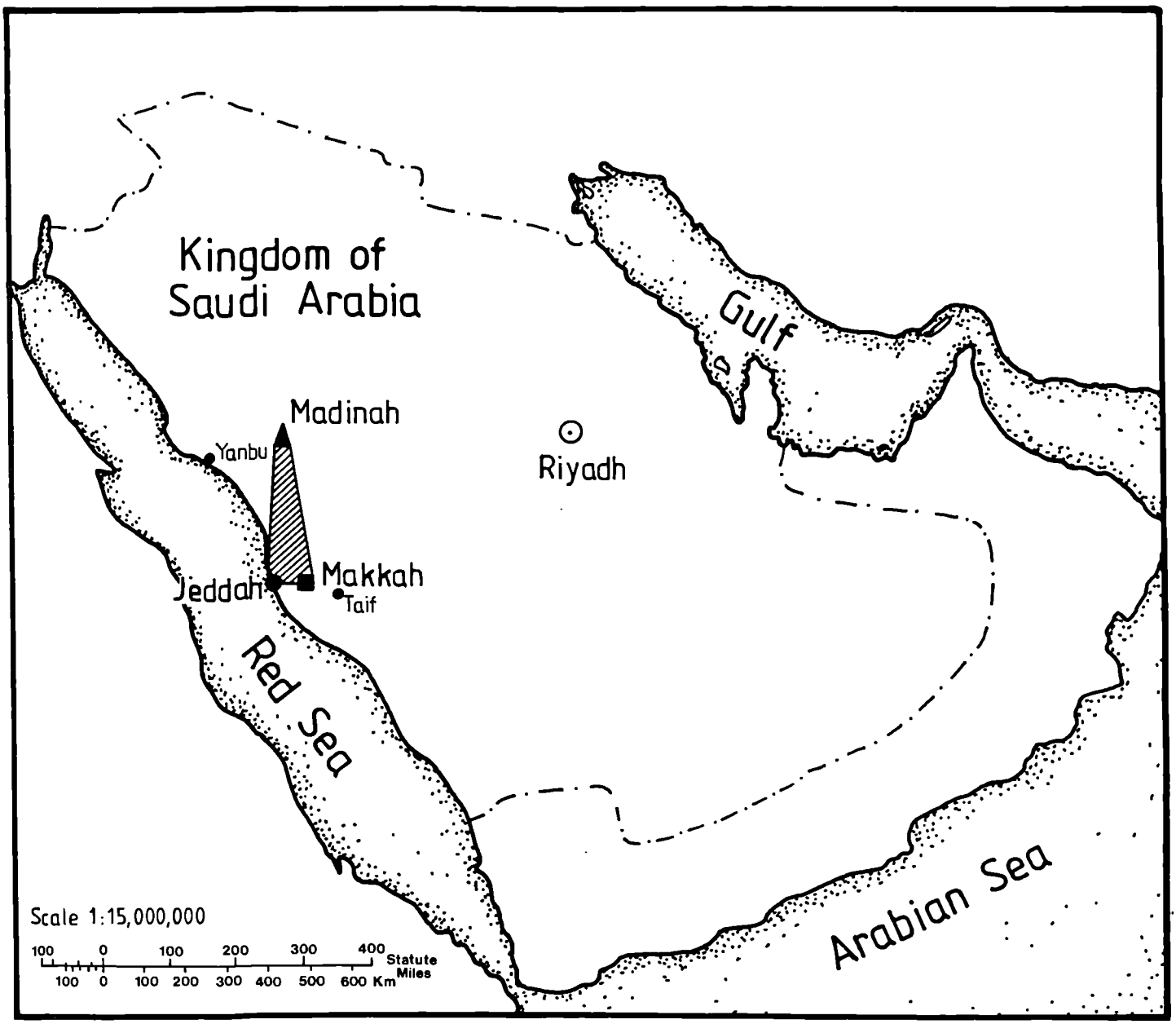
1.2 Setting of the Hajj region

The Hajj region, or as it is called locally, the 'Hijaz Region', lies on the west of Saudi Arabia and east of the Red Sea. Despite the Hajj movement which occurs between and within Jeddah, Madinah and Makkah, the Hajj region extends to include other cities, towns and villages which are affected by the seasonal activities of the Hajj (see Figure 3.5). The Hajj region incorporates Yanbu city which used to be the second harbour for pilgrims after Jeddah seaport. Yet most of the pilgrims who use sea transport for international travel arrive at Jeddah. It may also include Taif city, which is an essential entry to Makkah from eastern ports, and Allieth town which is considered as the southern entry to the Holy Makkah. Nevertheless, the study area will concentrate on Jeddah, Madinah and Makkah (which form a triangular shape (see Figure 1.1)) owing to the fact that regional movement in the Hajj occurs between these three cities. A brief geographical picture of each city follows.

1.2.1. Makkah

The Holy Mosque, which is considered the centre of Makkah city, lies on 21.25° north latitude and 39.50° east longitude. Geographically, Makkah is located at a point where an eastern extension of the Tihama coast meets with the granite hills of the Sarawat, at an elevation of 277 m above mean sea level. It is situated on rock hills called 'coastal elevations' lying between the coastal plain of the Red Sea to the west and the Sarawat mountains to the east. This is considered a central location in terms of settlement between the two directions. In the west, Jeddah lies on the Red Sea coast at a distance of 73 km from Makkah and in the east, Taif is situated at roughly the same distance. Both are cultural centres which were founded as a result of Makkah's influence.

Figure 1.1 The Hajj Region in Kingdom of Saudi Arabia



Makkah was built around the holiest shrine in the Muslim world (the Ka'ba). It is toward this house of God that hundreds of millions of Muslims turn every day in their prayers, and to this very ancient city that hundreds of thousands of them flock every year. In addition, it holds many places of religious and historical significance, such as the shrine of Ibrahaim (Abraham), the well of Zamzam, and the mounts of As-Safu and Al-Marwah (As-Saba'ai, 1979).

Topographically, the city is closely confined by steep-sided barren hills which channel its development along a series of valleys (wadis) - e.g. the Ibrahim and Tundebaway valleys. This topographical situation has been one of the major factors influencing the urban pattern and expansion of Makkah (El-Hamdan, 1976:32).

The topographical situation, indeed, plays a role in determining the types of urban development in the city, in that most of the housing is located in the narrow flat areas of the wadis (valleys). The street pattern has also been influenced by topography. The network of main roads radiates from the city centre (the Holy Mosque) and follows the meanderings of the valley (see section 3.3.4).

The population has been estimated by the Ministry of Municipal and Rural Affairs (1987) at around 700,000 with a density of 131 people per hectare. This means that Makkah is the second largest city in the region, and the third largest in the country.

Climatic conditions in Makkah are characterised by long hot summers and short mild winters, with temperatures ranging between an average summer maximum of 40^{o} C and an average winter minimum of 15^{o} C. Rainfall ranges from 10 to 120 mm per year; and the greatest monthly total on record is 20 mm.

1.2.2 Madinah

The second holiest city in Islam after Makkah is Madinah, the city of the Prophet Mohammed, which has the prophet's mosque. It is visited by hundreds of thousands of Muslims each year. Although a visit to Madinah is not one of the requirements of the Hajj, most external pilgrims visit it once they have journeyed to Saudi Arabia.

Madinah is situated about 400 km north of Makkah. It lies on 24.28° north latitude and on 39.30° east longitude, on a plateau immediately to the east of the Hejaz Mountains, about 150 km east of the Red Sea, and at the northern end of a huge basaltic flow. This plateau is surrounded by hills and lava flows (Harrah's).

Climatic conditions in Madinah are more continental than those of any other city in the region. Minimum temperatures reach a low average of 10° C in January while the maximum temperatures reach a high average of 42° C in July. Total annual rainfall reaches about 104 mm.

In 1987 the city covered an area of about 24,980 hectares. About 11 per cent of this area was used by public utilities, including the road network. The population was estimated at 500,000, with a population density of some 20 people per hectare (MoM & RA, 1987)

1.2.3 Jeddah

On the eastern shore of the Red Sea lies the Saudi Arabian port and city of Jeddah, the largest and most important port city in the country. It is considered as the main entry to Makkah for people who come by air or sea.

As a result of its favourable location the communication system that developed in Jeddah offers the highest accessibility possible, both to the other parts of Saudi Arabia and to the outside world. Both the airport and the harbour are of high international standards and are highly efficient in the handling of freight and passengers, especially pilgrims. In 1987 the population of Jeddah was about 1,312,000, i.e. the largest city in the region and the second largest in the country.

Climatic conditions in Jeddah are influenced by its location on the Red Sea. This location, between the Mediterranean type of climate, and the monsoon type of climate, causes high humidity during the summer months. Temperatures are high almost all year round reaching a maximum monthly average of 39° C in July, and a minimum monthly average of 17° C in January. Relative humidity has an average monthly maximum of between 75 percent and 80 percent. Rainfall is unpredictable although the city is subject to winter rainfall which occurs between October and April.

The most important thing to mention here is King Abdul Asiz International Airport in Jeddah. It has been designed to cope with one of the world's busiest air transport routes, particularly during the pilgrimage season. The airport is built on an area of 105 sq km (65 sq miles). It is divided into three air terminals: the domestic terminal, the international terminal, used by 40 international airlines, and the pilgrims' terminal. "*The latter was built from a high-resistant material to resemble an Arab tent, and has won an international award as an advanced engineering innovation.*" (MOI, 1988). In fact this terminal, or as it is called 'Pilgrims' City' is a separate building inside the airport. It consists of shops, banks, restaurants, health services and so on. The court of the terminal can contain about 33 planes of different sizes at the same time. In 1986, 106 planes arrived at the terminal on one day (Almansory, 1987, 233).

Jeddah is also the largest port in the kingdom of Saudi Arabia for the transportation of passengers and goods. It is regarded as the port for Makkah, from which pilgrims arriving by sea head towards the Holy City. The port plays an essential role in handling millions of tons of materials and thousands of passengers. The port was redeveloped to include 40 quays which can handle all sorts of goods as well as pilgrims arriving by sea.

1.3 Identification of the Hajj

The Hajj is a pilgrimage whereby one travels to the Holy Places to do a specific action. Pilgrimage in Islam, the Hajj, * is a set of prescribed rites at specific hours and days in assigned locations in and around Makkah. Each year, millions of pilgrims converge on Makkah to perform their religious duty at the same time. Movement requirements of this event will be recognised by a brief description of Hajj rites in chronological order as described below (Bushnak, 1977).

As already indicated, on the eighth day of Dhul-Hijja, almost all of the pilgrims are in or around Makkah. On the morning of the eighth, some pilgrims go from Makkah to Muna (a distance of about 8 kms) to stay there for that day, and the rest either proceed directly to Arafat or stay in Makkah. Being in Arafat on this day is the most important rite of the Hajj. Pilgrims spend their day in Arafat in Prayer and supplication, and prefer to visit the Mountain of Mercy, but there are no required activities within Arafat. Immediately after sunset on the ninth, all pilgrims desire to leave Arafat. They move to Mozdalifah (6 kms from Arafat), where some spend the night. Some pilgrims stop in Mozdalifah for a short time to pray, then continue to Muna.

Early in the morning of the tenth day, all pilgrims are back in Muna where each individual first throws seven pebbles at the third pillar of the Jamarat, ** sacrifices an animal, and then shears or shortens the hair on his head. After that the pilgrim can

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* The Hajj is the fifth 'pillar' of Islam. The other four are first, uttering the Shahadah (there is only One God and Muhammad is his messenger); second, the five daily prayers; third, fasting the month of Ramadan; fourth, paying the annual Zakat.

** Jamarat are three places in Muna, each has a pillar representing a symbol of the devil (Shaitan)

take off his Ihram. They celebrate on this day by visiting each other, feasting and socialising which generates additional local movement in Muna. Sometime during this day, or the following two days, pilgrims go to Makkah, usually in the evening when it is cool, to perform the Tawaf and Sa'ee in the Sacred Mosque, then return to Muna to spend the night there. *

On the 11th, 12th and 13th of the month, the only required activity is throwing seven pebbles at each of the three Jamarat pillars early in the afternoon. Some pilgrims make their sacrifice there, or additional ones, and the mood of celebration continues. Pilgrims are allowed to leave Muna on the twelfth and most of them do so. The only right left at this stage is a farewell Tawaf which is to be performed before departing Makkah.

From the description of the rites and also pilgrim movement to Makkah, it should be clear that there are two kinds of movement of pilgrims in the Hajj region. Firstly to cities (Jeddah, Madinah, Makkah) and secondly between the Holy Places within Makkah (Arafat, Mozdalifah, Muna and Al Haram).

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* Tawaf means walking around Al Kahbah seven times. Sa'ee means walking between two small hills (Safat and Marwo) seven times.

1.4 Purpose of this study

The aims of this study are to examine and analyse the geographical transportation characteristics of the Hajj movement phenomenon, to evaluate the existing transport systems in the Hajj region and to put forward suggestions that would lead to their improvement. Therefore, research will be concentrated on the following aspects:

1. The identification and analysis of the most important factors affecting the transport of pilgrims, such as transport facilities and increased numbers of pilgrims and so on.
2. The determination and breakdown of movement patterns of pilgrims, either between the cities of the Hajj region or the holy places in Makkah, with the aim of evaluating such patterns according to the Hajj objective and pilgrimage instructions.
3. Identification and discussion of the major transport problems which pilgrims face in the Hajj region, and putting forward some suggestions for their solution.

However, the latter is limited to external pilgrims who constitute about 60 per cent of the total number of pilgrims (see Chapter 5). Pilgrims from within Saudi Arabia are not involved in the analysis for many reasons, the most important being:

A. Internal pilgrims stay in the region for a very limited period of time (on average about 5 days) which makes it very difficult to conduct a similar type of survey of them as that made of external pilgrims.
B. Internal pilgrims usually prepare and provide most of their own services, such as accommodation, transport and guidance, which makes them different from external pilgrims.

C. At least 50 per cent of internal pilgrims are from the surrounding region and many are connected with the service industry for pilgrims in one form or another. Even those who come from other regions of the country are sometimes very hard to separate from the residents of Makkah itself.

D. The small size of the sample (500) in the pilgrims' survey means it is limited. Because of the constraints of time and resources, it was not possible to cover a larger sample in a survey carried out by one person, assisted by a few students during the Hajj season, so it was decided to concentrate mainly on external pilgrims.

1.5 Previous Studies

There is an enormous amount of material pertaining to the historical and religious aspects of the Hajj. However, such sources contain scant information about routes, caravans, or descriptions of journeys made during the Hajj. In short, transport and communication data are relatively thin on the ground. Most of these are to be found in the Arabic classics, notably Akhbar Makkah by Al-Azraki (829), *Shifa'a al-Garam bi-Akhbar al-Balad al-Haram by al-Fasi* (1354), *Mer'at al'Harameen* by Refat Basha (1925) and the history of Makkah by al-Sibai (1959). In addition, travellers paid much attention to the Hajj, and Makkah particularly. Western travellers such as J C Buckhardt, especially in his book '*Travels in Syria and the Holy Land*' Vol 3 and travellers such as Burton, Rutter, and Philby have also written about the Hajj.

Notwithstanding, there are other materials written about the movement of pilgrims and their routes to Makkah from outside the Hajj region, one notable example being the North African experience as described by Al Nagar (1972) in his book *The Pilgrimage Tradition in West Africa with special reference to the nineteenth century.* Birks (1978) turned his attention to the patterns of movement and routes to Makkah across the savannas of Africa. Both books dealt with the same broad area and in the case of the latter presented new data from a geographical viewpoint.

However, the Saudi Arabian government has sponsored many studies related to the service needs of the contemporary Hajj, the most relevant of which is a feasibility study of the objectives which were set out by the Ministry of Planning in the First (Five Years) Development Plan (1975). Such objectives were to promote regional development in the kingdom, to provide reliable essential services and to ensure an

equitable distribution of social services. Thus the group of consultants who were working on master plans for cities in the western region of Saudi Arabia, including Makkah and Madinah, undertook several studies related to the Hajj. The first master plan concerning the cities of the region was carried out by the British firm, Robert Matthew, Johnson-Marshall & Partners at the beginning of the 1970s. It reported socio-economic surveys incorporating the Hajj and transport issues at critical local and regional points. It also projected the future requirements of the local road network. It sought to meet many objectives to develop the cities of the western region. One of these objectives was to encourage the development of appropriate public transport systems in order to assist in achieving a balanced choice between private and public transport (Robert Matthew, 1972, 5).

Thus in 1976 the Ministry of Communication secured a contract with Jamieson MacKay and Partners, Consulting Civil and Transportation Engineers, to carry out the urban public transport studies for the western region including Jeddah, Makkah and Madinah. They concluded that services of public transport should be designed to achieve three objectives, which are:

A. Maximum convenience for passengers by having services routed close to their origins and destinations.

B. Operational efficiency by matching the capacity of the system to the levels of passenger demand throughout each sector of the city.

C. A low fares policy in order to encourage the use of public transport (Jamieson MacKay, 1977, 4).

More recently, Dar-al-Handasah Consultants and the Saudi Consulting Group (DHC, 1985) have undertaken comprehensive development plans for the Makkah region. It has been carried out for the Ministry of Municipal and Rural Affairs. DHC reported the results of valuable Hajj surveys which included vehicle and pedestrian counts. It also projected some requirements relating to transport affairs such as the construction of more network links, 'the fourth ring road' in Makkah (see Chapter 3) and building a high-speed rail link between Jeddah, Makkah and Madinah (DHC, 1985, Report 7, 23).

However, in the author's opinion, some of these studies are based on misconceptions of the Hajj and its function; whereas others were basically concerned with the extension of construction and investment in transport facilities. Nonetheless they provided valuable alternatives and recommendations, particularly with regard to settlement and urban development plans. Thus some projections which were recommended by the consultants have been adopted and implemented by the government but no study was uncovered which evaluated the suitability of such constructions and projections for the pilgrims and the Hajj, particularly with respect to the Hajj movement.

Of the research studies which are available, those dealing with the Hajj movement or the transport of pilgrims are limited. The majority of these are focused either on the non-Hajj period or non-transport issues. However, a more recent study by Makki (1988) investigated the problems of urban transportation in Makkah outside the period of the Hajj, in a Ph.D. thesis. Yet it may be asserted that the author's study which aims to examine the transport of pilgrims in the region during the Hajj period is complementary to Makki's study. One example of the research related to non-trans-

port affairs in the Hajj is Makky's Ph.D.thesis (1979) which concerns itself with the characteristics of pilgrims' accommodation in Makkah. He investigated the spatial structure of pilgrim housing in Makkah by surveying the variation of rental cost, accommodation size and quality with the factors of distance and accessibility to the Holy Mosque.

Mecci (1979), in his Ph.D.research, analysed the effects of modern pilgrimage on the urban geography of Madinah. Hassan Ilam (1979) also examined aspects of the urban geography of Makkah and Madinah. It is obvious that the former focused on Madinah while the latter is a general study in terms of urban geography. Bushnak (1977) presented his dissertation about planning and evaluation of special event transportation systems with application to the Hajj. He used the approach of engineering systems analysis. Before this, El-Hamdan in 1976 provided an historical account of routes and modes used by pilgrims and developed forecasting models to estimate the number of foreign pilgrims for the years 1983 and 1993. In addition to this, Angawi (1975) and Farsi (1973) studied some aspects of the Hajj from an engineering viewpoint. Long (1973) gave an historical account of the development of Hajj institutions and health services. He also analysed the social, economic and political impact of the Hajj on Saudi Arabia.

The available research on the topic of pilgrims' transport, however, is very limited in scope. They are often case studies which, in the main, deal with the Hajj from a non-geographical point of view and they are frequently out of date. The volume of change affecting the region has rendered such research somewhat obsolete. There is a need for a study that identifies the common characteristics of the Hajj movement

and determines the problems of transport which may arise throughout the transportation system as it currently exists in the Hajj region.

The Hajj Research Centre (HRC), which was established in 1975 and used to belong to the University of King Abdul Asiz in Jeddah and was transferred to the University of Umm al-Qura in Makkah, is considered to be a centre of information regarding the Hajj. However, its studies and reports did not appear until recently. Although the HRC has carried out several surveys and many studies about the Hajj, few of these have been published and as the majority remain unpublished, some are not available at all. Finally, since 1986 each year the Ministry of Communication in Saudi Arabia usually organises local conferences to discuss aspects related to the Hajj movement and several papers are presented. The author has attended a number of these conferences and presented one paper in 1987 about the factors influencing the increase or decrease of pilgrim numbers.

1.6 Study Method

This study concerns itself mainly with the description and analysis of data obtained from published statistics and update surveys, and from fieldwork carried out by the author in 1989. A variety of materials and reading that pertain to aspects of transportation and which relate to the topic of the research have also been covered.

A computer search was made in the library of the University of Durham and King Abdul Asiz City for Science and Technology in Riyadh to collect as much relevant material on the study subject as possible.

Data collection was based on the following sources:

1. Written materials which relate to the research subject or the study area.
2. Relevant reports published by advisory and consultative bodies such as: the special studies carried out by British consultants, Robert Matthews, Johnson-Marshall & Partners (1972) for the Ministry of the Interior; and Kocks Consultants, GMBH (1982) for the Ministry of Planning which covered the Saud Arabia National Transportation Plan; and Dar-al-handasah Consultants and Saudi Consulting Group, DHC (1985) for the Ministry of Municipal and Rural Affairs; Hajj Research Centre (HRC) which belongs to the University of Umm al- Qura.
3. Official reports and statistics published by Government bodies. Such resources are considered main elements upon which the research depended, in order to structure the background data; notably that from the Central Department of Statistics (CDS) in the Ministry of Finance and National Economy, the General Department of Traffic (GDT) which comes under the control of the Public Security sector in the Ministry of the Interior.

- Ministry of Planning (MOP)
- Ministry of Communications (MOC)
- Ministry of Information (MOI)
- Deputy Ministry for Town Planning
- Ministry of Hajj and Endowments (MOH)
- Hajj Research Centre (HRC)

All of the above, and others, were contacted and interviewed by the author. They were also a source providing information and reports which related to the research task.

4. Fieldwork

For determination of patterns of pilgrims' movement and to find out the pilgrims' attitude to the transport system in the Hajj region, the author carried out extensive fieldwork in Hajj 1989.

The fieldwork was undertaken over a period of two months and ten days in Saudi Arabia (from 15.6.89 to 27.8.89) mainly in the pilgrimage region. During this period the following occurred:

- Many government agencies were contacted and some information was collected. Many booklets and reports were made available to me and specific questions were answered. Some private organisations, such as the 'Matawif' (a pilgrims' organisation), transport and airline companies were contacted, either in the Hajj region or in Riyadh;

- I had the opportunity to perform the pilgrimage for the seventh time. It took four days (9th to 12th Dhul Hajjah) and during this I made notes and took photographs;
- An extensive survey was made in the Hajj region before and after Hajj activities.

In fact the survey was carried out with the assistance of the Hajj Research Centre in Makkah who provided twelve students of different nationalities to help. These students proved very helpful in interviewing those pilgrims who spoke neither English nor Arabic, as the students could speak the pilgrims' own languages. In addition to this I already had five students from Riyadh who provided extra help.

The survey was conducted in two stages. The first stage took place during the pre-Hajj period and involved the classification of cars entering Makkah. The second stage occurred after the Hajj when questionnaires were distributed.

The First Stage

Classification of the numbers of cars entering Makkah before the Hajj is not available from the Traffic Department nor the Hajj Research Centre although both publish statistical books about the Hajj movement annually. Therefore a specific form had to be devised to count and classify the vehicle entering Makkah. Out of the five roads entering Makkah, two were selected because, according to official statistics, they dealt with the greater volume of traffic and these roads were used to classify the vehicles in circulation. This survey was carried out during two days (7th and 8th Dhul Hajjah) in which the traffic flow reached its official statistical peak. A team of students filled in a specially designed form every fifteen minutes (see Appendix 1).

The Second Stage

A series of interviews with pilgrims and guides were conducted in the post- Hajj period, ie on the 13th Dhul Hajja (16th July). It took 17 students 7 days to complete the questionnaire.

A questionnaire had been developed for the research and pilot study made on the Hajj in 1988 (see Appendix 2).

The questionnaire was written in Arabic and English and was designed for external pilgrims and was very detailed. It had been developed from the questionnaire used in the pilot study undertaken in the season of 1988.

Sample size:

Five hundred and forty questionnaires were distributed amongst pilgrims (of these 33 were rejected because they were incomplete). This number represented about .06 per cent of the official total of 774,560 pilgrims in 1989. The stratified sampling design was used to subdivide this figure proportionately amongst the numbers of pilgrims arriving in Saudi Arabia by air, land and sea as below:

Mode	No. of Pilgrims	Percentage	Sample Size
Air	534,662	69%	372
Land	195,950	25%	135
Sea	43,948	6%	33
Total	774,560	100%	540

The Approach:

The sample of pilgrims was in direct proportion to the number arriving by air, land and sea. At Jeddah airport 372 interviews were carried out by 8 students who were

evenly dispersed in the pilgrims' terminal area. The students chose at random every third pilgrim from each group sitting down.

Meanwhile five students were distributed in the car parks in Makkah which are specially provided for land pilgrims. As in the airport, selection was done on a random basis.

At the seaport of Jeddah where pilgrims are accommodated in flats, two students carried out a survey by selecting every second flat in the building complex and interviewing the first person they encountered.

Finally, all pilgrims' questionnaires have been coded on coding sheets and the survey data were put into the computer at the Computer Centre of the University of Durham. At this stage of the analysis, the software used was mainly SPSS^{X}, GIMMS, Doggs and Minitab. Cross-tabulation, frequency tables, graphs and other statistics were used in the analysis. Regression and chi-square statistical tests were also applied in the analysis of some events.

1.7 Structure of the thesis

The thesis has been divided into nine chapters, four of which (chapters two, three, four and five) were concerned with factors influencing the transport of pilgrims, both in relation to transport facilities and transport users. The latter, which is also considered essential background for the research, used the secondary and official data to examine the development and spatial patterns of the main aspects of the Hajj movement. The other chapters focus on the patterns and transport problems of the Hajj movement. Therefore, most of the data contained in these chapters were dependent on fieldwork. The last chapter is given over to recommendations and conclusions (see Figure 1.2).

Chapter One gives an idea of the significance, purpose and methodology of the study, as well as a brief geographical picture of the Hajj region.

Chapter Two deals with the broad identification of some terms used in the research. This chapter also throws light on the connection between the time geography model and patterns of journeys to the Mosque in general, and to the Holy Mosque in particular. It concludes with a delineation of the most important factors influencing journeys to the Hajj in Makkah (Hajj movement).

In Chapter Three the development and spatial features of the general road network in Saudi Arabia, and in particular that of the Hajj region are discussed and analysed. In this chapter, the importance of this aspect which facilitates the transport of pilgrim is discussed.

Chapter Four is confined to looking at the volume and types of vehicles used in the region, either in the Hajj or non-Hajj period. This work is necessary in order to discuss

and determine the volume and type of vehicles available in the area to facilitate and serve pilgrims during the Hajj season.

Chapter Five is concerned with the number of pilgrims and the increase in pilgrims, as well as their geographical distribution. The main factors influencing the international movement of pilgrims has also been quantitatively analysed in this chapter.

Chapter Six consists of discussion and analysis of the patterns of pilgrim movement in the Hajj region. It also includes: inter-city flow; patterns of arrival and departure of the Hajj movement; and duration of stay in the Hajj region in general and in Makkah in particular.

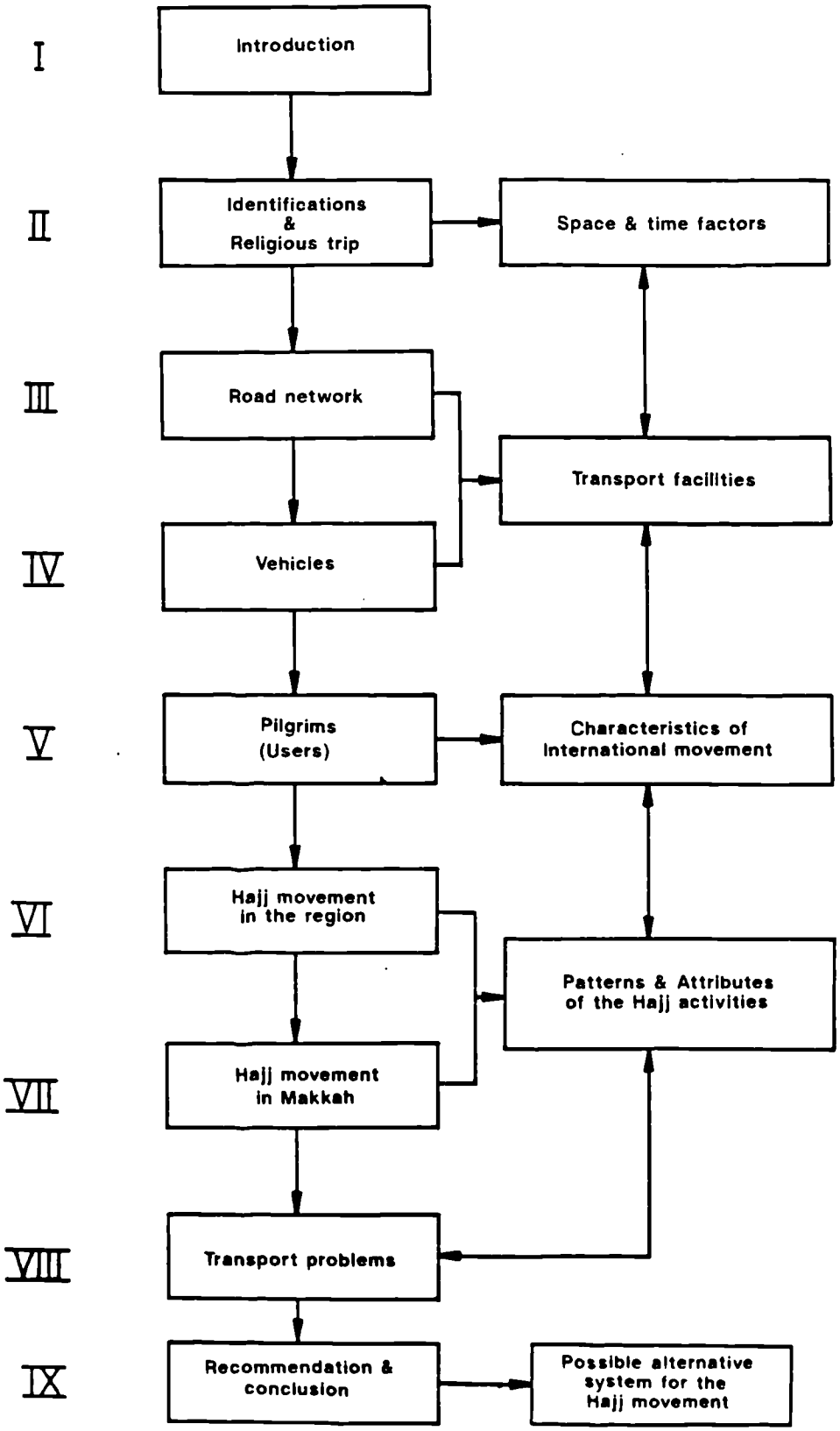
Chapter Seven continues to develop some of the concerns which appeared in Chapter Six: the patterns of pilgrim and vehicular movement are the major subject of this chapter which is concerned with aspects of movement patterns between the holy places.

Chapter Eight constitutes a micro-level analysis of the major problems of the Hajj movement which have been obtained from the characteristics and attitudes of pilgrims towards the transport system. This led to conclusions regarding the main problems which the pilgrims face during the Hajj movement between the holy places.

An attempt to develop a possible alternative system for Hajj movement is explored in Chapter Nine. This chapter includes the main recommendations to relieve Hajj movement problems in terms both of regional and local movement. The chapter closes with the conclusion of the thesis.

Figure 1.2 Structure of the thesis

Movement and transport of pilgrims in the Hajj region



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Chapter 2

A Conceptual Framework of Trips to the Mosque

2.1. Introduction

It is useful to pose the question, 'What is transport?' at the outset in order to discuss or evaluate a subject that represents such an influential factor in both social and economic life. Basically, transport is concerned with the movement of people or goods from one place to another for a particular purpose. In economic terms, the demand for transport is a derived demand. Transport as such does not really produce a tangible product as from a factory, and the meaning of the word 'demand' in this context is that transport is required not for its own sake but because it is useful in satisfying some other need, i.e. transport is a utility (Robinson, 1978).

Transport plays a necessary part, not only in facilitating the movement of goods but also in the development of services. The customers must be transported to the place at which the service is available or vice versa. The housewife must be transported to the shops, children to school, doctor to patient and worshipper to church or mosque etc.

As services become more specialised and the size of production units optimised the catchment area of the service (its market) must be extended (White, 1983). Roads, railways, ships, buses and aeroplanes are various forms of capital, but unlike natural resources, capital is man-made since man has to create it for himself. Transport, therefore, is a kind of capital commodity, in just the same way as a piece of factory equipment, but while the latter can be used physically to produce goods, transport is used to provide a service (Robinson, 1978). Thus, transport provides a means of moving persons or goods from one place to another.

Transport is considered an important social function.

> *"A fundamental feature of social life which has developed during the last century is the separation of work and residence. This has been made possible by transport developments, enabling people to live in a better environment and at the same time allowing to travel to a place where the reward for their labour is higher" (White, 1983, p.3).*

In addition to that, transport performs an essential role for people who travel for recreational or religious purposes. The former is very important in the European communities, while the latter plays an important role in the Middle Eastern communities. However, it should be noted that most of the authors who have written about transport have neglected the role of transport in religious activities. Essentially , the function of transport is to close the spatial gap between producer and consumer, using both these words in their widest possible sense.

But, how does geography relate to transport? Geographers are concerned with the study of transport for two main reasons. Firstly, transport is a significant human activity with a strong spatial component and is therefore a legitimate object of study in its own right, as much as agriculture, steel production or retailing. Secondly, transport is an important factor influencing the spatial variation in many other social and economic activities (White, 1983). Generally speaking, the study of the role of transport in geography, including patterns and modes of transport, quantitative studies of the movement of goods and people, and the relationships between transport and other geographic factors.

In the nineteenth century geographers such as F. Ratzel and A. Hettner, recognised the importance of transport as providing features of the landscape and as an agent of geographic change. In the early twentieth century leading French geographers (P. Vidal de la Blache, J. Brunhes) developed transport geography as part of what they called 'geography of circulation', which studied not only the tangible landscape

features but also the less tangible movements of goods and people. The subdiscipline developed little until the 1950's, when studies of specific transport modes (ports, air transport, railways) were started. Then in the 1960s, North American geographers, led by E.L. Ullman, W.L. Garrison, E.J. Taafe and others, demonstrated the applicability of the techniques of quantitative geography. As a consequence, there was a rapid expansion of studies in transport geography (Johnston, 1986).

However, the geographer focuses his attention on the spatial structures formed by the different modes of transportation and attempts to understand the processes that have created them, while the economist concentrates his study on the cost characteristics of these modes and the engineer may study the comparative operating characteristics of the modes (Taaffe, 1973).

Moreover, geographers are concerned with the study of Man in relation to all aspects of the environment - physical, economic and social. This leads them to an interest in the interaction between environmental factors, and between environmental factors and human activities.

These chapters will discuss some conceptions about causes of movement and patterns of movement with reference to the movement for religious purposes. Finally, because time and space are considered essential factors in influencing the Hajj movement it is helpful to review writings about time geography.

2.2. Causes of Movement

The previous section looked at the definition of transport. Following on from this it is logical to pose the question : Why does movement take place at all?

To answer this query it is helpful to refer to Ullman's Principles which specify most of the causes of movement. Transport, as already stated, is demanded because it is useful in satisfying a need. This is really a fundamental point since transport does not take place if this need is not present (Robinson, 1978). Ullman put forward three main reasons to explain the interactions between regions : complementarity, intervening opportunity and transferability (Ullman, 1973).

Interaction between regions will not take place unless two conditions are met. First, there must be a need in one region that can be met from another region, and secondly, as a result of this, the area of demand must be able to pay for the supply so that a two-way movement develops (Knowles, 1981). In their way the two regions can be said to be complementary and this complementarity is the basis for interaction between them.

> *'Interaction between complementary regions will only take place if there are no intervening opportunities for buyers or sellers to get what they require more easily' (Knowles, 1981, p.110).*

Suppose, for example, a Parisian is going on holiday and his intention is to go to the Costa Brava in Spain. He may travel southwards via Orleans, Limoges, Toulouse and Carcassonne with the firm intention of following the coastal road, rounding the eastern end of the Pyrenees, to reach the Costa Brava. However, after leaving, the sun is hot, the sea is blue and he likes the place, and the outcome is that he spends the rest of his holiday on the French side of the Pyrenees and never gets to the Costa

Brava (Robinson, 1978). Thus it will be seen that '*intervening opportunities is a negative concept in that it may prevent movement from occurring even where there is specific complementarity*' (Lowe, 1975, p.11). The basic assumption often made is that all trips will want to remain as short as possible. It also encourages people to select a lesser but still adequate alternative rather than the more distant but best location.

However, Ullman's (1956) spatial interaction model, above, has been adopted by Murphy (1985) when he discussed the preconditions for creating "*tourist spatial interaction*". In fact some researchers eg. Mansfield (1990) argued that Murphy's analogy of Ullman's spatial interaction concept seems to work quite well, as a whole. In applying the intervening opportunities concept to explain the reasons for emerging tourist flows, for instance, the analogy is not totally correct (Mansfield, 1990, p376). Unlike other types of travel (particularly shopping trips and the journey to work) tourist travel itself is sometimes perceived as part of the tourist adventure (Hudman, 1980). Hence, the rationale of looking for a destination corresponding to one's expectations, but which is more distant than any other similar destination, is perfectly understandable (Mathieson and Wall, 1982). Moreover, regarding pilgrimage to Makkah, there are no other opportunities for Muslims to perform the Hajj in an alternative place instead of Makkah according to the Islamic Instructions.

So far, it is obvious that the idea of complementarity may explain why transport takes place, but perhaps;

> "*the most important factor of all is the cost of making the journey. This is important in considering firstly, whether or not the journey is made at all, and secondly, how or which mode of transport is used for the journey*" *(Robinson, 1978, p.12).*

A journey or anything that is involved in interaction between two places must be capable of being transferred. This transferability is measured by the real cost of transport. However, the main point is that interaction between regions will take place only if the person or product is able to pay for the transport.

But Lowe and Moryadas (1975, p.10) appended another cause of movement which they call 'place and time utility'. They defined 'utility' as "*the capacity of a commodity or a service to satisfy human want*" but Wilson identified place utility as:

> "*the added economic value of a commodity created by transporting it from the place or area in which it has little or no usefulness or value to place or places in which it has greater usefulness or utility*", *(1954, p.5).*

However, Wilson's definition seems to be an economic explanation of place utility that does not take into consideration movements for recreation or religious purposes, for example. There are many patterns of movement and migrations which occur from one place to another as a result of other causes. Movement to holy places exclusively for spiritual or religious reasons can be considered an important element of the mobility of people. As Birks stated:

> "*Pilgrim journeys from a large number of those population movements which are not a consequence of political or economic motives and are perhaps more difficult to evaluate and regulate than movements consequent of more secular motives.*" *(Birks, 1978:3)*

So he emphasised that movement patterns to and from religious places

> "*tend to be an especially important facet of mobility within an area because they are usually centripetal.*" *(Ibid.)*

Many places stimulate the movement of people because of the attraction of religious places or historical locations such as the Vatican in Rome and Makkah in Saudi Arabia.

> *"Time utility transportation enhances the ability of goods to satisfy human events by making goods available not only where they are needed but when they are needed. This results in time utility" (Wilson, 1954, p.7).*

Many products have a short shelf life, and fresh inventions must be obtained periodically. In addition to this, all human activities are associated with time but in some cases movement increasingly takes place within a specific period such as a public holiday like Bank Holiday Monday in England. This tends to result in peaks of movement and transport and notoriously long traffic jams. In Makkah, for example, when the Hajj period begins at the end of the Islamic calendar this results in the movement of large numbers of people towards the Hajj city.

There are four concepts mainly applicable to the movement of goods or people. Most movement can be understood and explained in terms of these four concepts, which should all be taken into consideration simultaneously in order to provide a parsimonious explanation of why place to place movement occurs.

It may be useful to spell out the main journey purpose categories or reasons why transport takes place, especially for personal movement. There are seven broad groupings when considering personal movements according to Robinson (1978, p.10).

(i) Work - there will normally be a journey to work each day to the place where the person is normally employed.

(ii) Firm's business - this is rather different from (i) above insofar as it involves journeys made during the course of work as distinct from a precise journey to one's place of work.

(iii) Education - journeys which are made by school children, students, parents, etc.

(iv) Shopping and personal business - such as going to the supermarket, hairdressers, solicitors or to church; these are of a semi-regular or intermittent nature.

(v) Social and entertainment - this category includes a wide range of activities such as visiting friends and relatives, going to a place of recreation.

(vi) There are some journeys for which there is no specific purpose other than to be with or assist some other person; for example driving someone to the station or taking children to school and so on.

(vii) To reach home - any of the journey purposes above can start or finish at home and while some journeys may not be home-based, over 40 percent of all journeys people make are for the sole purpose of reaching or getting back home.

The above list delineates the various purposes of personal movements, but it is significant to note that although these categories may be appropriate to European communities or Islamic countries where slightly different classifications of personal movement appertain. There exists another factor which affects the movement or activity of most people in the Middle East and in Saudi Arabia in particular, and this is religion which requires people to perform specific activities, whether daily, weekly or yearly; movement from one place to another will be explained more precisely in the next sections.

2.3. Patterns of movement

The basic unit of movement is a trip : this may be defined as "*the one-way travel from one point to another for a particular purpose*" (Lane, 1971, p.39). The two end points of a trip are usually referred to as the origin and the destination of that trip (Robinson, 1978). A trip can therefore be simply represented as in Figure 2.1.

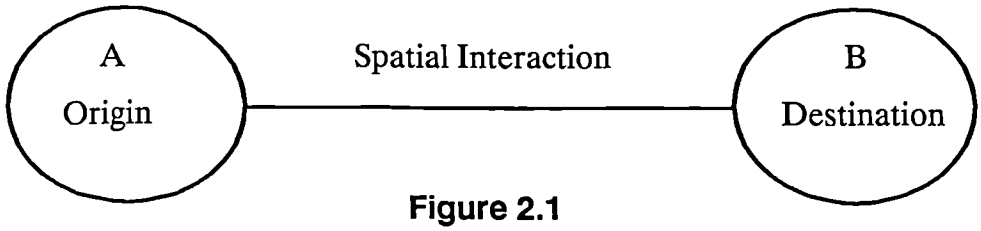


Figure 2.1

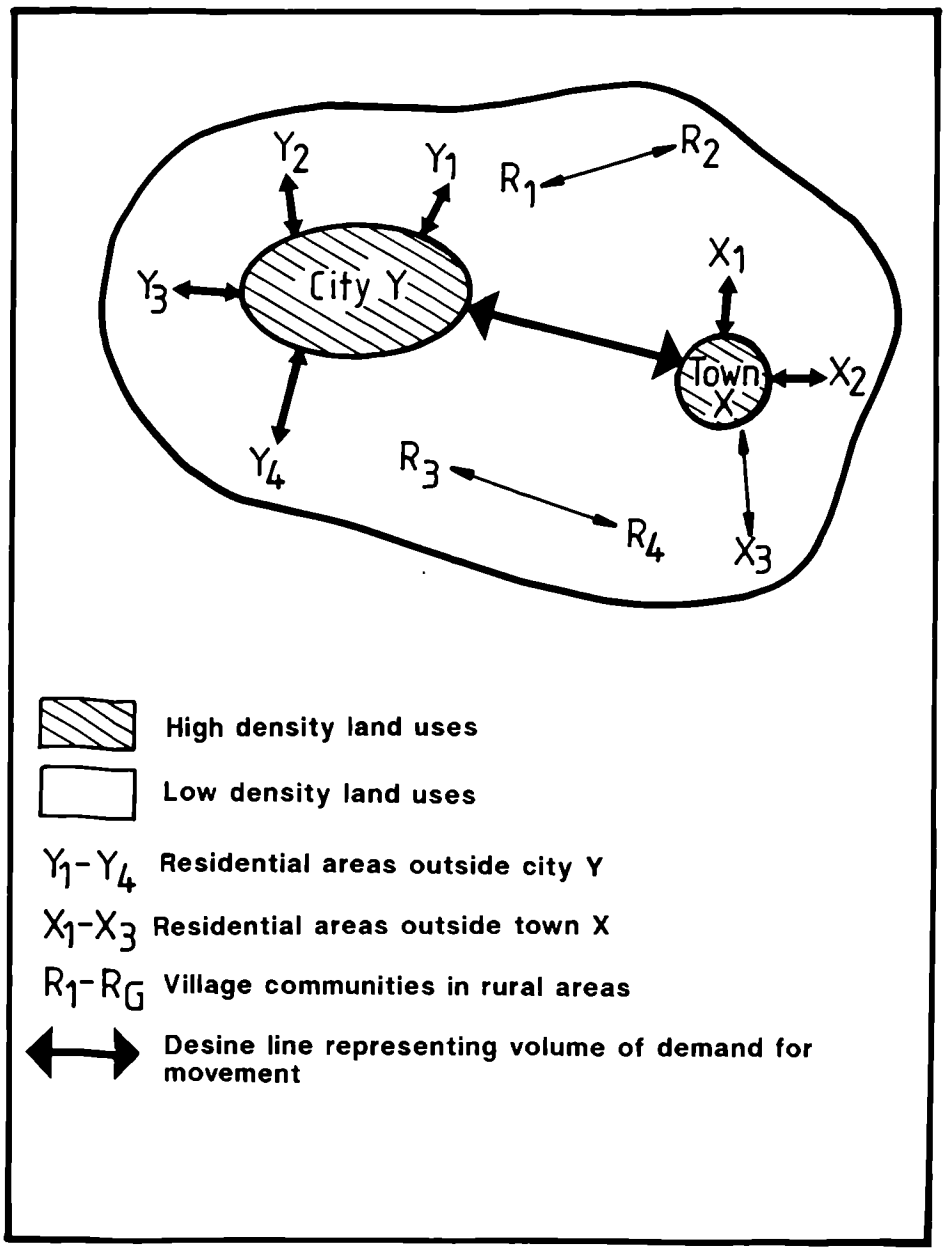
It is clear from the above that the trip has three components or dimensions; the origin, which is the departure point; the point of arrival, called the destination; and movement or spatial interaction which is located between these two points, and includes distance and duration of trip.

The pattern of movement within urban areas is more complex than that outside urban areas. Urban traffic consists of two main elements; movements into the area from outside and movements within the urban area. The most important movements in cities are trips made to and from work or for the purpose of shopping. For convenience, "*trips are often split into two groups*" (Robinson, 1978, p.49):

(i) home-based trips : such trips have one end i.e. the home of the person making the trip, which may be either the origin or destination of the given trip.

(ii) non-home-based trips : these have neither origin nor destination trip-ends at the home of the person making the trip.

Figure 2.2 General patterns of movement



Source: Robinson, 1978 (Adapted from C. A. O' Flaherty, Passenger Transport Past Future, 1969)

The patterns of movement made by people may be classified according to purpose as essential, or in relation to time, such as daily or weekly patterns. They can also be categorised by the mode of transport used. However, the main patterns of movement are shown by desire lines in Figure 2.2. On the basis of this figure, one can distinguish the following general patterns of movement (Robinson, 1978, p.51) :

(i) High density - high density travel, e.g. Town x to City y (inter-urban travel);

(ii) Low density - low density travel, e.g. Village R_1 to Village R_2 (rural travel);

(iii) Low density - high density travel, e.g. Suburb Y_1 to City (one component of urban travel);

(iv) Movement within high density zones, e.g. within City Y, which along with (iii) combines to give total urban travel.

It is plain from the above categories that there are three main spatial patterns of movement : inter-urban, urban and rural, and each one has its own specific patterns of movement whether with regard to time of transport or purpose of journey. For instance;

> "*there are easily recognizable, regular and predictable temporal patterns of movement in all towns and cities, although the timing and duration of the peaks and lulls of movement vary with the size of towns, their occupational and industrial character, and their location*" *(Daniels, 1980, p.59).*

So far as movement or trips for religious purposes is concerned, there are three patterns of movement included in Islamic religious activity : daily, weekly and seasonal. Each of these periodicities is related to the making of trips to the mosque. In Saudi Arabia, for example, most of the male Moslems carry out these temporal activities which, briefly described, are:

The daily pattern : Islamic religion requires male Moslems to pray as a group in the mosque at specific times. Moreover, five trips every day are made to the mosque and back to the home or place of origin. These mosques usually serve only small areas within the various quarters of the town, and the trips often do not exceed 500 m or ten minutes duration on foot. In fact, there is no transport problem or any difficulty of overcrowding at all in this pattern for several reasons, the most important being that such mosques are usually well spread out. They are normally close to the home or place of work, and therefore within walking distance. Secondly, although Islamic religion encourages worshippers to pray in mosques as a group, in some areas most people pray at home or at their place of work. Thirdly, women are not ordered to pray in the mosque, despite the fact some women prefer to visit the mosque for extra prayers, particularly the Holy mosque in Makkah and Madinah.

The weekly pattern : this movement takes place once every Friday, at midday. It is similar to the above trip, but the prayer lasts for one hour, and more distance is involved because the Friday prayer is performed in the Jomoah mosque (Al-Jamai) which is bigger than the daily mosque. This mosque serves a larger part of the quarter than the daily mosque and accommodates a larger congregation. Some of the people who go to the Jomoah mosque, travel by private car and the rest are pedestrians. Sometimes, especially when the prayer finishes, there is a small amount of congestion or overcrowding in the mosque area, particularly in the famous mosques in big cities.

The seasonal pattern : this may be subdivided into two patterns. The first is movement, twice a year, to the large mosque in which the two major religious feasts are celebrated. This is called the Eid Prayer. So the gathering is greater than in the aforementioned mosques as the result of only a small number of these mosques being

found in the city or town. Therefore, we find a small city or town has only one or two mosques in which Eid Prayer takes place, while it has more than a hundred mosques for Jomoah prayer and more than three hundred mosques for daily prayer. However, most of the people who wish to go to the Eid Prayer usually travel by private car or public transport because the mosque is far away from home. Thus there is some congestion and traffic jams occur in the cities, particularly when the prayer ends.

The second is the Hajj movement which takes place once a year for the entire Islamic World. This pattern of movement completely differs from the preceding patterns where prayer can be carried out in any place, whereas, the Hajj must be in Makkah. Although the Hajj duty is a once-in-a-lifetime commitment there are some people who perform it many times for extra prayers. In addition to this, there is another pattern called Omrah which is just a visit to perform a specific activity inside the Holy mosque. It takes place any time in the year but very often the volume of movement increases during the fasting month (Ramadan) when worshippers desire to make extra prayers. Normally, one would expect the majority of worshippers to be from Saudi Arabia and the Gulf states.

From the above, it appears that there are four types of movement for religious purpose and each one has a specific place and particular time. They are:

- The five prayers, every day in the mosque;
- the Jomoah prayer, every Friday in the mosque of Al- Jamai;
- Eid prayer, twice a year in the Eid mosque;
- The Hajj to Makkah, once a year in Hajj region.

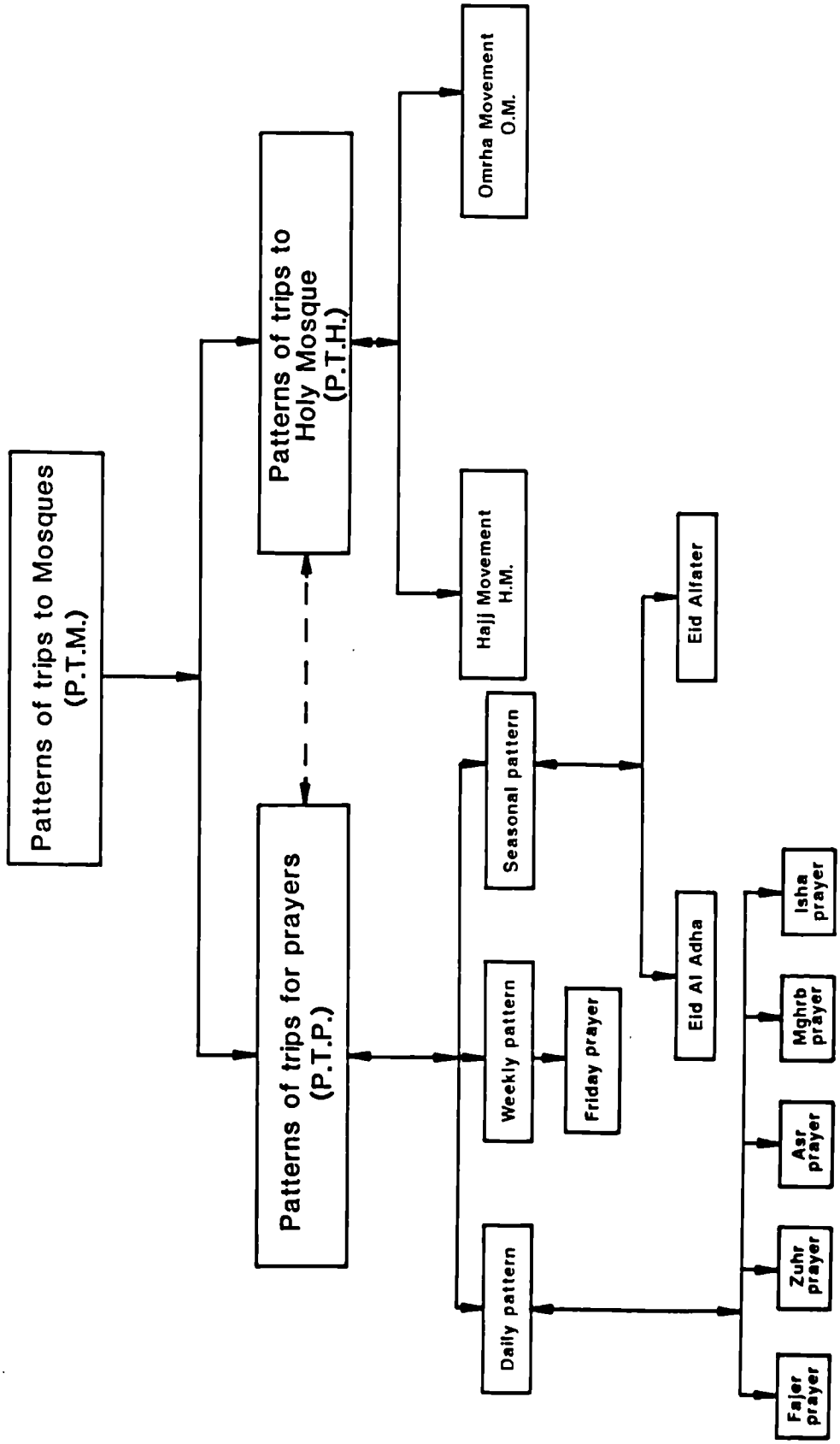
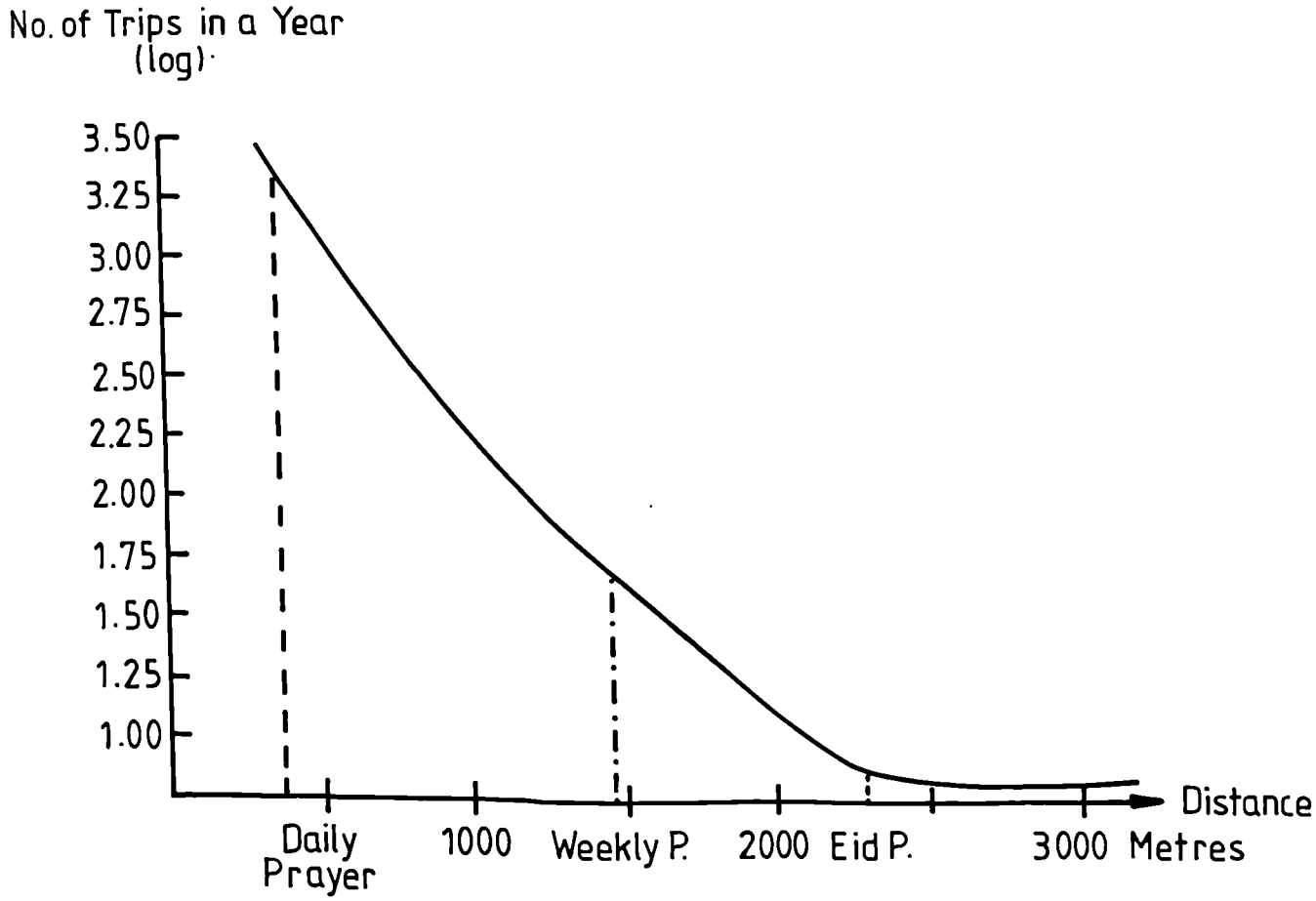


Figure 2.3 Model of movement patterns to Mosque

These patterns of movement can be represented by a simple model in Figure 2.3. An attempt to identify the nature of the correlation between distance and interaction of worshippers using the various types of mosques has been developed through the use of a simple graph (Figure 2.4). The aforementioned number of trips for P.T.P (Pattern of trips for Prayer) which every male Muslim should make have been fixed by Islamic rule. So this can be illustrated in a straightforward way with the y-axis representing the number of trips an individual makes in one year and the x-axis representing distance (which has been estimated and based on observation). Clearly the diagram shows that the frequency of trips made to the mosque decreases as the distance between home and mosque increases. The same may apply on the gravity model that imply volume of movement demand (interactions) between two regions or places will increase as the distance between them decreases, and vice versa (Taafe, 1973, G Knowles, 1981). In line with this, the volume of movement demand for the mosque decreases as time-space increases. The basic principles of time and space are discussed in the next sections.

Figure 2.4 The relationship between frequency of trips to the mosque and distance



Number of trips to the mosque for one year

Type of Mosque	Daily Prayer	Weekly P.	Eid P.
No. of Trips	1800	50	2

2.4 Space, Place and Time

The patterns of movement to various mosques obviously involve two factors or dimensions. The first is space or place, which may represent a mosque or distance between home and mosque. The second is time, which perhaps represents the frequency of the activity and timetable of the prayers. It is interesting to outline such elements in this state as follows.

The term space, implying areal extent, is used in both absolute and relative forms in human geography. The term encapsulates a broad concept, particularly as "*it is a treacherous philosophical word*" as J. Blaut (1961) said. It can be considered as location, position, place, etc.. So at an introductory level the word space is usually treated simply as an alternative expression for territory or region, if it is used at all (Parkes, Thrift, 1980). "*Space is thus apprehended and structured by both place and movement*" (Osterreith, 1985:38).

So the categorical relationships which exist between the notions of space, place and movement might be organised. Space is a category inclusive of place and movement which "*has the power to transform space into a series of places*" (Ibid, p.39). In general, it seems that space provides the context for places but derives its meaning from particular places (Relph, 1976).

In *The Dictionary of Human Geography* place is a portion of geographical space occupied by a person or thing (Johnston, 1989). However, the meaning of a place is, from a geographer's viewpoint, a much wider concept, and is dependent on the manner in which our intentions are directed and focused.

In terms of spatial analysis "*places refer to locations in geometric space and to the law-like attributes of these locations*" (Osterreith, 1985:38). In the humanistic perspective, place "*is not a collection of empirically observable objects and events, but rather the repository of meaning*" (Entrikin, 1976:626). Basically, a place is a centre of action and intention, it is "*a focus where we experience the meaningful events of our existence*" (Norberg-Schulz, 1971, p.19). Pocock also, with wider phrasing, stated that

> "*The concept of place provides an organising concept for what is termed our immersion in, or interpenetration with the world. With its experiential perspective and varied scale, place relates to an area which is bounded and has distinctive internal structure, to which meaning is attributed and which evokes an effective response*" *(Pocock, 1981:17)*

Relph, in his book *Place and Placelessness*, writing about essence of place, concludes that

> "*The basic meaning of place, its essence, does not therefore come from locations, nor from the trivial functions that places serve, nor from the community that occupies it, nor from superficial and mundane experiences, though these are all common and perhaps necessary aspects of places. The essence of place lies in the largely unselfconscious intentionality that defined places as profound centres of human existence.*" *(Relph, 1976:43)*

Places may be defined in terms of the functions they serve or in terms of communal and personal experience (Relph, 1976). So they are differentiated as a result of involving a concentration of our intentions, our attitudes, purposes and experience. Moreover, places are

> "*the contexts or backgrounds for intentionally defined objects or groups of objects or events.*" *(Relph, 1976:42)*

Sacred places, however, are appointed as places of worship. *The New Encyclopaedia Britannica stated:*

> "*A place of worship became sacred and suitable by virtue of the Holy's appearing at that place. Sacred places serve also sites of natural and historical significance for the community.*" *(N.E.B., 1991: 777)*

Relph (1976:15) believes that "*sacred space is that of archaic religious experience; it is continuously differentiated and replete with symbols, sacred centres and meaningful objects*".

However, Sacred or Holy Places in Islam are defined as specific locations in Makkah allocated by the Prophet Muhammed to perform the Hajj activity at definite times. So the significance of such places (Muna, Musdalifah and Arafat) are associated with time. One relation between place and time is movement, according to Carlstein (1978). Movement takes time and occurs in space. In other words

> "*Objects occupy space and activities take time; individuals are indivisible and so in a sense are certain activity sequences. This is a type of absolute constraint, which, though seemingly trivial, must be taken into account.*" *(Lenntorp, 1981:389)*

So it postulates a space and time field which will be explored in the following sections.

2.4.1 Time-space model

Time geography or time-space models have been developed by the Lund school of geography, led by Torsten Hagerstrand in the 1960s, which sought to add a temporal dimension to the spatial analysis of activities and to demonstrate the temporal structuring of space. This idea aimed to explain how relative location in space and time of humans and resources affects capacity and performance of socio-environmental systems. Thus T. Carlstein said (1982, p.39);

> "*The model and notation system of time geography offer one such possibility, since they can handle - descriptively or deductively - features such as resource utilization, settlement, interaction in and between groups, organization of domestic units, and time at location*".

Fortunately geographic space can be represented on a plane. A human population living in the area which the place represents, is supposed to have arranged several

sets of 'stations' serving its needs. The most important of these sets of stations, as Hagerstrand said, are 'dwellings, and places of work'... The stations can be represented on the plane as points ... Now if we add time (t) as a third dimension we get a picture of a simplified 'time-space' (Hagerstrand, 1973) Figure 2.5.

Basically, space and time are resources on which individuals have to draw in order to realize particular '*PROJECTS*'.

> "*Once a person has made a commitment to partake in any project at a given time and site several constraints take effect.*" *(Pred, 1984:282-283)*

The realization of any project is subject to three constraints (Hagerstrand, 1970, pp.21-61)

i) Capability constraints, which limit the activities of individuals because of their biological construction and/or the tools which they can command. ii) Coupling constraints, which define where, when and for how long the individual has to join other individuals, tools and materials, in order to produce, consume and transact and here the clock and the calendar are the supreme anti-disorder devices. iii) Authority constraints. These impose limited access to either space locations or time locations. Evey environmental context is replete with control areas or domains of authority; in other words, they impose certain conditions of access to and modes of conduct within particular space-time domains.

Everyone and everything has a history or biography consisting of all movements made between sets of fixed space-time locations or stations (Parkes, Thrift, 1980). Dynamic maps have been in use by Parkes and Thrift to illustrate the biographies of three individuals and also introduce to this notation the idea of a space-time bundle. (Figure 2.6).

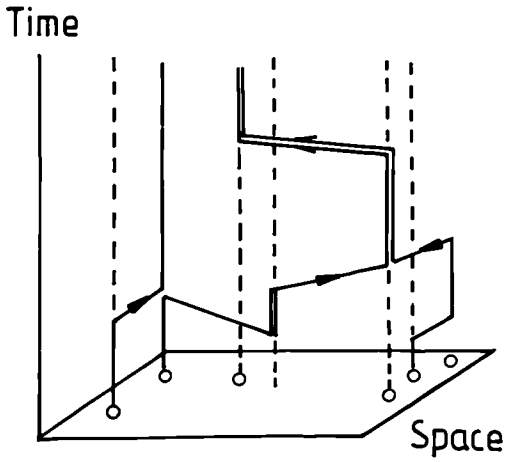


Figure 2.5 Three individuals in time - space

(Source: Hagerstrand 1963)

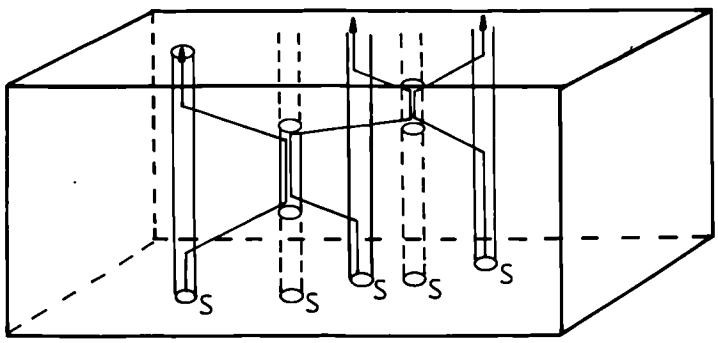


Figure 2.6 ( ) paths, ( ) stations, and ( ) bundles

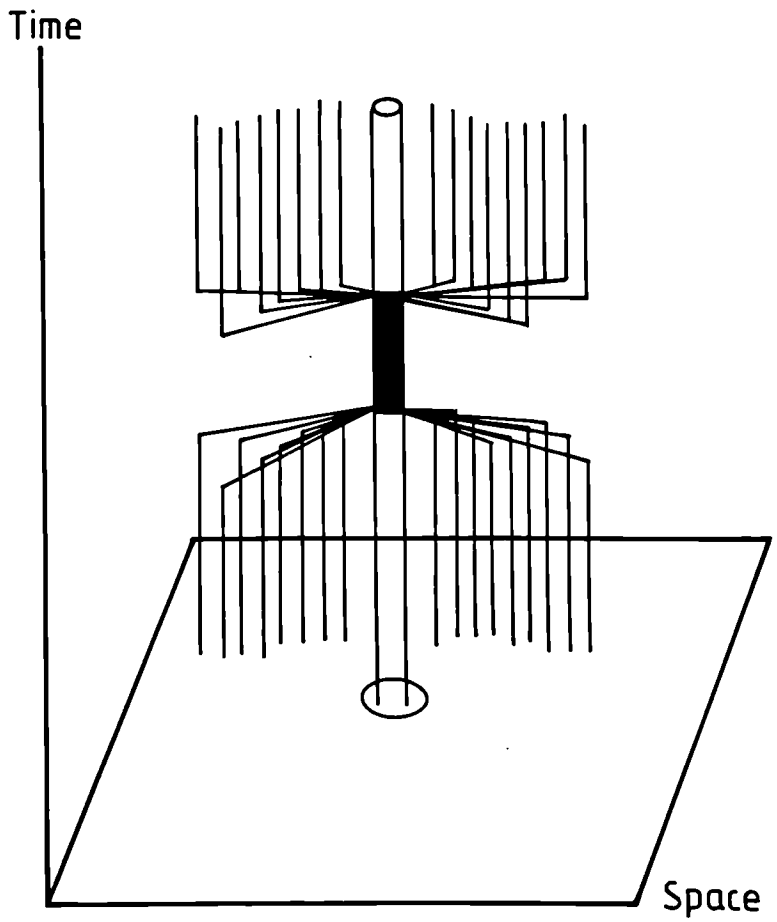
(Source: Parkes and Thrift 1980)

When the paths of two or more individuals meet together at a station for some period of time, they form a bundle.

There is no doubt that graphic complexity would be huge if large populations in sizeable regions for a long time period were to be drawn as paths; the graph of one day for a small village is quite complicated even if computer plotters were programmed to do the actual drawing. But the important task of a graphic notation system is to reveal the underlying logic of human society and ecology in space and time. Simple graphs can be strategically employed to pinpoint the elements, relations and mechanisms which have principal importance for socio-environmental structure and operations (Carlstein, 1980, p.45). The graph also presents a broad view of interaction between station and individuals and depicts the relationship between time and distance, using a simplified two-dimensional time-space model.

The physical environment in which individuals act may be said to consist of "*channels of transport and communication and station*" such as houses, work places, establishments for education and welfare, shops, and arrangements for recreation. Individuals reside in these stations, move about or send messages between them in order to cooperate economically and socially, make use of services, or have their needs and wishes met. These stations appear in the country or region in different numbers and form geographic patterns with varying relative distances, from the high degree of packing and differentiation in city areas, to the low degree of packing and less differentiation in the sparsely settled regions (Hagerstrand 1966, translation by Carlstein 1980).

Figure 2.7 Picture of a school as a bundle



Source: Carlstein, T. (1982)

Each human individual is placed in an environmental situation where other individuals or objects are located at a greater or smaller time-space distance away. Distance must be overcome through time demanding movement. All places where individuals stop to act or interact with some other individual, organism or object are 'stations' which form the elements in the settlement system and then spatial bases for activity and interaction (Carlstein 1980, p.68).

The aim of this task is to illustrate that time plays an essential role in any human activity and subsequently helps to explain any geographical phenomenon.

> *"Time geography thus allows us both to conceptualise (...) and to represent for the lives of particular people the meeting of agency and structure." (Cloke, 1991:109)*

Therefore it is useful to conceptualise in a general way about religious trips from a time-space perspective.

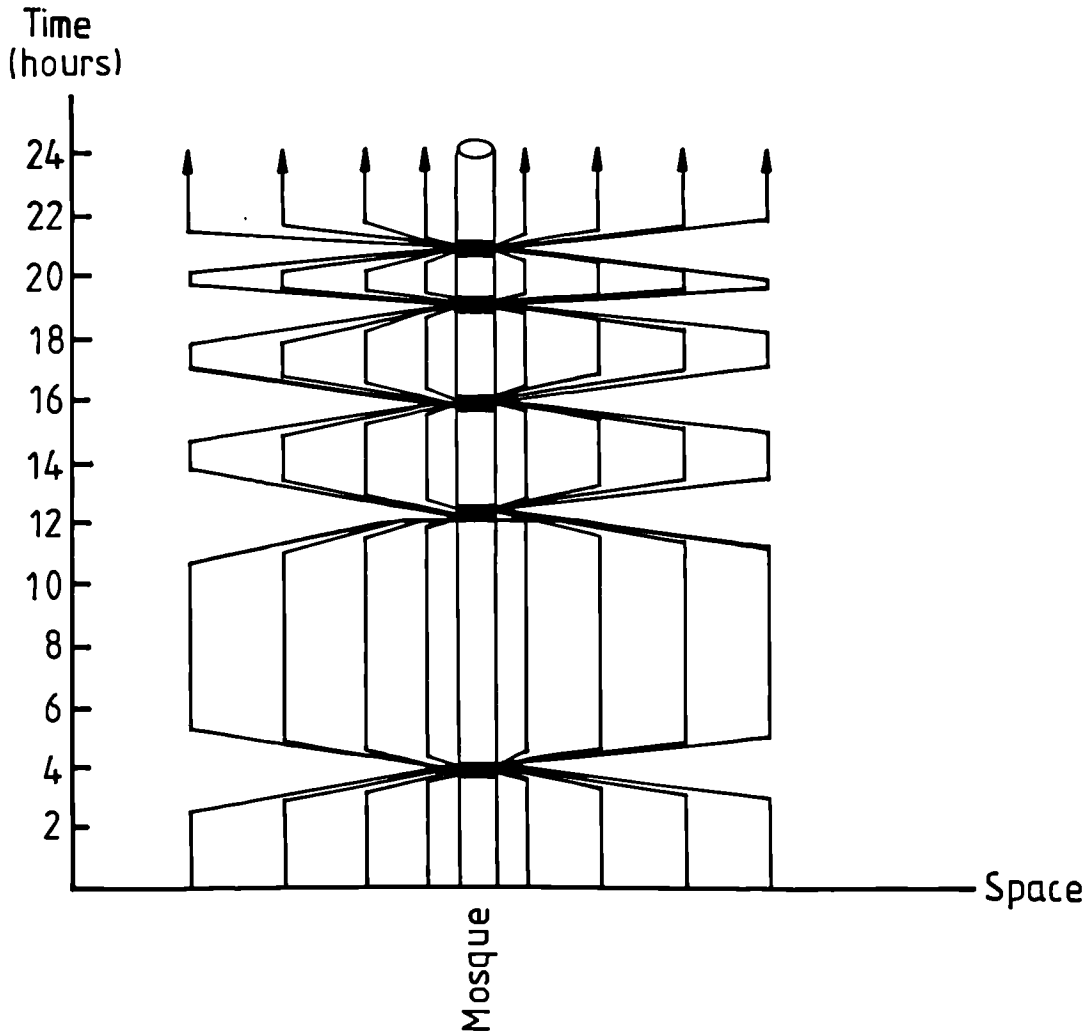
2.4.2 Time - Space and Trips to the Mosque

In Saudi Arabia, for instance, as in any Islamic community, the mosque is considered one of the important stations. The mosque generates various kinds of movement and trips which form geographic patterns of religious journeys. This phenomenon make combinations of individuals into groups. They come into contact with one another and are gathered into 'bundles'.

> *"These have typical geometric structures for various types of groups found in society. Households, schools, and shops, for instance, can all be graphically depicted" (Carlstein, 1980:69).*

In the generalized picture of a school as a bundle, the individual pupils leave their homes in the morning, attend school classes during the day and later return home (Figure 2.7). Similarly, a mosque creates the same kind of picture. From a daily

Figure 2.8 The frequency of trips to the daily mosque in time - space map



perspective, the pattern of movement associated with a mosque is characterised by groups of individuals worshipping together during the prayer period of the day, and later radiating outward when they return home, go to work, the shop or market place etc. Later in the day they return to the mosque once again to perform another prayer as in Figure 2.8.

This picture is repeated five times a day as mentioned earlier. It is clear from Figure 2.8 that the first time is in the morning before sunrise, the second is at midday, the third is in the afternoon, the fourth is after sunset and the last one begins one hour and a half after sunset.

Apart from one paper presented in Arabic by A.S. Al-Amdi to the Eighth General Conference of the Arabian Urban Committee in 1986, there would appear to be no research or surveys regarding the pattern of trips for prayer (P.T.P) which includes daily, weekly and Eid prayer. This paper studied spatial distribution of the mosques in Makkah city.

The research depended on 623 questionnaires being distributed to worshippers in 153 mosques selected randomly from amongst the total number of mosques registered to the Ministry of the Hajj and Endowments. Unfortunately, this study did not mention any reference to time, space or mode of transport. Nevertheless, at this stage, it is convenient to see what the study revealed regarding distance and the attitudes of worshippers towards it.

By looking at Table 2.1 below, it is evident that around 34.2. percent of worshippers' houses lay 100 metres from the mosque. Following on from that, 17.3 percent of the sample study showed that worshippers' houses are located between 100 - 199 metres

from the mosque. Significantly, a fair percentage of worshippers (16.9 percent) live over 800 metres from their mosque. Clearly, this is a long distance to cover on a daily basis and therefore many people travel by car.

Table 2.1 The distance between house and mosque

Distance	No. of the study sample	%
Less than 100 metres	213	34.2
100 - 199	18	17.3
200 - 299	75	12.0
300 - 399	57	9.1
400 - 499	20	3.2
500 - 599	30	4.8
600 - 699	5	0.8
700 - 799	10	1.6
More than 800	105	16.9
Total	623	100

Source:*Al-Amdi, 1986, 27.*

The study took into consideration what worshippers thought to be a comfortable distance between home and mosque so that this would enable planners to construct mosques in the future in accessible locations.

From Table 2.2 it can be seen that the highest percentage of worshippers, 37.6 percent, preferred to cover a distance between 100- 199 metres, those who desired to travel less than 100 metres represent the second highest percentage, 35 percent, and the third highest percentage, 12.5 percent, was made up of those who believed a

distance of 200-299 metres was the most appropriate distance. Therefore it can be seen the majority of worshippers surveyed in this study, 85 percent, preferred a middle distance around 200 metres.

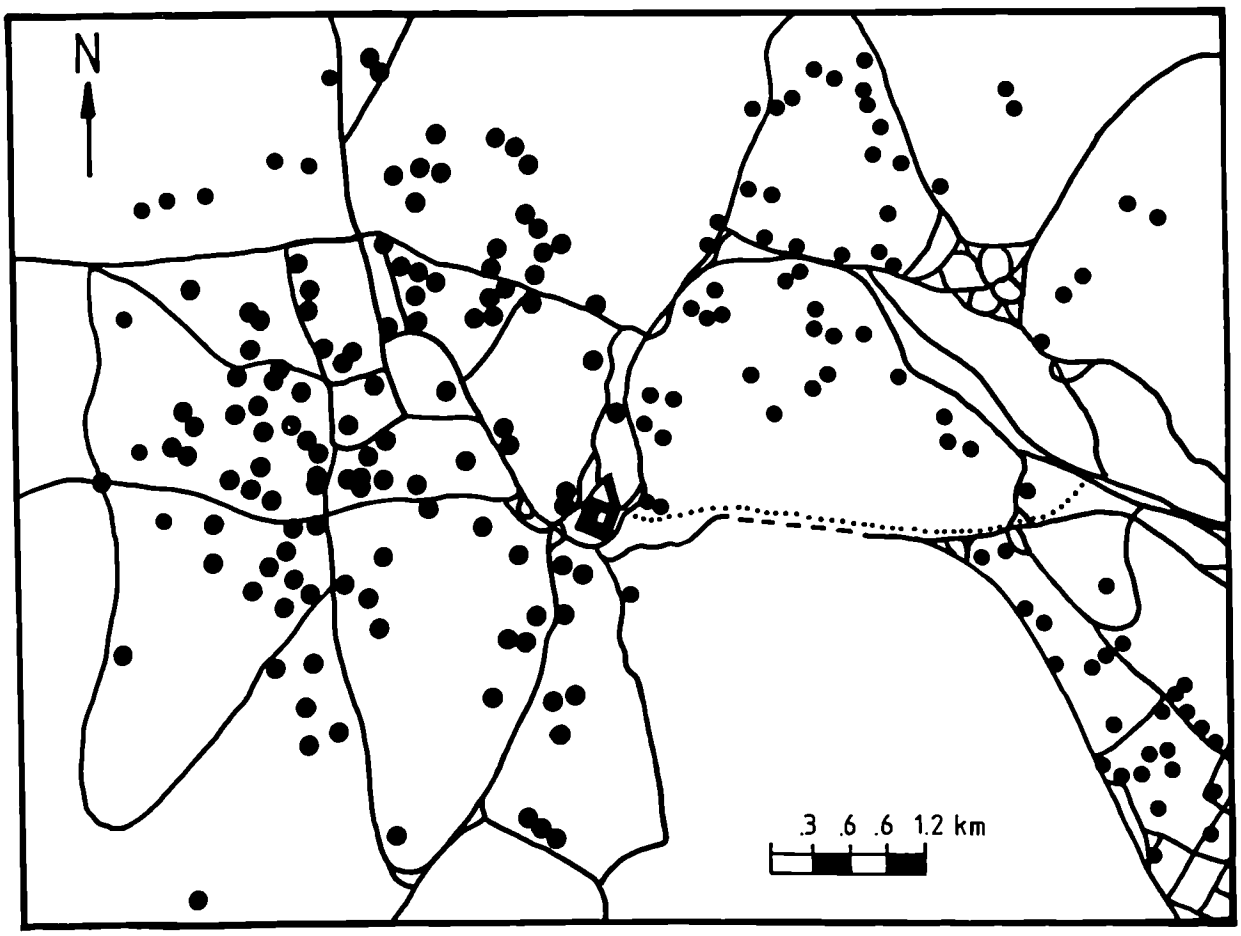
Table 2.2 The distances that Worshippers preferred

Distance	No. of the study sample	%
Less than 100 metres	218	35.0
100 - 199	234	37.6
200 - 299	78	12.5
300 - 399	32	5.1
400 - 499	15	2.4
500 - 599	28	4.5
600 - 699	2	0.03
700 - 799	-	-
More than 800	16	2.6
Total	623	100

Source:*Al-Amdi, 1986, p.28.*

As far as ease of accessibility to the mosque is concerned, the study reveals that the majority of worshippers do not consider this to be difficult as Table 2.3 illustrates below:

Figure 2.9 Spatial distribution of mosques in Makkah city 1986



Holy Mosque

Mosque

(Source: Al Amdie 1986)

Table 2.3 Ease of accessibility to the mosque

Accessibility	No. of the study sample	%
Easy to reach	623	87
Difficult to reach	81	13
Total	623	100

Source:*Al-Amdi, 1986, 29.*

It is possible to say that this percentage reflects a number of people who live in close proximity to the mosque and do not experience any problems travelling from their home to the mosque, so around 35 percent go to the mosque on foot. In addition, the study indicates that 33 percent of worshippers choose to pray at a certain mosque because it is nearby (author's translation, Al-Amdi 1986).

The result of this survey made by Al-Amdi demonstrates very clearly that the daily pattern of movement to a mosque is uncomplicated. Although such activity occurs at specific times, this does not make awkward demands on the community because mosques are widely distributed in every quarter of every city or town; a point which is supported by the map of Makkah which shows the location of mosques in that particular city (Figure 2.9). In other words the bundles of the daily mosque reveal a capacity to cope with large numbers and the individual can select any station in which to carry out his religious activities.

Regarding the weekly pattern of movement to the Jomoah mosque it is important to note that this type of mosque accounts for 62 percent of the total number of the mosques in Makkah, which is 153 (Al-Amdi, 1986). This pattern can be represented by time-space maps as in Figure 2.10. The bundle associated with this pattern

obviously seems thicker than before as a result of the larger number of people congregating on this one place from various places as previously mentioned. Therefore the distances here become longer because the places which allow the daily pattern to occur have been replaced by fewer places. Moreover, in Makkah city, for instance, daily prayers can take place in any one of 153 mosques whereas Friday prayers can only take place in any one of 95 mosques. So a significant percentage of worshippers go to the Jomoah mosque by private car. Because Friday is a holiday, in Saudi Arabia, a considerable amount of personal travel is for religious purposes, from 10:00 until 14:00 when most of the shops, offices, factories and banks are closed. Consequently, the movement of goods is at a very much lower level during this period on Friday compared to other weekdays. Journeys to mosques, very often are well spread throughout the morning hours, but there is a noticeable increase in congestion when worshippers leave the mosque around 13:00-14:00, particularly in big cities such as Riyadh, Jeddah and Makkah.

However, the fundamental problem here is car parking which, in fact, is a general problem for all the services and amenities to be found in any city, such as hospitals, schools, the government buildings and, of course, the mosques. Al-Amdi's study illustrates that 62.4 percent of worshippers expect to encounter parking problems around the mosque as Table 2.4 shows. Thus during the period of Friday prayer, which is usually of one hour's duration at least, movement of traffic is sometimes made difficult because car owners who were unable to find a parking place, leave their cars in the streets and roads in the vicinity of the Jomoah mosque. Hence the availability of adequate car parking facilities is an issue of principle importance for those mosques that are used for Friday prayer and also Eid prayer.

Figure 2.10 Mobility of individuals path for activity of Friday prayer in the Jomoah Mosque

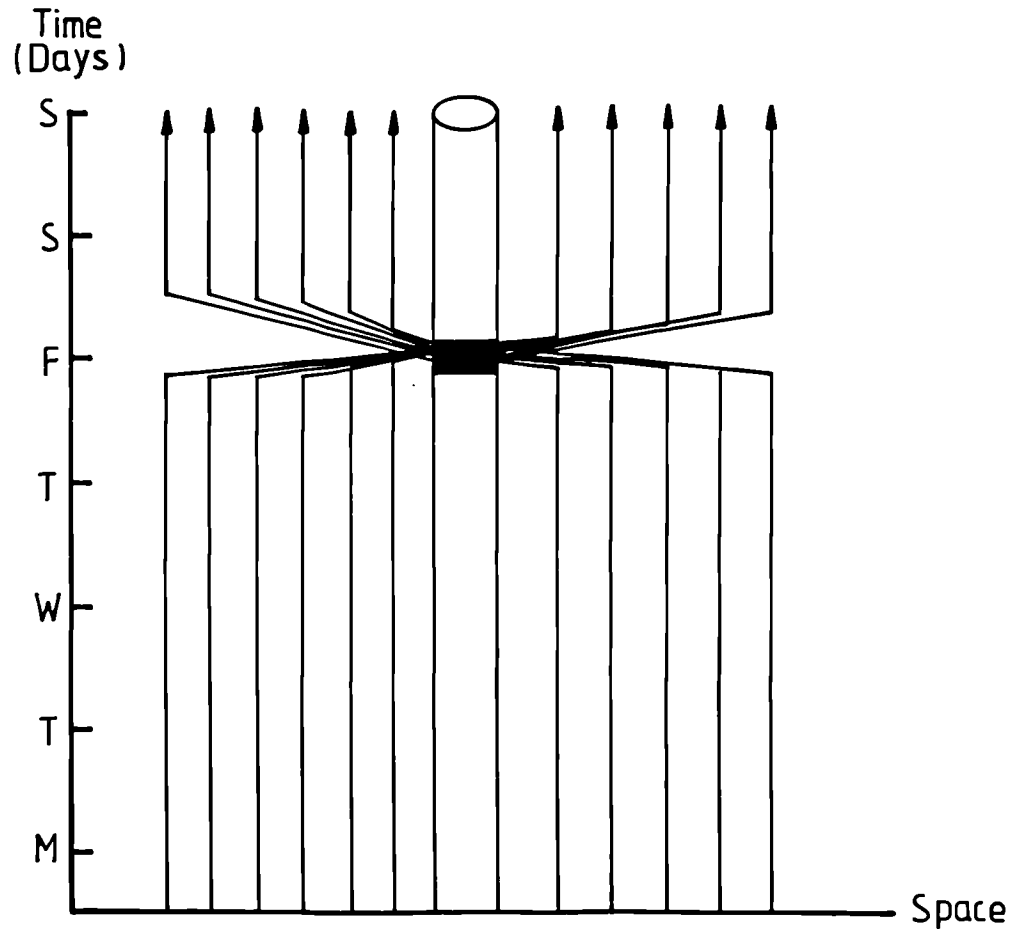


Table 2.4 Availability of car-parks near mosques

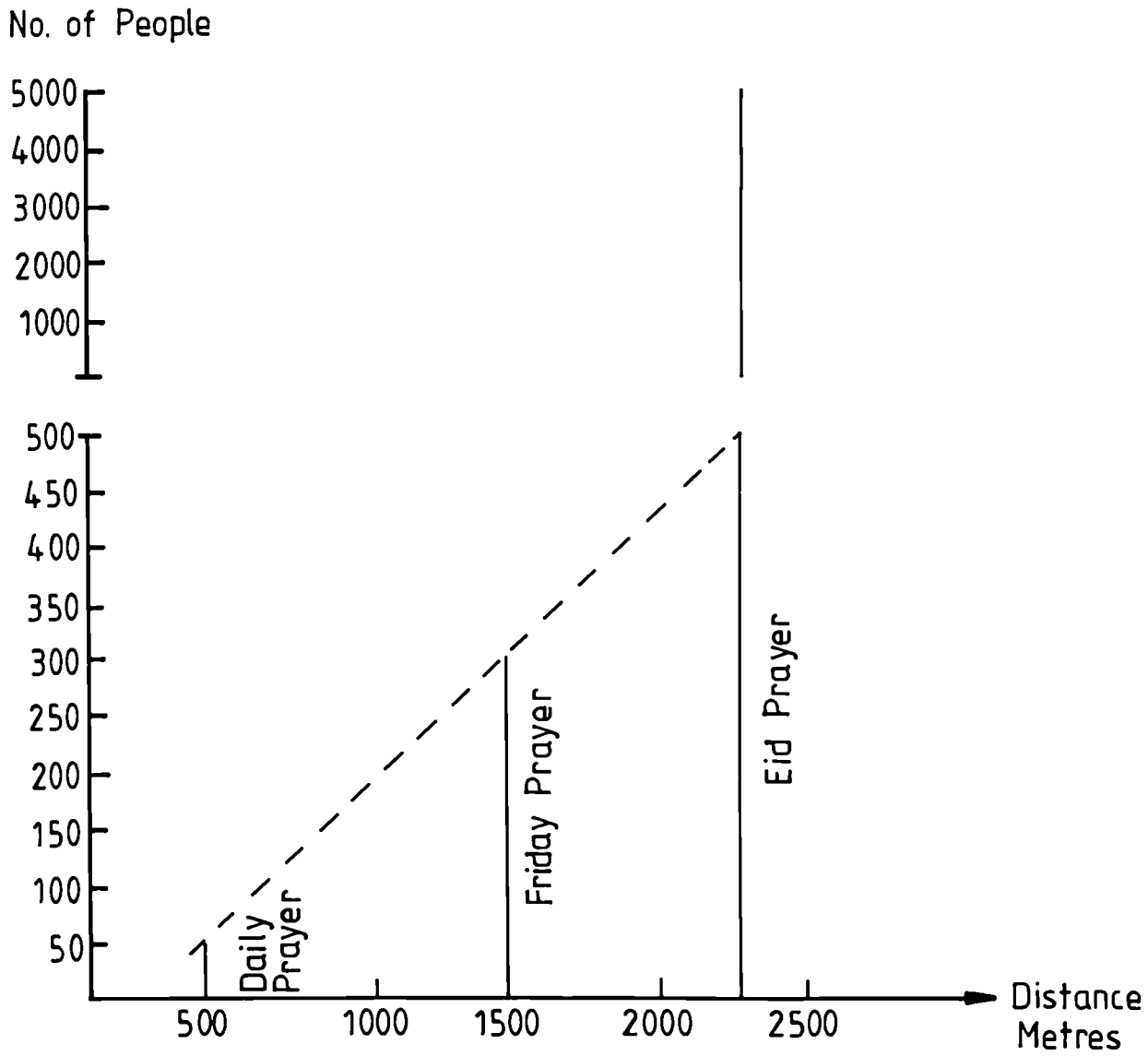
Car parks	No. of sample study	%
Available	234	37.6
Not available	389	62.4
Total	623	100

Source:*Al-Amdi, 1986, p.26.*

Eid prayer is the third pattern of movement for religion in the Islamic community. It takes place twice a year. The first is when the Fasting month (Ramadan) ends and the festival starts on the first day of the next month. The second is on the tenth of Dhul-Hijjha (the last month of the Islamic lunar calendar). The journey from home to the Eid mosque begins one hour before sunrise and prayers start one hour after sunrise. They return around 08:00 or 09:00 from the mosque. Unfortunately, there are no statistics or information in terms of the volume of movement associated with Eid prayer as is the case for daily and weekly pattern of movement. However, because Eid prayer occurs on public holidays it is fair to say that in Saudi Arabia, during the above mentioned period, much of the traffic is made up of people going to the mosque or returning from it. The only possible exception to this would be in Makkah at the time of the Hajj.

As was outlined before, the groups associated with Eid prayer are much larger than those to be found in the daily or weekly pattern as a result of the concentration and gathering together of people in fewer places and, of course, this kind of pattern involves longer distances. Hence, for example, only 28 mosques in Makkah, including the Holy mosque, have been permitted to accommodate Eid prayer.

Figure 2.11 The correlation between density of worshippers and distance

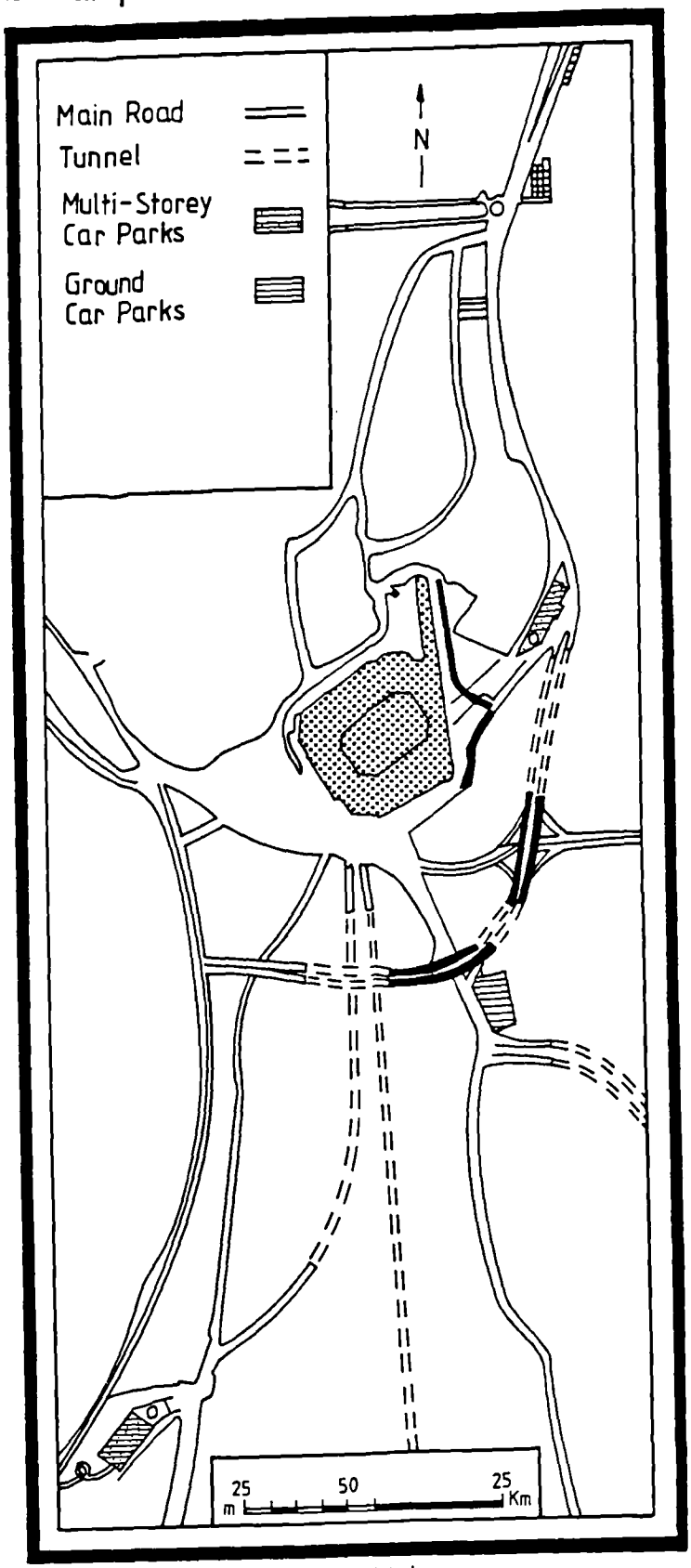


A rough estimation of the average of people to be found in the daily, weekly and Eid mosques, would be 50, 300 and 500-5,000, respectively. This points to a correlation between the density of worshippers and distance. Then it is possible to say that there is a proportional relation (density increases as distances rise) which is illustrated in Figure 2.11.

Thus, because the private automobile is used for Eid prayers, the car parking problem here should be more complex than that connected with the weekly pattern, and this problem is naturally even more complex during the Hajj period in Makkah. In fact several consultants such as Robert Matthew (1972) and DHC (1985) have discussed the problem of car parking in the Makkah region and in Makkah city in particular. They showed that there was an acute car parking problem in the city centre during the Hajj period. To satisfy the demand for parking in these areas, the consultants made some recommendations to establish multi-storey car parks in the suburbs. The city authority has adopted the recommendations by building a multi- storey car park where parking was very limited and needed rapid action to improve the situation, particularly around the Holy Mosque in Makkah (see Figure 2.12).

In addition to this, recent studies such as Makki (1988) and Asiz Abrahman (1988) have examined in greater detail the problem of car parking. Furthermore, a specific study of car parking problems in the Holy Places was dealt with by Hamad (1988). In view of this, it would appear that there is no need to discuss the problem further.

Figure 2.12 Car parks around the Holy Mosque (Al-Haram)



Source : Al-farsi (1988) Jeddah

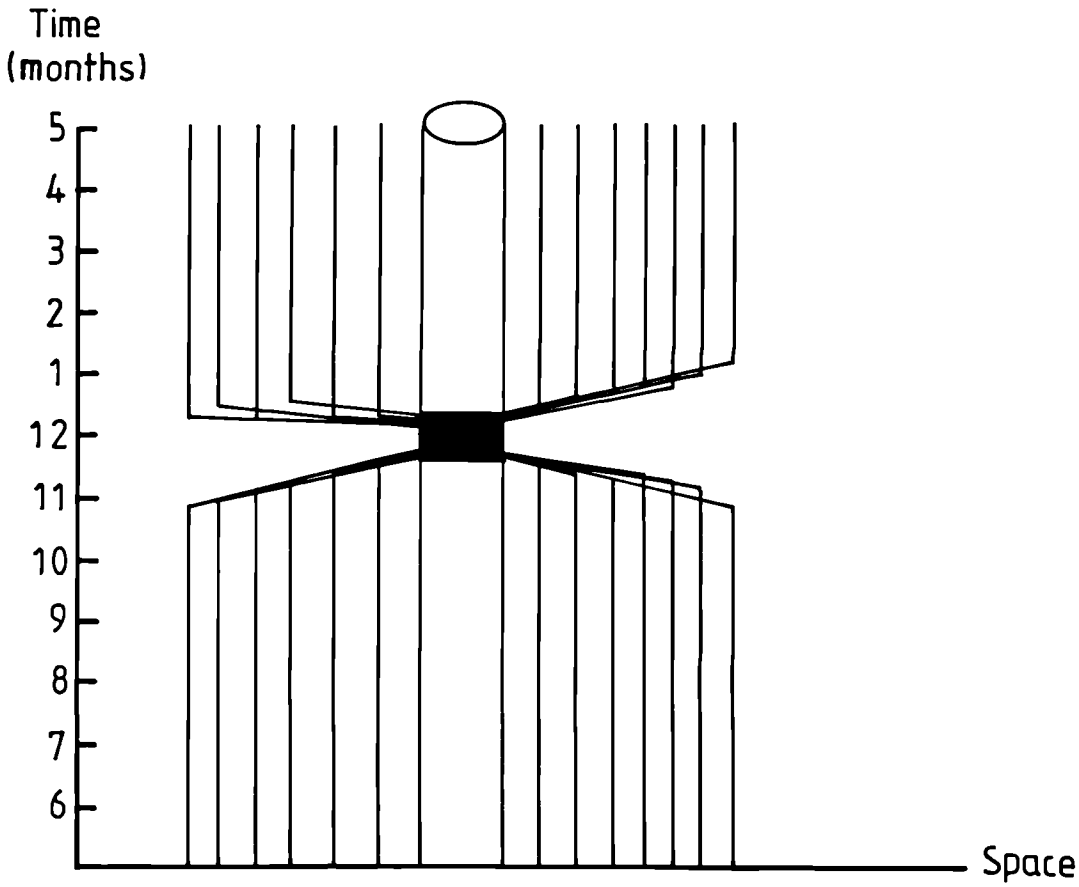
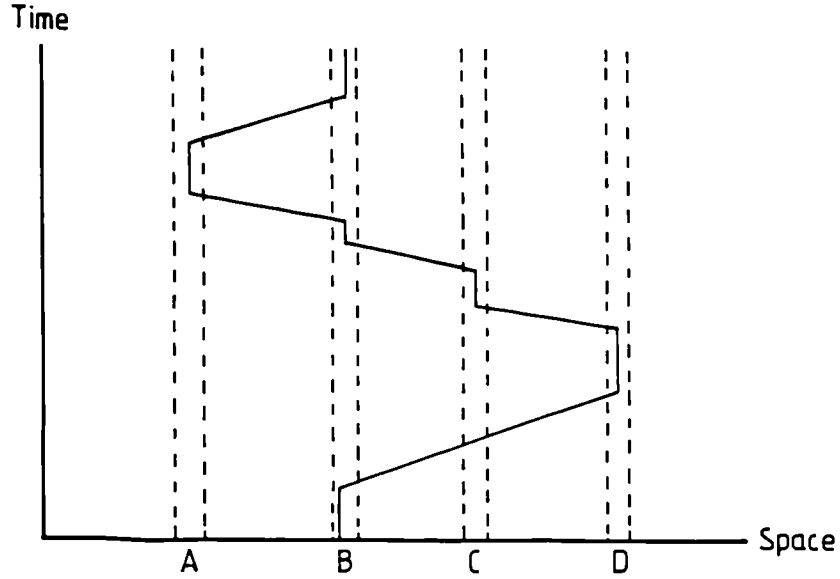


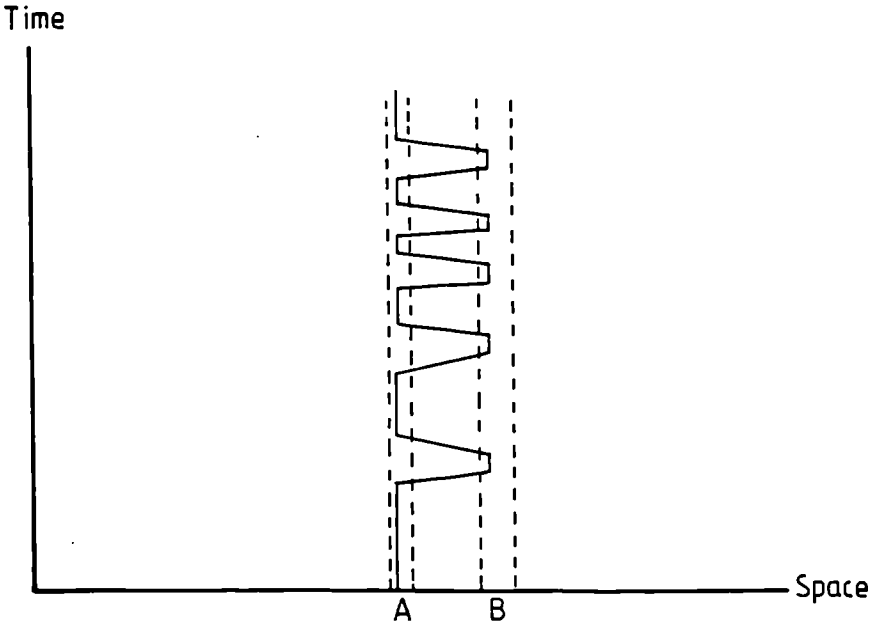
Figure 2.13 Pattern of movement for the Hajj activity in time - space map

Figure 2.14A An individual path of the Hajj activity in time - space map over a day



A = Al Haram B = Muna
C = Mozdalifha D = Arafat

Figure 2.14B An individual path of the prayer activity in time - space map over a day



A = Home B = Mosque

Figure 2.15 Hierarchy for the patterns of trips to Mosque by time - space map

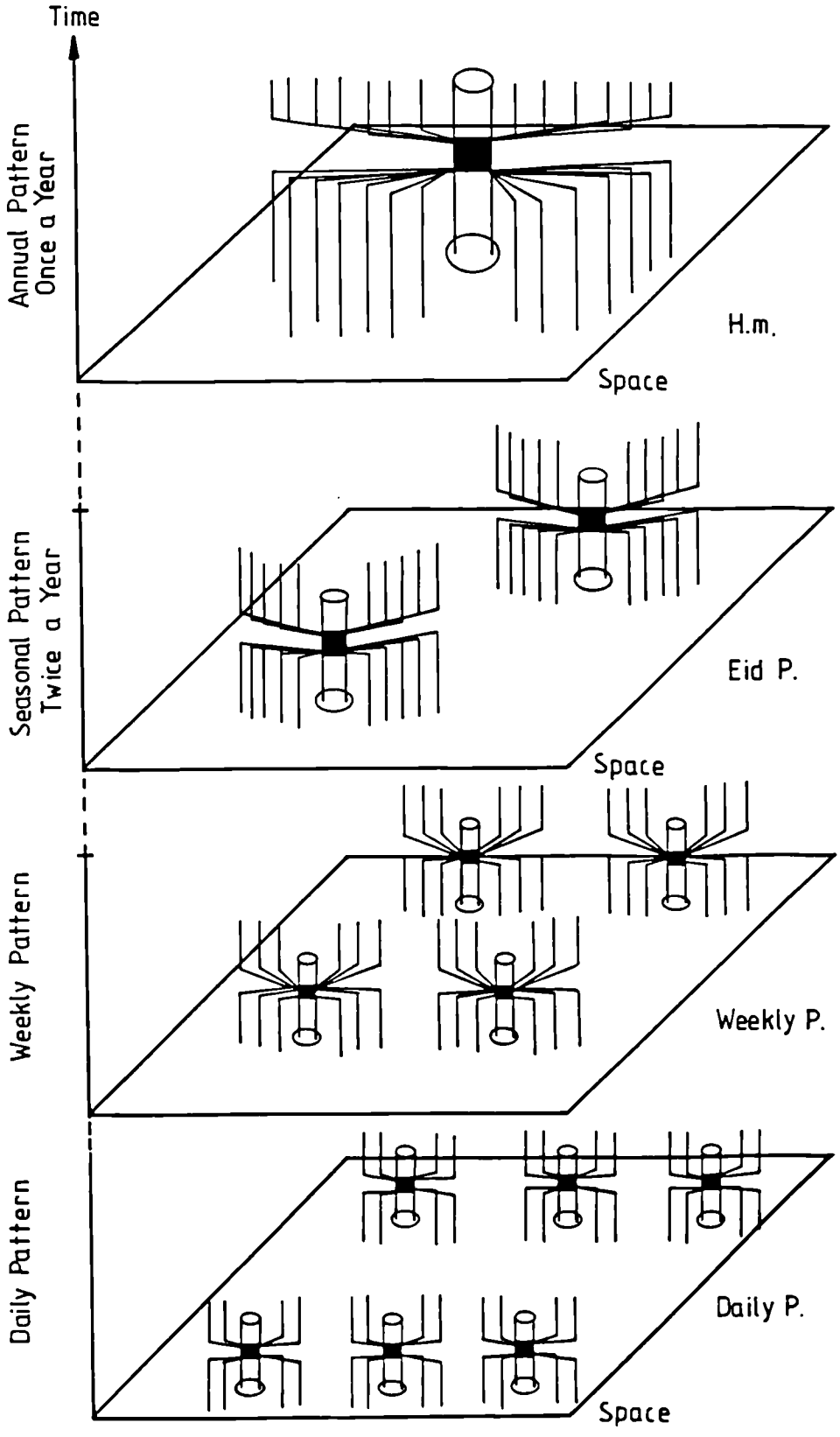
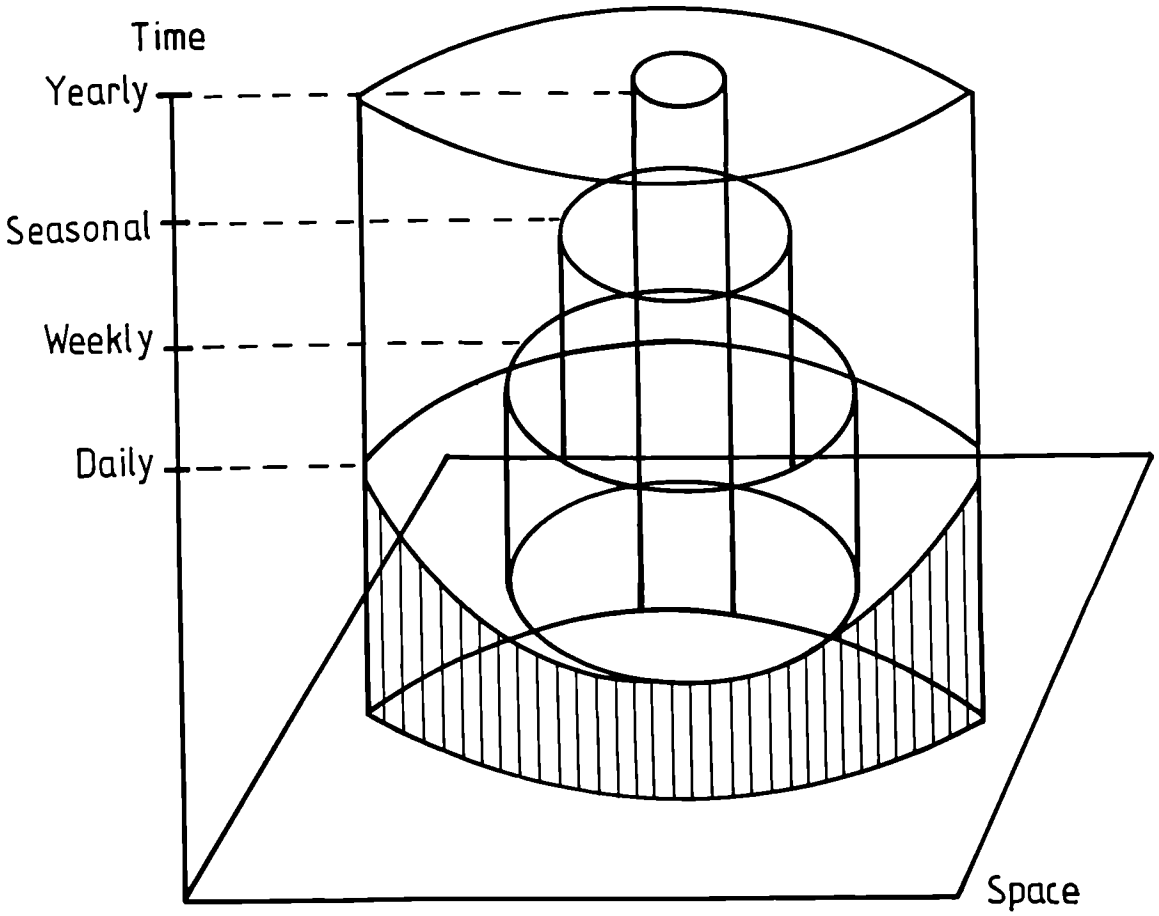


Figure 2.16 Hierarchy for the domains of different kinds of mosques



2.5. The Importance of factors influencing the Hajj movement

The pattern of Hajj movement, probably, can be represented by a time-space map as in Figure 2.13. Such a pattern has specific characteristics determined by space and time. In other words, the Hajj activity must take place at designated places, which are Makkah and Holy Places, and at scheduled times i.e. during the middle days of the last months of the year. Both location and duration have been fixed since the 14th century by the Prophet Muhammed and it is not possible to alter either of these fixtures. The P.T.P. are made by local people while the Hajj involves local, national and international people as well. The Hajj necessitates travelling and repeated movement from one place to another which subsequently involves longer distances and greater movement. So, taking one day and comparing one person's activity during the Hajj with their ordinary P.T.P., the individual's path would look something like Figure 2.14a and b. Noticeably the P.T.P. entails travelling to one place to carry out prayers whereas H.M requires several visits to various places. The correlation between the patterns of various trips for religious purposes in the Islamic world in terms of patterns of movement and time-space can all be illustrated by using a time-space map as in Figure 2.15 which depicts the hierarchy for these patterns. This hierarchy can be represented in a simple diagram as in Figure 2.16 which illustrates the various domains of the different kinds of religious activity on a time-space model.

It is plain from the above that the Hajj movement, like any project, is considerably subject to the coupling and the authority constraints that impose limited access to either space location or time location. Furthermore, the limited areas in which the Hajj occurs is a very significant factor influencing movement because it includes

physical, topographical and environmental constraints. Muna, for example, which is one of the Holy places, covers an area of only 6 square kilometres but it has to accommodate over 1.5 million pilgrims who wish to perform their Hajj duties in this small place. This situation affects conditions of movement and system of transport for the pilgrims.

In addition to the limited space in the Hajj area, another factor that influences the performance of Hajj rites is the canonically fixed times. For example, Nafrah (mass departure) must begin at sunset in the 9 Dhul Hijjha and should be completed by midnight. The time limits generate tremendous crowds during the Hajj Nafrah. In the Hajj 1983, for instance, around 75,000 vehicles carried more than 1.6 million pilgrims from Arafat to Muzdalifah (6.5 kilometres distance) taking 12 hours to do so even though there were nine roads (D.H.C. report No. 2, 1985). The 2.5 million people must perform Rami within a 6-hour period on any one of the 3 or 4 days allowed for this ritual.

However, time and space limitations are not the only main factors which affect H.M. There are many fundamental factors influencing H.M. and transport of pilgrims. It is interesting here briefly to outline the remainder of the more important factors.

Existing facilities for transport

The role of transportation facilities during Hajj is to provide safe and efficient movement for the pilgrims that converge on Makkah every year. The single system, which is available in the Hajj region, is road transport. Thus transportation facilities, at this stage, are defined as the fleet of private, commercial and public transport vehicles, and the services needed for their utilisation such as roads, car parks and so

on in the Hajj region. All play a part in facilitating the transport of pilgrims within a city or between cities.

Volume of pilgrims

Generally, the number of pilgrims coming to Makkah for the Hajj have been increasing over the years. For instance, ten years ago in 1974 slightly less than 1.5 million people were involved in the Hajj. In 1983, the figure had risen to more than 2.5 million. About 1.0 million of these came from abroad, while the rest were resident pilgrims. Nearly 1.2 million were resident non-Saudis and the remaining 0.3 million were Saudis (C.D.S. 1988). Most of the external pilgrims arrived in Saudi Arabia by air. In the Hajj of 1983, around 72 percent used this mode of transport. Another 22 percent arrived by land routes and the remaining 6 percent came by sea (ibid, 1983). The pilgrims who came by air and sea entered the Kingdom at Jeddah. Pilgrims from within the Kingdom used a variety of transportation modes to reach Makkah. In addition to the increased numbers of pilgrims, the variety of geographical distribution and the socio-economic structure of pilgrims play an important role in affecting the Hajj movement.

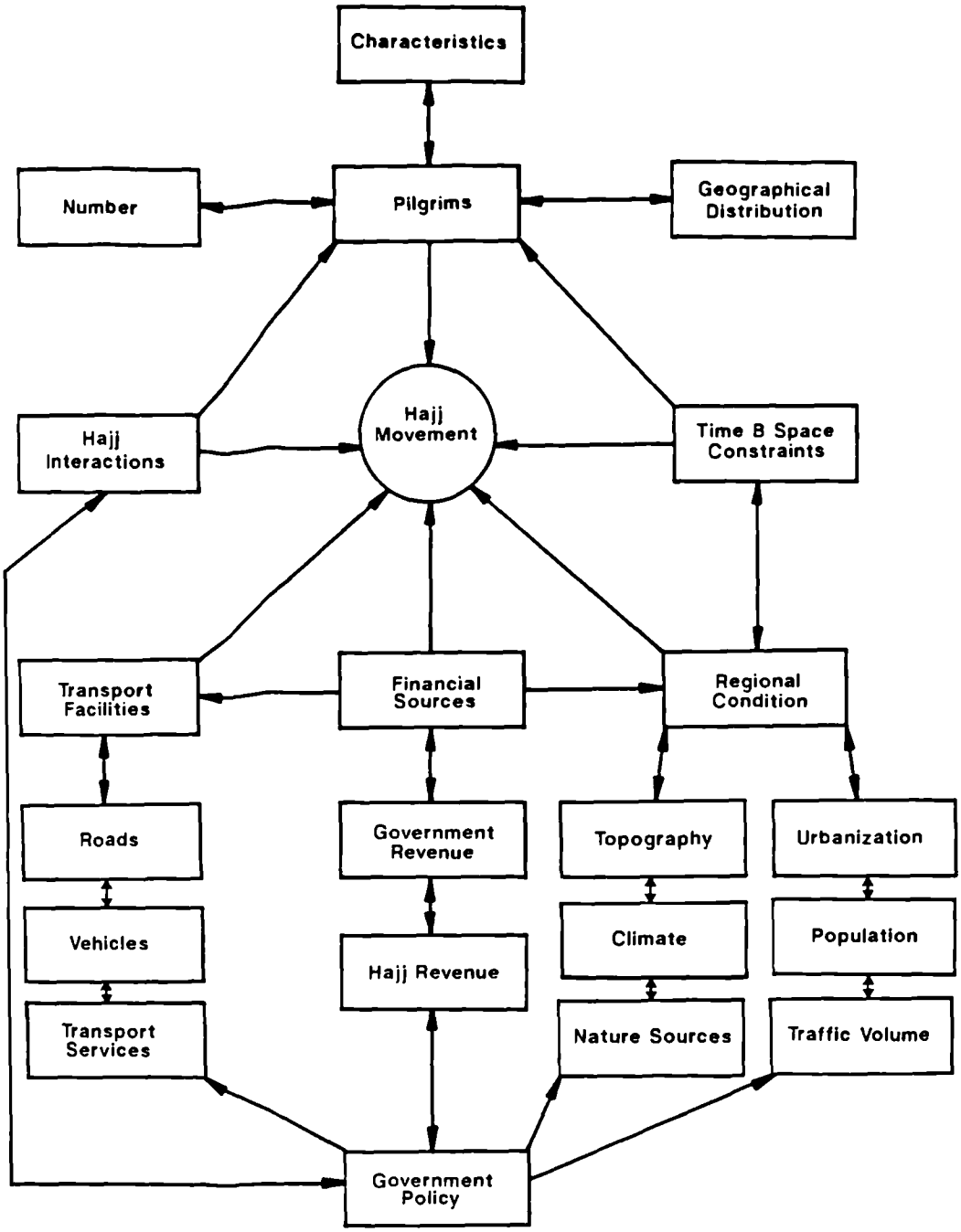
Authority policy for the Hajj movement

The authorities responsible for the control and safety of people during the Hajj exercise specific policies so that the movement of people inter-city or within a city are confined. Almost all pilgrims enter the region by motorised vehicles. Left unmanaged, the influx of vehicles could paralyse the entire transportation system. To manage this colossal movement of vehicles and people, the General Department of Traffic and Public Security (Ministry of Interior) prepares a traffic management plan

for every Hajj. The traffic management plan for the Hajj of 1983, for example, involved several strategies such as restrictions on the entry of small vehicles into Makkah and parking restrictions within Makkah and so on.

These main factors which have been indicated above may be illustrated by a simple model in Figure 2.17. The next three chapters will be confined to discussing such factors before examining patterns of the Hajj movement and problems of pilgrims' transport.

Figure 2.17 The main factors influencing the Hajj movement



Summary

The identification of some elements related to transport and movement have been discussed in this chapter. However, most of the available literature on geographical transportation has focused on travels and trips for occupational, educational, or recreational purposes. There is a paucity of geographical studies about travels and trips for religious purposes. The Islamic religion, for example, affects the movement or activity of most people in the Middle East in that it requires people to make a trip or travel to perform a specific religious activity, whether this be daily, weekly or annually.

In Saudi Arabia, where several movement patterns (P.T.M.) for religious purposes can be observed (see Figure 2.3), three kinds of patterns of trips to mosques (P.T.M.) can be seen in terms of time and space.

The first one, patterns of trips for prayers (P.T.P.), takes place at specific times, although the place of worship is unspecified providing it occurs in a mosque. However, according to Islamic rule such mosques can be established in any place. So the circumstances of transport and movement for this group (P.T.P.) are uncomplicated and do not make awkward demands on the community because their mosques are widely distributed in the cities and towns of Saudi Arabia.

The second pattern is associated with the Omrah movement (O.M.) which stands in contrast to the first type, i.e. it takes place at any time but should be in a specific place, which is, the Holy Mosque in Makkah. Although the volume of movement for Omrah very often increases during the fasting month (Ramadan), trips are confined to the place of accommodation and the Holy Mosque in Makkah. Despite the increase of

demand on transport facilities during Ramadan month, it is not as great as during the Hajj.

The Hajj movement, which is the third type of P.T.M., has specific characteristics determined by space and time. The Hajj activity must take place at designated places, which are Makkah and the Holy Places, and at scheduled times i.e. between the eighth and the thirteenth of Dhul Hajjah month. So the Hajj necessitates travelling and repeated movement from one place to another. It involves people of local, national and international origin, which subsequently involves longer distances and greater movement. Moreover, the Hajj movement, like any project, is considerably subject to the coupling and the authority constraints that limit access either to space location or time location. However, time and space limitations are not the only main factors influencing the Hajj movement and the transportation of pilgrims: other factors such as transport facilities, volume of pilgrims' numbers and governmental policy towards the Hajj, will be discussed in the next chapters.

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Chapter Three

Network of Roads

3.1 Introduction

A principal factor influencing pilgrim transportation in the Hajj region is the routes used. The road network routes used by the pilgrims play a significant role in facilitating all activities related to Hajj movement.

A road network is made up of many single routes which link together two or more points or centres of movement. So it may be regarded as a set of inter-connected routeways along which movement takes place. Most of the different modes of transportation form prominent landscape features. Indeed roads, railway tracks, waterways and electricity structures are frequently the most imposing features on the landscape. In well-populated, industrial and urban areas there is usually a dense pattern of transportation lines (Robinson, 1978).

Various authors have researched and written about the road networks of Saudi Arabia. Assad Abdo (1969) drew an historical picture of inland transport and described the pattern of caravan routes before and after the advent of Islam in the Arabian Peninsula. He also discussed the evolution of modern roads in Saudi Arabia. Mecci, M. (1979), in parts of his dissertation studied and described the effects of modern pilgrimage on transport in the city of Madinah.

More recently, the impact of socio-economic change on Saudi urban transportation, particularly in the Eastern Region, has been examined and discussed by Amer Al-Metair (1987). Mekki, Z. (1988) also gave a broad description of the pattern of roads and streets of the city of Makkah in his study of transportation problems in Makkah outside the period of Hajj. The Ministry of Communications in Saudi Arabia occasionally publishes reports which indicate the mileage and location of roads on

which construction has been completed. All these, as well as other reports, have been utilised in this study.

Although this study will concentrate on the region on which the Hajj focuses, it is important to consider broadly all road networks in Saudi Arabia owing to the interconnectedness of all the road networks in the region. So the next section will discuss briefly the general road network in Saudi Arabia. After that the descriptive analysis will concentrate on the Hajj region network. Finally the analysis of the road network will be examined in the last section.

3.2 The road network in Saudi Arabia

It is helpful to subdivide the series of development of the modern road network into two stages. The first is before the initial development plan (pre-1970) and the second is after this plan, i.e. post-1970.

3.2.1 Development of the modern road network pre-1970

Assad Abdo (1969) presented in his thesis interesting maps illustrating the different stages of development of Saudi Arabia's road network, from 1938 to 1965 (Figure 3.1). It is clear from this diagram that the first modern road in Saudi Arabia was built in 1938 in the Hajj region, linking Jeddah to Makkah. This road was only 73 km in length, and built by Egypt with money from the *Wagfs* of the Holy Mosques (Al Sayyad, 1956). The reasons for the Hajj region attracting modern roads before other parts of the Kingdom are threefold:

a) The region includes two holy cities of Makkah and Madinah, which are visited annually by large numbers of pilgrims. Development of transportation was an obvious requirement to facilitate the movement of pilgrims between Makkah, Madinah and the port of Jeddah, particularly since the Hijaz railway was destroyed in the first World War (Abdo, 1989).

b) The economic position of the Saudi government at that time was poor. This situation permitted no development and, as has been stated above, the road which was built in the region was financed by non-Saudis, as all Muslim governments felt responsible for the holy cities and the development of the Hajj facilities.

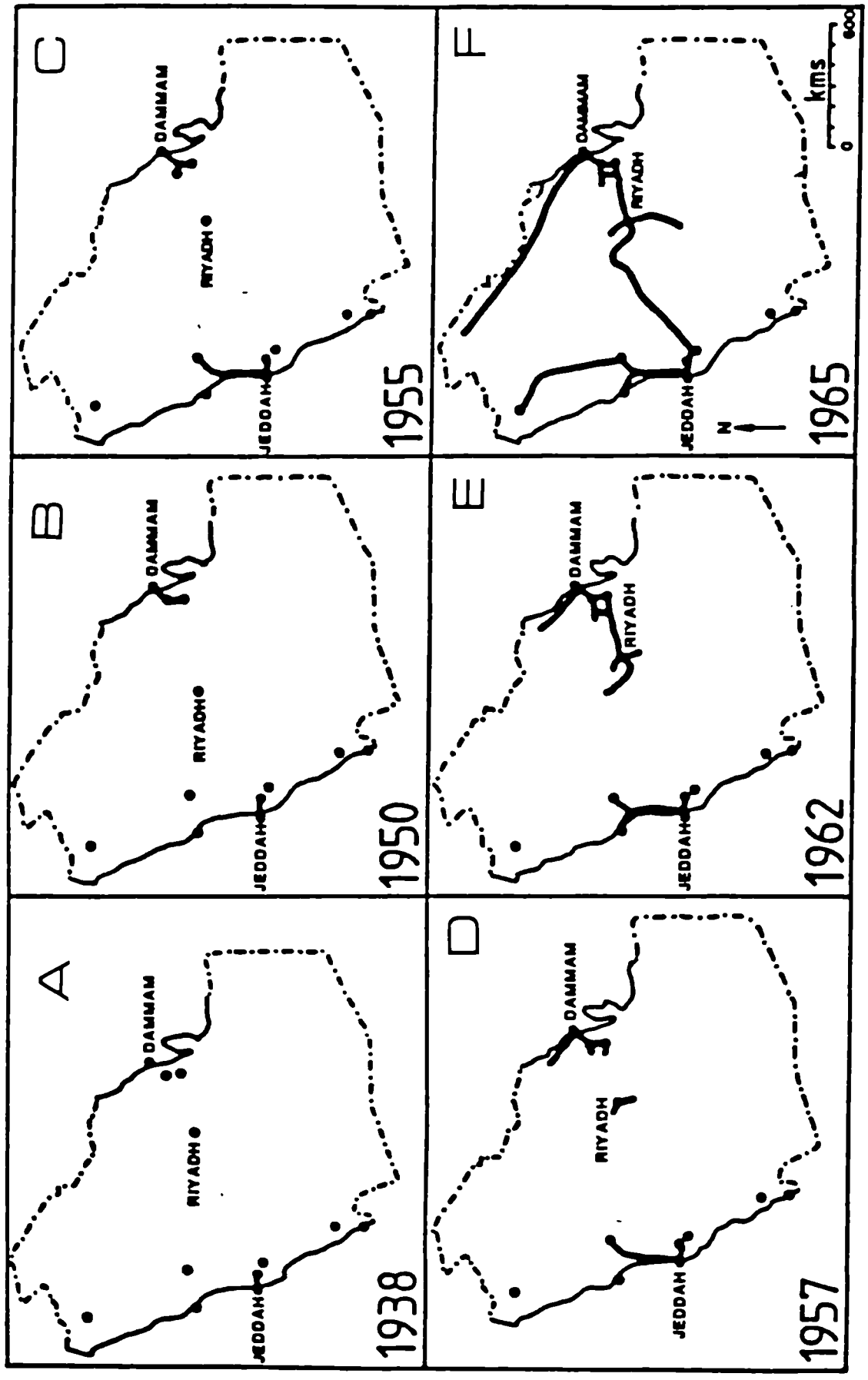
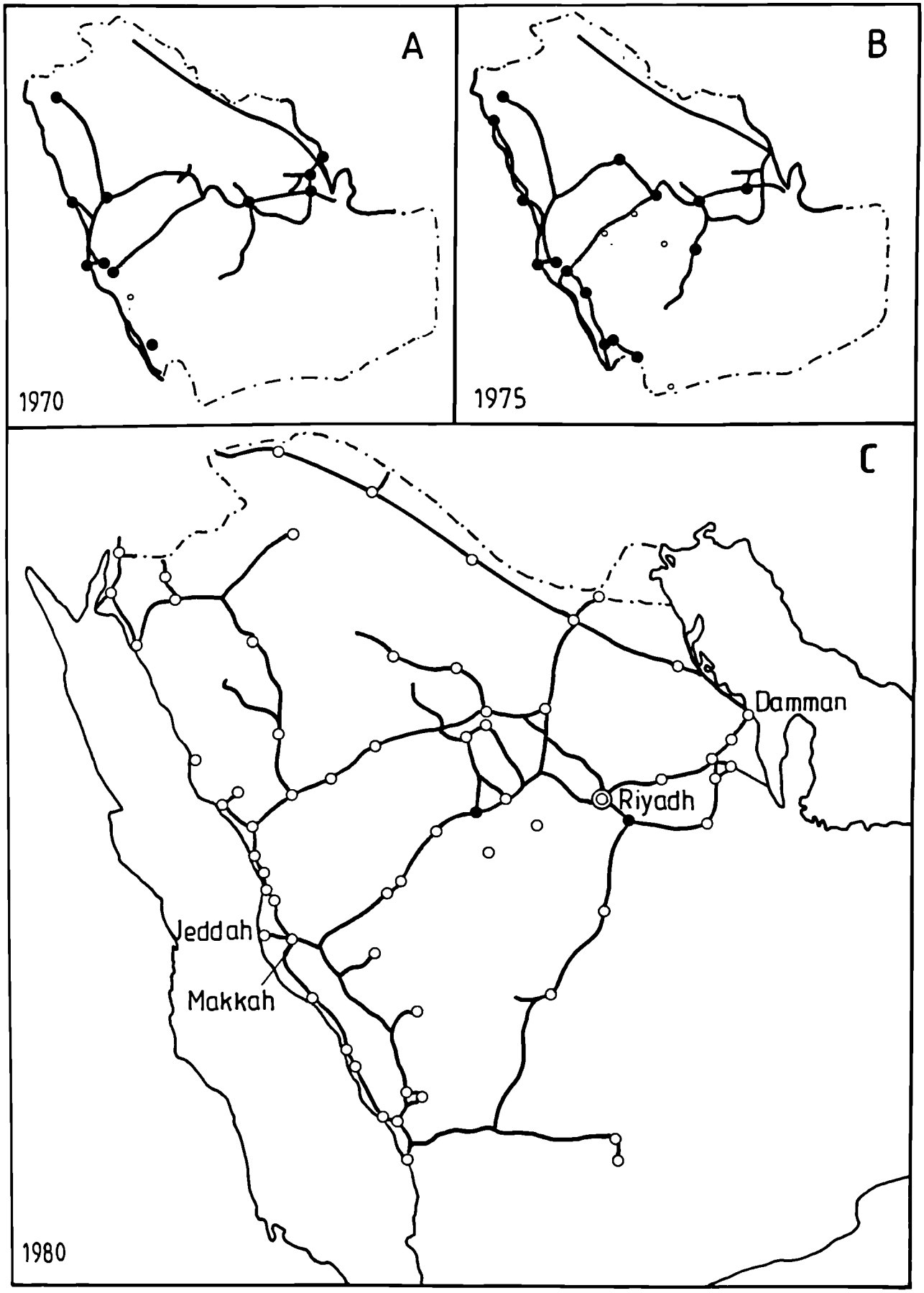


Figure 3.1 ROAD DEVELOPMENT pre-1970

Source : Assad Abdo, Thesis, 1969.

Figure 3.2 Development of the road networks post-1970



c) On the other hand, the economic situation of the Hajj region in general, and its main cities in particular, was relatively better than the other areas of Saudi Arabia as a result of the Hajj revenue. This led to the Hajj region enjoying greater economic and social progress (Ibid, 1969).

During the 1950s the next paved road was built by Aramco in the Eastern Region, where oil was discovered in 1936 and produced in 1938. This road was a 55 km link between Dammam and Ras Tannurah (see Figure 3.1B) The first time the government of Saudi Arabia spent money on roads was in 1951 when it started the construction of Madinah-Makkah road (424 km) which was completed in 1955 (Assad Abdo, 1969) - see Figure 3.1C. For the first time it was possible to travel by motor transport for the entire journey between Jeddah, Makkah and Madinah in safety and comfort. The journey time from Jeddah to Madinah was cut from an average of two days to an average of 6-8 hours, at that time, and the possibility of unlimited delay was ended. All these benefits encouraged the government to construct more modern roads. At that time, 1954, there were two separate modern road networks A) in the Hajj region network in the west, linking the holy places (a total of about 527 km long) and B) in the economic region in the east connecting the oil-fields with the main ports and main cities (400 km long).

When Riyadh was chosen as the governmental capital in 1953, the need to link the capital with the economic areas in the east, and with the religious area in the west, became pressing. Both sides have essential ports in the country. Riyadh being closer to the east than the west, and the attraction of economic prosperity, encouraged the government to link Dammam at first by railway (completed by 1952, see Figure 3.1D) and then by road (completed in 1961). This new road linked the road networks in the

Gulf to the networks of short roads constructed in the centre of Saudi Arabia to link Riyadh with the main agricultural areas (Figure 3.1E).

In 1961 the project to link Riyadh with the western part of the Kingdom was started. This road, 810 km in length, linking the capital with the Hajj region, was completed in 1965. By joining Taif in the west to Riyadh, the road enabled travel from the Gulf area to the Hajj region along an east-west axis.

The construction of this road precipitated a revolution in pilgrim transport along the east-west axis. Inhabitants of central Saudi Arabia and of the Gulf were able to travel overland to Makkah with ease and safety, and consequently many more felt able to perform the Hajj more than once, which had been very difficult in earlier times.

Since then the extension of the asphalted roads has penetrated away from the centres of the east-west axis, both northwards and southwards. This extension began when the Makkah-Madinah road was extended to reach as far north as Tabuk (111 km), and thence to the border with Jordan. The 300 km long Tapline Road starts in the eastern area and extends north-westwards, parallel with the Kuwaiti, Iraqi and Jordanian borders with Saudi Arabia. This road, which followed the oil pipeline, is shown in Figure 3.1F. However, pre-1970 the total length of paved road completed did not exceed 8,000 km (MOC, 1986).

3.2.2 Development of the road network post-1970

The process of expansion continued, and received a boost when the government decided to prepare specific plans for all sectors of the Kingdom, public and private. The First Development Plan, lasting from 1970 to 1975, built 3,221 km of new roads (MOP, 1975). The most important road of this stage was the road of the network of

the coastal plain beside the Red Sea. Established by 1975, it ran from the northerly extreme on the Saudi-Jordanian border to the southerly extreme on the Saudi-Yemeni border, and is about 1800 km long. In the Second Development Plan (1975-1980), a 555 km carriageway from Taif towards the southerly crossing of the mountain ranges of the Hejaz and Asser, at Dahran Aljanob had been constructed. Figure 3.2A,B and C show the different stages in development of the Saudi road networks since 1970. Road development has gone well during the period of the Third Development Plan due to the construction of expressways in various parts of the Kingdom such as Jeddah-Makkah (70 km), Riyadh-Dammam (300 km) and Makkah-Madinah (424 km).

However, road construction has been a significant feature of the Kingdom's development, and has dictated patterns of movement and traffic. Most development projects, whether for public services, religious purposes, agriculture or industry, have been met with the construction of the necessary new roads (MOC, 1985).

> "*The basic structure of the Kingdom's road network is now largely complete. All of the major cities and many rural areas are connected and adequate pilgrim access to Makkah and Madinah is provided*" (MOP, 1985:371).

Generally, in 1980, the total road network length was 25,000 km of paved roads and 20,000 of agricultural roads. By 1987, this total had increased to 81,500 km, divided as follows (MOC, 1986:51):

Expressways and divided highways	3,500 km
Primary and feeder roads	26,500 km
Paved agricultural roads	3,000 km
Agricultural roads	48,500 km
Total	81,500 km

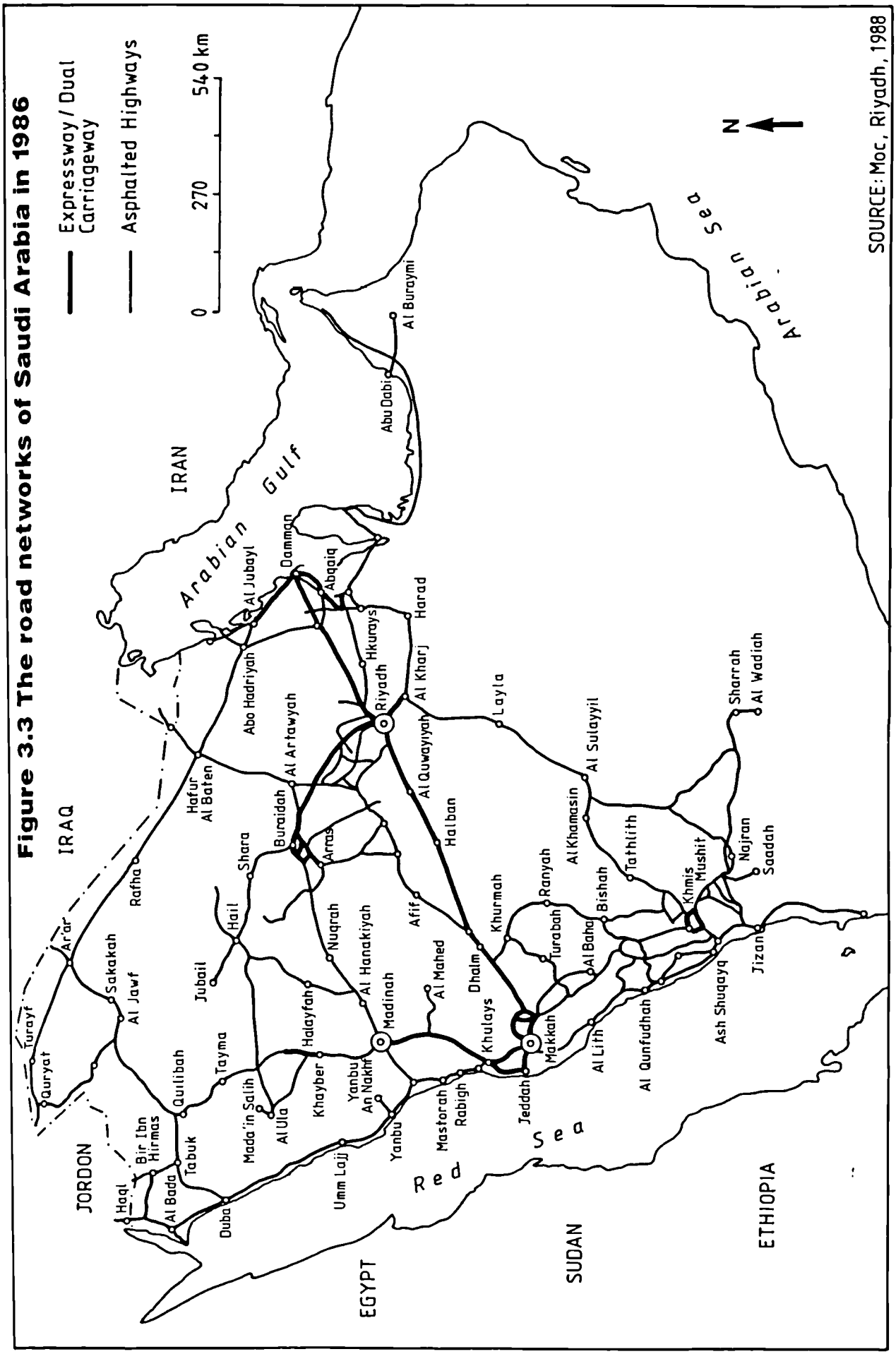


Figure 3.3 The road networks of Saudi Arabia in 1986
Expressway / Dual Carriageway
Asphalted Highways
0
270
540 km
N
SOURCE: Moc, Riyadh, 1988
IRAQ
IRAN
JORDON
EGYPT
SUDAN
ETHIOPIA
Arabian Gulf
Red Sea
Arabian Sea
Turayf
Ar'ar
Quryat
Sakakah
Al Jawf
Rafha
Hafur Al Baten
Qulibah
Tayma
Jubail
Hail
Shara
Haql
Bir Ibn Hirmas
Tabuk
Mada'in Salih
Al Ula
Khayber
Halayfah
Buraidah
Al Artawyah
Abo Hadriyah
Al Jubayl
Dammam
Abqaiq
Hkurays
Harad
Riyadh
Al Kharj
Al Quwayiyah
Layla
Al Sulayyil
Sharrah
Al Wadiah
Al Buraymi
Abu Dabi
Duba
Al Bada
Umm Laji
Yanbu
Yanbu An Nakhl
Nuqrah
Arras
Al Hanakiyah
Madinah
Mastorah
Rabigh
Afif
Al Mahed
Dhalm
Khulays
Halban
Khurmah
Ranyah
Turabah
Al Baha
Bishah
Al Khamasin
Tathlith
Khmis Mushit
Najran
Saadah
Jeddah
Makkah
Al Lith
Al Qunfudhah
Ash Shuqayq
Jizan

From the foregoing, it is evident that, regarding the entire road network in Saudi Arabia (see Figure 3.3), there are four axes of roads considered fundamental to the network which serves the Hajj region as can be seen in Figure 3.4. These axes are:

A. The east-west Expressway is about 1,275 km extending from Dammam in the east to Jeddah in the west. It also joins Riyadh in the centre of the Kingdom, with Makkah in the west. This axis used to be a single carriageway, except for the Jeddah-Makkah section which was dual carriageway. In 1981, a new road in this section was opened as the Kingdom's first motorway. The Dammam-Riyadh Expressway was completed in 1985. Its horizontal and vertical curves have been designed to a high standard, permitting a traffic speed of 120 km/hr.

   Many overpasses have been constructed to serve traffic joining or leaving the road at cities, towns and villages along its length. There are also many animal crossings, in the vicinity of pastures, to allow them movement (MOC, 1986).

   One part of this axis is still under construction: the road between Al-Mowah and Al-Mazahmiyah. This is 550 km long. To date, one carriageway has been completed. The second is expected to be completed by 1993.

B. The axis of the east-west carriageway is about 960 km in length, and runs from Ragai on the Saudian-Kuwaiti border, passing through Al'artawyah, Buraydha and Al-Hanakiyah to Madinah. The MOC have planned to convert the section between Buraydah and Madinah into an expressway (about 527 km). This may happen during the Fifth Plan (1990-1995). In fact, the entire length of the road perhaps needs to be converted into an expressway, in order to serve better those pilgrims travelling overland via Kuwait and Iraq.

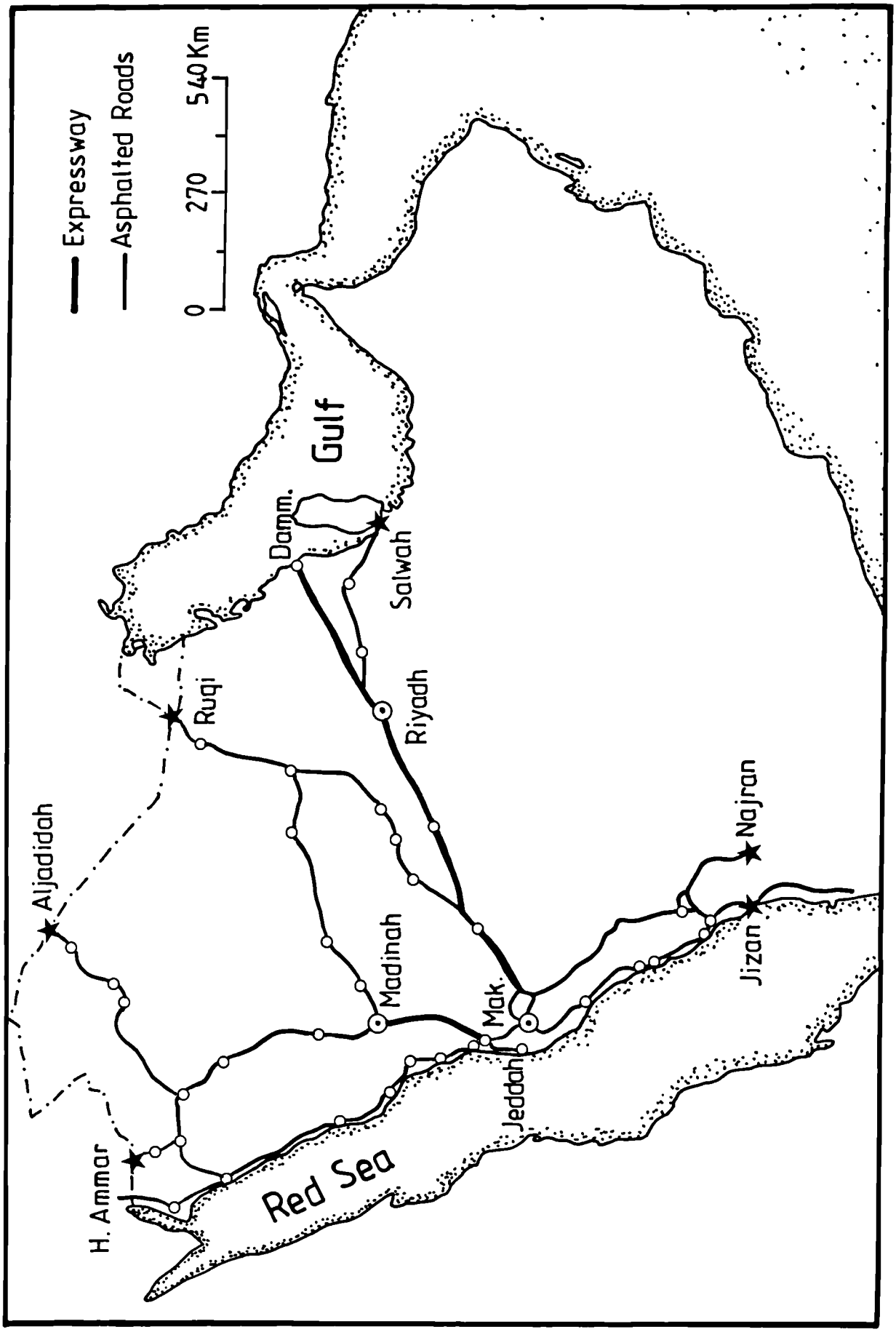


Figure 3.4 The main axes and points of entries in Saudi Arabia for the Hajj movement.

C. A north-south axis, this road follows the edge of the western mountains. The road is 1350 km in length, and runs from Tahran' Aljanob in the south to Harha Ammar in the north. The southern section is very hilly, as the mountain ranges south of Makkah are tall and complex. In places the road tunnels through mountains, and its height ranges from 1500 m to 2400 m above sea level. By way of contrast, the expressway linking Makkah with Madinah, despite being situated between mountains, has an elevation which ranges between 600 m and 1200 m above sea level. From Madinah the road extends northwards as a two-lane single carriageway as shown in Figure 3.3. The MOC intend to upgrade this road to a dual carriageway.

D. The coastal plain axis runs the length of the Saudi Red Sea coast. It links many settlements on the coastal plain with the Hajj region (see Figure 3.4). The road is a single two-lane carriageway. It is characterised by plain relief, in stark contrast with the southern part of the mountain axis. So most Yemeni pilgrims performing Hajj by land use this road.

These axes may be considered as international roads because of their connection with the road networks of neighbouring countries. Between them they have six points of entry into Saudi Arabia along the borders with the neighbouring countries (see Figure 3.4). These points of entry are used by pilgrims travelling overland. So, those coming via Jordan enter Saudi Arabia at Harah Ammar and travel south to Madinah via the northern part of the north-south axis. The pilgrims coming overland via Iraq enter Saudi Arabia either at Al Jadedah or Ruqi. Those who cross the border at Al Jadedah travel south-westwards to the northern axis, while the pilgrims coming via Ruqi use the axis of the east-west carriageway which is also used by pilgrims coming via Kuwait.

Pilgrims travelling overland from the rest of the Gulf states cross the Saudi-Qatar border at Salwa point, and pass Hafouf and Riyadh on their way to Taif along the Dammam-Jeddah expressway. Pilgrims who come by land from South and North Yemen enter the country from either Jizan or Najran point on the Saudi-Yemeni border. Those who enter via Jizan travel along the coastal plain road calling at Al-Qunfudah and Al-Laith to Makkah whereas the pilgrims who come via Najran travel over the Abha-Taif carriageway i.e. the north-south axis.

3.3. The road network in the Hajj region

3.3.1 Introduction

In the light of technical characteristics, the roads supervised by the MOC have been classified into three groups (MOC, 1986:62):

I: Main Roads

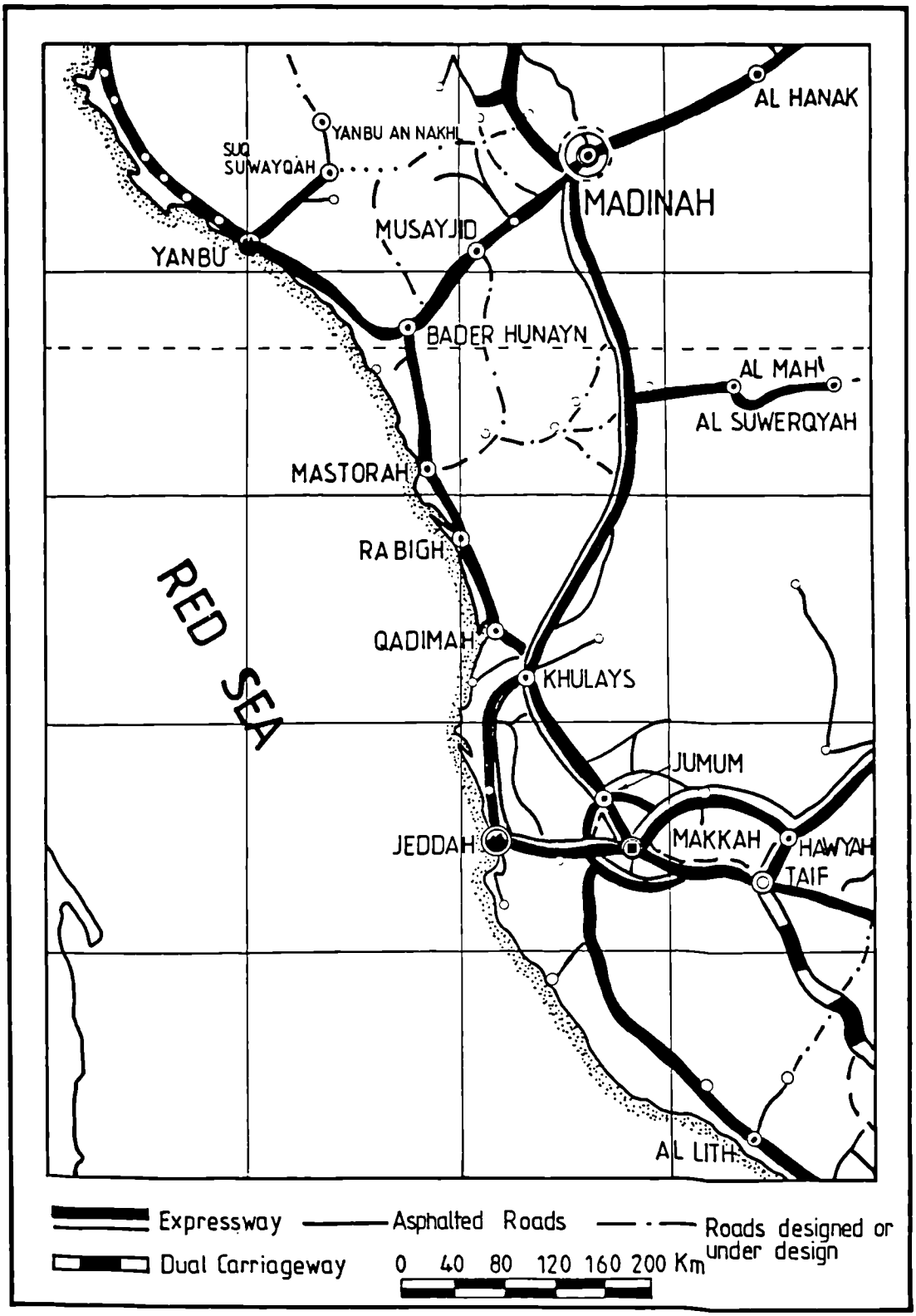
II: Secondary Roads

III: Sub-Roads

The MOC's numbering of the roads was, however, dependent on this classification, but their system, in fact, has not been applied yet, and the maps, which may include this classification, were also not available. Such maps, indeed are in significant demand by people, particularly pilgrims, for guidance and directions.

It may be convenient to subdivide the road networks of the Hajj region into two main categories: rural and urban networks. The network includes the expansion net of rural roads such as the Hadda/Al-Jammam road, the Al-Jummam/Az-Zaimah road, the Az-Zaimah/Al-Madhig road, etc.. This part of the network is not involved in Hajj movement and will therefore not be included in this study. Regarding the urban roads in the Hajj Region, the study will concentrate on inter-city roads and road networks around the city of Makkah, since, as illustrated in Figure 3.5, it is in these networks of the Hajj region that the Hajj movement takes place.

Figure 3.5 The road networks of the Hajj region.



Source: MOC, 1986

3.3.2 The inter-city roads

The inter-city roads, which may be called the major primary roads in the Hajj region consist of six primary roads converging on Makkah (D.H.C., 1985). The following roads are shown in Figure 3.5:

- Old Makkah/Jeddah road
- Makkah/Jeddah Expressway
- Makkah/Madinah Expressway
- Makkah/Taif Expressway
- Makkah/As'saul Expressway
- Makkah/Al-Laith road

The principal characteristics of the above network may be described as follows:

Old Makkah/Jeddah road

This road links Jeddah and the west of Makkah city. Jeddah is considered to be the main point of entry to Makkah from the west; because of the complexity of its land relief Makkah does not have its own international airport. Furthermore, although the city is accessible from the sea, it has never developed as a seaport on account of the dangers presented to shipping by the presence of coral reefs. In addition to this, the distance between Makkah and the seaport (95 km) is greater than that between Makkah and Jeddah (75 km) (Mekki, 1988).

Between Jeddah and Makkah, this road passes Bahrah and Hadda. It is a dual-carriageway with two lanes in each direction.

A report published for Makkah by Robert Matthew (1971) showed that this road is used to about 20 percent of its practical capacity during the non-Hajj period, with a rise to 89 percent during the Hajj. This report concluded that by 1990 the increase in traffic along this road and other routes to Makkah would be very substantial, since a six-fold increase in non-Hajj traffic seemed likely between Makkah and Jeddah. It was recommended that a new three-lane, double-carriageway motorway should be built between Jeddah and Makkah to meet future traffic demands between the two cities (Matthew, 1971). Accordingly, the government decided to build a new road as an expressway: this was started in 1978 and completed in 1981.

Makkah/Jeddah Expressway

This is the major artery for bringing in the air- and seaborne pilgrims to Makkah from Jeddah, particularly during the Hajj season. It plays a significant role in transporting passengers and goods between the two cities. It also provides direct access to Makkah for road traffic entering the Kingdom from the north and west via the axis of the coastal plain and passing through Jeddah. This expressway separates the Hajj movement from Jeddah city traffic, facilitating the direct and easy transport of pilgrims to Makkah.

On account of the increasing volume of express traffic, this road is very important. It is 64 km long and consists of eight lanes (four in each direction), with a 20-metre wide median island (see Plate 3.1). The right-hand lane is specifically for freight vehicles and buses, the remaining lanes being for all other types of motor vehicle. The expressway has been provided with six interchanges to connect areas on both sides of the road. Construction costs totalled SR500 million (MOC, 1986:83). Although this

Plate 3.1 The Makkah-Jeddah expressway (above and below). The picture below shows part of the Port Bridge (12.5 km long) which runs from the seaport of Jeddah and crosses over Jeddah city to the expressway.

road runs parallel to the old one, it is shorter and reduces the distance between Makkah and Jeddah by 10 km.

Makkah/Madinah Expressway

The importance of this road derives from the fact that Madinah is the site of the Mosque of the prophet Muhammed, which the majority of pilgrims wish to visit before or after the performance of the Hajj in Makkah. For this reason it is considered an essential expressway in Saudi Arabia. In addition, it also links two important seaports - Yanbu and Jeddah.

This road originates north of Makkah, near the Al-Amrah Mosque, where it is linked to the third Makkah ring-road, and heads towards Madinah, passing through a number of towns and villages until it is linked to the second Madinah ring-road.

> "*This road is 421 km long, and consists of three lanes in each direction, separated by a 20-metre wide median. There are 25 interchanges serving a large number of towns, villages and wadis along its course.*" (MOC, 1986:82)

This road is being built to high engineering specifications to handle the increasing numbers of pilgrims arriving by road, sea or air, and also to provide a potential service for traffic flow between Makkah and Madinah as well as to serve local traffic between towns and villages located along its course.

A 70 km road-link, constructed to the same specifications connects the expressway with the city of Jeddah. This has facilitated the travel of pilgrims from their point of arrival to the Holy Places. The cost of this road (excluding property acquisition) is SR2,642,109 (MOC, 1986).

Makkah/Taif Expressway

In fact, not all of the road between the two cities (a total distance of about 77 km) is expressway: only that part which stretches from east of Makkah, going eastwards towards Taif and ending at the Al-Kur Mosque, over a distance of some 37 km. It has three lanes in each direction with a 20 metre median.

The road is essential as it ensures rapid traffic movement between the cities without passing through the Holy Sites in Muna, Mozdalifah and Arafat, as was the case before the establishment of this road.

The other section of this road runs from the Al-Kur Mosque across the Al-Hadah mountains towards Taif for a distance of 40 km (see Plate 3.2). It takes the form of a single lane (about 5 metres wide) in each direction. About 10 km before Taif the road becomes an expressway. As well as serving the pilgrims who use it to reach Makkah, it provides a good link between the agricultural areas in the vicinity of Taif and Makkah, the farmers of which supply these cities with fresh food, poultry and fruit daily (Mekki, 1988).

Makkah/Asil Expressway

This road originates north-east of Makkah and goes eastwards with a slight northerly slant towards Al-Hawah, near Taif. It is 95 km long and passes a number of towns, serving the residents and transporting agricultural products from these towns to Makkah. It is an alternative route for those coming from Riyadh or Qasseam regions who want to travel to Makkah without entering the city of Taif, or who dislike driving through the Al-Hada mountains whereas those who travel via the Al-Hada road (Makkah/Taif Expressway) should enter Taif city. This road has three lanes in each

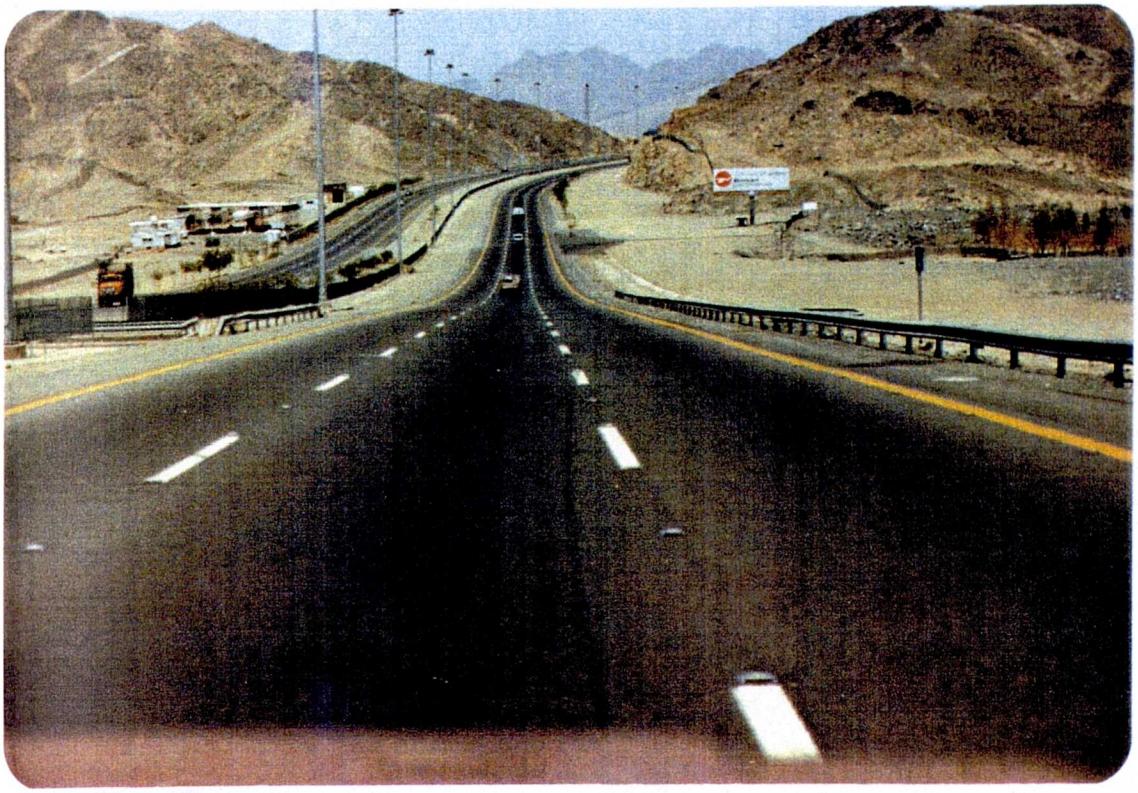


Plate 3.2 Above, a view of the Makkah-Taif Expressway. Below, a section of the Makkah-Taif route called the Al-Hadah road.

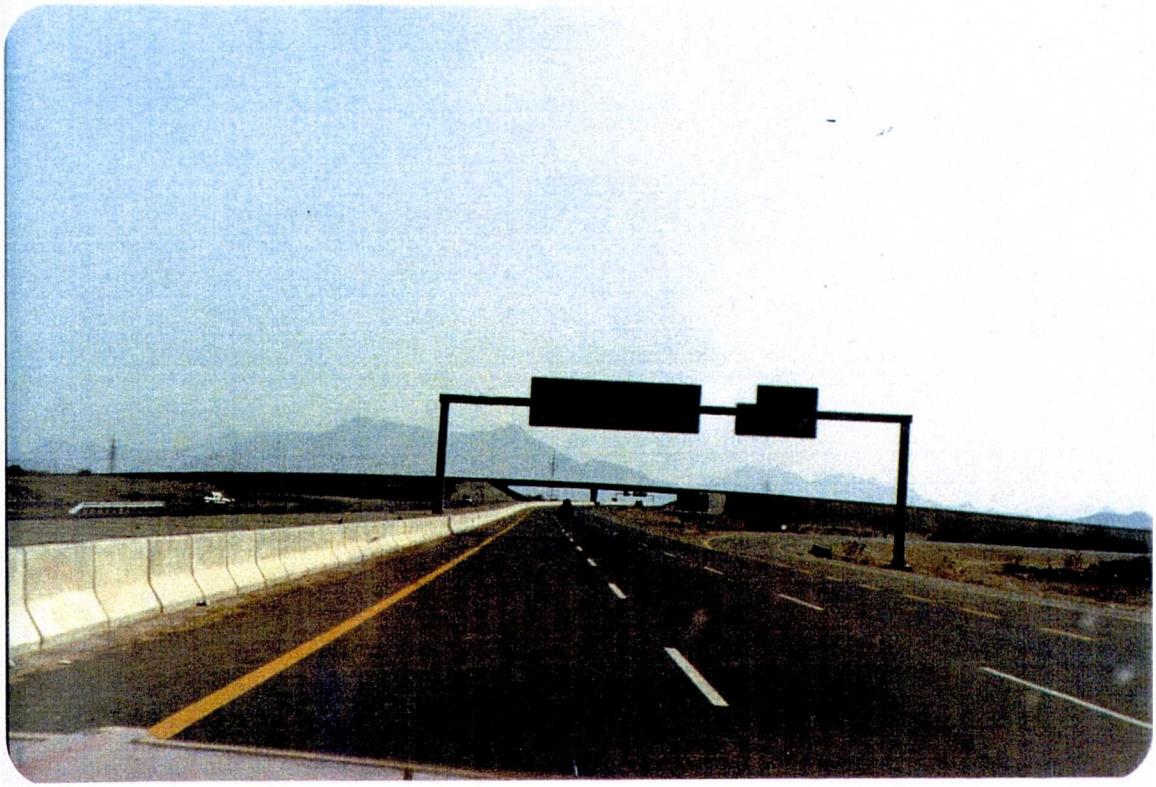
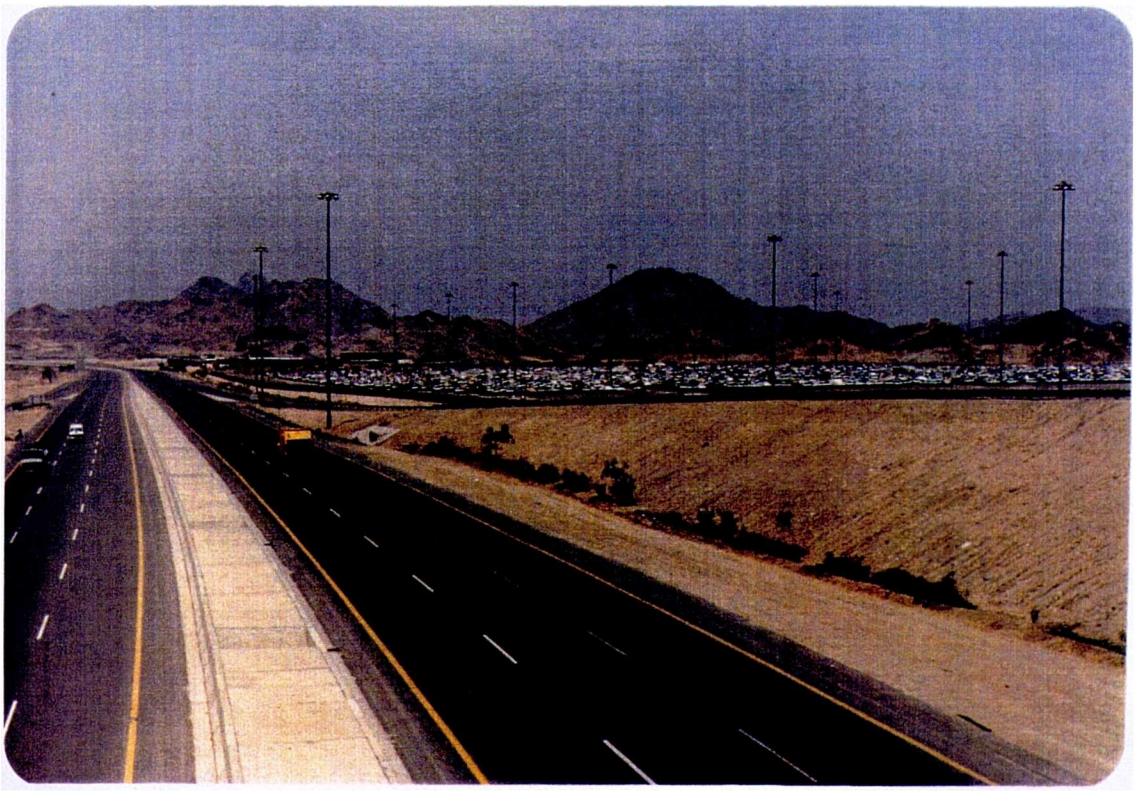


Plate 3.3 Views of the Makkah-Asil Expressway (above and below) and the peripheral car park of small cars at the roadside (below).



direction with a concrete partition 1m high and 1m wide separating the two carriage-ways (see Plate 3.3).

Although both of these roads are important routes for general travelling and for pilgrims coming to Makkah from the eastern areas and from the airport at Taif, it is easier for trucks and long lorries carrying food supplies to Taif or the eastern areas to use the Makkah/Asil Expressway rather than the Makkah/Taif Expressway through the Al-Hada mountains (Mekki, 1988).

Makkah/Al-Laith Road

This road is classified as single-carriageway, having one 5 metre wide lane in each direction without a central reservation. It is located to the south-west of Makkah and heads southwards in the direction of Juzan, passing Al-Laith and Al-Qumfudah to South Yemen. Although it is the main road bringing overland pilgrims from these areas, its volume of traffic is relatively light compared with the above roads, even during the Hajj period.

3.3.3 Traffic volume of the inter city roads

Generally the regional roads, mentioned above, provide adequate capacity for the year-round traffic of goods and people including during the Hajj period. D.H.C. (1985) carried out vehicle classification counts on the six roads over various periods during the year. Two periods have been selected to clarify the traffic volume in non-Hajj and Hajj periods. Table 3.1 shows some traffic characteristics such as the number of lanes, the maximum capacity per hour, peak periods, total traffic by direction, and percentage of buses and trucks. In addition, the volume to capacity (v/c) ratios were calculated.

> *The v/c ratio is a measure of congestion, based on the generalised capacities of the roadways*", D.H.C. (1985, v6:63)

Although the traffic volume of the common period is tripled during the Hajj period, the peak-hour v/c ratio of the expressways did not exceed 0.20. This means that these roads enjoyed high levels of the capacity for which they had been designed, particularly in the rural parts (see Table 3.1). However, the old Makkah - Jeddah and Makkah - Al-Laith roads, which both have the lowest volume of traffic among the six roads, jumped five-fold during the Hajj period. This multiple increase was reflected in the v/c ratio which reached 0.67 for each of them (Table 3.1). This means that both roads experienced more pressure in terms of the capacity, when the traffic volume on the Hajj period assumed more than half their capacity. Attention should be paid to the two roads, for improvement and upgrading.

The traffic volume of buses and trucks vary between the two periods. At non-Hajj times, the volume of buses does not exceed 2.0 percent of the total volume on any one of the six roads, while during the Hajj period the volume increases to more than 12 percent. On the contrary, the volume of trucks at non-Hajj times increased on the regional roads except on the Makkah - Jeddah expressway and declined in the Hajj period (Table 3.1). This is because the traffic of goods faces restrictions during the Hajj in order to facilitate traffic movement for passengers.

Table 3.1 Traffic characteristics on the regional roads of the Hajj area

	Road name and period of observation	No. of lanes	Peak hour volume	24 hour A - B	24 hour B - A	Bus %	Truck %	Hourly cap-acity	Peak hour v/c ratio
1	Old Makkah/Jeddah road	2+2							
	non-Hajj period		284	4641	5763	0.4	33.5	2100	0.23
	Hajj period		1422	8546	18486	12.0	12.1	2100	0.68
2	Makkah/Jeddah Expressway	4+4							
	non-Hajj period		858	9137	11064	0.9	5.0	8000	0.11
	Hajj period		1447	12584	18850	12.5	7.3	8000	0.18
3	Makkah/Madinah Expressway	3+3							
	non-Hajj period		416	4405	4399	2.0	23.4	6000	0.13
	Hajj period		1307	2279	13780	6.1	15.8	6000	0.22
4	Makkah/Taif Expressway	3+3							
	non-Hajj period		298	4034	4320	0.6	11.0	6000	0.05
	Hajj period		881	3699	8508	1.3	5.5	6000	0.15
5	Makkah/As-Sail Expressway	3+3							
	non-Hajj period		541	5236	5717	0.4	30.0	6000	0.09
	Hajj period		1124	8581	9804	8.3	15.6	6000	0.19
6	Makkah/Al-Laith Road	1+1							
	non-Hajj period		146	1807	1521	0.5	24.8	1059	0.14
	Hajj period		706	2575	5430	5.8	18.1	1050	0.67

Source: *DHC, 1985, V.2*

3.3.4 Road Network of the Holy Makkah

In fact, this network involves not only the road network of Makkah city itself, but also the Holy Places of Arafat, Mozdalifah and Muna. Although the former network is associated with the latter, it is convenient to discuss each of them separately.

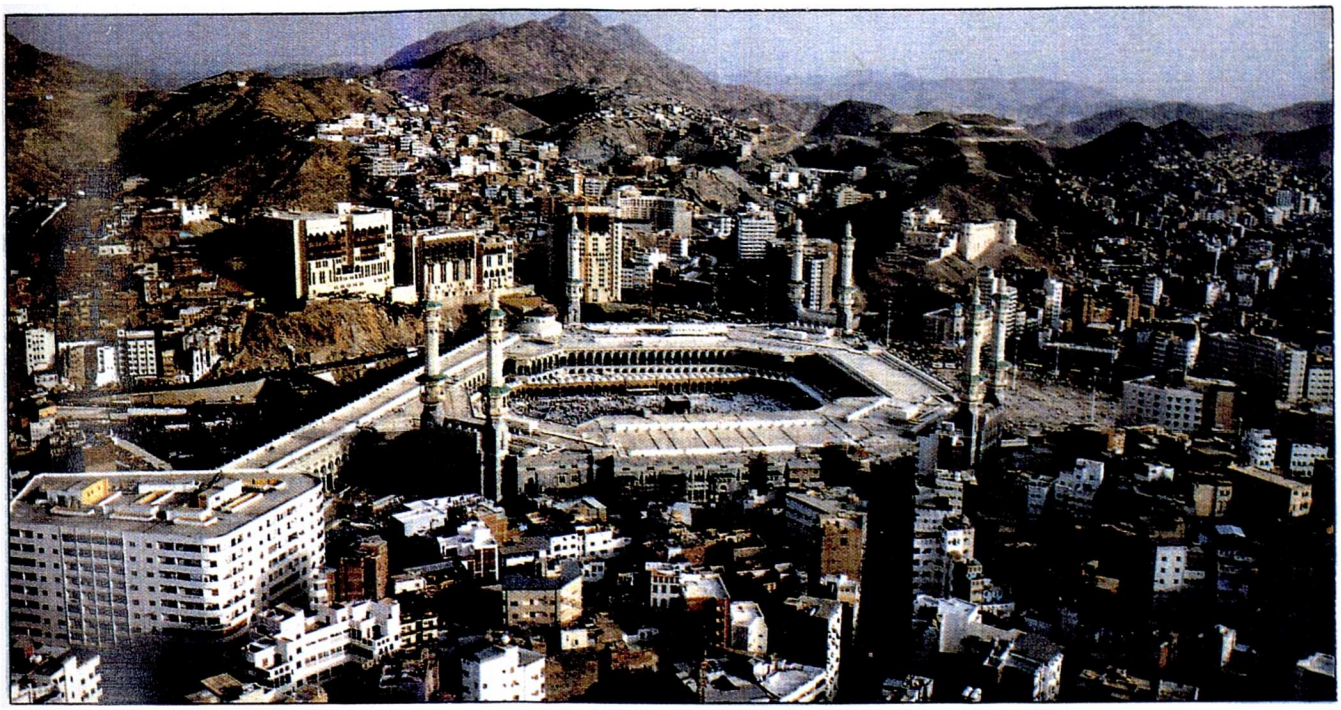
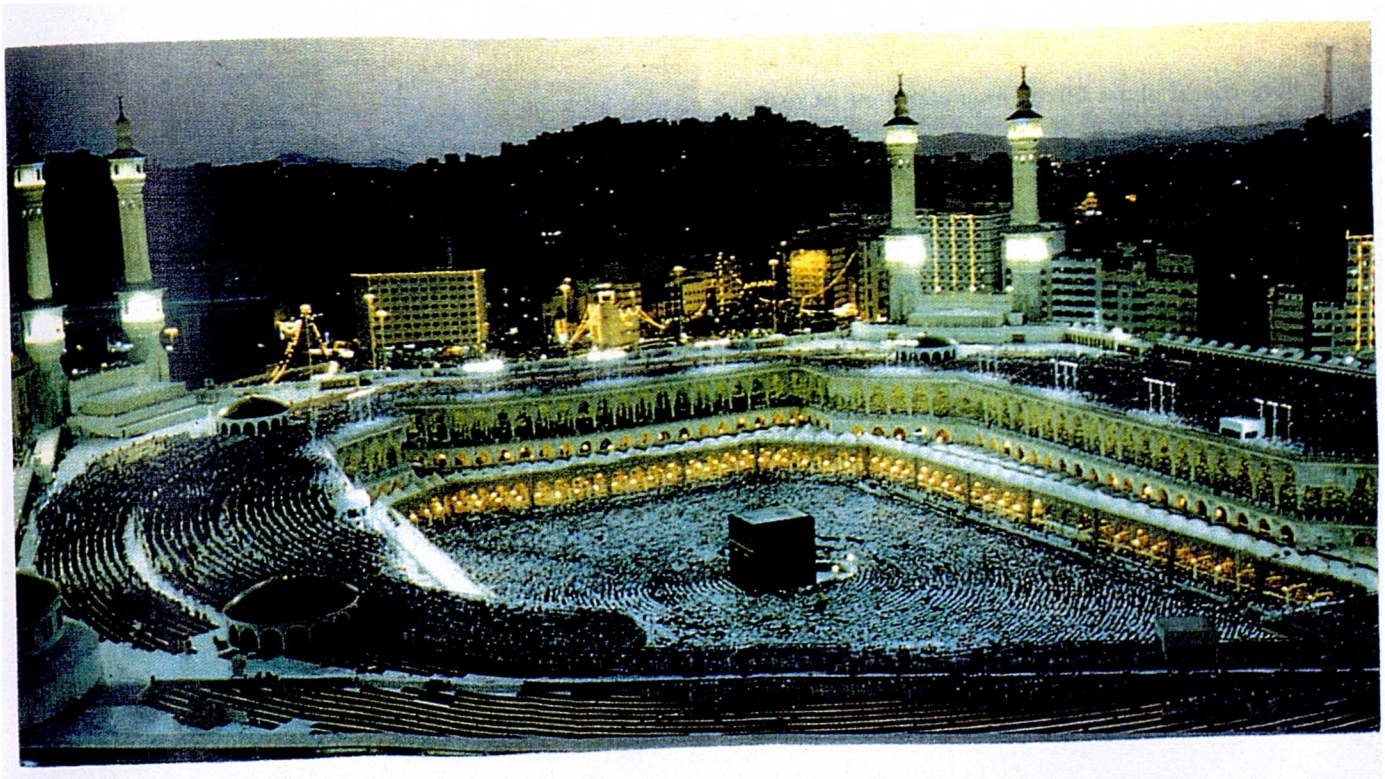


Plate 3.4 The Holy Mosque is in the middle of the Makkah city. The above picture shows the whole Haram building including the Mass'a corridor to the left of the Mosque. The photograph below shows the Holy Mosque with worshippers praying towards al-Ka'bah in the middle. (both photographs were provided by the Ministry of Information)



3.3.4.1 Makkah Urban Road Networks

As has been indicated, Makkah has subdivisions: its centre is the Holy Mosque (see Plate 3.4), which is considered to be the fundamental point of the city, playing an essential role in its effect on land-use and consequently on the road network. In addition to this, the urban network of the city has been affected by mountainous terrain. Thus the directions of roads follow the courses of valleys. This is particularly true in the case of old roads such as Al Haram Street, which follows the edge of the Ibrahim valley, and Al Hijrah Street along the bottom of the valley where the Holy Mosque (Al-Haram) is located.

A significant proportion of the residential areas is located on steep hills, so that access to some parts of the city is difficult. The older parts of Makkah, for example around Al-Haram, have traditional streets which are narrow and winding and in some cases include steps leading to properties on higher levels. On the other hand, the newer neighbourhoods in Makkah, such as Al-Aziziyah and Al-Nuzha, have wide landscaped roads and streets. However, the landscape of Makkah has been changed by rapidly-expanding land-use during the 1970s.

> "Early in (70s), the Kingdom adopted development policies and programmes that positively impacted on all facets of economic and social life. A very important change was the popularisation and increased availability of the automobile. The tremendous increase in personal freedom and mobility that it provided also resulted in a drastic morphological change in Makkah's development. No longer limited to the compact city limits, which of necessity were within short walking (or riding) distance, the Holy City grew very rapidly" (D.H.C. V.6, 1985:11).

The availability of motorised vehicles has made it possible for people to locate further from the city centre and as a result of this, traffic volumes on the roads within Makkah are continually increasing. The numbers of vehicles of various types registered by the

Traffic Department of the Makkah region during the 1970s rose from 11,900 in 1971 to 100,516 in 1981 (G.T.D., 1971) - i.e. an estimated overall increase of 744 percent, with an annual increase of 8,862 vehicles. Although these figures cover rural areas of Makkah as well as the Holy City itself, they indicate the magnitude of development and increase of traffic volume in the city. Robert Matthew predicted that the number of vehicles would increase from 9,030 in 1971 to 65,800 in 1981: by this date that number had already been exceeded (see Table 3.2). The increase in the number of vehicles rose by 628 percent, compared with a population increase in the city of only 56 percent during the same period. In the Hajj period the number of vehicles within Makkah associated with the Hajj movement increased from 81,522 in 1974 to 101,940 in 1986 (CDS 1988) - i.e. an increase of 125 percent.

Table 3.2 Growth of vehicle numbers in Makkah City according to a high population projection of Matthew, 1971

Year	No of vehicles	Percentage	Population	Percentage	Remarks
1971	9030		301000		Statistics
1981	65800	628%	470000	56%	Estimated

Source: *Matthew, M.P.R., 1971.*

Such a rapid increase in the numbers of vehicles making up the traffic volume of the Holy City, both during and outside of the Hajj period, has created a great demand for new routes and for improvements of the existing network (which have already been made towards developing the city network). In addition to this, there are some projects which are still under construction, such as the fourth Makkah ring-road.

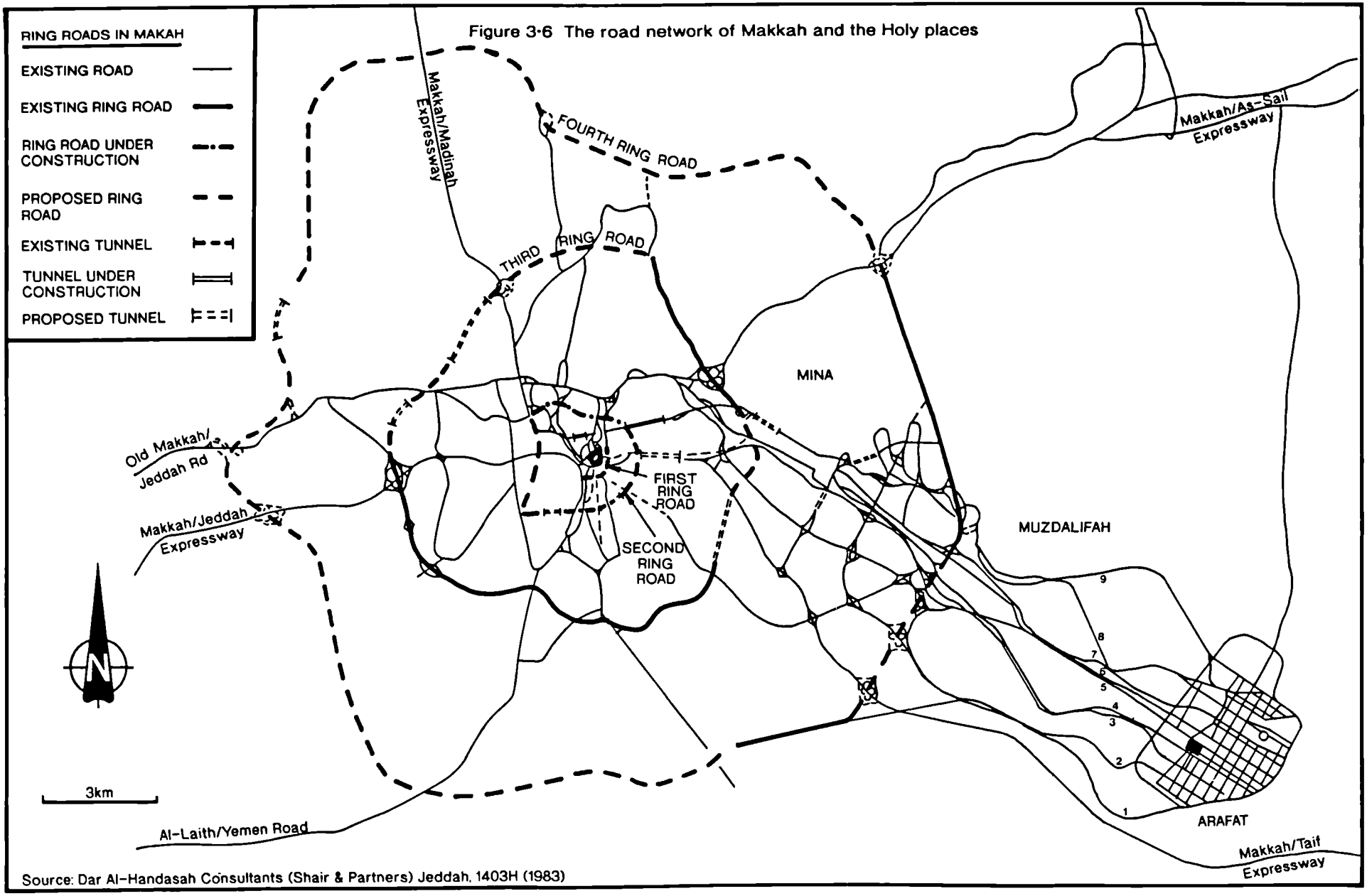


Figure 3·6 The road network of Makkah and the Holy places

Source: Dar Al-Handasah Consultants (Shair & Partners) Jeddah, 1403H (1983)

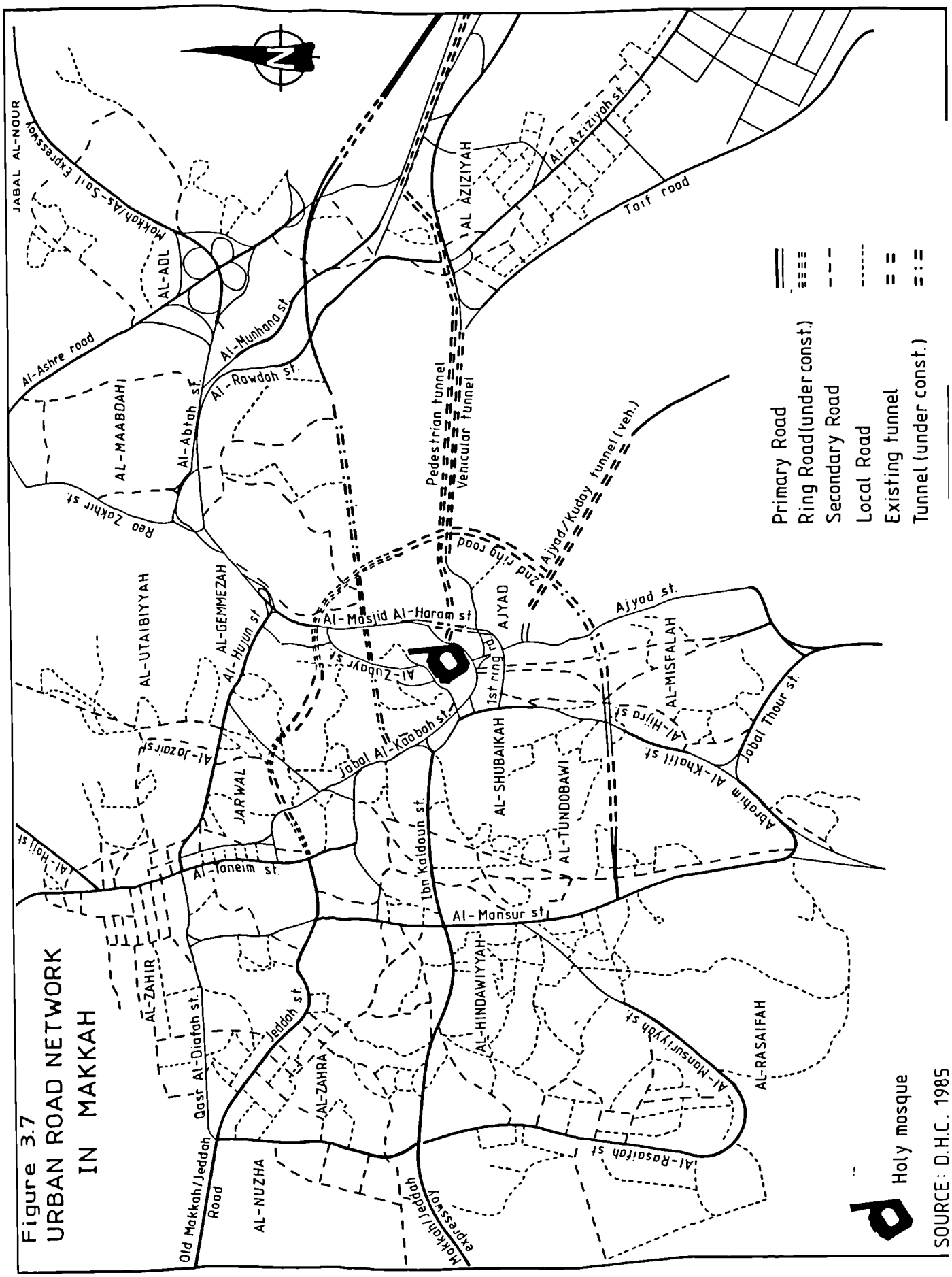


Figure 3.7
URBAN ROAD NETWORK
IN MAKKAH

SOURCE: D.H.C. 1985

As can be seen in Figure 3.6 Makkah has a complex network of roads serving Al-Haram and the residential and commercial areas, as well as those associated with the network of the Holy Places which will be discussed later.

As far as the urban road network of Makkah is concerned, it may be classified into primary and secondary roads, local streets and alleys. This classification was adopted by D.H.C. (1985) who derived it from the function performed by each. The primary road system is identified as a system of arterial roads connecting the major centres of activity in Makkah. It carries a major proportion of the traffic volume. These primary roads also connect with regional roads leading to and from Makkah. The secondary road system connects with the primary network. It provides service at a lower level than the primary system. It also serves various geographic areas smaller than those for the primary system and carries local traffic (D.H.C, V6, 1985). In addition, the road network includes four ring-roads and some newly-built tunnels in Makkah.

In the section which follows, aspects of the major roads, ring-roads and tunnels of Makkah city are described briefly.

A. Major Roads in Makkah

This part of the network is the urban network of Makkah. As may be seen in Figures 3.6 and 3.7, it lies within the third ring-road. Characteristics of the more important primary and secondary roads are shown in Table 3.3. Within the third ring-road there are 73.1 km of primary and 41.5 km of secondary asphalted road (D.H.C. v6, 1985). Unlike the local streets and alleys, the total lane-kilometres of asphalted road is 496 km.

In relation to the surface of settlement areas in Makkah (61.2 km^2 in 1983), the road density is 187 km of primary and secondary roads per 100 km^2. Reference to Table 3.3 shows that most of the primary roads carry two-way traffic (except for Al-Haram Street and Abdulah Bin Azzubay Street), while all the secondary roads are one-way only, except for a small part of Al-Hijra Street, which is two-way near Al-Misfalah and one-way near the Haram .

Table 3.3 The major urban roads in Makkah City

	Street Name	Length (Km)	One way/two way	No. of lanes in each direction	Median	Some notes of the D.H.C.
A	**Primary roads**					
1	Al-Taneim Street	4.2	2	2	Yes	Continuation of Makkah/Madinah Road,heavily used
2	Jabal Al-Kaabah St.	1.2	2	3	Yes	Heavily used street,steep gradients
3	Ibn Khaldoun St.	6.0	2	3	Yes	Major entrance to the Haram from the western areas
4	Ibrahim Al-Khalil St.	6.6	2	3	Barrier	Connects with Al-Laith,Yemen Road/major links to the southern areas
5	Ajyad St.	5.3	2	2-3	Barrier	Connects with land-pilgrim parking area,serves Ajyad area
6	Ajyadas-Sud Street	5.4	2	3	Barrier	provides access to the Holy Places
7	Al-MisJid Al-Haram St	5.2	1	3-4		Heavy traffic from the Haram
8	Abdullah Binaz-Zubeyr St	2.0	1	4		Heavy traffic going to the Haram
9	Al-Hujuu St	4.6	2	3	Barrier	Serves very busy commercial and residential areas
B	**Secondary roads**					
10	Al-Hijrah St	4.6	2-1	1-2		Links with Al-Misfalah parking
11	Khalid Ibn Al-Walid Street	0.9	1	2		Serves residential and commercial areas
12	Al-Andulus St	1.4	1	2		Serves residential and commercial areas

Source: *D.H.C., Report 2, part 2 (1985), Municipal of Makkah (1987)*

Some roads of primary streets have a median island with planted trees or merely cement or stone barriers - for example streets nos. 1, 2 and 3 in Table 3.3.

Entrances and exits of the Al-Haram, such as Nos. 3, 4, 6, 7, 8 and 10, are heavily used streets, serving commercial and residential areas. In addition, most of the hotels and markets are concentrated around these streets. During the high seasons, these streets experience pedestrian - vehicular conflict, particularly around the Haram. One of the most important streets not in Table 3.4 is Al-Aziziah Street (see Plate 3.5), which provides continuity for Al-Masjed Al-Haram Streets and a link between the Al-Maabda and Al-Aziziah districts, while serving industrial and commercial areas at a high level. In addition it is regarded as the backbone of the Hajj movement as it links the Haram area with the Holy places (see Figure 3.6). This street is now connected directly with Al Haram and Muna on either side via tunnels through the hills which were previously obstacles between them. In addition, there are many bridges between Muna and the tunnels of the Haram. However, the D.H.C. has suggested improvements to intersections of some streets, such as Al-Tanaim Street, and in fact most of the roads in Makkah have been subject to improvements and developments, some of which are under construction.

These projects have entailed considerable government expenditure. Abrahim Al-Khalil Street, for instance, one of the most important leading to Al-Haram, was widened to 25 metres in 1982. This involved the demolition of some houses, which cost S.R. 157,962,629 (around £45 million at the time) in payments to house owners alone (Mekki, 1988:114). Because the central region has been accustomed to high traffic density at most times due to the lack of an alternative route avoiding it, many projects were initiated in order to build ring-road systems, which before 1980 did not exist in Makkah.

B. The ring-roads

As mentioned above, the primary road network of Makkah also includes four ring-roads in various stages of planning, design and construction. These are: the First Ring-road, the Second Ring-road, the Third Ring-road and the Fourth Ring-road. This type of road performs a special function of transportation, with a significant role as a distribution, radial and collection source, thus participating in reducing congestion and producing easier access to the fringe of the urban area. They also contribute to faster traffic flow and provide a direct link between districts, reducing the time taken for a journey. Ring-roads can also encourage the development of cities by making the remote areas (between the radials) more accessible (D.H.C. V6, 1985).

In fact this system is made up of new projects dating from 1980 when the first stage of the Haram Ring-road was begun with the construction of tunnels and bridges linking Jeyad Street south of Al-Haram with Al-Qushashia to the east. Although the construction of ring-roads still continues, the major parts of all ring-roads other than the Fourth are complete. Further details of the length, direction, type of median and function of each road are shown in Table 3.4 and Figure 3.7

These projects were extremely costly: the construction of the tunnels for the Second Ring-road, for example, cost SR400 million in 1983-85 (about £85 million)(MOC, 1986).

Table 3.4 The Main Characteristics of the Four Ring-roads in Makkah City

	Length (Km)	Direction of Flow	No. of lanes per direction	Type of median	Notes
First ring-road	2.8	Two-way	2	Barriers	Surrounds the Haram area; interchanges with Jabul Al-Kaabah and Ibrahim Al-Khalil streets; it has three tunnels completed; east section parallel to the Al-Mosjed Al-Haram street; expected to relieve vehicular pressure around the Haram area
Second ring-road	9	two-way	3	Barrier	Surrounds the city centre at a distance of around 1.5 km from the Haram; four tunnel sections totalling 5km; interchanges with seven major streets of Makkah: expected to divert through-traffic from the central areas
Third ring-road	28	two-way	3	Barrier or island	About 4-5 km from the Haram; connects with the six regional roads coming into Makkah; the southern section providing good direct access between Makkah/Jeddah and Taif Expressways as well as between the Holy Places and Makkah
Fourth ring road	57	two-way	3	island	only the eastern section connecting the Makkah/As-Sail Wxpressway with the Holy Places (along King Faisal Bridge) is completed

Source: *D.H.C. (1985) and Municipal of Makkah (1987)*

Although the benefits of the ring-roads bring several advantages to urban transport in that they relieve and facilitate traffic movement in the city, the stage has not yet been reached when all four ring-roads are needed in the non-Hajj period when the population of Makkah does not exceed 600,000 (DHC, 1985). Even during the Hajj period the Fourth Ring-road may cause disadvantages in relation to the Hajj movement. These will be discussed further below.

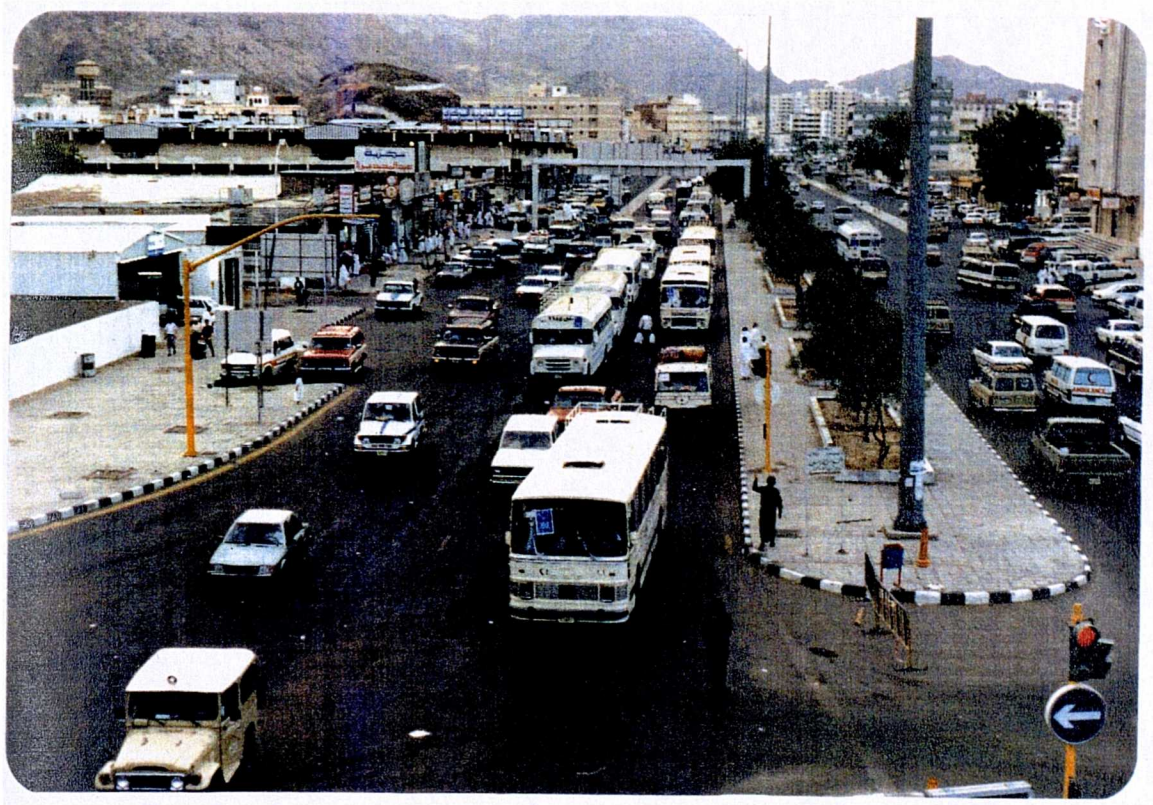


Plate 3.5 Al-Aziziah street during the Atasaad movement to Arafat (above). A view of the Third Ring Road (Kuday street) during the non-Hajj period (below).

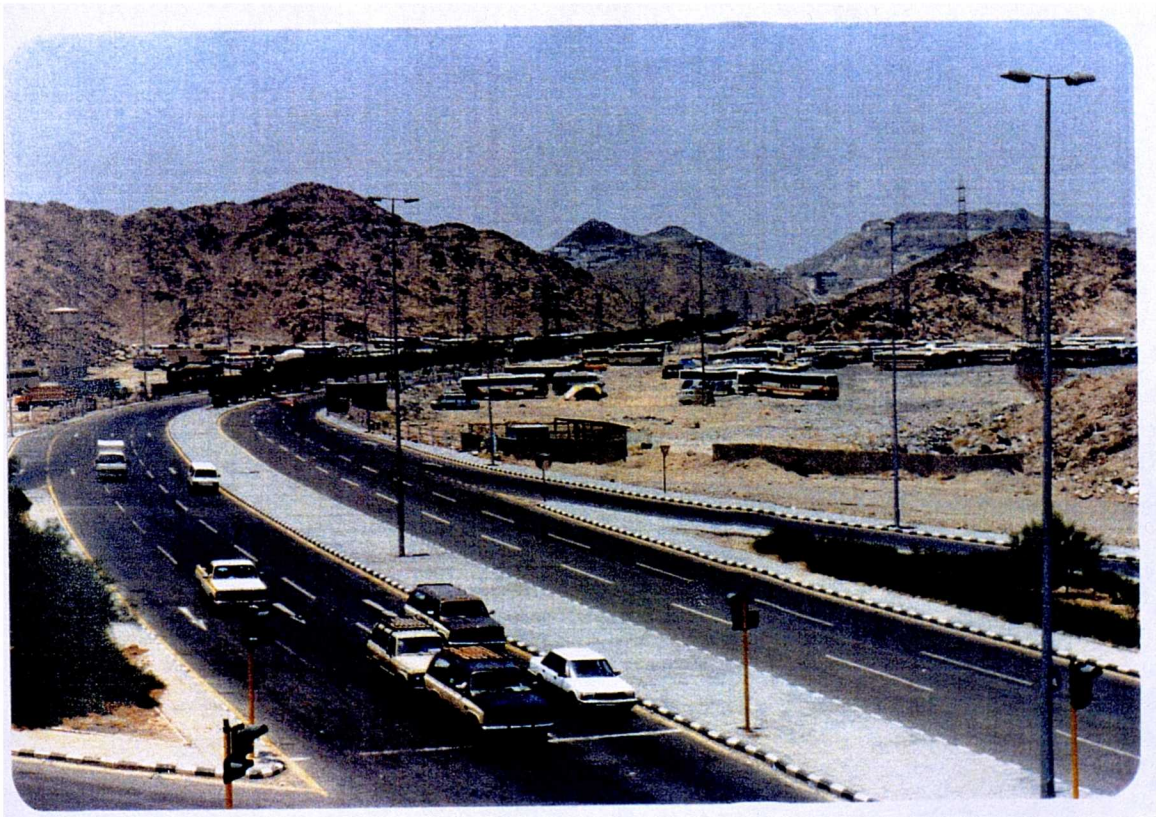


Table 3.5 Characteristics of completed radial tunnels in Makkah City

	Tunnel name	Length (km)	Part of the road	No. of tunnels in section	No. of lanes	Function of tunnels	Other facilities
1	Ajyad As-Sud Tunnels						
A)	Vehicular Tubes	1.2	Ajyad As-Sud Street	2	3	Vehicular	Cross-passes
B)	Pedestrian Tubes	1.2+0.6	Pedestrian road in Holy PLaces	2	2	Pedestrian	Toilets/ Crosspasses
2	Kuday/Bab Al-Malik	1.2+0.5	Linked to Ajyad Street	1	2	Vehicular/ pedestrians	toilets/cross-passes
3	Ajyad/Kuda	1.6	Mozdalifah Street	2	2	Vehicular	Cross-passes
4	Al-Hijra	0.7	Al-Hijra Street	1	2	Vehicular/ pedestrian	Toilets/cross -passes
5	Kadwah	0.3	Linked to Ajyad Street	1	2	Vehicular	toilets
6	Al-Malawi/ Shib Amir	0.5+0.6	King Fahd Street	2	3	Vehicular	Cross-passes

Source: *DHC, R2, Part 2, 1985; Municipal of Makkah, 1987; and observations of Author*

C. Tunnels

As has been indicated, the topography of Makkah is complicated: the mountains and valleys create difficulties for communications between distant areas of the city. Thus, to connect recently-developed areas by a surface facility would have involved enormous design and construction problems, and for this reason such tunnels were built to link areas separated by mountains. At present the tunnels form parts of the road and pedestrian networks. The city area alone has almost 20 km of tunnels incorpor-

ated in radial and ring-roads. Although some are still under construction, most have now been completed. More tunnels have been proposed for the future.

> "*The tunnels have a significant influence on the developing city form and on relative land values. Makkah has been able to develop wherever land suitable for construction exists because the tunnels have shortened otherwise overly long connecting route distances.*" (D.H.C. V6, 1985:26)

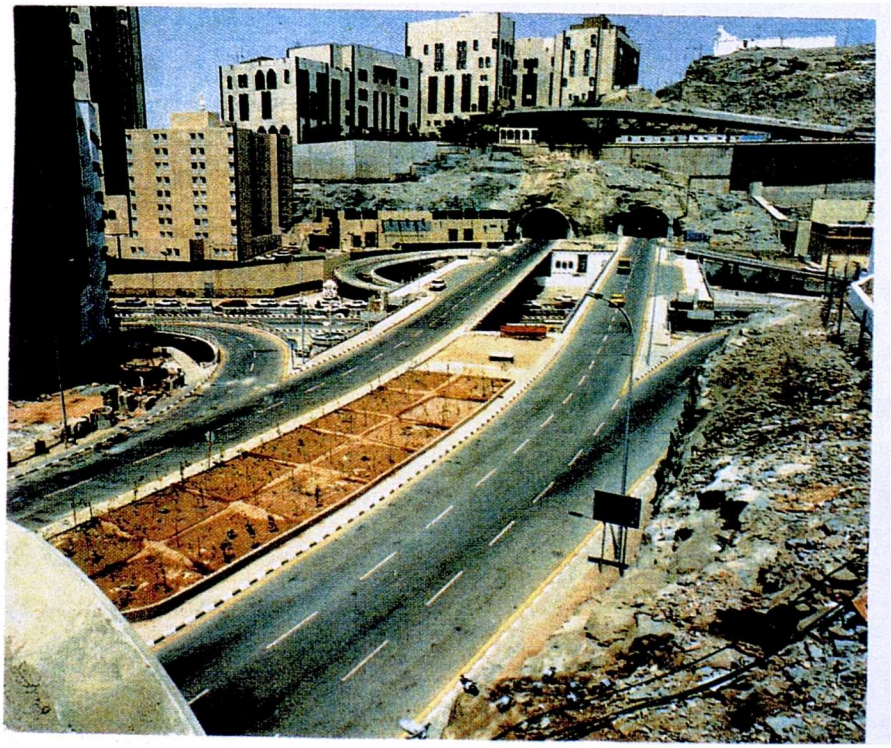
Four tunnels on the first ring-road have been completed and opened to traffic (see Plate 3.6). On the Second Ring-road, which has four tunnel sections (about 5 km [in total]), three sections have been completed. Most of the tunnels for the Third and Fourth Ring-roads are under construction, with others being planned.

There are two types of radial tunnel in Makkah: vehicular and pedestrian. Most were constructed to carry the flow of people and vehicles radially towards the Al-Haram. These tunnels include public toilets and ablution facilities as well as a ventilation system. There are also emergency exits available at regular intervals that direct traffic outwards. They are lighted and have a fire detection system that includes early warning signals (D.H.C. V6, 1985).

Table 3.5 illustrates some characteristics of the radial tunnels, while Figure 3.6 shows their location throughout the road network of Makkah. In addition to these, there are other radial tunnels still under construction or proposed.

Once again, in spite of the facilities offered by the tunnels in terms of urban transport traffic flow in Makkah, the multiplicity of tunnels converging on the Holy Mosque could lead to multiple problems within the Al-Haram area during the Hajj movement when there is a rapid flow into this confined space. As has been shown in recent years, this could lead to severe overcrowding which will be explained next.

Plate 3.6 An aerial view of road tunnels in Makkah (above, source: Ministry of Information). A closer view of the tunnels which were constructed for the First Ring Road in Makkah (below, source: Ministry of Information).



3.3.4.2 Overview

> "*Building new roads, it seems, is not the way to relieve congestion. Traffic expands to fill the space available*" (Askwith, R. 1990:18).

The above may apply to Makkah city, the construction of converging tunnels, and the fourth ring road in particular, may create more entries to the city centre, allowing vast numbers to reach the Holy Mosque (Al-Haram). A disadvantage that may arise from this is that over one million pilgrims can converge on the Al-Haram area, the capacity of which does not exceed half a million. The point is more graphically illustrated for Tawaf, one of the Hajj rites inside the Mosque, which can accommodate only 50,000 pilgrims at a time (H.R.C., 1982).

It might be asserted that the movement of traffic towards the Holy Mosque could be mitigated by traffic management, e.g. restrictions on entry. However, it is very difficult to manage pedestrian movement, particularly when there is an onrush of people through corridors or tunnels. The disaster that occurred at Hillsborough football stadium in the UK (1989) when around 90 people died and in the Al-Masseem tunnel in Makkah (1990) where over one thousand people lost their lives are two sad reminders of this.

In addition, the project of the Fourth Ring-road may stimulate investment and property development which would lead to settlement, the expansion of Makkah and a consequent increase in the volume of vehicles and traffic movement (see next chapter). Consequently, Makkah would find it more difficult to function as a religious centre. It is important to note that a small city is better equipped to cope with an event like the Hajj than a large, sprawling city. Thus, when one considers that the essential

function of Makkah is a spiritual one serving the religious festivals and the Hajj, then it would seem appropriate to place restrictions on the growth of the city.

3.3.4.3 The road network in the Holy Places

The Holy Places are quite close together. Arafat is about 6 km from Mozdalifah, and the latter only 2 km from Muna. The furthest point of the Holy Places is no more than 20 km from Al-Haram. Figure 3.6 shows that in the area of the Holy Places there is an extensive network of roads which link with each other and with the Al-Haram in the city centre of Makkah.

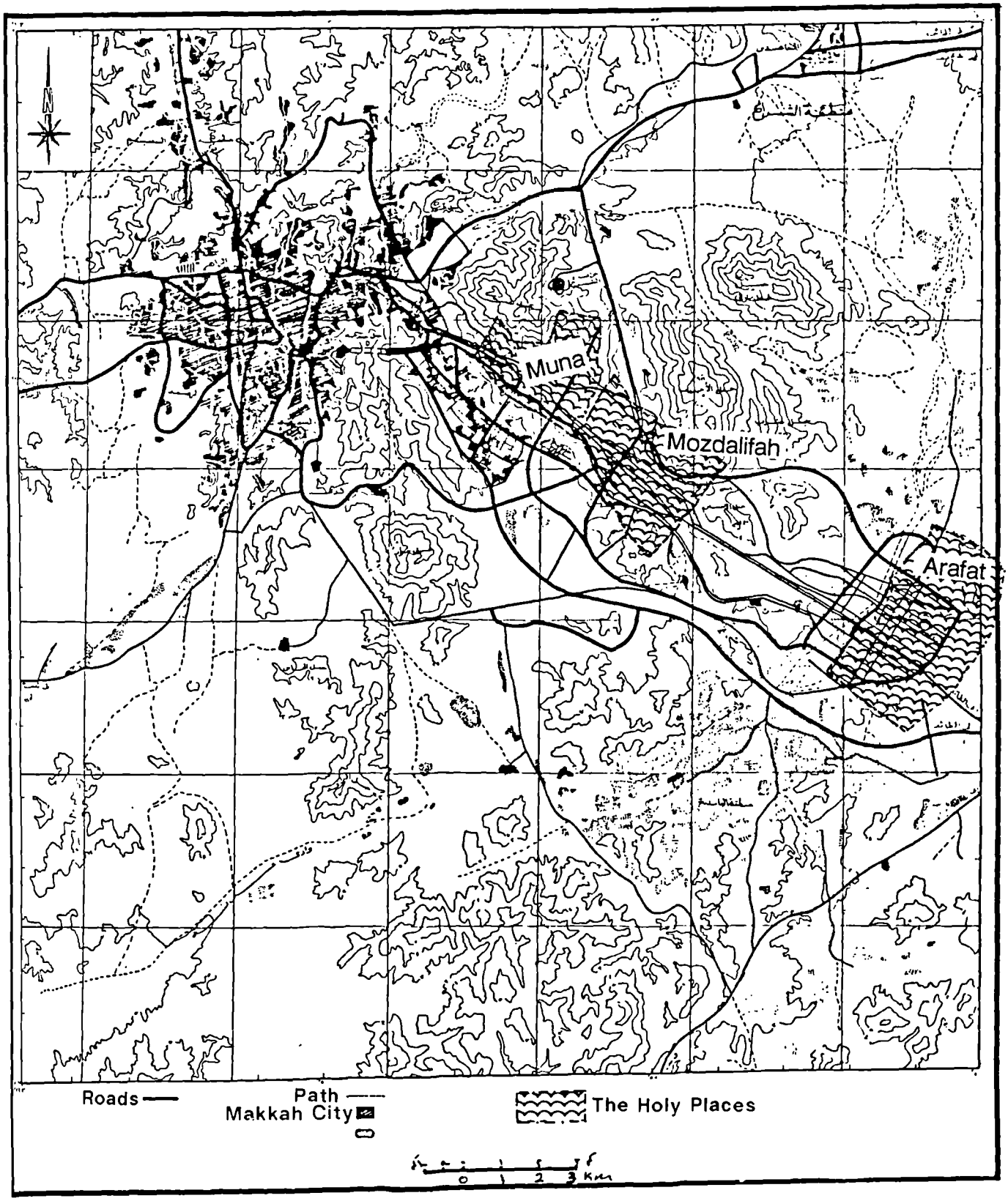
Nine roads connect Arafat with Mozdalifah, through which they run to Muna. At the approach to Muna on the Mozdalifah side, the nine roads contract to form seven, and then contract further to become three at the bottleneck beyond Muna caused by the mountains on both sides (see Figure 3.8).

Discussion of the roads in the Holy Places leads to the following brief examination of land-use in these areas.

A. Arafat

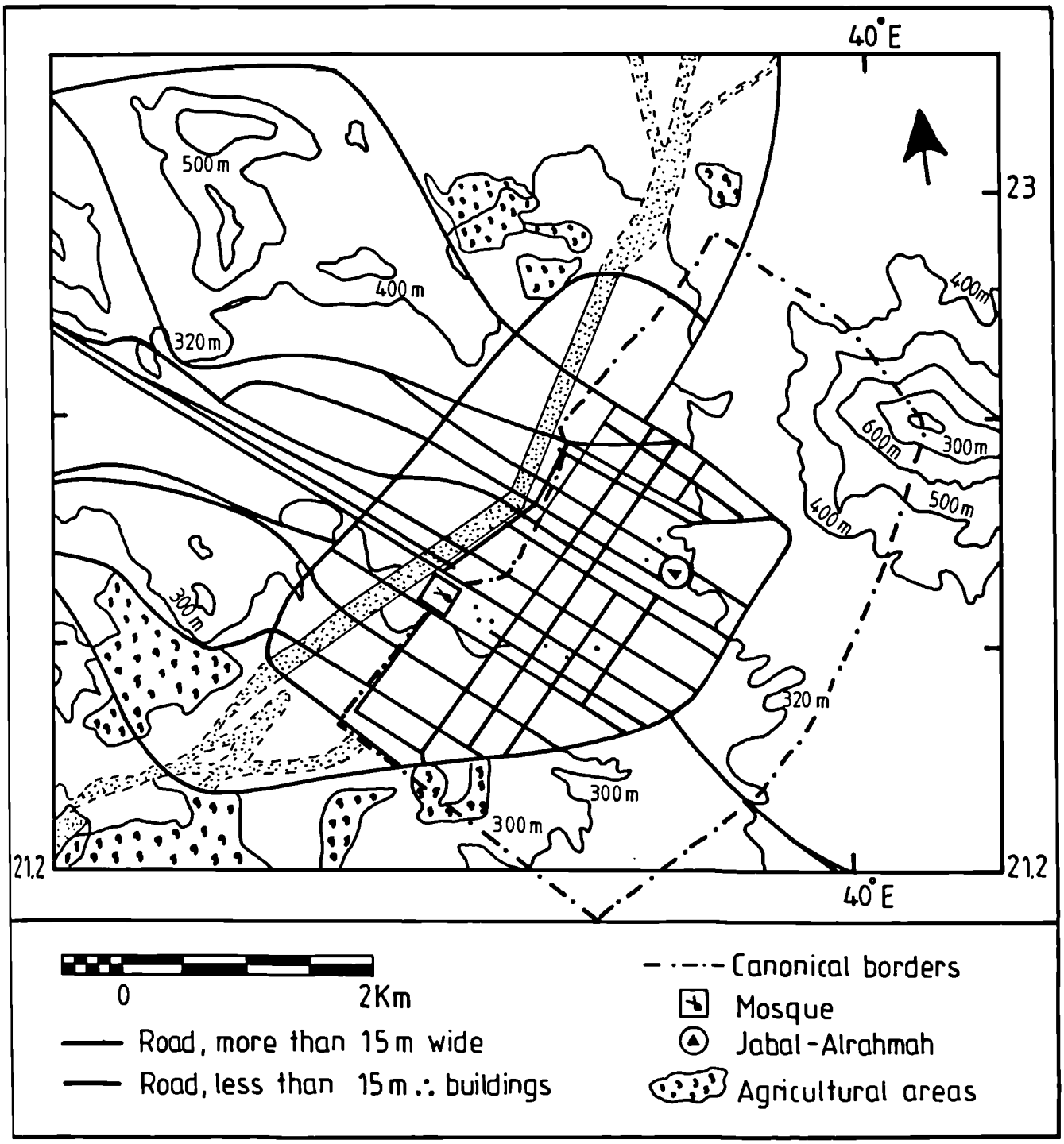
The area of Arafat is about 1,390 ha (13.9 km^2) (Matthew, 1971). The road networks occupy almost 10 percent of its total surface, the total length of the paved roads inside the border of Arafat being 45 km. Their widths range between 15 and 30 m. Most parts of Arafat are linked by this network which extends north-westwards from Arafat to Mozdalifah and Muna. In all there are nine roads, one of which is a ring-road that links all the others on the eastern borders. In addition there are many crossroads which join these main roads together, as is shown in Figure 3.9. When these roads exist from Arafat, the width of each does not exceed 12m, particularly when they cross

Figure 3.8 Locations of the Holy Places in Makkah



Source: Ministry of Muncipal and Rural Affairs (1983)

Figure 3.9 Topography of Arafat.



Source M.O.M 1984

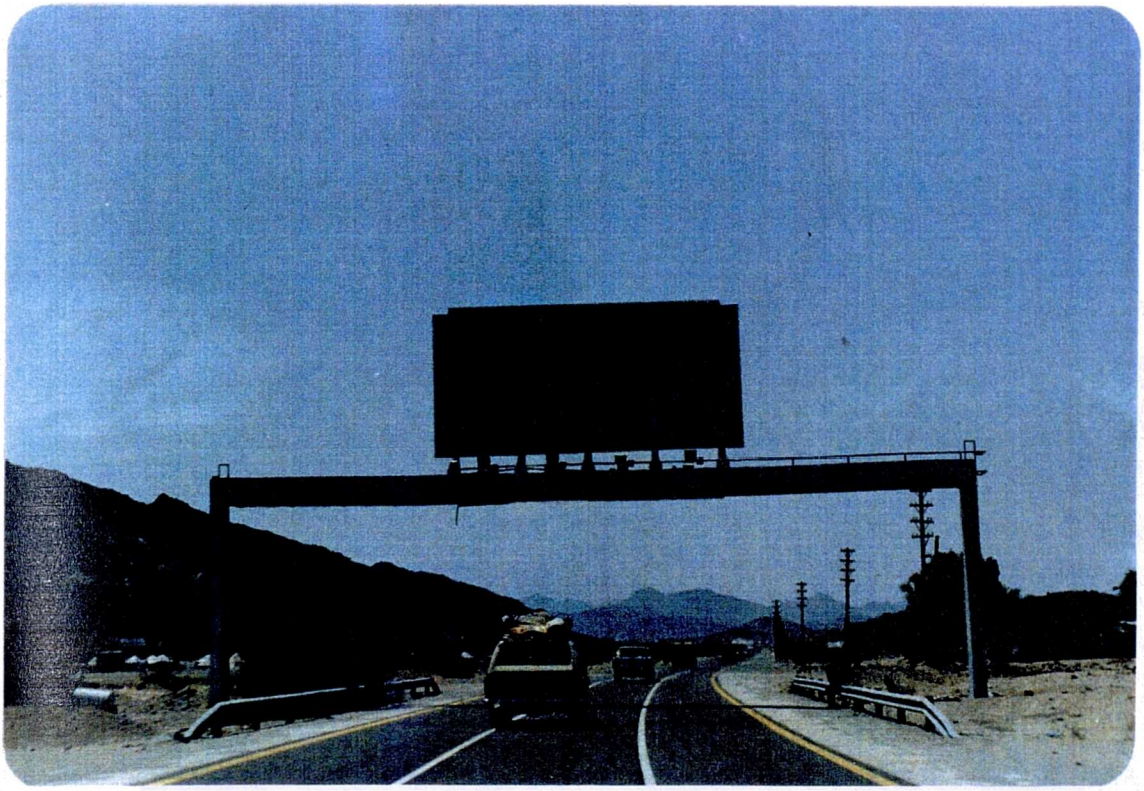
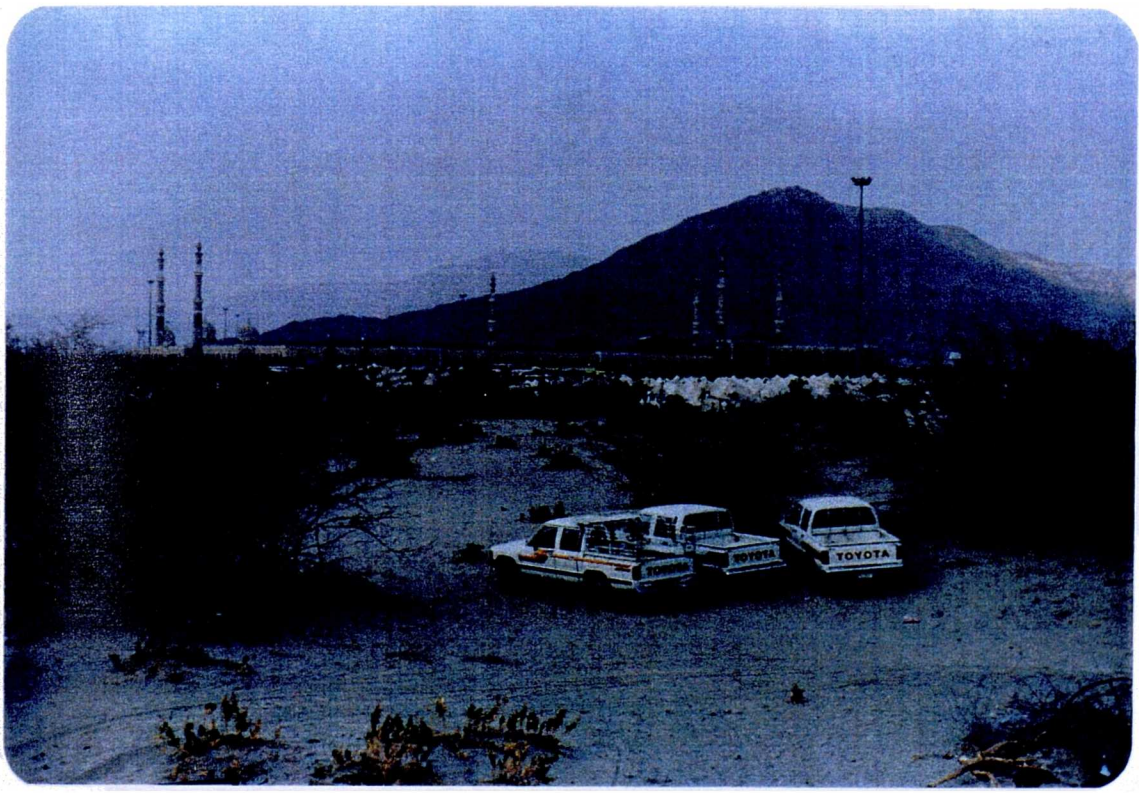


Plate 3.7 Road No. 3 to Arafat during the Al-tasaad period (above). The Nomerah Mosque on the edge of the canonical border of Arafat (below).



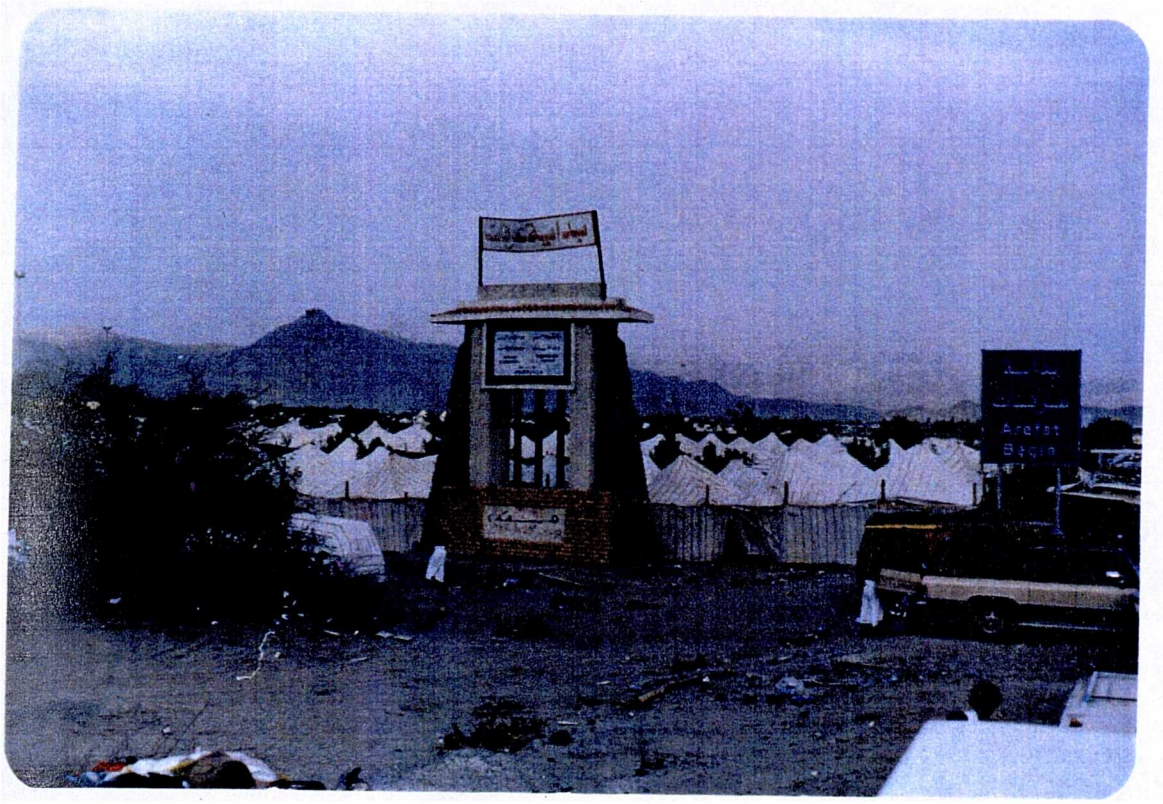
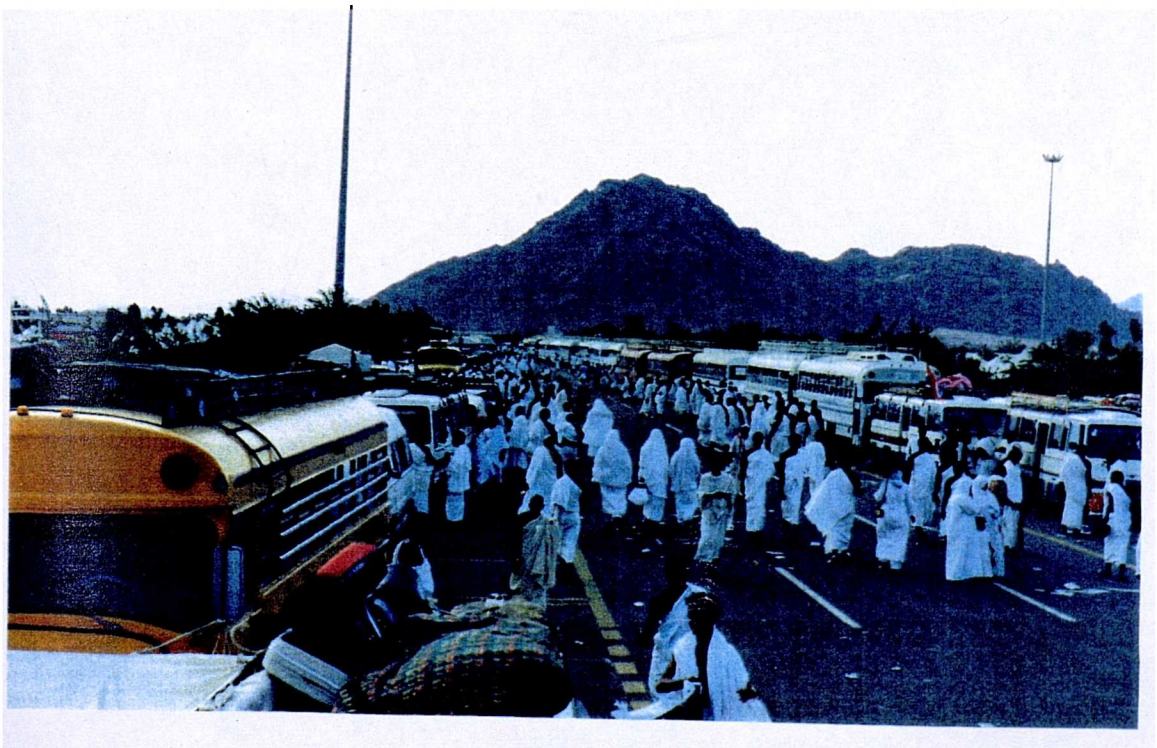


Plate 3.8 A sign indicating the canonical border of Arafat (above). A view of Road 3 during Waqfah (below).



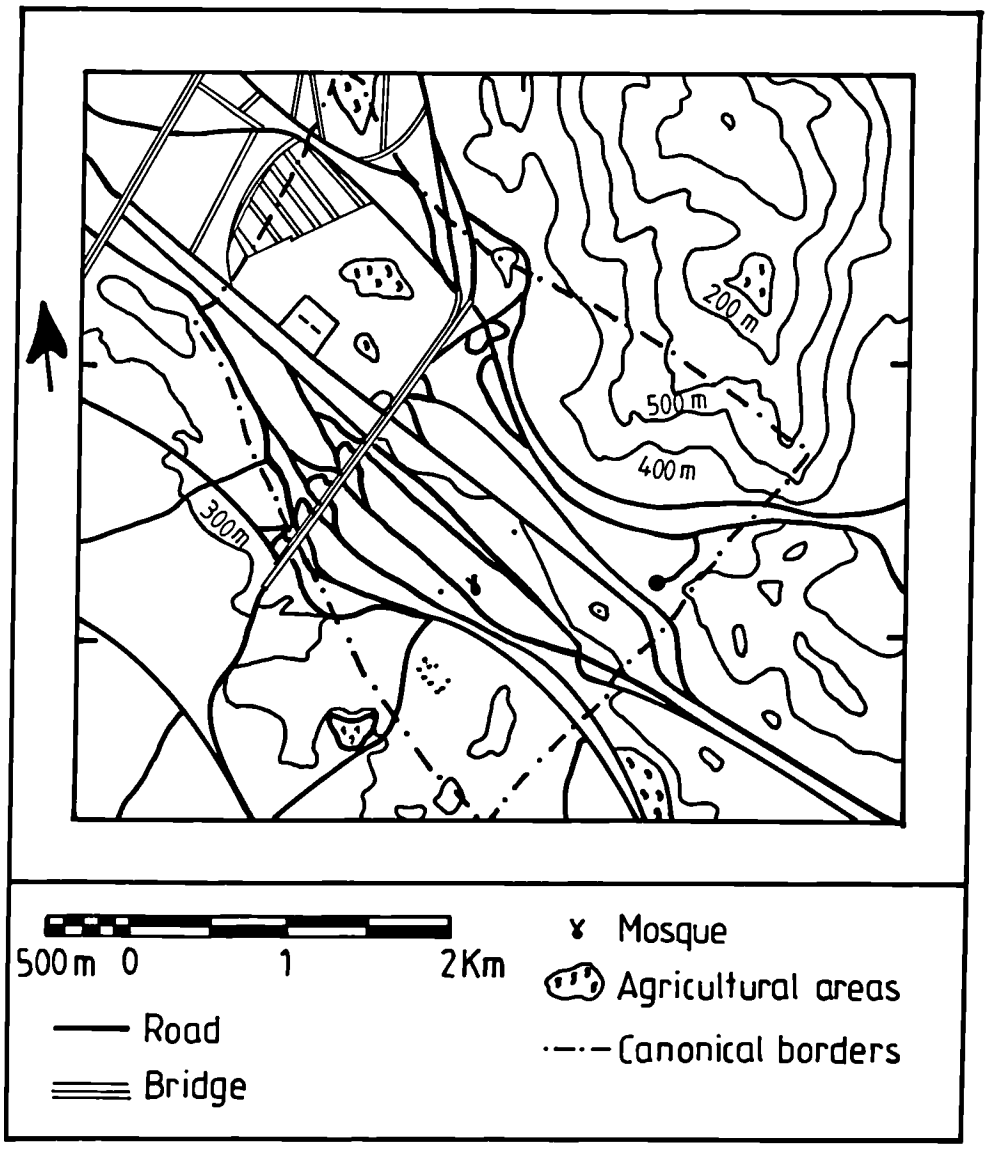
the bridges of the Oranah Valley on the western border of Arafat. Because of this, these bridges cause constrictions during the departure of pilgrims from Arafat, resulting in overcrowding and congestion of the traffic movement. The nine roads continue towards Mozdalifah for distances ranging from 6 km to 10 km. This variation may be attributed to the presence of rock hills which make it impossible for some routes to be direct: these are consequently longer because of the deviations necessary to avoid the hills; this is particularly the case with the routes from the two sides of Arafat.

B. Mozdalifah

As indicated above, the roads from Arafat pass through Mozdalifah (see Figure 3.8) via gaps between the rock hills. Each gap consists of a bottleneck where several routes meet in order to negotiate the obstacle, resulting in points of overcrowding in traffic movement. The width of the first gap, that on the right of the entry to Mozdalifah, is 40 m, and through this two roads pass: Road No. 9 (two-way) and Road No. 8 (one-way) (see Plate 3.9). The next gap, between two mountains, has passing through it Roads Nos. 5, 6 and 7 each with a width of 9 m, as well as two pedestrian routes each 30 m wide. The total width of this neck is 138 m. The two gaps were split during constructionof the roads.

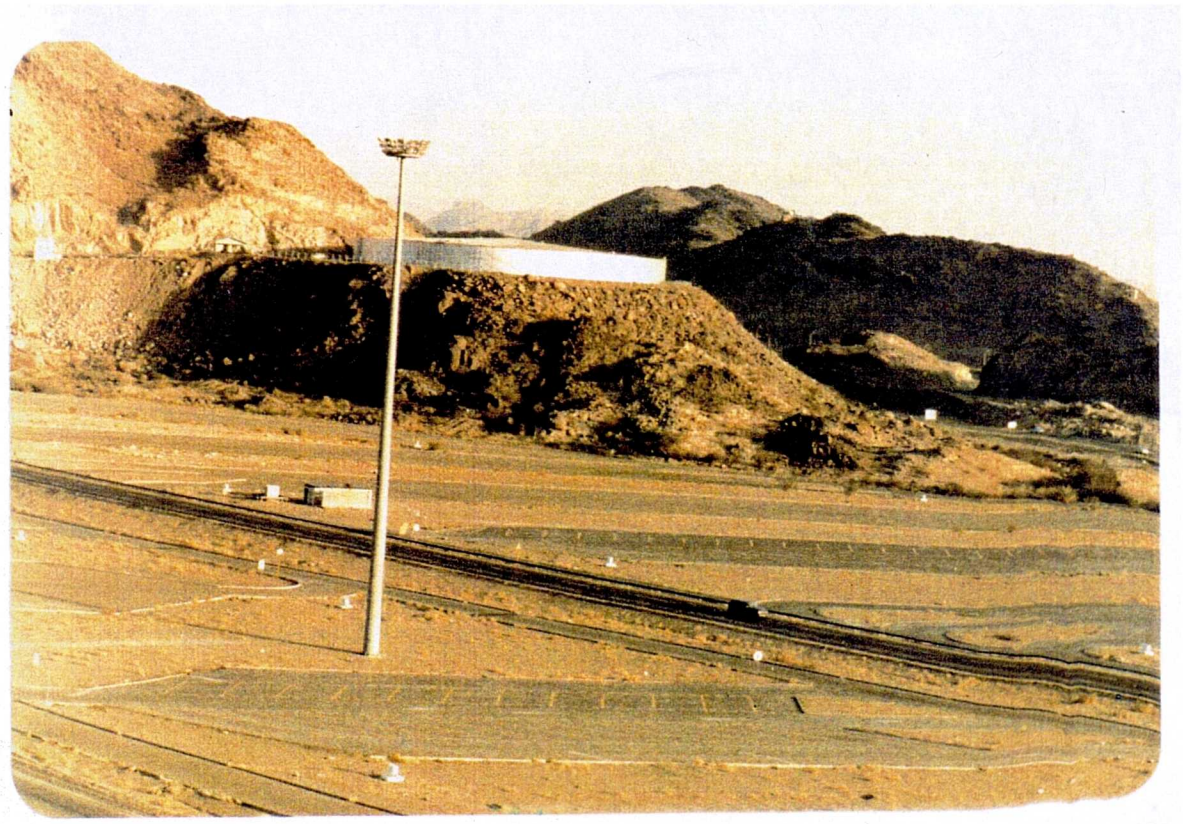
Road Nos. 3 and 4 pass through a natural aperture. The remaining roads (Nos. 1 and 2) reach Mozdalifah from the south via the King Faisal Bridge or their feeders. King Faisal Bridge carries two-way traffic running along the width of Mozdalifah (see Figure 3.10). This bridge, which links the nine routes to each other, is 2.5 km long and has 18.9 m wide carriageways in each direction.

Figure 3.10 Topography of Mozdalefah



Source M.O.M 1984

Plate 3.9 A col on road No. 8 (above). A photograph of one of the nine roads running through Mozdalifah which link the Holy Places taken during the non-Hajj period (below).



A notable characteristic of Mozdalifah is the existence of car parks along the sides of the main roads, which are asphalted and organised. Mozdalifah itself is situated between Muna and Arafat. It is a 'transitory' area, where pilgrims stop during Nafrah (departure from Arafat) for Maghrib and Isha prayers and to collect pebbles for 'rami' (throwing) at Al Jamarat. Some pilgrims stay in Mozdalifah until midnight, while others remain until the fajer prayers before sunrise.

The area of Mozdalifah is 963 ha, 682 ha of which is made up of flat areas, the remainder being hills. (Matthew, 1971). The extensive road network and car-parks significantly diminish the amount of land available for rest and worship. Disorganised parking and inefficient car park layout are the main causes of blockage of the Nafrah movement in Mozdalifah.

C. Muna

In terms of the Hajj movement, Muna is considered the most important of all the places within the Holy Places. It is the area where all pilgrims must spend at least 3 nights. The valley of Muna is approximately 3.5 km long and 1 km wide, with a total area of 780 ha within its canonical boundaries (HRC, 1980). The area of the valley floor is only 470 ha, and the area round the valley up to 50 m above the valley level is estimated to be 130 ha.

The land-use of Muna is very complicated. In spite of the limitations of space, there are three specific places in Muna to which specific activities have been allocated. These places are:

A. Al-Jamarat (places of throwing pebbles)

B. Mosque of Al Haif

C. Places of Sacrifices

In addition to this, public services/facilities, commercial activities, roads and bridges, as well as residential areas, are all contained in this narrow valley, as can be seen in Figure 3.11 and Plate 3.10

In 1982, HRC carried out a land-use survey of Muna to assess the extent of problems relating to the utilisation of the limited space available. This survey showed that the Muna area faces high pressure in terms of constriction and various land-uses. For this reason, pilgrims often experience problems getting to places in their Holy valley to stay for the requisite period. Table 3.6 shows that more than 32 percent of the surface of the Muna valley has been used for roads, public services and the three specific places (Al-Jumart, Mosques, sacrifices). In addition, 14 percent is reserved for official foundations and 5.84 percent is occupied by permanent buildings. The rest of the area, which is only 48.08 percent of the total, is used for tent dwelling by the pilgrims.

Apart from the residences of pilgrims, the various land-uses in Muna, shown in Table 3.5, occupy more than 50 percent of its area. According to this survey, the net residential area is only 226 ha, although some pilgrims find accommodation within the permanent buildings (palaces, guest house, dispensaries, hospitals and other offices) that cover about 27.5 ha. There was also 38 ha of the area under bridges and at Al-Jamarat as well as platforms in the roads provide additional shelter. This means a total residential area of 291.5 ha, giving a residential density of more than 4800 persons per hectare according to the statistics of 1989. In the Hajj of 1983, when there was a record number of pilgrims, the density reached more than 8500 persons per

hectare - less than 1.2 m^2 per person. This congestion and overcrowding makes living difficult, particularly in hot weather.

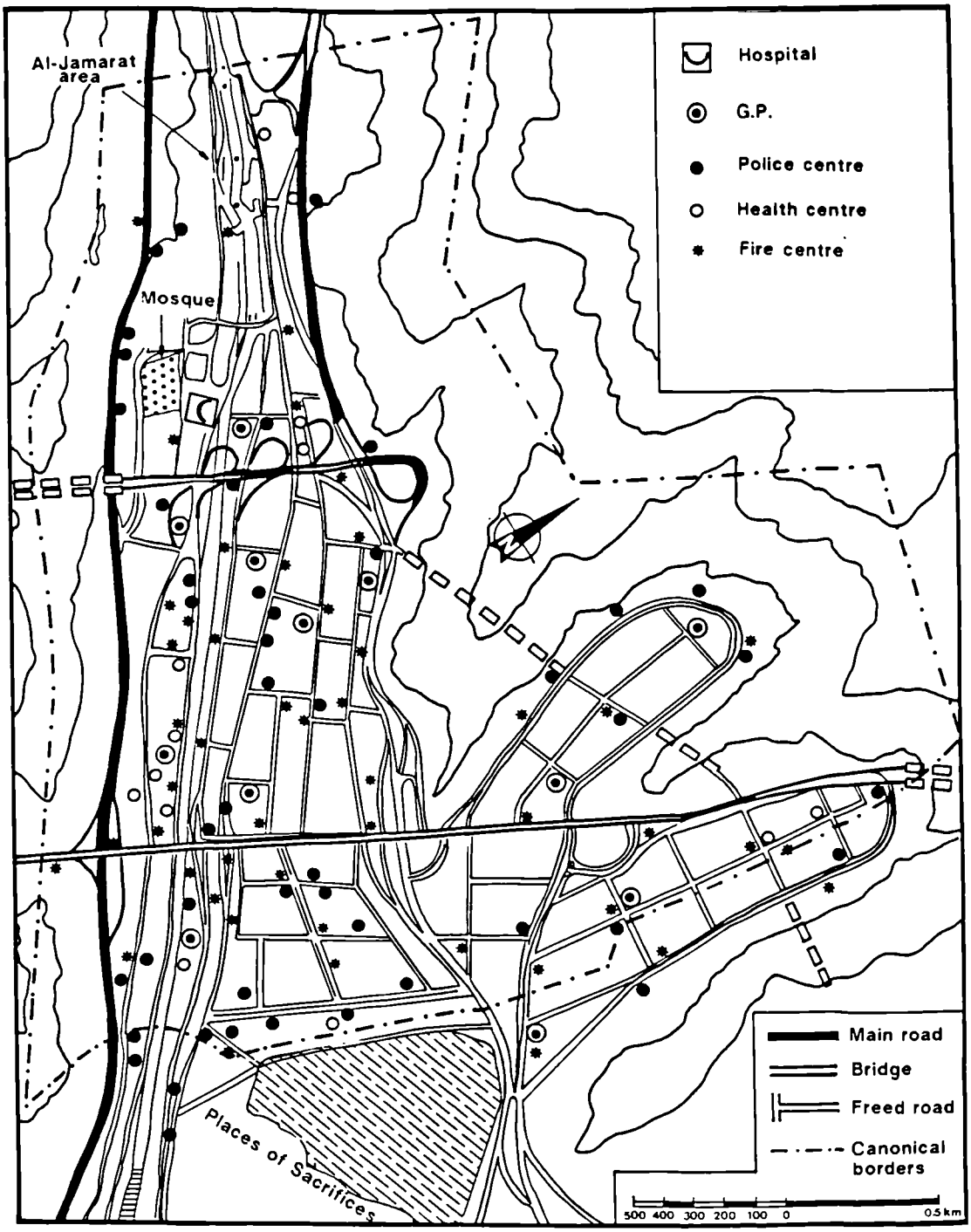
Table 3.6 Land use in Muna in 1982

Land Use	Ha	Percentage
Al Jamarat Mosque of H. Sacrifice places	10.5	2.22
Roads and bridges	128.7	27.40
Public Services	11.2	2.39
Official foundations	66.1	14.07
Permanent buildings	27.5	5.84
The rest areas	226.0	48.08
Total	470	100

Source: *HRC, Report No. 1, 1982.*

However, it is obvious from Table 3.5 that the road networks, whether they are used for vehicles or pedestrians, and bridges occupy 27.40 per cent of the surface of Muna. As can be seen in Figure 3.11, this network is very complex as a result of the narrow area and topographical pattern of Muna. The road network coming from Mozdalifah which is indicated, pierces Muna along the length of the valley. But in Muna several roads unite to form one line owing to the narrowness of the land: here Roads Nos. 1, 2 and 3 join into one road called King Abdulaziz Street on the southern side of Muna. The rest extend inside the valley to take specific names particularly when they pass King Abdulaziz Bridge, Road No. 5 is named King Faisal, Road Nos. 6 and 7 are called Al Jawhrah Street and Souq Al Arab Street. Road No. 8 extends on the northern side of Muna and is called King Fahd Street, while Road No. 9 ends at the

Figure 3.11 Land use of Muna



Source: H.R.C. 1982

start of the valley. These roads merge at the western end of the valley to become three roads only at the bottleneck, as can be seen in Figure 3.11. There are a number of branch roads which extend along the valley side making links between these roads. These branch roads are between 6 m and 8 m wide. In addition to this, two bridges cross the width of the valley from south to north, linking the two sides of Muna as well as the roads extending along the length of the valley. The two bridges are also considered entries and exits to and from Muna. Each one carries two-way vehicular traffic. They are: (DHC, v8, 1989)

- King Kaled Bridge which is located 1.25 km eastwards from Jamrah Al Agabah. It is 740 m long and 16.60 m wide for each carriageway.
- King Abdul-Aziz Bridge is located 1.20 km eastwards from King Kaled Bridge. It extends for 1200 m and is 16.65 m wide for each carriageway.

As regards tunnels in Muna, they are of two kinds; some tunnels are specifically for pedestrian use, and others are for vehicles.

However, there is an enormous network of roads, bridges and tunnels in the narrow valley, yet it is necessary to take the aim and purpose of the Hajj movement inside Muna into account. The majority of pilgrim movements during their sojourn in Muna concentrate on three places. They are Al Haram, Al Jamarat and sacrifice places to and from the accommodation in Muna. It was observed in the Hajj of 1989, that because the pedestrian passages between the network of long roads in Muna are so few, pilgrims were compelled to walk between the tents through ropes and pegs, particularly when going to or returning from the places of sacrifice. This state of affairs led to congestion and overcrowding in the paths which the pilgrims discover as

passages between the main roads. Therefore it is necessary that small passages about 3 m wide should exist between the main roads which extend along the length of the valley with a distance of 200 m between each passage and the next.

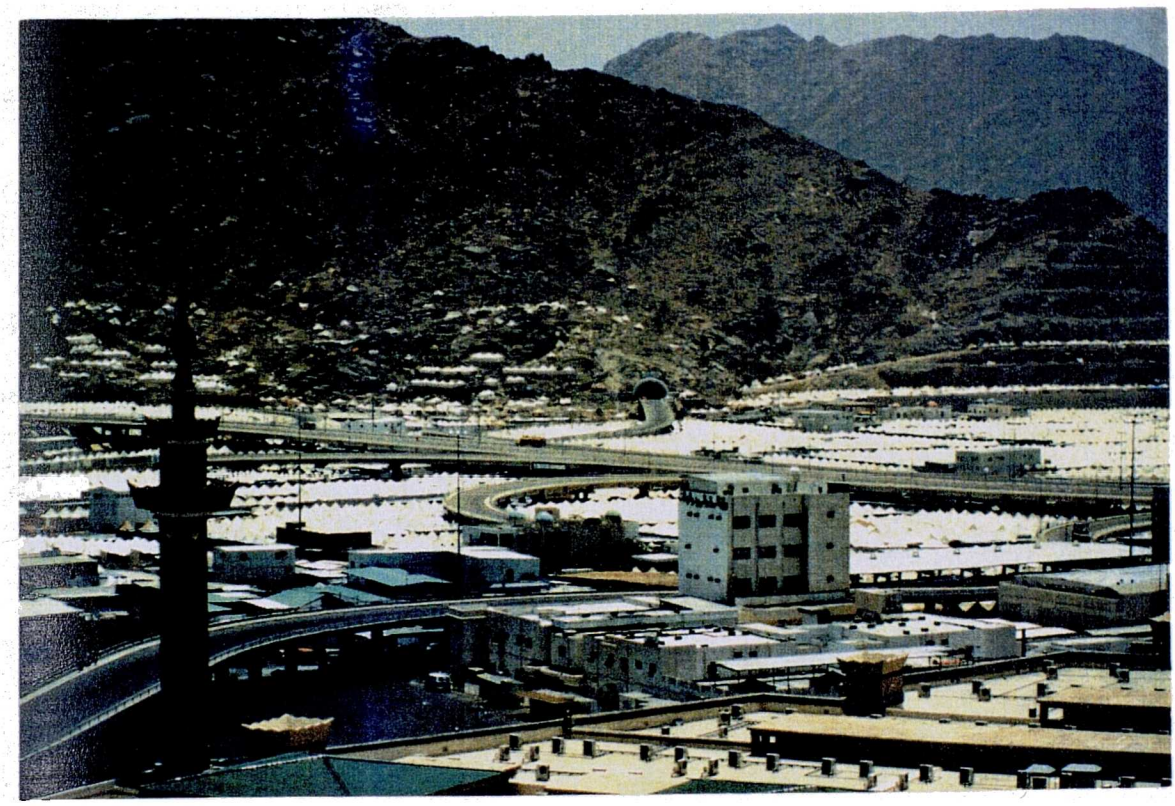


Plate 3.10 King Khalid Bridge in Muna before the Hajj activity starts (above) and an aerial view of the same bridge during the Hajj activity (below, source: Ministry of Information).

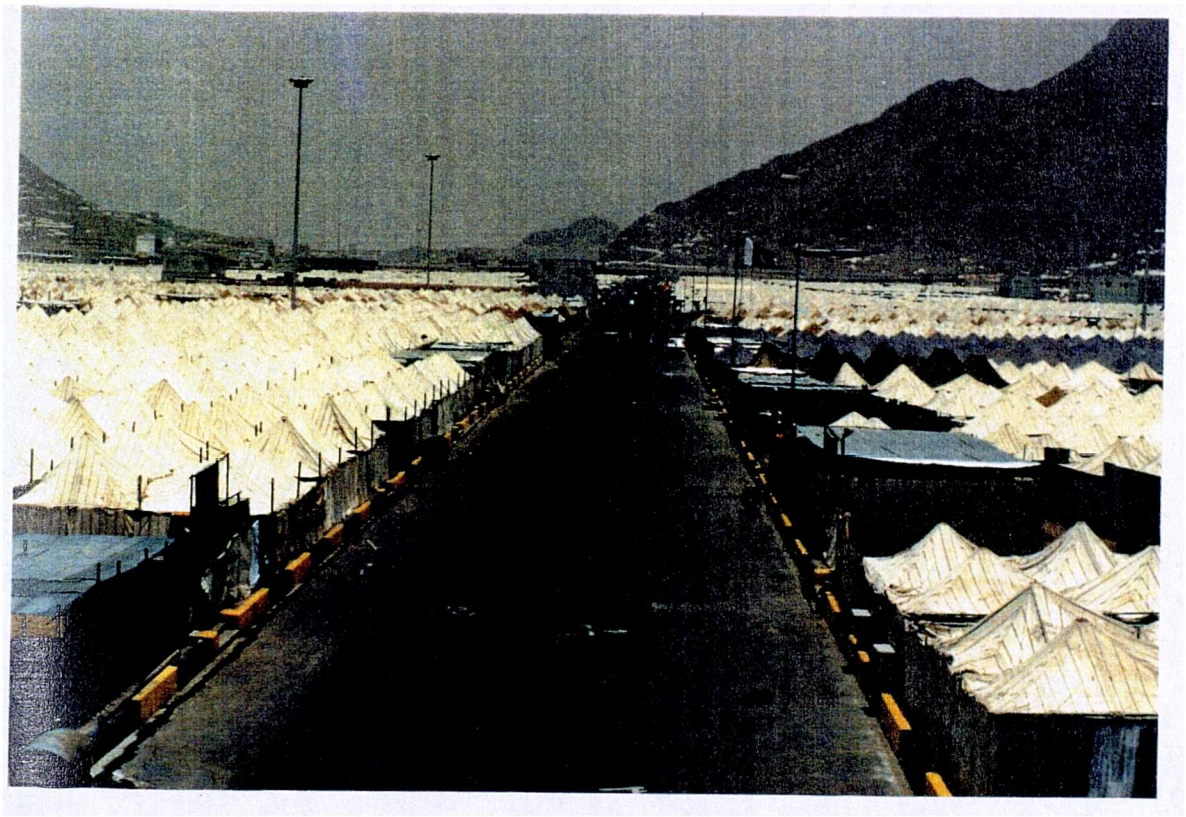
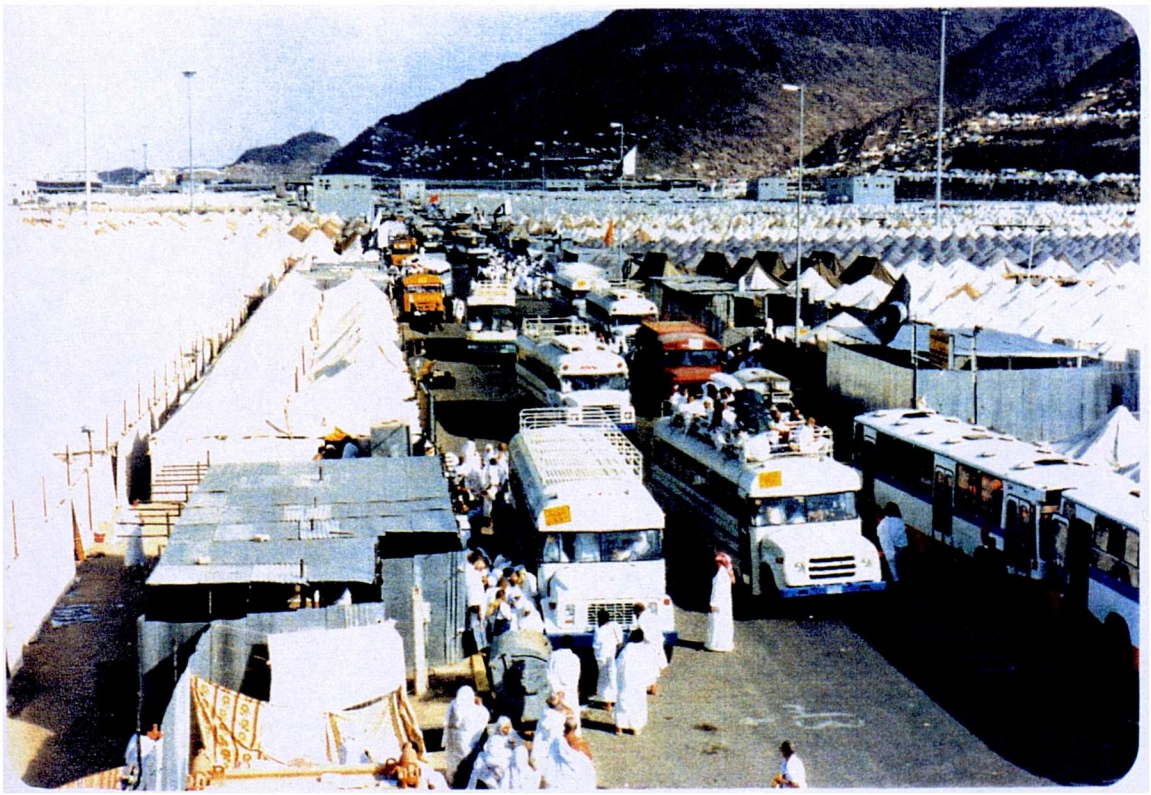


Plate 3.11 Above, one of the Muna roads which run along the valley, before the peak of Hajj movement. Below, the same road at time of Hajj activity.



3.4 The analysis of the road networks

3.4.1 Introduction

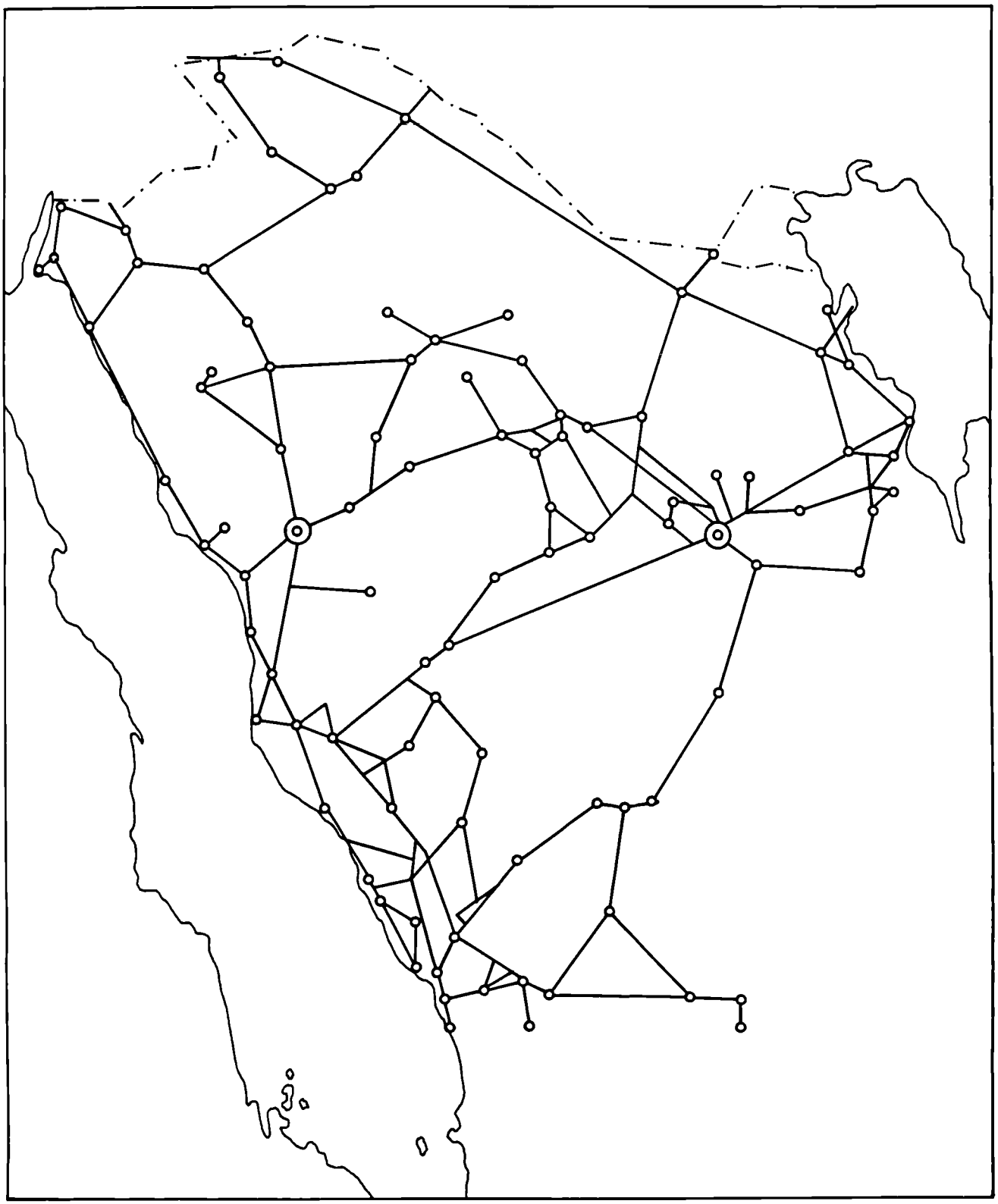
As illustrated by the map in Figure 3.3, the Saudi road network extends to most parts of the kingdom, and links all the main settlements. The purpose of this section is to analyse the present distribution of the main network of asphalted roads i.e. inter-city and principal rural roads, but not feeder roads or intra-city roads. To understand the broad skeleton of the road network, it is useful to reduce the actual network to a topological network, as can be seen in Figure 3.12. A topological map or graph, as it is commonly called, reduces a transport network into its simplest form to help us to see the characteristics of transportation networks more easily.

> "*Topology is a form of geometry which is concerned with the positions and relationships between points and lines and areas, but not with the distance between points, the straightness of lines or the size of areas*" (Briggs, 1972:9).

Elements of graphs or topological networks consist of a series of points, which are usually linked together by lines which often enclose areas of space. Points on a graph are commonly referred to as 'nodes' or 'vertices', linking lines are usually called 'arcs'. Some authors use the terms 'edges' or 'links' and areas enclosed by arcs or links are referred to as 'regions' or 'faces' (Haggett, P. and Chorley, R., 1969)(Robinson, 1978).

During the past several years a set of measures of network characteristics has been developed in order to provide a better basis for the comparison and evaluation of networks. These efforts have drawn heavily on the concepts of graphs, connectivity and accessibility in order to describe the topological structure of networks (Taaffe, 1973). At this stage, the examination will focus on connectivity and accessibility of the road network in Saudi Arabia as a whole and the Hajj region in particular.

Figure 3.12 TOPOLOGICAL MAIN NETWORK IN SAUDI ARABIA



3.4.2 Examination of the road networks of Saudi Arabia

A. Connectivity of the network

Connectivity, in graph theory, is the degree to which the nodes of a network are directly connected to each other (Goodall, 1987) or to put it another way, the connectivity of a network may be defined as the degree of connection between all vertices by arcs (links). There are several methods that can be used to measure the degree of connection between the vertices of a given network by simple indices. One of these is called the Beta Index (B.I.) which is a very simple measure of connectivity by finding the ratio between the number of arcs and the number of vertices

i.e. $B = \frac{\text{arcs}}{\text{vertices}}$ *(Knowles, 1981)*

By applying the B.I. to the road networks of Saudi Arabia we find the value of this measure equal to 1.43, where the number of arcs in the network amount to 145 and the number of vertices total 101. This value is similar to the Beta Index of France, for instance, which was 1.42 in 1980 (Knowles, 1981). This means that the road networks of Saudi Arabia have, at present, as high a degree of connectivity as exists in developed countries, despite Saudi Arabia being a developing country.

Another index, the Alpha Index may be considered the best measure of the connectivity of a network, particularly a fairly complex network.

> "*This is composed of the ratio of the number of fundamental circuits to the maximum possible number of circuits which may exist in a network*"
> (Robinson, 1973:75)

Expressed alternatively in the form of a fraction, the Alpha Index is:

$$\frac{a - n + 1}{2n - 5}$$

where a equals the number of arcs and n the number of nodes. The alpha index gives a range of possible values from 0 to 1. The higher the index, the greater is the degree of connectivity in the network. Simple networks, such as trees, have nil values. A value of 1 is indicative of a completely integrated network in which every possible link exists between the various nodes (Ibid, 1978).

As far as the road network in Saudi Arabia is concerned, the alpha index of such network is 0.23, while in Syria, for example, in 1985 was 0.20.

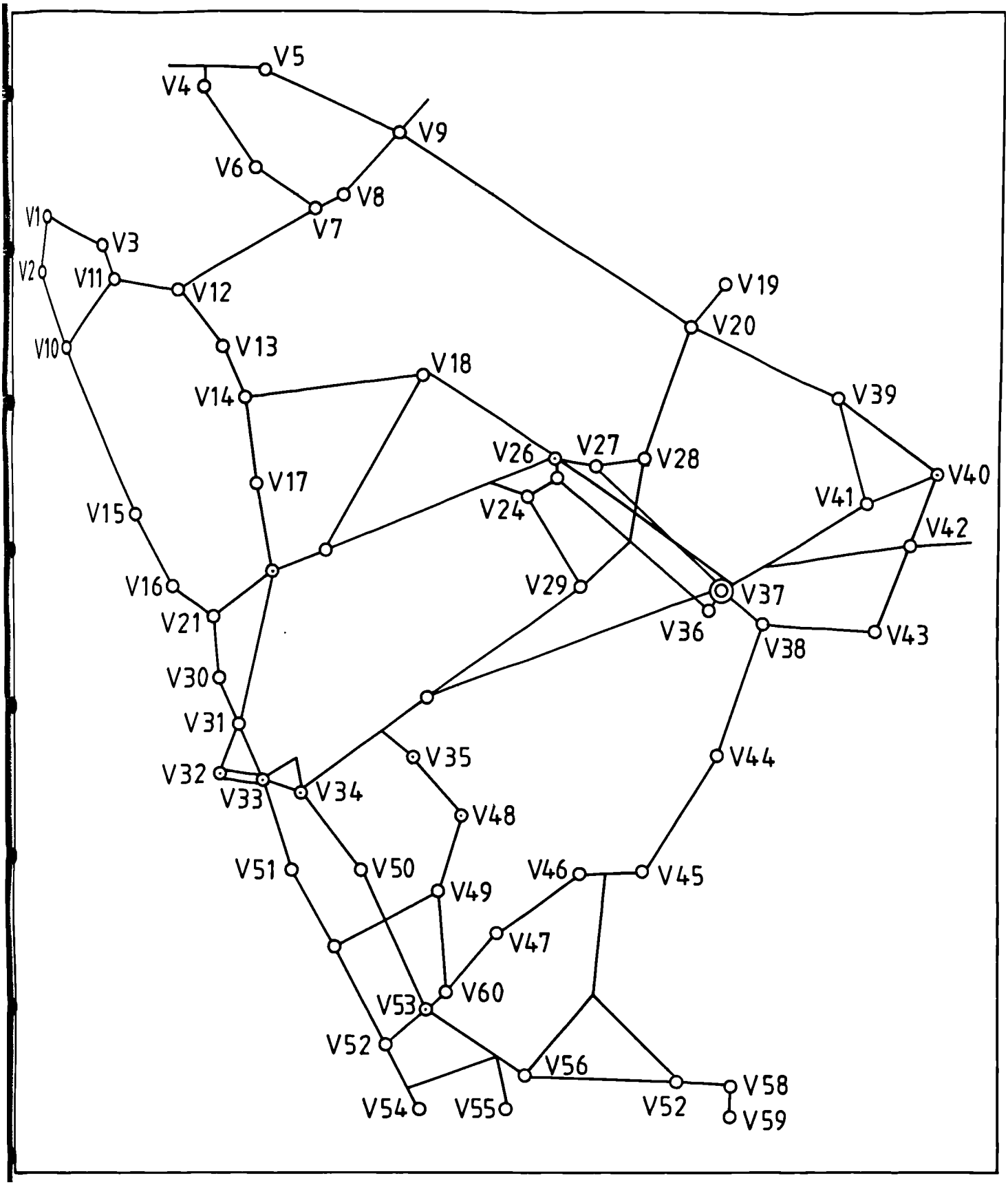
B. Accessibility

One of the most important attributes of a transportation network is associated with accessibility. The geographer is particularly concerned with accessibility as a locational feature. The two measurements outlined above were concerned only with the completeness of links between nodes in a network. But there are some important aspects which must be considered when the transport network is examined, such as the relationship of the linkages and flows between centres or functions of nodes and accessibility and so on (Robinson, 1978). Therefore, it is of benefit to turn our attention to the different ways in which the degree of accessibility within networks can be measured.

Accessibility can be measured topologically in three different ways:

(i) by the number of direct connections to other centres which is obtained directly from the connectivity matrix. A summation of each row of the matrix equals the total number of direct linkages from one given node to another. The higher the value of an individual node the greater is its accessibility to all other nodes.

Figure 3.13 Topological map of the main settlement centres in Saudi Arabia



(ii) by the Shimbel Index, designed from the shortest-path matrix, which indicates the number of arcs needed to connect any node with all the other nodes in the network by the shortest path.

(iii) by the associated number - the number of arcs needed to connect a node to the most distant node from it. So the associated number is the highest number in each row of figures in the matrix (Robinson, 1978).

In fact, in a complex network consisting of a larger number of nodes and with possible alternative routes between some centres, as is the case with the road network in Saudi Arabia (Figure 3.12), it would be difficult to cope with all 101 nodes of the network by using the matrix. It is easier to select settlement centres in order to determine a limited number of direct connections between one city or town and another, depending on the topological map shown in Figure 3.13. Then by ranking cities in terms of the magnitude of their direct road connections, it is easy to establish a hierarchy for main centres (Table 3.7). It is obvious that Riyadh and Makkah are at the top of the rank. But such a method ranks Tabuk (VII), for example, equal to Jeddah (V32) in terms of accessibility which is in fact misleading with evidence that the former is connected to Makkah by a sequence of seven links, whereas the latter is connected to Makkah by only one link, see Figure 3.10. Taaffe commented on this method saying:

> "*The degree of a node has serious limitations as a measure of accessibility. For surface modes of transport, accessibility involves more than the direct connections between nodal pairs.*" (Taaffe, 1973:119)

So it is frequently better to measure the accessibility between nodes that takes into account indirect connections; that is, a linkage between a pair of nodes which passes through one or more intermediate centres. Therefore it is convenient to use the method of the Shimbel Index and associated number mentioned above to determine

the degree of accessibility in terms of selected main settlement centres, as shown in Table 3.7. The shortest-path matrix has been used to produce a value of the accessibility degree for the 22 centres in terms of the main road network in Saudi Arabia. In addition, the associated number was considered in this investigation. The resulting values may be ranked in order and a hierarchy determined as in Table 3.8. These results may be compared with those derived from structural measures of accessibility using a direct connection as mentioned above (see Table 3.7). Riyadh continues to be the most accessible centre on the road network of Saudi Arabia, whereas Makkah, which has the same number of direct connections as Riyadh, retreated to seventh position when using the Shimbel method (as shown in Table 3.8). The reason for this is that Makkah is located on a distant node on the network, whereas Riyadh is situated in the middle. Madinah has retained its place as third in rank as a result of being situated in the interior which is the main reason for all first six centres that have greater accessibility than Makkah. Jeddah is the least accessible major centre in the Hajj region, whereas Taif ranks second in the Hajj region cities after Madinah which occupies first place in terms of accessibility. However, the spatial pattern based on minimum-distance paths shows a stronger spatial organisation focusing on Riyadh. Centres having direct connection to this centre such as Buraidah and Al Kharj, or else are away from the perimeter of the network and also have more than two linkages of direct connection, such as Madinah and Taif, have high levels of accessibility as can be seen in Table 3.8.

Table 3.7 Hierarchy of 21 centres according to direct connections

Rank	City	No.	Number of connections to other cities
1	Riyadh	v37	6
1	Makkah	v33	6
2	Madinah	v22	4
2	Buraidah	v26	4
2	Taif	v34	4
2	Abha	v53	4
2	Al Hufuf	v42	4
2	Arar	v9	4
3	Jeddah	v32	3
3	Hail	v18	3
3	Tabuk	v11	3
3	Yanbu	v21	3
3	Al Kharj	v38	3
3	Aras	v24	3
3	Najran	v56	3
3	Damman	v40	3
3	Jizan	v52	2
4	Turayf	v5	2
4	Al Sulayyil	v45	2

Table 3.8: Ranking of selected settlement centres of K.S.A. according to shortest-path matrix and associated number

Rank	Centres	Shortest path total	Matrix Mean	Associated number
1	Riyadh v37	268	4.67	8
2	Buridah v26	279	4.67	9
3	Madinah v23	285	4.76	9
4	Al-Kharj v38	286	4.77	10
5	Taif v34	286	4.77	10
6	Hail v18	289	4.80	10
7	Makkah v33	293	4.88	10
8	Al Bahah	311	5.18	10
9	Hafer Al Baten v20	313	5.22	10
10	Jeddah v32	326	5.43	10
11	Al Hafowf v42	333	5.55	10
12	Damman v40	340	5.67	11
13	Aras v24	348	5.78	11
14	Yanbu v16	352	5.86	11
15	Al Sulayil v45	357	5.95	11
16	Arar v9	375	6.25	13
17	Tabuk v11	387	6.45	14
18	Abha v53	403	6.71	14
19	Najran v56	424	7.07	14
20	Jazan v54	445	7.41	14
21	Turayf v5	446	7.43	15
22	Haql v1	483	8.05	16

Nevertheless, it may be regarded that the Hajj region, which includes the cities of Madinah, Taif, Makkah and Jeddah, (in order of their degree of accessibility) possesses direct connection with Riyadh expressway via Taif, because there are no cities

between them; only some small settlement centres along the long road. Therefore it is possible to say that the cities of the Hajj region as a whole enjoy quite good levels of accessibility with the rest of the centre of the network.

3.4.3 Concerning the road networks of the Hajj region

Figure 3.14 shows topologically the road network of the Hajj region, both inter-city and rural.

As far as connectivity of the network in the Hajj region is concerned, the degree of connectivity which emerged from B.I. was 1.35. The total number of arcs and nodes were respectively 46 and 34. Use of another method (Alpha Index) displayed connectivity of 0.20. This means that the degree of connectivity of the network of the Hajj region is less than that which has been shown for the Saudi Arabian network.

This may be attributed to the nature of the landscape of the Hajj region, which has a complex relief where road-cutting is expensive in comparison with other regions in the Kingdom (for example, the central area or the eastern area which are both characteristically flat).

Regarding the accessibility of the Hajj region network, it is instructive to use the shortest-path matrix among 34 centres (see Figure 3.14). By using the Shimbel Index, it is possible to rank the values in the hierarchical order displayed in Table 3.9. It is plain from the hierarchy that the cities of the Hajj movement (Madinah, Jeddah and Makkah) rank highest in the Hajj region in terms of accessibility. However, the town of Khulays (V21) occupies the first position (i.e. above Madinah) and the village of Jumum (V26) is third (i.e. above Jeddah and Makkah, which are respectively fourth

and fifth). This may be attributable to the location of the V21 and the V26, which are both situated more or less in the centre of the network as shown in Figure 3.14.

Although Makkah has more than four direct road connections - more than Jeddah and Jumum - it comes only fifth in the hierarchy. Topologically speaking, this may be ascribed to its relatively distant location. Nevertheless, Makkah is on a good express-way to Jeddah and Madinah where the Hajj movement takes place.

Figure 3.14 : Topological map of the road network in the Hajj region.

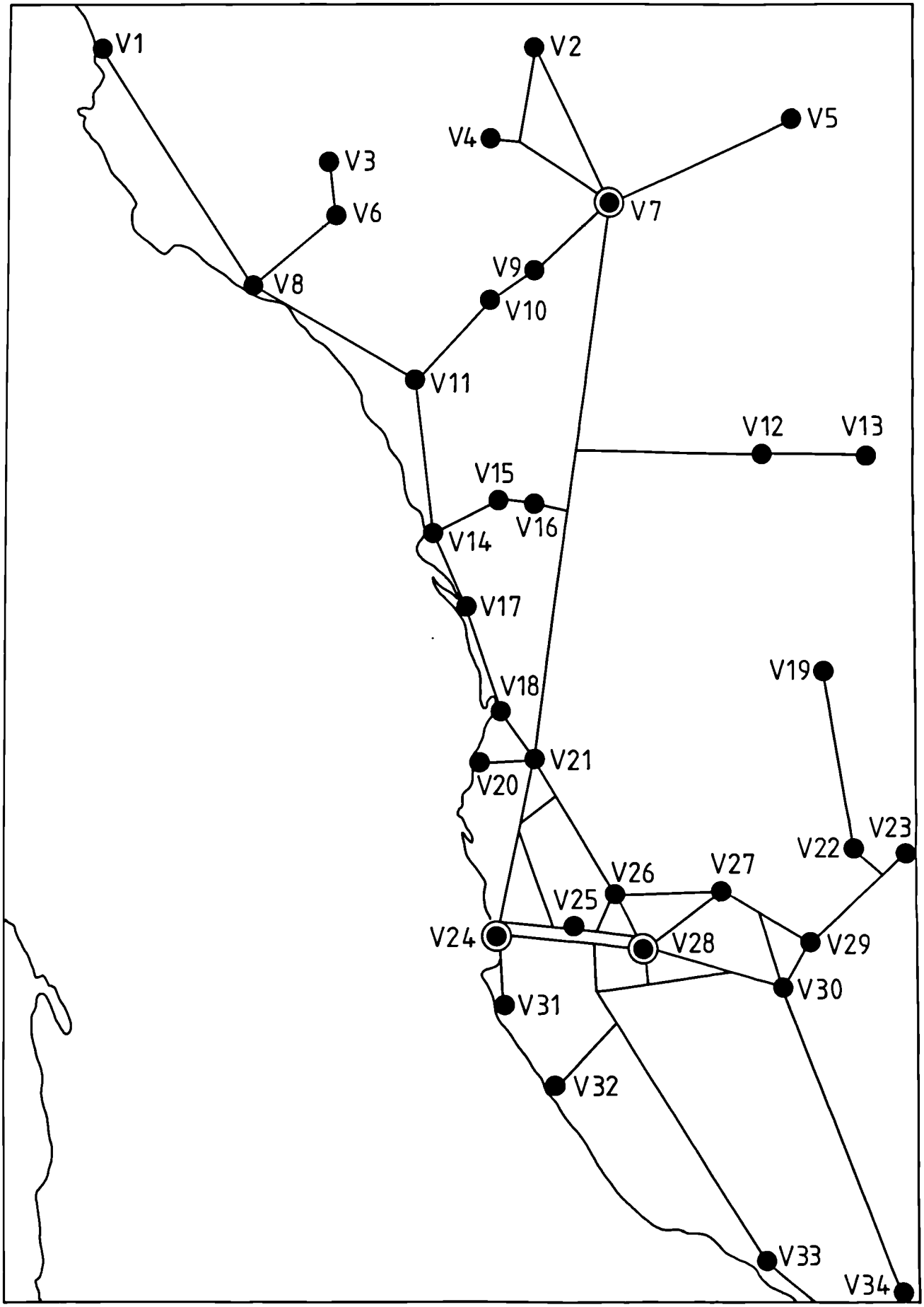


Table 3.9 Hierarchy of the settlement centres in the Hajj region

Rank	City	No. of V	Shortest path totals	Matrix Means
1	Khulays	v21	102	3.0
2	Madinah	v7	114	3.3
3	Jumnan	v26	116	3.4
4	Jeddah	v24	118	3.5
5	Makkah	v28	129	3.8
6	Al-Gorashi	v09	131	3.8
7	Toul	v20	134	3.9
8	Abu-Tayahu	v16	134	3,9
9	Al-Zymah	v27	134	3.9
10	Hada	v25	137	4.0
11	Khaybez	v02	140	4.1
12	Mastorah	v17	144	4.2
13	Al-Hanakyah	v05	145	4.2
14	Qadimah	v18	146	4.3
15	Badezhunnya	v14	147	4.3
16	Al-Bostan	v15	148	4.3
17	Al-Ras Al-Aswad	v31	149	4.4
18	Al-Taif	v30	150	4.4
19	Al-Suwerqyah	v12	153	4.5
20	Hawyah	v29	153	4.5
21	Badez	v11	158	4.6
22	Al-Laith	v33	173	5.1
23	Musayjid	v10	174	5.1
24	Nwat	v04	177	5.2
25	Radwan	v23	183	5.4
26	Al-Mahed	v13	184	5.4
27	Al-Bahah	v34	184	5.4
28	Yanbu	v08	187	5.5
29	Al-Shabah	v32	200	5.9
30	Asharah	v22	211	6.2
31	Al-Bokah	v06	214	6.3
32	Ummlajj	v01	215	6.3
33	Al-Mahani	v19	245	7.2
34	Yanbo Anahd	v03	246	7.2

Summary

The development of the road network in Saudi Arabia seems to be well underway. The basic structure of the kingdom's road network is now generally complete. All of the cities and many rural area are connected by expressway or carriageway providing good access for pilgrims to Makkah and Madinah in the Hajj region.

There are four axes of road considered fundamental to the network of Saudi Arabia which serve the Hajj region (see Figure 3.4). These axes are: the east-west expressway; the east-west carriageway; the north-south axis; and the coastal plain axis. These axes may be considered as international roads because of their connection with the road networks of neighbouring countries. Between them they have six entries used by pilgrims travelling overland. Consequently, the MOC ought to regard these axes as international roads which need to be maintained to a high level. It is important, for pilgrims travelling overland, that all main routes are upgraded to the standard of the east-west expressway, particularly the axis of the east-west carriageway.

In terms of connectivity, the road network of Saudi Arabia is quite good displaying a B.1 rating of 1.40 (which is comparable to the French road network). Riyadh and the centres of settlement that surround it enjoy quite efficient levels of accessibility as a result of their location in the middle of the network.

Regarding the road network of the Hajj region, there are six major roads leading to and from Makkah, of which four are of expressway standard. By these roads, Makkah is directly linked with Jeddah and Madinah, both of which are considered essential stations for pilgrims in the Hajj region. These roads also link Makkah with the national

and international road networks. The regional roads provide adequate capacity all year round, including the Hajj period, for the traffic of goods and people.

"*No abnormal delays are experienced on any of them*" (HRC, 1989).

Furthermore, according to the Shimbel Index, the cities of the Hajj region, Madinah, Jeddah and Makkah rank highly amongst the other centres of settlement which enjoy higher levels of accessibility, taking third, fourth and fifth place respectively (see Table 3.9).

The road networks of Makkah city, in general, serve the Al-Haram (Holy Mosque) and the residential and commercial areas. Many of these are new, serving the new neighbourhoods and are built to high standards. During the non-Hajj period, the older parts of Makkah, such as those around the Haram area, experience traffic congestion at peak periods in the morning and evening. However, during the Hajj, such areas, as in the Holy Places, suffer from heavy traffic jams and conflicts between pedestrians and vehicles, so special attention should be paid to solve the problem.

In the Holy Places, there is an extensive network of roads which link with each other and with the Al-Haram area in the centre of Makkah. Nine roads connect Arafat with Mozdalifah, through which they run to Muna. At the approach to Muna on the Mozdalifah side, the nine roads contract to form seven, and then contract further to become three at the bottleneck beyond Muna where steep mountains restrict road building.

However, despite the enormous network of roads in and between the Holy Places, the traffic situation and the movement of pedestrians continues to worsen year by year. This means that the extension of a road or tunnel building programme will not

alleviate the problems of the Hajj movement while the volume of vehicles continues to increase and occupies all available space. Therefore it is necessary to turn our attention to the second aspect of the transport problem, vehicular volume, which is discussed in the next chapter.

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Chapter Four

The Existing Vehicular Facilities

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Summary

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4.1 Introduction

Before studying the patterns of Hajj movement and the transport of pilgrims, it is appropriate to examine the types of vehicle available in the area, and their respective numbers.

There is a strong relationship between mobility and the vehicles available. Consequently, problems of transport and movement increase and become more complex with increases in the size of the vehicle fleet (Owen, 1960).

Although the car has obvious advantages, the disadvantages are more complex. Colin Buchanan gave a warning in 1963 when he wrote in *Traffic in Towns*, that;

> *"the motor vehicle has been responsible for much that adversely affects our physical surrounding. There is its direct competition for space with environmental requirements, at its greatest where space is limited ... the record is one of steady encroachment, often in small instalments, but cumulative in effect. There are the visual consequences of this intrusion; the crowding out of every available square yard of space with vehicles, whether moving or stationary, so that buildings seem to rise from a plinth of cars; the destruction of architectural scenes; visual effects from the clutter of signs, signals, bollards, railings, etc. associated with the use of motor vehicles"* (Buchanan, 1963, p.23).

There is absolutely no doubt about these phenomena. The car has had a tremendous impact on our lives and particularly on the lives of those living in urban areas. However, the emphasis here is on a description of the volume, types and existing condition of vehicles, whether in the private or public sector, in the central Hajj region in general, and Makkah city in particular. It is convenient to start by indicating briefly the volume of vehicles in Saudi Arabia.

Although the term 'vehicle' is usually used in relation to land transport modes, some authors, such as Robinson and Bamford (1978), use the term to imply vessels and

aircraft in the case of sea and air transport respectively. In this study, 'vehicle' will be used to denote car, whether private or public transport, small or large.

The information presented here has been derived from various sources, such as the statistical year book published by CDS and traffic statistics produced by GTD. Studies such as the thesis of Z. Mekki and reports by MOC and DHC were also used.

4.2 Growth of Vehicle Numbers in Saudi Arabia

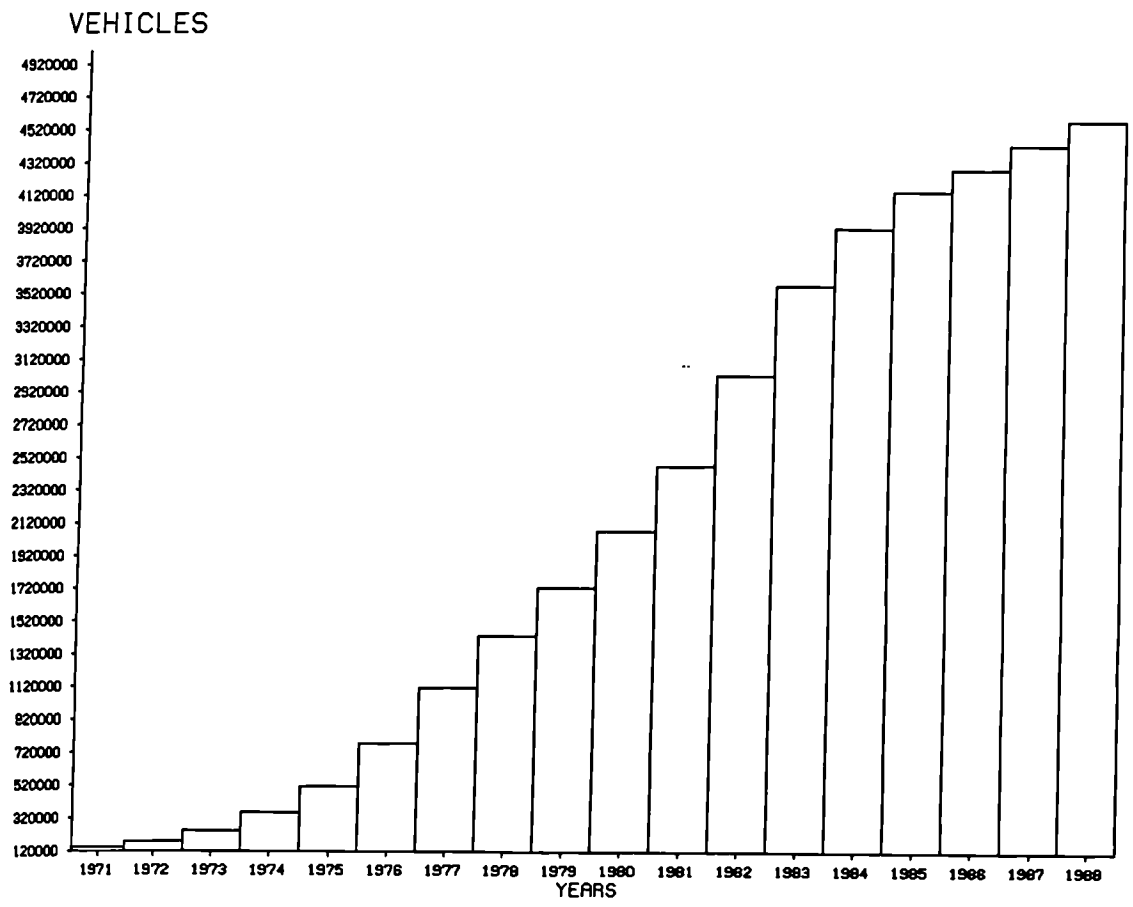
By way of a comparison, it is useful to note that in 1971 there were only some 145,000 vehicles registered. During the next decade there was a rapid increase in the number of cars. In 1980 there were over 2 million vehicles. In 1988 this number had risen to over 4.5 million. As illustrated in Table 4.1 and Figure 4.1, the 1980s have seen a much more rapid rate of increase.

Table 4.1: Development of vehicle numbers registered in the Kingdom, 1971 - 1988

Year	No. of vehicles	Change
1971	144,768	100
1972	180,185	124
1973	242,974	178
1974	355,022	245
1975	514,361	355
1976	774,443	535
1977	1,112,973	769
1978	1,432,909	990
1979	1,723,116	1,190
1980	2,069,479	1,430
1981	2,467,903	1,705
1982	3,018,811	2,085
1983	3,569,009	2,465
1984	3,919,871	2,708
1985	4,144,245	2,863
1986	4,280,986	2,957
1987	4,427,991	3,059
1988	4,574,244	3,160

Source: *GDT (General Department of Traffic), 1988*

FIG. 4.1 : DEVELOPMENT OF VEHICLE NUMBERS REGISTERED IN S.A, 1971-88



SOURCE:GDT , 1988

According to the number of vehicles registered by GDT, there was a twenty one-fold increase in the total number of vehicles on Saudi roads from 1971 to 1986. On the other hand, the total road length has increased only nine and a half-fold during the same period (see Chapter 3). In fact Table 4.1 is somewhat misleading, since the number of registered vehicles shown may not represent the exact number in use on the roads, since many vehicles remain in the registration files despite their having been scrapped. This is due to the fact that there is no annual tax paid by owners in Saudi Arabia. In 1983 the GDT required that all road vehicles be registered and receive new licence plates. Subsequently, it was found that the total number of Saudi vehicles reached a figure of 2,163,253 (GDT, 1983). The new vehicles registered later than 1983 may be added to this figure to get the total number of vehicles for each year post-1983, as shown below in Table 4.2.

Table 4.2 The number of vehicles using Saudi roads from 1983 to 1988

Year	No. of vehicles	Index No.	Road length km*	Index No.
1983	2,163,253	100	41,397	100
1984	2,514,115	116	72,306	175
1985	2,738,489	127	79,363	192
1986	2,875,230	133	85,607	207
1987	3,022,235	140	90,391	218
1988	3,168,488	146	96,140	232
* Including agricultural roads				

Source: *G.D.T. 1988, ECDS, 1988.*

The table also shows the development of roads since 1983. It is plain from the above that the development of roads is in advance of the growth in number of vehicles. Total road length has increased to more than double that of 1983, while the number of vehicles has risen only 46 percent of 1983. This means that there were enormous

developments in road construction during the 1980s, while vehicle numbers, which had had a tremendous increase throughout the 1970s, has faced restrictions in latter years as will be discussed later. Consequently in 1988 the density of vehicles per road-km was 33. In the United Kingdom, for instance, the density was 59 vehicles per public road-km in 1987, when the number of vehicles licensed for use on British roads was 22.2 million with road network totalling some 376,100 km (COI, 1989:319).

However, the volume of vehicles in Saudi Arabia is somewhat high in comparison with the size of the population. The average is 4 persons per vehicle on the basis that the population is 12 million (1988)(United Nations, 1989). In 1984, in Egypt, for example, the equivalent average was almost 45 persons per vehicle when, at that time, the population was 45.7 million. It is generally recognised that this tremendous increase in the number of vehicles in Saudi Arabia (Tables 4.1 and 2) originates from five main sources.

- The economic prosperity which Saudi Arabia has seen during the 1970s and early 1980s. This can be shown by the increase of the estimated revenues in the government budget, from 13,200 million SR in 1972/1973 to 340,000 million SR in 1981/1982 (C.D.S. 1986:123). This economic growth resulted in increases in the GNP per capita, from 9 thousand dollars in 1972 to 16 thousand dollars in 1982, which created high purchasing power and consumption of food and goods (World Bank, 1975, 84)

- population growth and the changing population distribution in Saudi Arabia. The size of the population increased from 7.5 million in 1974 (CDS 1974) to about 12 million in 1984 - an annual average population growth in Saudi Arabia which is around 3.5 percent. On the other hand, there was a great wave of

migration from the countryside into the towns, which is a common phenomenon for any country during a period of development.

A comparison of the official population statistics for the years 1962 and 1974 in the largest towns may illustrate the general extent of the changing population distribution (see Table 4.3). In 1962, only around 9 percent of the population lived in the eight urban areas shown below. This percentage jumped to 32 percent in 1974.

Table 4.3 Population changes in selected Saudi Arabian Cities, 1962-1974

City	Population		Average of annual increase
	1962	1974	%
Makkah	158,908	366,801	10.9
Jeddah	147,589	561,104	23.2
Madinah	71,998	198,186	14.6
Riyadh	169,185	666,840	24.5
Taif	53,954	204,857	23.0
Damman	35,000	127,844	22.1
Boraidah	35,000	69,940	8.3
Abha	17,500	30,150	6.0

Source: *C.D.S. 1965, 1975.*

The importance of the above situation is that the cities of Saudi Arabia began to experience an urban transport problem. As urban populations continued to increase, the need for travel also increased as the distance between home and place of work became greater, and urban transport developed to satisfy this need (Robinson, 1978).

- A third cause of the increase of vehicle numbers has been that the customs duty used to be quite low. It did not exceed 4 percent of automobile prices during the 1970s and early 1980s. This low level of customs duty proved an

added incentive as people could buy cars relatively easily. In addition to this, by 1986 the price of Japanese cars was lower than American and European cars. In 1981, for example, the price of a 4-5 person car ranged between R.S 15000-35,000 (around £3,500-7,500) in agencies of Japanese cars, while cars of the same size were almost double the price in markets of American and European cars. This lower price of Japanese cars, which have been increasingly imported into Saudi Arabia, has contributed towards extending car ownership among the people in Saudi Arabia (Mekki, 1988). However, by 1987, the government decided to increase the import duty to 15 percent. Thus in 1988 the ratio of annual increase of vehicle numbers has been affected by this decision (see Table 4.2 and Figure 4.1) as well as by the rise of car prices charged by exporters themselves - now more than double those charged before 1987.

- A fourth factor influencing growth in the number of vehicles is the low price of petrol in Saudi Arabia, which encourages people to use cars. In 1989 the cost of one litre of Saudi petrol was SR 0.53 (£0.10 at the rate of £1.00 = SR 5.70). This stimulates car usage for all types of trips, even for short distances.

- In addition to the above, Saudi Arabia has no alternative to cars for intra-city transport. This has led to an increase in the construction of roads, in order to meet the requirements for the increasing number of motor vehicles (see Chapter 3).

As far as types of vehicles in Saudi Arabia are concerned, Table 4.4 shows that in 1988 the number of private cars accounted for more than half the total number of vehicles. This volume was due to the ease with which cars could be bought as a result of the increased levels of income as mentioned above. Social factors may have contributed to the increased volume of private cars, which provide better access than public transport.

Table 4.4 Types of vehicles in Saudi Arabia, 1988

Type of vehicle	No. of vehicles	%
Private car	1,720,099	54.3
Trucks	1,381,324	43.6
Bus	29,416	0.9
Taxi cab	24,677	0.8
Motor cycle	12,972	0.4
Total	3,168,488	100.0

Source: *GDT, 1988.*

In addition to this, there are no alternative systems of public transport apart from the bus and taxi which provide only limited access. The existing road standards and the highway planning proposals also provided a high degree of freedom for using private cars. The considerable changes of land-use of urban areas in Saudi Arabia throughout the 1970s and 1980s extended the gap between homes and places of work, making possession of a car a necessity of life. Finally, the significant advantages which private cars provide for the patterns of movement of people have led to a preference for travelling by car rather than by bus. Private transport provides much more uniform service to an entire area. It can use any street or road. It can reach every house. It can

pick up and set down people and goods anywhere. All parts of a town are accessible to it (Leibbrand, K., 1970).

After private cars, the number of trucks ranks second, with more than 43 percent of the total (see Table 4.4). In fact, the term 'truck' in the registration of the GDT includes pick-ups, light trucks, truck-semi-trailers and trailers. Truck traffic on Saudi Arabia's inter-city highways is, in general, very high, accounting for more than 50 percent of the total traffic on some links (e.g. between Riyadh and Dammam), (MOP, 1982:2-20). From Figure 4.2 which illustrates volumes of vehicle traffic on main roads of Saudi Arabia in 1980, the participation of trucks in terms of traffic volume may be seen. It is obvious that the volume of truck traffic in the industrial area (Eastern region) is much higher than in the western area (Hajj region).

Buses in Saudi Arabia do not exceed 1 percent of total vehicles, according to the vehicle registrations of 1988 when the number of buses was 29,416. The volume of taxis was close to that of buses, as may be seen in Table 4.4. In 1980 both buses and taxis contributed only 5 percent to the total traffic volume on inter-city roads (MOP, 1982).

Besides the geographical distribution of vehicle volume among the administrative regions of Saudi Arabia, it is plain from Table 4.5 that the greatest number of vehicles is concentrated in the Makkah region, where it had 34.5 percent of the total vehicles registered in 1983. The reason for this is that there are three major cities in the Makkah region: Makkah City, Jeddah and Taif. Unlike the Makkah region, the Madinah region ranked fourth after Riyadh, Eastern Region, Qassim and Aseer. Although there are no data available in the statistical bulletins of GDT about vehicle

numbers in cities in Saudi Arabia, it is possible to infer from this Table (4.5) that the Hajj region, which involves Makkah, Jeddah and Madinah city, contains a greater fleet of vehicles in comparison with the rest of the regions of the Kingdom. The next section will concentrate on Makkah itself, to give a clear picture of this volume of vehicles.

Table 4.5 Number of vehicles registered according to the districts of the Kingdom in 1983

	Region	No.of vehicles	%
1	Makkah	746,545	34.5
2	Riyadh	567,461	26.2
3	Eastern Region	382,979	17.7
4	Qassim	103,122	4.8
5	Aseer	84,635	3.9
6	Madinah	69,121	3.2
7	Tabouk	40,760	1.9
8	Hail	37,773	1.7
9	Najran	32,324	1.5
10	Jizan	29,870	1.4
11	Northern Prov.	23,317	1.0
12	Al-Jouf	18,155	0.8
13	Al-Baha	14,991	0.7
14	Qurayat	12,200	0.6
Total	2,163,253	100.0	

Source: *G.D.T., 1988*

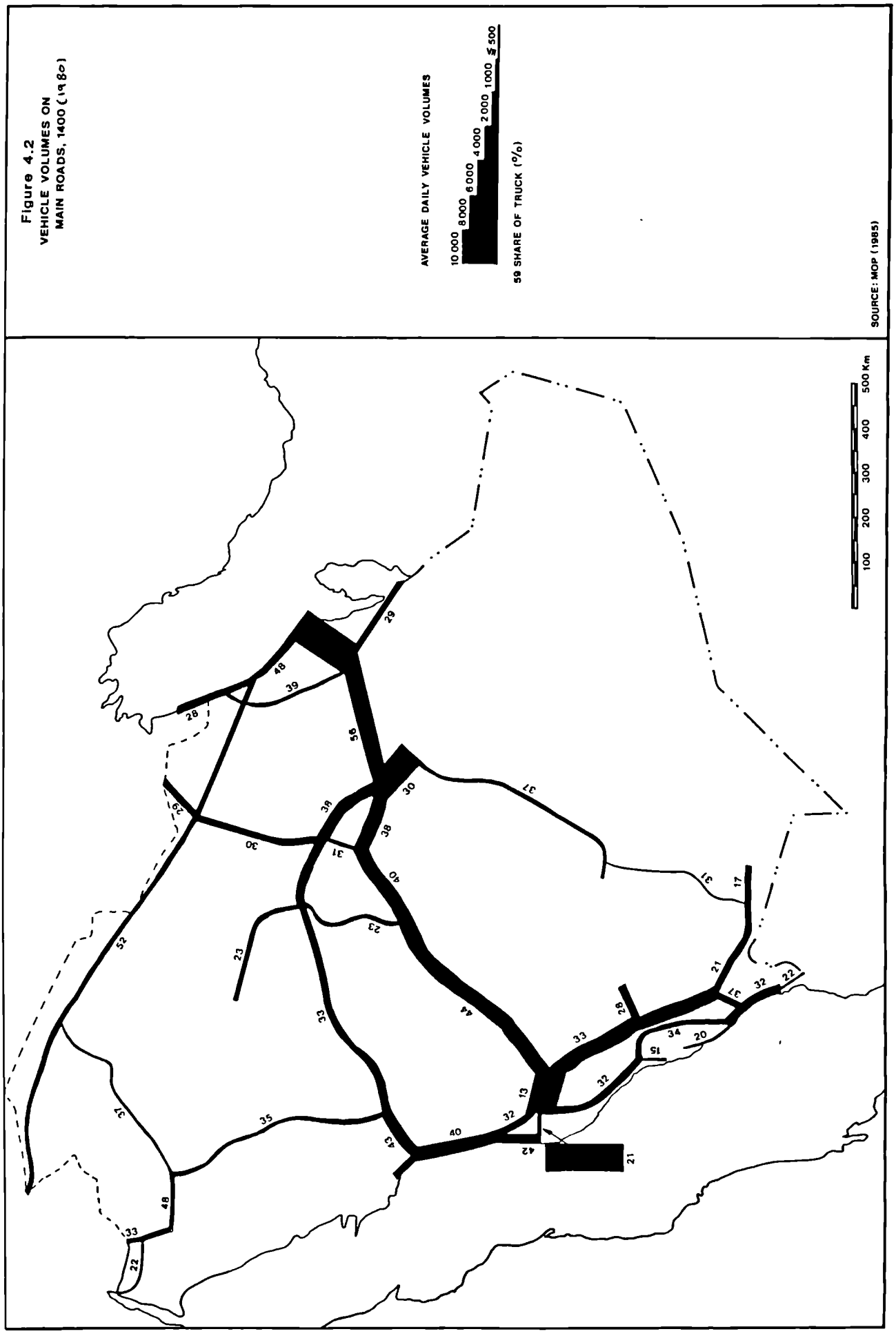


Figure 4.2
VEHICLE VOLUMES ON
MAIN ROADS, 1400 (1980)
AVERAGE DAILY VEHICLE VOLUMES
10 000 8 000 6 000 4 000 2 000 1 000 ≤ 500
59 SHARE OF TRUCK (%)
SOURCE: MOP (1985)
100 200 300 400 500 Km

4.3 The fleet of vehicles in the Hajj region

4.3.1 Introduction

It has been shown that in terms of vehicle numbers during the non-Hajj period in 1983, the administrative region of the Holy Makkah is ranked highest in the Kingdom. This phenomenon is a consequence of the socio-economic situation of the region. It is here, in the region which already has the highest density of vehicles in the Kingdom, that the Hajj movement takes place.

During the Hajj period, about 90 percent of internal pilgrims come to Makkah by means of their private cars, as do overland pilgrims from abroad. This enormous number of vehicles creates a complex situation of transport movement and flow. Thus, in order to understand the movement situation through the Hajj activity, it is helpful in this section to look at the existing condition of vehicles in the Hajj region.

Unfortunately, the annual statistical publications produced by GDT do not include specific details about number of vehicles and car ownership within each city, but only in terms of regions. According to the data of GDT (1989) the number of vehicles in Makkah and Madinah region totals 1,199,251. This number, which includes the cities of Jeddah and Taif, represents 60 percent of all vehicles in the Kingdom.

However, data concerning car ownership have been obtained from DHC, which has made a socio-economic survey in Makkah. This survey was conducted in 1983 at the level of households in Makkah and the village clusters. It consisted of interviews with the heads of about 5,400 households selected by a stratified random sampling technique, and represents a sample size of about 5 percent of all the households in the

region. This survey, as well as the official statistics, has been used in this work to look at the types of vehicles and car ownership in Makkah.

4.3.1 Types of vehicles in Makkah

In 1983 GDT published a report on vehicle numbers and types for each region in the Kingdom. These numbers may be added to the number of vehicles which GDT issued from their plants each year to obtain the approximate number of vehicles in 1988 as has been made for Saudi Arabia (see Table 4.6). It is plain from the table that in 1988 during the non-Hajj period, more than one million vehicles existed in the Makkah region, 59 percent of which were private cars. In terms of GDT classification, private cars included larger cars, such as stationwagons (9 passengers) but the majority are small cars (4-5 people). The second largest category was trucks which made up 39 percent of the vehicles. The term 'truck' embraces several different kinds of vehicle, including pickups and trailers. Buses and taxis make up less than 2 percent of the vehicle fleet. Thus, it may be said that public transport vehicles in the HR form only a low proportion of the vehicle fleet.

However, the GDT system of vehicle registration procedures may need to be improved and might include a more disaggregated classification of vehicles, i.e. pickups, light trucks, trailers, small buses, large buses etc. In this regard, registration procedures should be structured so as to reflect the distribution of vehicles amongst the different cities or towns. The present vehicle distribution is biased in favour of the regions or Emirates.

Table 4.6 Plates issued in Makkah region by type, 1983-1988

Year	Private car	Truck	Taxi	Bus	Motorcycle	Total
1983	434,340	295,993	6,545	6,585	3,082	746,545
1984	68,449	48,22	568	186	78	117,507
1985	53,441	33,172	169	846	12	87,640
1986	13,900	7,147	149	102	-	21,298
1987	22,291	11,133	1,328	1,530	3	36,282
1988	29,399	12,965	568	1,058	13	44,003
Total	621,820	408,636	9,327	10,307	3,188	1,053,278
%	59	39	0.8	1.0	0.2	100

Source: *GDT, 1983-1988.*

Nevertheless, the statistics of GDT show that between 1983 and 1988 the growth of private cars was 40 percent while public transport modes (buses and taxis) increased by 30 percent.

In 1983, Makkah residents owned and operated 92, 649 vehicles of various categories, as shown in Table 4.7. In addition, 14,876 other vehicles were owned by commercial establishments (DHC, 1985, v9:32). These figures, which include commercial and public transport vehicles, represent around 14 percent of the total number of vehicles in the Makkah region in 1983 (Tables 4.6 and 4.7). From the aggregate which was registered in 1988 by GDT, it is possible to estimate roughly that the vehicle fleet in urban Makkah in 1988 amounted to 147,458. This means that the vehicle fleet of Makkah city increased by 45 percent between 1983 and 1988 whereas the vehicle number of Makkah region has risen only 41 percent. This fleet may be classified into private vehicles and public transport. Unlike the pilgrim buses and SAPTCO, the public transportation involving taxis and minibuses makes up only a small proportion

in Makkah; only 3 percent of the total (Table 4.7). It is convenient at this point to give a brief outline of private vehicle and car ownership. Public transport will be discussed later.

Table 4.7 Number of Vehicles in Makkah City in 1983

Type of vehicle in Makkah	Owned	Provided by employer	Total	%
Cars	75,721	2,754	78,475	84
Commercial vehicles	8,556	1,367	9,923	11
Public Transportation	2,402	89	2,491	3
Motorcycles	1,478 293	1,771	2	
Subtotal	88,157	4,503	92,660	100
In rural areas				
Cars	4,914	46	4,960	55.2
Commercial vehicles	3,761	95	3,856	43.1
Public Transportation	55	12	67	0.8
Motorcycles	73	-	73	0.9
Subtotal	8,803	153	8,956	100
Total		4,656	101,616	

Source: *DHC (1985)*

4.3.1.1 Private Vehicles

This category, which includes personal and commercial vehicles, as well as the motorcycle, constitutes more than 95 percent of the total fleet in Makkah city, and 98 percent in the rural area (Table 4.7). The greatest proportion of the vehicle fleet is personal cars (84 percent), which includes cars, jeeps and stationwagons; however, 4-5 person cars make up 97 percent of the total number of personal cars (DHC,

1985:v2). A large number of these vehicles are individually owned, but there are around 3.5 percent provided by employers such as the government or private firms for personal use. As can be seen in Table 4.7, the number of personal cars in rural areas in much lower than in Makkah itself, where commercial vehicles are used as personal cars.

Commercial vehicles include pick-ups,lorries, water tankers, construction vehicles and trucks, but pickups are by far the most prevalent commercial vehicles, 50 percent in Makkah and more than 89 percent in rural areas (DHC, 1985,v6). This can be attributed to the fact that the pickup can be used both as a small truck and as a personal vehicle.

With the exception of pilgrim buses, industrial and commercial firms also own and operate their own vehicles. About 5 percent of all vehicles in Makkah and its rural areas were owned by large and small firms. In fact, taxis and most of the mini buses are considered as privately owned by households. There were no organised taxi service companies in the Hajj region. In the next section, this point will be discussed further.

4.3.1.2 Car ownership

According to DHC (1983) data of car ownership, 55.6 percent of the households in Makkah owned at least one personal car and 11.5 percent owned two or more, with an average of 80 cars per 100 households. But in 1985 a survey made by Mekki (1988) indicated that 22 percent of Makkah's households have no car, 51.8 percent have one car, while 26.3 percent have more than two cars i.e. about 78 percent of the households own cars. This contrast between the information of DHC and Mekki is the result of

the former having excluded commercial vehicles, particularly pickups, which some use as personal cars. This difference may also be attributable to an increase of car owners among households in 1985 as a result of continuous growth of income during the 1980s. The average annual income of a Saudi household in Makkah was $22,118 (DHC, 1985: v9,p.9). The gross national product (GNP) per capita of Saudi Arabia increased from 11,260 in 1982 to 12,230 in 1985 (The World Bank, 1982, 1985).

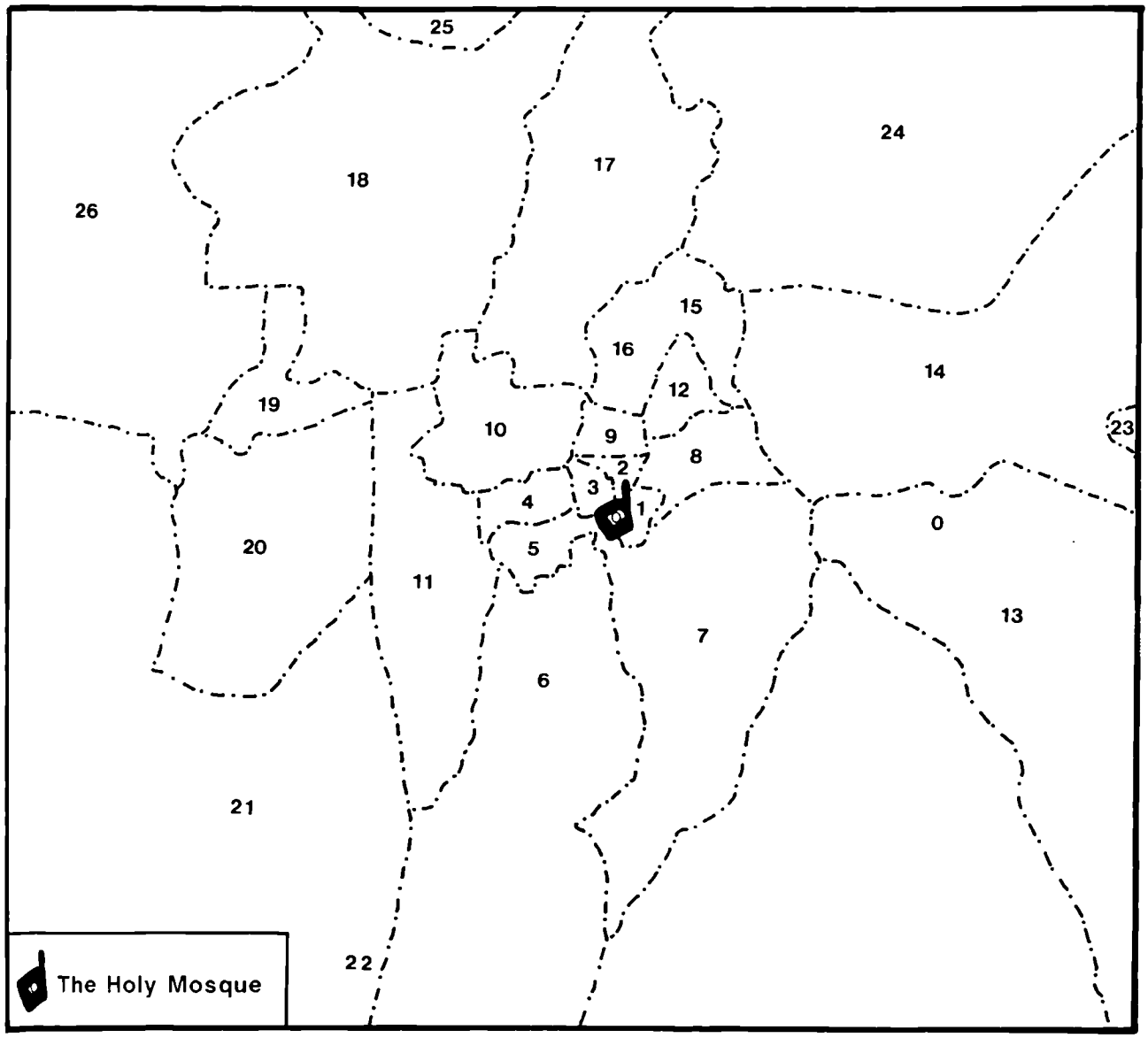
Regarding distribution of car ownership in terms of districts of Makkah it is obvious from Table 4.8, which is illustrated by Figure 4.3, that there is a clear trend to a higher level of car ownership in the newer districts. The older districts, which consist of the centre and surrounding areas, not only have fewer cars, but also have a high proportion of households with no car. This may be attributable to the fact that the income level for households in the new districts is higher than those who live in the old districts such as Al-Qushashiyyah, Al-Shubaikah, Suq al-Lail and Al-Naqa, which all surround the Haram area. Another explanation for this may be the physical, practical problems of owning and using a car in the older city.

Table 4.8: Car ownership distributed in terms of Hara (districts)

Hara (district)		% of Household by the number of cars owned				
		No. of households	0 cars	1 car	2 cars	+3 cars
1.	Al-Qushashiyyah	363	63.1	33.3	3.6	0
2.	Al-Qararah	1,117	39.6	45.3	10.1	5.0
3.	Al-Shamiyyah	1,405	42.9	36.7	15.7	4.7
4.	Harat al-Bab	2,179	40.6	47.2	8.5	3.7
5.	Al-Shubaikah	2,531	66.0	25.9	6.1	2.0
6.	Al-Misfalah	13,665	48.9	40.8	8.3	2.0
7.	Ajyad	4,832	54.2	37.9	5.9	2.0
8.	Suq al-Lail	1,579	55.8	29.1	12.1	3.0
9.	Al-Naqa	1,255	50.7	40.6	8.7	-
10.	Jarwal	5,815	44.1	41.1	12.1	2.7
11.	Al-Tundobawi	8,169	46.6	40.7	9.3	3.4
12.	Shib Amir	4,771	44.5	44.1	8.9	2.5
13.	Al-Aziziyah	2,377	14.6	55.7	14.3	15.4
14.	Al-Faisaliyyah	8,198	35.7	48.7	10.8	4.8
15.	Al-Gemmezah	1,820	46.2	40.2	11.4	2.2
16.	Al-Sulaimaniyyah	2,060	50.8	40.2	7.0	2.0
17.	Al-Utaibiyyah	11,273	45.9	44.9	7.0	2.2
18.	Al-Zahir	9,073	34.7	56.5	7.1	1.7
19.	Al-Zahra	881	33.4	61.1	2.7	2.8
20.	Al-Hindawiyyah	9,485	45.3	45.2	7.6	1.9
21.	Al-Rasaifah	1,329	45.1	48.0	3.7	3.2
22.	Mina	516	76.0	12.0	7.9	4.1
23.	Al-Maabdah	6,116	42.4	46.3	7.8	3.5
24.	Al-Taneim	995	31.3	51.0	15.7	2.0
25.	Al-Nuzha	1,565	13.2	66.2	10.3	10.3
Total		104,680	44.4	44.1	8.5	3.0

Source: *DHC (1985)*

Figure 4.3 Makkah Districts 1985



Source: ALIFARSI, M. (1985)

These districts are also characterised by a small area and lower population compared with the newer districts (Mekki, 1988). This is because the majority of such places are occupied by commercial markets and accommodation for pilgrims is used as seasonal dwellings. The interesting point here is that the district of Al-Aziziya, which is considered as an isolated area between Al-Haram (the Holy Mosque) and the Holy places, is placed high in terms of car ownership since more than 55 percent of households have one car and 29.7 percent possess two or more cars which may be accounted for by the fact that it is one of the new, large districts with a relatively high standard of living in Makkah. A similar situation is applicable in the district of Al-Faisaliyah, which occupies fifth place with respect to car ownership of households (see Table 4.8 and Figure 4.3). This phenomenon may have a negative effect on the Hajj movement during the pilgrimage season as a result of the existence of many cars in these districts and the increased mobility of the population. It is therefore very important for the planners and Municipality of Makkah to consider this point. It may be a good suggestion to put a restriction upon further building of dwellings, or other construction in such districts which are not related or which do not service the Hajj movement.

4.4 Public transport

4.4.1 Introduction

E.J. Mishan mentioned that:

> *"for a fraction of the money the nation is currently spending on the maintenance of private cars and on the Government services necessary to keep the traffic moving... we could provide a comfortable, frequent and highly efficient public transport service"* (Mishan, 1967:128).

Before him, Wilfred Owen also noted that '*mass transportation facilities would have to be relied upon to accommodate a substantial proportion of peak-traffic*' (Owen, 1966:120). There are considerable benefits in using public transport. The personal car is broadly less efficient in its use of land as a result of transporting so few people and its requirement for long, wide roads and large parking areas. Private cars also consume more energy than public transit, measured in passengers carried per km. The benefits of use of a public system for transport are not confined to economic aspects. Yet there are many objectives, among them the following:

- The environmental objectives: public transport may participate effectively towards reducing damage of the environment which has occurred everywhere as a result of an increase in the number of vehicles.

> *"Transportation is the major source of air pollution, putting over 100 million tons per year of carbon monoxide (Co), hydrocarbons (Ho), and oxides of nitrogen (No) into the air .... Vehicles do add significant proportions of nitrogen oxides and hydrocarbons (33 percent) and 6 percent of the particulates. In total, 60 percent of the pollutants in U.S. cities is transportation-related, and almost all of this amount comes from the private automobile."* (Stutz, F.P., 1986:335).

This is apart from noise pollution which has a profound influence on life wherever vehicles are present.

- The social objectives, which basically create equality of spatial opportunity, particularly with respect to access to hospitals, schools, shopping and other amenities. Public transport systems might be able to give lower income groups such opportunities to travel conveniently and cheaply.
- The safety objectives: it is intuitively plausible that, in most cases, public transport is demonstrably safer than private transport; in Saudi Arabia for instance, the incidence of accidents is higher for 1000 passengers per kilometre using private cars than it is for those using public transport (Kurdi, 1986). The size, height, weight and body efficiency of the public buses are significant in increasing safety. In addition constant maintenance and services are legally required for public transport, all playing an important role in road safety standards (Al-Nakeeb, 1981).

These positive factors of public transport make such a system the most convenient mode for mobility, particularly where congestion, overcrowding and other transport problems are experienced in special events such as the Hajj movement. In this section Saudi Arabian road public transport will be described before discussing the system in the Hajj region.

4.4.2 Public transport in Saudi Arabia

Before 1978, there was no public transport company or organised road transit in Saudi Arabia. Transport services between towns were provided by private taxis, jitneys (mini buses) and cars. Such means were arranged in each city or town by travel stations having a number of offices, each one dealing with a specific destination. These offices individually contracted with a number of car owners. Travel stations were supervised

by the Traffic Departments in each town. There are no data available about the number and type of such vehicles serving travel passengers whether in rural or urban centres.

Regarding public transportation within cities, there are paratransit passenger transport services which operate within urban areas, including services to and from airports. Paratransit is a transportation service provided by an operator and available to all parties who meet the condition of a contract for carriage, i.e. pay prescribed rates (Al- Awakary, 1989:35). Most paratransit means do not have determined routes or schedules; private taxis, limousines and jitneys are examples.

In 1988, there were about 24,677 private taxicabs in Saudi Arabia (see Table 4.4) which represented 0.8 percent of the total vehicles registered. Unlike in the Eastern Region, taxicabs have no organised control or radio, but drive through the streets in search of customers. Some city centres have a specific place (Taxi stop) or taxi ranks for picking up passengers to be taken to their chosen destination.

In recent years, limousine companies have been established. Although the car limousines have no radio inside the car, they seem to be more organised and have a more or less fixed charge, in contrast to that of private taxis. Each company has a phone number which is available in the phone book. In 1987, 16 companies were licensed to provide limousine services between airports and adjoining cities, and about 91 companies provided car rental, limousine and taxi services within cities. The combined fleet size of all these companies is estimated at 2,123 vehicles (MOC, 1987).

As shown in Table 4.10, Riyadh and Jeddah are ranked first and second in terms of the size of their limousine car fleets and number of operating companies; both cities are of considerable size and have the greatest capacity, mobility and volume in the Kingdom.

A significant type of paratransit service operating in cities of the Kingdom is the jitney (mini bus). Most vehicles in the jitney paratransit fleet are owned and operated by individuals who perform their services without any operational strategy, coordinated management, marketing plan and/or government regulations, except for a fixed-fare policy (Al-Ankary, 1989). Thus the system's operation changes from route to route and even from day to day. But in some cities such as Riyadh and Jeddah, there are determined routes for the jitney service. However, decisions on daily frequency of service runs, start and finish of daily services and number of work days per week depend solely upon the individual driver/owner. Despite some negative aspects of this system, it is reliable, efficient and popular. However, before a better picture of the operation of this service may emerge, further study is necessary on the part of the authorities. At this time the paratransit system covers some aspects in which SAPT-CO, on occasion fails, or is unable to do.

SAPTCO

A modern public transport system was introduced by the MOC in 1979, when it constituted SAPTCO to serve the citizens and alleviate the adverse social and health effects of increased numbers of private cars (see Section 4.2).

A Royal Decree was issued in 1979 establishing SAPTCO with a capital of one billion SR, 30 percent of which was funded by the government. The government shall continue to provide subsidies to the company for a 15 year period (MOC, 1986:22). SAPTCO began operation in Riyadh in 1979 offering intra-city services with safe and modern buses. Later this service was extended to the rest of the cities in the Kingdom. Fares were much lower than the actual costs. Inter- city services were also introduced

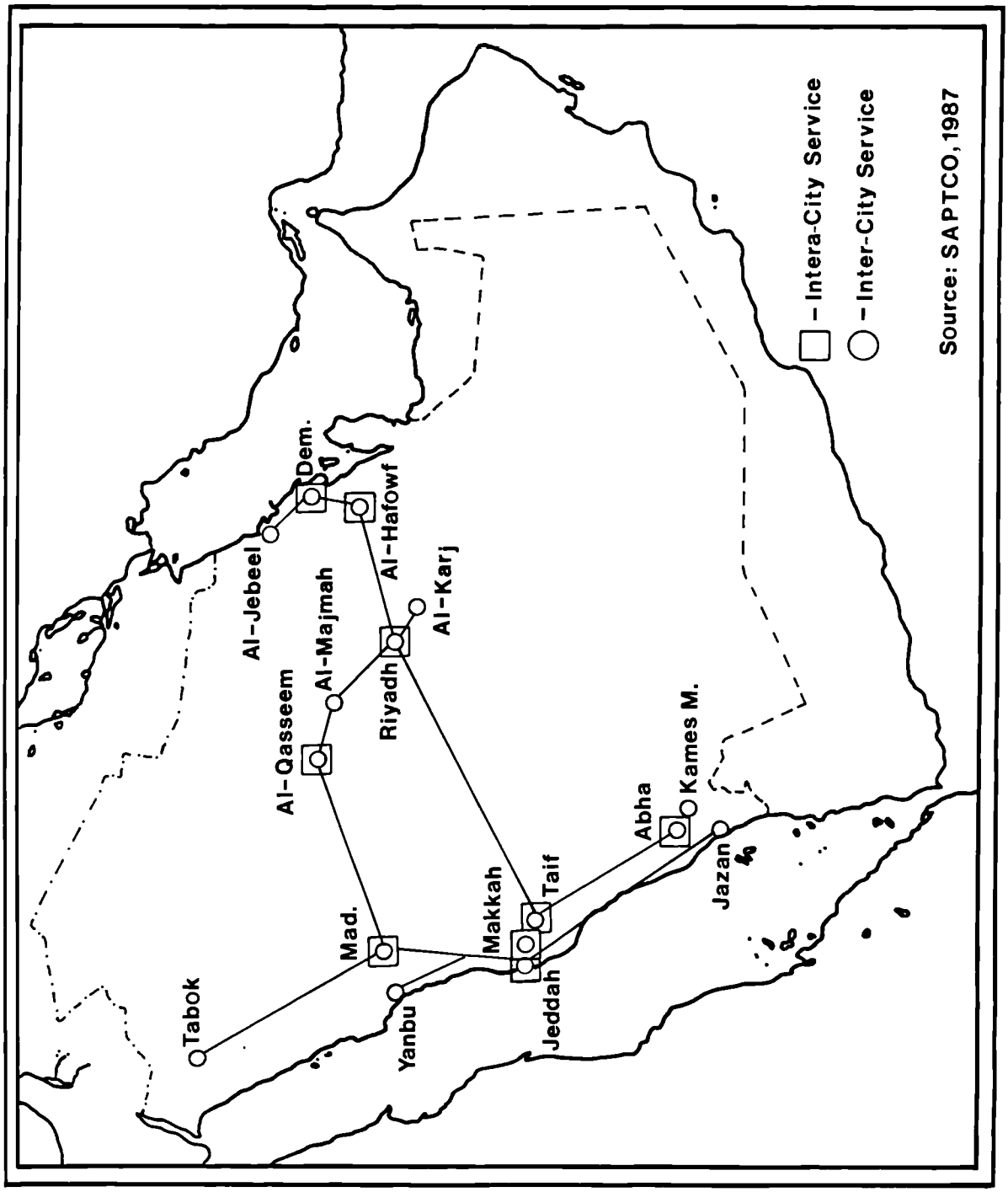


Figure 4.4 The intera-city and inter-city services by SAPTCO

between main cities of the Kingdom (see Figure 4.4). Two main routes were established to link the Eastern and Central provinces with the Hajj Region; the first of these runs from Dammam to Jeddah via Hofuf, Riyadh, Taif and Makkah, and the second from Riyadh to Madinah via Al-Qassim. The HR has also been linked with northern parts towards Tabok, and with southern parts towards Abha (see Figure 4.4). SAPTCO's bus fleet has growth steadily in proportion to operational increases. The company now uses many different types of buses as shown in Table 4.9.

Table 4.9 SAPTCO's Type of buses in 1987

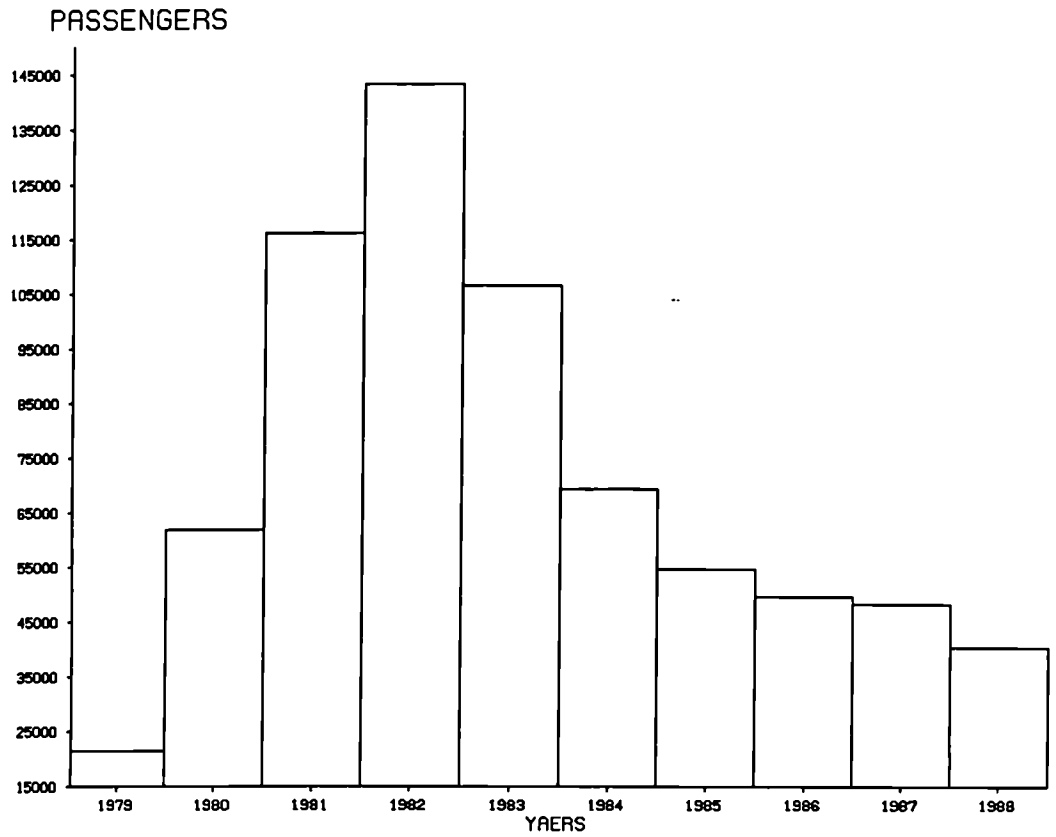
	Type of bus	Number	Capacity of passengers
Intra-city service	Standard buses	720	43
	Double decker buses	130	92
Inter-city service	Type (1)	200	47
	Type (2)	50	47
	Type (3)	10	71
Total		1,115	

Source: *SAPTCO (1987)*

One of the characteristics which distinguishes SAPTCO from the paratransit buses is its schedules and fixed routes with specific bus stops which have shelters. The cost of an intra-city service used to be one RS per passenger whatever the length of the route, but since 1983 the fare has risen to two RS (SAPTCO, 1983).

Figure 4.5 shows that there was a significant reduction in SAPTCO customers for the period 1984-88. The extreme competition from paratransit services, particularly the jitney system mentioned above, a decrease in expatriate employment resulting from migration from the country on completion of construction projects, and the increasing

FIG. 4.5 : SAPTCO TOTAL INTER-CITY PASSENGERS 1979-88



SOURCE:SAPTCO ,1988

car ownership rate are the major factors which led to this decline. In addition to this, the increase in bus fares and the operation of illegal cost bus services are considered to be other reasons for this change. In fact, there are many problems facing SAPTCO, some of which will be mentioned in due course.

4.4.3 Public Transport in the Hajj Region

Public transportation services are available to passengers on payment of a fee or fare. In the Hajj region, as in the whole country, such services are provided by a paratransit system or SAPTCO. However, in addition to this there are pilgrim transport companies which play a very significant role in terms of the Hajj movement. Some individuals also make their vehicles available for hire, particularly during the seasons. The existing conditions for these systems will be indicated in this section.

4.4.3.1 Paratransit system

This system involves taxis, limousines and jitneys. Apart from limousines, no official data are available as to the number of paratransit vehicles in the Hajj region or in Makkah. The only available data are the total number of taxis for Makkah region which in 1988 was around 9,327. In 1983, however, DHC gave the number of privately owned taxis and minibuses (jitneys) in the possession of households in Makkah. The former was 1,594 while the latter was 920 (DHC, 1985, v6).

Although there is a fixed hire for taxis in Makkah, the fares charged are sometimes subject to bargaining. The fares of the jitney system usually follow the SAPTCO fare structure. Generally, hires of taxis and jitneys on Fridays and during the Hajj and Ramadan season are highest because of heavy demand. The author has found that the rates of jitneys, for instance, rise more than four times during the Hajj season.

These jitneys, with capacities ranging from 12 to 21 passengers, often serve main roads and routes which are not covered by SAPTCO. During the normal periods, jitneys usually operate between 06.00 and 21.00, but at the Hajj period, when the traffic movement operates throughout the day, jitney owners may work more than 18 hours at a stretch. The owner continues to work until he feels tired, and then he stops to sleep anywhere away from movement centres. This mode of operation has played a significant role in terms of the Hajj movement. In 1989 more than 38 percent of all vehicles operating within Makkah during the Hajj were jitneys (CDS, 1989). In 1983, for instance, according to CDS data, there were about 58,000 jitneys added to the existing number in Makkah (920) i.e. 98 percent of this mode was from outside of Makkah.

As far as the limousine system is concerned, Table 4.10 shows that Makkah has only a small number of limousine cars compared with Riyadh or Jeddah. This is not surprising, taking into account the size of the city. The surprising fact is that Madinah has a greater number of limousine cars than Makkah, although the population of the latter is more than one-and-a-half times that of the former. This means limousine cars in Makkah play a limited role in terms of traffic movement. The reason for this is the restrictions which the government put on small vehicles entering Makkah during the Hajj activities in an attempt to reduce the number of vehicles.

This policy has led to the MOC placing a restriction on the issue of licences to limousine companies in Makkah City. In addition to this, many individuals in Makkah hire out their personal cars, particularly during the seasons. In spite of its illegality, this situation has created considerable competition between the owners of the various

classes of small vehicles (taxis, limousines and personal cars) which is not advantageous to the limousine companies.

Table 4.10: Limousine services in various cities of the Kingdom, 1987

City	Airport limousine No. of operating companies	No. of cars	City limousine No. of operating companies	No. of cars
Riyadh	7	374	76	873
Jeddah	4	237	7	218
Makkah	-	-	2	60
Taif	-	-	-	-
Dammam Re.	3	125	4	140
Madinah	2	45	-	-
Yanbu	-	-	-	-
Jubail	-	-	2	60
Total	16	781	91	1,351

Source: *MOC (1987)*

4.4.3.2 SAPTCO in the Hajj Region

The role of the SAPTCO transport service is clearer in the Hajj region than in any other. This is particularly true in Makkah, both intra-city or inter-city.

Intra-city service:

Consultation of Table 4.11 reveals that although the Hajj period services are not included in this figure, Jeddah and Makkah are the foremost cities of the Kingdom in terms of the number of operating routes and number of passengers served by SAPTCO. This is in spite of the fact that Riyadh possesses a greater fleet of buses. Riyadh had 232 buses, whereas Jeddah and Makkah had only 207 and 142 respectively.

The reason for this is attributable to the seasons of the Amrah which take place in this region. This means that these seasons such as Ramadan, Amrah are considered favourable opportunities for investment by SAPTCO. Although Madinah involves the HR, it had only 12 routes and 74 buses carrying less than 8.2 million passengers. This means that the demand for SAPTCO's services in Madinah is not as in Jeddah and Makkah. The use of personal cars for hire, greatly extending the paratransit system (see Table 4.10) and a relatively small population are the main reasons for these variations.

Table 4.11: SAPTCO's Intra-city Services 1988-89

Region	No. of operating routes	No. of buses	No. of passengers
Jeddah	25	207	11,810,411
Makkah	22	142	11,309,729
Riyadh	21	232	8,173,120
Dammam	12	74	4,690,466
Madinah	9	47	1,670,828
Taif	5	24	746,598
Qassim	8	21	577,066
Hofuf	6	20	752,893
Abha	2	13	607,903
Total	110	780	

Source: *SAPTCO 1989.*

In Makkah at peak hours in the non-Hajj period, SAPTCO operates 142 buses (see Table 4.11). About 30 percent of this fleet are double- deckers (SAPTCO, 1989). The single decker bus has 35 seats for men and 7 for women separated by a screen at the back according to Islamic instructions. The double-decker bus has 76 seats for men and 17 seats for women.

At present, the intra-city SAPTCO service consists of 22 routes, most of which converge on the Haram (SAPTCO, 1989). Figure 4.6 illustrates these routes and the main bus terminals. The frequency of the bus services on routes ranges between 12 minutes to 40 minutes, mainly depending on the length of the route. Sometimes the buses cannot keep to schedule because of traffic congestion or diversions which usually arise from roadworks (Mekki, 1988). One of the characteristics of SAPTCO is the bus stops which are not found in the jitney system. The average distance between one stop and the next is comparatively short: around 350 metres. In the U.S. for instance, their average ranges between 400 m and 600 m (Vuchic, 1981:270).

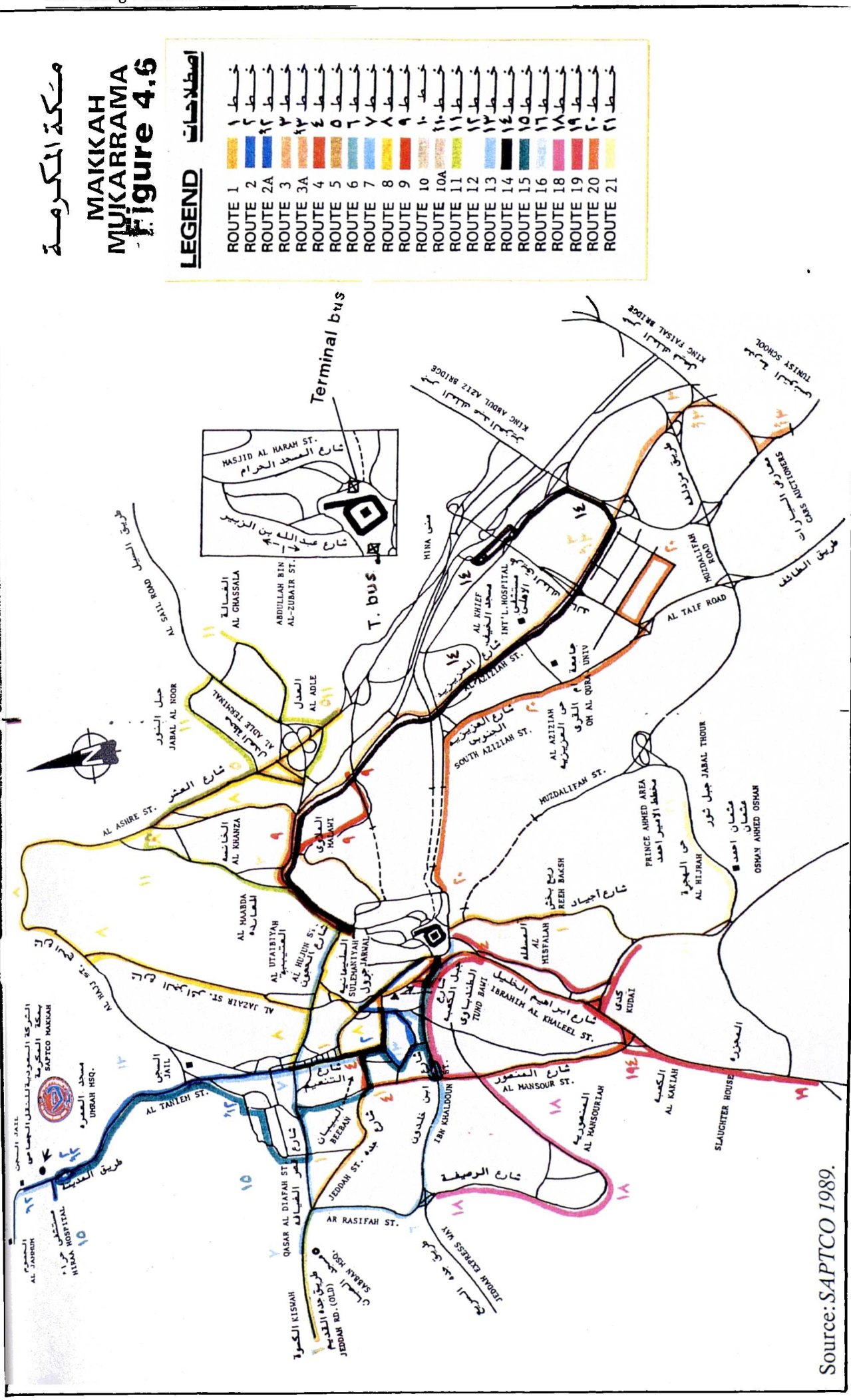
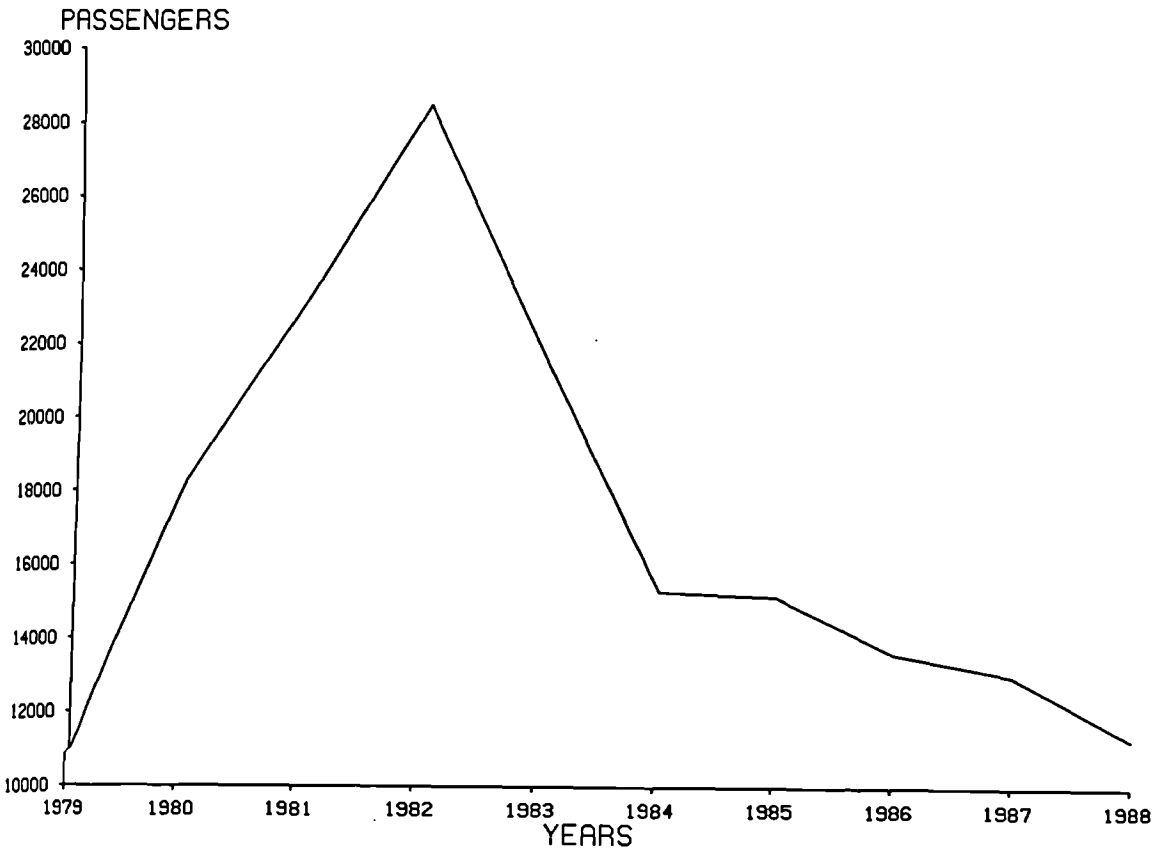

مكة المكرمة
MAKKAH MUKARRAMA
Figure 4.6
LEGEND اصطلاحات
ROUTE 1 خط ١
ROUTE 2 خط ٢
ROUTE 2A خط ٢أ
ROUTE 3 خط ٣
ROUTE 3A خط ٣أ
ROUTE 4 خط ٤
ROUTE 5 خط ٥
ROUTE 6 خط ٦
ROUTE 7 خط ٧
ROUTE 8 خط ٨
ROUTE 9 خط ٩
ROUTE 10 خط ١٠
ROUTE 10A خط ١٠أ
ROUTE 11 خط ١١
ROUTE 12 خط ١٢
ROUTE 13 خط ١٣
ROUTE 14 خط ١٤
ROUTE 15 خط ١٥
ROUTE 16 خط ١٦
ROUTE 18 خط ١٨
ROUTE 19 خط ١٩
ROUTE 20 خط ٢٠
ROUTE 21 خط ٢١
Terminal bus
T. bus
MASJID AL HARAM ST.
AL ASHRE ST.
AL TAHLEH ST.
AL TAIF ROAD
MUZDALIFAH ROAD
MUZDALIFAH ST.
MINA
AL AZIZIAH
SOUTH AZIZIAH ST.
IBRAHIM AL KHALEEL ST.
AL MANSOUR ST.
IBN KHALDOUN ST.
JEDDAH ST.
AR RASIFAH ST.
JEDDAH EXPRESS WAY
SLAUGHTER HOUSE
TUNISY SCHOOL
KING FAISAL BRIDGE
KING ABDUL AZIZ BRIDGE
Source: SAPTCO 1989.

Table 4.12: Performance of intra-city SAPTCO bus services, 1983

Route No.	Route name	Peak buses	Daily trips	Annual passengers	Daily average
1.	Kiswah Factory/Ar-Ribakhsh	7	140	1,098,732	3,095
2.	Al-Omrah Mosque/Ar-Ribakhsh	6	168	1,601,107	4,510
3.	King Faisal Bridge/Bab Al-Omrah	14	247	3,540,038	9,972
4.	Al-Bibyan/Bab Al-Omrah	11	249	3,490,878	9,833
5.	Al-Adl Square/Bab Al-Omrah	3	70	784,907	2,211
6.	Sabban Mosque/Ar-Ribakash	14	246	3,262,349	9,190
7.	Sabban Mosque/Bab Ali	9	220	2,068,675	5,827
8.	Al-Adl Square/Ar-Ribakksh	4	75	527,566	1,486
9.	National Hospital/Bab Ali	8	196	1,609,024	4,532
10.	King Abdul Aziz University/Bab Ali	10	251	2,219,021	6,251
11.	Al-Ghassalah/Bab Al-Omrah	5	119	1,150,789	3,242
12.	Kaki Building/Bab Al-Omrah	9	237	2,455,856	6,918
13.	Al-Jumum/Bab Al-Omrah	3	39	415,536	1,171
14.	Mina/Bab Al-Omrah	3	54	612,677	1,726
15.	Al-Omrah Mosque/Bab Al-Omrah	5	108	656,032	2,693
16.	Al-Omrah Mosque/Bab Ali	9	221	2,634,821	7,422
17.	Tonisy School/King Faisal Bridge	1	44	14,129	40

Source: *SAPTCO, Fourth Annual Report, 1983*

FIG. 4.7 NO. OF SAPTCO PASSENGERS, INTRA-CITY IN MAKKAH



SOURCE SAPTCO, 1988

According to SAPTCO data in 1988, the average daily number of passengers on all routes of Makkah was between 30,000 and 35,000. This average was 80,000 a day in 1983, when the volume of passengers was considered to be at its peak (see Figure 4.5). The years following 1983 witnessed a constant decline of passenger numbers which, in fact, occurred in most cities of the Kingdom. The probable reasons for this decline have already been mentioned.

Table 4.12 presents the routes, the number of peak period bus services in the non-Hajj period, and the total annual number and average daily number of passengers carried. It shows that the most heavily used intra-city bus route is route No.3, which has a daily average of 9,972 passengers. It starts from King Faisal Bridge and ends in Bab Al-Omrah at Al Haram, crossing the areas of Al- Shamiyyah, Al-Maabdah and Al-Asiziyah. This route is considered to be the main axis of the Hajj movement. This means that the HM occurs along the most important route in terms of Makkah traffic. Route No.4 follows the above route regarding level of use. It provides services between Al-Bibyan and Al-Mansur, Al-Misfalah, the Haram and Al-Ghuzah. The third route is No. 6, which has a daily average of 9,190 passengers and provides services between Al-Ri Bakhsh and the areas of the Haram, Al-Hafayir and Sa'a Square. The last two routes are located on the west of Al-Haram which is another side of Route No.3.

Inter-city services:

SAPTCO also provides inter-city bus services between cities of the Hajj region and other cities of the Kingdom. The Hajj region possesses more than 35 percent of the inter-city routes of Saudi Arabia and about 62 percent of the SAPTCO inter-city fleet

(see Table 4.13). Although the Hajj movement was excluded from the number of passengers in Table 4.13, the movement volume of passengers of the Hajj region cities is more than that of any other city in the Kingdom as has been seen in terms of intra-city services. Passenger flow from Jeddah at the top of the list, accounts for 27 percent of overall inter-city passenger flow; Makkah had 16 percent, while Riyadh, which has a population of about a million, took only 13 percent of passenger flow travelling by SAPTCO after Madinah, that had 15 percent. This means that more than 57 percent of the inter- city passenger flow of SAPTCO takes place in the Hajj region. Thus it may be said that SAPTCO service was more successful in the Hajj region than in any other area of the Kingdom.

Table 4.13: SAPTCO's inter-city services 1988

City	No. of routes	No. of buses	No. of passengers
Jeddah	5	63	523,481
Makkah	4	45	310,293
Madinah	2	35	290,310
Riyadh	5	42	241,141
Dammam	2	23	146,670
Taif	1	15	179,974
Qassim	1	7	55,705
Others	11	1	167,808
Total	31	231	1,915,382

Source *SAPTCO, Annual Report, 1988*

DHC (1985) presented data about inter-city SAPTCO bus passenger trip interchange. These data were collected in 1983 by a one-day (24 hour) survey at the bus terminals in Makkah and Jeddah, as well as at a checkpoint at the entrance to Makkah (DHC, Part 2 1985:p.99). From these data, the Haram has been shown as a point of origin

and destination for the people who indicated that they were going to perform Omrah or were returning after having performed it. As can be seen in Table 4.14 the largest proportion of passengers, 50 percent, came from Jeddah, 25 percent of which came specifically to perform Omrah.

Table 4.14: Inter-city SAPTCO bus ride trip interchange 1983 (percentage)

	Destination							
Origin	Haram	Rest of Makkah	Jeddah	Madinah	Taif	Riyadh	Other	Total
Haram			19.3	2.4	1.8	-	-	23.5
Rest of Makkah			16.1	1.2	1.3	-	-	18.6
Jeddah	28.5	20.5	-	-	0.9	-	0.1	50.0
Madinah	4.5	0.9	-	-	0.1	-	-	5.5
Taif	0.8	0.5	0.9	*	-	-	-	2.2
Riyadh	-	-	0.1	-	-	-	-	0.1
Other	*	-	-	*	-	-	-	0.1
Total	33.8	21.9	36.4	3.7	4.0	-	0.1	100
* Less than 0.1 percent								

Source: *DHC, Part 2, 1985.*

Similarly, *42.1 percent left from Makkah, 25.4 percent of which were* destined for Jeddah. There are strong interactions between Makkah and Jeddah, considered the main door of economic, social and religious activity, giving rise to travel between these two cities for a variety of purposes. Many pilgrims visiting Makkah during the non-Hajj period for Omrah used the public transportation after arriving in Jeddah. The percentage of the bus ridership coming from Madinah was 5.5 percent, around 4.5 percent of whom went to the Haram and 2 percent of whom went to Madinah

after performing Omrah. A large proportion of these, however, came from the prophet's mosque in Madinah or went to visit it. Other interchanges of trips are small.

The problem which SAPTCO faces here is the reduction in the number of inter-city passengers since 1983 (Figure 4.7) which is similar to what occurred in terms of intra-city services. The factors influencing this matter may be summarised as follows:

- The rapid decline in expatriate workers, who particularly since 1983, have formed the largest proportion of passengers.
- The sharp increase in private car ownership (discussed above) in Saudi Arabia and especially in the Hajj region.
- The freedom to operate paratransit systems without any restrictions, producing strong market competition for SAPTCO.
- The restrictions imposed on expatriate employees, who have to have permission from their employers to undertake inter-city journeys.

SAPTCO's services for the Hajj

Unlike in the Hajj region, the economic activity of Saudi Arabia in general is relatively reduced during the Hajj period; officially there are at least 10 days off work, and local services are somewhat reduced throughout this period. Thus, each year during the Hajj season SAPTCO relocates some of its resources of manpower and vehicles from other cities of the Kingdom and commences special Hajj services in the Hajj region. A high-level service is then reinstituted in Makkah in particular.

In Hajj 1988, SAPTCO deployed a total of 1,013 buses distributed as follows: (SAPTCO, 1989)

- 650 buses without air-conditioning, 129 of which were double decker buses (see Plate 4.1)
- 231 air-conditioned buses, 17 of which were double decker buses
- 97 hired air-conditioned buses
- 25 air-conditioned mini buses

SAPTCO provides special services between the peripheral car parks and Muna and the Haram for pilgrims who must leave their small cars at these parking areas. This service starts around 12 days before 'Arafat Waqfah'. On 9 Dhul Hijjah, the service from the car parks runs directly to Arafat. During the days of the Hajj activity, the service from the car parks is somewhat reduced, but it is resumed after the Hajj activity to transport the pilgrims returning to their own vehicles. These activities were served by about 225 buses in 1988.

In addition to this, SAPTCO work beside companies of pilgrims' transport, carrying the pilgrims between Jeddah, Makkah and Madinah and between the Holy places. In 1988 SAPTCO contributed 132 buses for this purpose. These comprised 2 percent of the buses of such companies participating in the Hajj Movement (see Table 4.16). SAPTCO also hires some buses to carry external pilgrims (from Turkey for instance) and presses them into service at the Hajj time. In the Hajj of 1989, according to data obtained from the General Syndicate of Cars, 144 buses from SAPTCO, having 6,768 seats, were available for transporting pilgrims between Holy places i.e. an increase of 12 buses compared to previous years. But, in fact, only 81 percent of these buses were used for this purpose, according to the policy of the General Syndicate that will be indicated in the next section.

Plate 4.1 SAPTCO buses queuing along one side of Al-Aziziah street to reach Muna bus station (above). SAPTCO double-decker buses en route to pick up pilgrims from Muna to Arafat (below).

From the survey of pilgrims which was made by the author in 1989, it emerges that the percentage of pilgrims who used the SAPTCO service for travelling between the Holy places, ranges between 3.2 percent and 6.9 percent of the sample, as can be seen in Table 4.15. It is obvious from this table that the highest percentage (6.9) given to SAPTCO is in respect of the return of the pilgrims to Muna from Al-Haram. This may be attributable to the strategic location of the SAPTCO terminal, which is situated near Al-Haram (see Figure 4.6). The second most important route served by SAPTCO is from Makkah or Muna. Both have terminals and facilities for SAPTCO. SAPTCO's participation in terms of Arafat and Mozdalifah, however, served a relatively small percentage of pilgrims compared with the previous places. This is because pilgrims stay at Arafat and Mozdalifah for a very limited time (one day for Arafat, one night for Mozdalifah), while in Muna pilgrims have to stay at least three nights.

Table 4.15: Percentage of pilgrims that SAPTCO has transported between the Holy places in 1989

From Makkah or Muna to Arafat	5.9
From Arafat to Mozdalifah	4.7
From Mozdalifah to Muna	3.2
From Muna to Haram	5.9
From Haram back to Muna	6.9

Source: *Survey of 1989*

4.4.3.3. Pilgrims' Buses

There are special buses for external pilgrims which belong to many companies at Makkah. These companies have contracts with the government by which they undertake the responsibility to transport external pilgrims throughout the Hajj region and

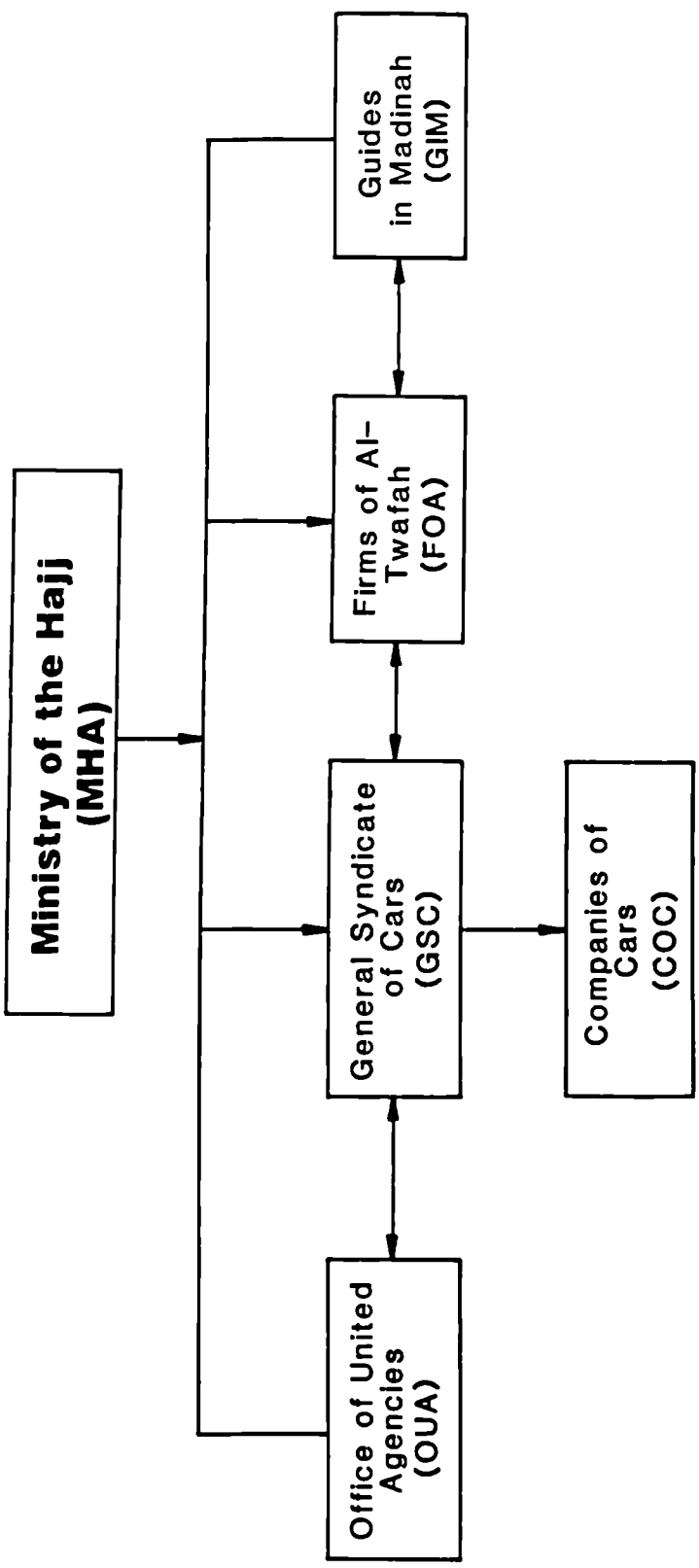


Figure 4.8 The main administrations of the pilgrims transport belong to the Firms of Al-Twafah (FOA)

between the Holy places in Makkah. The contract was initiated in 1952 when the government established the General Syndicate of Cars (GSC) to supervise these companies (Jafri, A.H. 1988). In fact these buses remain essentially unutilised throughout the rest of the year (at non-Hajj periods) and are used only when the pilgrims start arriving in the Kingdom in large numbers.

GSC

The GSC works as a middleman or broker between bus companies and firms of Al-Twafah (organisers), see Figure 4.8. The GSC, which belongs to the Ministry of the Hajj, is responsible for the operation, coordination and organisation of transporting the external pilgrims in the Hajj region.

It started in 1953 with five companies who owned 1,015 cars (buses and small cars) with a total of 34,699 seats. During the 1950s and 1960s, this number was adequate to guarantee the transport of pilgrims in HR. Although the policy of GSC allows for any new companies to enter this scheme, none has offered the more competitive and lucrative private sector markets. In some seasons when pilgrim numbers have decreased, these companies have suffered losses. This led to the government subsidising the established companies in 1975 and 1978 with the provision of a total of 3,000 buses to be paid for in instalments over 15 years (Jafri, A.H., 1988).

As a result of increasing numbers of pilgrims during the 1970s and 1980s, and the increasing demand upon buses for their transport, five new companies have been recorded by GSC. In 1984, the fleet of pilgrim buses reached 4,380. In consequence of some older companies having been withdrawn from the concession, other new companies were contracted with the GSC. In 1988, the total of pilgrim buses reached

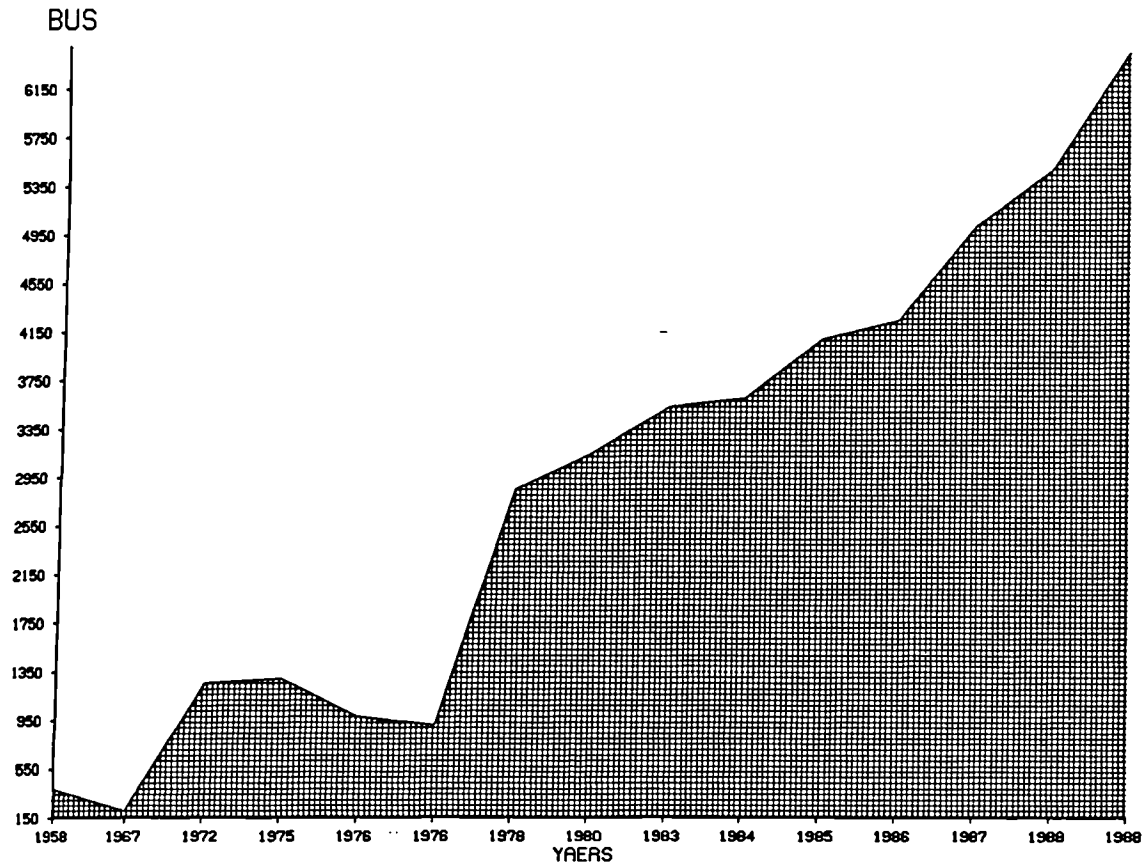
6,465 with a capacity of 317,608 seats. Figure 4.9 describes the development of pilgrim buses since the establishment of the GSC in 1953 and Table 4.16 shows the number of buses and seats in 1988 for each of the companies which are subject to the policy of the GSC. In the season of 1989 a new company called Al Harameen entered this service with 240 buses. Thus the fleet of buses available for pilgrims in 1989 consisted of 6,705 buses with 332,645 seats. Fifty eight percent of these buses are modern and have air-conditioning, while the rest do not. The cost of transport for the Hajj activity has been fixed by the GSC: 435 SR (about £73) for an air-conditioned bus and 345 SR (£58) for a non air-conditioned one (MOH, 1989). This categorisation, however, often creates complex situations in terms of passenger administration, as many pilgrims have ended up travelling on non-air-conditioned buses when they have paid for air-conditioning, and vice versa. This will be discussed later.

Table 4.16: Total numbers of buses and seats belonging to companies of pilgrims transport in 1989

Name of Company	No. of buses	No. of Seats
Al Tawfeg	1683	81788
Al Wagl A-ddaheli	421	17921
Al-Andalos	161	7979
Dallah	664	34494
Al Magrabi	1570	84550
Al Kahki	1046	46137
SAPTCO	132	6295
Hoker	120	12275
Makkah	233	11593
Madinah	160	7400
Om Al Korah	145	7176
TOTAL	6,465	317,608

Source: *GSC, 1989*

FIG. 4.9 : DEVELOPMENT OF NUMBER OF GSC BUSES, 1953-1988

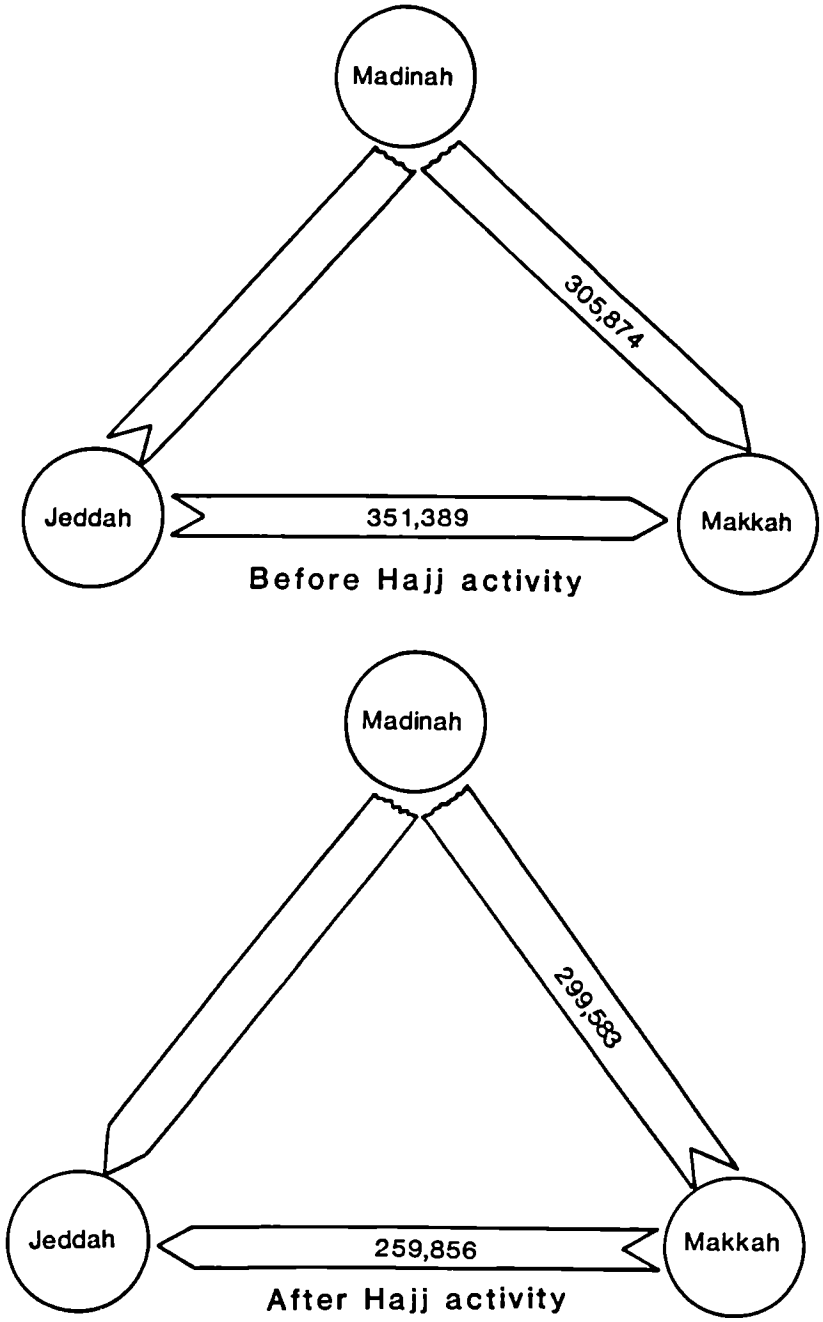


SOURCE: GSC , 1988

GSC inter-city service

In contrast to the services provided to overland pilgrims, GSC buses provide a service for those external pilgrims who arrive in the country by air or sea, transporting them between Jeddah, Makkah and Madinah. The services usually start once the pilgrims begin arriving at the airport or seaport of Jeddah. Before the Hajj activity in Makkah, there is no specific direction that pilgrims should travel. Thus some pilgrims travel to Madinah first, then go to Makkah; some go directly to Makkah, and then after the Hajj activity travel to Madinah. Figure 4.10 shows the number of external pilgrims who have been transported by GSC between the cities of the Hajj region. In 1987 the total number of pilgrims who arrived at Makkah by means of GSC buses was 657,263 i.e. 90 percent of pilgrims entering the country by air and sea. According to the instructions of the Hajj Ministry (MOH), 1989) all pilgrims of this category should pay the cost of transport within the Hajj region of the entry point for GSC via the Office of United Agencies. In spite of this, about 10 percent of those pilgrims used private or public modes of transport to travel to Makkah instead of the GSC services. On departure from Makkah, only 76 percent of those pilgrims were transported to Jeddah by the GSC. This means that the percentage of pilgrims who did not use the GSC services for departure from Makkah was 24 percent higher than the number arriving by this means. This may be accounted for by two reasons. Firstly, the existence of private and public modes of transport which are more readily available in Makkah where it is difficult to exercise control over pilgrims making use of specific modes of transport. On the other hand it is easy to do so when the pilgrims arrive at the airport or seaport. Secondly, there are usually years when some pilgrims remain in Saudi Arabia illegally in order to look for work or simply to extend their visits.

Figure 4.10 Volume and pattern of pilgrims transport for inter-city by GSC; 1987



GSC Service in Makkah

Although the number of air and sea pilgrims in 1989 was 578,610 the total number transported by GSC buses was only 366,597 i.e. 63 percent of the total number of air and sea pilgrims. These pilgrims were carried by 4,763 buses representing 68 percent of all buses available to the companies (GSC, 1989). This means that in 1989, the demand upon buses of the companies was less than the supply. There are several reasons which may account for this reduction in demand. The most important of these is the system that the GSC applies in operations of transporting the pilgrims. This system is a shuttle bus service provided twice between the Holy places. According to GSC data in 1989 about 72 percent of those pilgrims were transported by two shuttles, while the rest were carried by a single shuttle. Despite the fact that this system has the advantage of reducing the number of vehicles participating in the HM, there were many disadvantages created by the nature of the shuttle service system, such as a long waiting period for the second shuttle, loss of bus drivers and incorrect directions taken by traffic police. The second reason is the competition provided by the private sector cars which are available in Makkah. According to the GDT data, in 1989 the total number of vehicles shared in the Hajj movement in Makkah has been recorded as 49,281 vehicles; more than 60 percent were small cars, pickups, jeeps and mini buses (see Table 7.2). Some pilgrims who disagree with the system of the GSC, or those who came via official delegations prefer to use private vehicles rather than scheduled GSC buses. In addition, the overland pilgrims who come by coach very often continue to use the same mode of transport between the Holy places. The data of GTD (1989) illustrated that 10,261 buses were in existence in Arafat during 'Annafrah' (departure). This means about 46 percent of these did not belong to the GSC. The third

influence on the operation of GSC buses was pedestrians, those pilgrims who travel by walking between the Holy places. Such factors and others will be further discussed in the following chapters.

Plate 4.2 A fleet of GSC buses transporting pilgrims to Arafat during the Atasaad period via Al-Aziziah street (above), and another type of GSC bus on King Abdulaziz Bridge in Muna (below).

Summary

In Saudi Arabia, the growth of vehicle numbers rapidly increased from 145,000 in 1971 to 4.5 million in 1988. About 55 percent of the total vehicles in Saudi Arabia were private cars while the buses and taxicabs did not exceed 1.5 percent.

In the Hajj region, in terms of vehicular volume during the non-Hajj period, the administrative region of the Holy Makkah is ranked as the highest in the Kingdom (Table 4.5). According to the data of the GDT (1988) the number of vehicles in the Makkah and Madinah region totals 1,199,251. This number represents 60 percent of all vehicles in the Kingdom. About 59 percent of the number of vehicles in the Makkah region were private cars. The next largest category was trucks which make up 39 percent of vehicles. Buses and taxis composed less than 2 percent of the vehicle fleet which means that vehicles of public road transport in the Hajj region form a very low proportion of the overall number of vehicles. Moreover, the statistics of GDT show that between 1983 and 1988, the growth of private cars was 40 percent while public road transport increased by only 30 percent.

Although the annual statistical publications of GDT provide some data about the number of vehicles in the Kingdom, the GDT system of vehicle registration procedures may need to be improved and might include a more disaggregated classification of vehicles, ie. pickups, light trucks, trailers, minibuses and buses etc. In this regard, registration procedures should be structured so as to reflect the distribution of vehicles in the different cities and towns. In 1988, however, Makkah had around 147,458 vehicles which consisted of private vehicles and public road transport modes. The private vehicles which include personal and commercial vehicles as well as the

motor cycle, made up more than 95 percent of the total fleet in Makkah. The greatest proportion of the vehicle fleet was personal cars (84 percent), which included cars, jeeps and stations wagons. In fact, the volume of vehicles in Makkah can be said to be higher because of the size of the city and its smaller road network. It has been found that in 1988 the density of vehicles per road-lane km was 298 vehicles, on the basis that the length of lane of the primary and secondary roads was 495 km (DHC, 1985, V9). Moreover, in 1985, around 78 percent of households owned cars. About 26 percent had more than two cars.

It is, however, very important for the planners and municipality of Makkah to consider the problem of increasing numbers of vehicles as a result of the increase in the number of affluent residents. It may be a good suggestion to introduce rules limiting the number of private cars in Makkah and encouraging people during the Hajj period to use public transport, particularly those who live around the Holy Places (see section 4.3.1.2).

Public transport services in the Hajj region are provided by a paratransit system or by SAPTCO. In the Hajj period in addition to this, the GSC is responsible for transporting external pilgrims. In 1989 more than 38 percent of all vehicles operating within Makkah during the Hajj were jitneys (mini buses); 35,740, more than 90 percent, came from outside Mikkah.

Although there is one public road transport company (SAPTCO) for the whole Kingdom of Saudi Arabia, SAPTCO has faced a constant decline of passenger numbers since 1983 particularly on the non-Hajj services. The high vehicle ownership, high income level and the increasing competition with jitneys are considered to be

the main problems hindering SAPTCO attempts to provide cost effective public transport. In the Hajj of 1988, SAPTCO deployed a total of 1,013 buses providing services between and within cities of the Hajj region. In spite of the company's large fleet of buses, SAPTCO provided only 2 percent of the buses which were made available to GSC for the transportation of pilgrims between the Holy Places. Although the GSC is responsible for the transportation of all air and sea pilgrims within the Hajj region, only 76 percent of those pilgrims were transported to Jeddah by the GSC. Between the Holy Places only 63 percent were served by GSC buses. These pilgrims were carried by 4,763 buses representing 63 percent of all buses available to the transport companies.

This means that in 1989, the demand upon the bus companies was less than the supply. Again the competition provided by the private sector cars available in Makkah can be considered to be one of the main reasons causing this reduction in demand. But issues such as what percentage of pilgrims used different types of vehicles among the patterns of the Hajj movement and in general what the relationship is between mode of transport and patterns of the Hajj movement, may be answered in the next chapter.

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Chapter Five

Analysis of Pilgrim Statistics

5.1. Introduction

Before discussing the pattern of the pilgrim movement in the Hajj region, it is appropriate to examine the international aspect of patterns of such movement with respect to development and geographical distribution.

Official data regarding pilgrims is collated by two departments in Saudi Arabia:

I Department of Nationality and Immigration (D.N.I.)

II Central Department of Statistics (C.D.S.)

The first department is under the aegis of the Ministry of the Interior and it directly records the numbers of pilgrims from abroad coming into the Kingdom of Saudi Arabia by air, sea and land. Passport numbers are recorded immediately at the point of arrival by the immigration department. Similarly, the numbers of visas issued to foreigners are recorded by Saudi Arabian embassies around the world. From these statistics there is a distinction made between people coming for pilgrimage and people coming for work and settlement. Every year the department publishes statistical information on external pilgrims (Al Matari, 1979).

The second department records statistics of pilgrims within the Kingdom. Two methods are employed. The first method is by the creation of checkpoints at all entrances to Makkah near the end of Dul-Eidha's month (almost 15 days before the Hajj), when registration numbers of vehicles and numbers of pilgrims are recorded. Then the number of land pilgrims from abroad is subtracted from their number. The remaining figure is the number of pilgrims coming to Makkah from within the Kingdom.

The second method involves making an estimation of the number of pilgrims that is based on a sample survey of the inhabitants of Makkah. Normally, this is carried out by C.D.S. who question a specific number of households in Makkah City - more than two thousand distributed in all the city - once the Hajj has finished. On the basis of such information, the number of the people from Makkah who performed the last Hajj and the number of those who intend to carry out the coming Hajj, can be estimated (C.D.S. 1980).

C.D.S. collect details and statistics on pilgrims from inside the Kingdom and abroad, tabulate their information and publish it in annual reports. The reports contain the following statistical information:

- General statistics of pilgrims for specific years.
- Statistics of internal pilgrims which are sub-divided into categories of sex, nationality and means of transport to pilgrimage.
- Statistics of external pilgrims which are also sub-divided into categories as above.
- Various statistics of vehicles used in pilgrimage.

As well as this there are other statistics illustrating comparative figures and fluctuations over different years.

What is worth mentioning is that it was not considered necessary to record the number of pilgrims from within the Kingdom until 1970 when the C.D.S. published its first report.

As regards external pilgrims, it is possible to say that the statistics for the latter half of the Hajry century (since 1926) are considered a reliable and accurate source of information only since the establishment of the Saudi Arabian Government. Hitherto statistics were only an approximate estimation compiled by historians at various phases of the Islamic ages.

In addition to this there is the Hajj Research Centre (H.R.C) which occasionally publishes a number of reports, surveys and general statistics concerning various aspects of the Hajj. The centre frequently derives information of general statistical interest from the C.D.S. Its methods will be delineated in due course.

However, this study will concern itself principally with pilgrim statistics that relate to modern times (since the establishment of the Saudi government). Statistics recorded before this time will be used briefly in a comparative way to show how the number of pilgrims has increased. The geographical distribution of pilgrims will be also be discussed and analysed in this chapter.

Finally an attempt to test the principal factors related to the Hajj movement and pilgrim transportation will be developed by computer in this work.

5.2. Development of pilgrim numbers

Ideally, a study of this subject requires analysis of pilgrim numbers in the past during the last Islamic ages i.e. from the first pilgrimage made by the prophet Mohammed over 1400 years ago, right up to the present day in order to perceive the overall, historical pattern of pilgrim numbers. Unfortunately, information regarding the Islamic era is a rare and diminishing resource. There are estimates that exist in books written by travellers and historians who made references to the numbers of pilgrims but they tend to be subjective and based on conjecture. Official records were not in existence at that time; the early governors of Makkah did not feel a need to book or count pilgrims because they neither paid taxes nor had passports.

However, the number of pilgrims who made the first pilgrimage with the prophet Mohammed in 632 has been estimated at approximately 114,000 (Iben Kather, 1966). There is no doubt that pilgrim numbers increased in the Islamic ages that followed the first Hajj. This is because more people converted to Islam and large areas outside the Arabian Peninsula came under the sway of the new Muslim leaders. The historical, political and economic events which affected the Islamic territories throughout successive periods influenced the increase or decrease in the numbers of people making their pilgrimage. The Crusades, for example, which were waged throughout the eastern coast of the Mediterranean during the 11th, 12th and 13th centuries, were the cause of a decline in the number of pilgrims coming from the northern regions of the Arabian Peninsula. Similarly, the Mongolian invasion of Iran, Iraq and Syria in the 13th century may have been the cause of another decline. In contrast, certain years during the same period, e.g. 1279, witnessed an increase in the number of pilgrims. It

has been estimated that the number of Egyptians alone amounted to 40,000 (King, 1972).

The Hajj caravan which usually includes tens of thousands pilgrims was in its heyday during the times of the Ottoman empire. There were three big caravans - Egyptian, Syrian and Iraqian which departed from specific geographical locations such as Cairo, Damascus and Baghdad which served as gathering points for pilgrims from different areas. "P. Boxhall has mentioned that the Egyptian caravan included pilgrims from north, west and central Africa" (Al-Sha'air, 1979). As a result of the negative correlation between wars and insecure conditions in Islamic areas on the one hand, and the numbers of pilgrims on the other, there was a general decline in the numbers of pilgrims from the beginning of the 18th century when the ever-weakening Ottoman Empire entered its last phase. The Ottoman government was too preoccupied with wars in Greece and the Yemen to make passage through the Hajj roads safe and secure. Accordingly, the numbers fell, e.g. the Hajj caravan of Syria was made up of only 5,000 pilgrims in 1814 and less than 1,000 pilgrims in 1853 (Al-Sha'air, 1979).

Although no accurate statistics are available regarding bygone periods, the assertion that pilgrim numbers in general were on the increase despite the many negative factors can still be made and more detailed analyses of official statistics supporting this claim will be dealt with later. As mentioned, the official records of pilgrim numbers began only with the establishment of the Saudi Arabian government and this has been confined to external pilgrims i.e. those who come from outside Saudi Arabia. It was not until 1970 that the records were extended to include internal pilgrims as well. In the light of this, it is useful to subdivide this subject into two

sections : external and internal pilgrims, in order that a clearer and more complete picture of pilgrim movement emerges.

5.2.1 External pilgrims

There is a long series of statistics available on external pilgrims dating back to 1926 and it is convenient to identify two periods : the pre-1970s and the post-1970s.

Table 5.1. Numbers of external pilgrims from 1926 to 1970.

Year of A.H	Year of Grace	No. of piligrims	Percentage + or -
1344	1926	57,957	-
1345	1927	90,662	56.43
1346	1928	96,212	6.12+
1347	1929	90,764	5.66-
1348	1930	81,666	10.02-
1349	1931	39,045	52.19-
1350	1932	29,065	25.56-
1351	1933	20,181	30.56-
1352	1934	25,291	25.32+
1353	1935	33,898	34.03+
1354	1936	33,830	0.20-
1355	1937	49,517	46.37+
1356	1938	76,224	53.93+
1357	1939	59,577	21.83-
1358	1940	32,152	46.03-
1359	1941	9,024	71.93-
1360	1941	23,863	164.43+
1361	1942	24,743	3.68+
1362	1943	62,590	152.96+
1363	1944	37,857	39.51-
1364	1945	37,630	0.60-
1365	1946	61,286	62.86+

Year of A.H	Year of Grace	No. of piligrims	Percentage + or -
1366	1947	55,244	9.85-
1367	1948	75,614	36.86 +
1368	1949	99,069	31.02 +
1369	1950	107,652	8.66 +
1370	1951	100,578	6.57-
1371	1952	148,515	47.66 +
1372	1953	149,841	89.00 +
1373	1954	164,072	9.50 +
1374	1955	232,971	41.99 +
1375	1956	220,722	5.25-
1376	1957	215,575	2.33-
1377	1958	209,197	2.96-
1378	1959	207,171	0.97-
1379	1960	203,369	22.30 +
1380	1961	285,948	12.86 +
1381	1962	216,455	24.30-
1382	1963	199,038	8.04-
1383	1964	266,555	33.92 +
1384	1965	283,319	6.29 +
1385	1966	294,118	3.81 +
1386	1967	316,226	7.51 +
1387	1968	318,507	0.72 +
1386	1969	374,784	17.66 +
1389	1970	406,295	8.40 +

Source: *Ministry of Interior (Passport Affairs) Riyadh.*

Central Department of Statistics, Riyadh.

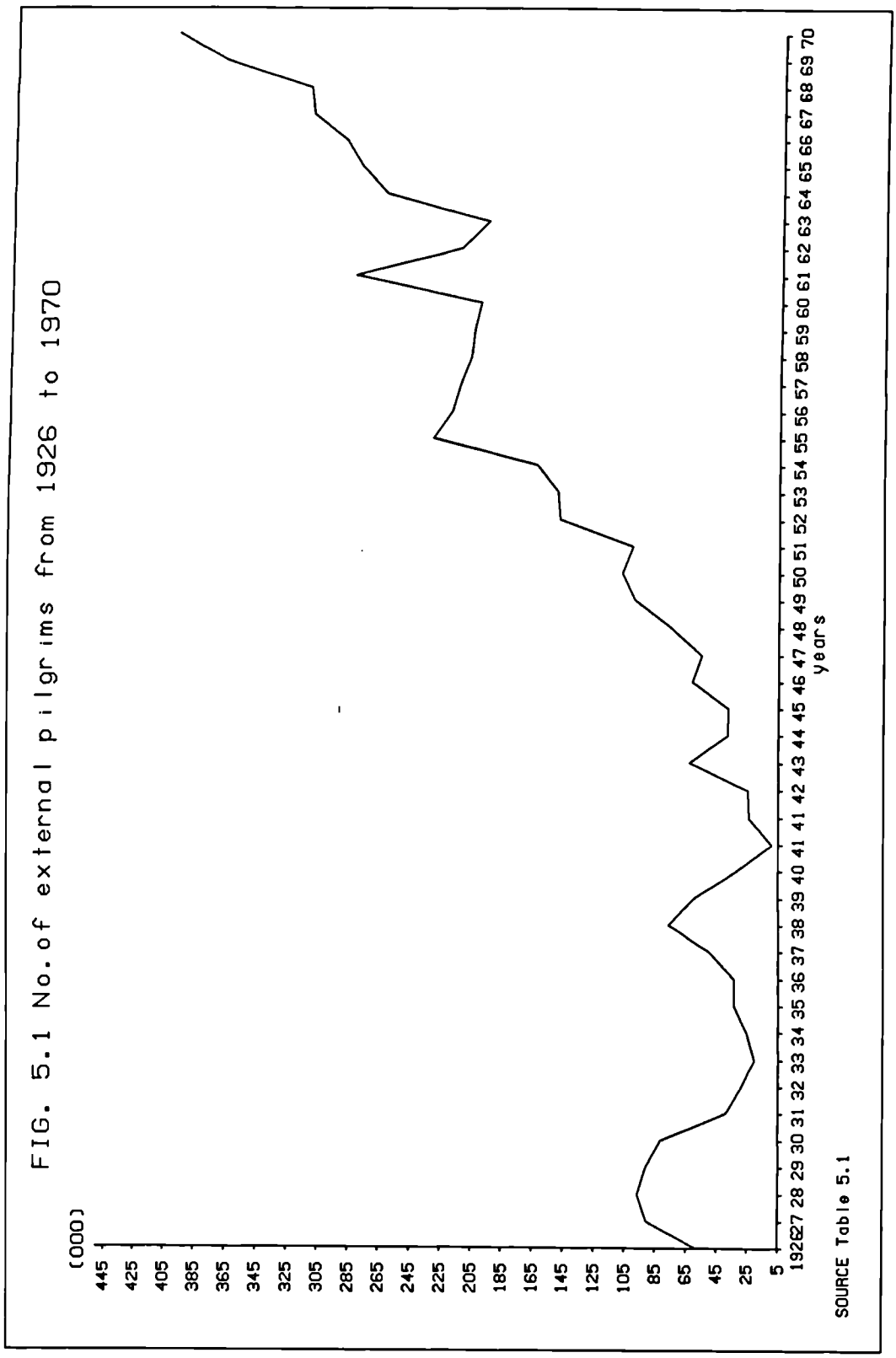
FIG. 5.1 No. of external pilgrims from 1926 to 1970
(000)
445
425
405
385
365
345
325
305
285
265
245
225
205
185
165
145
125
105
85
65
45
25
5
1926 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70
years
SOURCE Table 5.1

5.2.1.1 External pilgrims - pre 1970s

The statistics displayed in Table 5.1 have been contemplated and discussed by several researchers and writers like El Hamdan (1976), Al Sha'ar (1979) and M. Mecci (1981). Most agree that there are many factors causing the increase or decrease in the number of pilgrims and also most of them concurred that projected figures for future pilgrimages are likely to show an increase. Table 5.1 which spans a period of 45 years, includes 46 Hajj seasons because the Greek year is ten days or so longer than the Hajry year. This table shows that when records began in 1926 the number of pilgrims stood at 57,957 and then rose over the next two years to 90,662 and 96,212, only to decrease in 1929 to 90,764, 5.66 percent less than the previous year. However, if the records for 1926-1929 are left to one side for a moment, it is possible to categorise the remaining records in terms of decades : the thirties, forties, fifties and sixties as in Table 5.2 below:

Table 5.2 Mean, standard deviation and coefficient of variation of pilgrim numbers through 45 years

	Category	Arithmetic Mean	Standard deviation	Coefficient of variation
1.	1930-1939 (30s)	44,829	20,233	0.45
2.	1940-1949 (40s)	47,188	25,062	0.53
3.	1950-1959 (50s)	175,629	45,635	0.26
4.	1960-1969 (60s)	275,832	53,382	0.19

From this a clearer analysis and understanding of the development of the numbers of pilgrims can be gained. Thus a study of Tables 5.1, 5.2 and Figure 5.1, reveals:

- that the numbers of pilgrims were generally on the increase as evidenced by the rising of the arithmetic mean for each decade - from 44,829 in the thirties

to 234,329 in the sixties. This occurred despite the fact that many years during the 45 year period had seen a decline in numbers.

- despite peace and security having been well established in the Arabian Peninsula by the Saudi government, the pilgrim numbers were at a low level for most of the 1930s and 1940s. In fact the pilgrimage, was at a high level of 96,212 in 1928, a figure which was not matched or exceeded until 1949 when it reached 99,069. To a great extent, two world-wide crises would account for the above figures i) the Great Depression which followed the stock market collapse of 1929 and persisted to shatter economies throughout the 1930s and ii) the Second World War of 1939-45 (El Hamdan, 1976). The effect of these two crises on pilgrim numbers was very great indeed and can be readily seen in Table 5.2 and Figure 5.1. The worldwide economic crisis was probably responsible for the decline in pilgrim numbers in the 1930s, shown in Figure 5.1 as a declining curve for this particular decade. In a comparable way, the Second World War had a dramatic effect on the number of people making pilgrimages. At the beginning of the 1930s numbers fell to 20,181 in 1933. However, after this, numbers began to increase gradually until war broke out and began to affect pilgrim numbers in an adverse way. In 1941 the number plunged to reach its lowest level of 9,024. Although pilgrim numbers wavered through the war years, overall figures did not reveal a fundamental and sustained increase until the end of the 1940s when the worst effects of war were over.

- numbers for the early years of the 1950s indicated a clear upward turn to reach 232,971 in 1955 and although minor fluctuations took place towards

the end of the decade, negative figures are a small percentage as is illustrated in the Table 5.1.

- in the 1960s numbers have shown a continuous increase, with each year bringing in substantially more pilgrims than the previous year, with the notable exceptions of 1962 and 1963 when they declined sharply to low levels. Such decreases may be attributed to civil war in North Yemen, an area which traditionally contributes a large percentage of pilgrims, and to other political disturbances in various Arabian countries.

5.2.1.2 External pilgrims in the 1970s and 1980s

The seventies and the eighties are considered to be a period of immense increases in the numbers of pilgrims. In addition to the marked increases that characterised these years there are statistics and information related to internal pilgrims which will be discussed later.

When the 1970s is compared with the previous decade it will be found that the arithmetic mean of pilgrim numbers for the former is more than double that of the latter. Whereas the yearly average in the 1970s was 708,801, it reached only 275,832 during the 1960s. Generally, the figures displayed in Table 5.3 illustrate that the number of gains each year exceeded the number of losses and that there were more positive than negative seasons. Even during 'negative' years when a fall in pilgrim numbers has been experienced, figures do not register a loss in excess of 20 percent while in 'positive' years percentages have risen to reach a 51 percent increase or more over the previous year. Figure 5.2 shows that in 1971 the number of external pilgrims stood at less than 250,000 rising dramatically to a peak at 918,777 in 1974. In between,

there was a sudden fall in January 1974, probably as a result of the Arab-Israeli war which began in October 1973. Perhaps many of the people who wanted to make their pilgrimage in 1973 resolved to delay their plans until the war finished. Indeed, this would explain the extraordinary high level of external pilgrims in 1974. After this high point, figures fell to more normal levels of increase for the rest of the 1970s.

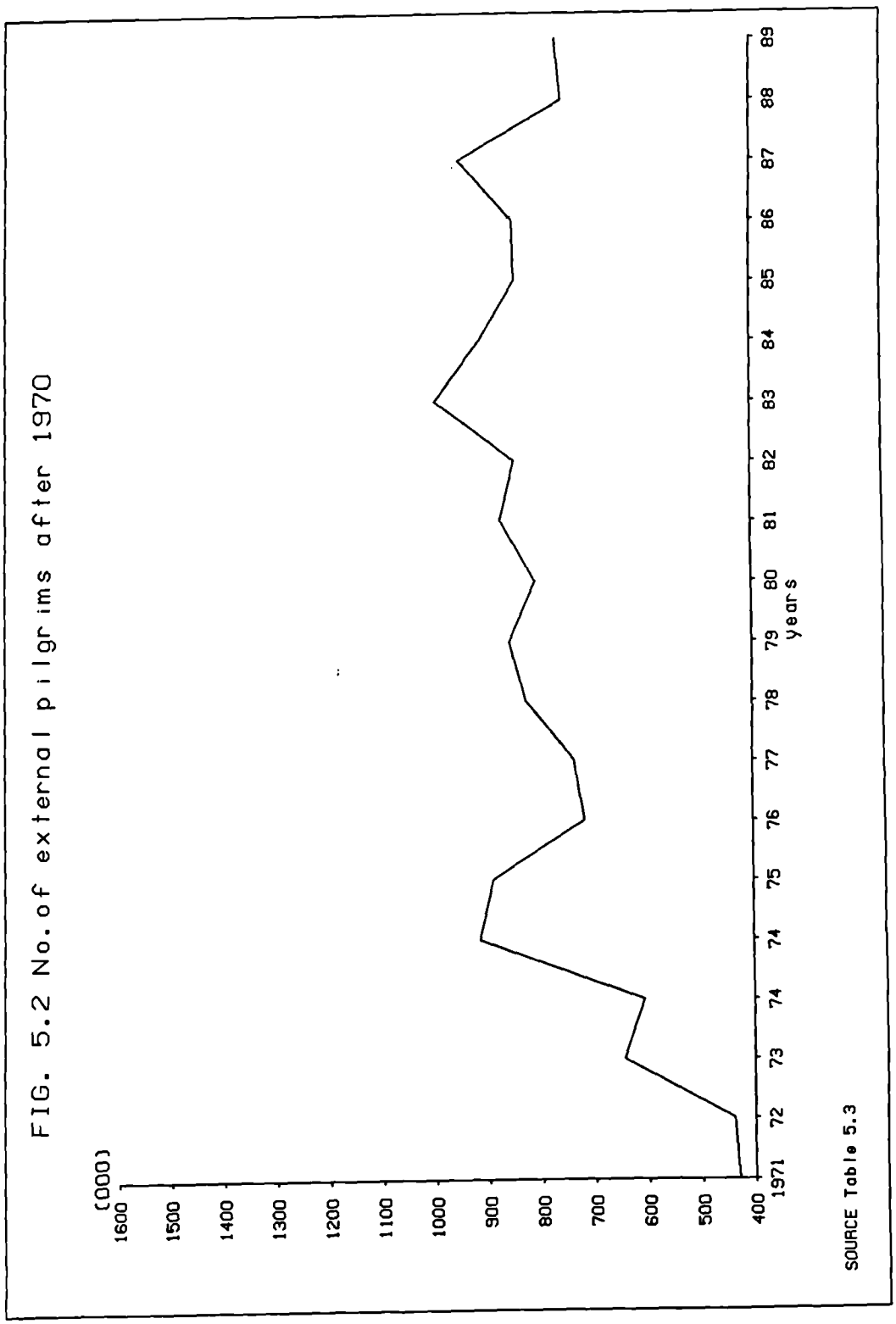
FIG. 5.2 No. of external pilgrims after 1970
(000)
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
1971 72 73 74 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
years
SOURCE Table 5.3

Table 5.3. Numbers of external and internal pilgrims and percentage changes from 1971 to 1989.

Year of A.H.	Year of Grace	No. of external pilgrims	Percentage of change	No. of internal pilgrims	percentage of change	total of pilgrims
1390	1971	431,270	+6.2	648,490	-	1,079,760
1391	1972	439,339	+1.9	562,688	-13.2	-1,042,027
1392	1973	645,182	+34.6	571,769	+1.6	+1,216,951
1393	1974	607,755	-5.8	514,791	-10	-1,122,546
1394	1974	918,777	+51.2	566,198	+10	+1,484,975
1395	1975	894,573	-2.6	663,294	+17	+1,557,867
1396	1976	719,040	-19.6	737,392	+10	1,456,432
1397	1977	739,319	+2.8	888,270	+20.5	+1,727,589
1398	1978	830,236	+12.3	1,069,174	+20.4	1,899,420
1399	1979	862,520	+3.9	1,217,169	+13.8	1,079,689
Yearly mean		708,801		743,923		1,452,724
1400	1980	812,892	-5.8	1,136,742	-6.6	-1,949,634
1401	1981	879,368	+8.2	1,063,812	-6.4	-1,943,180
1402	1982	853,555	-2.9	1,158,000	+8.8	+2,011,555
1403	1983	1,003,911	+17.6	1,497,795	+29.3	+2,501,706
1404	1984	919,671	-8.4	744,807	-50.2	-1,664,478
1405	1985	851,761	-7.4	738,015	-0.9	-1,589,776
1406	1986	856,718	+0.6	743,757	-0.8	+1,600,475
1407	1987	960,386	+12.0	658,938	-11.4	+1,619,324
1408	1988	762,755	-20.5	616,801	-6.4	-1,379,556
1409	1989	774,560	+1.5	692,435	-12.3	+1,466,995
Yearly mean		867,557		905,110		1,772,667

Source: *Central Department of Statistics, Riyadh.*

In 1980 pilgrim numbers decreased by 5.8 percent compared with the previous year, as shown in Table 5.3. Such a decline may be linked to the activities of the Jheman movement whose gunmen assaulted the Holy Mosque in Makkah following the Hajj

of 1979. They claim to acknowledge one of them as a Mahdi (leader of muslims). This movement was duly quelled by Saudi security forces without incurring undue damage on the holy precinct itself. Yet this almost unprecedented attack deterred many from making the journey to Makkah the following year.

Fluctuations have also continued in the eighties, yet this closing decade has yielded some of the highest figures, with an all-time record for 1983, the first and so far only time that the number of external pilgrims has exceeded one million. During the 1983 Hajj season Jeddah International airport received 125 planeloads of pilgrims a day for three weeks (S.A.A. report 1988).

There are many reasons for the great increases in pilgrim numbers during the past two decades; chief among them is an improvement in economic conditions and an increase in per capita income in the oil-producing countries such as Iran, Indonesia, Libya and Nigeria. As well as this, improved and efficient transportation has made it possible for pilgrims from as far away as China, Indonesia or England to arrive in Jeddah within six hours or so by air, while pilgrims from the Middle East can reach the same destination after a 2 or 3 hour flight.

The number of countries from which pilgrims travel has been extended in modern times with the emergence of countries like the United States of America, Australia and Canada where muslims now live in minority groups.

Although war is considered to be a main negative factor influencing the number of pilgrims, generally, the Iran-Iraq war of recent years has not resulted in a major decrease, but on the contrary has resulted the highest level recorded in 1983, as

mentioned previously. This would suggest that the religious fervour generated by the Iran-Iraq conflict has had a profound influence on the numbers of pilgrims.

Another factor to bear in mind is the increase in the population of the Islamic world. It is generally recognised that there is a direct relationship between the increase of population mobility and the increase of population in specific areas. In this context, the pilgrimage is best considered as a form of population mobility which may be termed religious tourism. Therefore the increase of pilgrim numbers is a result of population rises in Islamic countries.

Finally, the development of sophisticated communication techniques which facilitated the broadcasting of the sights and sounds of the Hajj to the whole world may be said to have awakened in many the desire to perform the Hajj, thereby increasing numbers.

However, Figure 5.2 and Table 5.3 show that numbers fell sharply after 1983 and, with the exception of 1987 when figures rose 12 per cent above the previous year, continued to decrease until 1988 when the lowest number of external pilgrims for ten years was registered.

This suggests that the number of pilgrims has been affected in an adverse way by certain elements and factors. Prime amongst these would be the cost of living and its subsequent effect on the financing of a pilgrimage during the Hajj. A secondary factor was the adoption by many Islamic countries of a policy which imposed limits on the numbers of pilgrims. Finally, a significant factor was the decision made by the Saudi Arabian government to limit pilgrim numbers by allocating specific percentages for those countries sending pilgrims to Makkah following the events of August 1987 when

clashes between Shi'ite muslims and Saudi Arabian police resulted in over four hundred deaths. Percentages were based on the population of the feeder countries and this decision was ratified by a conference attended by the relevant Islamic countries. For every million muslims, one thousand pilgrims would be allowed entry. (Observer, 21.3.88). Consequently, numbers fell steeply in 1988 as is illustrated by Figure 5.2, despite the slight increase in 1989. Nevertheless, the arithmetic mean of pilgrim numbers throughout the 1980s rose 22 percent over the 1970s mean. (see Table 5.3).

5.2.2 Internal pilgrims

As indicated above, the record of pilgrims coming from inside Saudi Arabia had started only in 1971 when 648,490 were registered as internal pilgrims, 62 percent of which were Saudi and the remaining were non-Saudi. Generally the number of internal pilgrims made up about half the volume of the total pilgrim numbers performing the Hajj. However, in recent years, this number has declined relative to external pilgrims, as will be explained below (see Table 5.3).

Some researchers have suggested that when the 'wakfah' or 'standing in Arafat' falls on a Friday, the number of pilgrims increases. This is because, from a religious point of view, a Friday pilgrimage is thought to be doubly rewarded. The British firm of planning consultants, Robert Matthew, Johnson and Marshall said in its report on the pilgrimage of 1971 (A.H. 1390) "In 1390 A.H. the 9th Dhal-Hyjah fell on Friday, thus making it a very favourable year to make the Hadj" (R. Matthew, et al, report 1972). Thus it is possible to ascribe the increased number of internal pilgrims in 1971 to the fact that the Wakfah was on a Friday. Figure 5.3 shows that although numbers

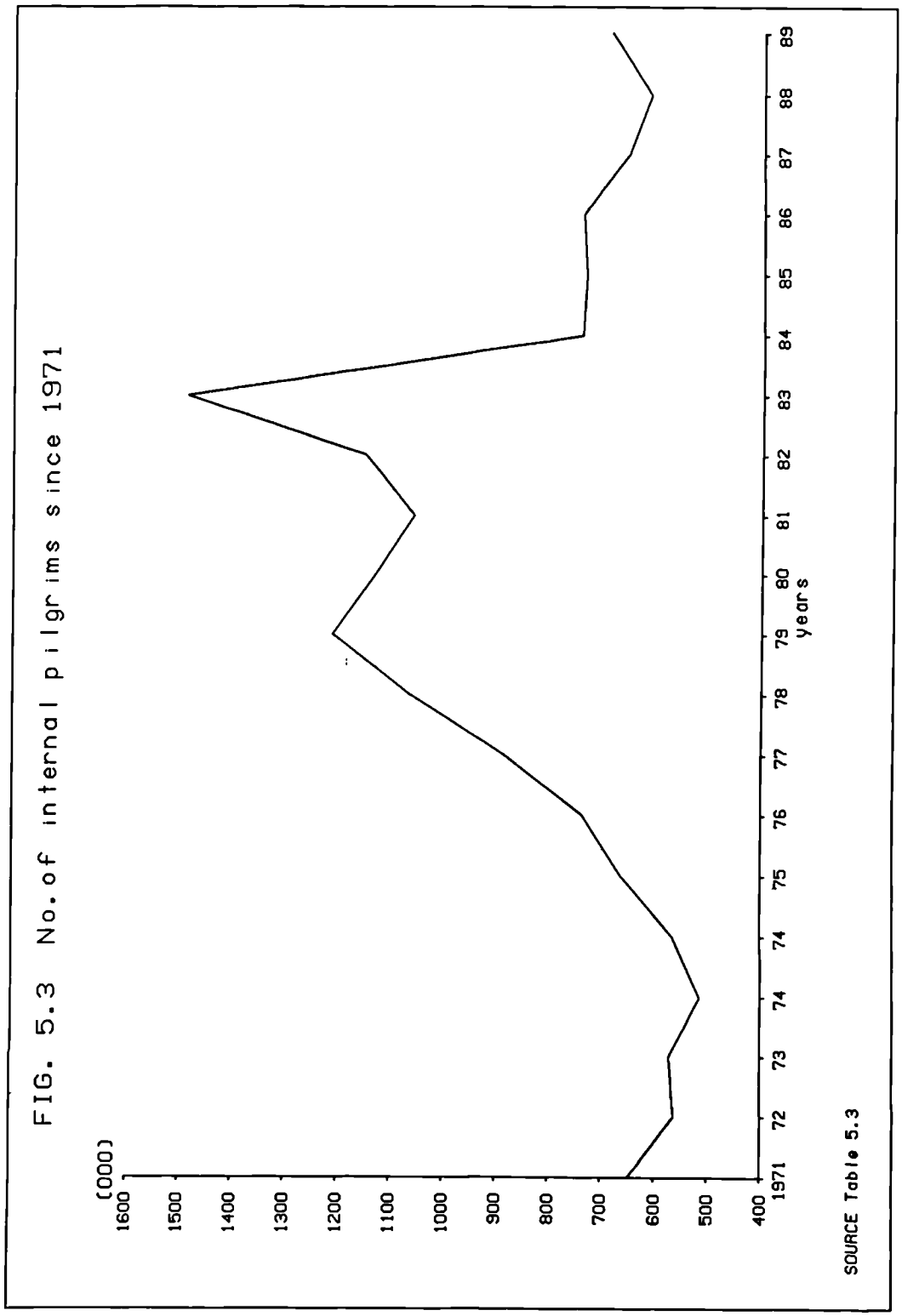
FIG. 5.3 No. of internal pilgrims since 1971
(000)
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
1971 72 73 74 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
years
SOURCE Table 5.3

increased in 1971 they fell into a relative decline over the following three years thereafter, continuing to grow until 1979 when the highest level for the 1970s was recorded only to fall off sharply at the beginning of the 1980s. This decline may be attributable to the aforementioned Jeheman movement and the restrictions placed on small vehicles entering Makkah which were first applied in 1980. Because the Hajj of 1983 took place on a Friday, numbers jumped to reach their highest point since statistical records for internal pilgrims began in 1971. This increase is considered to be a record for the number of pilgrims coming from Saudi Arabia only.

In fact the majority of this number (1,204.833) were classified as foreign residents. About 80.4 per cent of the total number of internal pilgrims were non-Saudis in 1983. Such a pattern started to make itself clear after 1974. As can be seen in Table 5.4 Saudis had constituted a majority of internal pilgrims before Hajj 1975 when their share steadily declined to 19.6 per cent of Hajj 1983. One explanation for this is that "expatriate workers have shown a significantly higher propensity to perform the Hajj than the local population in any particular year" (D.H.C. 1983). Many muslims working in Saudi Arabia and the Gulf States take the first opportunity available to perform the Hajj and they frequently sponsor their parents and relatives to do so as well. So internal pilgrims were greater in number than external pilgrim in the years leading up to 1984 and this is borne out by Figure 5.4. In the Hajj of 1983, for example, internal pilgrims represented 59.9 per cent of the 2,501,555 people who attended, whereas external pilgrims accounted for only 40.1 per cent of the total figure.

Largely as a result of the considerable increase among internal pilgrims in the early 1980s the Saudi government decided to reduce their numbers after the Hajj of 1983. In order to control numbers, a foreign resident is allowed to carry out his Hajj duties

on only one occasion unless he is in the company of his parents or family members who have not already performed their Hajj. This decision was implemented by a police checkpoint system which stamped the registration books of foreign workers who had performed the Hajj. As a direct consequence of this system the number of internal pilgrims fell steeply from 1.4 million in 1983 to only 744,807 in 1984, a reduction of more than 50 percent, (see Figure 5.3). Despite this restriction placed on foreign workers resident in Saudi Arabia the number of non-Saudi pilgrims still represented the majority of all internal pilgrims as is illustrated by Table 5.4.

It is important to note that climatic conditions in Makkah may be considered another factor affecting the number of pilgrims going to the Hajj. Makkah is located in an area that is well known for high summer temperatures around 40°C. which contrast with winter temperatures that range between 29°C and 12.5°C. Not surprisingly it is thought that the number of pilgrims rises when the Hajj takes place in winter and that they fall when the Hajj occurs in summer. Although this point cannot be said to be a determining influence, it remains nevertheless to be one more factor affecting the fluctuations in pilgrim numbers. The sudden decrease in the number of internal pilgrims after 1983 occurred at a time when the Hajj fell during a period of hot weather as can be seen in Figures 5.3 and 5.4. It is believed that Saudis who perform the Hajj many times, in particular are prone to delay the Hajj because of hot weather conditions. An anecdote about a Saudi who had carried out the Hajj many times before 1983 serves to illustrate this point. When asked why he had not done it since 1983 he replied, "because of the hot seasons". Accordingly, Figure 5.4 reveals that the number of internal pilgrims after 1984 was lower than the number of external figures which

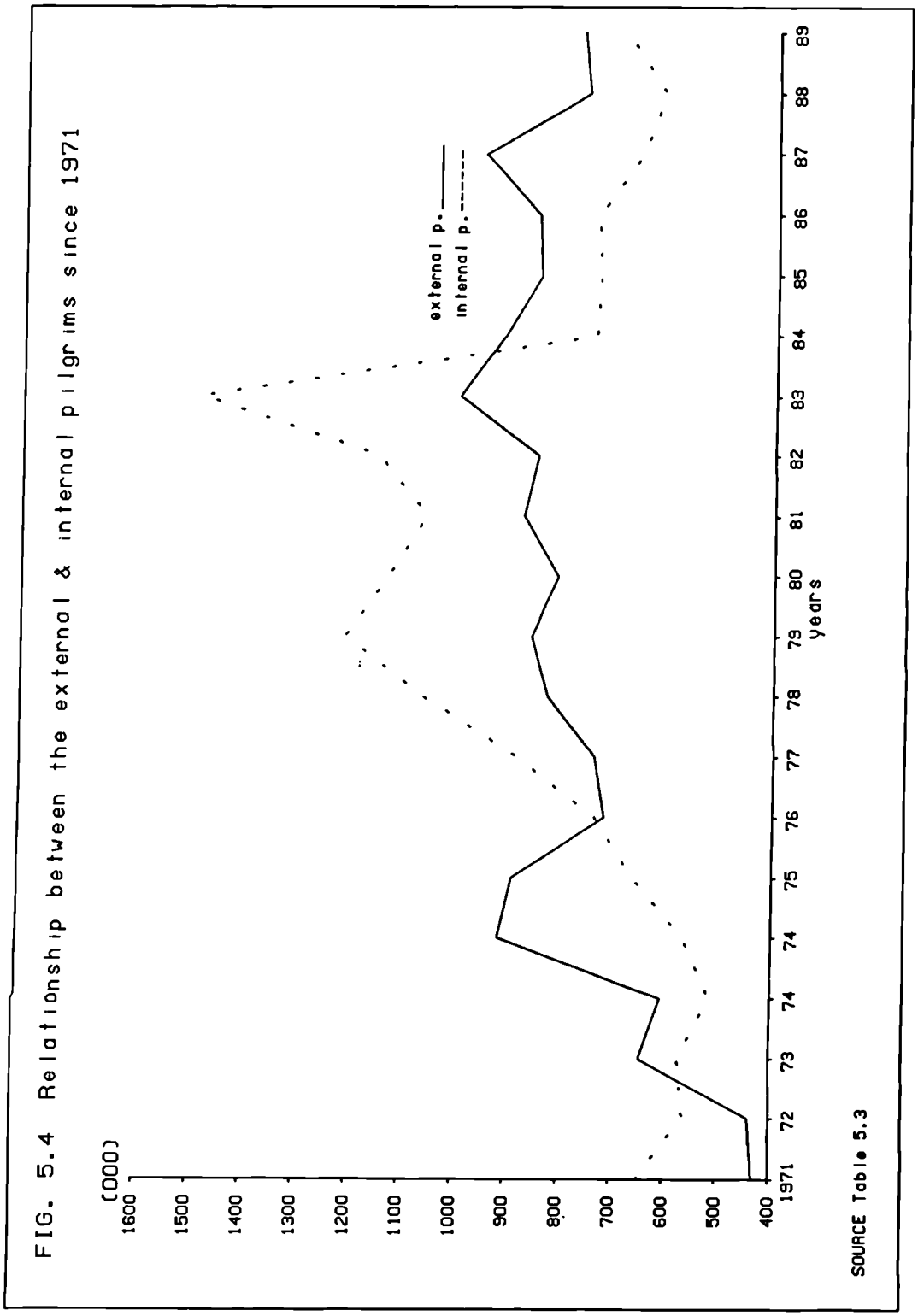
FIG. 5.4 Relationship between the external & internal pilgrims since 1971
(000)
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
external p.
internal p.
1971 72 73 74 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
years
SOURCE Table 5.3

would tend to imply that climatic factors seem to affect internal pilgrims more so than external pilgrims.

Table 5.4. Number and percentage of non-Saudi and Saudi pilgrims from inside the kingdom (1971 - 1987)

Year A.H.	Year A.D.	No. of Saudi pilgrims	Percentage	No. of non-Saudi pilgrims	Percentage
1390	1971	404,186	62.3	244,304	37.7
1391	1972	353,480	62.8	209,208	37.2
1392	1973	352,955	71.7	218,814	38.3
1393	1974	309,853	71.2	204,938	39.8
1394	1974	322,761	57.0	243,437	43.0
1395	1975	306,159	46.2	357,135	53.8
1396	1976	302,303	41.0	435,089	59.0
1397	1977	392,129	44.1	496,141	55.9
1398	1978	400,179	37.4	669,005	62.6
1399	1979	344,757	28.3	872,412	71.7
1400	1980	292,276	25.7	844,466	74.3
1401	1981	224,299	21.1	839,513	78.9
1402	1982	238,985	20.6	919,015	79.4
1403	1983	292,962	19.6	1,204,833	80.4
1404	1984	218,589	29.3	526,218	70.7
1405	1985	252,185	34.2	485,830	65.8
1406	1986	239,207	32.2	504,550	67.8
1407	1987	270,581	41.1	388,357	58.9

Source: *Central Department of Statistics, Riyadh.*

In sum the total number of pilgrims depends upon the factors that affect the volume and situation of both external and internal pilgrims. Although several negative factors have caused the total number to fall from more than 2.5 million in 1983 to only 1.4 million in 1988, the positive factors may prevail on occasions and so numbers increase

again. In any case the problems associated with the movement of pilgrims still requires study, concern and improvement.

5.3. Geographical distribution of pilgrims

5.3.1 Introduction

This study aims to make clearer the number of pilgrims from different countries and their involvement in the Hajj movement. This information will specify the nationalities and countries which make up the largest percentage which may affect various aspects of the Hajj; management of movement, transport, traffic, organisation and so on. Awareness of this is very important for those who plan and organise the Hajj.

Although Hajj rites are uniform for all pilgrims as decreed by Islamic rule, certain variation can be observed between pilgrims originating from different Islamic countries regarding the method and organisation of travel to Makkah or Madinah. For example, pilgrims from Iran, the northern regions of the Arabian peninsula and North Africa usually carry out a visit to Madinah before the Hajj, i.e. before travelling to Makkah. On the other hand, pilgrims from the Arabian peninsula, Somalia and mid-west Africa quite often make the trip to Madinah after the Hajj. In addition, most internal pilgrims, Saudis in particular, have been accustomed to going to Makkah three days or less before the Hajj takes place and some probably go to Makkah in the day of Wakfah (first day of the Hajj) without needing a guide, while external pilgrims go to the Hajj as early as possible, in some cases a month before the Wakfah. They often have made arrangements for a guide to secure accommodation, transportation and perhaps food.

Such various characteristics are reflected in the management of the Hajj and the movement of transport in particular. This imposes on the authorities a responsibility to consider the multifarious aspects of the Hajj and plan accordingly.

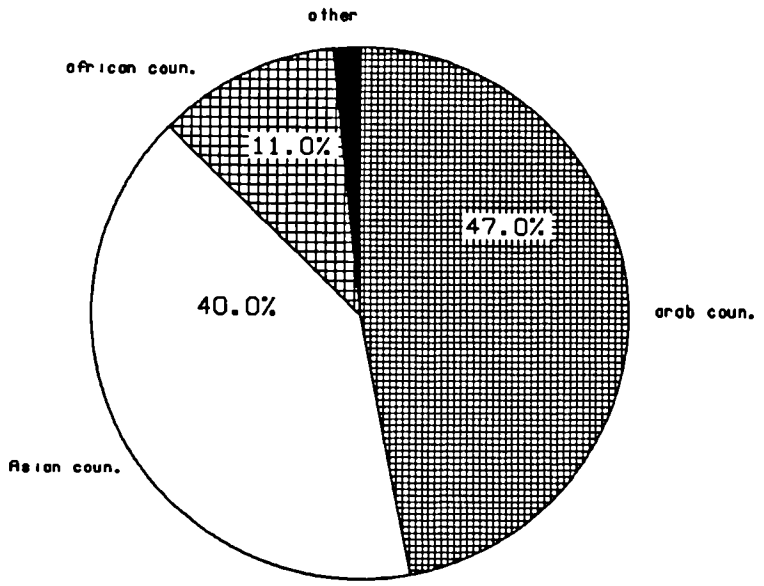

Fig.5.5 Geographical distribution of external pilgrims by yearly mean: 1971-87

source Tabl 5.5

An examination of the distribution of pilgrimage and the nationalities involved may also help in the process of predicting future trends. This in turn necessitates an understanding of the conditions and the factors controlling an increase or a decrease amongst pilgrims from different countries.

Table 5.5. Geographical distribution of external pilgrims over a total of eighteen years (1971 - 1987) showing arithmetic mean and percentage.

Nationality	total from 1971 to 1987	Arithmetic mean	% of external pilgrims	% of all pilgrims
Arab Countries	6,578,979	365,499	47	24
Non-Arab Asian countries	5,655,206	314,178	40	22.7
Non-Arab African countries	1,540,211	85,567	11	5.4
European countries	75,562	4,209	0.5	0.3
American countries	14,244	791	0.1	-
Australian	1,710	95	-*	-
Others	923,116	8,031	1.4	-
Total	14,789,028	778,370	100	-
* less than 0.02				

Source: *Ministry of interior (Passport Affairs).*

2. *Central department of statistics (statistical year book), 1971 - 1987.*

Study of this topic will be confined to an analysis of the 1970s up until the late 1980s i.e. from 1971 to 1987, a period that covers eighteen Hajj seasons. The distribution of external pilgrims may be categorised as follows: Arabic countries, non-Arab Asian countries and non-Arab African countries. These are the main areas from which external pilgrims come (see Table 5.5 and Figure 5.4.) to add to the numbers of internal pilgrims from within Saudi Arabia.

5.3.2 Pilgrims from Arabic countries

This group constitutes a quarter of the total number of pilgrims and accounts for half the total number of external pilgrims as in Table 5.5. The total number of pilgrims coming from Arab countries over 18 Hajj seasons (1971-1987) amounts to more than 6 million and results in an arithmetic mean of 365,499. This group represents 24 percent of all pilgrims or 47 percent of all external pilgrims. This means that Arab pilgrims in Asia and Africa make up a substantial percentage of external pilgrims.

According to statistics referring to relative change, the number of pilgrims in the above category has doubled during the period 1971-87 (see Table 5.6) but it can be seen in Figure 5.5 that there have been fundamental fluctuations revealing large gaps between increases and decreases. This would tend to suggest that the numbers of Arab pilgrims are subject to and affected by a range of factors influencing their total number. The high level of pilgrims from Arabic countries in December 1974 was a direct result of limitations and constraints imposed upon movement by the Arab-Israeli War of 1973. With the ending of the war their numbers increased significantly to 471,620 only to fall into a relative decline over the next few years before picking up again during the latter part of the 1970s when numbers increased to reach a peak of 513,231 in 1979. Then at the beginning of the 1980s numbers fell once more, probably because of the Jeherman movement referred to earlier and the Iran-Iraq War. In 1983 figures jumped to a level of 508,785 which might be attributable to the season falling on a Friday. However, it decreased again during 1984 and 1985 to reach the lowest level for ten years in 1986. Perhaps the restrictions which have been imposed by some Arabic countries which face difficulties in finding hard currency may account for this, together with the increased cost of the Hajj nowadays with

particular regard to accommodation and services in the Hajj region. Nevertheless in 1987 the number of pilgrims coming from Arab countries returned to increase to a level of 401,079 which tends to imply that numbers of pilgrims relating to this group are subject to annual fluctuations.

Table 5.6. Number of pilgrims from Arab countries over a period of eighteen years (1971 - 1987)

Year A.H.	Year of Grace	Pilgrims from Arabic countries	Percentage of total	Percentage of external pilgrims	Relative change
1390	1971	210,397	19.5	48.8	1.-
1391	1972	261,966	25.1	54.7	1.25
1392	1973	323,846	26.6	50.2	1.54
1393	1974	286,715	25.5	47.2	1.36
1394	1974	471,620	31.8	51.3	2.24
1395	1975	411,088	26.4	50.0	1.90
1396	1976	337,226	23.2	46.9	1.60
1397	1977	350,113	21.5	47.4	1.66
1398	1978	478,918	25.2	57.7	2.28
1399	1979	513,231	24.7	59.5	2.44
1400	1980	441,901	22.7	54.4	2.10
1401	1981	418,206	21.5	47.6	2.0
1402	1982	396,882	19.7	46.5	1.9
1403	1983	508,785	20.3	50.7	2.42
1404	1984	441,017	26.5	48.0	2.10
1405	1985	382,977	24.1	45.0	1.82
1406	1986	344,090	21.5	40.0	1.63
1407	1987	401,079	24.8	41.8	1.91
Yearly mean		365,499	24	47	

Source: *Central Department of Statistics, Riyadh.*

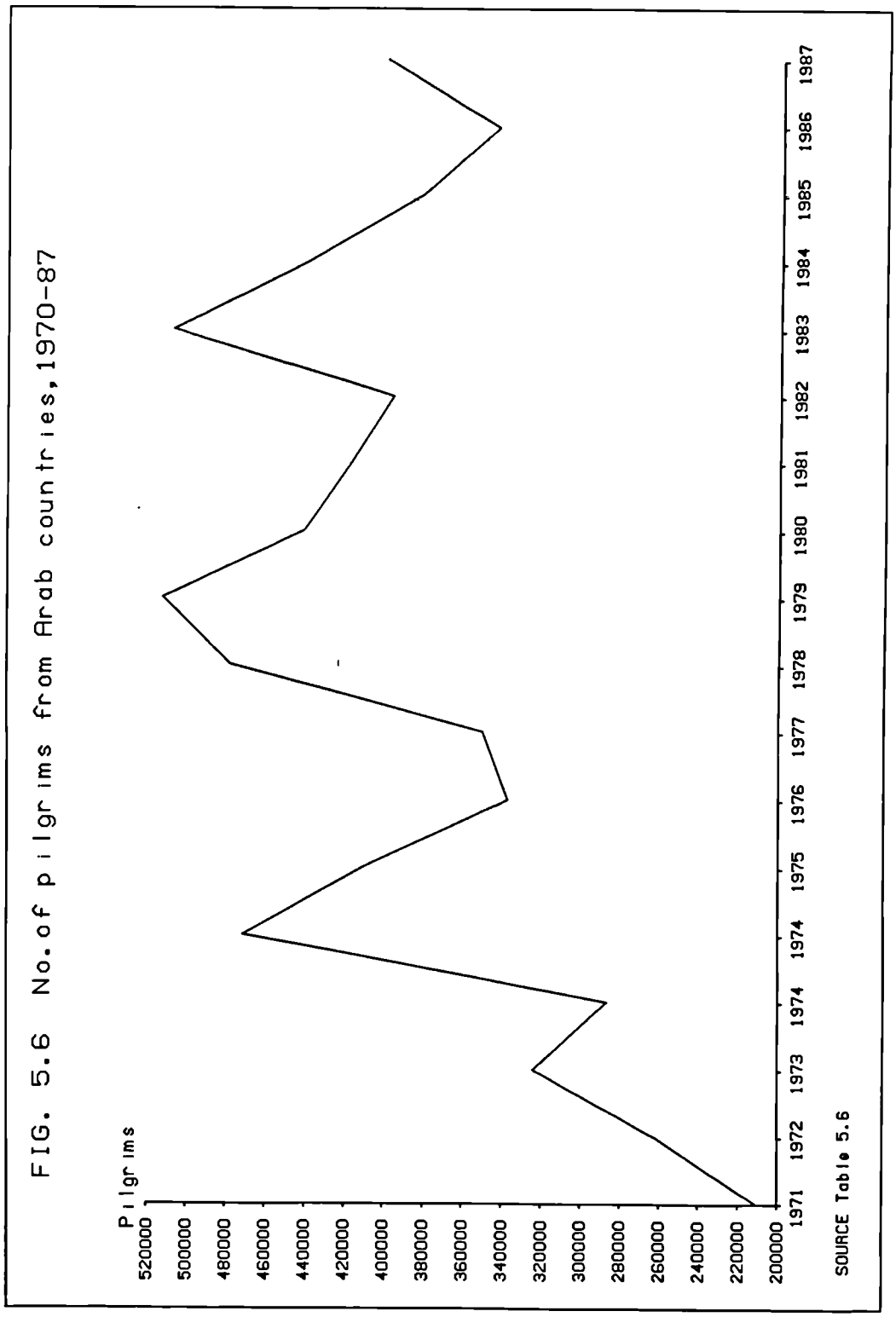
FIG. 5.6 No. of pilgrims from Arab countries, 1970-87
Pilgrims
520000
500000
480000
460000
440000
420000
400000
380000
360000
340000
320000
300000
280000
260000
240000
220000
200000
1971
1972
1973
1974
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
SOURCE Table 5.6

Although the percentages of pilgrims coming from the Arab regions of Asia and Africa were comparable, broadly speaking the numbers from Asia were in general higher than those from Africa. Over an eighteen Hajj season (1971-1987), pilgrims from Asia represented a figure of 3,651,333 or 55.5 percent of Arab pilgrims, whereas pilgrims from the African part totalled 2,927,646 or 44.5 percent. The significance of the numbers contributed by Asian countries can be more fully appreciated when one considers that Arab muslims in Asia constitute only 26 percent of all Arab muslims in contrast to the 83 percent of Arab muslims who live in Africa (Asmail, 1979). Such a phenomenon may be explained to some extent by the proximity of Arab muslims to Saudi Arabia and the lower cost of transport involved in travelling from one place to the other. Pilgrims from the Asian part have the advantage of air, sea and land transport, unlike pilgrims from the African part who can travel only by air or sea, land transport being difficult after the establishment of the State of Israel. This means that distance and mode of transport both play a significant role regarding pilgrim numbers. One must also bear in mind the relatively higher standard of living enjoyed by Asian Arabs vis-a-vis that of Arabs living in Africa.

The main reason for an increase of the Asian part refers to the North Yemen which had first position among Arabic States in terms of total pilgrim numbers, mean and percentage figures, see Table 5.7 and Figure 5.7. The percentage of pilgrims contributed by North Yemen ranged from 12 percent to 15 percent of all external pilgrims and around 19 percent of pilgrims from Arabic states. The mean figure for its pilgrims was 73,610 for the 1971-1987 period. In other words one fifth of Arab pilgrims came from North Yemen. One may attribute such an increase to many elements, a prime example being the relatively short distances involved which enables many of the

pilgrims from this country to travel overland and make use of existing and reliable modes of transport. In 1984 it was estimated that 68 percent of the North Yemen pilgrims had arrived in Makkah by land (C.D.S. 1984). In addition to that, the journey to the Hajj served two purposes from the point of view of Yemeni pilgrims, who look upon the Hajj season as an opportunity to work and to worship. North Yemenis, like pilgrims from the Gulf States, forego the taxes levied on external pilgrims. As foreign workers they are recruited according to free market principles and enjoy the distinction of being the only alien residents who can work in Saudi Arabia without having to undergo the process of a 'Saudi Visa-guarantor' (Beaüge, et al 1981). Another factor to consider is that the large number of Yemeni residents who used to live in Saudi Arabia tended to stimulate movement from their homelands so that families and relatives can be re-united and attend the Hajj together.

Egypt is ranked second in terms of mean pilgrim numbers coming from Arabic countries. The mean figure was 65,010 for the years 1971-1987, accounting for 3.2 percent of external pilgrims and 16.7 percent of Arab pilgrims who come from outside Saudi Arabia. Since 1984 Egypt has started to look like a contender for first place when its share of the number of pilgrims stood at 133,071 as opposed to a figure of 65,279 produced by the North Yemen which only the year before had accounted for 110,473 (C.D.S. 1983). The drop in numbers coming from North Yemen is probably connected with restrictions placed on small cars entering Makkah which were imposed at the beginning of the 1980's. In 1982, according to C.D.S. data, more than 80 percent of Yemeni pilgrims came to Makkah overland, most of whom travelled by small private cars.

Egypt's increased contribution is most likely a result of its growing population which is presently over 50 million (United Nations, 1986). It is interesting to note however, that Egypt's participation in the Hajj is quite small when judged against its population. In 1986, for instance, the number of pilgrims coming from Egypt represented just 2.2 per thousand of its total Muslim population (around 45.6 m. in 1986) whereas the number of pilgrims from the N. Yemen represented 4.7 per thousand of the total number of Muslims in that country (9,274,173 in 1986).

Iraq occupied third place in terms of Arab pilgrims after N. Yemen and Egypt. This country contributed 9.6 percent of the yearly mean of Arab pilgrims coming to Saudi Arabia where the mean of its share was 37,175. In recent years the movement of pilgrims from Iraq has been adversely affected by the Iran-Iraq war, particularly since 1981. Thus its share in 1986 had decreased to 60 percent of the yearly mean as in Table 5.7, to be only 14,551.

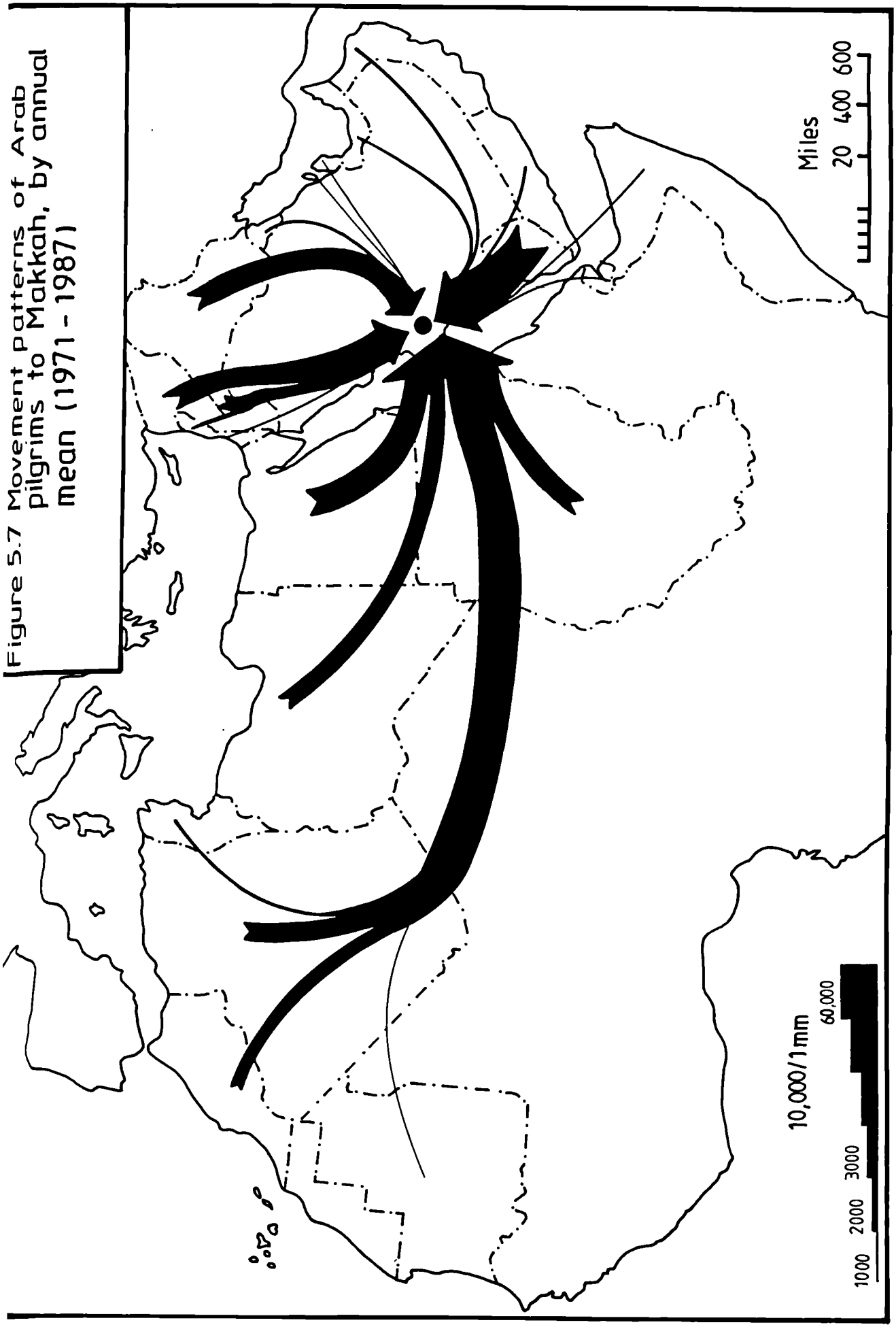

Figure 5.7 Movement patterns of Arab pilgrims to Makkah, by annual mean (1971-1987)

Table 5.7. Distribution of Arab pilgrims according to country of origin over a period of eighteen years (1971 - 1987).

Grade	Country	Total Pilgrim No. 1971 - 1987	Mean	Percentage
1	North Yemen	1,251,381	73,610	18.9
2	Egypt	1,105,179	65,010	16.7
3	Iraq	631,978	37,175	9.6
4	Syria	538,150	31,656	8.1
5	Algeria	538,150	31,656	8.1
6	Sudan	504,540	29,678	7.6
7	Libya	452,182	26,598	6.8
8	Morocco	356,781	20,987	5.4
9	Jordan	353,795	20,811	5.3
10	Tunisia	144,325	8,490	2.2
11	South Yemen	132,783	7,810	2.0
12	Kuwait	115,581	6,798	1.7
13	Lebanon	104,788	6,164	1.7
14	Oman	96,674	5,686	1.5
15	Somalia	78,867	4,639	1.2
16	U.A. Emirates	71,248	4,191	1.1
17	Palestine	48,860	2,874	0.7
18	Bahrain	45,276	2,663	0.6
19	Mauritania	19,972	1,174	0.3
20	Qatar	19,096	1,1123	0.3
21	Djibouti	7,653	450	0.1
	total	6,614,975	389,116	100

Source: *Central department of statistics, Riyadh*

Syria and Algeria vie with one another for fourth place and have done so especially in the latter years of the 1971-1987 period. Each one contributed 8.1 percent where their shares were 31,656 for Syria and 31,521 for Algeria. As has happened with

respect to Iraq, in much the same way pilgrim numbers from Syria have fallen probably owing to political troubles, so that in 1986 the number of pilgrims had decreased to 50 percent of the yearly mean of Syrian pilgrims.

The remaining rank order of the ten primary Arabic countries is as follows : Sudan in sixth place with a yearly mean of 29,678; Libya in seventh place (26,598); Morocco eighth (20,987); Jordan ninth (20,811); and Tunisia tenth (8,490), see Figure 5.7.

As for the rest of the Arab countries shown in Table 5.7 their share of the total mean of Arab pilgrims for 1971-1987 does not exceed 2 percent; these countries being characterised by small populations as in the Gulf States, a lower standard of living such as exists in Somalia, Djibouti and Mauritania, or else they are subject to specific political conditions as in the case of Palestine and the Lebanon.

5.3.3 Pilgrims from non-Arab Asian countries (N.A.A.C.)

For the years 1971-1987 pilgrims from non-Arab Asian countries amounted to 5,655,206 with a yearly mean of 266,770. They represent 17 percent of all pilgrims or 40 percent of those people who come from outside Saudi Arabia. In all, pilgrims from N.A.A.C. make up more than a third of the total number of external pilgrims. Generally, they lie in second position after the pilgrims from Arab countries in terms of the number of pilgrims travelling abroad to attend the Hajj. Their number is distributed between those countries which have a majority of Islamic people such as Pakistan, Iran, Turkey, Indonesia, Bangladesh and Afghanistan and those countries in which Muslims are in a minority like India, the Phillipines and Thailand.

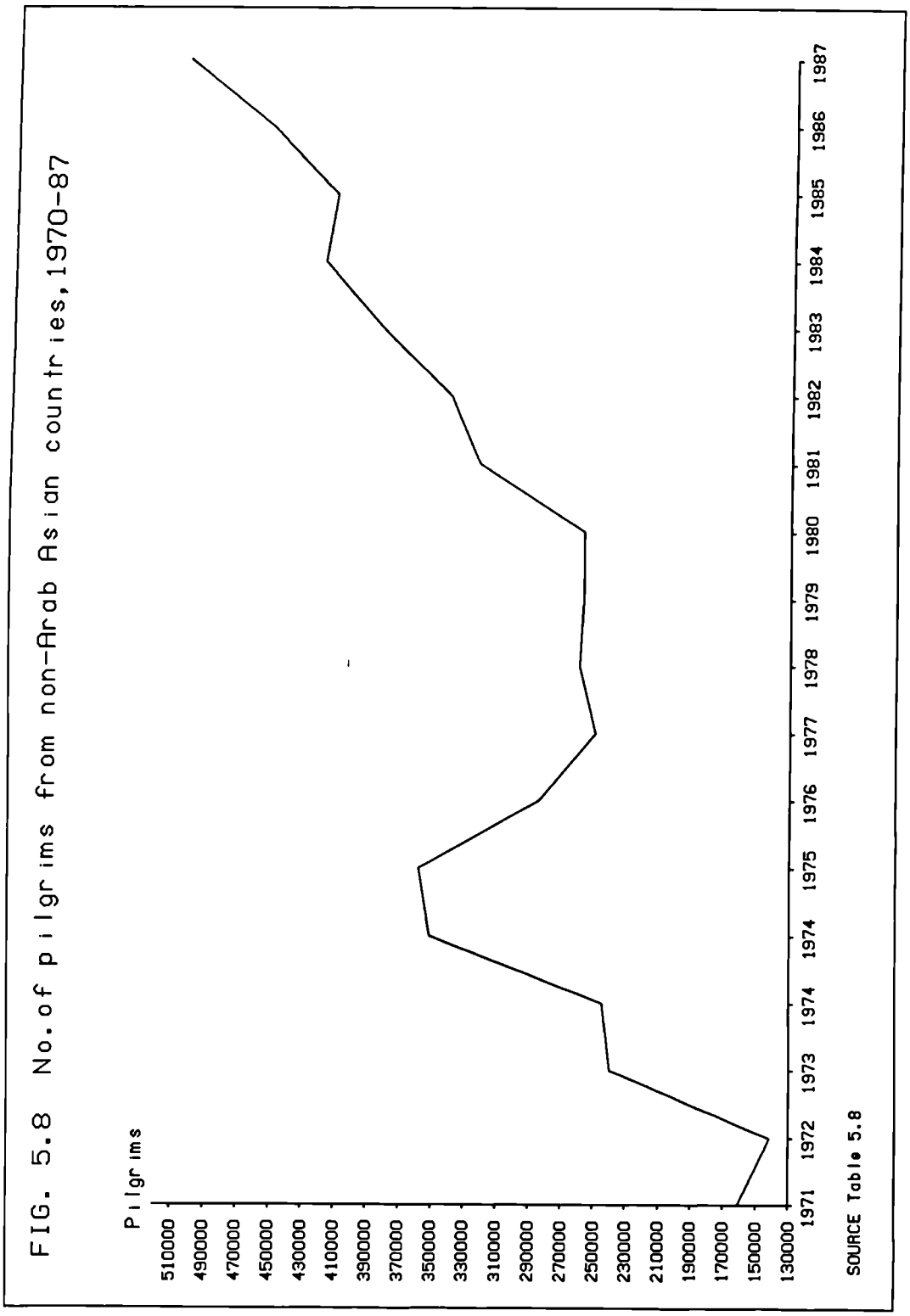
FIG. 5.8 No. of pilgrims from non-Arab Asian countries, 1970-87
Pilgrims
510000
490000
470000
450000
430000
410000
390000
370000
350000
330000
310000
290000
270000
250000
230000
210000
190000
170000
150000
130000
1971
1972
1973
1974
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
SOURCE Table 5.8

Table 5.8. Number of pilgrims, from non-Arab Asian countries showing percentages of external pilgrims and the total number of pilgrims 1971 - 1987.

Year A.H.	Year of Grace	Number of pilgrims	Percentage of total	Percentage of external pilgrims	Relative change
1390	1971	161,045	14.9	37.3	1.0
1391	1972	141,622	13.6	29.5	0.89
1392	1973	240,272	19.7	37.2	1.49
1393	1974	244,450	21.8	40.2	1.52
1394	1974	351,690	23.7	38.3	2.18
1395	1975	358,433	23.0	40.0	2.33
1396	1976	284,562	19.5	39.6	1.77
1397	1977	249,884	15.4	33.8	1.55
1398	1978	260,066	13.7	31.3	1.61
1399	1979	257,592	12.4	29.9	1.60
1400	1980	257,792	13.1	31.7	1.59
1401	1981	322,621	16.6	36.7	2.0
1402	1982	341,159	17.0	40.-	2.12
1403	1983	384,940	15.4	38.3	2.39
1404	1984	421,405	25.3	45.8	2.61
1405	1985	414,811	29.1	48.7	2.58
1406	1986	454,994	28.4	53.1	2.85
1407	1987	508,368	31.4	52.9	3.15
Yearly mean		314,178	20	40	-

Source: *Central department of statistics, Riyadh.*

The relative change calculated for 1971-87 (see Table 5.8) reveals that their number has trebled over the course of the 18 Hajj seasons. For instance, in 1971 the relative change index stood at 1.0 while in 1985 this had increased to reach 2.58. Although numbers dipped in 1976 and 1977 as in Figure 5.8 the general trend was one of increase in the 1980s when an index of 3.15 was recorded in 1987. This increase can

be attributed to the sudden rise in Iranian pilgrims after the Iranian Revolution in 1979 when its share increased to 152,149 which was a rise of 70 percent over the previous year. As well as this, Pakistan has been noted for its increased share in recent years.

As can be seen in Figure 5.9, four main countries dominate this group in terms of mean figures and pilgrim numbers: Iran, Pakistan, Turkey and Indonesia. Between them these countries account for 70 percent-90 percent of all pilgrims from non-Arab countries over the period 1971-1987 and if those for India were added this would increase to 94.2 percent (see Table 5.9).

Although Iran occupies first position in Table 5.9, contributing 24.8 percent of pilgrims from (N.A.A.C) and 10 percent of external pilgrims, it used to be third after Pakistan and Turkey before the Revolution of 1979 took place and resulted in a sudden increase in numbers. The statistics of pilgrims elucidated that unlike Turkey, the first six countries in Table 2.9 have experienced an increase in the 1980s. However, Turkey has witnessed something of a decline in its share of pilgrim numbers, from 21 percent in 1979 to only 17.7 percent after 1980. This decline may be attributable to certain restrictions being imposed by the Turkish government to protect the economy and limit the amount of money taken out of the country. The present rise in the cost of living in Turkey besides the increased cost of the Hajj also make it more difficult for Turks to travel abroad.

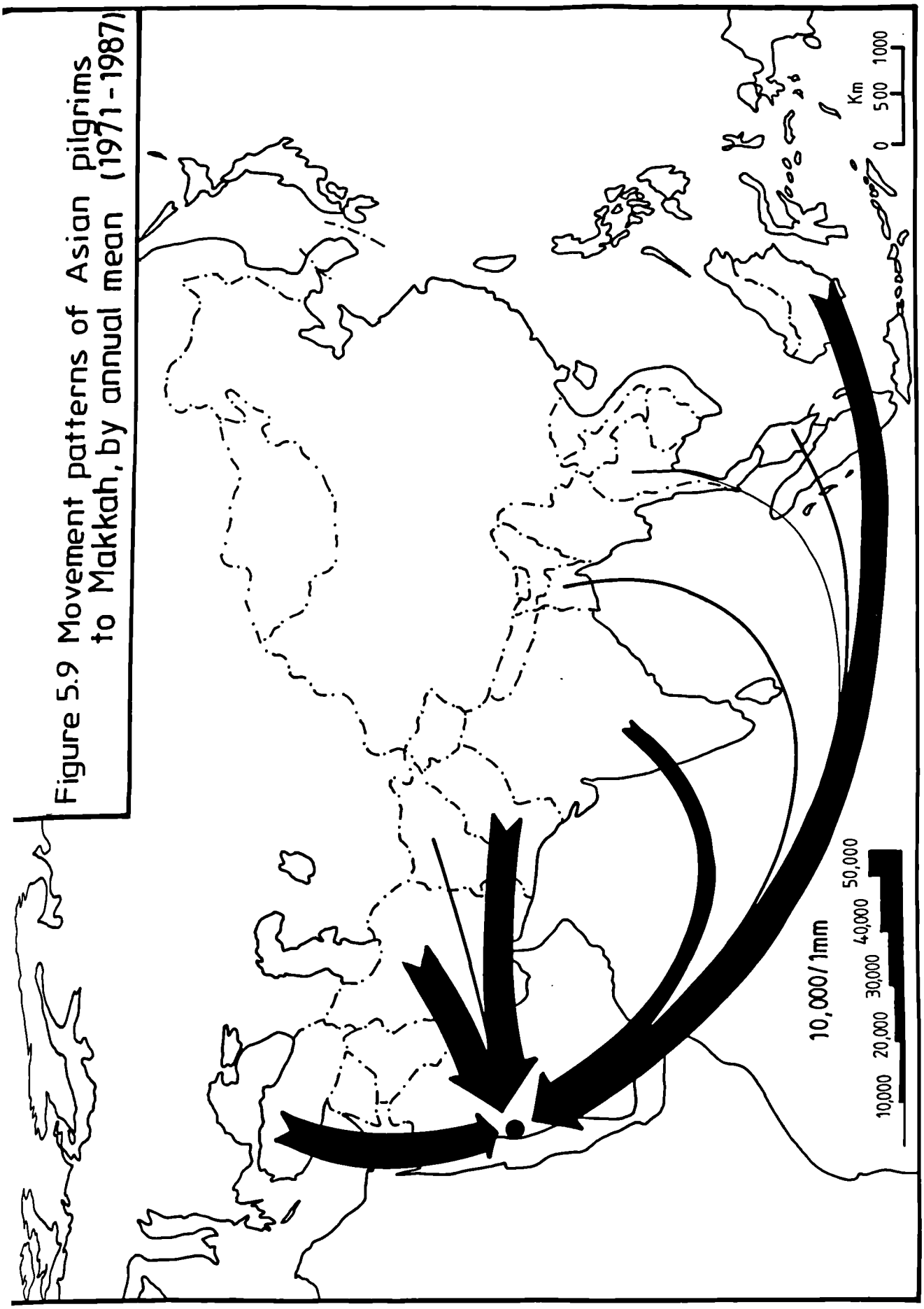

Figure 5.9 Movement patterns of Asian pilgrims to Makkah, by annual mean (1971-1987)

Table 5.9. Distribution of the pilgrims from non-Arab Asian countries showing mean figures for each country (1971 - 1987).

Grade	Country	Mean no. of pilgrims 1971-1987	Percentage of non-Arab Asian pilgrims.	Percentage of external pilgrims
1	Iran	78,069	24.8	10.0
2	Pakistan	68,120	21.7	8.8
3	Turkey	55,699	17.7	8.8
4	Indonesia	47,693	15.2	6.1
5	India	24,861	7.9	3.2
6	Malaysia	15,274	4.9	2.0
7	Bangladesh	10,215	3.3	1.3
8	Afghanistan	6,893	2.2	0.9
9	Thailand	6,656	2.1	0.9
10	Singapore	1,758	0.6	0.2
11	Philippines	1,260	0.4	0.2
12	China	955		
13	Brunei	953		
14	Srilanka	811		
15	Maldives	434	0.8	
16	Taiwan	361		
17	Burma	119		
19	Nepal	25		
20	Japan	10		
	Total	314,178		

Source: *Central department of statistics, Riyadh.*

Regarding Indonesia, which stands in fourth place as in Table 5.9 with a mean figure of47,461 and around 15.2 percent of pilgrims from N.A.A.C., one notes that its share of the number of pilgrims is not in proportion to the size of its population. Although it is one of the largest Islamic countries in terms of muslim population e.g. its muslim population is three times higher than that of Turkey, the mean number of Indonesian

pilgrims did not exceed 0.4 per thousand for the period 1979-87 while in Turkey, it stood at 1.3 per thousand. Perhaps Indonesia's geographical location on the edge of the Islamic world and the high cost involved in travelling to the Hajj from a country of low incomes may explain this. One item that emerged from the fieldwork of 1988 was that an Indonesian pilgrim wishing to attend the Hajj had to pay a sum of £1,800 to the Indonesian Hajj committee before he or she would be permitted to travel by air. Up until recently most of Indonesia's pilgrims used to travel by sea which used to take three months but as the cost of sea travel rose, so the numbers of pilgrims using this form of transport fell from 71.3 percent in 1973 to 17.7 percent in 1975. Sea travel now accounts for only a tiny percentage, the majority of Indonesian pilgrims preferring to travel by air. Figures for 1984 bear this out, while only 29 pilgrims travelled by sea, 40,928 travelled by air (C.D.S. 1984).

As far as Afghanistan is concerned its number of pilgrims has been affected by the Soviet invasion of 1979 when a meagre 1,990 pilgrims attended the Hajj compared to 8,241 the year before (C.D.S. 1979) In other words the Soviet occupation was responsible for an 88 percent decrease in the number of Afghani pilgrims.

Significantly the last ten countries in Table 5.9 are mainly countries in which Muslims are a minority group - the one exception being the Maldive Islands whose pilgrims do not exceed one thousand for any of the years 1971-87. Pilgrim numbers in these countries are given to fluctuations and show a lack of continuity or predictability. In some years they contribute a certain number of pilgrims while in others they do not appear in the record books.

5.3.4 Pilgrims from non-Arab African countries (N-A.Af.C.)

The assertion that African muslims participate in the Hajj is a reasonable one to make when one considers that the majority of African countries have some involvement in the celebration of Islamic religious ceremonies. About 47 of the 60 countries in Africa have appeared in statistical books recording activity in the 1970s and the 1980s. It has been estimated that pilgrims from the African continent constituted 28 percent of external pilgrims in 1987 (C.D.S. 1987).

Over the 1971-87 period non-Arab African countries have contributed a yearly mean of 85,567 and have represented 5 percent of all pilgrims and 11 percent of those pilgrims who come from outside Saudi Arabia.

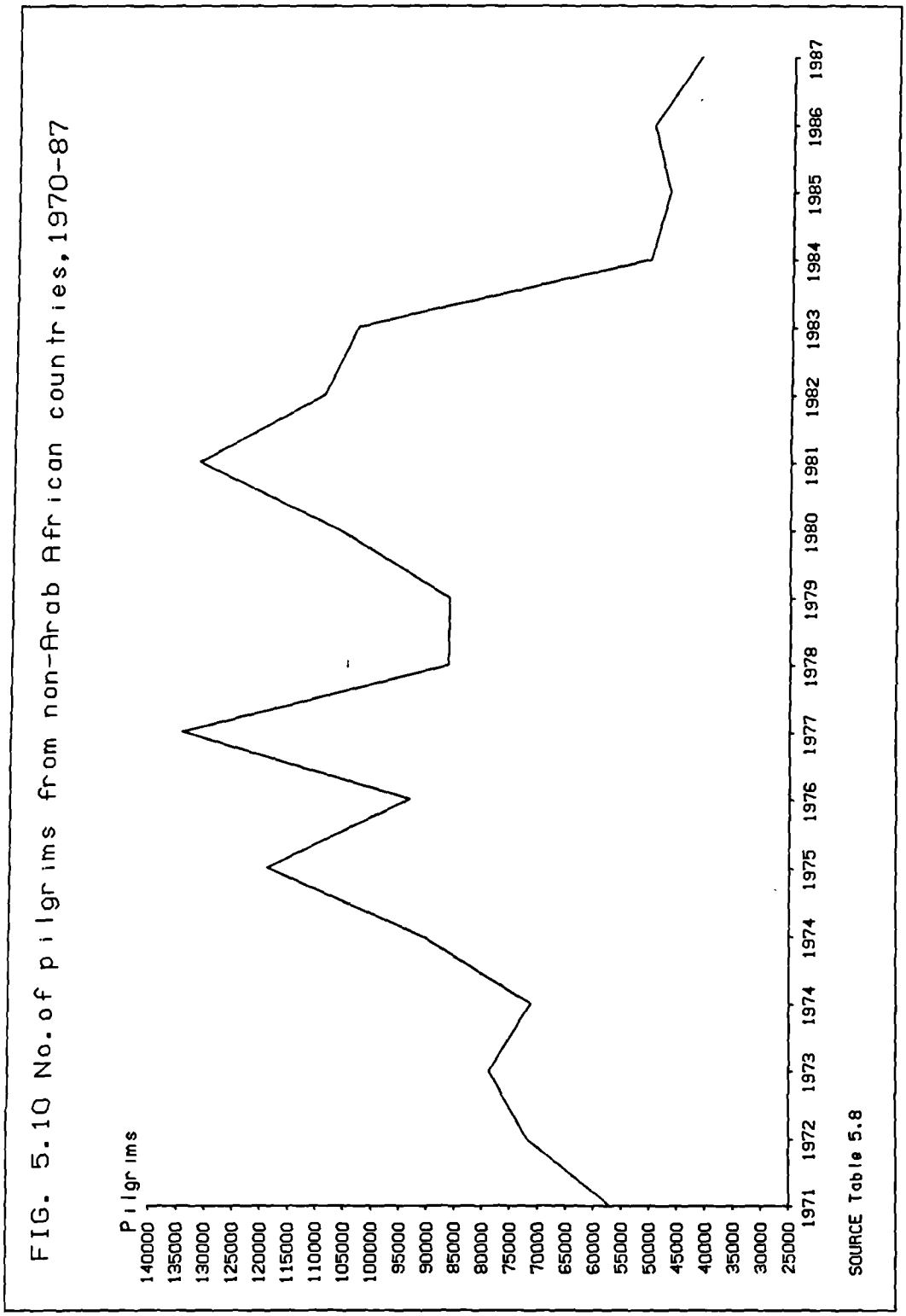
FIG. 5.10 No. of pilgrims from non-Arab African countries, 1970-87
Pilgrims
140000
135000
130000
125000
120000
115000
110000
105000
100000
95000
90000
85000
80000
75000
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
1971
1972
1973
1974
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
SOURCE Table 5.8

Table 5.10. Pilgrim numbers from non-Arab African countries (1971 - 1987) showing percentage of external pilgrims and the total number.

Year A.H.	Year of Grace	Number of pilgrims	Percentage of external pilgrims	Relative change
1390	1971	56,914	24.6	1.0
1391	1972	71,930	16.4	1.3
1392	1973	78,904	12.2	1.4
1393	1974	71,614	11.8	1.3
1394	1974	91,366	9.9	1.6
1395	1975	119,569	13.4	2.1
1396	1976	93,861	13.0	1.6
1397	1977	135,324	18.3	2.4
1398	1978	87,124	10.5	1.5
1399	1979	87,111	10.0	1.5
1400	1980	107,379	13.2	1.8
1401	1981	132,997	15.2	2.3
1402	1982	110,390	12.9	1.9
1403	1983	104,598	10.4	1.8
1404	1984	50,975	5.5	0.9
1405	1985	47,563	5.6	0.8
1406	1986	50,481	5.9	0.9
1407	1987	42,111	4.4	0.7
Yearly mean		85,567	11	-

Source: *Central department of statistics, Riyadh.*

As can be seen in Figure 5.10 and Table 5.10, the numbers of pilgrims in this grouping are erratic and a great deal of relative change, whether positive or negative, takes place from year to year. The chief among the political and economic conditions that may account for Africa's unsteady pilgrim numbers are political troubles and civil wars in black Africa which, in turn, influence the economic situation and social

structure in places such as Chad, Uganda and Senegal; the terrible drought suffered in widespread areas of Africa which led to the expansion of famine in many African countries e.g. Nigeria, Mali and Ethiopia, the harmful effect the above disasters have had on the standard of living as well as an economic policy which has seen imports exceed exports and consumption outstrip production; and finally, the introduction of measures imposed by many African countries which restrict the movement of pilgrims. One of the most important factors influencing African pilgrims has been the difficulties and restrictions overland pilgrims have encountered while travelling from the west of Africa across the Savanna to the Red Sea (see Birks, 1978, and Daham, 1981).

Thus, in recent years the numbers of pilgrims from Africa has seen a sharp and continuous decrease as the cost of financing a trip to the Hajj rose above percapita income. So in 1984 when pilgrim numbers were 104,508 they took a sudden downward turn to 50,975 one year later and in 1987 continued to fall to their lowest level of 42,111 for the 1971-87 period as in Figure 5.10.

Despite the large number of African countries which are involved with the Hajj movement (almost 80 percent of African countries) their combined contribution or share probably equals that of the North Yemen. With the notable exception of Nigeria, the majority of non-Arab African countries make up, individually, a small share of the total number of muslims participating in the Hajj. See Figure 5.11.

Figure 5.11 Movement patterns of African pilgrims to Makkah, by annual mean (1971-1987)

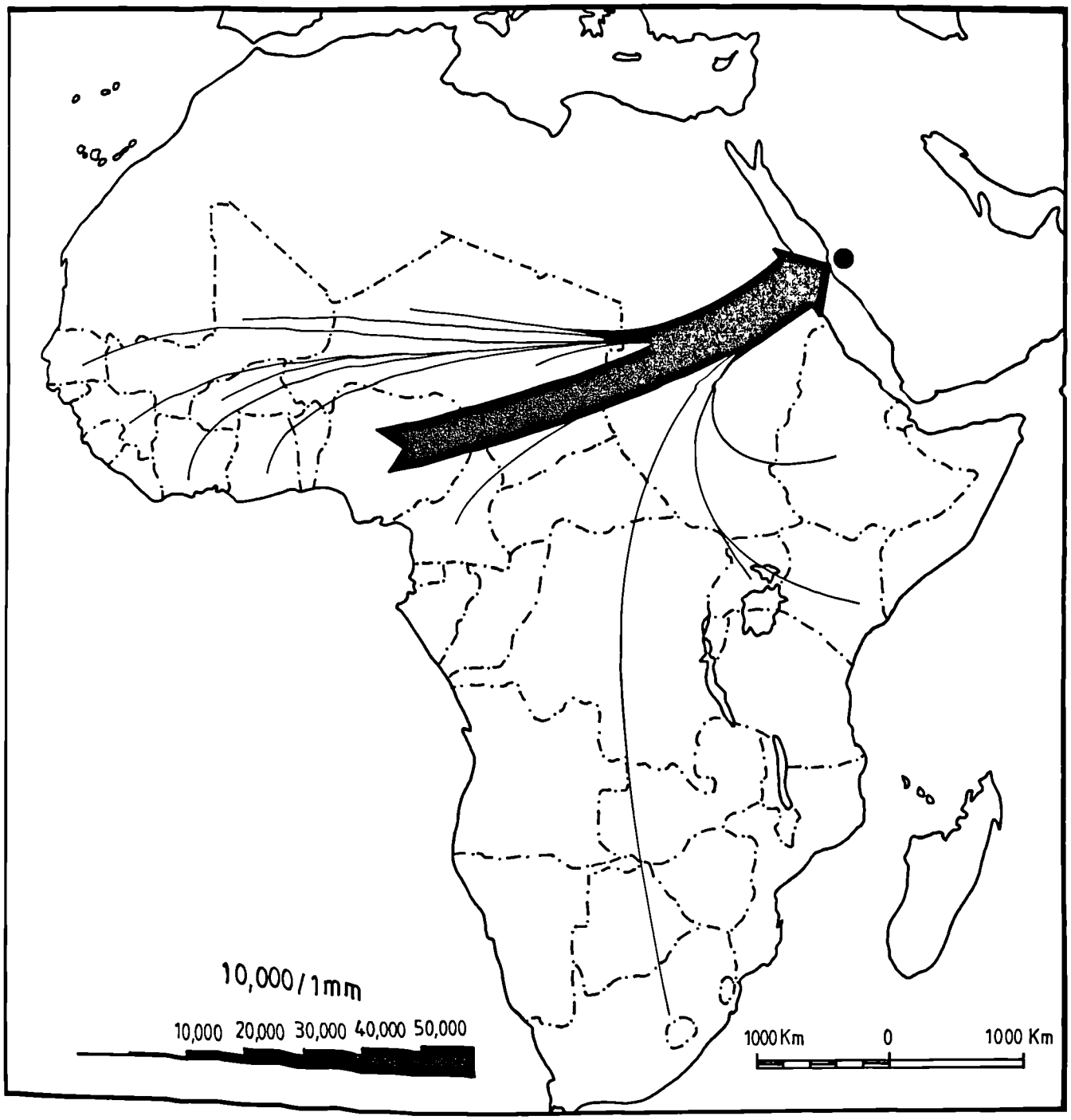

Table 5.11. The first ten countries showing mean figures of pilgrim numbers for the years 1971 - 1987.

Position	Country	Mean 1971 - 1987	Percentage of external pilgrims
1	Iran	78,069	10.0
2	North Yemen	73,610	9.5
3	Pakistan	68,120	8.8
4	Egypt	65,010	8.4
5	Turkey	55,699	7.2
6	Indonesia	47,693	6.1
7	Nigeria	47,693	5.2
8	Iraq	37,175	4.8
9	Syria	31,656	4.0
10	Algeria	31,521	4.0
	Total	528,926	68

Source: *Central department of statistics, Riyadh.*

Nigeria stands pre-eminent among the non-Arab African countries in terms of population size and the large percentage of Muslims who make up the total population. One estimate has put muslim numbers at 60 million in 1979 (Shaker 1980). Over a period of 13 Hajj seasons (1971-87) Nigerian pilgrims achieved a mean figure of 65,853 while the rest of the African countries reached an estimated 29,526 and they accounted for 9 percent of external pilgrims (C.D.S. 1981). In 1977 the numbers of pilgrims coming from Nigeria reached a pinnacle of 104,577 and even though Nigeria continued to be included in the top ten countries contributing to the Hajj over a span of thirteen seasons, this pattern altered in 1983 when numbers fell to 76,153. Thereafter they proceeded to fall steeply in 1984 to 23,655 and this decline was to characterise subsequent years. This fall can be connected with several factors already

alluded to e.g. political instability, drought, famine and the government-imposed restrictions.

In all, it is possible to identify the ten countries which between them contribute a majority figure of 68 percent of all external pilgrims (see Table 5.11). This percentage has been derived from the mean number of pilgrims for the years 1971 to 1987. However, competition is normally confined to the ten countries shown in Table 5.11 as well as Libya, Sudan and Jordan. When these latter countries are added to the group, this accounts for 79 percent of the total number of external pilgrims.

5.4. Test of some factors influencing pilgrim numbers

5.4.1. Introduction

It is quite interesting to analyse mathematically some important factors which affect the pilgrims who come from various countries. In previous sections, most of the factors influencing the phenomenon have been discussed and understood in terms of statistical description. Here, what is needed now, is to carry the analysis a step further and determine quantitatively the way in which the pilgrims' movement to the region is influenced by those factors. Thus it will be possible to judge a degree of this effect and relationship to each other. In fact this objective may not be easy to achieve; particularly in phenomena where the underlying factors are varied and inter-related. This is exactly the case in the pattern of pilgrim movements, where there are many social, economic, political, religious and geographical factors affecting movement to the pilgrimage region.

However, some researchers, such as Mansfield (1969) and Smith (1971), have used measurement techniques relating to the movement of people to attraction areas finding that population, income, cost and distance were by far the most important factors, *since they are the easiest to define and measure*. Thus, we shall focus on these elements, for which data are available, to find out the degree of their effect on the patterns of the pilgrims' movement by using a statistical approach, i.e. the multiple regression model.

5.4.2. Data variables

The data used in this work were obtained from a variety of sources: the numbers of pilgrims coming from each country are published by the Central Department of

Statistics in Saudi Arabia, which has been mentioned before. Data on population and income of the countries were acquired from the World Bank Report (1988). The percentage of Muslims was taken from the book 'Muslim Peoples' by Weekes (1984) and 'Islamic World' by Shaker (1980).

Data regarding distance were obtained from air mile distance. They were obtained by measuring, on the map, the straight line distance between the capital of the country concerned, and Jeddah, plus forty two miles which is the distance between Jeddah and Makkah. The underlying assumption in this method is that the capital is the centre of gravity of the population in each country. This assumption finds some justification in the fact that the capital city is the usual place of embarkation on the pilgrimage journey, since it usually accommodates the international airport of the country and so travel within the country outside the capital may be disregarded. There are, of course, pilgrims who arrive by land and by sea but the difference between straight line distance and actual road distance where these two modes are concerned can be ignored when one considers that the overwhelming number of pilgrims (around 82 percent of the sample) arrive by air. Twenty-nine countries, each sending more than 1,000 pilgrims, have been using in this model as a sample representing about 75 *percent of all external pilgrims in 1986* which has been chosen as the most recent year with available data (see Table 12). The pilgrims from Iraq and Iran are not included in this sample for two reasons; the first is due to political and military conflict, the second is the lack of data regarding income. The same applies to the Lebanon and Afghanistan where similar problems operate.

It has been observed that the cost of travel from the same country of origin varied even among pilgrims using the same mode. In the case of the air mode, for instance,

the variations in the cost of air travel may have been due to competition between airlines, and the availability of different arrangements for charter flights and package tours. In fact, the highest degree of variation in travel cost was observed among land travellers, while the highest degree of uniformity was observed among sea travellers. Unfortunately, there were insufficient data available for cost and time of travel by land, and the two modes (land and sea) represented less than 20 percent of the sample as mentioned (14 percent for land and 4 percent for sea). However, the data relating to the cost and time of air travel can be relied upon as a source of information. Thus the data of these variables were obtained from Saudi Arabian Airlines who were pre-eminent among the pilgrim services and the other airlines.

5.4.3. Constructing the Model

The regression model has become one of the most widely used statistical tools for analysing multifactor data. It is appealing because it provides a conceptually simple method for investigating functional relationships among variables (Chatterjee, S., 1977). A regression model containing only one independent variable is called a bivariate regression model. A model containing more than one independent variable is referred to as a multiple regression model. Generally, the model is concerned with situations where we are examining how a single variable is functionally dependent on one or more independent variables and when the form of the functional relationship is linear. Its operational structure varies in different situations based on the level of measurement of the independent variables (Clark, 1986). In this purpose income distance, population, cost and travel time of each country represent independent variables.

Table 5.12: No. of Pilgrims from 29 Countries and their Distribution Among the Transport Modes by Percentage

Country		No. of pilgrims	air %	land %	sea %
1.	North Yemen	43512	32.0	68.0	-
2.	Pakistan	92305	73.0	17.0	10.0
3.	Egypt	98606	75.0	3.6	21.4
4.	Turkey	54624	10.0	90.0	-
5.	Indonesia	59172	99.7	-	0.3
6.	Nigeria	29899	99.8	-	0.2
7.	Syria	15803	94.0	-	6.0
8.	Algeria	28093	96.0	4.0	-
9.	Sudan	28724	97.7	1.0	1.3
10.	Libya	14509	99.0	-	1.0
11.	India	39344	73.0	6.0	21.0
12.	Morocco	22912	94.0	6.0	-
13.	Jordan	17165	13.6	86.4	-
14.	Malaysia	26043	99.9	-	0.1
15.	Bangladesh	13631	80.0	2.5	17.5
16.	Tunisia	6887	83.0	7.0	-
17.	South Yemen	6852	99.0	1.0	-
18.	Kuwait	8308	23.5	76.5	-
19.	Thailand	1685	99.7	-	0.3
20.	Oman	12804	6.8	93.0	0.2
21.	Somalia	4487	98.0	2.0	-
22.	Amarat	6549	71.3	28.7	-
23.	Mauritania	1243	99.0	1.0	-
24.	Singapore	1873	99.9	-	0.1
25.	Philippines	1323	99.5	-	0.5
26.	Senegal	2501	98.7	0.4	0.9
27.	Niger	1465	80.0	-	20.0
28.	Mali	2092	95.0	-	5.0
29.	South Africa	2498	100	-	-

Source: *CDS, Hajj Statistics, 1986, 1987*

The problem here was that the five countries in the sample whose pilgrims travelled by air, made up less than the total percentage who used the air mode i.e. 70 percent of the total pilgrims (see Table 5.12). The available data of cost and time of travel are related only to air travel. Thus two different attempts were developed to fit a multiple regression model to the data in Appendix 3.

A) In the first test an attempt was made to try to fit the model of the following form to the total of pilgrim numbers per million of the muslim population from each country of the sample.

$$Y_i = a + B_1X_{1j} + B_2X_{2j} + B_3X_{3j} + B_4X_{4j} + B_5X_{5j}$$

Where Y_i = number of pilgrims per million of the muslim population from country;

a, B_1 -B_5 are parameters to be estimated by the model.

X_{1j} = per capita income of country j (GNP)

X_{2j} = distance of countries from Makkah

X_{3j} = numbers of Muslim population country j

X_{4j} = cost of travel from country j to Makkah and return

X_{5j} = time of travel from country j to Makkah and return

The method of stepwise in SPSSX package has been used to analyse the above factors in the first run. The result of this run can be seen in Table 5.13.

Table 5.13. Regression results of the first attempt by stepwise method.

Variables	Correlation Coefficients	Regression Coefficients	T-value	Sig T
income (X_1)	.5763	.3580	-1.837	.0011
Variables not in the equation				
Time (X_5)	-.4132		-1.837	.0776
Cost (X_4)	-.4076		-1.668	.1074
Distance (X_2)	-.3503		-.1560	.1310
Popul (X_3)	-.3910		-1.518	.1410
Constant (a)1382.7700		R^2 0.3321		

It is plain from the table above that R^2 was 0.3321 which means that 33 percent of the variation in pilgrim number (Y_1) can be explained by such an independent variable. Thus income (X_1) was the only variable which had a positive correlation and effective power, while the other variables had negative correlations. This result suggests that the variable of income played a significant role in terms of volume of pilgrims' movement. This can be seen, for example, in the variation of the volume of pilgrim number between Singapore and the Philippines which both have similar values of cost and time of travel. The former contributed 1873 pilgrims while the latter sent only 1323, although the Muslim population of the Philippines is fourteen times greater than that of Singapore (see Appendix 3).

However, the stepwise regression method accepted in the equation only the significant variable, which is, in our case, the income variable (see Table 5.13). So to involve all the variables above in the equation, the Enter method in SPSSX was used in the second run to analyse the same data. As shown in Table 5.14, the R^2 value has risen to .4516. This means that 45 percent of the variation in pilgrim numbers (Y_j) can be explained by a combination of those factors (X_1, X_2, X_3, X_4, X_5). In contrast to the

first run, the rest of the factors; distance, population, cost and time of travel, showed a coefficient of determination (R^2) which had increased by 12 percent.

Table 5.14. Regression results of the first attempt, by enter method.

Variables	Regression coefficients B	T-value	sig T
Income (X_1)	.2663	2.502	.0199
Distance (X_2)	.1151	.173	.8643
Popul. (X_3)	-.0140	-1.331	.1963
Cost (X_4)	-.3127	-.552	.5866
Time (X_5)	-26.3220	-.160	.8746
Constant (a) = 3274.787		R^2 = .4516	

Although the result has been improved by use of the enter method, the value of R^2 is still poor. This might be attributable to the lack of compatibility and appropriateness of the data, particularly with respect to the value of cost and time of travel. Therefore the second attempt should consider this fact.

B) In the second attempt, instead of taking all the countries sending more than 1000 pilgrims, we chose only those which used air travel as a major mode of transport to and from Saudi Arabia. Less than 70 percent of pilgrims in five countries, namely North Yemen, Turkey, Jordan, Kuwait and Oman, travelled by air and so they had to be dropped from the sample. Consequently the same model will deal with 24 countries.

By using Stepwise of SPSSX in the first run, the results of this regression are shown below.

Table 5.15. Regression results of the second test by stepwise method.

Variables	Correlation Coefficients r	Regression Coefficients B	T-value	Sig T
income (x1)	.6615	.3606	4.138	.0004
Variables not in the equation				
Distance (X_2)	-.2664		-1.178	.2074
Popul. (X_3)	-.3735		-1.301	.2024
Cost (X_4)	-.3487		-1.316	.2520
time (X_5)	-.3274		-1.491	.1507
Constant (a) = 1059.4414		R^2 = .4377		

As can be seen from Table 5.15, the results of Stepwise method are better than before with R^2 = .4377 which means that the compatability of the data had improved the effective power of independent variables (X_1, X_2,...) upon the dependent variable (Y). However, income (X_1) is still superior in terms of influencing pilgrim movement. The correlation coefficient of income was both positive and highly significant at the .0005 confidence level. In contrast, variables of distance, population, cost and time of travel showed a negative correlation and were not significant even at level .05 (Table 5.15). Thus those variables were rejected from the equation by Stepwise method. But by using Enter method in the second run of this attempt, R^2 value reached 0.5280, which means all five factors (X_1 + X_2 + ...) explain 53 percent of the effects on the pattern of pilgrim movements (Y).

A regression line has been plotted for each factor shown in Figure 5.12 by using the Doggs package. It is surprising to see the population variable as the negative factor. This would be explained by the fact that the number of pilgrims per million of the muslim population in Singapore, for instance, was 6500 in 1986; whilst in Indonesia the number was only 391, although the latter has a sizable Muslim population (around

151,424,000) whereas the former has only 442,000 Muslims. Both are approximately the same distance, and cost and time to travel are comparable. Significantly the two countries have different levels of income (see Appendix 3). This confirms the findings of the regression model i.e. the income factor has an influence of 44 percent on the pattern of the Hajj month, more so than the rest of the factors which had only 9 percent according to the Enter method in SPSSX.

However, it is quite obvious from all this that there are other factors which might have greater effect and play an essential role in terms of explaining the variation in patterns of pilgrim movements: religious and political issues. Those factors are in fact difficult to fit into the model owing to resource and time constraints.

In fact, the multiple regression model has been used by El-Hamdan (1976) to predict the numbers of pilgrims in the future. He relied upon four independent variables; income, distance, cost and time of travel. According to his data and results of analysis "the number of pilgrims in 1983 will be 1,025,000", which is indeed more than the actual number which was only 1,003,911, and he also predicted that in 1993 the number will be 1,661,000 pilgrims coming from abroad. However, it is doubtful that the number of pilgrims will reach this volume in 1993 when one considers that the number and pilgrims in the Hajj of 1990 did not exceed 828,000 pilgrims (*Arab News*, vol. XV, No. 216). In addition, the decision of the Saudi Arabian government to limit pilgrim numbers, which was adopted by the Islamic conference in Amman in 1987, has already had, and will continue to have, an effect on the development of pilgrim numbers. As a result of the conference, the number of pilgrims allowed to visit Makkah during the Hajj season was based upon a percentage of the population of each country. Thus, for every million muslims, one thousand pilgrims would be

admitted. In this case, the forecast of pilgrim numbers will have to be based upon the population size of each country participating in the Hajj movement.

Although there are many factors influencing the number of pilgrims positively or negatively as mentioned above, the limitation of pilgrim number may control the volume of pilgrims, and prevent an increase of pilgrim numbers which exceed each country's allocated proportion. Therefore it may be possible to predict pilgrim numbers in the future. This projection will be based on the population forecast of each country sending pilgrims. The data of natural increase in population were obtained from the United Nations (1980 to 1988). In the Islamic countries, the rate of annual natural increase of population for the period 1990 to 2000 is expected to continue as it did in the period, 1985 to 1990. The muslim population of each country sharing the Hajj movement has been calculated for the years 1990, 1995 and 2000 as shown in Appendix 4.

Thus, the proportion which would be allowed to come to Makkah (1/1000) has been applied to the Muslim population of each country and Table 5.16 sums up the results of the total number of external pilgrims for the years 1990, 1995 and 2000. However, there are two countries (Indonesia and India) which were expected to send only half of this percentage above i.e. 1/2000 of the Muslim population can be applied to these countries to forecast their pilgrims. The reason for this arises from the fact that since 1970 these two countries never send more than 1/2000 of the population at any season of the Hajj (see section 5.3).

Table 5.16. Projections of pilgrim numbers for years 1990 - 2000

	1990	1995	2000
Actual figures*	827,236	-	-
Projected figures	859,000	970,000	1,092.000
* From Ministry of Interior (Passport Affairs) in Arab News July 1,1990,p2			

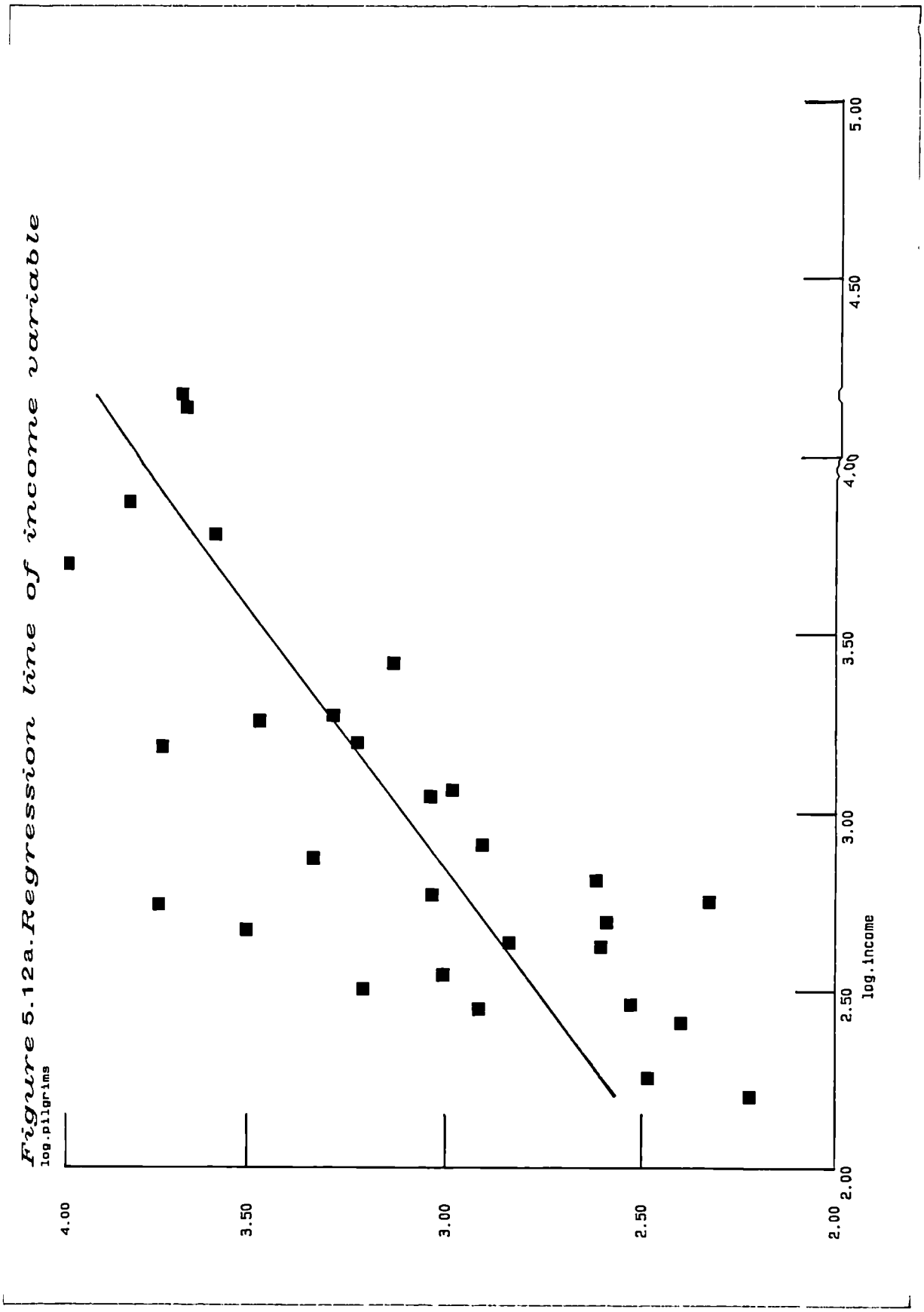

Figure 5.12a. Regression line of income variable

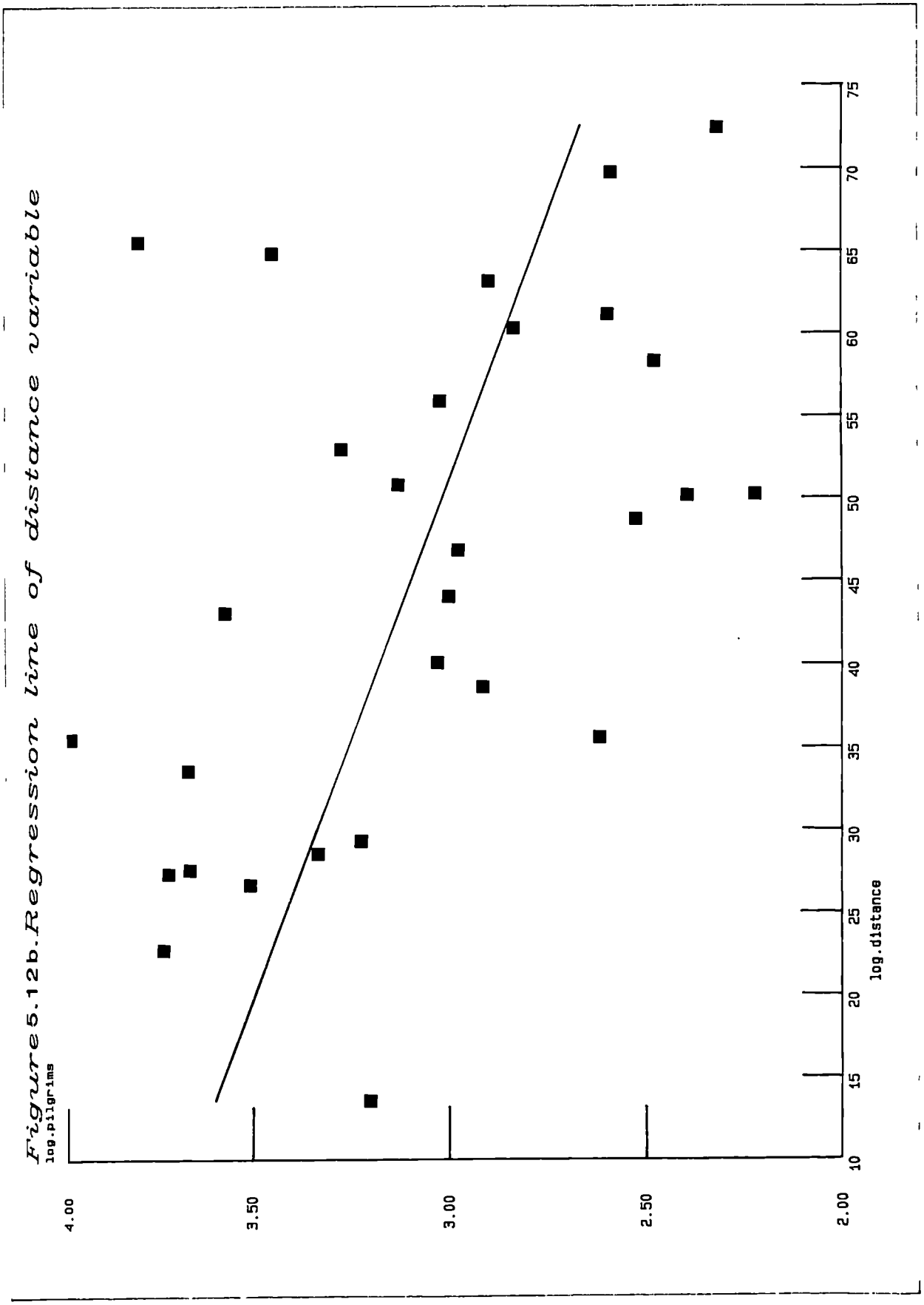
Figure5.12b.Regression line of distance variable
log.pilgrims
4.00
3.50
3.00
2.50
2.00
10
15
20
25
30
35
40
45
50
55
60
65
70
75
log.distance

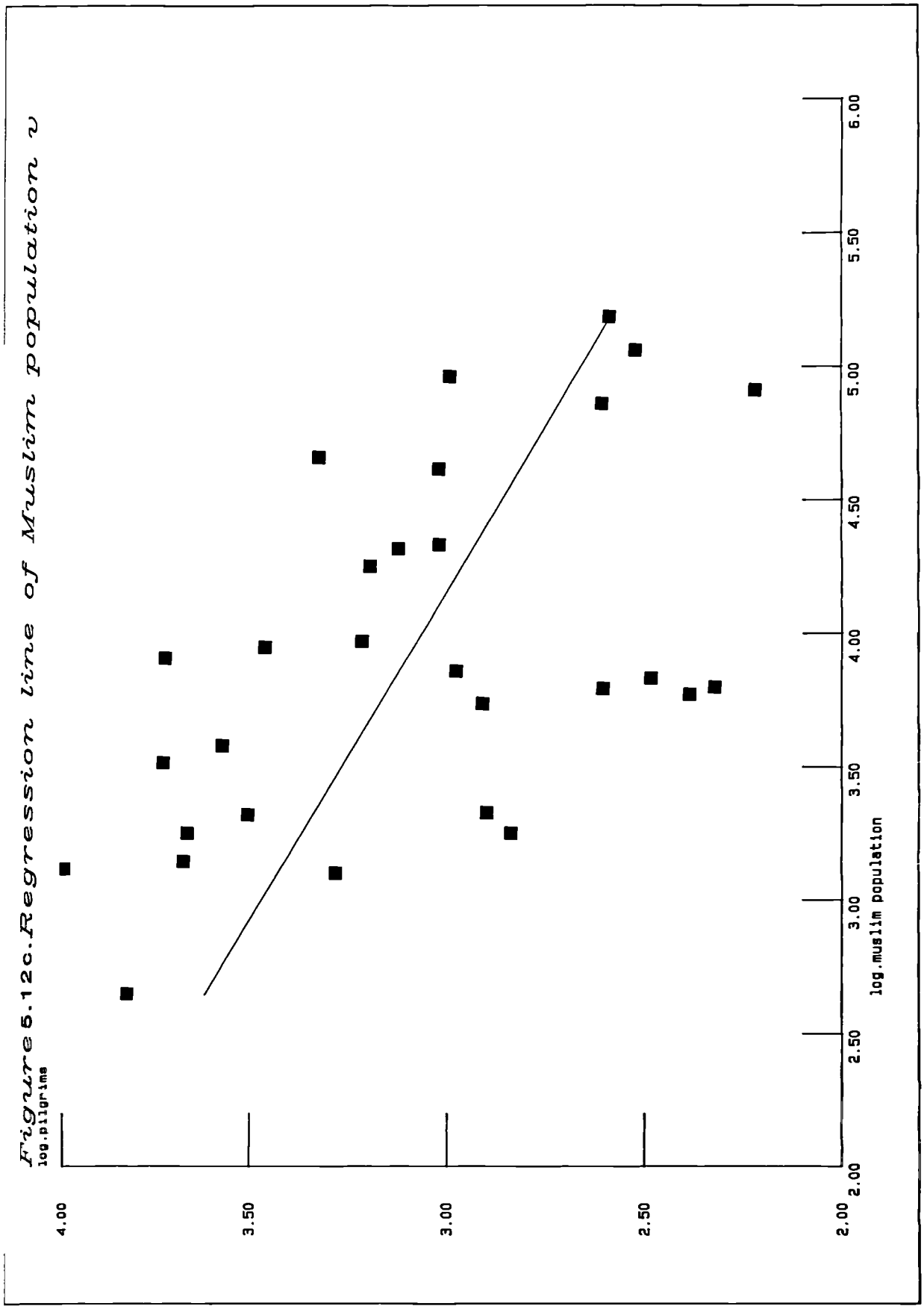

Figure 5.12c. Regression line of Muslim population v

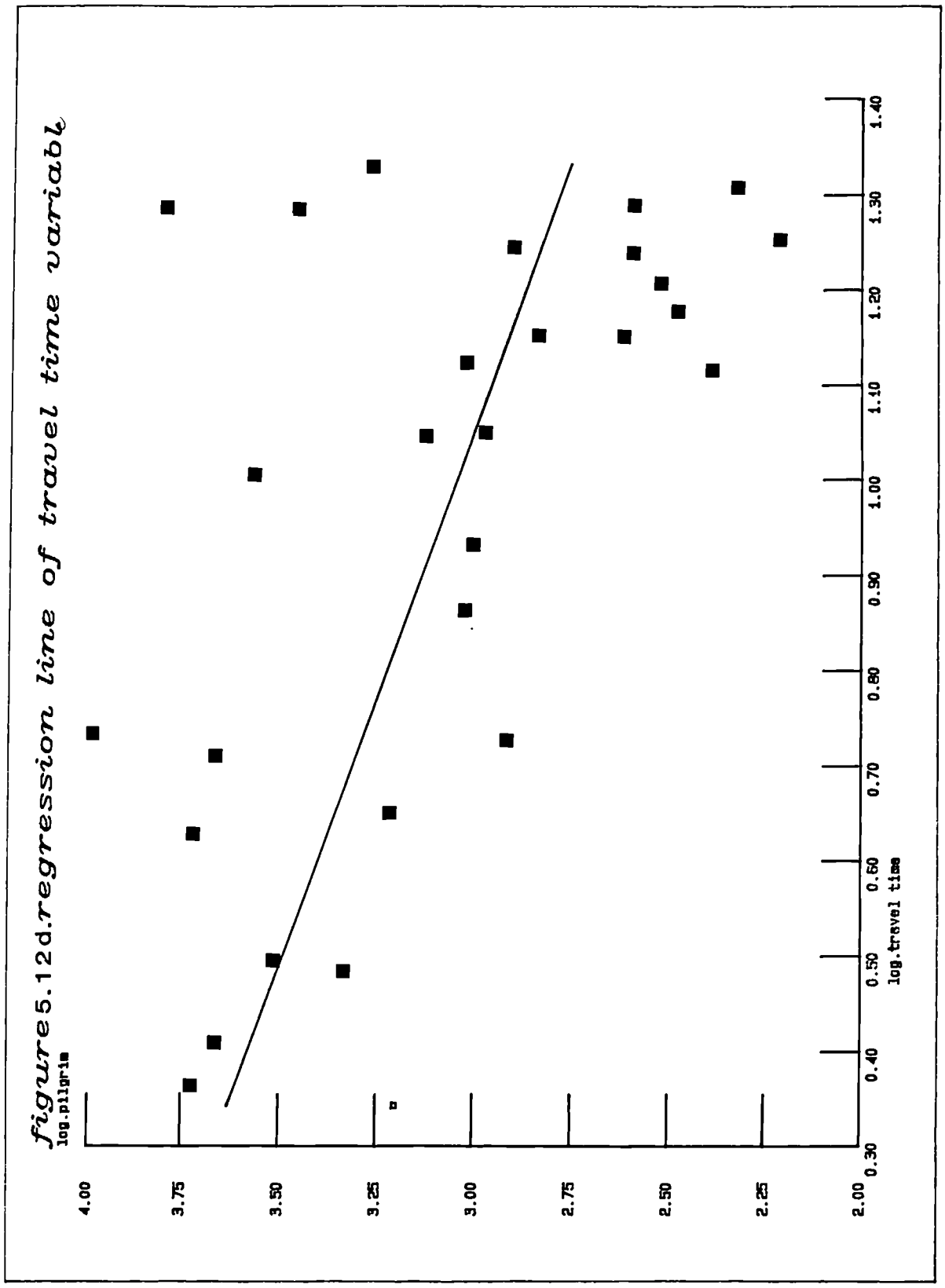

figure 5.12d. *regression line of travel time variabl*

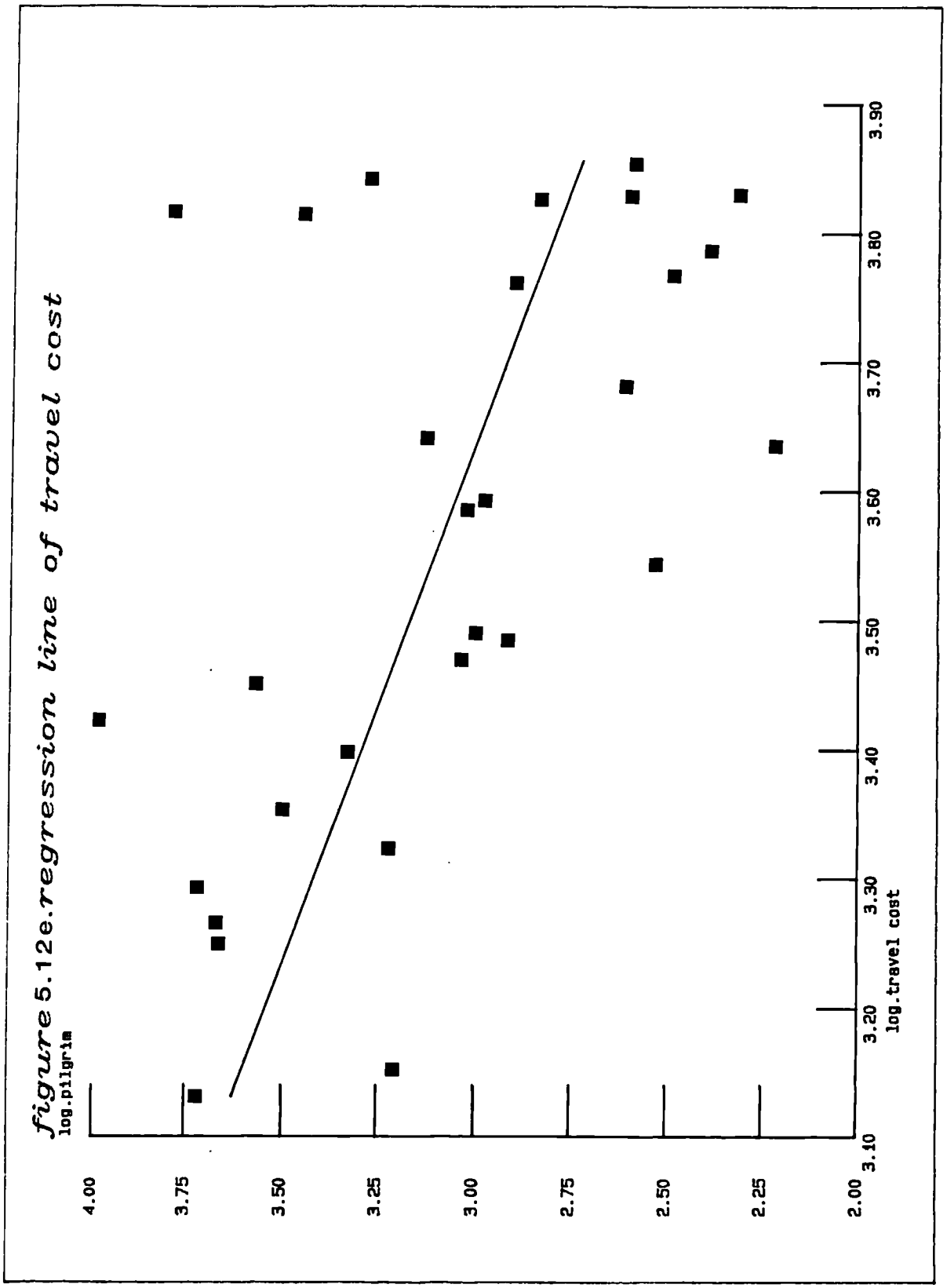
figure 5.12e. regression line of travel cost
log.pilgrim
4.00
3.75
3.50
3.25
3.00
2.75
2.50
2.25
2.00
3.10
3.20
3.30
3.40
3.50
3.60
3.70
3.80
3.90
log.travel cost

Summary

The number of pilgrims has been increasing in general, as is shown by the increase of the arithmetic mean for each decade: from 44,829 in the thirties, to 234,329 in the sixties, and the mean of pilgrim numbers for the seventies is more than double that of the sixties. This occurred despite the fact that for many years during the decade of the sixties there had been a decline and fluctuation in numbers. When, in 1983, 2.5 million pilgrims performed the Hajj in Makkah, it was considered a record. Forty per cent of these were external pilgrims. In 1989 the total number of pilgrims was about 1.5 million, with external pilgrims making up about 50 per cent of this total. Thus we can see that pilgrims coming from abroad are increasing in proportion to internal pilgrims. The reasons for this are discussed in Section 5.2.

Although pilgrims to Makkah come from over 60 countries worldwide, 80 per cent of the total number of external pilgrims come from 13 countries (see Table 5.11 and Section 5.3.4).

It has been found that there are many factors influencing the increase or decrease in the numbers of pilgrims. Statistics on pilgrims were analysed and tested by statistical techniques and the findings show that income accounted for 44 per cent of variation in the patterns of Hajj movement. Some factors related to transport - aspects such as distance, population, cost and time of travel had little influence and accounted for only 9 percent. This means that there are other factors which have great significance and play an essential role in terms of variations in the patterns of movement of pilgrims. Such factors may be confined to religious and political issues which are, in fact, difficult to fit into a statistical model owing to resource constraints, as mentioned.

Nevertheless the Muslim population factor seems to be the key element which affects international patterns in the Hajj movement. This can be confirmed by the fact that the number of pilgrims allowed to visit Makkah for the Hajj was based upon a percentage of the population of each country according to the decision undertaken by the Islamic Conference in Amman in 1987. Thus, the projections of pilgrim numbers for the years 1995 and 2000 have been estimated (see table 5.16).

Although this decision will control the volume of pilgrim numbers, as a method of control it will only be effective in the short term - until the year 2000. The number of pilgrims is going to rise as long as the population continues to increase. Thus the problem of the increase in the numbers of pilgrims exceeding the capacity of the Hajj region to take them will reappear. This suggests that other means should be taken to control the increase of pilgrim numbers when they threaten to rise above the capability of the Hajj region to accommodate them:

1) Instructions to people not to repeat the performance of the Hajj; and the setting up of procedures to implement this restriction;
2) Raising the limitation percentage to 1 in 2,000 of the Muslim population of each country, instead of its present level of 1 in 1,000. This new limitation might be applied at a later stage, perhaps at the beginning of the next decade, ie, after the year 2000.

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Chapter Six

Hajj Movement in the Pilgrimage Region

6.1 Introduction

The literature review has been performed, and the secondary data have been described and analysed in previous chapters. The existing road networks and vehicles used to transport pilgrims and the relevant statistics have been discussed, in order to illustrate as clearly as possible the salient features of the patterns of Hajj movement.

In this chapter an attempt is made to describe and analyse patterns of Hajj movement, mode of transport and flow characteristics between the cities of the Hajj region. These aspects are examined both to discover the principal attributes of Hajj movement, and to identify the major problems facing pilgrims with regard to transport during the Hajj period. Duration of pilgrim sojourn will be discussed, highlighting problems regarding patterns of time of arrival and departure.

This work depends on data collected during a survey conducted in 1989. The design and methodology of this survey have been described above in Chapter One. Official data are utilised in an attempt to illustrate variations within the information.

The data collected in the survey were processed on Durham University's mainframe computer. The resulting data output by the SPSS^X program was then subject to further analysis and interpretation. Cross-tabulations were developed for selected variables relating to the field of study. The results were presented in two categories of patterns of movement: international and regional. These are examined in four sections: travel patterns to Saudi Arabia; traffic movement in the Hajj region; pilgrim movement in the Hajj region; and duration of stay in the region.

The number of observations missing in each variable was ignored, the analysis of the information concentrating on only the answered cases. It is important to note that these data and their study are confined to external pilgrims (see Chapter One).

6.2 Travel patterns to Saudi Arabia

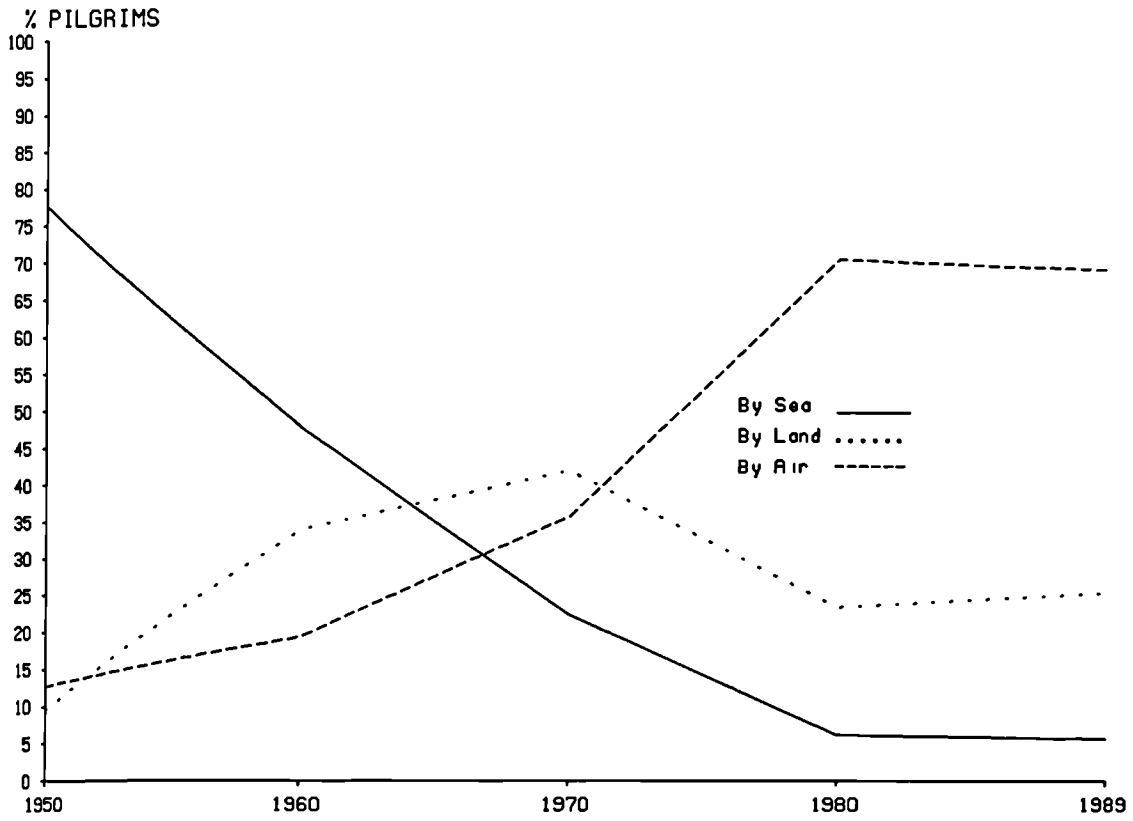
The purpose of this section is to examine some aspects relating to international movement such as mode of transport to Saudi Arabia, and the travel patterns of the pilgrims.

6.2.1 Alterations in mode of transport

As indicated in Chapter Five, the number of external pilgrims has increased greatly, rising rapidly throughout the 1970s and 1980s. This change has been accompanied by another of equal significance concerning the modes of transport available to pilgrims. The historical development of the change in route networks, discussed above in Chapter Three, was in most part the result of changes in the political situation of the Islamic countries, affecting peace and security within the Arabian Peninsula (see Chapter Five). The fundamental developments in transport technology have led to an increase in the choices of modes available. Over the past decade a new pattern of pilgrim travel has emerged.

According to the official data of CDS, until the end of the 1950s sea travel was the dominant mode of travel to the Hajj region used by external pilgrims, taking 77.7 percent of the total in 1950. Air and land modes of transport accounted for only 12.74 percent and 9.56 percent respectively (see Table 6.1). As mentioned above, the rapid development in transport facilities in Saudi Arabia, and world- wide developments

FIG. 6.1 Relationship between the travel mods of pilgrims to S.A from 1950 to 1989



SOURCE Table 6.1

in the technology of transport, greatly changed this pattern. The development of modern roads in Saudi Arabia has led to a shift towards using land-based means of travel from neighbouring countries. The development of airport facilities and the introduction of larger and faster aeroplanes has enabled growth in the percentage of pilgrims from other countries travelling by aeroplane. The overall trend has therefore been away from sea-based modes of transport, in spite of the massive investment devoted to improving harbour facilities in Jeddah, particularly for pilgrims. These changes are shown in Table 6.1 and Figure 6.1.

Table 6.1

Number of external pilgrims by mode of travel to Saudi Arabia

Year	Sea pilgrims	%	Land pilgrims	%	Air pilgrims	%	Total
1950	83,897	77.70	10,327	9.56	13,757	12.74	107,981
1960	125,114	47.70	86,392	33.93	50,812	19.37	262,318
1970	90,992	22.39	170,331	41.93	144,972	35.68	406,294
1980	51,552	6.20	190,048	23.38	572,292	70.40	812,892
1989	43,948	5.67	195,950	25.30	534,662	69.03	774,560

Source: CDS, *Statistical Yearbook* Issues 10-23 (1975-1989)

It is clear that the shift towards modern modes of transport is continuing, as illustrated in the years following 1950. The number of pilgrims arriving by sea has been declining, while the numbers arriving by air have shown a continual and sharp increase. The numbers arriving by land are intermediate between the numbers arriving by air and by sea.

A comparison between these trends is shown in Figure 6.1. Such shifts may be accounted for by several factors, some of which are listed below.

- Geographical location of each country with respect to the Hajj region. This determines the numbers travelling and modes of transport used according to what is available in that country. Moreover, for every country, depending on its geographic location, there are either two or three modes of transport available. Air travel is available to all countries. Travelling by land is possible for the countries which are either adjacent to Saudi Arabia or can be reached by continuous overland roads; this is not possible, for example, from Indonesia, Malaysia and the Philippines. Sea travel is available from all countries with ports. This excludes land-locked countries, such as Afghanistan.

- The advantages and facilities offered by air travel, such as speed, comfort, economy and flexibility, compare favourably with other modes of transport involving slower journeys and higher cost.

- An increase in income in some Islamic countries has been evident, particularly in those producing oil, such as Libya, Iraq and Iran.

- Air transport can surmount restrictions and restraints faced by those travelling by land or sea; wars and political crises being examples of such restrictions. The Iraq-Iran conflict, for instance, led to the disappearance in the 1980s of pilgrims restricted to land travel from Afghanistan, Iran and Pakistan. The greatest percentage of these pilgrims then travelled by air.

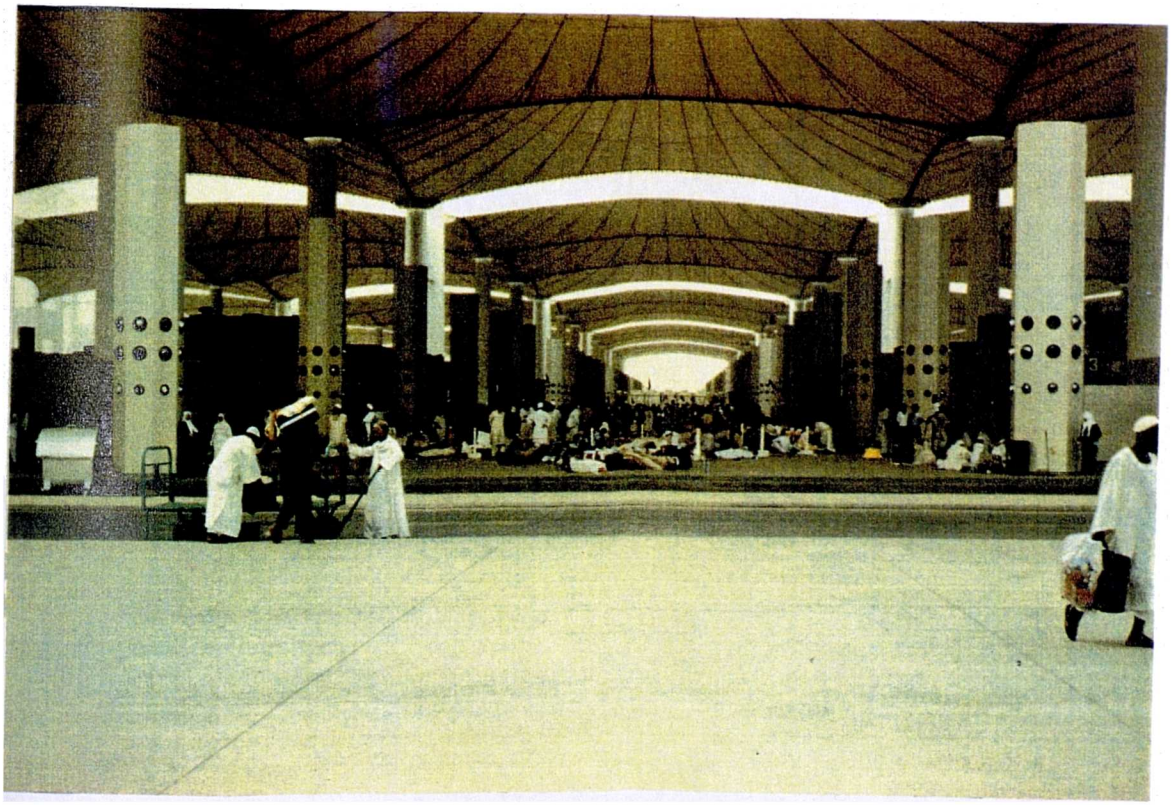
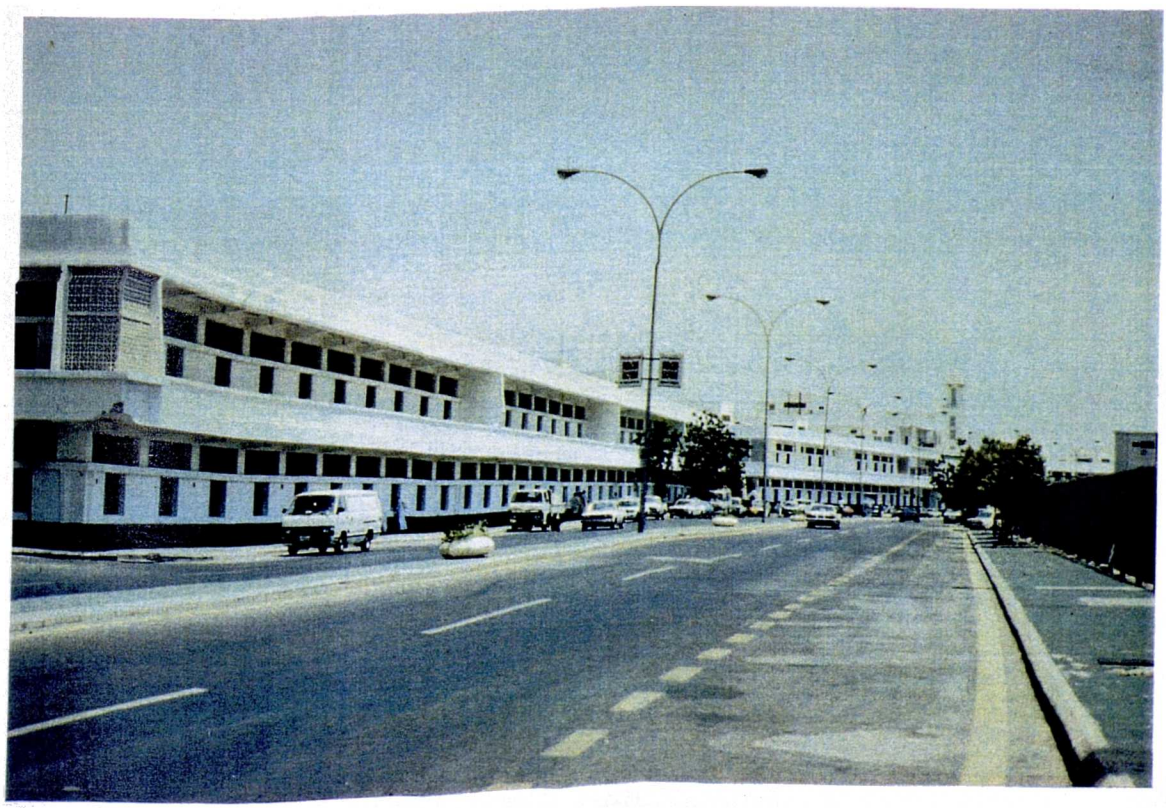


Plate 6.1 Pilgrims at Jeddah airport (Pilgrim city) preparing to depart (above). In the photograph below the accommodation provided for pilgrims who arrive by sea can be seen.



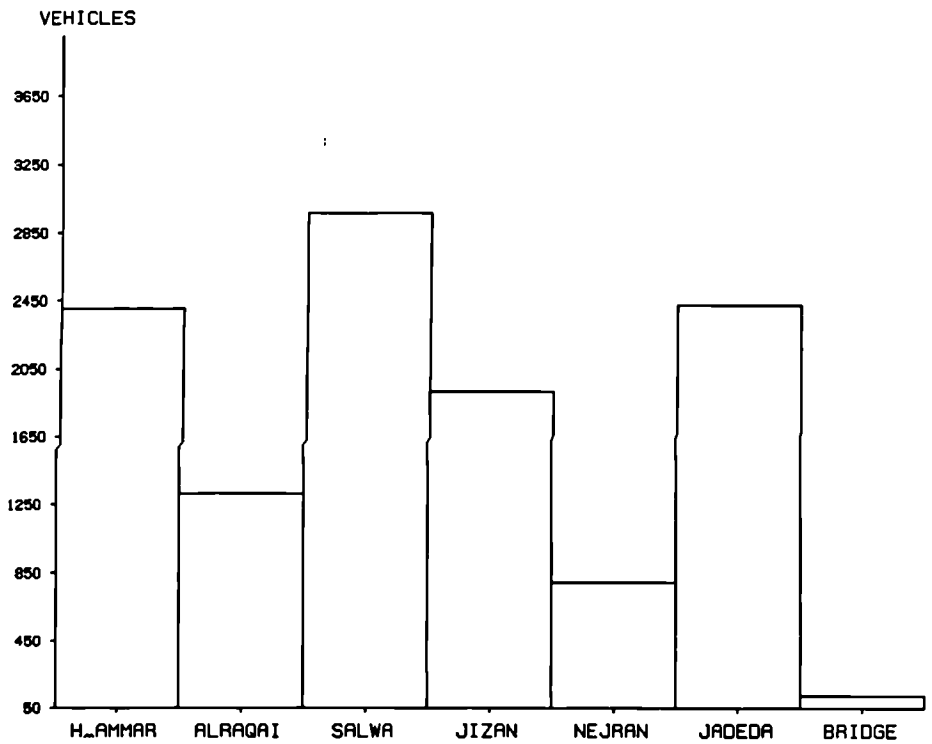
- It is significant to note that Saudi international airports, particularly Jeddah Airport, were developed in terms of capacity and capability.

The above factors illustrate how air transport now carries more than two thirds of the international movement to the Hajj region. In 1989, the number of pilgrims arriving by air reached about 70 percent of the total (see Table 6.1). Land-based transport accounted for 25.30 percent, whilst sea travel, mostly used by people from countries with a lower income, carried the remaining 5.67 percent. This shift reduced the time and strain involved in travelling, and increased the numbers able to perform the Hajj quickly and easily. As mentioned above, the survey of pilgrims has been subdivided according to these categories of transport: air, land and sea. Because land travel is characterised by variations in patterns of travel and arrival, more details are discussed in the next section of this chapter.

6.2.2 Travel patterns of land pilgrims

Pilgrims entering the Kingdom by land are recorded at the border stations by the Ministry of the Interior: Passport Affairs. In 1989 a total of 195,950 pilgrims travelled to Makkah in 11,936 vehicles (GDT, 1989).

FIG. 6.2 : Volume of vehicles of land pilgrims, distributed by entry points of S.A



SOURCE:CDT ,1989

Table 6.2

Number of vehicles used by external pilgrims from 20 May - 15 July 1989, according to point of entry.

Entry point	Halat Ammar	Al-Raqai	Salwa	Jizan	Nejran	Al- Jade-dah	King Bridge	Total
20/5/89-14/6/89	2,183	1,317	2,940	1,788	428	2,413	122	11,191
15/6/89-22/6/89	218	-	25	126	365	11	-	745
Total	2,401	1,317	2,965	1,914	793	2,424	122	11,936

Source: GDT, 1989 (Statistics of vehicles for Hajj 1989)

The record started one month and 23 days before the Hajj activity. Because the entry points are far away from Makkah, the great majority (11,191) came into the Kingdom in the early days of this period (see Table 6.2). It is obvious from the above table and from Figure 6.2 that the highest volume of traffic flowed through the Salwa station, which served pilgrims coming from Qatar, Imarat and Oman to the east of Saudi Arabia. The second highest figure came through Al-Jadedah, which serves pilgrims coming from Iraq. Halat Ammar, serving those coming from or through Jordan, Saray and Turkey, took third place. Both the latter are located in the north of the Kingdom. Southern stations such as Jizan and Nejrun serve among the smallest numbers. This does not reflect the volume of pilgrims flowing through such stations however, because the greatest volume of pilgrims coming from the eastern parts travel by small car, whilst those coming from the north very often use coaches, buses or mini-buses (illustrated below).

According to GDT data (1989) the impact of incoming vehicles on road transport within the Kingdom is minimal compared with existing capacities and flows. In 1989,

the daily peak from Salwa, for instance, was recorded to be only 515 on 1/7/1989, whilst all other daily volumes were far less than 400 vehicles (GDT, 1989).

Unfortunately, there are no official figures for each entry point to show the type of vehicles or number of pilgrims travelling by land. In relation to this, from the survey it may be useful to cross-tabulate between the variables 'transport mode' and 'entry points' used by pilgrims travelling by land. The result of this is shown in Table 6.3. There were 94 out of the land sample (96) that answered. The highest proportion, 36.2 percent, travelled by small private car; coaches carried about 31 percent, whilst the larger private car (estate wagon) came third in this list, carrying 18 percent.

Table 6.3

Modes of transport used by pilgrims travelling by land, according to entry points, 1989

Station	Halat Ammar	Al-Raqai	Salwa	Jizan	Al-Jadedah	Total	%
Coach	22	-	-	-	7	29	30.9
Public bus	1	-	-	-	1	2	2.1
Mini-bus	4	-	-	1	-	5	5.3
Station wagon	10	-	-	6	1	17	18.1
Private car	20	1	10	3	-	34	36.2
Official car	-	-	1	-	-	1	1.1
Taxi	2	-	-	-	1	3	3.2
Pick up	2	-	-	1	-	3	3.2
Total	61	1	11	11	10	94	-
Percentage	64.9	1.1	11.7	11.7	10.6	-	100

Source: Fieldwork, 1989

Generally, pilgrims coming from the northern stations such as Halat Ammar and Al-Jadedah use coaches more than other modes, whereas those who travel from the eastern and southern stations tend to use private cars. In fact, the four first types of transport (coach, bus, minibus and station wagon) may all be classified as public transport. In this case, more than 56 percent of land-based pilgrims travelled in this category.

Table 6.3a

Condensed Recategorisation of Table 6.3

	Harha Ammar	Salwa	Jezan and other	Total	%
Bus and minibus	27	-	9	36	38.5
Private car and other	34	12	12	58	61.5
Total	51	12	21	94	
%	64.6	12.5	22.9		100

The categories of Table 6.3 were reduced, above, to be able to test the relationship *between mode of transport and entry points by using chi-square.* In this case the null hypothesis (Ho) asserts that there is no significant difference between the entry points in terms of the modes of pilgrim transportation. The alternative hypothesis is that the observed difference between the samples reflects a real difference in the population at large.

The value of X^2 which was calculated by using the $SPSS^X$ program is 8.6. At the 0.05 significance level with 4 degrees of freedom, the critical value of X^2 is 5.99. Since the calculated value of X^2 is greater than this, the null hypothesis can be rejected at the

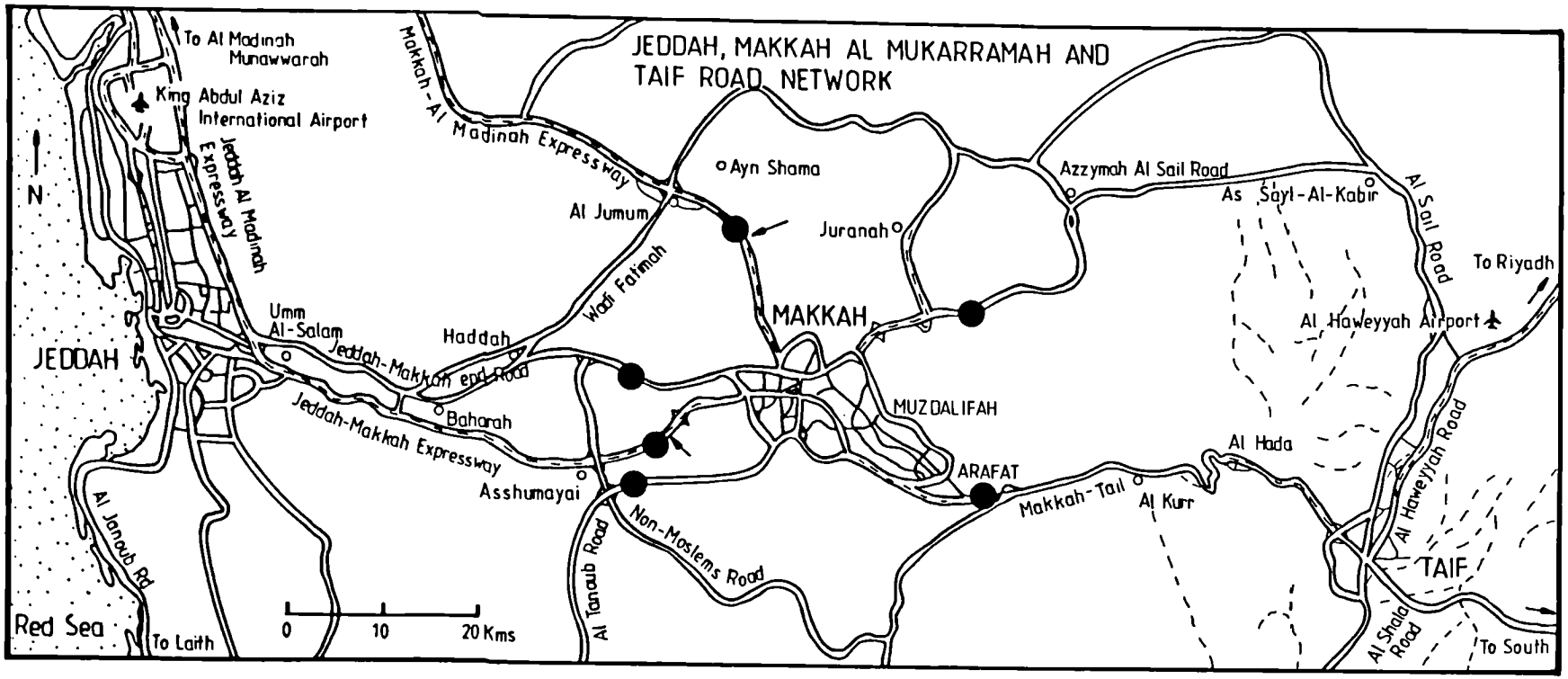
0.05 significance level. Thus, the alternative hypothesis can be accepted, that there is a real difference between the entry points with respect to the modes of pilgrim transportation.

6.3 Patterns of vehicular movement

6.3.1 Traffic flow

The numbers of vehicles entering and leaving Makkah are available during the Hajj period. The counts were conducted on the six regional roads converging on Makkah at check-points near Makkah, as shown in Figure 6.3. These counts were carried out by HRC (1989) using 24 hour machine traffic counters for one month. Using the same approach, GDT also publish annually a report of statistics of vehicles showing Hajj movement. However, the period over which the GDT counts are performed, being only 15 days, is shorter than that for the HRC count. These data will be used to demonstrate the absolute traffic movement on Makkah's regional roads.

Figure 6.3 Locations of the Counting Sites



● Locations of the counting sites by HCR and DHC

→ Locations of the counting sites by author Fieldwork

Table 6.4

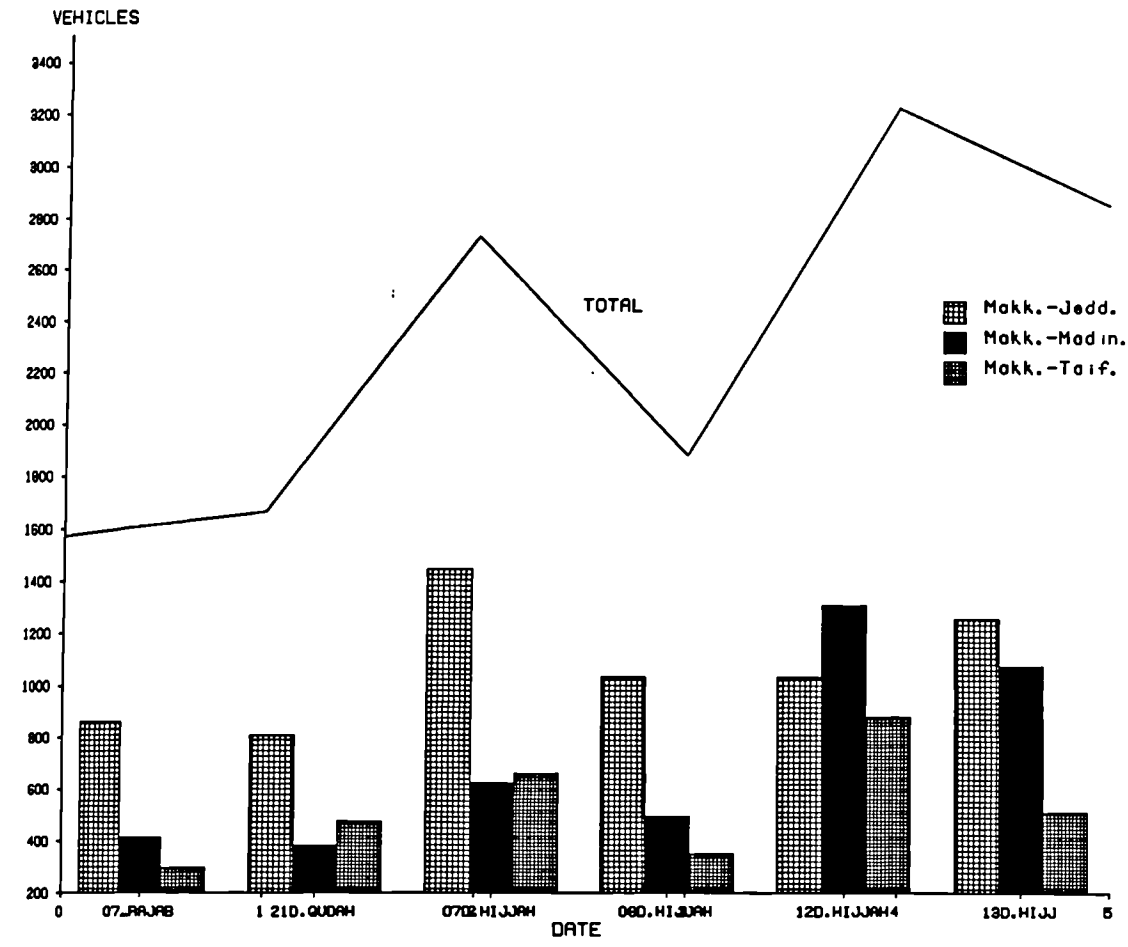
Peak hour volume of traffic on regional roads collected during non-Hajj and Hajj periods in 1983

Road	Makkah-Jeddah Expressway	Makkah-Madinah Expressway	Makkah-Taif Expressway	Total
Date of counts				
07 Rajab (8 April)	858	416	298	1,572
21 Dhul Qudah (18 August)	806	384	475	1,665
07 Dhul Hajjah (2 September)	1,447	624	660	2,731
08 Dhul Hajjah (3 September)	1,034	496	352	1,883
12 Dhul Hajjah (4 September)	1,035	1,307	881	3,223
13 Dhul Hajjah (5 September)	1,258	1,078	515	2,851

Source: DHC (1985) Report N2 Part 2.

However in order to understand the movement of traffic on regional roads during the Hajj period, it is helpful to look first at their movement during the non-Hajj period. Unfortunately no official data are available for this period, with the exception of those produced by some companies of consultants such as DHC (1985). The data in Table 6.4 were selected from a report published by DHC (1985). The table shows peak hourly volumes of traffic on some regional roads on specific days: in the non-Hajj period (07 Rajab); three weeks before Hajj activity (21 Dhul Qadah); just before the Hajj (07-08 Dhul Hajjah); and immediately after the Hajj (12-13 Dhul-Hajjah). These data were obtained using automatic counting machines located at specific points, as illustrated in Figure 6.3. The day of 07 Rajab was chosen as the highest peak-hour volume outside the seasons of Hajj and Ramadan. Table 6.4 and Figure 6.4 show the peak hour volume of traffic during a non-Hajj period being about half the volume of

FIG. 6.4 :Peak hour volume of traffic flow to Makkah of Hajj 1989



SOURCE:HRC ,1989

traffic during Hajj, particularly on the days on which people were leaving Makkah. On 07 Rajab, the peak hour volume was 1,572 vehicles in total on all roads, whilst on 07 Dhul Hajjah this figure jumped to 2,731, an increase of about 73 percent. Three weeks before Hajj (21 Dhul Qudah) the volume was at the same level as during the non-Hajj period (see Figure 6.4). This means that the impact of Hajj movement was felt from later than 21 Dhul Qudah (see Figure 6.4). However, during the period when pilgrims were leaving Makkah (21 Dhul Hajjah), the volume of traffic increased to more than double that of the non-Hajj period (see Table 6.4).

It is clear from Figure 6.4 that except on 12 Dhul Hajjah, the Makkah-Jeddah Expressway carried the greatest volume of traffic. The Makkah-Madinah Expressway was the next most heavily used regional road, followed by the Makkah-Taif Expressway. The volume of traffic reflects, in general, the patterns of travel in the Hajj period outside Makkah. The high traffic volumes on the Makkah-Jeddah Expressway reflect the strong ties between the cities of Makkah and Jeddah, for this road is considered the main entry route into Makkah.

According to HRC data (1989), the Makkah-Jeddah Expressway was still carrying the highest volume of traffic both to and from Makkah, as illustrated in Figure 6.5. In 1989, 47 percent of all traffic on the six regional roads used the Makkah-Jeddah Expressway and there was also 7 percent for the old Makkah-Jeddah road. The next most highly used road was the Makkah-Madinah Expressway, carrying about 16 percent. The other four roads illustrated in Table 6.5 carried between 3 percent and 15 percent. This means that more than 70 percent of all traffic movement during the

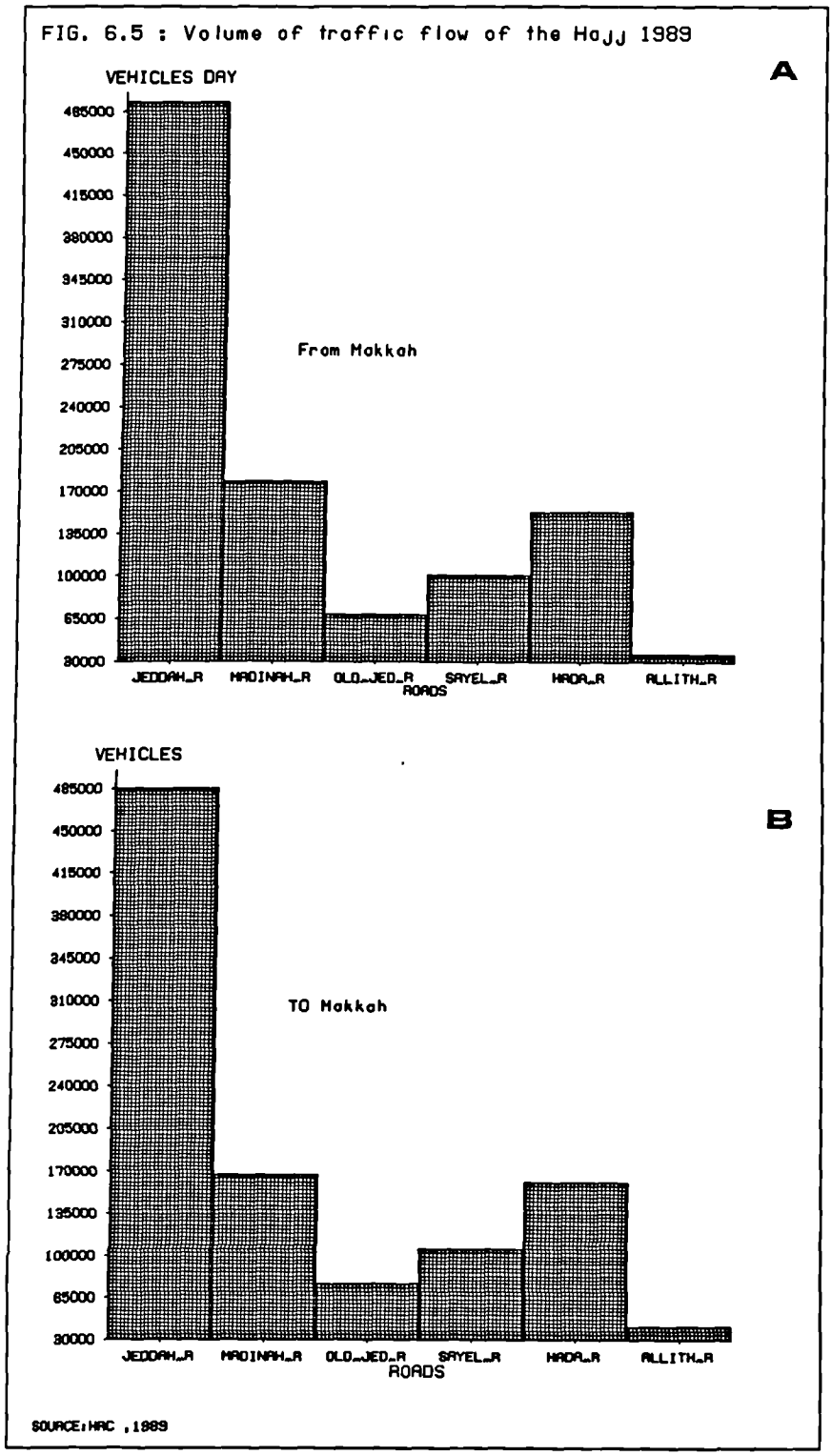


FIG. 6.5 : Volume of traffic flow of the Hajj 1989
A
VEHICLES DAY
485000
450000
415000
380000
345000
310000
275000
240000
205000
170000
135000
100000
65000
30000
From Makkah
JEDDAH_R
MADINAH_R
OLD_JED_R
SAYEL_R
HADA_R
ALLITH_R
ROADS
B
VEHICLES
485000
450000
415000
380000
345000
310000
275000
240000
205000
170000
135000
100000
65000
30000
TO Makkah
JEDDAH_R
MADINAH_R
OLD_JED_R
SAYEL_R
HADA_R
ALLITH_R
ROADS
SOURCE: MRC , 1989

Hajj period took place between the main cities of the Hajj region, i.e. Makkah, Jeddah and Madinah.

Table 6.5

Volume of traffic on the regional roads of Makkah throughout the month of Hajj (1989)

	Jeddah Exp.	Madinah Exp.	Old Jeddah Road	Sayel Exp.	Hada Exp.	Yemen Road	Total
To Makkah	484,924	166,929	76,472	105,384	160,454	41,373	1,035,536
From Makkah	492,279	178,067	67,931	100,909	153,201	35,932	1,028,319
Total	977,203	344,996	144,403	206,293	313,655	77,305	2,063,855
Percentage	47.4	16.8	7.0	10.0	15.0	3.8	100

Source: HRC 2989 (see Appendix 4)

According to HRC and GDT data (1989) daily vehicle flows into Makkah start to exceed the usual average of approximately 36,000 vehicles per day about two weeks before the day of Arafat, 09 Dhul Hajjah. Figure 6.6 shows that traffic movement increased to reach a first peak volume (about 41,000 vehicles per day) at the stage before Hajj activity (02 Dhul Hajjah). Traffic flow then fell sharply during the days of 3, 4 and 6 until reaching a level of 31,000 per day. The reason for this fall is the ban on small cars entering Makkah. There is a policy to restrict the entry of small cars, from 03-12 Dhul Hajjah, allowing entry only to vehicles carrying nine or more passengers. In spite of this restriction, the highest peak occurred on the eighth day, when the traffic flow to Makkah jumped to more than 43,000 vehicles (see Figure 6.6). On this day, which is the day before 'Arafat Waqfah', company buses parking

outside Makkah are allowed by Traffic Management to enter Makkah City to transport pilgrims to Arafat. The period of Hajj itself has the lowest level of traffic entering or leaving Makkah, as illustrated in Figure 6.6. After the Hajj, on 12, 13 and 14 Dhul Hajjah, there is a three day peak when the volume of departing traffic reaches about 60,000, 64,000 and 44,000 vehicles respectively, amounting to twice the average (see Figure 6.6.B.).

The difference between the number of vehicles entering and leaving Makkah permits an estimation of the proportion of vehicles remaining in Makkah over the Hajj, this being the approximate number of vehicles which will also be used for transporting the pilgrims between the Holy Places. According to GDT data (1989) the vehicles remaining in Makkah during the Hajj period was 40,143, counted from 27 Dhul Qudah to 09 Dhul Hajjah (1 - 12 July 1989), see Table 6.6.

Table 6.6

Vehicles entering and leaving Makkah between 1- 12/7/1989

Date	Vehicles entering Makkah	Vehicles leaving Makkah	Surplus in Makkah
27-30 Dhul Qudah (1-4 July 1989)	159,623	158,195	+1,428
01-09 Dhul Hajjah (5-12 July 1989)	358,209	319,494	+38,715
Total	517,832	477,689	+40,143

Source: GDT (1989) 'Statistics of the Vehicles on the Hajj road, 1989'

This large volume of vehicles (40,143) (see Chapter Four), added to the traffic already present in Makkah (147,458), creates a complicated situation in terms of Hajj movement in Makkah City and the Holy Places, as discussed below in this chapter.

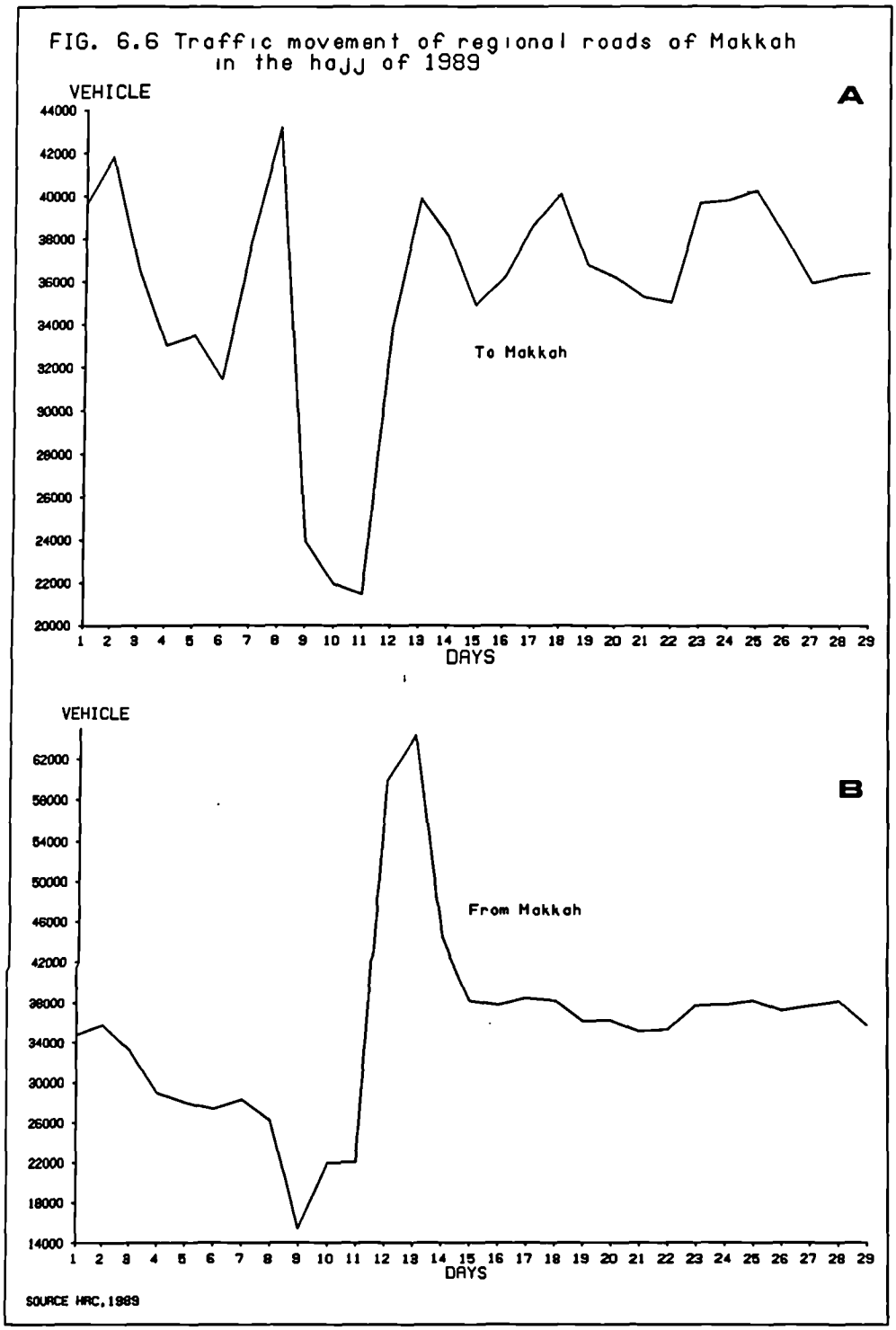


FIG. 6.6 Traffic movement of regional roads of Makkah in the hajj of 1989

6.3.2 Vehicle classification counts

Because there are no data available on the classification of vehicles entering Makkah, a survey was undertaken to determine the number and type of those vehicles. Classification counts were conducted on the two major roads: Jeddah-Makkah and Madinah-Makkah, at specific points 200m beyond the checkpoints from which small cars were restricted (see Figure 6.3). These counts were conducted on two days: 07 and 08 Dhul Hajjah. The two days were selected as days of peak traffic flow pre-Hajj, according to GDT data on 1984-1989.

For the survey, teams of two trained surveyors were stationed at each point mentioned above, with forms (shown in Appendix 1). They recorded the volume of traffic by the nine types of vehicle shown in Table 6.7, for 24 consecutive hours. The number of each type of vehicle was recorded for each 15 minute period.

The purpose of this survey was to discover the proportions of the most common types of vehicles used to enter Makkah. Table 6.7 shows that about 49,373 vehicles entered Makkah on the two roads concerned during the 24 hours of the survey. The highest percentage of these (more than 29 percent) was for station wagons. It is surprising to find that the second place (28 percent) was taken by small cars, in spite of the above-mentioned restriction on the entry of such cars into Makkah. Moreover the highest percentage on 07 Dhul Hajjah on the Jeddah-Makkah road and on 08 Dhul Hajjah on the Madinah-Makkah road was of small cars (see Table 6.7). Such enormous numbers of small cars (13,871) may be attributed to drivers with official permission from the authorities. This suggests that the system of permission undermined the aim of the restriction (to restrict the number of small cars).

Table 6.7

Twenty four hour volume on the two major roads outside Makkah, by vehicle type, on 07 and 08 Dhul Hajjah

Type of Vehicle	Jeddah to Makkah		Madinah to Makkah		Total
	7th day (%)	8th day (%)	7th day (%)	8th day (%)	
Small car	5,259	5,335	1,556	1,521	13,871
	(36.3)	(25.2)	(22.2)	(24.8)	(28.1)
Station wagon	4,687	6,733	1,850	1,458	14,728
(9 passengers)	(31.0)	(31.8)	(26.4)	(23.8)	(29.8)
Pilgrim bus	1,494	3,858	416	406	6,174
	(10.0)	(18.2)	(6.0)	(6.6)	(12.5)
SAPTCO	88	75	219	183	565
(single deck)	(0.6)	(0.4)	(3.2)	(3.0)	(1.2)
SAPTCO	13	52	34	42	141
(double deck)	(0.08)	(0.3)	(0.48)	(0.7)	(0.3)
Minibus	1,318	2,938	723	525	5,504
	(8.8)	(13.9)	(10.3)	(8.6)	(11.2)
Truck	1,512	1,512	672	793	4,489
	(10.0)	(7.2)	(9.6)	(12.9)	(9.0)
Tanker	90	173	1,233	984	2,480
	(0.6)	(0.8)	(17.6)	(16.0)	(5.0)
Other	384	497	320	220	1,421
	(2.6)	(2.4)	(4.6)	(3.6)	(2.9)
Total	15,045	21,173	7,023	6,132	49,373
	(100)	(100)	(100)	(100)	(100)

Source: Fieldwork 1989

During the 1989 Hajj, the number of vehicles retained at the peripheral car parks was 15,017 (GDT 1989:16). This number accounts for car parks on all the six roads entering Makkah during the whole Hajj period. The number of vehicles permitted to enter (13,871) represented only two roads and two days. This suggests that the proportion of small cars with permission to enter was too large. The majority of drivers with permission to enter were inhabitants of Makkah commuting between Makkah City and outside (Interview held on 17 July 1989 with an official of the Traffic Department in Makkah). However, in order to reduce the number of permits, the policy of granting permission would bear review and possible regulation by the responsible departments. This procedure could help to attain the ultimate goal of totally banning small cars, thus reducing overcrowding and congestion during the Hajj period in Makkah.

Pilgrim buses form the third highest contribution to the volume of traffic, with 6,174 (12.5 percent) entering Makkah via the Jeddah-Makkah and Madinah-Makkah roads on 07 and 08 Dhul Hajjah (see Table 6.7). Buses ranked sixth in the total volume of traffic on the Madinah-Makkah road, and third on the Jeddah-Makkah road. The reason for this may be attributed to car parks of company buses, which are located on the Jeddah-Makkah Expressway, from where on 08 Dhul Hajjah the buses are permitted to transport pilgrims between the Holy Places during the Hajj period. Hence the flow of buses on 08 Dhul Hajjah increases two-and-a-half-fold over that of 07 Dhul Hajjah on the Jeddah-Makkah road (see Table 6.7).

The fourth highest contributors (11.2 percent) to the volume of traffic were minibuses (carrying 9-25 passengers).

Trucks (pick-up, lorry, trailer etc.) ranked fifth, with 4,489 trucks (9 percent), and 2,480 tankers (5 percent). The Hajj season requires a guaranteed supply of food and goods to satisfy the needs of two million pilgrims in Makkah, resulting in an increase in the number of trucks entering Makkah. It is important, therefore, to consider these demands in relation to the need to restrict the movement of trucks. It might be necessary to plan for movement in terms of the following four types:

1 Trailers for transporting food

2 Light trucks for transporting food

3 Trailers for transporting construction goods

4 Light trucks for transporting construction goods

The first and second categories would be able to obtain permits to enter Makkah according to the traffic plan laid down by the government. In the same way that small cars are forbidden entry into Makkah City during the Hajj period, so too should the third category given above. The fourth category should be prevented from entering only during the peak days of the Hajj season.

Regarding tankers, the greatest percentage of these were water tankers supplying drinking water. The continued existence of this phenomenon is surprising, as there is a network of water pipes providing sufficient water for the city's needs, according the *Nadwah* newspaper (1989, no.9322). However, that this phenomenon does exist is evidence that there remain some places which rely on tankers for the delivery of water. An extension of the existing system of pipes could therefore be considered by the Municipality of Makkah, improving the supply of water for Makkah and its pilgrims, and reducing the number of tankers entering the city.

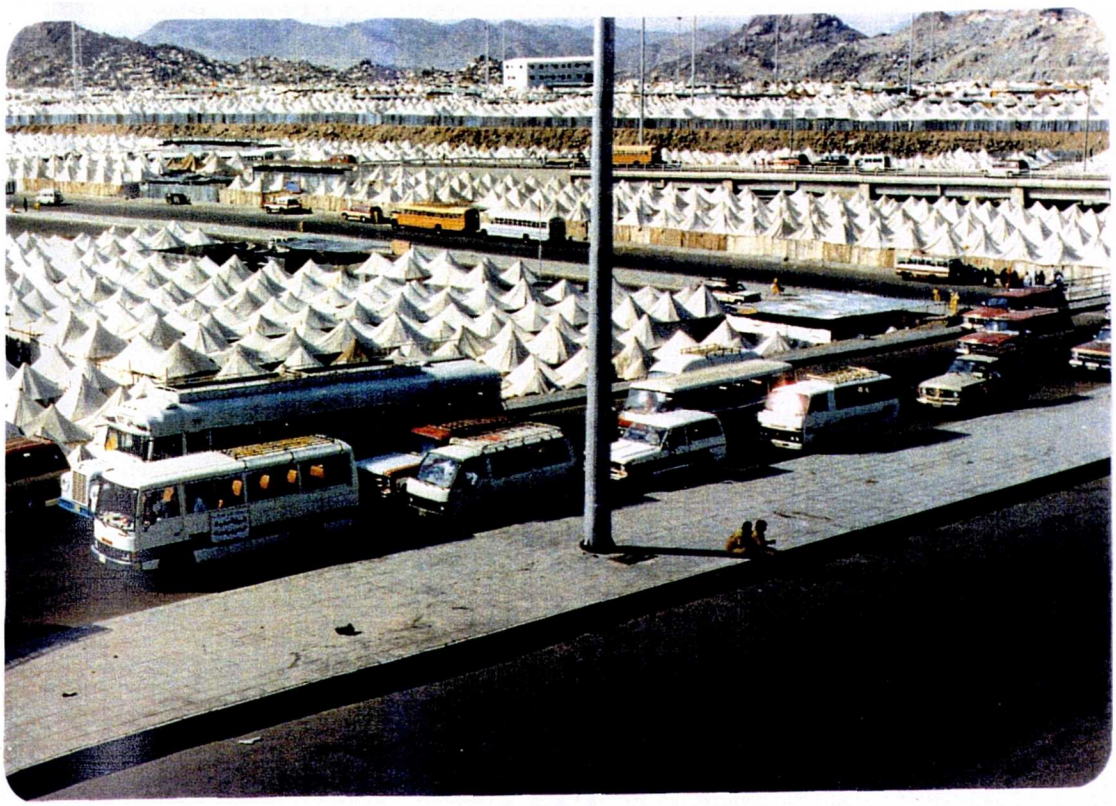


Plate 6.2 Different types of station-wagons, which are shared during the Hajj movement in Muna (above) and in Arafat (below), see section 6.3.2.

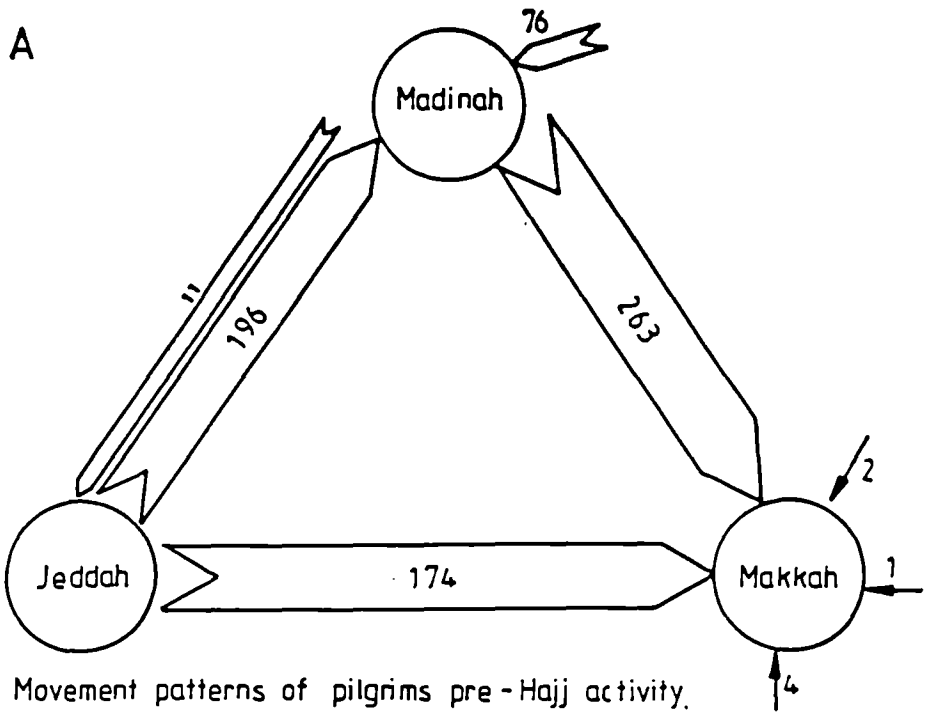
Before leaving this topic, further attention should be paid to the type of vehicle forming the highest percentage of those contributing the volume of traffic, i.e. station wagons. The capacity of this vehicle cannot exceed ten passengers , although its size on the road and in car parks is similar to that of a minibus, able to carry 12 passengers. The station wagon has a 450 horse power engine, similar to that of a GMC bus, which carries 35 passengers. Both vehicles exude the same volume of exhaust fumes, a major environmental pollution problem. As a mode of transport during the Hajj, in the limited space and very hot weather, the station wagon is less efficient than both the minibus and a GMC bus. In order to reduce traffic congestion and pollution in Makkah during the Hajj, it may therefore be worth suggesting a rise in the minimum permitted number of passengers per vehicle from nine to 12. As with small cars, the entry of vehicles with a seating capacity of fewer than 12 could be forbidden from 01 to 13 Dhul Hajjah.

6.4 Movement of pilgrims in the Hajj region

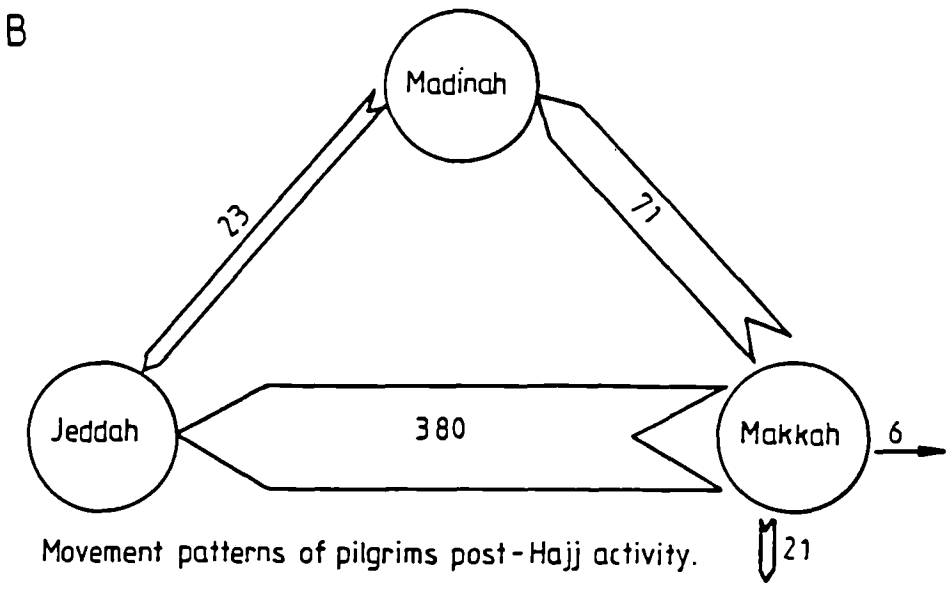
6.4.1 Movement patterns of pilgrims

As indicated above, the Hajj activity, which takes up four to five days, must be in Makkah. There are therefore two patterns of movement in terms of inter-city flow around the Hajj region: pre- and post-Hajj activity. The results of a survey of traffic volume distribution of external pilgrims between the cities of the Hajj region are compiled in Table 6.8. This table was constructed by cross tabulating between the origin of the pilgrim coming to Makkah and the destination of the pilgrim on departure. In addition, a simple model was developed to illustrate movement patterns of pilgrims between the major cities of the Hajj region (see Figure 6.7).

Figure 6.7 Movement patterns of pilgrims within the Hajj Region.



Movement patterns of pilgrims pre-Hajj activity.



Movement patterns of pilgrims post-Hajj activity.

The movement of pilgrims between Jeddah and Madinah was calculated according to how many visited Madinah from Jeddah before the Hajj. In this case there were 444 respondents, forming 87 percent of the sample of 507.

Table 6.8

Origin and destination of pilgrims within the Hajj region after performance of the Hajj in Makkah.

To / From	Jeddah	Madinah	Al-Taif	Other	Total	%
Jeddah	149	22	-	3	174	39.2
Madinah	192	47	7	17	263	59.2
Al-Taif	-	1	-	-	1	0.2
Al-Lith	-	-	-	4	4	0.9
Other	1	-	-	1	2	0.5
Total	342	70	7	25	444	-
%	77.0	15.8	1.6	5.6	-	100

Source: Fieldwork, 1989

It is clear from the table above and Figure 6.7 that the greatest flow of pilgrims arriving in Makkah was from Madinah. There were 263 out of the 444 pilgrims arriving in Makkah after visiting Madinah. This means that before the Hajj activity about 60 percent of inter-city movement by pilgrims occurred on the Madinah-Makkah Expressway (see Chapter Three). The flow volume from Jeddah to Madinah was the second greatest, where 196 pilgrims (44 percent) went to Madinah before the Hajj. The reason given was that the majority of external pilgrims visited Madinah before the Hajj. The findings of the survey reveal that about 96 percent (448) of the pilgrims

who had performed this visit had done so before the Hajj, whilst only 4 percent carried it out afterwards. Thus flow from Jeddah to Makkah was lower in volume after than before the Hajj.

Other directions of movement of pilgrims from outside Makkah made up a very small proportion of the total (see Figure 6.7). These were often made up of those pilgrims coming by land, being a much smaller percentage in 1989 than those travelling by air or by sea to Jeddah. About 17 percent (76) of pilgrims arrived by land through Madinah. The volume of pilgrims travelling overland to Makkah was made up as follows: 4, 1 and 2 pilgrims passed through Al-Lith, Al-Taif and others respectively.

In fact the geographical location of land pilgrims is considered a significant factor in terms of the patterns of their flow volume and directions. Most pilgrims travelling by land originate from countries to the north or north west of Saudi Arabia, such as Turkey, Lebanon, North Africa and Europe, passing through Madinah before arriving in Makkah. On the other hand, pilgrims travelling overland coming from the south are comparatively few, corresponding to the geographical distribution of external pilgrims (see Chapter Five). From the survey, about 70 percent (96) of the land sample approached the Hajj region from the north and north east, whilst only 12.5 percent arrived from the south.

Movement patterns post-Hajj (Figure 6.7B) show attributes of movement opposite to pre-Hajj patterns (Figure 6.7A). On departing Makkah, about 80 percent of pilgrims headed for Jeddah, and only 15 percent went towards Madinah. This is because the majority of pilgrims prepared to return home after Hajj via the airport and seaport of Jeddah (see Table 6.5). In pattern (B), the flow volume to Jeddah from

Madinah was small in comparison with pattern (A). This relates to the people who perform this visit after Hajj, which in 1989 was only 4 percent, according to the survey. The other direction of flow from the Hajj region consisted of a very small proportion of the total, as a result of the small percentage of pilgrims travelling by land (see Figure 6.7B). However such patterns of movement do not reflect the actual patterns of traffic flow in the Hajj region, discussed above in a previous section. It has been found that the Jeddah-Makkah road, for example, carried the highest volume of traffic both to and from Makkah with respect to vehicle flow, whereas it carried only the third highest volume concerning pilgrim flow.

Finally, it is interesting to test the result of Table 6.8 by using the Chi Square Test. The purpose of performing this test is to find out whether there is a significant difference, in terms of the volume of pilgrim movement, between cities from which movement originated and cities for which the movement was destined. As can be seen in Table 6.8, more than 50 percent of the table cells have fewer than two observed frequencies. So the value of the origin variables Al-Taif, Al-Lith and Other, as well as the destination variable Al-Taif, possess only 1.6 percent of the volume of movement, and can therefore be ignored for the present. Table 6.9 was produced to concentrate on the values on Jeddah and Madinah, which represent about 90 percent of the total volume of movement of pilgrims. This latter table can be used to analyse the relationship between patterns of pilgrim movement in terms of origin and destination in the Hajj region.

Table 6.9

The major frequencies of pilgrim movement in the Hajj region, 1989

To / From	Jeddah	Madinah	Other	Total	%
Jeddah	149	22	3	174	40.5
Madinah	192	47	17	256	59.5
Total	341	69	20	430	100

*This table was calculated from table 6.8

The null hypothesis (H_0) is that, in terms of pilgrim movement, there is no difference between the cities of the Hajj region. The alternative hypothesis is that there is a difference. From the sample data shown in Table 6.9 it can be seen that 73 percent (192/256) of the pilgrims who arrived in Makkah from Madinah went to Jeddah after the Hajj activity, whereas only 18 percent of those leaving Makkah went to Madinah. The null hypothesis assumes that this difference is only an apparent difference due to chance in the sampling process, and is not representative of movement in the pilgrim population. Use of the SPSS^X computer program revealed a chi square value (X^2) of 9.0 at two degrees of freedom. At a significance level of 0.01, the calculated value of X^2 is slightly below the critical value. Therefore, the null hypothesis cannot be rejected. However, at the customary level of significance (0.05), the null hypothesis can be rejected, and the alternative hypothesis can be accepted, i.e. that there is a difference between Jeddah and Madinah in terms of the movement volume of pilgrims arriving at, and departing from, Makkah.

6.4.2 Modes of pilgrim travel

This topic covers type of vehicles used for travel between Jeddah-Makkah-Madinah. The only mode of transport available within all parts of the Hajj region is the motor vehicle, in spite of existing airlines between Jeddah and Madinah. According to the 1989 survey, the percentage of pilgrims using this airline was small (7.5 percent out of the sample of 507). In relation to land pilgrims, about 36 out of 96 came to Makkah by car, whilst 25 were transported by coach (see Table 6.10).

Table 6.10

Modes of transport carrying pilgrims to Makkah according to international transport modes

Modes of transport	Air	Land	Sea	Total	%
Pilgrim bus (GSC)	220	9	17	246	51.3
Coach	38	24	2	64	13.3
Public bus	34	-	3	37	7.7
Mini bus	5	6	2	13	2.7
Private (saloon)	11	15	1	27	5.6
Private car	9	36	1	46	9.6
Taxi	23	3	6	32	6.7
Official car	2	-	1	3	0.6
Pick up	1	3	-	4	0.8
Motor cycle	2	-	-	2	0.4
Other	5	-	1	6	1.3
Total	350	96	34	480	-
Percentage	72.9	20.0	7.1	-	100

Source: Fieldwork, 1989

Regarding pilgrims travelling by air and sea, the policy of the Hajj Ministry is that these pilgrims should be transported by GSC buses (pilgrim buses). The survey illustrated that in 1989 only 63 percent of air-borne pilgrims and about 50 percent of sea-borne pilgrims were transported to Makkah by GSC bus (see Table 6.10). This figure, in fact, is considerably less than during the Hajj of 1987, when 90 percent travelled by pilgrim bus, according to GSC data (see Chapter Four). Such a difference may be explained in several ways. First, the pilgrims interviewed might not have recognised the classification of transport modes in the questionnaire (see Appendix 2), particularly between pilgrim bus, coach and public bus. However, even assuming that all these three modes are classified in one category, the percentage (about 82 percent) is still low in comparison with 1987. This means that the second reason, the existence of various alternative modes chosen by pilgrims instead of the GSC bus, has more impact. This is because such modes perhaps provide more comfortable facilities, such as taxis, which carried the second highest percentage of air- and sea-travelling pilgrims (See Table 6.10). In addition to this, the modes of public transport catering for Hajj movement have no schedule, usually depending upon waiting for the bus to fill up before departing. Some pilgrims are not prepared to wait in this manner, and therefore choose a quicker and easier means of travel.

The survey reveals that 6 out of 495 pilgrims (1.2 percent) complained about the long wait for the departure of buses. However 70 percent of the pilgrims who were asked about the biggest transport problem facing them en route to Makkah reported no problem at all. The major problem that was mentioned (by 4.5 percent of respondents) was the lack of air conditioning in the vehicles, and further investigation revealed that 30.6 percent of these vehicles had no air conditioning. Another problem

mentioned related to management aspects, was dissatisfaction with the Office of United Agencies at Jeddah airport, mentioned by 22 (4.3 percent) pilgrims. The remaining problems related to the hot weather (2.2 percent), length of time spent travelling (2.9 percent) and behaviour of drivers (1.8 percent).

Finally, it is important to understand the relationship between international modes of transport (air, sea and land) and the kinds of vehicles used by pilgrims in the Hajj region. As was previously indicated, the majority of air- and sea- borne travellers used the pilgrim bus into the Hajj region, while pilgrims travelling by land used private car or coach. However, using the Chi Square test, the null hypothesis (Ho) here is that there is no difference between the local modes of transport in terms of frequency and the international modes used by pilgrims. The alternative hypothesis is that the observed difference between transport modes in terms of numbers of pilgrims transported reflects a real difference in the population of the samples as a whole.

Type of vehicles in Table 6.10 have been re-aggregated to reduce the cells of expected frequency which are less than 5. The Chi Square test will rely upon Table 6.11 below.

Table 6.11

Modes	Air	Land	Sea	Total	%
Pilgrim bus	220	9	17	246	51.3
Public bus	77	30	7	114	23.8
Private car	20	51	2	73	15.2
Taxi	23	3	6	32	6.7
Other	10	3	2	15	3.1
Total	350	96	34	480	100

Source: See Table 6.11

The value of X^2 which has been calculated using the $SPSS^X$ program, is 167.2. The degree of freedom in this case is 8. At all significance levels, the calculation value of X^2 (167.2) is greater than the critical value. So the null hypothesis can be rejected at any level of significance. This means that we can accept the alternative hypothesis that there is a real difference between the local modes of transport in terms of frequency and the international modes used by pilgrims..

6.5 Duration of Pilgrim Sojourn

6.5.1 Duration of stay in Saudi Arabia

One of the major problems which the transport system faces is the variation in the patterns of arrival and departure times amongst the pilgrims.

"In the past, when the steam ship was the main mode of travel, pilgrims not only came in smaller numbers than they do today; but also stayed a longer time in the region than they do now. Some remained for as long as six or seven months, and many

of them used to spend the month of Ramadan in either Makkah or Madinah. Beside leaving the region many pilgrims used to stay until the third or fourth month of the next year." (Al-Hamdan, 1976: 186)

More recently, with modern modes of transport providing faster and more frequent travel, pilgrims spend as little as three weeks in the Hajj region, and few stay longer than two months. The 1989 survey revealed that 36 percent of 483 pilgrims stayed less than 21 days, and around 35 percent spend a period ranging between 21 and 30 days. The pilgrims who sojourn more than fifty days make up only about 5 percent of the total (see Table 6.12). Thus, the average number of days that the pilgrims spend in Saudi Arabia, has been found not to exceed 27 days. Such data have been derived from the difference between patterns of arrival and departure dates of pilgrims.

Table 6.12

Duration of stay in Saudi Arabia by external pilgrims

Length of stay (days)	Number of pilgrims	%
0 - 10	39	8.1
11 - 20	135	28.0
21 - 30	172	35.6
31 - 50	115	23.8
51 +	22	4.6
Total	483	100
Missing cases	24	
Sample volume	507	

Source: Fieldwork, 1989

The survey revealed that more than 50 percent of pilgrims arrived in the Hajj region during the period 11-30 days before Hajj activity. However, a more important fact revealed by the survey was that 8 percent of pilgrims spent a period of fewer than eleven days. In 1973 only 0.2 percent of 687 pilgrims used to spend this period, according to the pilgrims' survey which was undertaken by Al- Hamdan (1976). The implication of the short duration of the season is its impact on transport facilities, movement, employment and other services. The change in the pattern of arrival and departure of the pilgrims is considered to be a recent phenomenon, and may be attributable to the change in mode of travel to the Hajj region, as has been shown in previously in this Chapter. Table 6.13 illustrates the length of the sojourn in Saudi Arabia compared with mode of travel. It is plain from this Table that the average number of days spent in Saudi Arabia by sea pilgrims is much higher than that spent by land and air pilgrims. About 42 percent of the pilgrims who came by ship stayed for more than a month, whereas only 4.4 percent of land pilgrims and 34 percent of air pilgrims stayed that long. The reason for this may be that the international movement of ships and planes are often subject to specific schedules, whereas travelling overland is more flexible. Private transport, which consists of 30 percent of the Hajj movement, as mentioned, is not usually subject to specific terminal or determined schedules. Thus the average number of days spent by the pilgrims who came by land was the lowest, not exceeding 19 days (see Table 6.13).

Table 6.13

Duration of stay in Saudi Arabia by mode of arrival

Mode of arrival	Length of stay (days)										
	0 - 10	%	11 - 20	%	21 - 30	%	31 - 50	%	51 +	%	Average
Air	17	4.7	94	26.2	126	35.1	110	30.6	12	3.3	28.2
Land	13	14.4	38	42.2	35	38.9	4	4.4	-	-	19.0
Sea	-	-	5	15.2	14	42.4	4	12.1	10	30.3	35.4

Source: Fieldwork, 1989

Examination of the relationship between length of stay and mode of travel can be enhanced by applying the chi-square test to the data in Table 6.13. The null hypothesis (H_0) is that there is no difference between the values of each category of stay duration in terms of mode of arrival. The SPSS^X program revealed a chi- square value of 98.0 at eight degrees of freedom. The calculated value of chi-squared is considerably greater than the critical value at any level of significance. The null hypothesis, therefore, can be rejected, i.e. mode of travel clearly influences length of stay.

6.5.2 Arrival and Departure Patterns

From the foregoing it has appeared that each mode of international transport has a specific pattern for the length of stay of the pilgrims who use it. This phenomenon is further confirmed by statistics obtained from CDS (1989). Although the available data are confined only to patterns of arrival, it might be convenient to quote their data here. The accumulating total numbers of external pilgrims are shown in Table 6.14. It is evident from the Table that, until the end of the 18th of Dhul Qudah (20 days before the Hajj), about 30 percent of the pilgrims who travelled by sea had

arrived. By that same time, 26 percent of air pilgrims had arrived, but only 4 percent of those who came by land, had arrived.

Table 6.14

Cumulative total of pilgrims arriving in Saudi Arabia by date and mode of travel [A.H. 1409; A.D. 1989]

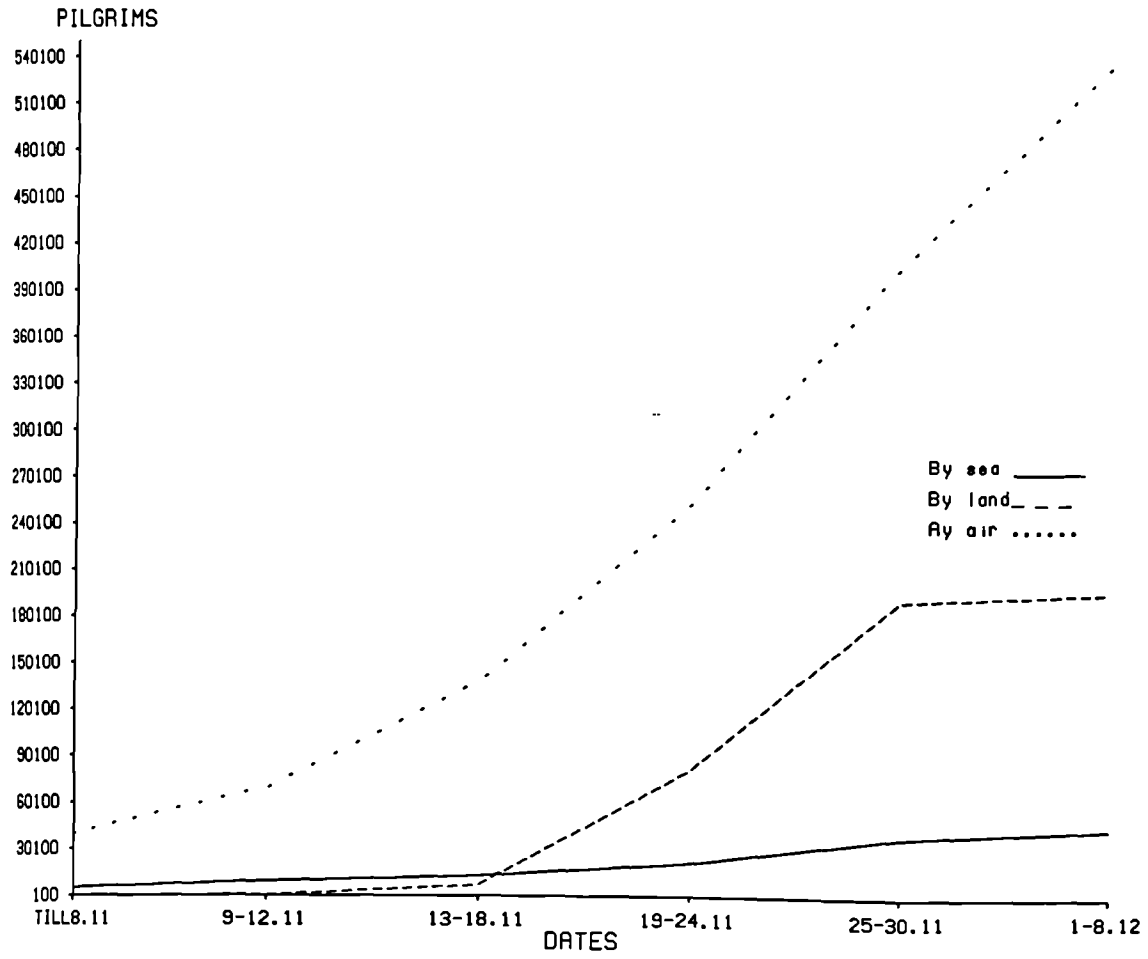
Dates	Mode of travel						Total (all modes)	
	Air	%	Land	%	Sea	%	Number	%
Up to 8/11 (12/6)	39,649	7.4	130	0.06	5,234	11.9	45,013	6
9-12/11 (13-16/6)	69,430	13.0	352	0.2	9,292	21.0	79,074	10
13-18/11 (17-22/6)	138,342	26.0	7,018	3.6	13,056	29.7	158,416	20
19-24/11 (23-28/6)	252,884	47.3	81,150	41.4	21,261	48.4	355,295	46
25-30/11 (29/6 - 3/7)	406,014	76.0	190,529	97.2	38,597	87.8	635,140	82
1-8/12 (4-11/7)	534,662	100	195,950	100	43,948	100	774,560	100

Source:CDS (1989) *Statistics of Pilgrims*

The groups of air and land pilgrims, who constituted more than 94 percent of the total (see section 6.2), have both shown sharp rises in numbers only 18 days immediately preceding the Hajj activity (see Figure 6.8). More than 50 percent of them arrived within only one week, according to the official statistics (CDS, 1989).

Regarding departure patterns, the pilgrims usually start to leave the region suddenly after the Hajj, which finishes on 12 Dhul Hajjah. Departure takes place over a shorter period than arrival. The survey reveals that the average number of days the pilgrims stay in the region after the Hajj is only 4 days. Table 6.15 shows that 86 percent of 493 pilgrims left the Hajj region within 5 days and only 6 percent stayed more than 10 days.

FIG. 6.8 Accumulative total numbers of external pilgrims arriving in Saudi Arabi by dates and modes, 1989



SOURCE FIELDWORK, 1989

Table 6.15

Patterns of movement according to dates of arrival and departure

Dates (1989)	Pilgrims arriving	
	Number	%
Upto 12/6	104	21.2
13-16/6	15	3.0
17-22/6	67	13.7
23-28/6	123	25.2
29/6 - 3/7	60	12.2
4-11/7	121	24.7
Total	490	100
No response	17	3.3
Dates (1989)	Pilgrims departing	
	Number	%
15-20/7	424	86
21-25/7	42	8.5
26-30/7	10	2.1
31/7 - 4/8	14	2.8
5/8 & after	3	0.6
Total	493	100
No response	14	2.8

Source: Fieldwork, 1989

In fact, these statistics regarding the departure patterns of pilgrims, obtained from the survey, may not reflect the variety of the population, due to the sample locations being at exit points such as air and sea ports, as mentioned. However, an unpublished report was undertaken by HRC (1988), which indicated that the average number of days that the pilgrims sojourn in Saudi Arabia after the Hajj, was 7 days. The report

of the HRC demonstrated that about 90 percent of the pilgrims left the Hajj region within 10 days. This means that the demand for regional and international transport modes reached its peak in the course of the departure patterns, rather than the arrival patterns.

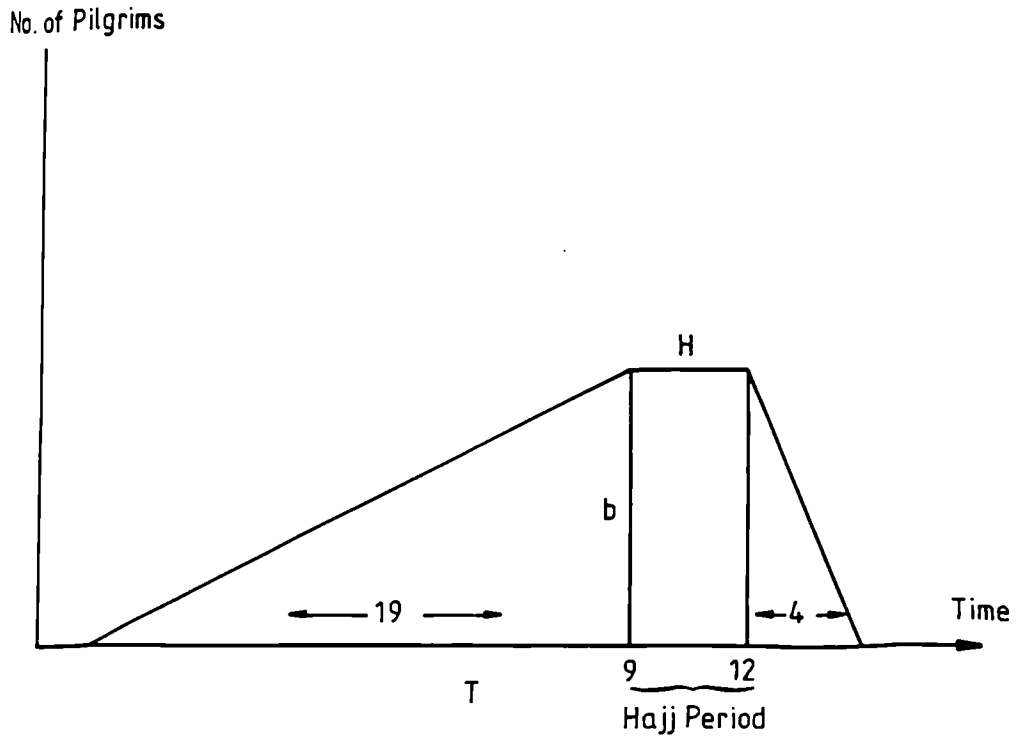
This enormous demand may have caused the GSC buses not to transport the pilgrims satisfactorily in the course of departure. In the survey, the pilgrims were asked about the mode of transport used during their departure from Makkah. The survey showed that only 46 percent of the air and sea pilgrims (384) were transported by the GSC buses. In the case of the arrival patterns in Makkah, more than 60 percent were served by the GSC (see Section 4.4.3.3)

6.5.3 Duration of stay in Makkah

It has been clarified by the above discussion that the pilgrims spend an average of 19 and 4 days pre- and post-Hajj activity. It is known that the minimum period which the pilgrims must stay in Makkah is 4 days. However, there are no available data to illustrate the duration or average length of stay in Makkah. Thus, it may be possible to derive this average by using a simple geometrical model, shown in Figure 6.9. This model assumes that all pilgrims must be in Makkah during the Hajj activity, which takes 4 days. Before this period, they start to arrive in Makkah gradually, from the beginning of the average length of stay in Saudi Arabia until they completed their arrival at the 9th of Dhul Hajjah. Similarly, they began to leave Makkah immediately at the end of the Hajj in 12 Dhal Hajjah.

The total number present during the four day Hajj period is assumed constant which can be represented by 'b'. The area under the profile curve represents total person-

Figure 6.9 Geometrical model time of the pilgrims present in Makkah



days spent in Makkah. Thus, the average length of stay in Makkah may be obtained by dividing the area of the trapezium by the total number of the pilgrims. This process can be represented as follows:

$$A = \frac{\frac{1}{2}(T + H)b}{b}$$

where

A = an average length of stay in Makkah

T = an average length of stay in Saudi Arabia

H = the period of the Hajj activity

b = the total number of pilgrims

The calculated average is approximately 15 days. However, according to the HRC data, the average length of the departure patterns is 7 days, giving a calculated average for the average length of stay as 17 days. It would be fair to suggest that the average length that pilgrims stayed in Makkah ranged from 15 to 17 days.

Finally, it is important to stress that this change in the inflow and outflow was a reflection of the fact that pilgrims were staying for shorter durations. According to Al-Hamdan (1976) and CDS data (1960-1972), in 1961 and 1971 the average length of stay in Saudi Arabia used to be 51 and 35 days, respectively. Such a decline may be a direct consequence of the shift of pilgrims away from sea travel towards air and overland travel (see section 6.2.1). In addition to this, increases in the cost of transportation and accommodation in Saudi Arabia and maybe other factors contri-

buting to the decline in the length of stay. This means that the short duration of stay for the Hajj may continue for as long as these factors persist. As a result of this attenuation of the Hajj season, however, transport facilities will face increased pressure and demand.

Therefore, the authorities and planners should bear this phenomenon in mind when embarking on any project or policy relating to Hajj movement.

Summary

Besides international movement, the travel patterns of external pilgrims have changed in terms of modes of transport. In 1950, sea travel was the dominant mode of transport to the Hajj region - 77.70 percent at that time. Recently, this percentage has shifted with the development of modern modes of transport. In 1989 about 70 percent of external pilgrims arrived in Saudi Arabia by air, whilst those who travelled by sea did not exceed 5.8 percent. The majority of pilgrims coming to the Hajj from neighbouring countries do so by overland transport (25.30 percent). The reasons for this shift were indicated in section 6.2.

According to the survey, about 65 percent of land pilgrims arrived in Saudi Arabia via Halat Ammar on the Jordan-Saudi border. Most of the land pilgrims were transported by coach, public bus, mini bus and station wagon, which accounted for more than 56 percent of these pilgrims. Thirty six percent came to the Hajj in private cars.

As regards the traffic movement of vehicles within the Hajj region, it is revealed that the peak-hour volume of traffic during the Hajj period was well over double that of

the non-Hajj period (Table 6.4). Among the six roads leading to Makkah, the Jeddah-Makkah expressway was considered to carry the highest traffic volume, followed by the Madinah-Makkah expressway - i.e. more than 70 percent of all traffic movement of the Hajj outside Makkah took place within the Makkah-Jeddah-Madinah inter-city system. Apart from the vehicle numbers entering and leaving Makkah in 1989, those which remained in the city during the Hajj period totalled 40,143. Addition of these numbers to the number of existing vehicles owned in Makkah resulted in a total volume of about 147,458 vehicles, leading to great complexities of traffic movement in terms of the Hajj movement in Makkah and the Holy Places.

Vehicle classification counts have been developed by survey in order to determine the number and type of vehicles entering Makkah via Jeddah and Madinah in the course of 07 and 08 Dhul Hajjah. The survey produced the following order: station wagons (30 percent), small cars (28 percent), pilgrim buses (12.5 percent), mini buses (11.2 percent), trucks (9 percent) and tankers (5 percent). It may be more convenient and helpful to minimise the number of vehicles entering Makkah during the Hajj (from 03 to 13 Dhul Hajjah) more efficiently as follows:

- To raise the permitted passenger capacity from 9 to 12 seats, which would reduce the number of station wagons;
- The policy of granting permission to enter needs re- regulation by the responsible departments in order to reduce the issue of permits as much as possible;

- Carrying out a process to guarantee the supply of food, goods and drinking water within Makkah before the Hajj period in order to limit the number of trucks and tankers entering Makkah.

The patterns of pilgrim movement in the Hajj region, pre- and post-Hajj activity, have been shown in the simple model presented in Figure 6.7. The volume of pilgrim movement from Madinah to Makkah was considered to be the highest volume in the Hajj region prior to the Hajj activity, whilst pilgrim movement after the Hajj activity was greatest between Makkah and Jeddah (Figure 6.7).

Relating to modes of regional transport, the only mode used to transport pilgrims within the Hajj region is motor vehicles, although 7.5 percent of the sample (507) were transported between Jeddah and Madinah by air. About 82 percent of the air and sea pilgrims were transported by public transport (pilgrim bus, coach and public bus). Although the above modes should be used by all, about 18 percent of those pilgrims travelled by taxi or other private hire vehicles. Comfortable facilities provided by these private modes and long periods of waiting for buses were considered as the main reasons for a shift towards private hire.

Regarding the main transport problems during the travel of pilgrims in the Hajj region, 70 percent of 495 reported no problems at all. The major problem highlighted by pilgrims was the condition of the vehicles - 23 pilgrims (4.5 percent) claimed that there was no air conditioning in vehicles although the survey showed that only 30.6 percent of vehicles were not air conditioned. The next problem pertains to aspects of management, with 22 pilgrims (4.3 percent) complaining that procedures involving the Office of United Agencies took too long.

The problems which are experienced are exacerbated by the attenuation of the period of stay in the Hajj region, giving rise to a range of needs which have to be kept in mind by any agency or body dealing with pilgrims and their transport in particular. The authorities, planners and administrators should consider such problems when embarking on any project or policy relating to Hajj movement.

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Chapter Seven

Hajj Movement in Makkah

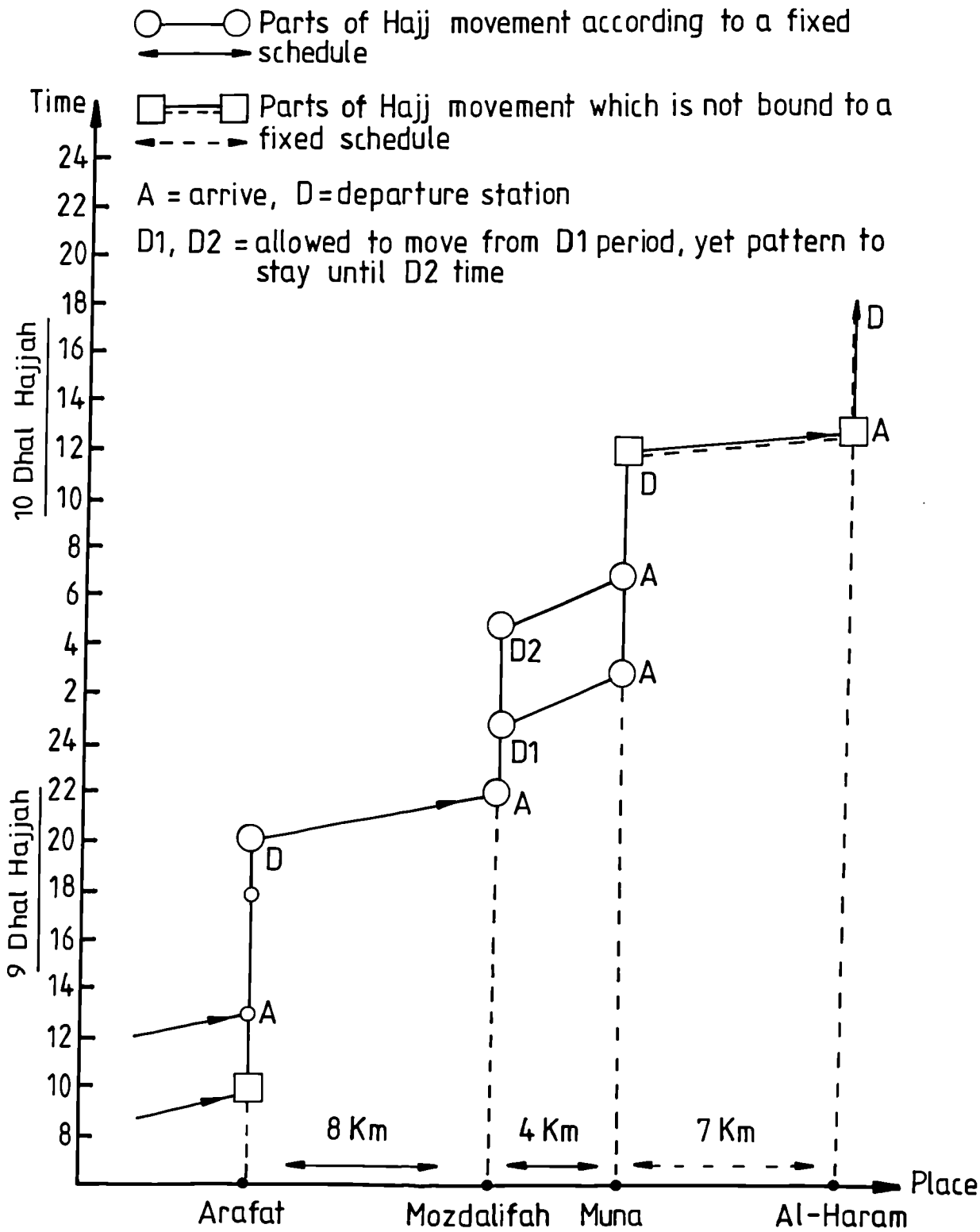
7.1 Introduction

Pilgrimage to Makkah (Hajj) involves the movement of over a million people, from many parts of the world. It may be the world's biggest annual special event (Bushnak, 1977). All pilgrims go through the same prescribed Hajj procedure which requires them to travel, perform specific activities, and lodge at predetermined locations during a specific five-day period. As indicated above, Hajj activity relies to a considerable extent on place-time factors. However, some rites are subject to a specific place and schedule, such as staying a day in Arafat ('Waqfah') and staying a night in Mozdalifah, while other rites are dependent on a specific place, with flexibility concerning the time element, such as circling the Ka'bah ('Tawaf').

According to the Islamic instructions which pilgrims follow for the Hajj, a simple model based on space-time has been developed to describe the movement between the Holy Places (see Figure 7.1). Although during recent times the majority of pilgrims have been transported between the Holy Places by vehicles, the model was based on the 'natural' modes of transport current at the time of the prophet Muhammad, such as animals or walking, so that the time budgeted for the movement was within 40 hours. The main objective for a pilgrim is to perform the Hajj as the prophet did, and as interpreted by Islamic scholars. In the Hajj of 1989, pilgrim movement patterns may be evaluated according to this model as shown below:

In fact this work is a complement of the previous chapter, the patterns of pilgrim and vehicular movement during the Hajj activity in Makkah will be the major subject of the chapter. It should be noted here that the movement of pilgrims *within* the Holy Places is not included in this study.

Figure 7.1 Patterns of the Hajj movement among the Holy places according to Islamic instructions



7.2 Patterns of Pilgrim Movement Between the Holy Places

Pilgrim movement between the Holy Places is seen as a complicated but fundamental phenomenon of the Hajj. This activity probably gives rise to the highest short-term movement of human beings anywhere in the world (MOP, 1982). In 1989 this movement involved some 1.5 million pilgrims and 92,234 vehicles (CDS, 1989). Such numbers of humans and vehicles create a considerable mix of movement between vehicles and pedestrians, both of which are discussed in the following sections.

As indicated above, on the day of Arafat, (09 Dhul Hajjah), all pilgrims have to be in Arafat from after midday until sunset. At sunset everyone travels to Mozdalifah, and then on to Muna within 12 hours (see Plates 7.1 and 7.2).

The essential factor influencing patterns of pilgrim movement is the instructions of Islam concerning the Hajj. According to these, some rites constitute *duty* and are obligatory for pilgrims, for example, 'waqfah', staying in Arafat from midday till sunset of 09 Dhul Hajjah, spending the night in Mozdalifah until at least midnight, staying in Muna for two nights (10 and 11 Dhul Hajjah) and making the 'Tawaf' (circling the Ka'bah) and 'Sa'ee' (walking between the hills) in the Holy Mosque. On the other hand, some are regarded as *extra* rites, such as spending the night of 08 Dhul Hajjah in Muna, remaining in Mozdalifah until sunrise of 10 Dhul Hajjah and remaining in Muna until 13 Dhul Hajjah.

Thus slight variations may be found amongst pilgrims in terms of movement patterns of the Hajj activity.

(source Ministry of Information)

Plate 7.1 Pilgrims in Arafat on the 9th of Dhul-Hijjah. The photograph above shows massive numbers of pilgrims in and around Jabal Al-Rahmah which is in the middle of Arafat. Some individuals are worshipping in Arafat (below).

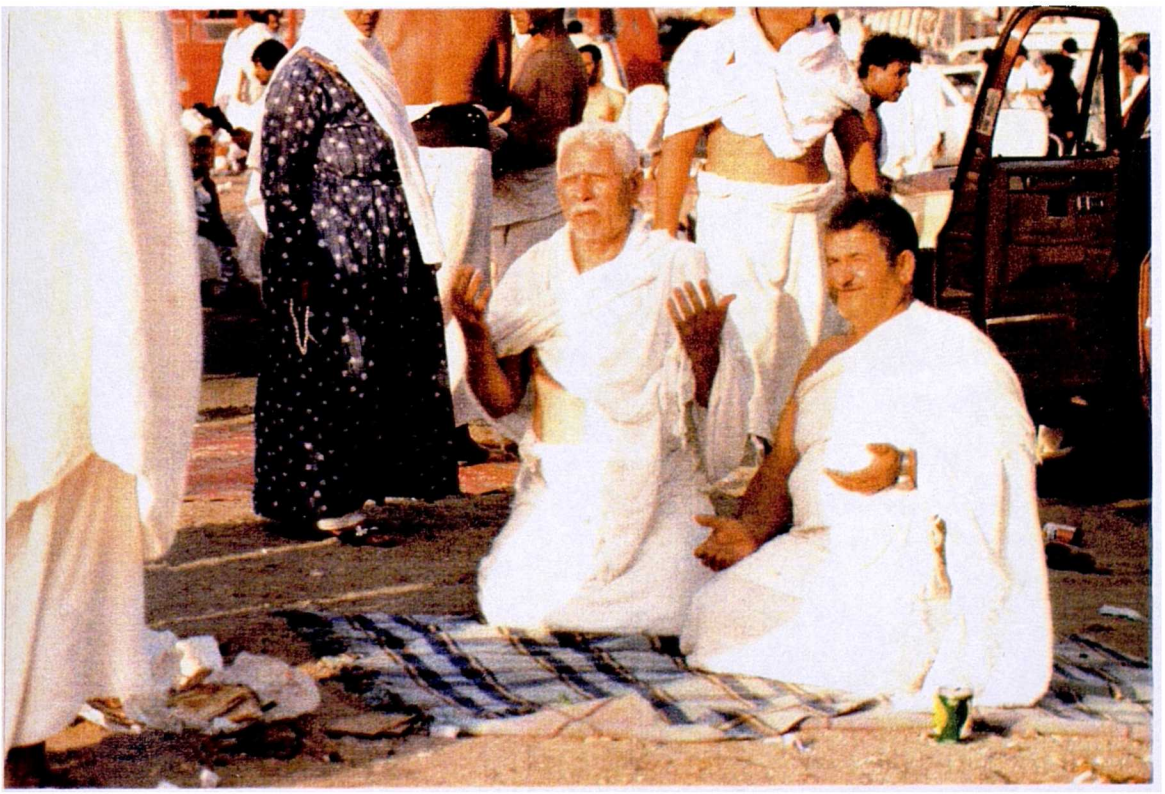


Plate 7.2 Vehicular movement on one of the nine roads during the Nafrah from Arafat to Mozdalifah (above). Pilgrims are staying in Mozdalifah, spend all the night of 9-10 Dhul-Hijjah or some time before they leave to Muna or Al-Haram.

Figure 7.2 Movement patterns of pilgrims between the Holy places in Makkah and movement volume according to the survey, 1989

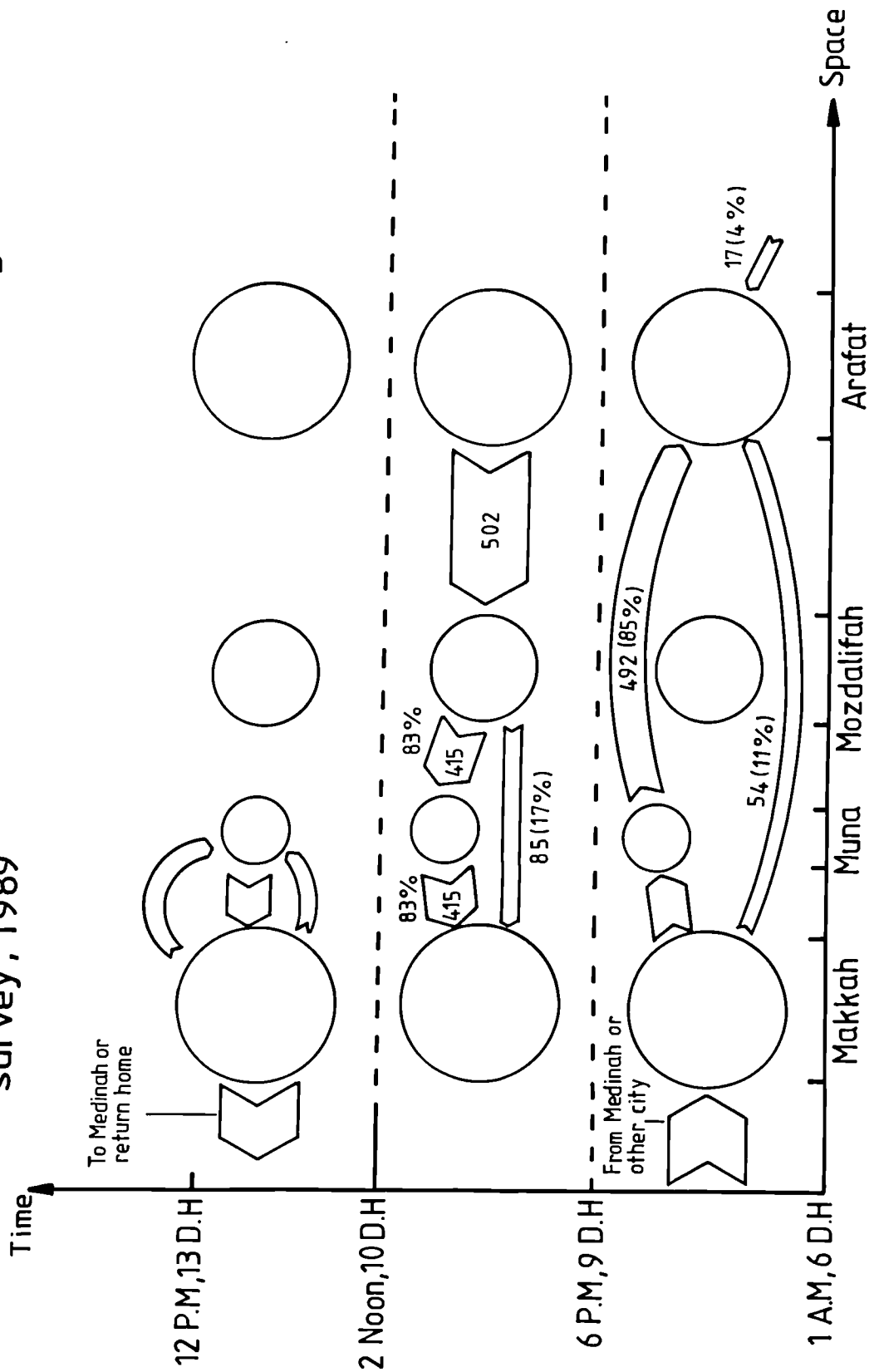
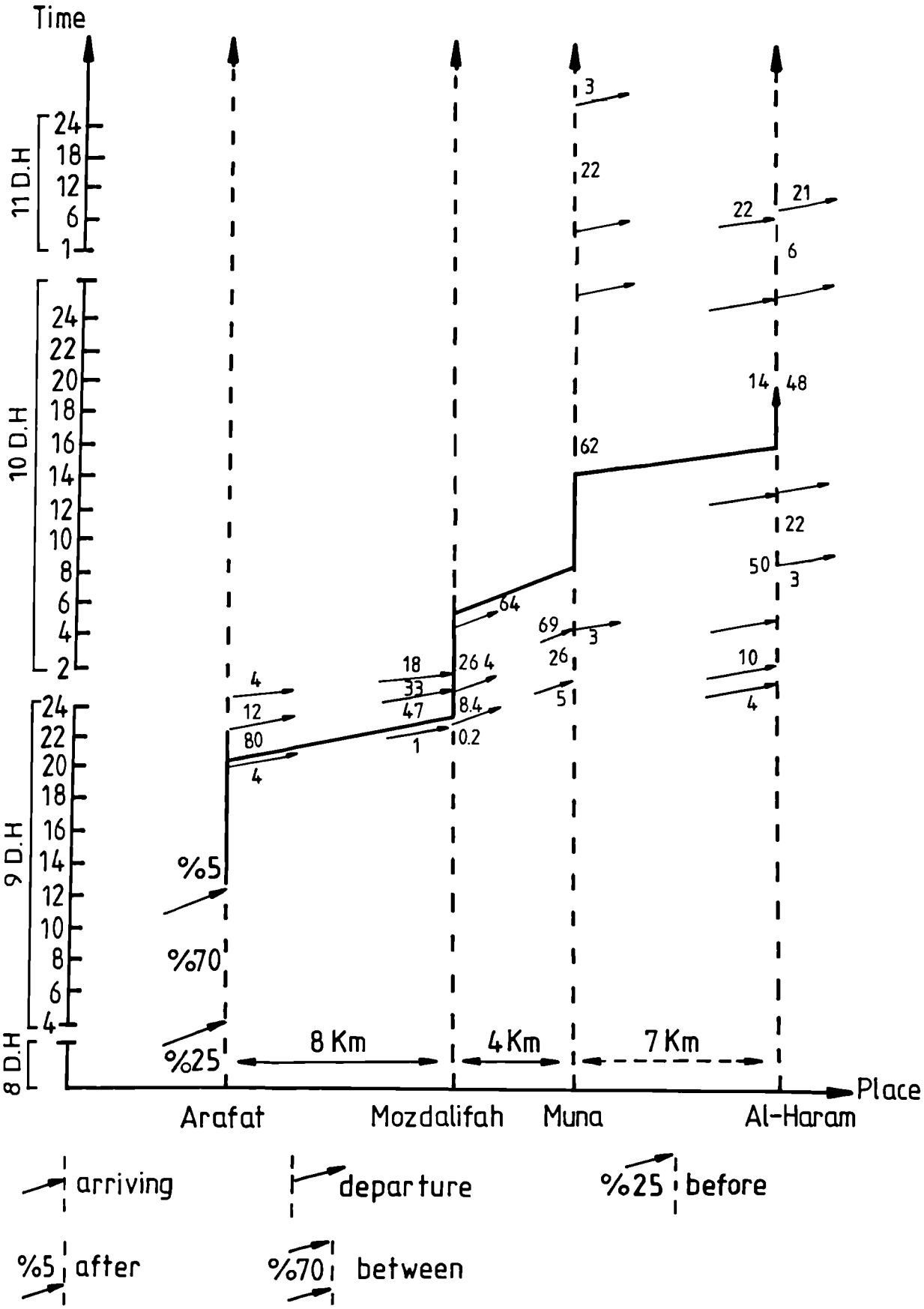


Figure 7.3 Movement patterns of pilgrims by time-space map according to the survey 1989



In the survey pilgrims were asked about the time and places of their arrival and departure for each pattern of the Hajj activity between the Holy Places. The results of this are illustrated in Table 7.1. Movement patterns of these pilgrims between the Holy Places and the flow volume are presented in Figure 7.2. It is clear from this figure that the majority of pilgrims (85 percent) came to Arafat from Muna after having spent the day of 08 Dhul Hajjah there, whilst only 11 percent were transported directly to Arafat from Makkah. In fact, the pattern of arrival at Arafat has far fewer problems associated with it in comparison to those of departure from it, since some pilgrims move to Arafat early, starting from the day of 08 until 09 Dhul Hajjah. Although the Waqfah of Arafat starts from 12:00 to 19:00 on 09 Dhul Hajjah, it emerged from the survey that around 25 percent of pilgrims arrived in Arafat on 08 Dhul Hajjah (Table 7.1).

Thus, in comparison with the movement from Arafat, the movement to Arafat is distributed over a relatively long period of time (see Figure 7.3).

About 350 pilgrims - 70 percent of the sample (505) - arrived at Arafat in the space of 8 hours, whilst on departure, more than 400 (79 percent) left Arafat for Mozdalifah in the space of only 3 hours. As may be seen in Figure 7.1, the reason for this is the 'fixed schedule' which commences from Arafat. The pilgrims are required to spend the night of 09 Dhul Hajjah at Mozdalifah.

Although the GSC guarantees to transport the external pilgrims between the Holy Places according to the Hajj schedule, 62 out of 503 were found to be somewhat overdue with respect to departure time from Arafat, leaving after 22:00. Moreover, 19 (4 percent) persons had to stay in Arafat until midnight. Of the pilgrims questioned

about the reasons for such lateness, 180/507 complained of problems relating to departure from Arafat: 18 percent of the sample attributed delays to traffic jams and overcrowding of vehicles, and around 14 percent stated that the bus transporting them from Arafat was too late. Bus delays during the Hajj constitute one of the main problems of movement faced both by the authorities and by the pilgrims, particularly with respect to the movement from Arafat to Mozdalifah (*Nafrah*). This problem may apply to the shuttle bus system discussed in Chapter 4: the bus drivers sometimes return to Arafat too late after the first shuttle because of overcrowding or losing the way (Interview held on 15 July 1989 with the Chairman of the GSC).

Table 7.1 Movement patterns of pilgrims between the Holy Places, according to time of arrival and departure

Arrival Time	Number of Pilgrims	%	Departure Time	Number of Pilgrims	%
1: Arafat					
Before 12:00 of 08 D.H.	34	6.7	Before 19:00 of 09 D.H.	20	4.0
12:00 of 08 D.H. - 04:00 of 09 D.H.	93	18.3	19:00 - 22:00	402	79.9
04:00-12:00	350	69.0	22:00 - 24:00	62	12.3
After 12:00	28	5.5	After 24:00	19	3.8
Total	505	100		503	100
2: Mozdalifah					
Before 19:00 of 09 D.H.	4	0.8	Before 22:00 of 09 D.H.	1	0.2
19:00 - 22:00	237	47.2	22:00 - 24:00	42	8.5
22:00 - 24:00	169	33.7	00:00 - 04:00 of 10 D.H.	131	26.4
After 24:00	92	18.3	After 04:00	322	64.8
Total	502	100		496	0.2
3: Muna					
Before 00:00 of 10 D.H.	25	5.0	00:00 - 04:00 of 10 D.H.	16	3.6
00:00 - 04:00	130	25.9	04:00 - 24:00	312	69.6
After 04:00	346	69.1	00:00 - 24:00 of 11 D.H.	108	24.1
			00:00 - 24:00 of 12 of D.H.	12	2.7
Total	501	100		448	100
4: Al-Haram					
Before 00:00 of 10 D.H.	16	4.0	Before 05:00 of 10 D.H.	15	3.4
01:00 - 04:00	44	10.0	05:00 - 12:00	98	21.6
04:00 - 12:00	229	50.0	12:00 - 24:00	219	48.3
12:00 - 24:00	65	14.0	00:00 - 05:00 of 11 D.H.	26	5.7
On 11 of D.H.	103	22.0	After 05:00	94	21
Total	457	100		453	100

Source: Fieldwork, 1989

Note: All times in the table above are consecutive; 24:00 has been used for midnight where the focus is on the preceding day, 00:00 has been used for midnight where the focus is on the following day.

With regard to the departure of pilgrims from Mozdalifah, the greatest proportion, 453/496 (90 percent), left after midnight - the officially allowed time (Figure 7.1). About 83 percent of these went to Muna to perform rites such as stoning the Great Devil and sacrificing animals, which, according to the Hajj, are preferable before going to Al-Haram. However, the remaining 17 percent of pilgrims leaving Mozdalifah moved first to Al-Haram to carry out Tawaf (circling the Ka'bah).

From 10 to 13 Dhul Hajjah, pilgrim movement is focused on Muna on one side and Al-Haram on the other (see Figure 7.2). The main characteristic of movement pattern around Al-Haram is that, unlike in the other Holy Places (Arafat, Mozdalifah and Muna) the performance of rites in Al-Haram is not bound to a fixed schedule. The departure of pilgrims from Muna and their arrival at Al-Haram tends to be spread throughout the duration of Hajj activity (see Figure 7.3). There was, however, a peak period (04:00 - 24:00 of 10 Dhul Hajjah) with respect to the volume of pilgrims (61.5 percent - 312/448) departing Muna for Al- Haram. The peak volume of pilgrim (45.2 percent - 229/457) arriving at Al- Haram to perform *Hajj Tawaf* occurred 04:00 - 12:00 (an eight hour period) of 10 Dhul Hajjah. In contrast, only 13 percent arrived at Al-Haram 12:00 - 24:00 (a twelve hour period) of 10 Dhul Hajjah. So, despite there being no fixed time for this particular activity, pilgrim flow tends to concentrate. To avoid the congestion and overcrowding which often occur in Al-Haram during the performance of Tawaf, volume flow could be regulated in such a way as to spread more evenly throughout 10 Dhul Hajjah the arrival time of pilgrims at Al- Haram. "*The maximum capacity of the grand floor of the circling of the Ka'bah (Tawaf) is 40,000 persons, yet in crowding situations attains higher levels. The performance of Tawaf takes forty minutes to one hour.*" (Atthad Al-Muhandseen, 1980, p.65).

According to pilgrim statistics, and also the results of the survey of 1989, it may be estimated that the number of external pilgrims who performed Tawaf within the eight hour period 04:00 - 12:00 was in excess of 300,000 - i.e. more than 40,000 per hour. This was in addition to the total of 692,435 internal pilgrims required to carry out the same rites of the Hajj activity. This means that such volumes of flow which were over the capacity of Al-Haram created a complex situation of overcrowding and congestion, so more attention should be paid by authorities to considering this problem.

7.3 Traffic management during the Hajj

After pilgrims arrive in Makkah, they travel on foot to visit the Al-Haram. This pedestrian traffic creates obstructions for the smooth flow of vehicular traffic and safety hazards for the pilgrims themselves. Similar conflicts and bottlenecks are experienced in Muna when pilgrims try to reach their camps.

To manage this colossal movement of traffic and people, the General Department of Traffic and Public Security, Ministry of the Interior, prepares elaborate traffic plans for each Hajj.

The plans reflect many years of experience in handling complex movements in Makkah according to the logistics prescribed by religious authorities for the Hajj rites and according to the exigencies of the situation. (DHC; Vol.8, 1989; 73)

The traffic management plan for Hajj includes three major basic elements (GDT, 1988). First, as noted above, to minimise the number of vehicles in Makkah, the entry of vehicles with seating for fewer than nine passengers and without official permits is forbidden from 03 to 13 Dhul Hajjah. Such vehicles are either turned back, or are

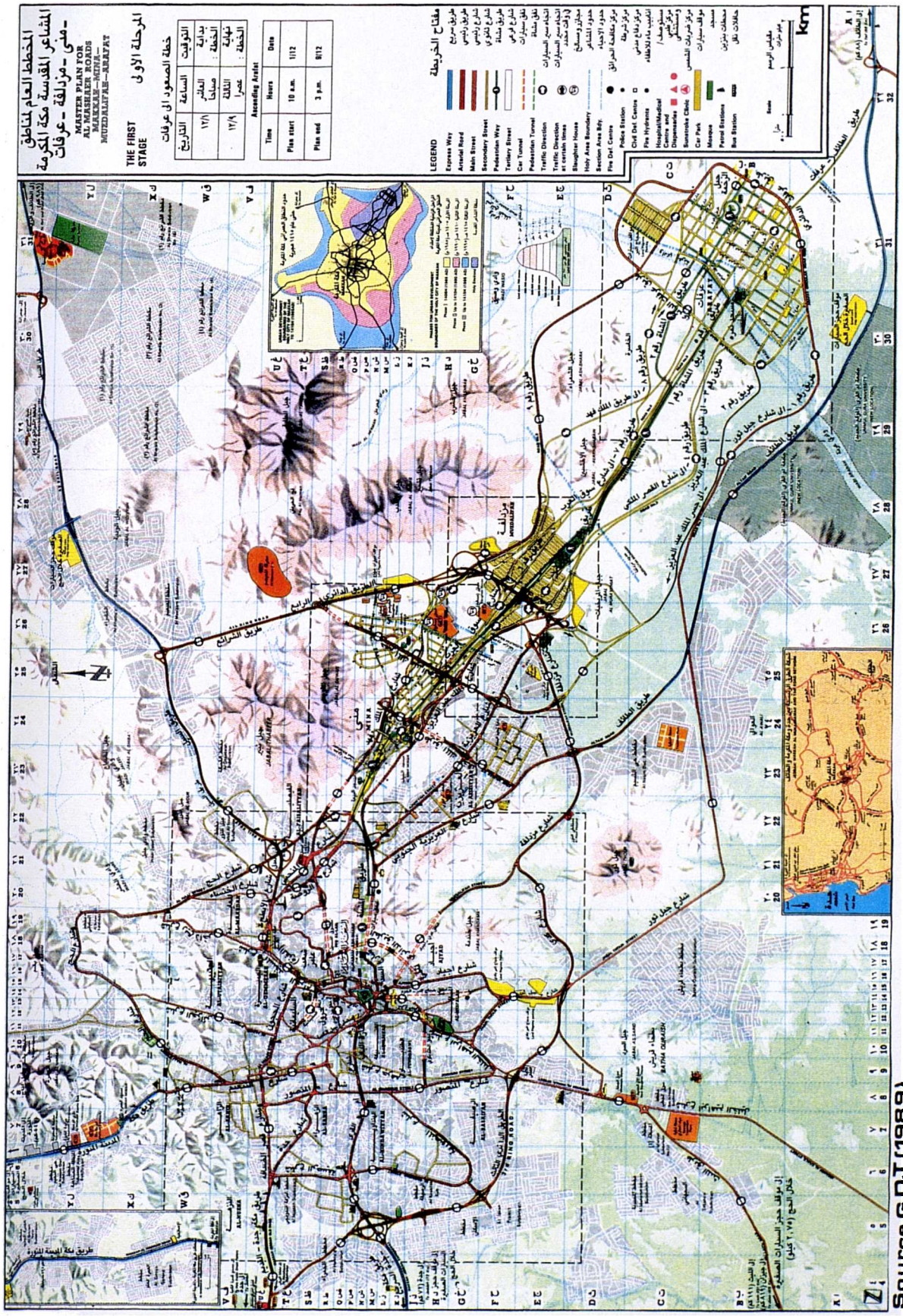

المخطط العام لمناطق المشاعر المقدسة مكة المكرمة
- منى - مزدلفة - عرفات
MASTER PLAN FOR AL MASHAER AL MUQADDASA ROADS MUZDALIFAH—ARAFAT
THE FIRST STAGE
المرحلة الاولى
خطة الصعود الى عرفات
Ascending Arafat
LEGEND
Express Way
Arterial Road
Main Street
Secondary Street
Pedestrian Way
Tertiary Street
Car Tunnel
Pedestrian Tunnel
Traffic Direction
Holy Area Boundary
Police Station
Civil Def. Centre
Fire Hydrants
Car Park
Mosque
Petrol Stations
Bus Station
Source G.D.T (1989)

Figure 7.4A

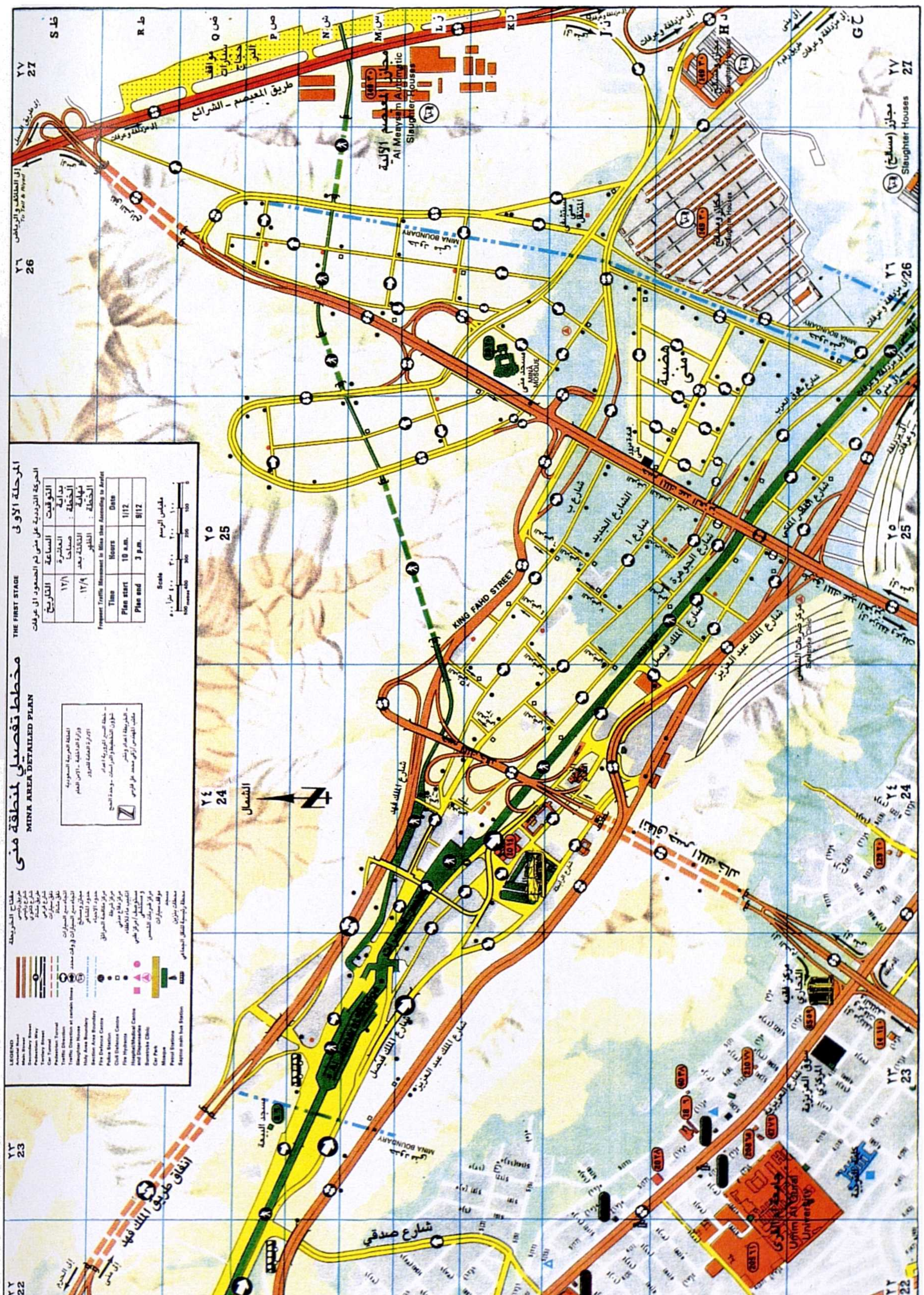

MINA AREA DETAILED PLAN
THE FIRST STAGE
KING FAHD STREET
MINA MOSQUE
Slaughter Houses

Figure 7.4B

Plate 7.3 The above photograph shows a police checkpoint on the Jeddah-Makkah expressway preventing the entry of small cars into Makkah. Similarly (below) cars are prevented from entering Muna (see section 7.3 and 7.4).

parked in one of the five peripheral car parks on the outskirts of the Holy City. Public transport vehicles then carry the occupants of the small vehicles to Makkah and the Holy Places. According to the GDT (1988) report, this regulation has considerable advantages in easing traffic flow.

Second, parking on all city streets carrying significant volumes of traffic is forbidden. This simple provision facilitates traffic flow on all streets other than those around Al-Haram, where the sheer numbers of vehicles and pedestrians make traffic flow extremely heavy and dangerous, in spite of the prohibition on parking.

Third, a detailed day-by-day traffic management plan becomes effective in Makkah and the Holy Places from 01 Dhul Hajjah to the evening of 13 Dhul Hajjah. The object of this plan is to facilitate the movement of traffic according to the needs of pilgrims to reach certain areas on certain dates. On some days, such as 09 Dhul Hajjah, the direction of traffic is different in the morning and afternoon. Efforts are always made to ensure appropriate movement. The traffic plan for the Holy Places for Hajj 1989 may be seen in Figures 7.4 A and B.

7.4 Vehicular movement among the Holy Places

It was indicated in a previous chapter that the number of vehicles remaining in Makkah during the Hajj period (27 Dhul Qadah to 09 Dhul Hajjah) was 40,143. It should, however, be remembered that these vehicles are additional to the 147,458 vehicles owned and operated in Makkah on a permanent basis (see section 6.3.1).

According to the movement patterns and traffic management of the Hajj, the vehicular movement during the first seven days of Dhul Hajjah is mostly between Makkah

and Muna, where the pilgrims go to make their encampments. From the morning of 07 Dhul Hajjah to the afternoon of 09 Dhul Hajjah, the roads are dedicated primarily to providing access towards Arafat. Although not entirely free-flowing, traffic moves well during this period.

According to CDS data for 1989, movement between Arafat, Mozdalifah and Muna involved some 49,281 vehicles. Generally, a large proportion of these vehicles were mini buses and station wagons (37 percent); second in number were small cars, pick-ups and jeeps (30 percent). The numbers of buses, whether belonging to the GSC or overland pilgrims, amounted to only 21 percent of the vehicles transporting pilgrims between the Holy Places (see Table 7.2). Although the pattern of such movements was regarded as passenger transport, lorries and trucks made up 10 percent of the total number of vehicles. In spite of the purpose of these vehicles being for transporting the equipment for camps and other needs of the pilgrims, they were seen to carry pilgrims between the Holy Places, in contravention of the GDT ruling prohibiting this practice on grounds of safety.

Table 7.2 Numbers of Vehicles Transporting Pilgrims between Holy Places according to Type

Type of Vehicle	Existing in Arafat at Time of Departure	Remaining in Muna	Total	%
Small cars; pick-ups; jeeps	13,166	1,686	14,852	30
Mini buses and station wagons	18,195	86	18,281	37
Buses	10,261	66	10,327	21
Lorries and trucks	4241	579	4820	10
Others	971	232	1,203	2
Total	46,834	2,447	49,281	100

Source: GDT, 1989 'Vehicle Statistics on the Hajj Roads'; CDS, 1989 'The Total Results of the Hajj Statistics'

As far as the survey data are concerned, Table 7.3 shows that a large proportion of pilgrims used some type of motorised vehicle to travel between the Holy Places - in fact, not less than 75 percent in relation to all movement patterns. The largest proportion of these, ranging from 25 percent to 48 percent, were transported by pilgrim bus (GSC bus). It appears that the participation of the pilgrim buses has risen in terms of long-distance travel, such as that from Makkah to Arafat, from Arafat to Mozdalifah, and *vice versa* (see Figure 7.1).

Unlike walking, the next mode of transport varied with respect to variation of movement patterns. The findings relating to travel to and from Arafat showed that coach, station wagon and minibus, respectively followed GSC buses in order of popularity as modes of transport for pilgrims. In addition to this, the movement pattern from Mozdalifah to Muna was the same as that from Arafat to Mozdalifah. Between Muna and Haram, after pilgrim buses, taxis and mini buses were most used. (respectively 19.3 percent and 14.6 percent going to Al-Haram, and 21.8 percent and 15.5 percent returning to Muna) (Table 7.3). The reason for this is that there is restricted entry to the Holy Places, particularly Muna, for taxis and paratransits during the Hajj activity (GDT, II, 1989). They serve only the areas linking the Holy Places and the Holy Mosque in the city centre. Thus, with the exception of the pilgrim buses, taxis and paratransits were found to have the highest level of participation in terms of movement patterns to or from Al-Haram, whilst coach, station wagon and mini bus had a greater share in terms of movement to and from Arafat (see Table 7.3). Moreover, most of the shared modes of transport which carried pilgrims between Muna - Al-Haram and the return journey, were private vehicles owned by individuals such as taxis, station wagons and mini-buses (see Chapter 4).

Table 7.3 Distribution of Pilgrims among Modes of Transport between the Holy Places according to the 1989 Survey

Mode of Transport	To Arafat	%	From Arafat to Mozdalifah	%	From Mozdalifah to Muna	%	From Muna to Haram	%	From Haram to Muna	%
Walk	37	7.3	72	14.5	129	25.5	49	9.9	39	8.1
SAPTCO bus	30	5.9	24	4.8	19	3.7	30	6.0	35	7.3
Pilgrim bus	245	48.3	239	48.0	189	37.4	135	27.2	122	25.4
Coach	46	9.1	44	8.8	44	8.7	42	8.5	38	7.9
Minibus	37	7.3	33	6.6	29	5.7	74	14.6	74	15.4
Station wagon	50	9.9	39	7.8	41	8.1	48	9.7	45	9.4
Private small car	12	2.4	7	1.4	9	1.7	19	3.7	19	4.0
Taxi	33	6.5	24	4.7	28	5.5	96	19.3	105	21.8
Official car	2	0.4	3	0.6	3	0.6	1	0.2	1	0.2
Wanette	2	0.4	1	0.2	1	0.2	2	0.4	2	0.4
Pick up	9	1.8	1	0.2	1	0.2	-	-	-	-
Truck	2	0.4	10	2.9	9	1.8	-	-	-	-
Other	1	0.2	1	0.2	3	0.6	1	0.2	1	0.2
Total	506	100	498	100	505	100	497	100	481	100

Source: Fieldwork 1989

Pilgrims are usually transported to Mozdalifah and to Muna by the same modes transporting them to Arafat. However as can be seen in Table 7.3, the number of pilgrims using motor vehicles declined towards Mozdalifah, whilst the numbers of pilgrims walking increased. This phenomenon is discussed below in the next section.

Through the experiences and the surveys carried out by the author in the Hajj season, the *Nafrah* movement at sunset on 09 Dhul Hajjah forms one of the largest movements of vehicles and people over a short time span. Vehicular traffic movement on this day is very slow due to a number of factors, including increased numbers of vehicles, pedestrian cross-flows, and accidents causing stoppages. Using cross-tabulation between patterns of arrival and departure time of pilgrims using automobiles, it is possible to discover variations in the time of pilgrim trip with respect to *Nafrah*.

Table 7.4 Distribution of the pilgrims travelling by vehicle according to time of departure and arrival, during *Nafrah* on 09 Dhul Hajjah, 1989

Time of arrival	19:00-22:00	%	22:00-24:00	%	after 24:00	%	Total	%
Time of departure								
Before 19:00	3	20	7	46.7	5	33.3	15	3.6
19:00-22:00	192	57.5	104	31.1	38	11.4	334	79.3
22:00-24:00	-	-	26	48.2	28	51.9	54	12.8
After 24:00	-	-	-	-	18	100	18	4.3
Total	195	46.3	137	32.5	89	21.2	421	100

Note: 15 observations were missing

Source: Fieldwork

The survey revealed that 421 out of 507 pilgrims transported to Mozdalifah from Arafat by vehicles, i.e. 83 percent of the sample. Table 7.4 shows that about 80 percent of those pilgrims left Arafat at the canon time between 19:00 and 22:00 on 09 Dhul Hajjah, 57.5 percent of whom arrived in Mozdalifah (6-8km from Arafat) during the

same period of time. This means that there were about 43 percent arriving in Mozdalifah beyond canon time (19:00-22:00).

From the way in which this questionnaire was designed (see Appendix 2), it is difficult to determine the time spent travelling. However in the course of such as *Nafrah*, the author was transported by station wagon (GMC) in a total of 25 minutes, departing at 19:40 and arriving at 20:15 via Road No. 3. At that time, the traffic flow on this road was quite smooth, in spite of being full to capacity. All three lanes were occupied by vehicles, and driving conditions were sometimes bumper-to-bumper.

Some 11 percent of the pilgrims leaving Arafat between 19:00 and 22:00 were found to arrive after midnight (see Table 7.4), indicating a journey of more than two hours for a distance not exceeding 8km. This problem may be attributed to several factors creating congestion, overcrowding and subsequent delay. One of the main factors may be the unbalanced density of traffic volume on the nine roads linking Arafat and Mozdalifah.

There are no available data regarding the traffic volume on each of the nine roads during *Nafrah*. Available data produced by GDT (1989) are confined to the time before *Nafrah*. Nevertheless, these data may be used as evidence of this claim, of the unbalanced density. Table 7.5 shows the number of vehicles going up to Arafat in the course of 08 and 09 Dhul Hajjah. Unlike the case of Road No.5, the variation of traffic volume density amongst the nine roads was extensive. Road No.3 for example, which has one-way traffic, recorded more than 25,000 vehicles, whilst Road No.7, also one-way, recorded only 3,746 vehicles - i.e. 15 percent of the traffic volume of Road

No.3. According to the GTD plan (1989), a contraflow was introduced on Road No.5 to serve vehicle movement returning from Arafat.

Table 7.5 Numbers of Vehicles going up to Arafat throughout the Days of 08 and 09 Dhul Hajjah 1989, distributed according to the Road

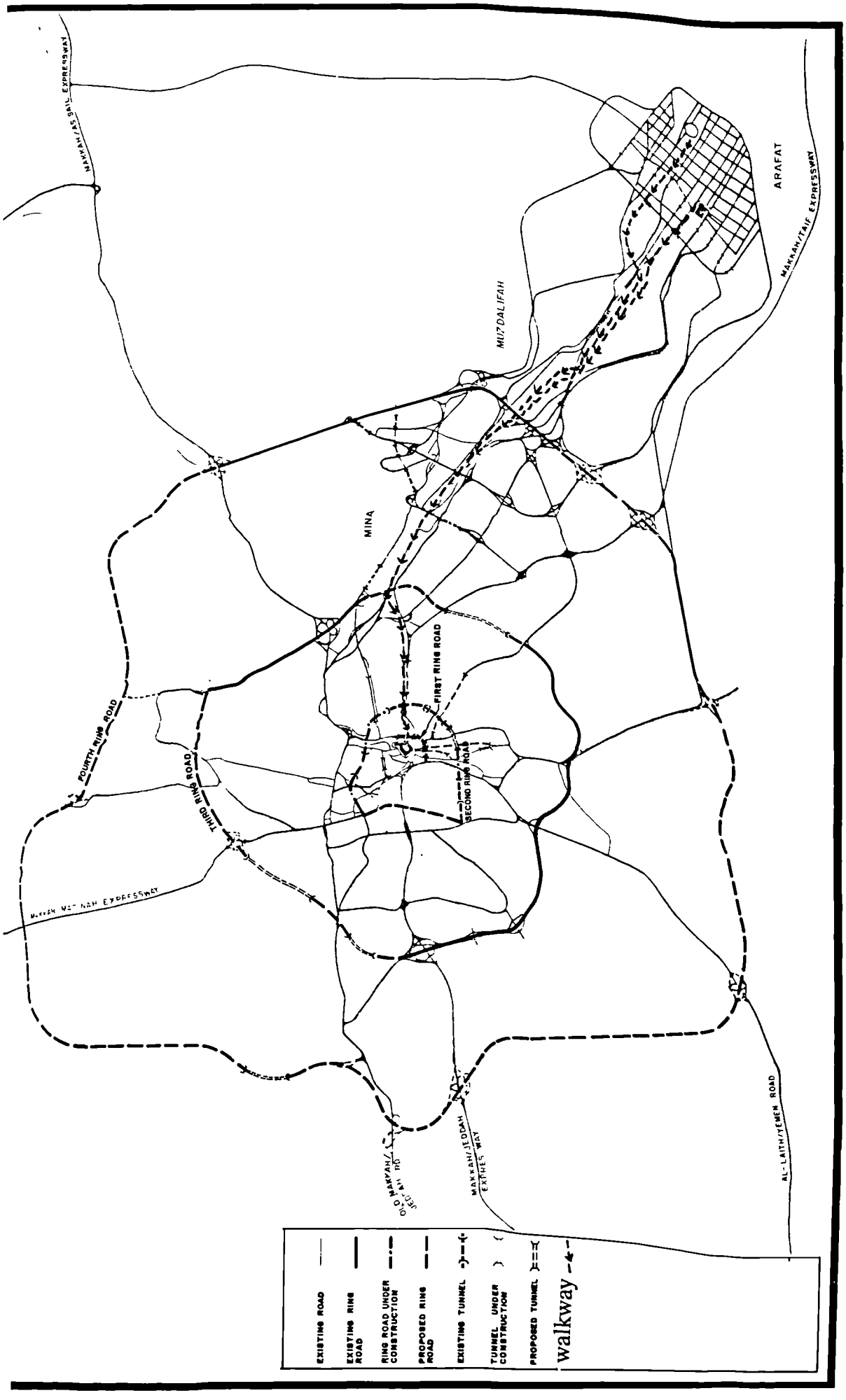
Road number:	1	2	3	4	5	6	7	8	9	Total
Day:										
08 Dhul Hajjah	6,550	10,906	14,135	3,192	55	2,456	2,089	2,453	3,002	44,838
09 Dhul Hajjah	5,831	9,221	11,260	3,712	24	3,906	1,657	3,877	3,487	42,975
Total	12,381	20,127	25,395	6,904	79	6,362	3,746	6,330	6,489	87,813

Source: GTD 'Statistics of the Vehicles for Hajj of 1989', p.21

The problem of imbalance of traffic volume between the roads created not only congestion and traffic jams on the roads experiencing a high traffic density, but also generated an uneven distribution of pilgrims immediately after arriving in Mozdalifah. It is therefore significant to note here that the balance of traffic volume between the roads linking the Holy Places should be an essential consideration in terms of traffic management.

7.5 Pedestrian Movement

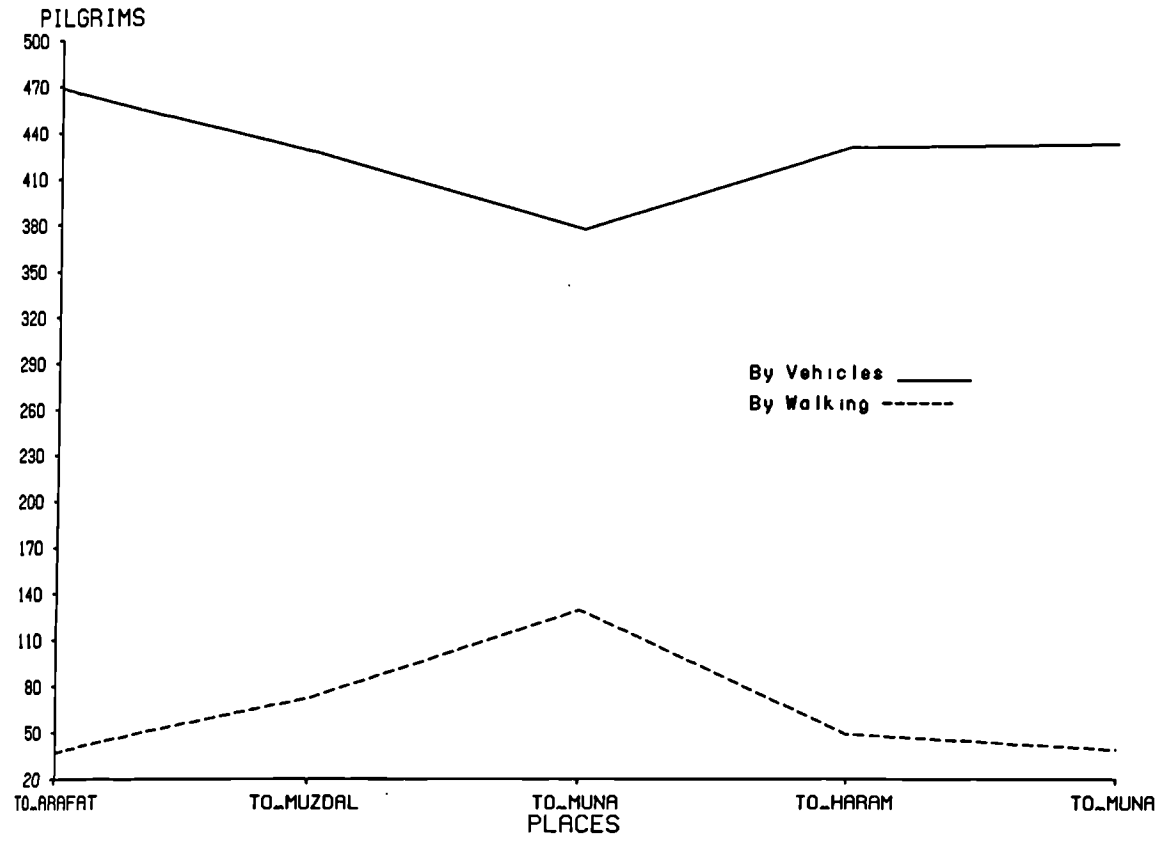
As may be seen in Figure 7.5, passing right through the middle of Arafat, Mozdalifah and Muna, and leading to Al-Haram through a pedestrian tunnel is a pedestrian walkway. It is 21km in length, from the Mount of Al-Rahmah in the middle of Arafat to Al-Haram in the city centre. This walkway provides direct access to the Al-Jamerat area where stoning takes place, and is very heavily used during Hajj.



Source: DHC (1985)

Figure 7.5 The pedestrian way throughout the road networks of the Holy Places.

FIG. 7.6 Relationship between the movement volume of pedestrian and vehicles amoing the Holy Places in 1989



SOURCE FIELDWORK, 1989

Table 7.3 shows that the number of pilgrims who walked between Arafat and Mozdalifah was about 72 out of 498 (14.2 percent). As noted above, pilgrims travelling on foot increased in terms of the movement from Mozdalifah to Muna at the expense of the numbers who were transported by vehicles (Table 7.3). Figure 7.6 illustrates the rise in the volume of pedestrians to a peak in Muna, when about 25 percent of 505 pilgrims travelled between Mozdalifah and Muna on foot, whereas for the journey between Muna to Haram, the number of pedestrians declined - it is possible that the weather was a main contributory factor to this. The movement from Arafat to Mozdalifah takes place at night, and Mozdalifah to Muna in the morning (see Figure 7.3) when the temperature is much lower than during the day, while the remaining patterns of movement occur during the day. The short distance between Mozdalifah and Muna is also a fundamental factor pushing up pedestrian volume between the Holy Places (see Figure 7.1).

7.5.1 Pedestrian movement within the Holy Places

HRC reported that in 1980 more than 50 percent of the movement patterns of the pilgrims in Makkah were carried out on foot. The pedestrian movement between and within the Holy Places has been observed by the author. Although many pedestrians use the walkways in the course of *Nafrah*, large numbers may be seen walking along the vehicular roads. This is not only extremely hazardous for themselves, but also results in severe pedestrian- vehicle conflict. In most cases, the pedestrian roads are not known to many of the pilgrims, who, in general, seek short paths in order to keep their walking distance to a minimum. Thus vehicle-pedestrian conflicts occur frequently at many places, thereby impeding traffic flow. This problem is severe in the

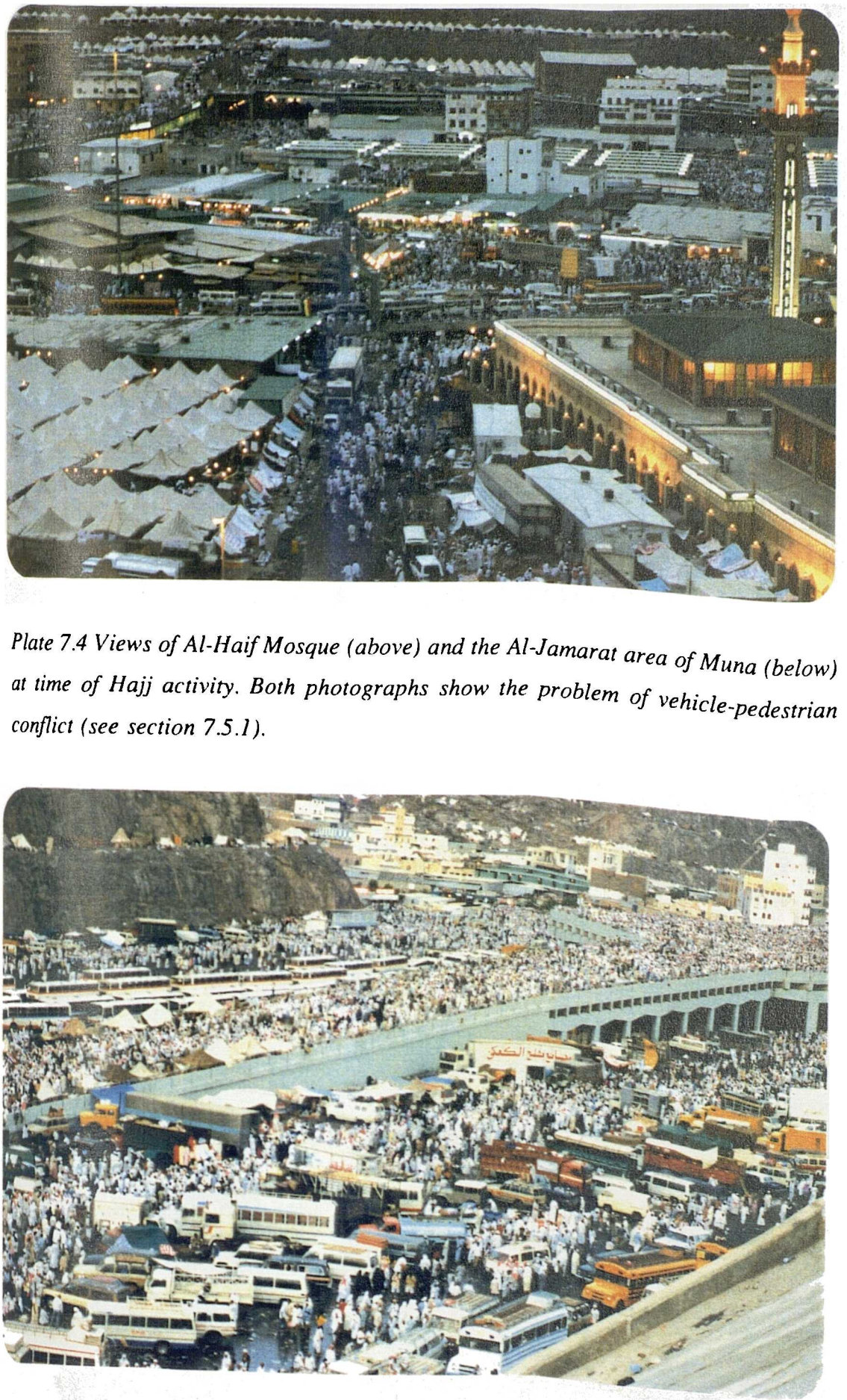


Plate 7.4 Views of Al-Haif Mosque (above) and the Al-Jamarat area of Muna (below) at time of Hajj activity. Both photographs show the problem of vehicle-pedestrian conflict (see section 7.5.1).

Plate 7.5 Vehicle-pedestrian conflict in Muna (above) a situation which is aggravated by street vendors occupying pavement space. The picture below shows the problem of entry of vehicles into the Al-Jamarat area, see section 7.5.1.

areas which are between the places of the Hajj rites, such as between the Namera Mosque and the Mount of Al-Rahmah in Arafat, between Al-Haif Mosque and Al-Jamarat area, and between the camps and places of sacrifice in Muna. Many pedestrians are found crossing vehicular roads going to or returning from such places. These flows are so heavy at certain points, in spite of control by a large number of special traffic policemen, that long queues of vehicles were formed (see Plates 7.4 and 7.5).

A major reason for the pedestrian problem in the Holy Places seems to be inadequacies in the layout of the walkways. Many of them are not interconnected to enable continuous pedestrian flow. All of the walkways cross vehicular roads, impeding the flow of vehicular traffic (DHC, V8, 1985). In Muna, for example, there is no provision for pedestrians on the road system except for the main pedestrian walkways in the middle of the area, mentioned above. There are no sidewalks on the vehicular roads, nor are there convenient cross- walk paths to connect with the main walking areas. This situation compels the pilgrims to use the vehicular roads to get from one place to another. Again this results in very unsafe conditions and extreme congestion. The road capacity is also reduced by the presence of vendors who use the pavements (see Plate 7.5). Many pilgrims also use the pedestrian roads for pitching their tents and/or generally resting (see Plate 7.6). Besides this, there is the Al-Jamarat area, where the pilgrims throw pebbles at three symbolic devils. As the numbers of pilgrims have increased over the years, the performance of this rite has become more difficult on account of the use of vehicles in the Al- Jamarat area. According to DHC (1985) information and other experiments, the result is demonstrated by the fact that whilst a walking trip from the western side of Al-Aziziyah to the Al-Jamarat area would take

about half an hour, the same journey by car via the King Khaled or King Abdul Aziz Bridges would take from 2 to 6 hours. The need for more walking space in Muna and the Al-Jamarat area is therefore evident. Additional parking spaces for vehicles could be provided in Al-Aziziyah, from which the pilgrims could walk to Al- Jamarat or Muna (DHC, Vol.8, 1989).

The Holy Places, and particularly the Al-Jamarat area which experiences such severe problems, have very limited space, and this and the spilling over of pilgrims onto the road, are considered the main reasons why the further construction of pedestrian roads within the Holy Places might not solve the problem (see Chapter 3). However, the prohibition from entry of vehicles into these places, such as the restrictions already applied to the Al-Haram area, may be the only consistent solution to avoid the pedestrian-vehicle conflict. (Emergency and security vehicles may be excepted from these restrictions.)

The problems of pedestrians are complex, particularly those which occur inside the Holy Places. However, the Hajj Research Centre (HRC) has a plan for detailed examination of these issues by means of a comprehensive survey on Hajj 1989. However, since this topic is beyond the scope of this study, it will not be discussed further here.

7.5.2 Pedestrian movement between the Holy Places

In the survey, the pilgrims were questioned about their attitude to walking between the Holy Places. It is clear from Table 7.6 that about 50 percent of the pilgrims interviewed were in agreement with the enforcement of travel on foot between Arafat, Mozdalifah and Muna. Those who were not of this opinion represented 40.6

percent and 36.7 percent in terms of the respective journeys between Arafat and Mozdalifah and between Mozdalifah and Muna. On the other hand, the majority of pilgrims (46 percent) did not support the idea of walking the return journey between Muna and Al-Haram: those who supported the idea numbered 37.3 percent (Table 7.6). The reasons for this correspond to those mentioned in connection with pedestrian volume between the Holy Places (Table 7.3). The weather and the distance are considered to be the main factors influencing variations in pilgrim attitudes to walking between Arafat-Mozdalifah-Muna on the one hand, and between Muna-Al-Haram on the other (see Table 7.6).

Table 7.6 Attitude of Pilgrims to Walking between the Movement Patterns of the Hajj Activity

Response	Patterns of Movement							
	From Arafat to Mozdalifah	%	From Mozdalifah to Muna	%	From Muna to Haram	%	From Haram to Muna	%
Agree	238	49.9	254	50.1	189	37.3	183	36.1
Disagree	206	40.6	186	36.7	233	46.0	237	46.7
Unknown	57	11.2	57	11.2	68	13.4	67	13.2
Missing	6	1.2	10	2.0	17	3.4	20	3.9
Total	507	100	507	100	507	100	507	100

Source: Field Work, 1989

Regarding the travelling time of pedestrian pilgrims, the survey revealed that 87 percent of pilgrims left Arafat at canon time (19:00-22:00) and about 50 percent arrived at Mozdalifah at the same time. Conversely, only 80 percent of the pilgrims

who travelled by car managed to leave Arafat at this time and 47 percent arrived at Mozdalifah at the above time, a figure lower than that of the pedestrian pilgrims (see table 7.7). The interesting point here is that 20 percent of motorised pilgrims arrived at Mozdalifah too late, after midnight, while only 4.2 percent of the pedestrians did so (Table 7.7). Moreover, using cross-tabulation between patterns of the arrival and departure times of pedestrian pilgrims and the patterns of those using automobiles, it emerged that only 1.6 percent of the pedestrians who departed between 19:00-22:00, arrived at Mozdalifah after midnight, indicating a journey of more than two hours. On the other hand, the percentage of the pilgrims using cars who arrived at this time (after midnight) reached 11.4 percent (see Table 7.4). This means that the journey times of the pedestrian pilgrims were sometimes shorter than those of pilgrims who travelled by automobile.

Table 7.7: Comparison of movement patterns of pedestrian with motor vehicles between Arafat and Mozdalifah according to travel time, 1989

Time of 9 Dhul Hajjah	Walk				Motor			
	departure		arrival		departure		arrival	
		%		%		%		%
Before 19:00	4	5.6	-	-	15	3.6	3	0.7
19:00-22:00	62	87.3	35	49.3	334	79.3	198	47.0
22:00-24:00	5	7.0	33	46.5	54	12.8	134	31.8
After 24:00	-	-	3	4.2	18	4.3	86	20.4
Total	71	100	71	100	421	100	421	100

Source: Fieldwork, 1989

A survey carried out by Al-Mehnabi (1989) and published by MoC pointed out that the average travel time from Arafat to Mozdalifah for pedestrian pilgrims was 1.48 hours. In 1983 the number of pedestrian pilgrims travelling from Arafat to Mozdalifah was estimated at 854,000 pilgrims i.e. 34 percent of the total number of pilgrims according to HRC (1984).

Therefore some researchers such as Bushnak (1977) and Angaw (1986) concluded that walking is an important alternative for movement between Arafat, Mozdalifah and Muna because the distances involved are relatively small (the distance per average trip is about 6km). It is appropriate to suggest that three major walkways, extending from Arafat to Muna, and passing through Mozdalifah could be established. These walkways would be separated at all intersections and vehicle conflict, with directional flow, access control and traffic surveillance. They would be interconnected with collector walkways which extend to major lodging and service areas to provide an integrated network where vehicles' movement would not interfere with pedestrian traffic. Such major walkways would be shaded with frequent rest and service areas. Special wheeled aids or luggage carts can be provided for individual pilgrims who desire to walk and take along their baggage. The use of luggage trolleys and wheelchairs would be forbidden on a specific walkway or off-peak periods (Bushnak, 1977).

The walkway which extends from Arafat to Al-Haram through Mozdalifah and Muna as mentioned has been recently shaded, particularly the parts located in Muna and Mozdalifah. However, this walkway was used as an unofficial place of accommodation by some pilgrims (see Plate 7.6). This problem adversely affects the purpose and condition of the walkway. In Muna, for example, it has been observed that around 20

metres in width of the walkway has been occupied by pilgrims, leaving only a 10 metre corridor for pedestrians to use. This problem should be considered by the authorities to prevent the unofficial occupation of the roads and walkways.

In addition, the condition of the existing walkways needs to be improved and up-graded. The most important thing to be considered is the design of the walkway at the entrance to Mozdalifah from Arafat in particular. As can be seen in Figure 7.7, the walkway suddenly twists into a sharp right angle. This shape creates extreme problems for pedestrians when they reach this point: overcrowding, congestion and separation are frequent. So the design of the walkway should be rethought so that these problems can be remedied.

(Source: Ministry of Information)

Plate 7.6 An aerial view of Muna and the shaded walkway (above), which was used for illegal accommodation by some pilgrims (below).

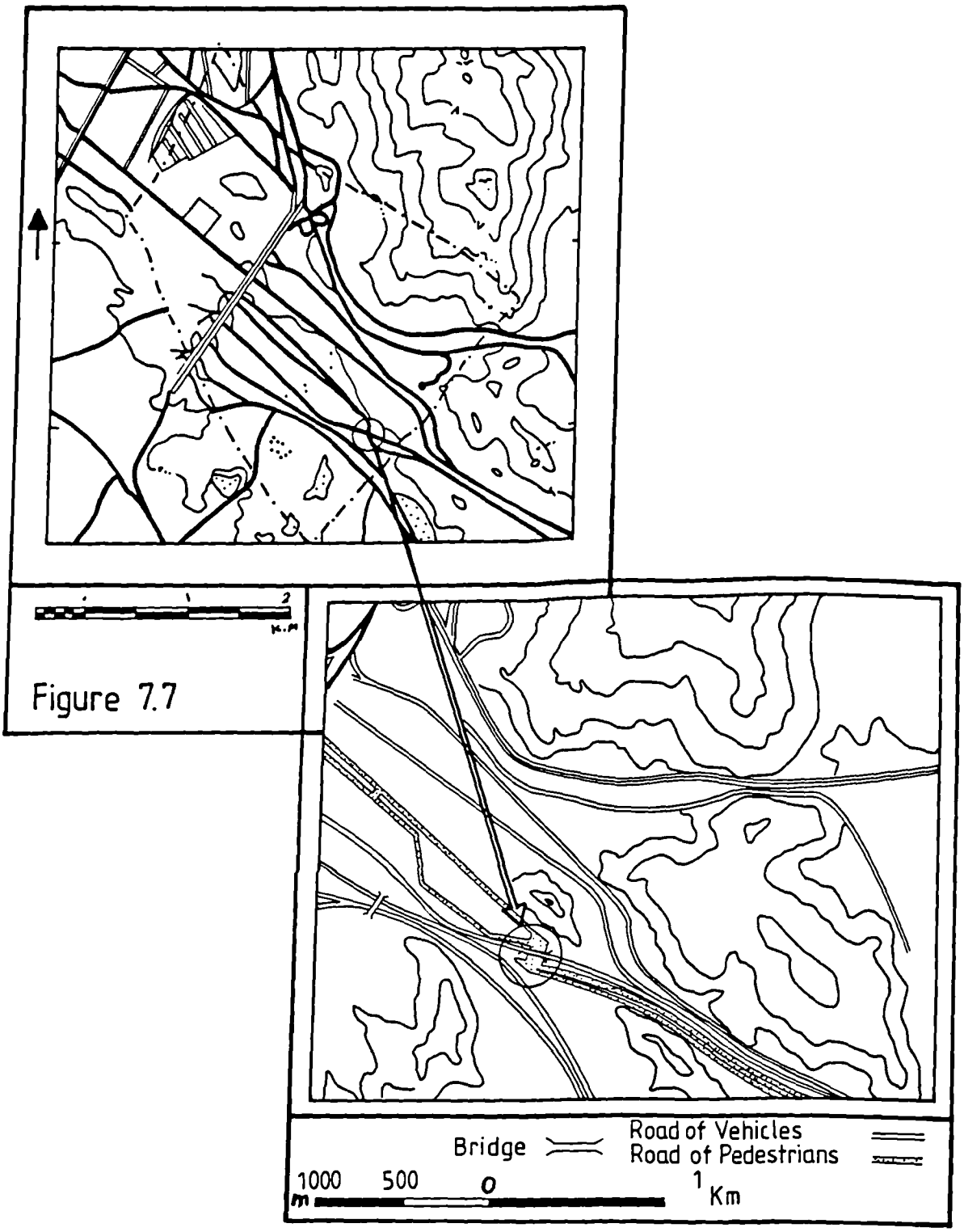


Figure 7.7

Summary

The patterns of movement of pilgrims between the Holy Places and the volume of flow were mapped in Figure 7.2. The majority of pilgrims (83 percent) went to Arafat from Muna, while only 11 percent travelled directly to Arafat. The departure from Arafat (*Nafrah*) at sunset (19:00) constitutes one of the largest movements of vehicles and people over a short time span. The survey found that about 62 out of 503 were somewhat late, having left Arafat after 22:00. About 19 persons had to stay in Arafat until midnight, because the buses picking them up were held up in traffic jams (see section 7.2).

There was unequal movement and congestion in the flow to Al-Haram, although there is no specific time determined for this pattern of movement. This phenomenon often created complex situations of overcrowding and congestion in the Holy Mosque, which has a limited capacity. It may be advisable, in order to avoid this situation arising, to spread this movement across the whole of 10 Dhul Hajjah.

In 1989 the Hajj Movement between the Holy places involved some 49,281 vehicles, 37 percent of which were minibuses and station wagons, 30 percent of which were small cars, pick ups and jeeps. The number of buses formed 21 percent (CDS, 1989). In all patterns of movement between the Holy Places, according to the survey, a large proportion of pilgrims (75 percent) used some type of motorised vehicle to travel. Thus, with the exception of the pilgrim buses, taxis and paratransits were found to have the highest level of participation in terms of movement patterns to and from Al-Haram, whilst coach, station wagon and mini-bus had a greater share in terms of movement to and from Arafat (see Table 7.3).

Although the average length of time spent travelling from Arafat to Mozdalifah (a distance of about 8km) during *Nafrah* was approximately half an hour, it took 11 percent of the pilgrims more than two hours. The rise in vehicle numbers leading to overcrowding and congestion were the main factors causing this problem. An additional ontributing factor here may be the unequal distribution of traffic on the nine roads linking the Holy Places.

Regarding pedestrian movement, the survey revealed that about 14 percent of the pilgrims travelling from Arafat to Mozdalifah did so on foot. This figure went up to 25 percent between Mozdalifah and Muna, whereas between Muna and Al-Haram and return the numbers travelling on foot went down to 9.7 and 7.7 percent respectively. Variations in the weather and distance involved may be the principle factors responsible for these changes. An attempt to forbid the entry of vehicles into areas where pedestrian-vehicle conflict is evident may help to improve this situation.

The attitude of pilgrims towards walking between Holy Places was expressed as follows: about 50 percent agreed to walk between Arafat- Mozdalifah-Muna if possible, whereas 37.3 percent preferred not to. This variation in preference may be attributable to the same factors mentioned above relating to the pedestrian movement between the Holy Places.

Research revealed that the travelling time of pedestrians between the Holy Places was sometimes shorter than for pilgrims who travelled by automobile. About 20 percent of motorised pilgrims arrived at Mozdalifah after midnight, while only 4.2 percent of pedestrians did so. Therefore, it is possible to draw the conclusion that walking is a significant alternative for movement patterns within and between the

Holy Places in Makkah. It has been observed that the distance and travel time involved are relatively small (6km and 1.48 hours per average trip between Arafat-Mozdalifah).

The construction of more walkways, particularly between the Holy Places, with all the necessary facilities is in great demand. The walkways should be separated from all vehicular traffic to avoid the pedestrian-vehicle conflict which is considered the essential problem of the Hajj movement in Makkah. In addition, the need to improve and upgrade existing walkways is one of the considerations which should be taken into account in order to develop the facilities of the Hajj movement.

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Chapter Eight

The Major Transport Problems of Hajj Movement

8.1 Introduction

8.2 Pilgrim Characteristics

8.2.1 Nationality

8.2.2 Sex Structure

8.2.3 Age Structure

8.2.4 Education Level

8.2.5 Pilgrim Groups

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Summary

References

8.1 Introduction

The main features and basic patterns of Hajj movement have been outlined above. It is appropriate here to consider Hajj movement problems, with particular reference to the results of a questionnaire survey. It was stated above that time and place are essential elements with respect to the Hajj movement: most of the rites are subject to specific schedules at specific locations. Such constraints create many problems related to the Hajj movement. The characteristics and attitudes of users are also important aspects of the transport issue.

The Hajj transport system attempts to cope with a highly complex population structure. This population is comprised of a heterogeneous mix of socio-economic structures and demographic attributes. Accordingly, the major transport problems facing pilgrims may be considered and determined as to the pilgrims' attitude to the transport system which they encounter.

This chapter examines pilgrim characteristics relating to problems of transport and movement. The final section focuses on the attitude of pilgrims with respect to transport problems in the Hajj region.

The data for this study have been derived from fieldwork which was undertaken in 1989 by questionnaire and interview (see Chapter 1)

8.2 Pilgrim Characteristics

Demographic and socio-economic attributes of pilgrims may affect the patterns of Hajj movement. Variations in nationality, educational level and demographic structure may have a multiple and complex effect with respect to movement systems and transport modes in the Hajj region. Although such problems are multiple and complex, a bivariate approach will be used to break down these aspects. The main objectives of this section are to give a broad picture of the demographic and socio-economic characteristics of pilgrims, and to try to explain the effect of each attribute on the Hajj movement and transport system of pilgrims.

The examination of such characteristics seems appropriate for three reasons. Firstly, it provides a picture of pilgrim population structure, and therefore may offer insight into the root cause of transport problems. Secondly, to emphasise the significance of the pilgrims' characteristics for the benefit of planners and authorities. They need to take into account such characteristics for forecasting, planning and changes to the transport system of the Hajj region. Thirdly, since the case study sample population represents only a small proportion of pilgrims, it is prudent to demonstrate the representativeness (or otherwise) of the sample in terms of the wider pilgrim population.

In contrast with other sets of data relating to pilgrims, there are no reliable statistics or data about these characteristics, not even the nationality data which used to emerge in the Hajj statistics of the annual report. Since 1987 data on the geographical distribution of pilgrims have been absent.

In describing the characteristics of the pilgrim sample, data from the questionnaires on the nationality, age, sex, level of education and collective groups are discussed here. The nationalities and distribution of the pilgrims have been generally examined in Chapter Five, with reference to official statistical data. Discussion in this section will be confined to external pilgrims interviewed in the 1989 survey.

8.2.1 Nationality

The composition of the sample in terms of nationality is examined first. In fact, variations in education level, language and attitude of pilgrims arose as a result of the variety of nationalities. Thus, variation in nationality affected the transport of pilgrims.

The 1989 survey sample identified 38 nationalities, as shown in Table 8.1. This number represents 76 percent of the principal nationalities in Hajj movement between 1971 and 1987 (see Chapter Five). There are no data specific to 1989, when the survey took place, about the nationality of pilgrims. Had such data existed, a comparison between the nationalities of the sample population and the overall pilgrim population could have been made. However, using statistics compiled in Chapter Five concerning mean numbers of pilgrims travelling to the Hajj, it is possible to say that from 1971 to 1987, 47 percent of pilgrims were from Arab countries, 40 percent were from non-Arab Asian countries, and 11 percent were from non-Arab African countries (see Table 5.5). Table 8.2 shows the distribution of respondents according to the main geographical areas from which they came, as compared with corresponding percentages of mean pilgrim numbers (1971-1987). It is evident from Table 8.2 and Figure 8.1 that, in the survey, Arab countries were heavily represented

at the expense of other geographical areas: 62.4 percent of external pilgrims were from Arab countries, whereas only 26.5 percent were from Asian countries. This is at variance with the 1971-1987 pilgrim statistics, which yielded 47 percent from Arab countries and 40 percent from Asian countries. Variation between the results of this survey and the mean percentages (1971-1987) may be attributable to two main causes. First, the number of pilgrims from Asian countries declined in 1987 when Iran stopped participating in the Hajj (Okud Newspapers, No. 8467, 1989). As was shown in Chapter 5, Iranian pilgrims usually averaged eighty thousand. Second, the relative decline of non-Arab pilgrims may also be explained by the deteriorating economic situation of their countries, applicable to pilgrims coming from Asia and Africa.

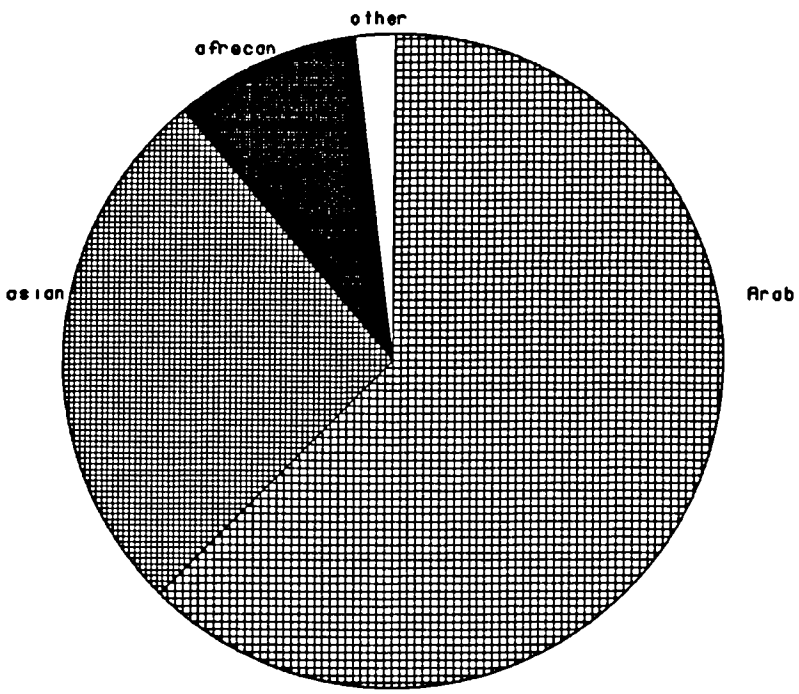
Table 8.1 Distribution of the pilgrim sample population according to nationality

Nationality	Number of pilgrims	%
Arab countries		
Egypt	76	15.0
Algeria	47	9.3
Syria	42	8.5
Morocco	39	7.7
Sudan	26	5.1
Yemen	20	4.0
Tunisia	19	3.8
Lebanon	11	2.2
U.A.E.	10	2.0
Somalia	6	1.2
Jordan	4	0.8
Kuwait	4	0.8
Djibuti	4	0.8
Libya	2	0.4
Oman	2	0.4
Palestine	2	0.4
Iraq	1	0.2
Total	315	62.4
Non-Arab Asian pilgrims		
Pakistan	44	8.7
Bangladesh	36	7.1
India	20	4.0
Turkey	17	3.4
Malaysia	7	1.4
Philippines	3	0.6
Indonesia	3	0.6
Afghanistan	2	0.4

Thailand	2	0.4
Total	134	26.5
Non-Arab African, European and American pilgrims		
Nigeria	20	4.0
Kenya	8	1.6
Gambia	4	0.8
Senegal	4	0.8
Uganda	4	0.8
Central African Republic	2	0.4
South Africa	2	0.4
Tanzania	2	0.4
Benin	2	0.4
Total	48	9.5
Other		
America	5	1.4
France	3	0.2
Total	8	1.6
Number of responses	505	100
Number of non-responses	2	

Source: Fieldwork, 1989

FIG. 8.1 : Geographical distribution of the pilgrims according to the survey, 1989



SOURCE: Fieldwork, 1989

Table 8.2 Comparison of the geographical distribution of pilgrims between the survey results of 1989 and the pilgrim statistics of 1971-1987

Areas/ countries	1989 sample		*1971-1987 statistics
	Number	%	% of mean number
Arab	315	62.4	47
Non-Arab Asian	134	26.5	40
Non-Arab African	46	9.5	11
Other	10	1.6	2
Total	505	100.0	100

Source: Fieldwork, 1989

* Quoted from Table 5.5.

Nevertheless, the sample is relatively representative in terms of the main geographical areas from which the pilgrims had come. With the exception of the Asian pilgrims, variation between the sample ratios and those of the 1971-1987 statistics is small.

8.2.2 Sex Structure

As knowledge of the gender composition of inhabitants of a particular area or city has such a value and importance to researchers and specialists, information about the gender of pilgrims is of no less value and importance. This is because data on the sex structure of any society or community is quite valuable in providing information concerning gender e.g. whether or not one sex exceeds the other and by what percentage. Such conclusions will allow researchers and planners to decide on what is more appropriate for that society or community. Pilgrims, regardless of their nationalities, can be perceived as a grouping which forms a community that stays for a period of time in the same place, and consists of both sexes with differing percentages depending on the year and the country of origin.

Although the sample was selected by a systematic method (see Chapter One), the representation of women was, as expected, small. The survey interviewed only 64 female respondents out of a total of 507, i.e. only 12.6 percent of the sample. This is lower than the proportion (one third) of women among external pilgrims shown by official statistics.

Social factors of tradition and religion may be the cause of the small representation of women in the sample: women are discouraged from associating with foreigners. The surveyor sometimes experienced difficulty in talking directly with women. When the survey took place, in some cases the women had tended to gather in separate groups. Even when the interviewer encountered women by chance, they sometimes refused or were unable to answer the questions.

It is difficult, therefore, to depend on this survey for an analysis of the sex ratios of the pilgrim population. Nevertheless, the representation (12.6 percent) of female pilgrims in the sample may not be unreasonable considering the restrictions mentioned above. Fortunately the data related to sex structure of external pilgrims were recorded by the authorities in the annual report of Hajj statistics. The Immigration Department's Statistics on pilgrims include data on classification of pilgrims into males and females, but unfortunately there are some years for which data have not been completed and these appear as gaps in Table 8.3.

In the absence of such figures the Department of General Statistics in Riyadh issued estimates for the years from 1976 to 1980 with regard to external pilgrims.

Before the year 1967, when the Department of Immigration started to classify pilgrims according to gender there was no information regarding sex, except what was

reported in estimates by some globetrotters, such as Ali Bey who put the number of pilgrims in the year 1220 AH (1805 AD) at 80,000 men, 2,000 women and 1,000 children (Ali Bey, 1816). This means that the percentage of female pilgrims at that time was only 2.5 percent. Assuming the latter estimate was reasonable, the apparent fall in the number of women pilgrims might be attributable to the difficulty and hardship of the pilgrimage journey at that time, in addition to the lack of security in the Arabian Peninsula in those days. The necessity for women to be in the company of male guardians was not always an easy one to provide, the result being that many women were unable to make a pilgrimage under such circumstances.

By examining the sex structure of pilgrims over recent years, we shall notice that the percentage of females has increased twelve-fold compared to the estimate made by Ali Bey. This tends to indicate the effects that developments in Islamic society in general, such as improved transport, state security and political stability, have had on the sex structure of pilgrims.

Table 8.3 Sex Structure of External Pilgrims (1971-1988) in Terms of Male Percentage

Years	Percentage of Males%
1971	65.3
1972	64.3
1973	63.6
1974	63.3
1974	62.2
1975	66.5
1976	64.2 *
1977	64.2 *
1978	64.2 *
1979	64.2 *
1980	64.2 *
1981	-
1982	-
1983	-
1984	62.7
1985	-
1986	59.6
1987	59.2
1988	59.4

Source: Ministry of Interior (Passport Affairs), Riyadh
Central Department of Statistics, Riyadh
* Estimated by C.D.S.

As revealed in Table 8.3, the percentage of male external pilgrims had ranged between 66.5 percent and 59.2 percent. It is significant that there was a gradual increase in female percentages at the expense of male percentages which dropped from 66.5 percent in 1975 to 59.2 percent in 1987. These changes were probably a result

of developments in transport and communication, which led to a greater use of transport because it was faster, cost less and was more comfortable. This is especially true of air travel which has been used by the majority of external pilgrims in preference to other means of transport. Such a shift helped to facilitate the attendance of women at the Hajj as it affords easy access, less hardship and enables families to travel together. In contrast, land travel takes a longer time and requires frequent stops at special rest camps. Both of these disadvantages mean that women who observe the social convention of Islamic culture find land travel uncomfortable because it puts them in close proximity to men for long periods of time.

The movement of women has an effect upon the movement of transport in general. As they travel as a member of a family or group, this tends to extend the amount of time needed for whole groups to get on or off buses together.

It is thought that men show greater endurance than women with respect to the specific burdens and difficulties that pilgrims may sometimes face whilst performing Hajj rituals. Unlike men, women need special attention and services, such as allocating toilets peculiar to them and extra numbers of sun sheds and rest places, especially between the various holy spots; in addition to that, each sex has different requirements of health services, supplies etc. during Hajj.

The sex ratio of pilgrims influences Hajj movement because there are traditions and customs in the transportation of women. It is customary for men and women to be isolated from each other. Often, one part of a bus, or one door of a double-decker bus, is allocated to women. It is important to recognise this factor with respect to any changes that may take place to the transportation system in the Hajj region.

8.2.3 Age Structure

Age structure is regarded as one of the important characteristics of any society or country. Researchers and planners cannot proceed without knowing and studying this characteristic, because it assists in enabling them to determine the character of a society and the inhabitants of a particular country. Therefore, knowledge of the attributes of pilgrims regarding age will help in deciding the rules and projects most appropriate to the age structure of pilgrims and thus ensure their well-being and safety. Moreover, it will help us to appreciate more clearly many of the problems facing pilgrims during the Hajj. If we are, for example, prepared to decide that 'walking' is to be the only means of transport between the holy places in Makkah, and to prohibit the use of cars therefore - a proposal that many researchers have suggested as a solution to the overcrowding that has been a feature of recent years - we must then give consideration to the aged pilgrims by ascertaining their percentage, and to think of ways and means that ensure their welfare, readiness and safety.

It is very rare to find data or information about the age composition of pilgrims which are based on official data or statistics. However, some data have been recorded in a report by Robert Matthew who briefly referred to the percentile classification of pilgrims on the basis of age groups for the year 1973 (Robert Matthew, 1972). As well as this the statistical reports of the Hajj Research Centre have contained data related to age structure which were based on the Sample Studies of the Hajj in 1980 and 1982. In 1980 the Hajj Research Centre made a general survey of pilgrims by taking a stratified sample of 1947 pilgrims who represented various national groups. The

H.R.C. identified six countries which represented the majority of external pilgrims as is illustrated in Table 8.4 below.

Table 8.4

Country	No. Sample	Group,Representation
Syria	374	Pilgrims of Arab Countries in Asia
Yemen	228	Pilgrims of Arab Countries in Asia
Algeria	432	Pilgrims of Arab Countries in Asia
Pakistan	371	Pilgrims of non-Arab Asian Countries
Turkey	59	Pilgrims of non-Arab Asian Countries
Nigeria	483	Pilgrims of non-Arab African Countries
Total	1947	

This survey has been conducted by means of interviewing the pilgrims at Makkah. It is interesting to utilise the data provided by the H.R.C. to discuss this topic further and compare them with the results of the survey to build up a broader picture of the age structure of pilgrims.

Table 8.5 shows the age structure of the pilgrims according to the HRC survey. As can be seen from this table, pilgrims in the 36-50 group made up more than one third, or 37 percent, and if their numbers were combined with those aged 51 years or more, one would find that pilgrims over the age of 36 accounted for about two thirds of external pilgrims. The remaining third was composed of those under the age of 36. However the percentage of those in the 16-35 age bracket was 35.3 percent in 1980 while in 1982 their percentage declined to 29.6 percent.

FIG. 8.2 : Age structure of the pilgrim sample by geographical areas in 1989

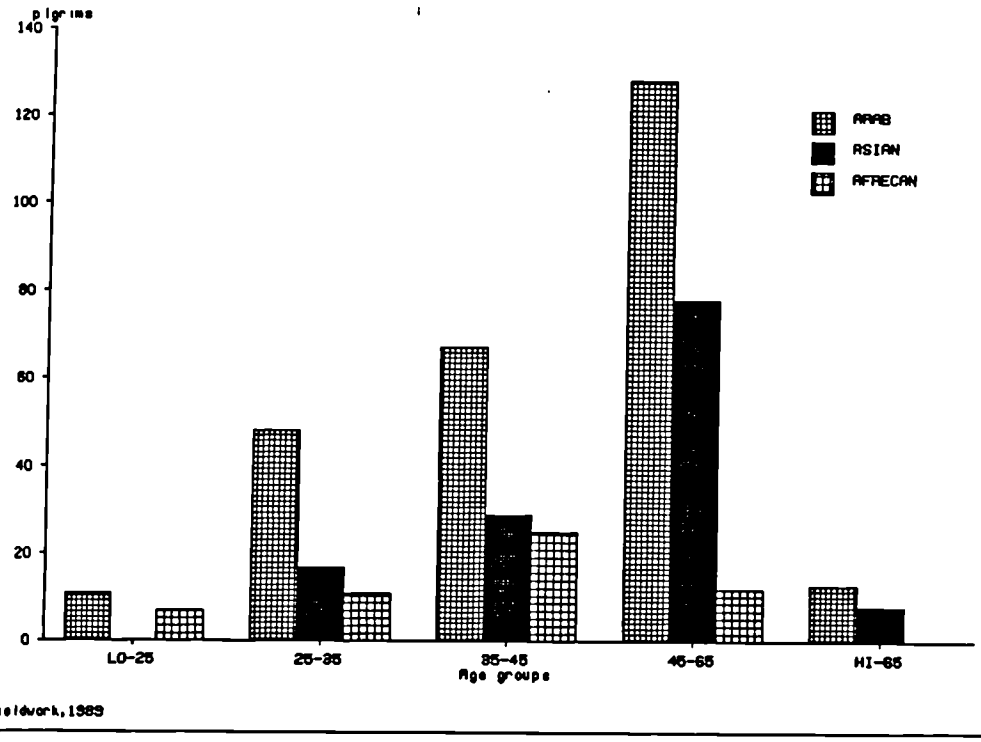


Table 8.5 Age Structure of External Pilgrims for the Hajj of 1980 and 1982

Age Group	1980	1982
Under 16	1.8	1.2
16-25	11.2	7.4
28-35	24.1	22.2
36-50	37.0	36.9
51-65	21.5	26.9
Over 65	4.4	5.4
Total	100	100

Source: Hajj Research Centre, 1980 and 1982

The survey undertaken by the author revealed the age breakdown of 500 (out of a sample of 507) respondents to the questionnaire. Table 8.6 shows the age group 45-65 years to have been the most numerous, accounting for 43 percent of the sample. With the over-65 years age group added to the above group, pilgrims over the age of 45 years accounted for about half of the sample. The second largest cohort is the age category 35-45 years which made up 33 percent of the total sample.

As illustrated in Figure 8.2 and Table 8.6, each younger cohort produced progressively fewer respondents: the age category 25-35 years accounted for 15 percent of the sample, and the age group under 25 years only 3.6 percent. This means that in 1989 about 80 percent of external pilgrims performing Hajj were over 35 years. These results are closely consistent with the HRC data (1982), as shown above. However, the trend of pilgrims in the older age groups is increasing while it is decreasing for the younger age groups.

Various factors and causes lie behind this phenomenon whereby older pilgrims outnumber younger pilgrims, some of which may be attributable to the country in

which the pilgrim lives and the regulations that are applied there or to the individual circumstances of the pilgrim him or herself. The state, for instance, may determine that an individual has to reach a certain age before he or she can qualify for pilgrim status. This system is in operation in many Islamic countries and the age of qualification is usually advanced. Another factor is the high cost likely to be incurred by muslims from remote Islamic countries. Younger pilgrims do not always possess the financial means to attend the Hajj and often have to wait until they are older. Frequently this is the case in South-East Asia. Although Islamic directives urge Muslims to make their pilgrimage to Makkah as soon as possible, many find they are unable to do so until they are considerably older. Capability would appear to be the key condition or prerequisite for the performance of the Hajj.

Table 8.6 Age structure of the pilgrim sample population according to geographical area

	Geographical areas							
	Arab		Asian		African		Total	
Age group	Number	%	Number	%	Number	%	Number	%
Under 25	11	3.5	-	-	7	12.7	18	3.6
25 - 35	48	15.3	17	12.9	11	20.0	76	15.2
35 - 45	67.7	36.1	29	22.0	25	45.5	167	33.4
45 - 65	128	40.9	78	59.1	12	21.8	218	48.6
65+	13	4.2	8	6.1	-	-	21	4.2
Total	313	100.0	132	100.0	55	100.0	500	100.0

Source: Fieldwork, 1989

Table 8.6 also shows the distribution of survey respondents according to age in three geographical areas. The application of the chi-square test to the data above reveals significant differences in the distribution of age groups between the different areas.

In this case, the calculated value of X^2 is 44.2 with 8 degree of freedom. The critical value had emerged considerably less than the calculated value of X^2 at any level of significance. Thus the null hypothesis can be rejected at the 0.001 significance level. From Table 8.6 it is clear that Asian pilgrims tend to be elderly, and that there were no Asian pilgrims under 25 years of age. In contrast, 12.7 percent of African and other pilgrims were under 25 years, but none was over 65 years. The reason for this may be accounted for by the Nigerian pilgrims who made up about 50 percent of the African pilgrims. The majority of these set out to perform the Hajj during the early years of their lives. They believe that Muslims should carry out the Hajj sooner rather than later. In 1981, 12.5 percent of the Nigerian pilgrims who had performed the Hajj were under 24 years of age according to the HRC (1981).

The age structure of the pilgrim population is considered a problem for the Hajj movement and its transport system. Naturally, elderly passengers are slower in movement than young passengers and this can result in delays when senior pilgrims embark or alight from buses or cars. It is important to consider the needs of older pilgrims in terms of transport services (Bahrani, 1989): planning and design for the future system of transport modes in the Hajj region needs to bear in mind the special demands made by these elderly pilgrims, particularly as they constitute a sizeable proportion of the pilgrim population.

8.2.4 Educational Level

The educational characteristics of individual pilgrims may influence a pilgrim's consciousness and cultural dominance amongst the other pilgrims. This study may help to specify the most appropriate system of transport consistent with a pilgrim's

educational level. The examination of this attribute is covered by discussion of two aspects: number of years in education and the knowledge of dominant languages.

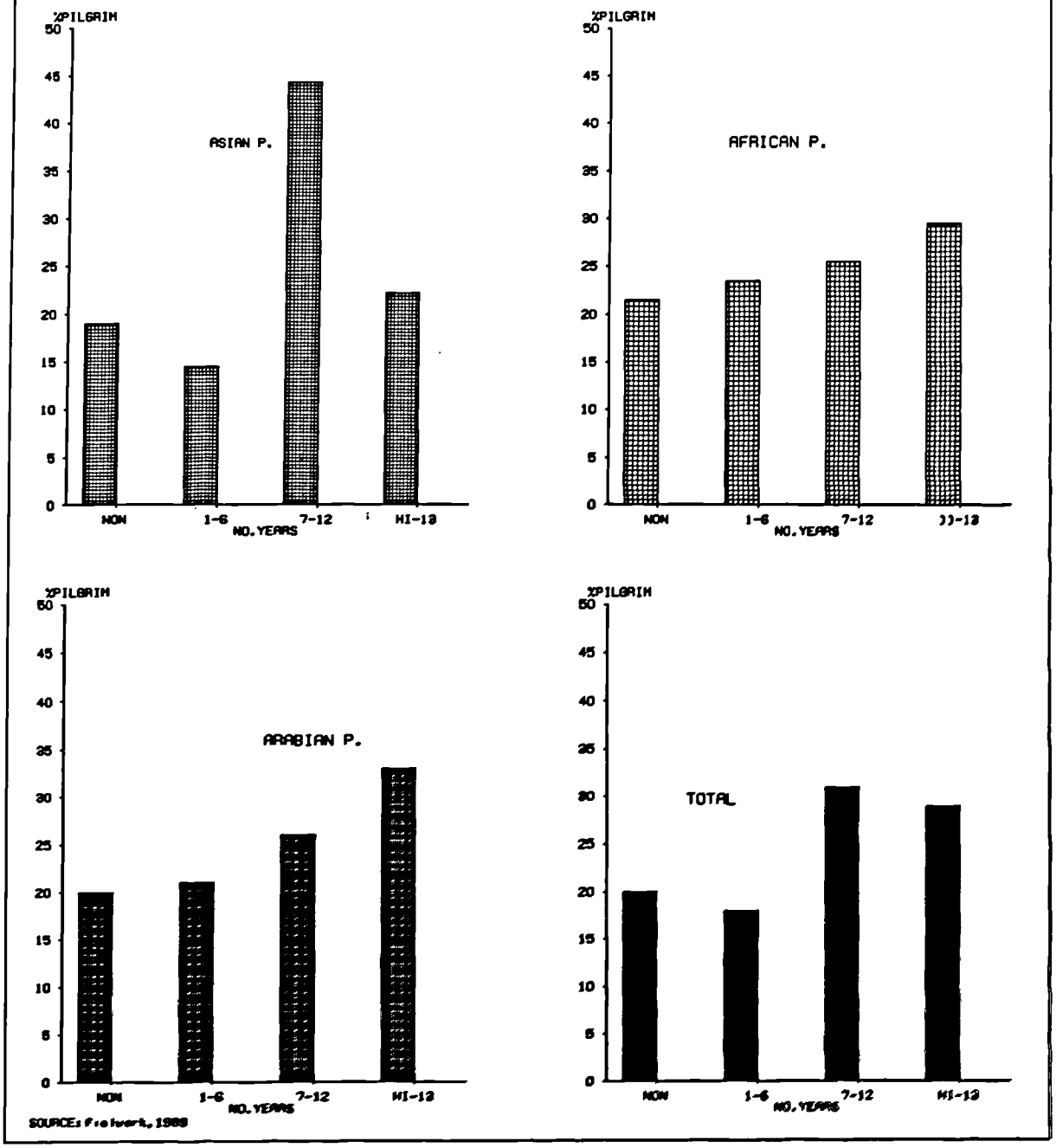
8.2.4.1 Number of years in education

The pilgrims were asked about the number of years they had spent learning and studying. Out of 507 questioned, 444 responded to this inquiry. The length of the questionnaire and the nature of the inquiry, which needs something of an account from the pilgrim, may be the main reason that 12 percent of the sample did not respond.

The valid responses of this issue have been shown below in Table 8.7, and Figure 8.3 shows

- that the percentage of illiteracy amongst the pilgrims was not less than 20 percent of respondents. Pilgrims from each of the three geographical areas showed much the same percentage of illiteracy, although African groups (21.5 percent) were above the general percentage, whilst the Asian groups (19 percent) were below.
- 19 percent of respondents were classified as having received only a primary education (1-6 years); 23.5 percent of the African group had received only up to this level of education; amongst Arab pilgrims this was 21 percent, and amongst Asian pilgrims it was 14.5 percent.
- intermediate and secondary level education (7-12 years) achieved the highest proportion of the total respondents (31 percent). Non-Arab Asian pilgrims took first place in the three geographical groups (44.3 percent) and

FIG. 8.3 : Education levels of pilgrims by geographical groups and total, in 1989



the Arab and African pilgrims similarly had around 26 percent of their groups.

- regarding higher education, around 30 percent of the respondents had received education to university or post-graduate level. Those with a high level of education were dominant in the Arab and African groups where they accounted for about 30 percent of each group. Asian pilgrims followed, at 24 percent of their group. On the other hand, the Asian group rose to first place of those with seven years or more of education (66 percent) compared with the Arab and African pilgrims with 59 percent and 55 percent respectively.

Table 8.7 Educational level of sample pilgrim population according to geographical area

Number of years of education	Geographical area							
	Arab		Asian		African & other		Total	
	Number	%	Number	%	Number	%	Number	%
None	54	20.0	23	19.0	11	21.5	92	20.7
1-6	57	21.0	18	14.5	12	23.5	83	18.7
7-12	71	26.0	54	44.3	13	25.5	138	31.9
13+	89	33.0	27	22.2	15	29.5	131	29.6
Total	271	100	122	100	51	100	444	100

Source: Fieldwork, 1989

Note: The classification of educational level used in the table is derived from the Saudi Arabian education system.

The differences between geographical groups in the distribution of pilgrims according to their level of education have been tested by chi-square. In this case the X^2 is 14.97. The critical value of X^2 with 6 degrees of freedom at the 0.05 significance level is

12.59. Thus since the calculated value of X^2 is greater than this critical value, the null hypothesis can be rejected at the customary level of significance (0.05). Therefore it is probable that the observed difference between the education levels held by the three samples of pilgrims is an indication of a 'real' difference between the three groups in the pilgrim population as a whole.

From the above, it is clear that 40 percent of the respondents were classified either as illiterate (20 percent), or as having received only a primary level of education (20 percent). Illiteracy is another dimension affecting movement in the transport system e.g. an inability to read signs and directions can cause people to get lost or find themselves in the wrong place, perhaps using an entrance as an exit. This in turn affects the smooth running of the transport system as it creates congestion, over-crowding and delays. However, time will surely change this picture toward better education levels. Cross- tabulation shows that most of the illiterate pilgrims were in the elderly age group (Table 8.8).

Table 8.8 The relationship between level of education and age structure of the sample pilgrim population

	Level of education				
Age category	None	1 - 6	7 - 12	13 +	Total
Under 25	1	3	10	3	17
25 - 35	7	8	27	29	71
35 - 45	24	27	45	57	153
45 - 65	52	44	54	37	187
65 +	8	1	2	5	16
Total	92	83	138	131	444

Source: Fieldwork, 1989

In practice the information about education levels amongst the pilgrims is insufficent to understand the problems of Hajj movement. The approach and language which can be used to deal with the pilgrims is considered significant to the transportation of pilgrims. This point will be discussed next.

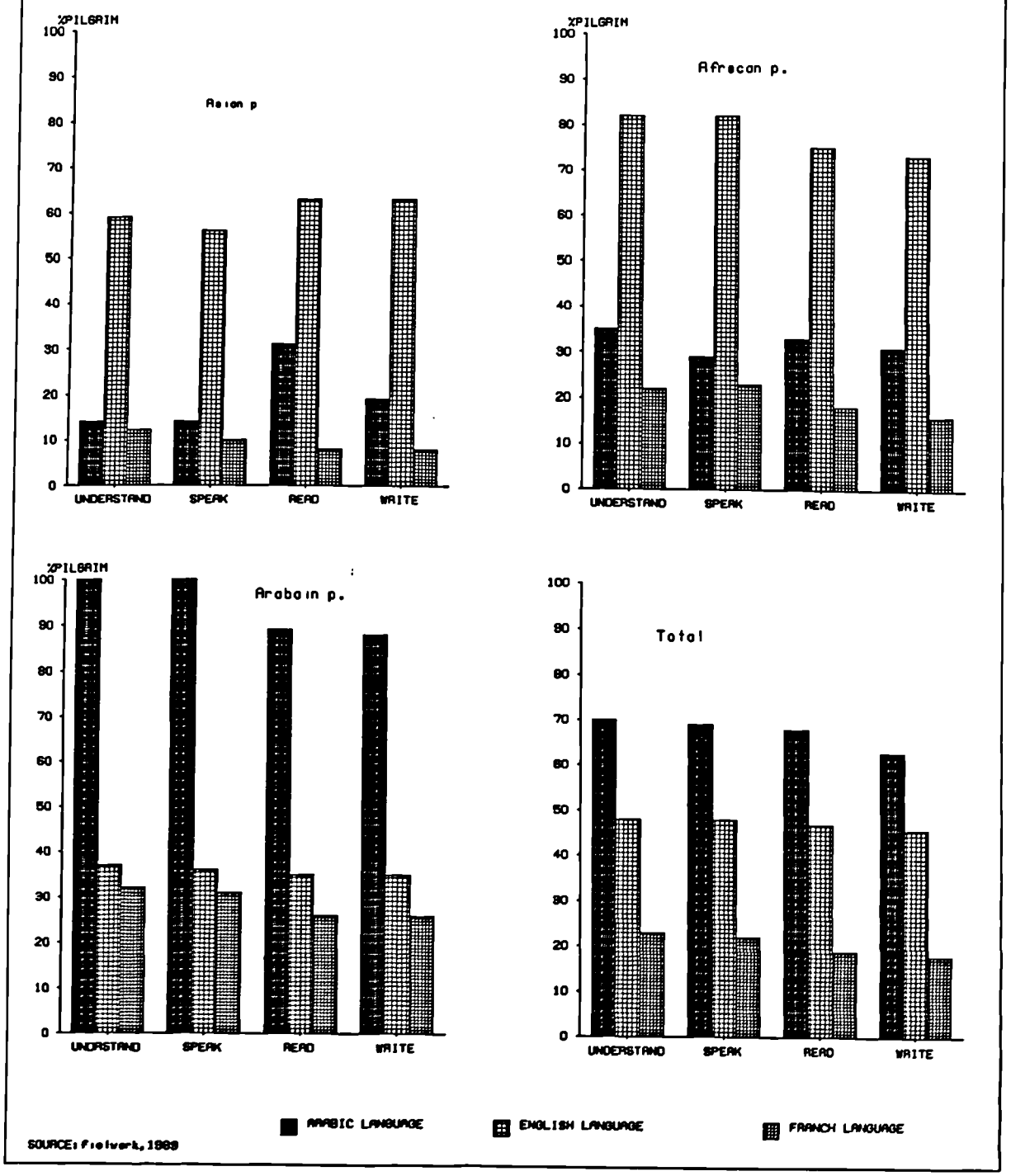
8.2.4.2 Knowledge of the dominant language

Knowledge of the dominant language of the pilgrims is essential in terms of the development of projects relating to instruction and guidance. There is a significant need to extend the necessary instructions for pilgrims, and to direct the Hajj movement (HRC. 1401).

Translation of instructions and directions of the Hajj into all languages of the pilgrims is impractical. Three languages, therefore, have been selected as the principal languages in the Islamic World: Arabic, the language of Islam and the public language for Arab countries; English, which is international and also an official language for most non-Arab Muslim countries; and French, second to English in the Islamic World.

The questionnaire confined itself to these three languages when examining the skill and fluency of the pilgrims in understanding, speaking, reading and writing in these languages. The result of the survey is shown in Table 8.9 and illustrated in Figure 8.4.

FIG. 8.4 : Distribution of the pilgrims by their knowlege of the three languages in 1989



SOURCE: Fieldwork, 1989

Table 8.9 Geographical distribution of sample pilgrim population according to their knowledge of Arabic, English and French

Langauge	Geographical area							
	Arab		Asian		African & other		Total	
	Number	%	Number	%	Number	%	Number	%
Arabic								
understand	286	100.0	18	14.0	18	35.0	322	70.0
speak	286	100.0	17	14.0	15	29.0	316	69.0
read	255	89.0	38	31.0	17	33.0	310	68.0
write	251	88.0	23	19.0	16	31.0	290	63.0
English								
understand	107	37.0	71	59.0	42	82.0	220	48.0
speak	104	36.0	68	56.0	42	82.0	214	48.0
read	101	35.0	76	63.0	38	75.0	215	47.0
write	100	35.0	76	63.0	37	73.0	213	46.0
French								
understand	91	32.0	15	12.0	11	22.0	105	23.0
speak	88	31.0	12	10.0	12	23.0	103	22.0
read	75	26.0	10	8.0	9	18.0	87	19.0
write	74	26.0	10	8.0	8	16.0	85	18.0
Responses								
Respondents	286	100.0	121	100.0	51	100.0	458	100.0
No response	30	9.5	13	10.7	6	12.0	-	-
Total sample	316		134		57		507	

Source: Fieldwork, 1989

Table 8.9 shows that between 9 and 12 percent of sample respondents, depending on the geographical region from which they had travelled, showed no response. This may be attributable to one of two main reasons. Some pilgrims were unable to understand,

speak, read or write Arabic, English or French. These pilgrims were, in the main, from Africa or Asia. Regarding the Arabic group - this may simply be the result of missing data.

However, not surprisingly, 88-89 percent of the Arab sample were able to read and write the Arabic language. In the case of non-Arab pilgrims, 31-33 percent of the African sample were able to read and write in Arabic and 29 percent were able to speak Arabic. Amongst Asian pilgrims, 31 percent were able to read, 19 percent were able to write and 14 percent were able to speak Arabic. This means that the African groups exhibited a greater ability to deal with the Arab language than other non-Arab pilgrims.

Regarding the use of English, the African group displayed greater comprehension skills as readers, writers and speakers of English (70 percent). Between 56-63 percent of Asians showed an ability to use English, whereas fewer than 35 percent of Arabs were able to do so.

Regarding the use of French, Arabic pilgrims emerged in first place, with not fewer than 30 percent of respondents being able to speak and understand and 26 percent able to read and write French. This may be accounted for by the fact that certain North African Arab countries, such as Morocco and Algeria, have French as a second language. Table 8.9 also reveals that whilst 16 percent to 22 percent of the African group were able to communicate in French, figures for the Asian group ranged between only 8 percent and 12 percent.

Generally, the survey found that about 70 percent of all respondents understood and spoke Arabic and no less than 63 percent could read and write Arabic. A figure of 47 percent was recorded for those who could communicate in English and less than 23 percent in French.

As might be expected, Arabic is the prime language of communication amongst pilgrims, more than half of whom possess the ability to understand, speak, write and read. English should be the second language used to guide and direct pilgrims during the Hajj movement as it is the language of more than half the non-Arab pilgrims.

8.2.5 Pilgrim groups

Pilgrims usually come to the Hajj region as members of a group. These groups display various characteristics regarding their size, gender and relationships. Indeed, the group nature of Hajj movement is one of its outstanding features, and exerts an important influence. In terms of physical movement, the group phenomenon gives rise to complicated situations as it is the norm for groups to congregate and move *en masse* from one place to another in order to carry out the rites of pilgrimage.

The aim of this work is to discuss the principle characteristics of Hajj groups by looking at their composition, specifically: size, gender and relationships. This study may throw some light upon the unique nature of Hajj movement, and in so doing, help to give an insight into the needs and demands of pilgrims' transport systems.

Pilgrims were asked how many friends or relatives accompanied them to the Hajj. The survey revealed that out of 507 pilgrims, 96 (19 percent) travelled singly. The majority of 81 percent replied that they had travelled as members of a group in the company of friends or family. It has been found that the arithmetic mean for groups was 18, and on average 13 of whom would be friends and 5 family relatives. In general, women accounted for 11.5 percent of family groups and 21 percent of friends groups. Table 8.10 shows that the median of the total number of pilgrims for each group was 6, the largest group numbering 220 pilgrims and the smallest being 2.

Table 8.10 The volume and size of pilgrim groups

	Relatives		Friends		Characteristics of total sample
	M	F	M	F	
Median	2	2	6	5	6
Maximum	40	25	70	50	220
Minimum	1	0	1	1	2
Sum	898	591	2543	1081	5113
Percentage	17	11.5	50	21.1	100

Source: Fieldwork, 1989

The size of pilgrim groups is illustrated by Table 8.11 which reveals that 25 percent of the sample were performing Hajj accompanied by one, two or three other people. Table 8.11 also shows that the percentage of respondents tended to decrease as the size of pilgrim groups increased: groups of 10 to 12 people accounted for only 6 percent of the sample. Groups which numbered 13 and above represent 21 percent of the sample, but this may be due simply to the width of the category. However, the pilgrim groups have a profound effect on the movement of pilgrims. The size and complexity of groups tends to constrain movement and cause delays, especially when passengers are about to be picked up or dropped off. It is not unusual to find, for example, that a small but incomplete group and a large complete group are both unable to take advantage of the seats available on a bus. Similarly, delays are caused when a bus is kept waiting by a small group awaiting one of their members or when a large group finds that it has to wait for a bus which has enough seats to carry the entire group. Therefore, a high degree of organisation is needed to cope with the complex groupings which attend the Hajj.

Table 8.11 Sample respondents according to size of group

Size of group	Respondents	Percentage
None	96	18.7
1 - 3	128	25.2
4 - 6	92	18.1
7 - 9	54	10.7
10 - 12	30	5.9
13 +	107	21.1
Total	507	100

Source: Fieldwork, 1989

The significant point to note here is that most individual pilgrims are subject to grouping in terms of movement or transport. This problem should be borne in mind in the planning stages of any new transport system which may be developed to serve the Hajj region during the pilgrimage season.

8.3 Transport Problems of Hajj Movement

The aims of this section are to

- determine and discuss the major problems of transport which the pilgrim faces in the Hajj region generally, and in Makkah in particular;
- evaluate the transport services generally, and public transport, such as GSC and SAPTCO buses, in particular.

This evaluation is based on information about pilgrims' attitudes obtained from the questionnaires (see Appendix 2).

It is appropriate first to evaluate the services of pilgrim transport as perceived by the pilgrims. The pilgrims were asked about their perception of the transport service level:

- 54 percent considered the service to be good,
- 27 percent considered the service to be intermediate
- 9 percent considered the service to be poor
- 10 percent were unknown (see Table 8.12 and Figure 8.5).

These responses suggest that the transport services are perceived by pilgrims as acceptable. Moreover, regarding the transport services provided by companies, a reasonable percentage of respondents said that the services of transport companies were at a good or intermediate level; 42.4 and 33.1 percent respectively; but about nine percent stated that such services were bad and not satisfactory (see Table 8.13).

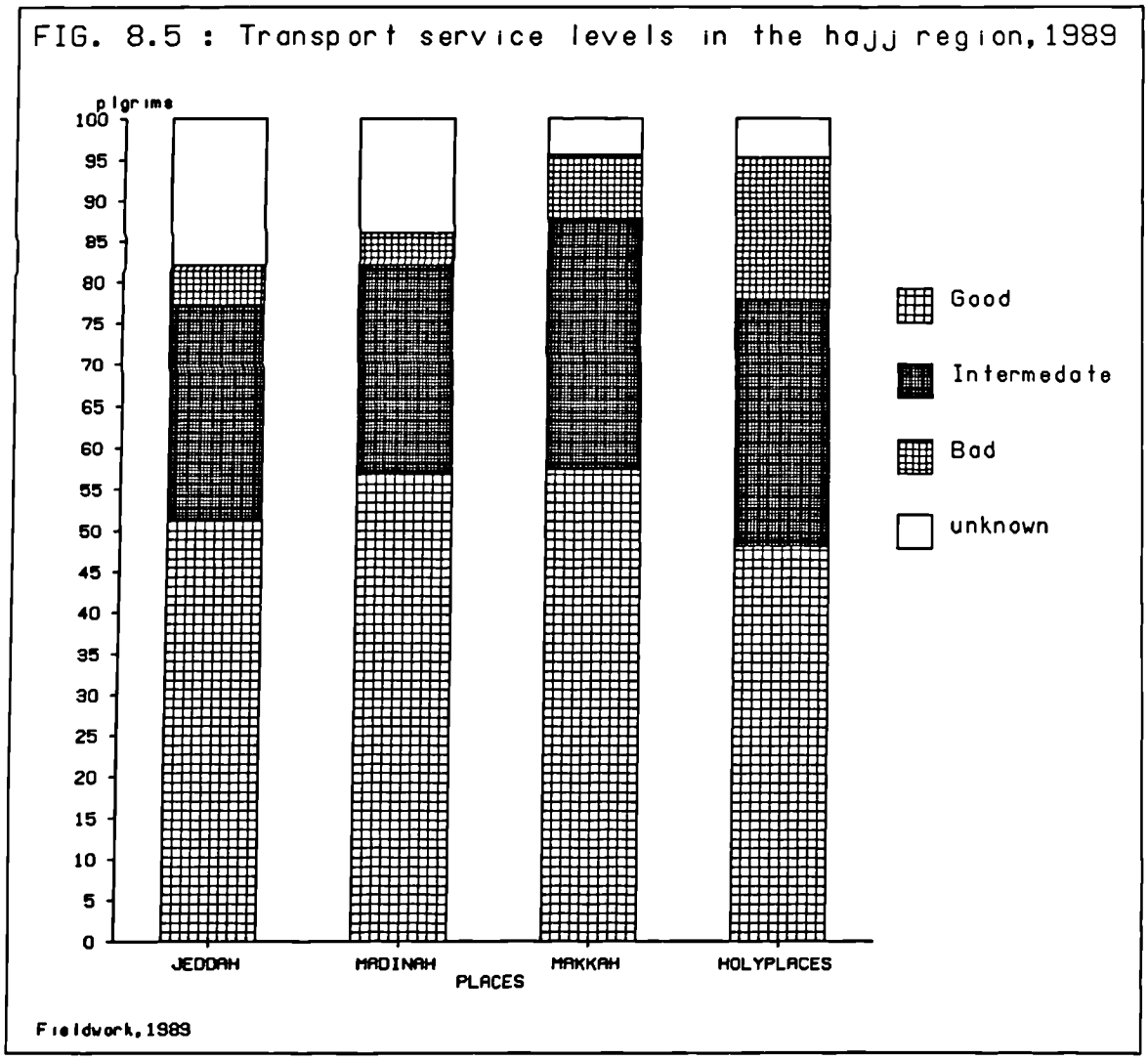


FIG. 8.5 : Transport service levels in the hajj region, 1989
pilgrims
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
JEDDAH
MADINAH
MAKKAH
HOLYPLACES
PLACES
Good
Intermedate
Bad
unknown
Fieldwork, 1989

Table 8.12 Transport service levels in the Hajj region

Place	Level	Good		Intermediate		Bad		Unknown		Total responses		No responses	
			%		%		%		%		%		%
Jeddah		250	51.3	125	25.7	24	5.5	88	18.0	487	100	20	4
Madinah		281	62.3	124	25.0	20	4.4	68	14	493	100	14	2.8
Makkah		283	57.4	149	30.2	40	8.0	21	4.4	493	100	14	2.8
Holy Places		238	48.2	146	29.6	86	17.5	23	4.7	493	100	14	2.8
Total		1052	54	544	27	170	9	200	10	1966	100		

Source: Fieldwork, 1989

Table 8.12 covers the entire Hajj region. The transport services of Madinah and Jeddah attracted high levels of satisfaction, with a high proportion of pilgrims questioned describing provision as either 'good' or 'intermediate'. Makkah and the Holy Places fared less well. Furthermore, the majority of those who considered the level of transport service to be poor were relating this to the Holy Places (17 percent) and Makkah (20 percent); whereas Madinah and Jeddah took only 4.4 percent and 5.5 percent respectively.

Table 8.13 Pilgrims' attitude to services of the transport companies

Level	No. of Pilgrims	Percentage
Good	215	42.4
Intermediate	168	33.1
Bad	48	8.5
Unknown	57	11.2
No response	24	4.7
	507	100

Source: Fieldwork 1989

It appears that the area where pilgrims perceived transport to be most problematic was around the Holy Places. More than anywhere else, the main problems of transport services have been found to be concentrated on the Holy Places and Makkah. It is important, therefore, to focus discussion of transport problems on the Holy Places.

The pilgrims were asked if they encountered problems during their travel around the Holy Places. The survey reveals that at least 23 percent of pilgrims questioned experienced problems. Travel relating to Arafat-Mozdalifah (*Nafrah*) generated the greatest dissatisfaction: 46 percent of 491 respondents. Travel from Makkah or Muna to Arafat (Tassaid) generated least dissatisfaction: 23 percent of the pilgrims complained about these routes (see Table 8.14). Levels of satsfaction for the remaining routes lay between these two.

Table 8.14 Pilgrims' responses towards problems encountered in each route between the Holy Places, 1989

Route	Response				Total	No response	All total
	No	%	Yes	%			
Makkah or Muna to Arafat	386	77.2	114	22.8	500	7	507
Arafat to Mozdalifah	263	53.5	228	46.5	491	16	507
Mozdalifah to Muna	307	63.0	180	37.0	487	20	507
Muna to Al Haram	320	66.4	161	33.4	482	25	507

Source: Fieldwork, 1989

The questionnaires asked about the type of problems which the pilgrims had faced and complained of during the Hajj activity.

Table 8.15 The main transport problems cited by pilgrims during the movement between the Holy Places

		Number of mentions				
Subject of concern		Travel to Arafat	Arafat to Mozdalifah	Mozdalifah to Muna	From Muna to Haram	Total
1	Crowding, congestion, delay	50	120	97	77	344
2	Inadequate bus services	10	27	42	31	110
3	Expensive fares	14	8		41	63
4	Unpunctual bus services	8	23	4		35
5	Lack of air conditioning in the vehicle	10	9	7		26
6	Driver inexperience eg. lacking knowledge of route	4	6	6	8	24
7	Lack of WC facilities on the roads	5	11	6		22
8	Traffic plan, police behaviour, traffic	3	10	8		21
9	breakdown of the bus services	5	5	3		13
10	other	4	9	7	4	24
	Total complaining pilgrims	113	228	180	161	682
	Total responses	500	491	487	482	

Source: Fieldwork 1989

These problems have been classified in the rank order shown in Table 8.15, which illustrates in detail the comments pilgrims made in the questionnaires. Before looking at precisely what pilgrims said, it is helpful to aggregate their comments by category of subject of concern as can be shown in Table 8.16.

Table 8.16 Subject of Concern

Subject of concern	Aggregate responses
Traffic situation	
– overcrowding	344
– driver inexperience	24
– breakdown of the bus	13
– police behaviour towards traffic	21
– unpunctual bus	35
Total	437
Vehicle condition	
– lack of air conditioning	26
– inadequate buses	110
– breakdown of the bus	13
Total	149
Transport fare	63
Road facilities	22
Other	24

Source:

By looking at both tables (8.15 and 8.16) four main subjects can be determined, which are discussed below.

8.3.1 Traffic Situation

Comments in this category related to overcrowding, congestion and delay. Several causes of congestion were complained about by the pilgrims. These Hajj movement problems were of concern to the greatest number of respondents, who indicated that their complaints applied to all routes between the Holy Places. More than 75 percent (344), out of a total of 437 respondents, specified overcrowding to be a problem. The

survey demonstrated that their complaints mainly concentrated on 'traffic jam', 'much congestion', and subsequent delay with respect to the next duty of the rites.

Amongst these comments, around 35 percent were focused upon the Nafrah pattern and 26 percent related to the Mozdalifah-Muna route. The remaining routes received less criticism than the foregoing in terms of traffic condition comments (see Table 8.15). The attributes and nature of each pattern of movement which have been indicated may be the main reasons for this variation. The Nafrah pattern, which has the greatest number of the complaints, places a massive short-term burden on the transport system: mass movement begins at a given time, i.e. immediately after sunset (see Section 6.5.2).

However, it is clear that congestion and traffic jams, particularly regarding vehicular traffic, are perceived as the most widespread and pervasive of problems throughout Hajj movement between the Holy Places.

> *"Such problems are caused as a result of the users' demand for road space being greater than the capacity provided by the road network". (Robinson, 1978)*

In practice, during Hajj 1989, the density of vehicles per road-kilometre was 360 over the network of the Holy Places, 137 km in length (see Chapter 3 and Table 6.13). In fact each of the eight roads linking Arafat and Mozdalifah has three lanes. In Muna there are two lanes for each road except King Abdulazeez and King Fahad Roads, which have three lanes. In this case the density was 140 vehicles per road- kilometre. This means that only 8.8 metres of road was available per vehicle, although more than 50 percent of the vehicle fleet in the Holy Places were buses and mini-buses, which need more than 25 metres of road length to keep them moving safely and smoothly.

It appears that the number of vehicles which participated in the Hajj movement was greatly above the capacity of the road network and space of the Holy Places.

The imbalance of traffic movement on the roads of the Holy Places is considered another cause contributing to the congestion problem. Some roads suffered considerably from such problems, while others had a reasonably good traffic flow (see Section 7.4).

Breakdown of buses is a principal cause of congestion. Although only a few pilgrims complained about this issue, 13 out of 682 comments (Table 8.15), it is the cause of extremely complicated problems with regard to Hajj movement traffic flow. It was not specified whether such incidents happened on or off the road. However, the author saw more than one vehicle broken down on the road itself, bringing traffic in that road lane to a standstill for a long time.

The inexperience of drivers may also adversely affect traffic conditions and subsequently cause congestion. This problem was complained of by some pilgrims. In the survey, 24 out of 682 comments were complaints from the drivers and staff of buses:

> *"some drivers do not know the right direction...one bus driver went the wrong way, which made the traffic stand still for two hours...some drivers drive badly...some drivers do not speak Arabic language."*

It is possible that such problems arise because the transport companies employ non-Saudi drivers, usually from Egypt or Turkey, as cheap labour. Many of these are coming to Makkah for the first time, and they have neither experience nor knowledge of the routes between the Holy Places. Moreover, some come in order to perform Hajj, even in the course of their work.

Traffic arrangements and police behaviour regarding traffic were criticised:

> *"the police sent us in a direction where cars were at a stand still...police directed us the wrong way".*

Although such comments were made by only a handful (21) of respondents, they point to particular traffic flow difficulties: the traffic plan and police behaviour regarding traffic may need to be reviewed, and an examination should be carried out by the authorities.

The problems detailed above (traffic congestion, driver inexperience, vehicle break-downs and traffic police behaviour) should perhaps be considered as negative factors which lead to the problem of unpunctual bus services. The survey received 35 complaints about unpunctual services. It is clear from Table 8.15 that most of these complaints concentrated upon Arafat-Mozdalifah travel. This may be related to the shuttle system, as mentioned above, for which the pilgrims must wait a long time for the bus to arrive in Arafat.

> *"The bus occasionally comes back very late to Arafat after delivering the first shuttle of the pilgrims in Mozdalifah. Moreover some buses lost their direction and could not get back to carry the next group waiting in Arafat; they had to walk or look for any vehicle to carry them to Mozdalifah". (Interview held on 16 July 1989 with Director of Transport Affairs of National Experimental Est. for Arab pilgrims)*

All the preceding problems discussed above are indeed interference, some of which generated others. However, it is probable that the main problem of the Hajj movement, which is traffic congestion, is caused as a result of these negative factors. This difficulty, and the other problems, might be dealt with and unravelled by some of the following suggestions.

- There is a need to reduce the number of vehicles involved in the Hajj movement. There are several ways to do this, e.g.:

A. To raise the minimum permitted number of passengers from nine to twelve per vehicle entering Makkah. Thus, as mentioned, the entry of vehicles with a seating capacity of fewer than twelve seats could be forbidden during the Hajj activity (from 1 to 13 Dhul Hajj);

B. To use double decker buses as much as possible for transporting the pilgrims amongst the Holy Places. In 1989 the number of this sort of vehicle was only 160 buses operating in the Hajj movement, i.e. 2.5 percent of the vehicle fleet belonging to transport companies (amounting to 6465 buses). Furthermore, unlike SAPTCO, 11 of the transport companies participating in the Hajj movement, totaling 6333 buses, had no double decker buses (see Section 4.4.3.2);

- To put into operation a plan to spread the movement, volume and flow of the vehicles so that they are evenly distributed according to the capacity of the roads linking the Holy Places;

- To enforce comprehensive and accurate maintenance of all vehicles of companies sharing the Hajj movement, to avoid any likelihood of breakdown of vehicles. The more elderly vehicles would be replaced by new, modern ones. In 1989 about 40 percent of the vehicle fleet belonging to GSC were 1978-1980 models and had no air conditioning (see Section 5.4.3.3);

- To establish a training course of at least two weeks for those who are directly responsible for transporting the pilgrims, particularly drivers and guards of buses. They might be taught directions, main addresses, traffic management, traffic information, and so on of the Hajj region and Makkah in particular. This is because few of the drivers employed in the Hajj movement are from Saudi Arabia, let alone

from Makkah. Such action may solve the inexperienced driver problem and subsequently relieve the problems of traffic congestion and overcrowding.

8.3.2 Vehicle Condition

The present condition of the vehicles and available facilities have been discussed in detail in Chapter 4. The difficulties and disputes regarding vehicles which the pilgrims confronted in the course of the Hajj movement will be examined here. As indicated, regarding the transport affairs of external pilgrims, GSC is accountable for comfortable and safe travel in the Hajj region.

Some pilgrims expressed concerns about the vehicles used to convey them between the Holy Places. Of 682 comments, 149 (22 percent) complained of one or more of three types of problem relating to vehicle condition: inadequate bus services (91), lack of air conditioning in the vehicle (26), and breakdown of the bus (13) (see Table 8.16).

The last of the above problems has previously been indicated as possibly being responsible for some of the troubles experienced with traffic flow, and a recommendation concerning this problem was given above.

Regarding the inadequacy of service, it is clear from Table 8.15 that comments on this subject rank second only to traffic congestion problems. There were 110 out of 682 (16 percent) comments which stated that:

The buses were not enough to carry the pilgrims among the Holy Places.

Responses varied from one route to another. However, the highest proportion of such complaints were on the Mozdalifah to Muna route, in which 42 pilgrims, 8.3 percent of the sample, made this point. The point was also made by 31 pilgrims who travelled

to Al-Haram from Muna. The remaining routes attracted fewer than 11 percent (see Table 8.15). This indicates that the problem of inadequate buses was concentrated on the Mozdalifah-Muna route.

The complaints may be explained as follows. Most of the pilgrims paid their fare in advance. Some departed Mozdalifah soon after midnight, whereas others decided to stay in Mozdalifah until sunrise. The bus, for which all had paid, did not return to collect those who stayed. Thus the latter group were without a bus. The only means of leaving Mozdalifah was to pay an additional charge which many claimed to be too high.

The shuttle system between Arafat and Mozdalifah was also considered as another reason that some pilgrims were left without a bus. This system often was not applied to the route between Mozdalifah and Muna.

In 1989 the fleet of buses available for the pilgrims by GSC consisted of 6475 vehicles, totaling 332,645 seats. The number of air and sea pilgrims was more than 570,000 (see Chapters 4 and 5). This means that the GSC, which was undertaking to transport those pilgrims, had seats for only 60 percent of them to travel at the same time. Asked whether there were enough seats to transport them between the Holy Places, 57 percent of the sample replied affirmatively, 36.5 percent replied negatively. This problem emphasises the recommendation made to use double-decker buses, which have the advantage of carrying nearly double the capacity of single decker buses, while taking up the same amount of road space.

As regards the problem of vehicle air conditioning, 26 (4 percent) of 682 comments indicated that:

"*there was no air conditioning in the vehicle which carried us*".

Complaints arose for two reasons:

- The weather of the Hajj region is very hot.
- Some of the external pilgrims, who had paid in advance for an air-conditioned vehicle, were transported in a vehicle which was not air-conditioned.

As mentioned above, the fare for an air-conditioned bus (first class) differed from the non air-conditioned (second class). Data about the number of pilgrims who paid for first class and those who paid for second class are not available. According to GSC data (1989), about 40 percent of buses (out of a total of 6965) were without air-conditioning (see Chapter 4).

In the survey a specific question for each route of the Hajj movement was designed to determine whether the mode of transport possessed air-conditioning (see Appendix 2). Table 8.17 shows that around half the land pilgrims came to the Hajj by air-conditioned vehicles. This group was usually transported within the Hajj region by their own vehicle. In contrast, most of the air and sea pilgrims were transported by GSC buses, which tended to be used for service on a variety of routes. Thus, the responses of air and sea groups in terms of air-conditioning changed according to the movement pattern.

Table 8.17 Pilgrims' responses according to the presence or absence of air-conditioning in vehicles on routes in the Hajj region in 1989

Pattern of movement	Air-conditioning		No air-conditioning		No reponse		Total
	Number	%	Number	%	Number	%	Total
Vehicle of land pilgrims	48	50	48	50	-	-	96
Air and sea pilgrims							
travel to Makkah	284	69.0	101	24.5	26	6.4	411
travel from Makkah	246	59.9	155	37.7	10	2.4	
Muna - Arafat	181	44.0	194	47.2	36	8.8	
Arafat - Mozdalifah	170	41.4	178	43.3	63	15.3	
Mozdalifah - Muna	141	34.3	161	39.2	109	26.5	
Muna- Al-Haram	139	33.8	212	51.6	60	14.6	
Al-Haram - Muna	131	31.9	218	53.0	62	15.1	
Total sample							507

Source: Fieldwork, 1989

Table 8.17 shows that, the best routes were those to and from Makkah, for which between 60 and 70 percent of respondents stated that the vehicle was air-conditioned. In contrast, the worst routes were those regarding travel amongst the Holy Places for which between 43 and 53 percent of respondents (411) stated that the vehicle was not air-conditioned. In spite of the very high temperature, the pilgrims who were transported by air-conditioned vehicles did not exceed 44 percent at any Hajj movement route in the Holy Places. Pilgrims choosing to ride rough on buses in the course of travel between the Holy Places, and the switching off of the air-conditioning by some

drivers, might explain the increase in the numbers of respondents who travelled by non air-conditioned vehicles.

> *"Some drivers believe that the engine would be affected if the air conditioning was kept turned on in weather of high temperature". (Interviews held on 18-20 July 1989 with some drivers of the GSC buses)*

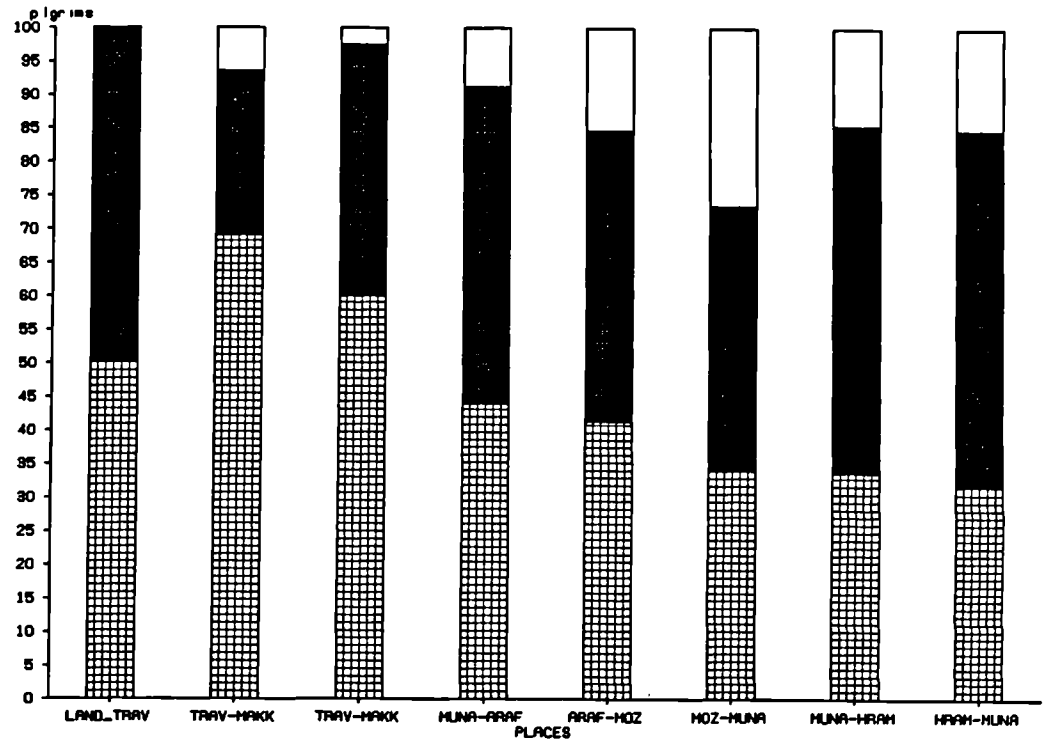
It should be remembered that about 40 percent of GSC buses were not air-conditioned.

As can be seen in Figure 8.6 and Table 8.17, unlike land pilgrims, the percentage of air and sea pilgrims who made 'no response' was high, particularly regarding movement patterns of the Holy Places. This may be accounted for by the number of pilgrims who did not know whether the vehicle was air-conditioned or not. It also included those who travelled between the Holy Places by walking.

Obviously, the best and most comfortable way to solve this problem might be to enforce all transport companies serving the pilgrims to use air-conditioned buses. This could be one of the main requirements applied to the companies by GSC.

Finally, the pilgrims were questioned precisely about the comfort of the vehicles which transported them amongst the Holy Places. The survey revealed that 62 percent of the sample considered the vehicle to be comfortable, whilst 32 percent did not. About 65 percent of those who replied in the negative, indicated specific trips on which s/he was transported by an uncomfortable vehicle. Travel from Arafat to Mozdalifah and from Muna to Al-Haram were the main trips on which those pilgrims suffered and were dissatisfied with the comfort of the vehicles. A cross-tabulation between pilgrims' attitudes in terms of vehicle condition and the modes of transport of the trips shown above has been developed in Table 8.18.

FIG.8.6: Distribution of the pilgrim responses for air and non air condition of the vehicleS in 1989



Fieldwork,1989

Table 8.18 The pilgrims' attitudes towards vehicle condition, distributed according to transport modes used between Arafat-Mozdalifah and Muna-Al-Haram.

Type of vehicle	Arafat - Mozdalifah						Muna - Al-Haram					
	Comfortable		Uncomfortable		Total of users		Comfortable		Uncomfortable		Total of users	
	No. of users	%	No. of users	%	No. of users	%	No. of users	%	No. of users	%	No. of users	%
Public bus	13	56.5	10	43.5	23	100	15	53.6	13	46.4	28	100
Pilgrim bus	159	67.7	76	32.3	235	100	98	72.6	37	27.4	135	100
Coach	31	70.5	13	29.5	44	100	32	76.2	10	23.8	42	100
Mini bus	19	57.6	14	42.4	33	100	42	58.3	30	41.7	72	100
Station Wagon	27	69.2	12	30.8	39	100	36	75.0	12	25.0	48	100
Small car	5	71.4	2	28.6	7	100	14	77.8	4	22.2	18	100
Taxi	12	50.0	12	50.0	24	100	50	53.8	43	46.2	93	100
Other	14	87.5	2	12.5	16	100	4	100		4	100	
Total	280		141		421		291		149		440	

Source: Fieldwork, 1989

As regards travel between Arafat and Mozdalifah, it seems from Table 8.18 that the pilgrims were not pleased with the transport modes of taxi, SAPTCO (public bus) and minibus. Each of these modes was considered unsatisfactory by a percentage of users ranging between 40 percent and 50 percent. The GSC bus was viewed negatively by 32 percent of users, which is about the same as most of the rest of the transport modes shown in Table 8.18. In the case of travel from Muna to Al-Haram and return, the attitudes are similar to those of Arafat-Mozdalifah. Generally, such results could be evidence that small cars, such as taxis, which showed more than 46 percent negative

responses, were impractical for Hajj movement. They usually occupy a large road space relative to their ability to satisfy the demands of transporting pilgrims.

With respect to SAPTCO, although the type of bus serving inter-city routes is comfortable and with good conditions, the type serving intra- city routes has very uncomfortable seats and poor internal design, particularly the modern Neoplan SDN414 (SAPTCO, 1987). The minibus was criticised by 40 percent of users, in spite of its prevalence. This mode is one type of para-transit which is privately owned by individuals.

Although people's attitudes to, and judgements of, comfort differ, the modes of transport which were criticised need more specific survey and examination to establish the condition and situation of these kinds of transport modes.

8.3.3 Transport Fare

A third type of transport problem perceived by pilgrims concerned transport fares. Nine percent (63 out of 682) of comments expressed the view that 'the fare was high', and some stated 'it was very high'. Referring to Table 8.15, it appeared that the travel from Muna to Al- Haram attracted a high number of the complaints amongst the routes between the Holy Places; 41 comments (i.e. 65 percent of the total comments on this problem) were against the cost of the transport fare between Muna and Al-Haram. The other routes attracted fewer complaints. Furthermore, no-one had commented on expensive fares in relation to the travel between Mozdalifah and Muna (see Table 8.15). Such variation of pilgrims' attitudes towards the fare issue between routes may be attributable to the differences in transport modes involved between the Holy Places. It has been seen in Section 6.5.4 that the major transport

modes serving the Muna-Al-Haram return route were vehicles privately owned by individuals. This may be the main reason for the complaints about high fares. Cross-tabulation between those pilgrims who made comments against this issue and their modes of transport has been undertaken in Table 8.19.

Table 8.19 Distribution of the fare complaints according to the modes of transport and movement patterns in the Holy Places

Modes	Movement patterns				
	to Arafat	Arafat to Mozdalifah	Muna to Al-Haram	Total	%
Public transport	3	3	17	23	36.5
Private transport	7	2	19	28	44.5
Walked	4	3	5	12	19.0
Total	14	8	41	63	

Source: Fieldwork, 1989

It is apparent from the table that 44.5 percent of the total comments on the fare issue derived from the pilgrims who used private hire vehicles (taxi, station wagon and minibus). The fares of the public transport modes, which involves SAPTCO bus, GSC bus and coach, were complained of by 36.5 percent. This means that the criticism of the fare issue was relatively concentrated upon private modes rather than public.

In fact, during the Hajj season there is no fixed hire charge for private transport modes in Makkah. The fares charged are often subject to the vehicle owner's opinion and to bargaining. Although the authorities issued orders to private vehicle owners to follow the price of public transport hire, the private transport fare has been found by the author in some cases to be higher than public transport. However, in some cases, the transport hire by private modes was close to the price of public transport. The

transport fare from Muna to Al-Haram by private minibus, for instance, was SR10, which is the same as the SAPTCO bus fare. This was found in practice, and has been seen several times by the author during the fieldwork.

The fare of the SAPTCO bus was fixed to range between RS2 and SR10 per trip, the fare depending on trip distance and traffic situation (interview held on 20 July with Director of SAPTCO in Makkah). The GSC set a fixed fare for all trips that pilgrims needed to make in order to perform the Hajj. Table 8.20 shows transport fares in the Hajj region, according to route.

Table 8.20 The transport fares by GSC services in Saudi Arabia

Tripline	Not air-conditioned (SR)	Air-conditioned (SR)
Jeddah, Madinah and Makkah or opposite	172.50	225.00
Makkah, Arafat, Mozdalifah, Muna and Makkah	150.00	150.00
Jeddah and Makkah or opposite	22.50	30.00
Total	345.00	435.00

Source: MoH, 1989, *Instructions of the Hajj*

In 1989 the total transport cost for all the journeys in performance of the Hajj was SR345 (£53) by non air-conditioned vehicle, and SR435 (£67) by air-conditioned vehicle.

Such cost indeed seems to be reasonable, with evidence that the single ticket for the journey between Jeddah to Makkah, where the distance is 75 km, cost only SR30 (£4.50) by GSC air-conditioned bus (see Table 8.20). So far with respect to the transport fare issue, the criticism has been focused upon intra-city trips of private vehicles in particular. In addition, the comments specifically concentrated on the

Muna-Al-Haram return route, as noted above. In order to reduce criticism, therefore, it would be helpful to fix and monitor the transport fare for private modes of transport.

The survey questionnaire attempted to collect data about the total expense of performing Hajj in general and transport (in Saudi Arabia) in particular. As was expected, large numbers of the sample left this question unanswered. Yet responses to the enquiry were obtained from 89.7 percent of the sample in terms of Hajj expenses, and from about 67 percent in terms of transport expenses. A possible reason for this lack of response may be that some pilgrims believe that money paid out to the Hajj is for the sake of Allah (God), and should not be talked about. Some pilgrims simply do not know even the approximate amount they have spent. However, according to the survey data, the author, generalised the responses into six categories concerning either Hajj expenses or transport expenses as shown in Table 8.21.

Table 8.21 Distribution of the pilgrims according to the expenses of the Hajj and of the transport expenses

The expenses of the Hajj by RS			The expenses of the transport in R.S.		
Category	No. of pilgrims	%	Category	No. of pilgrims	%
Less than 1000	30	6.6	Less than 100	61	18.4
1001 - 3000	182	40.0	101 - 300	117	35.2
3001 - 5000	129	28.4	301 - 500	72	21.7
5001 - 7000	59	13.0	501 - 700	18	5.4
7001 - 9000	25	5.5	701 - 900	13	3.9
More than 9000	35	6.5	More than 900	51	15.4
Total	455	100	Total	332	100

Source: Fieldwork, 1989

In 1972 British consultants reported that the arithmetic mean of the Hajj cost was SR721 per pilgrim, about 16.6 percent of which was taken up with transport affairs in Saudi Arabia (Robert Matthews, 1972). Generally, in 1989, the survey revealed that Hajj expenses for the external pilgrim in Saudi Arabia averaged about SR3840 (£590). In relation to transport expenses, the average was SR390 (£60). This means that transport costs in the Hajj region did not exceed ten percent of the whole Hajj expenses. This average, however, is less than the sum of SR435 which the pilgrim should pay to use the air-conditioned buses of the GSC (see Table 8.20). Thus the average of transport expenses might be more than that given by the survey. Nevertheless, assuming that this average was SR400 (£62), i.e. 10.5 percent of the total expenses of the Hajj, this is still reasonable in comparison with other expenses such as accommodation, food and gifts taking up the rest of the money consumed in the Hajj region.

8.3.4 Road Services

The construction of roads, and the connectivity and accessibility of the road network in the Hajj region, have been discussed above in Chapter 3. The comments which were made about road services, and WC facilities in particular, will be focused on here. In fact, the total number of comments was relatively small, only 3.2 percent of the total of 682 comments (see Table 8.16).

Pilgrims were asked about any problems concerning transport affairs suffered during the movement between the cities of the Hajj region. Only three out of 507 pilgrims complained of lack of service stations. More than five service stations were seen by the author along the Madinah- Makkah road; yet most of these were antiquated and

require modernisation to be consistent with the Makkah-Madinah expressway (see Chapter 3). Half of the total comments in response to this question concerned travel between Arafat and Mozdalifah (see Table 8.15). In fact, there are many WC units which were built along the roads, particularly the area located in Muna (Kandora 1987). However, the areas located between Arafat and Mozdalifah suffer from lack of such facilities, particularly along the pedestrian way. The WC units were established far more than 500 metres apart along the pedestrian way between Arafat and Mozdalifah (Bafageh, 1990). This problem can be remedied by providing pilgrims along the roads with WC facilities and drinking water, especially along the pedestrian way between Arafat and Mozdalifah.

Summary

The complexity of the pilgrim movement in terms of nationality, demography, education, language and group formation may create multiple and complicated problems for the system of movement and transport in the Hajj region. This should be borne in mind by anyone dealing with pilgrims, especially during the Hajj movement.

The multi-nationality, and sex and age structure of pilgrim groups are significant factors influencing the transport of pilgrims. Special attention should be given to the needs of female and older pilgrims, who account respectively for 30 percent and 21 percent of external pilgrims. In addition, the analysis of the education levels of pilgrims shows that around one-third of pilgrims were illiterate (16 percent) or had been educated only to primary level (20 percent). The importance of Arabic as the primary means of communication emerged from research which showed that more than 60 percent of the pilgrims communicated in Arabic. Consequently, this is the language that should be used to guide and direct pilgrims. English, as a second language, can also play a role in assisting pilgrims, as it is spoken by more than half of non-Arabic pilgrims. Finally, most individual pilgrims are subject to grouping where movement and transport are concerned. The average group size was found to be eighteen, of whom around 28 percent would be family relatives, the remainder being friends.

As far as attitudes of pilgrims towards transport services are concerned, 54 percent of respondents considered that transport provision was good, while 27 percent thought it was satisfactory. Although only ten percent on average considered transport services on Hajj movement routes in general to be poor, the average of those

who made critical comments about the shortcomings of transport provision was 34 percent. The Arafat-Mozdalifah service received the highest number of complaints, followed by the Mozdalifah-Muna transport service. Pilgrim dissatisfaction expressed itself in complaints about traffic congestion, the condition of vehicles used to transport pilgrims, fares and roadside facilities.

Traffic, in particular, attracted the highest number of complaints (344), more than 50 percent of the total comments concentrating upon overcrowded roads and long traffic jams between the Holy Places. Such problems are long-standing and, from a pilgrim's point of view, represent the major difficulties of movement.

The main causes of these problems have been discussed in Section 8.3 and possible solutions and strategies for addressing these issues have also been put forward.

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Chapter Nine

The Possible Alternative Transport System for the Hajj Movement: Recommendations

9.1 Introduction

Having discussed the main factors influencing the Hajj movement and determining the major transport problems which the pilgrims face in the Hajj region, we are now in a position to synthesize solutions for the main problems of the Hajj transport system. The above explanation and analysis of patterns of pilgrims' movement in the Hajj region and their problems, demonstrates that the Hajj movement is a special event and a unique phenomenon in the world which makes it difficult to apply any specific model or system of transport that has been successfully applied elsewhere. However as has been indicated the transportation problems of the Hajj Movement cannot be solved exclusively by building more roads and providing more vehicles.

> "*Any solution must be consistent with the function of the Hajj and the objectives of the Hajj transport system at large. The adopted solution for any part of Hajj transport system must be integrated with other components of the system to prevent creating new problems.*" (Bushnak, 1977: 104)

This is particularly true of the Hajj movement where there are many factors influencing transport of pilgrims which should be taken into account; the most important elements of which are time-space constraints, numbers of pilgrims, volume of vehicles and government policy involving the Hajj movement.

The way in which each of these elements operates has been investigated. By studying the factors influencing the increase or decrease in the numbers of pilgrims, an expected increase was predicted for the next ten years. Whether or not this prediction will turn out to be an over-estimate, the fact remains that even with a modest rate of increase, say between 4 percent and 6 percent a year in the numbers of pilgrims, the magnitude of the problems that will arise require serious consideration. Subsequently, for example, the number of vehicles which carry those pilgrims will

increase as a result of the increase of pilgrim numbers. Thus the Saudi Arabian Government's policy may play a very significant role in controlling the above factors.

However, the Kingdom's policy towards the Hajj is to find and implement a plan which affords high levels of comfort for large numbers of pilgrims and to make resources available to do so (MOP 1990). In this case the evidence suggests that the government is willing and in earnest to seek and support any plans that promise to provide acceptable levels of service for the Hajj movement and will not spare any technical or financial resources for its management.

Indeed, several proposals and projects for the Hajj movement have been developed by a number of consultants and researchers. Some of these will be discussed below in this chapter. An attempt will be made to provide possible alternative strategies for the Hajj movement either in terms of regional movement (inter-city in the Hajj region) or local movement (the Hajj activity in Makkah).

9.2. Regional Movement.

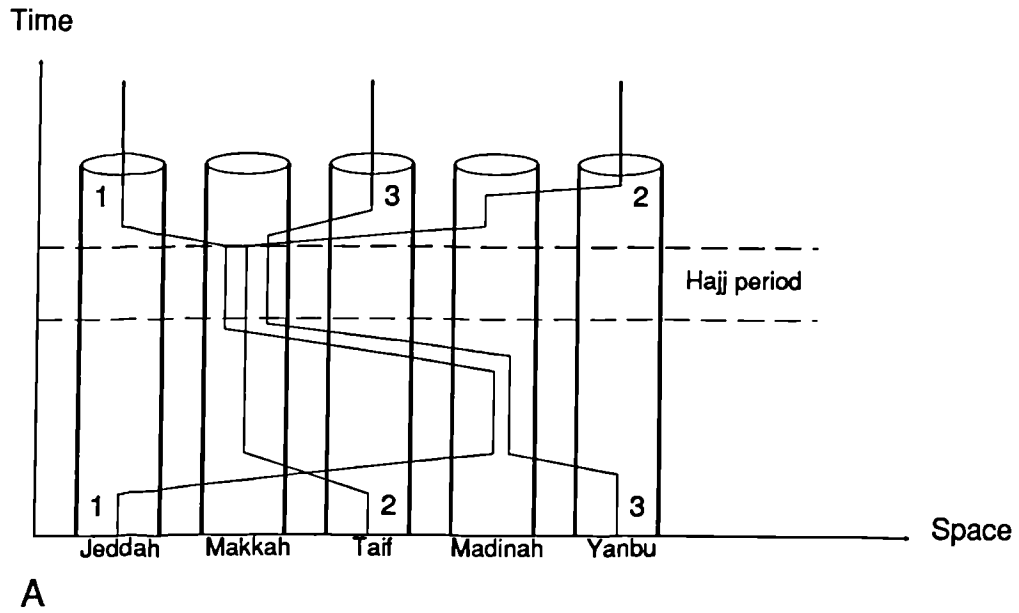
9.2.1. Review of some previous suggestions.

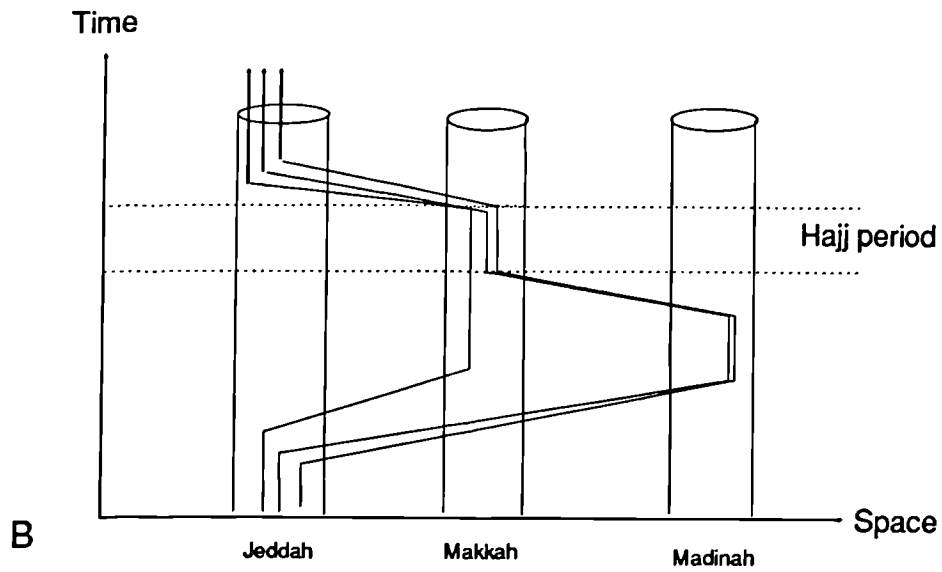
As has been illustrated by the survey, the transport problems of the Hajj movement between the cities of the region were not as complicated as those in the Holy Places in and around Makkah. The survey showed that 70 percent of the pilgrims who were asked about any problems that they may have encountered en route to Makkah reported no problems at all. However, about 27 percent of the pilgrims who visited Madinah stated that they had experienced some discomfort while being transported to or from Madinah. Lack of air conditioning in vehicles, the length of journeys and the large amount of time spent travelling between Jeddah, Madinah and Makkah, as well as the shortage of service stations on the Madinah expressway, were the major complaints cited by pilgrims. In addition, long waiting periods for buses departing for Madinah gave pilgrims cause for complaint. This means that a fair number of pilgrims feel discontented with the existing system of transport between the cities of the Hajj region: a problem probably exacerbated by the fact the region only has one entry point for external pilgrims travelling by air.

Robert Matthew consultant and his colleague (1973) stated in their report that in order to reduce the pressure on Jeddah during the Hajj

> "*In addition to Jeddah, Yanbu and Taif should be developed as entry points for Hadjis coming by air. This would require the construction of an airport at Yanbu and possibly, a Hadj terminal in Taif. Pilgrims landing at Yanbu might then be accommodated overnight in the existing Hadj terminal before travelling to Madinah. Those arriving at Taif could either travel directly to Mecca or stay over in Taif if facilities are provided. After completing the Hadj the Taif pilgrims might then travel to Madinah and leave through Yanbu. The Yanbu Hadji's would leave through Taif or Jeddah.*" (Matthew, 1973:158)

Fig 9.1 The path and stations of regional movement patterns for the matthews proposal (A) and the current patterns (B)





These suggestions, which were also recommended by El Hamdan (1976) may gain economic support through the wide distribution of the Hajj revenue and investment to develop the region, or as they express it

> "*The expenditure of Hadjis, which is equal to that of the oil companies in the Western Region, would be spread over a larger number of centres in the Western Region*" (ibid, p.159)

On the other hand, this proposal may generate many disadvantages. It would disperse the entry points of the Hajj movement more widely and this in turn would lead to more inter-city traffic, and the creation of five stations instead of two or three in terms of the patterns of pilgrims movement (see Figure 9.1). Consequently, five stations and their related new patterns would cause complex problems of management and regulation, both internationally and locally. All of this would require intensive arrangements for international air traffic movement, and distribution of managers, technicians and transport staff at several entry points. In other words, to manage and organise such a development may simply be too complicated. In addition, the Matthew proposal does not help to reduce the length of time spent travelling and the number of trips, about which pilgrims complained in the survey. As can be seen in Figure 9.1, the path of any individual pilgrim, in terms of a time-space map, passes through at least four stations which exist in the current pattern. Furthermore, the construction of two additional terminals in Taif and Yanbu airports would involve considerable government expenditure.

Another suggestion put forward by Al Sheheal (1981) in a working paper presented to the conference on pilgrims' transport in Makkah was this:

> "*in order to relieve traffic congestion, long journeys by bus or car, and to provide comfortable trips for the pilgrims, a high speed rail link between Jeddah, Madinah and Makkah is the best alternative means to contain a massive movement such as the Hajj.*" (Al Sheheal, 1981: 6).

In fact this suggestion has been taken up by certain officials involved in Hajj affairs, such as Boges (1981), the deputy of the Hajj Ministry, and some consultants, such as Louis Fisher (1981), see Figure 9.2 and Kocks (1982).

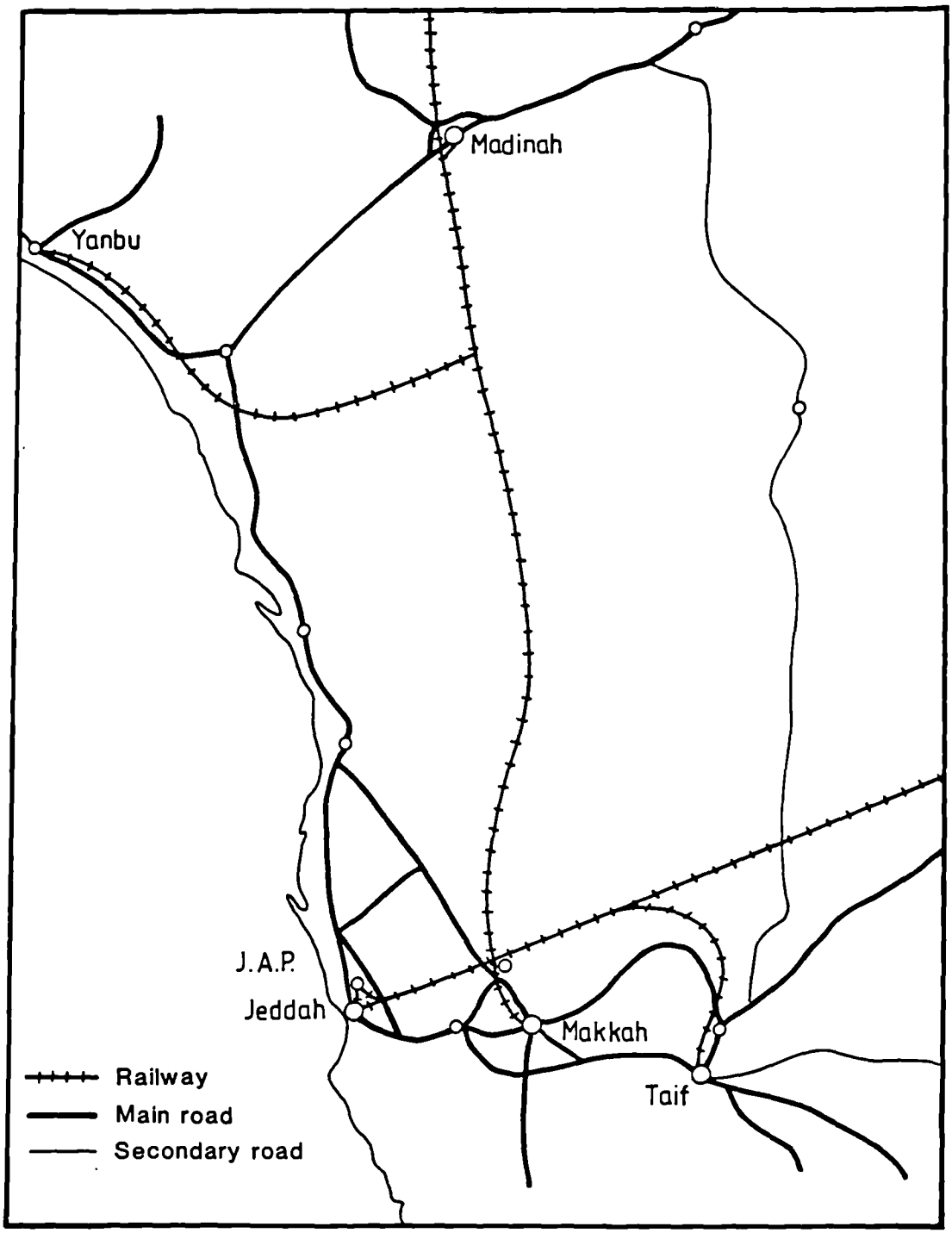
However, this group who support the idea of a rail system as an alternative means for the Hajj region, had relied upon the fact that the number of external pilgrims will reach 1,700,000 by the year 2000 according to their projections. The possibility of pilgrim numbers increasing by such an amount, however, is open to doubt, particularly in the light of the Saudi Arabian Government's policy of imposing a quota upon the number of pilgrims allowed into the country (see Chapter Five). In addition, the demand for public transport during the non Hajj periods is insufficient to warrant the construction of a vast railway network. It as been observed that the SAPTCO has experienced a decline in the number of passengers since 1984, in terms of both inter-city and intra-city passengers (see section 4.4.2)

Therefore it seems to be that the stage of construction of a rail transport system has not yet arrived as some consultants such as the DHC (1986) had recommended:

> "*The level of congestion in 1425H (2005) on the Makkah/Jeddah Express way predicted by the simulation studies can be further reduced by the provision of a high speed rail link between Jeddah, Makkah and Madinah. This would provide important additional benefits in terms of an alternative mode for long haul passengers traffic, faster and more reliable pilgrim transportation, and improved and safer conditions of travel.*" (DHC 1986:23)

Furthermore, Scott Wilson and Nazar Kurdy Consultants (1987) concluded in their report about "Hajj Transport" that the real demand to use the high speed rail will come after 2010. They added that this project requires a comprehensive study of public transport demands in Saudi Arabia and it would be advantageous to link the project with the Hajj region and the rest of the provinces, particularly the central and

Figure 9.2 Proposal of railway for the Hajj region.



Source: MOP (1981)

eastern areas of the Kingdom (Wilson, 1987). In fact the selection of any type of transport system for the Hajj region is of course determined by the results of the overall transport modelling for the whole country.

9.2.2. Alternative pattern for the regional movement of the Hajj.

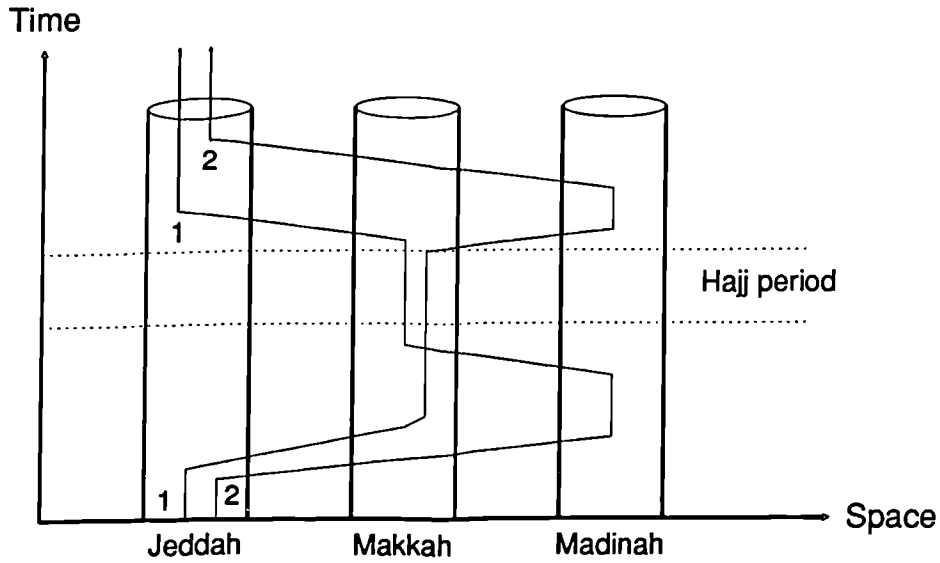
In Chapter Five, it was estimated that in 1995 a total of 970,000 pilgrims coming from outside Saudi Arabia will be performing the Hajj and about 679,000 pilgrims (70 percent) may land at Jeddah airport. Assuming that the arrival patterns of 1989 will continue for next ten years (see section 6.5.2.), over a one week period more than 48,500 on average will arrive daily at Jeddah airport. In the year 2000 it has been estimated that out of a total number of 1,092,000 pilgrims, about 764,000 will arrive by air. Although the International Jeddah Airport has been designed to cope with large numbers of pilgrims it can only do so at the expense of pilgrim comfort. The survey had revealed that 9 percent of the respondents complained about

> *"management aspects related to dealing with the office, of United Agencies in the airport; long queues in front of the office, long waiting periods for the bus"*

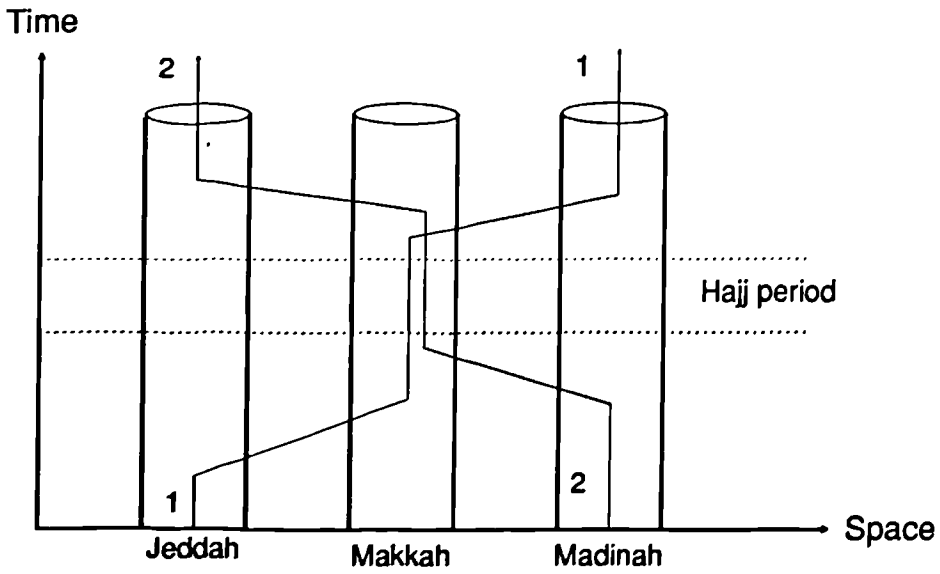
and so on.

In order to relieve the pressure on Jeddah airport it is logical to suggest that the airport of Madinah should be opened for the arrival and departure of external pilgrims. It would perhaps be helpful to build pilgrim terminals at Madinah airport to handle large passenger planes and to have all the facilities that pilgrims' need similar to those of Jeddah airport. Construction of this terminal and the running of it could be adapted to meet pilgrims needs: for the arrival of those who want to start the visit and perform the pilgrimage later, and for the departure of those who want to do the pilgrimage

Fig 9.3 The existing and alternative patterns of regional movement for air pilgrims



a : The existing pattern



b : The alternative

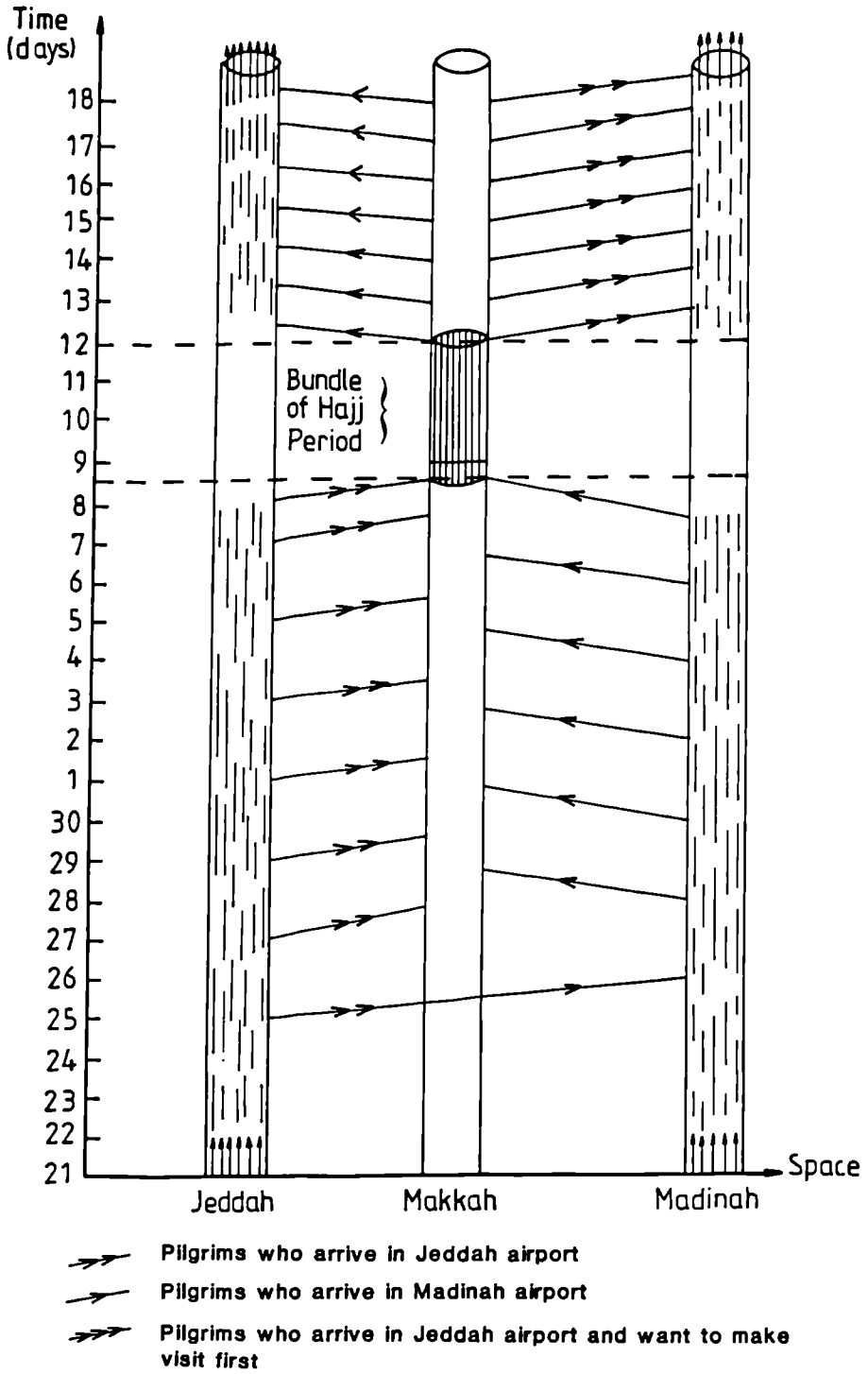
first and the visit later. This alternative system of inter-city transport of pilgrims has been also suggested by Bushnak (1977).

Because the time-space element is the key factor of the Hajj movement (see Chapter Two) an alternative movement pattern in the region can be illustrated, as shown in Figure 9.3.B, using two individual pilgrim paths in a time-space map. Thus a pilgrim's inter-city travel can be programmed so that a pilgrim lands in Madinah (path No.2), performs the visit, travels by land to Makkah, takes part in the pilgrimage and departs from Jeddah. Alternatively, a pilgrim can land at Jeddah (path No.1) take part in the pilgrimage, travel by road to Madinah, perform the visit and depart from there to his/her country. Both of them can be easily accommodated in the '*bundle*' of the Hajj period in Makkah (see Figure 9.3.B).

According to arrival and departure patterns gained from the survey, it is possible to conceptualize the framework of an alternative pattern by using a time-space model as shown in Figure 9.4. There are many advantages to be derived from this alternative pattern, some of which may be indicated as follows:

- It provides a new alternative entry point for pilgrims travelling by air, thereby relieving pressure on Jeddah airport.
- This new pattern of regional movement can reduce the pilgrim's need for inter-city travel between Jeddah, Madinah and Makkah and reduce the amount of time spent travelling which some pilgrims have complained about. By comparing the existing pattern (A) with an alternative pattern (B) in Figure 9.3 it is obvious for example, that path No.1 in pattern A, involves a considerable amount of time-space travel while the path of alternative

Figure 9.4 The alternative pattern of the regional movement for the air pilgrims.



pattern (B) is characterized by shorter periods of travel which permits more time for a stay in Madinah or Makkah.

The alternative pattern also reduces the demand for travel by road. Consequently the number of trips which a pilgrim has to make in the Hajj region will decline from four or three to only two. This will also result in lower travel costs and more efficient use of the GSC's vehicles. Besides this, it diminishes the problem of traffic movement during peak periods and the strain placed on inter-city transport services.

However, some disadvantages may arise as a result of using this alternative pattern of regional movement. One of these is that the GSC may lose some of the benefits it gains from the existing system and the number of trips taking place between cities in the region would be cut back. So the GSC and private companies who provide pilgrim transport may stand in opposition to this system. It also requires the control of international movement through detailed arrangements and procedures. Prospective pilgrims would have to be 'processed' in their own countries by a Saudi consulate. In theory it is possible to classify the pilgrims of different countries into two groups. The first group, made up of those want to make the visit first, should arrive at Madinah airport and the second group, those who want to perform the Hajj first, should arrive at Jeddah airport.

The problem is that more than 90 percent of air pilgrims, according to the survey, performed the visit first in Madinah (see section 6.4) i.e. about 90 percent of the pilgrims wish to arrive at Madinah airport. Clearly this means that more pressure will be placed upon Madinah airport, i.e. the problems associated with Jeddah airport could simply be transposed to Madinah airport. According to Islamic instructions,

there is no specific time to perform the visit and it is a matter of personal choice whether it occurs before or after the Hajj. Thus the problem can be overcome by determining the number of flights allowed to land at Madinah airport. Once this number has been reached, all other flights should be directed to Jeddah airport. Those pilgrims who arrive at Jeddah who wish to visit Madinah before the Hajj could be made to pay a surcharge to cover transport costs. Such an arrangement could be co-ordinated and administered by Saudi consulates abroad and the transport authorities in the Hajj region.

However, it is not possible at the present time to estimate the degree of success this scheme would attract or the logistical consequences it would have for domestic and international flights. Quite simply, it is a possibility which can be considered or tried out.

As far as the demand for transport facilities is concerned, the GSC, which was mentioned earlier, is responsible for the provision of transport for: pilgrims who arrive by air and sea; between the cities of the Hajj region, and the Holy Places. The patterns of pilgrim arrivals for 1989, shown in section 6.3, can be used to help estimate the approximate numbers of bus trips required. Thus the number of arrivals which might be expected at peak times on a day in 1995 are 50,000 at the airport and 3,800 at the seaport. The number of bus trips required to transport them to Makkah would be 1076 (bus capacity = 50). Correspondingly, figures for the year 2000 would be 55,000 pilgrims landing at the airport and 4000 arriving at the harbour, which would require a total of 1180 bus trips. These estimates represent the peak demand for transport between the ports of entry and Makkah in one day and they have to be met

alongside the other demands generated by the current movement of pilgrims between cities e.g. trips to Madinah.

However, as was shown in Chapter Four, in 1989 the GSC supplied 6,705 buses i.e. 332,645 seats, for pilgrim passengers. In fact, the significant point to make here is not concerned with the quantity of supply and demand but rather the quality of the buses used for the inter-city transport of pilgrims. As well as providing high occupancy, the condition and state of the buses should be adapted to suit the environment of the region so that safety and comfort are assured. The survey revealed that many pilgrims complained about the hot weather and the lack of air-conditioning (see section 8.3.2.). Clearly the easiest way to solve this problem would be to require all the transport companies to replace their old vehicles (around 40 percent of the fleet) with modern vehicles equipped with air conditioning. There is also a need to consider the use of two-way radios which bus drivers could use to report accidents, breakdowns and other problems to a control centre, which could then in turn contact one of the GSC help centres which are distributed along the roads of the Hajj region.

Finally, with respect to the road network, the second most important aspect of transport facilities, it was stated in the conclusion of Chapter Three that the regional roads provide adequate capacity for the traffic of goods and people during the Hajj period and for the rest of the year. It was shown that Makkah is directly linked with the cities of the region by routeways which meet expressway standards. However, the Makkah-Alieth road which is at present a single carriageway should be improved to become a dual carriageway in order to meet the expected increase in traffic between the two cities as more pilgrims begin to travel from the south.

9.3: The Local Movement

9.3.1: Some Previous Suggestions

Chapter Seven concluded that pilgrims' movement between the Holy Places is a complicated but fundamental phenomenon of the Hajj. The area where pilgrims perceived transport to be most problematic was around the Holy Places. The survey revealed that more than anywhere else, the main problems of transport services have been found to be concentrated in the Holy Places in Makkah.

The information gained from the survey and through personal observation showed that the major problems of the Hajj movement between the Holy Places are: congestion, overcrowding and delay. These attracted the highest number of complaints, more than 50 percent of all comments (see Table 8.15). However, of all limiting factors which may impose a rigid restriction on the movement and transport of pilgrims who can be accommodated in any one year, the most important are the time-space constraints of the Holy Places (see Chapter Two). So to look for a solution to the predicaments of the Hajj movement attention must be paid to how to use the existing time-space of the Holy Places to facilitate the Hajj movement. Before doing that, however, it is interesting to look at some previous recommendations which have been developed to solve the problems of pilgrims' transport.

El-Hamdan (1976) suggested a specific design to solve the problems of the transport and accommodation of pilgrims to meet the predicted needs of the Hajj movement. He proposed a new system of traffic circulation (see Figure 9.5):

> *"It consists of a circular motorway and a number of major distributors. The circular motorway would run on the periphery of Makkah and the valleys forming a loop surrounding the whole area and carrying two streams of traffic: the traffic on the inner carriageway running in a clockwise direction*

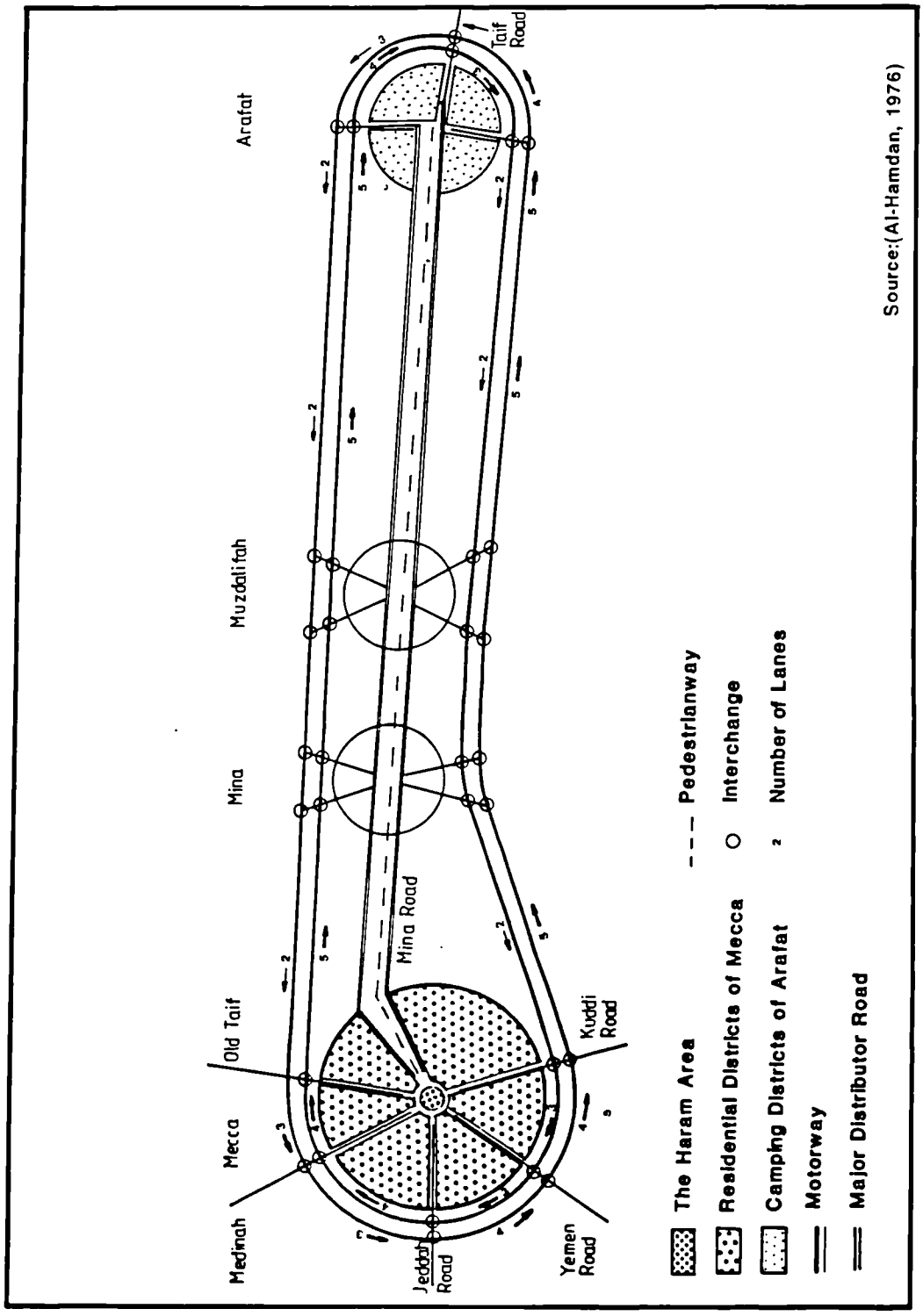


Figure 9.5 The proposed external circulation system between Makkah and the pilgrimage areas as depicted by El-Hamdam.

> *while that on the outer carriageway ran in an anti-clockwise direction. A system of suitably located interchanges would connect this motorway to the major distributors which lead to the main districts of Mecca, Arafat, Muzdalifah and Mina.*" (El-Hamdan, 1976:411)

The number of lanes in each carriageway in this circular motorway would be varied to meet the requirements of the tidal demand for road space. As he asserted:

> "*This change in the number of lanes would take place as the loop turned around Mecca or Arafat. So during the movement to Arafat... the southern section of the outer carriageway and the northern section of the inner carriageway would carry the eastbound traffic, and are therefore five lanes each. The other two sections would carry the westbound traffic from Arafat to Mecca and are only two lanes each ...*" (ibid p412)

However although this system would reduce movement through the central valley of the Holy Places to a minimum and eliminate the pedestrian/vehicle conflict, it is not adequate to meet the requirements of the Hajj movement demand for road space particularly during "the Nafrah". The capacity of this system does not exceed 12 lanes in any direction. However, at the present nine roads link Arafat and Mozdalifah, each with two lanes i.e. 18 lanes join the two Holy Places (see Chapter Three). In fact a system similar to the above circular motorway has existed since 1983. It is possible to say that roads No. 1, No. 9, the ring road of Arafat and the third ring road of Makkah can be considered a circular motorway surrounding Makkah City and the Holy Places. In addition, seven roads run from Arafat through Mozdalifah to Muna (see Figure 3.6). Despite this enormous network of roads, traffic movement during the Hajj in Makkah is still prone to large traffic jams and congestion, as the survey reveals.

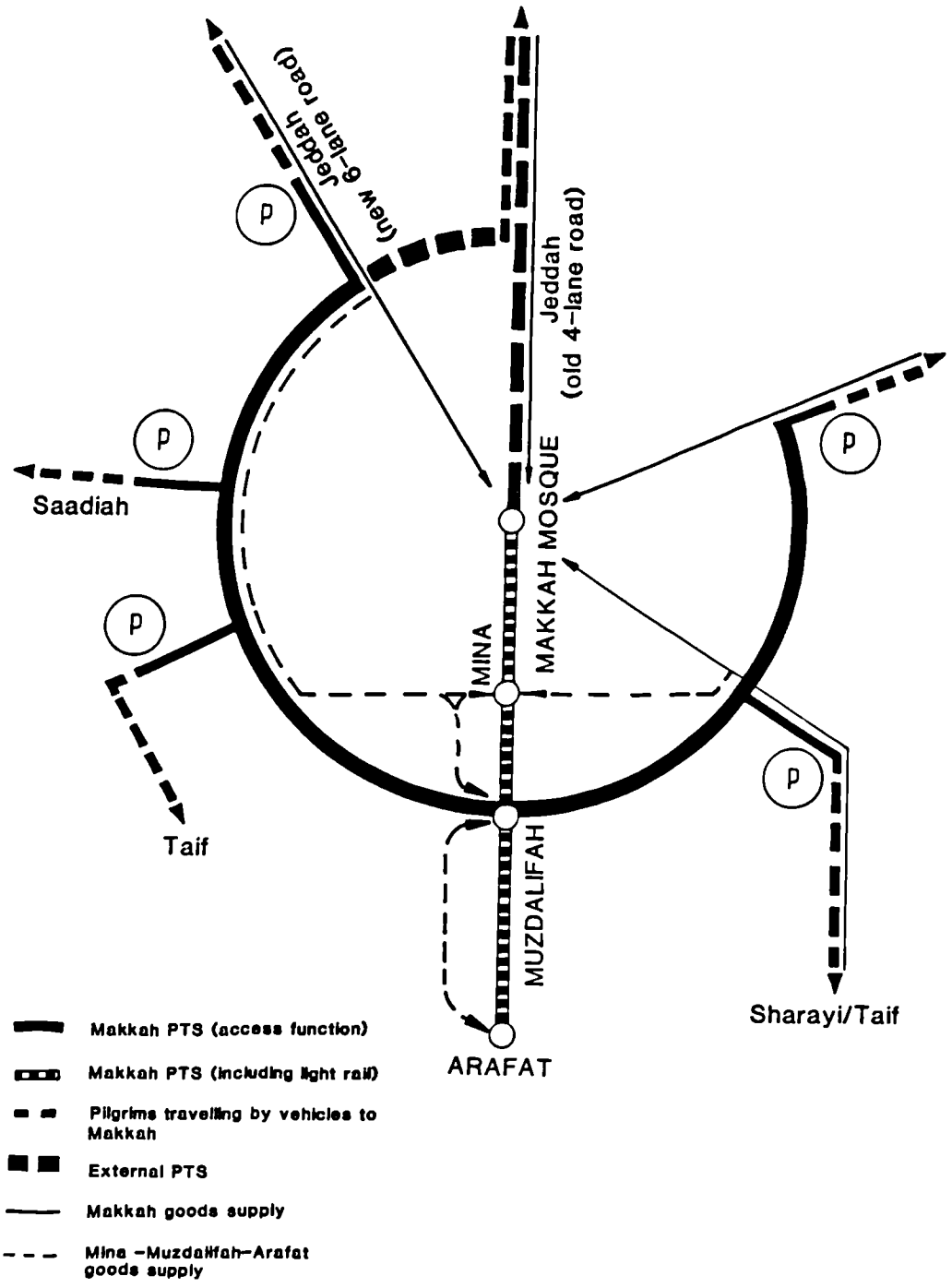
This system also involves complex instructions and needs a high degree of management and organisation which is difficult to implement amongst pilgrims who come for the first time and have various characteristics as has been seen in Chapter Eight. In addition, this system depends upon high speeds on the motorway to preserve flows

of movement and it is doubtful whether this could be sustained on account of limited capacity as well as the threat to safety standards posed by the high-speed movement of two million pilgrims.

Other recommendations were made by SGRRO (1981) and Kocks (1982) consultants which supported the idea of using a railway system in Makkah: that the railways could provide a solution to the problems of transporting pilgrims between the Holy Places, for instance using light railway networks, part of which would be underground (see Figure 9.6). This suggestion has been criticised by the Ministry of Communications Transport Department's consultant; it could not be implemented for the following reasons: (1) many pilgrims would come for a few days only, in many cases once in a lifetime, and from all over the world. They would be confused by such a modern system of transport, particularly those who come from rural areas; (2) the variety of languages and the cultures of the pilgrims would create problems; (3) most of the pilgrims want to sightsee, and would prefer surface transport (MoC, 1985). In addition, the restricted nature of a rail system, with its fixed tracks and terminals makes it less attractive than the car or the bus especially amongst the elderly pilgrims who make up at least 25 percent (see section 8.2) and need to be transported from door to door.

In fact among the various systems coming under the "new technologies" such as underground or suspension train, there is none which can be recommended unreservedly as the best way of providing transport within the Holy Places for several reasons.

Figure 9.6 Transport conception of the Hajj movement in Makkah by Kocks



Source : Kocks (1982)

First, according to Islamic culture the Holy Places should be preserved from any effect that may change its nature and tradition or conflict with religious and cultural objectives.*

Secondly, for economic reasons a heavy rapid transit system, for example, cannot be recommended for the transport of pilgrims between the Holy Places because of the short distances involved (see Chapter Three). The findings of research into the operational efficiency of various transport modes carried out by the Battelle Institute in Geneva (Bouladon, 1967) presented the 'misuse of transport technology as a significant contributor to transport problems in cities of the industrialised countries' (Dimitriou, 1990: 58). Road congestion and road safety problems are commonly associated with this phenomenon and there is evidence of widespread technological abuse of the use of transport facilities in the Hajj movement. The disaster of the Al-Masseum tunnel in Makkah (1990) when more than one thousand people died within a few hours is one example of this problem. It has been observed many times that the motor car was used for trip distances and purposes for which they are not operationally the most efficient, such as transit by car from Muna to Al-Jamarat Area which does not exceed 3 km.

Thirdly, those other systems which have already arrived at a state of development that permit an assessment of their reliability and safety, or which are already in operation, are not designed to cope with high volumes of passengers who have to be conveyed in one direction only, in a short amount of time and space. "The specific advantages

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* This prohibition comes from Hadath: the second source after Quran. When the wife of the prophet Mohammed asked permission for a small house to be built for her, he refused to do so (Al-Azraki 1978 U2 p.173).

of systems developed in Germany, such as Cabinlift H-Bahn or M-Bahn, lie in their high degree of adaptability to varying traffic demand" (MoP, 1981, p.33). So the Hajj transportation items must reflect the concept of simplicity and natural compatibility in aesthetics as well as in operation.

> "*The size of physical facilities and transportation elements within the Holy Places should be based on a human scale instead of vehicle scale in order to maintain the natural proportion with respect to the environment. Similarly, the utilisation of mechanical solutions for movements should be kept at a minimum level to reduce noise and air pollution and simplify operation and maintenance.*" (Bushnak, 1977: 103).

Therefore one possible alternative solution to the congestion of local movement in Mukkah during the Hajj should be based on making existing facilities consistent with time-space constraints.

9.3.2: Time-space constraints and the Hajj movement elements

From the above discussion it can be understood that the building of more roads is not the answer to traffic congestion during the Hajj movement in Makkah. "Transport planners are finding that constructing new freeways just attracts more cars, as some public transit riders switch to driving or new developments spring up along the new roads." (Lowe, 1990:124). Furthermore former Federal Highway Administration (FHWA) head Robert Farris concedes:

> "*We can no longer completely build our way out of the congestion crises by laying more concrete and asphalt. Time is too short, money is too scarce, and land is often not available.*" (Jillian, 1985),

Much of this applies to local movement of the Hajj in Makkah. However it has been indicated in Chapter Two that timing is considered the fundamental factor which makes the Hajj movement differ in such an extreme way from other religious movement patterns in Islam, such as Amrah which both take place in Makkah. The

latter can be undertaken at any time while the former should be at a specific time. Enne de Boen referred to the influence of the time factor and its importance for transport planning and the organisation of social events when he stated that "time is of essential importance when it comes to fitting people and things together for functioning in socio-economic system" (Boen, 1986: 139).

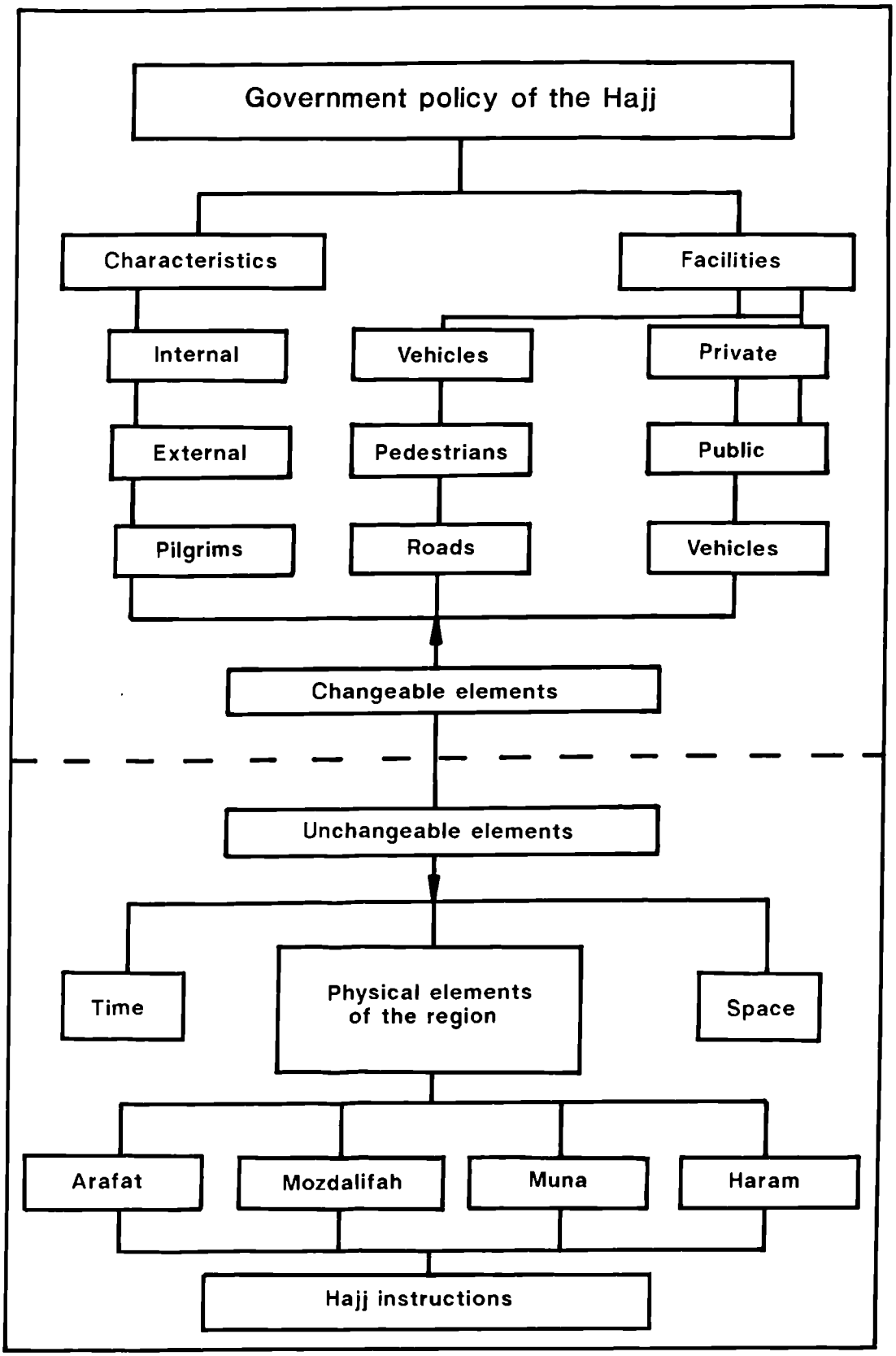
However, the basic requirement in the pilgrimage rituals is not only that they must be performed by all pilgrims during specified periods of time but also they must do so within specified places. The amount of space available within these places has also become a key factor. There are only so many hectares of land in Muna, Mozdalifah and in Arafat (see section 3.3.4.3). So it is clear that Hajj activity is subject to a series of time-space constraints including authority constraints (see section 2.3). These limitations of time-space on an increasing number of pilgrims and vehicles involved in the Hajj were major elements in the creation of traffic congestion, which is regarded as the main problem of the Hajj movement, as the survey revealed.

Traffic congestion is widespread in all motorised countries:

> "*Even the United States, with its extensive freeway system, faces major problems in trying to deal with rapidly growing levels of urban traffic congestion.*" (Howie, 1989:13).

In fact the Hajj movement in Makkah is a unique phenomenon because of its association with fixed time and space. Some urban congestion has been relieved by changes in time or space of work such as the introduction of a time-gap between the commencement of work in offices and the start of school (See Barber, G, 1986). In the case of the Hajj, changes in time or space are impossible because of authority constraints.

Figure 9.7 Unchangeable and changeable of the Hajj movement elements



Therefore any system or solution for transport problems of local movement in the Hajj should consider the time-space concept of the Hajj activity. This means that all the elements involving the movement and transport of pilgrims in Makkah can be changed except for time and space factors (see Figure 9.7). With the exception of the latter, the other factors must be harmonised with the time-space capacity of Hajj activity (see Chapter Seven). This can be achieved by the strategic planning of the contraction of the volume of changeable elements of the Hajj movement.

9.3.3: The alternative system of the Hajj movement in Makkah.

Having identified which elements of Hajj movement are changeable and which are not, it is possible to suggest strategic plans which may relieve the congestion problem. This plan might be considered as an alternative system. It consists of four fundamental recommendations: (1) using high-occupancy vehicles, (2) encouraging pilgrims to walk, (3) continuing to establish and implement a quota system, (4) other recommendations.

1. Using high-occupancy vehicles:

The application of a policy to encourage high occupancy vehicles which takes account of social and cultural traditions, would create a number of advantages (Howie, 1989) including solving the problem of traffic congestion which is the great problem of local movement in the Hajj.

In economic terms "*the small size of vehicles tends to result in high unit costs, especially of labour and fuel while a large vehicle will normally have substantially lower units costs.*" (Dimitriov, 1990:110). The high occupancy vehicle also utilises space, which is a very important factor in the Hajj, more efficiently than a low occupancy vehicle. Selection

Figure 9.8 The volume of passengers can be moved by car or bus per hour in a lane of a given size

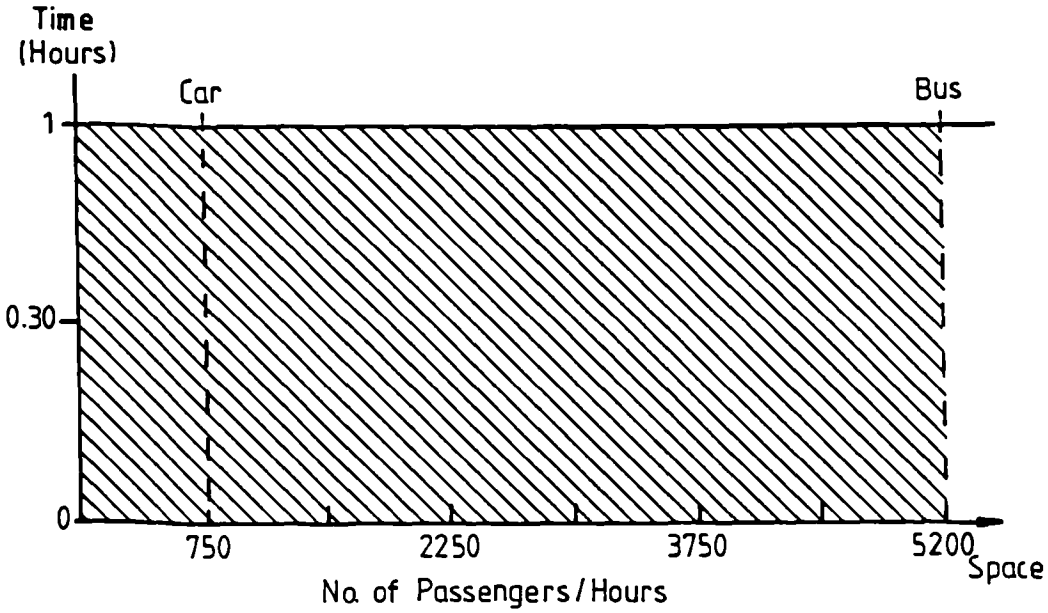


Figure 9.9 The variation between bus and car in terms of time-space concept

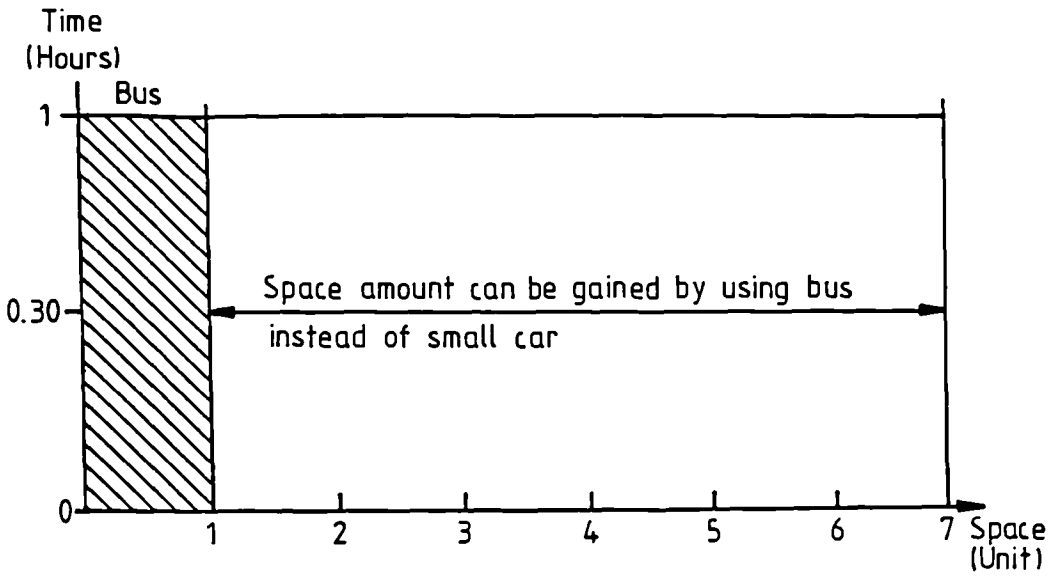


Figure 9.10 The volume of space unit occupied by each mode used in Hajj of 1989 in terms of time-space module

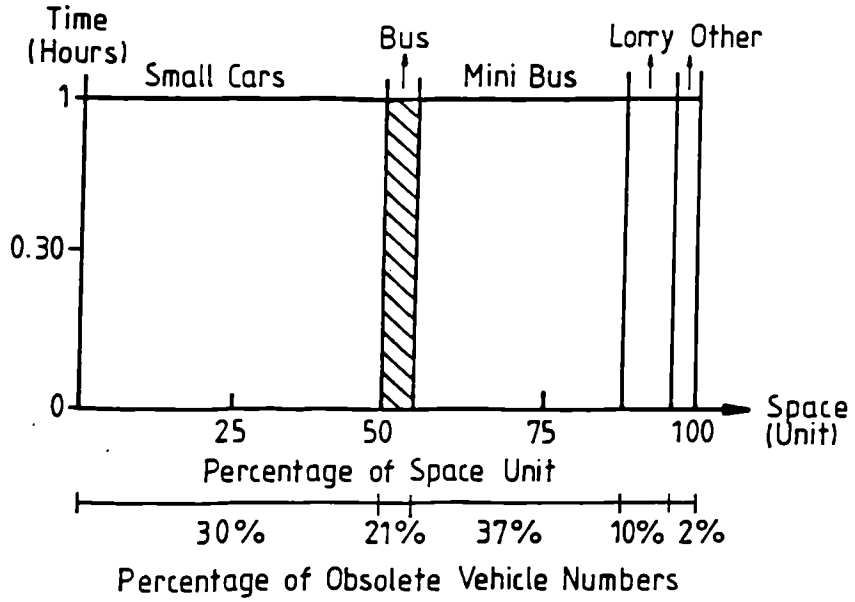
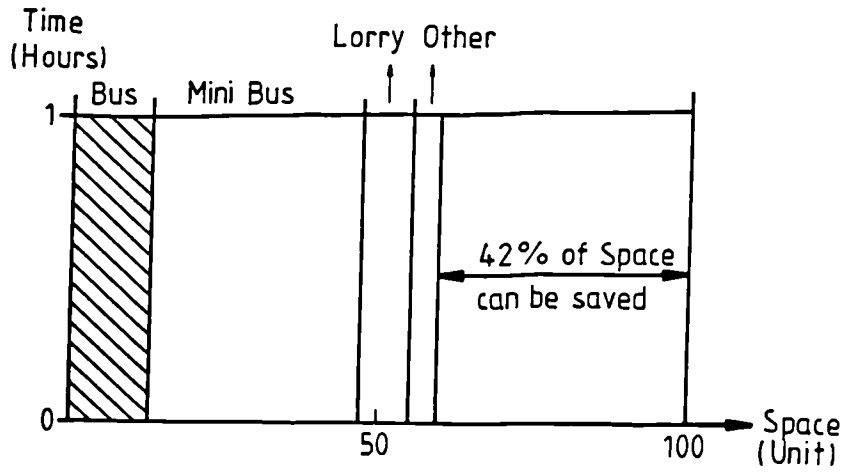


Figure 9.11 The percentage of space volume can be saved by using bus instead of small car



of vehicle type should be based on the local environment, available transport facilities and the characteristics of pilgrims. This would suggest that the capacity of the vehicle type chosen to transport pilgrims should be not less than that of a bus (40- 50 seats). Furthermore the mass transit mode can move more people per hour in a lane of a given size than cars can, even at high speeds

"Taking into account both "space" occupied and speed of travel ("time"), automobile traffic accommodates roughly 750 persons per meter-width of lane per hour, compared with 5,200 persons by bus in a separate bus lane" (Lowe, 1990:124). This means that one bus can transport the same number of people as seven small cars in the same period of time (see Figure 9.8). Further, a bus occupies only one seventh of the space used by small cars to transport the same number of people (see Figure 9.9).

By using the same concept, the transport modes involved in the Nafrah of 1989 (see Table 7.2) might be represented in Figure 9.10 to illustrate the volume of space units occupied by each mode in terms of the time-space model. This representation assumed that the minibus and lorry, which were used in 1989 to transport the pilgrims were equal to half a bus's capacity and the category of "others" in Table 7.2 can be taken to be small cars. Thus it is obvious from Figure 9.10 that the buses efficiently employed only 5 percent of total space units of the vehicles whereas the small cars occupied more than 50 percent even though the number of the former accounted for 20 percent of the total number of vehicles involved in the Hajj of 1989 whereas the latter accounted for 30 percent of the vehicles involved (see Table 7.2).

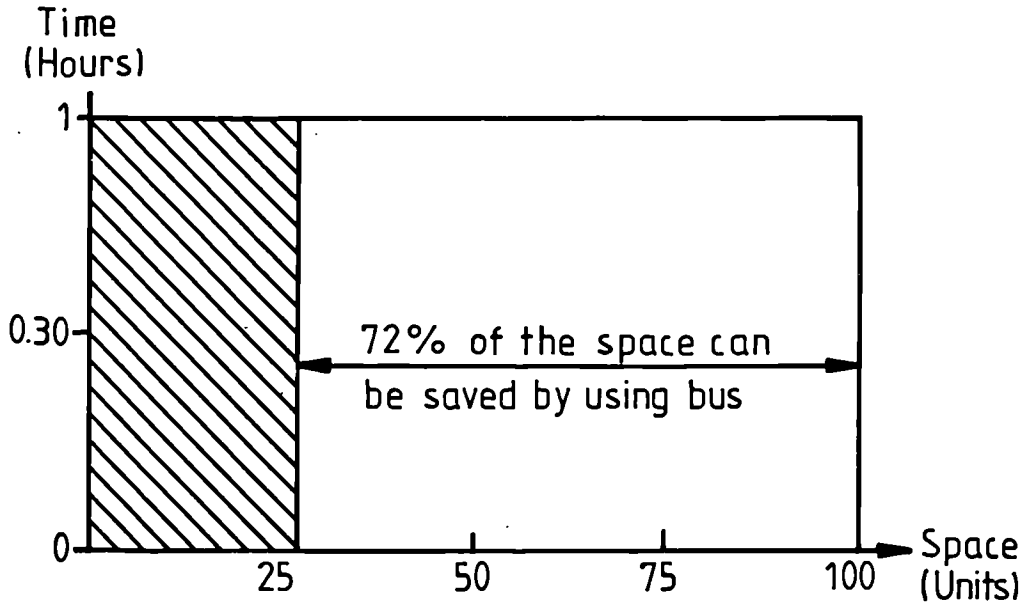
Simply in order to relieve traffic congestion and to leave more room for traffic movement of vehicles and people, the low-occupancy vehicle should be replaced by

the high-occupancy vehicle. Traffic congestion is usually aggravated, especially where small vehicles are involved in a massive movement (White 1990) like the Hajj event.

In the survey taken in the Hajj of 1989, although there were restrictions placed on small cars entering Makkah (see section 7.3), official statistics recorded 14,852 small vehicles which included cars, jeeps and pickups. This figure accounts for 30 percent of the total number of vehicles involved in the Nafrah (see section 7.4). Had small vehicles been exchanged for high occupancy vehicles, say, buses (5200 person flow/hour) only 2142 buses would have been required, instead of 14,552 small cars. This means that about 42 percent of the road space occupied by the vehicles could be saved by this change to a more efficient transport mode in terms of the time-space model (see Figure 9.11). Similarly if all low occupancy vehicles (small cars, lorries, mini-buses and others) which were used in the Hajj movement of 1989 could have been substituted by buses (40 seats or more), it would have resulted in a gain of over 70 percent of the road space taken up by these low occupancy vehicles (see Figure 9.12). Simply expressed, the number of buses required to transport all pilgrims in 1989 would have been 18,700 i.e. 40 percent of the total number of vehicles which appeared in that year.

This change would solve or relieve congestion problems to a significant degree, since "Traffic congestion or the delay imposed by one vehicle on another occurs on roads where there is insufficient space to accommodate the flow of vehicles" (Daniels, 1980). Therefore the enforced use of high-occupancy vehicles such as the bus, is a possible and convenient way to answer the question of time-space limitation and consequently to relieve the congestion problems of the Hajj movement for the future. Assuming all pilgrims wish to travel by bus and there is no-one on foot in 1995, for

Figure 9.12 The percentage of space volume can be saved by using bus in the Hajj movement instead of low occupancy vehicles



example, the number of buses required to transport all external pilgrims between the Holy Places would be 19,400 buses, i.e. 39 percent of the total vehicles involved in Hajj of 1989.

However, this estimation is only for external pilgrims. If the number of internal pilgrims is assumed to be equal to the number of external pilgrims, then they will account for 50 percent of the total number of pilgrims. This estimation relies on the fact that since 1984 the percentage of internal pilgrims ranged between 44 and 47 of the total number (see Chapter Five). In that case the number of buses needed to transport all pilgrims (external and internal pilgrims - 1,940,000) will be 38,800. It is most surprising to find that although the estimation of bus numbers relied upon a high projection (assuming all pilgrims will travel by motor not by foot) the number is still much lower than the total number of vehicles (49,381) involved in the Hajj activity in 1989.

However the number of buses required to transport the pilgrims between the Holy Places can be reduced much further by using double decker buses. If this were the case, then half the number of buses estimated above would be needed to provide the Hajj transportation demand for 1995, i.e. only 40 percent of the vehicle fleet of 1989. In fact the double decker bus (80-100 seats) is the best and most comfortable mode to meet the increased demand for transportation facilities as a result of the increase in pilgrim numbers. Therefore in the year 2000 the number of double decker buses needed to transport all pilgrims between the Holy Places at the same time would be 27,500 if the total number of pilgrims is around 2,200,000 (using the same method of estimation for 1995). Double decker buses represented only 55 percent of the vehicle's fleet in 1989.

However, in addition to the fact that the transportation by bus system has already been used and exists in the Hajj region and the main infrastructure of bus operation is available (see Chapter Three), using buses to transport the pilgrim is endowed with several advantages. Buses have flexibility where they can be used for all the various stages of the Hajj as well as for other parts of the Kingdom at non-Hajj periods. They also allow small groups of pilgrims to stay and travel together readily and they can be developed to carry higher volumes. Buses can be hired from any transport company either inside or outside the Kingdom to meet the demand of the Hajj movements as the SAPTCO has done in the programme of the Hajj services (see Chapter Four).

The alternative system for transporting pilgrims between the Holy Places depends upon there being a fair proportion of pilgrims who prefer to walk rather than to ride; a preference that should be encouraged so that the number of walkers increases substantially (see below).

2. The encouragement of walking

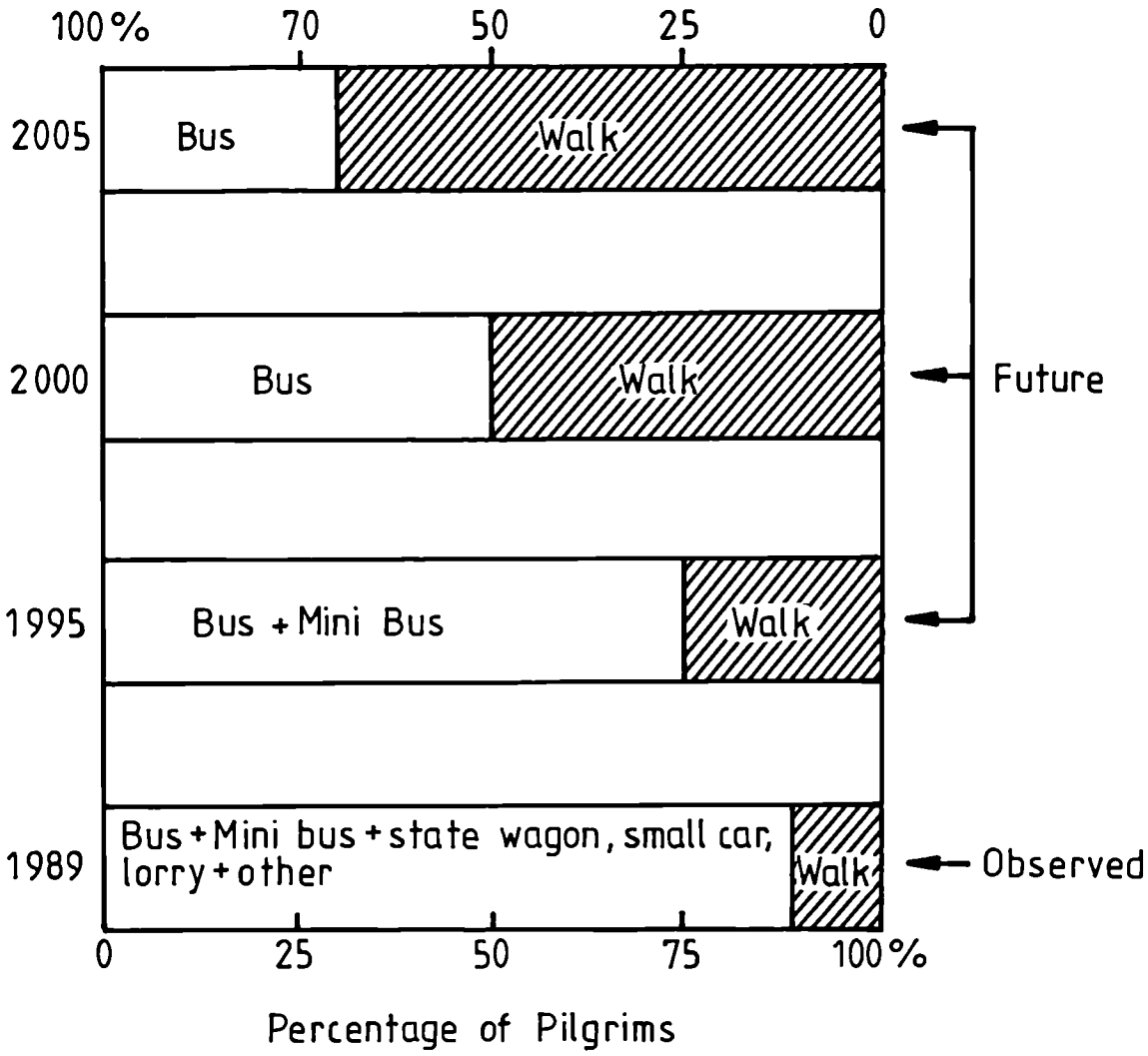
In spiritual terms, the Hajj is an expression of faith in the form of unity and equality symbolised by the Ihram (specific clothes for men). The extensive use of vehicles is considered a factor which isolates pilgrims from each other and lessens the sense of achievement and devotion to be derived from the physical effort of walking (Al-Muhandis, 1987). As the number of pilgrims rises, walking is increasingly dictated as the dominant mode by the time-space constraints of the Holy Places since "walking provides the highest capacity for movement per unit area" (Daniels, 1980). Furthermore the problems of noise and congestion associated with the use of vehicles in the

Holy Places can be further reduced by the encouragement of walking between and within the Holy Places.

In practice according to the survey, the pilgrims who travelled on foot ranged from 7 percent (Arafat - Mozdalifah) to 25 percent (Mozdalifah - Muna). By way of contrast, about 50 percent of the pilgrims interviewed were in agreement with the idea of 'walking only' between Arafat, Mozdalifah and Muna. In addition, the journey times of the pedestrian pilgrims were sometimes shorter than those of pilgrims who travelled by automobile. During the Nafrah movement, for example, only 1.6 percent of pedestrians who left Arafat between 19:00 and 22:00, arrived at Mozdalifah after midnight, whereas 11.4 percent of pilgrims using cars arrived after midnight, indicating a journey of more than two hours (see section 7.5).

Walking has many advantages which include the preservation of the natural environment, its flexibility and the fact that it requires a very simple infra-structure. It also allows the largest movement of pilgrims to be accommodated within the Holy Places during the Hajj. Therefore, provisions for pedestrians must be developed and improved. For those pilgrims who do walk they should have the right of way on the shortest and most direct routes. Thus, in addition to the present pedestrian walkway (see Figure 7.5), two other walkways, extending from Arafat to Muna, passing through Mozdalifah, could be established. These walkways should be separated at all intersections to avoid vehicle conflict and should include directional flow, access control, and traffic surveillance. The walkways would be shaded with frequent rest and service areas. They would be interconnected with collector walkways which extend to major lodging and service areas to provide an integrated network where vehicle movement would not interfere with pedestrian traffic.

Figure 9.13 Recommended transport modes of pilgrims local movement in the future



The establishment of such facilities could stimulate pilgrims to walk, particularly if some restrictions were placed on the use of vehicles within the Holy Places such as Al-jamarat and sacrifice areas. At a future stage vehicles could be forbidden over short distances, such as between Mozdalifah and Muna, (3-5 km) or between Muna and Al-Haram (6-7 km).

If actively encouraged, walking could become a significant mode of transport which could match the importance of bus transport. At a later stage it could even become the dominant mode (see Figure 9.13) i.e. the bus would be used only by those pilgrims who were unable to walk. Clearly, this is one development which would ensure that the use of vehicles was minimised, thereby considerably easing problems of congestion and overcrowding.

3. Using a quota system for pilgrim numbers

As pilgrim numbers increase, the amount of time and space in the Holy Places as well as the availability of transport facilities in the Hajj movement, decrease. Naturally this leads to the consideration of a set of restrictions or procedures to control such large numbers. So the decision of the Saudi Arabian government to use a quota system (see Chapter Five) to limit pilgrim numbers from Islamic countries should continue. Additionally, people might be educated not to repeat the performance of the Hajj. Although it is compulsory to go to the Hajj once in a lifetime, the survey found that about 29 percent of the sample had performed the Hajj more than once. Furthermore, of those pilgrims, 6 percent had repeated the pilgrimage more than five times (see Table 9.1). So the setting up of procedures to inhibit the repetition of the Hajj are needed.

However, the decision to use a quota system to control the volume of pilgrim numbers will be effective only in the short term - until the year 2000. The numbers of pilgrims is going to rise as long as populations continue to increase. Thus, the problem of the increase in the numbers of pilgrims exceeding the capacity of the Hajj region to take them will reappear. This suggests that other means should be taken to control the increase of pilgrim numbers when they threaten to rise above the capacity of the Hajj region to accommodate them. For example, the limitation percentage could be raised to 1 in 2,000 of the Muslim population of each country, instead of its present level of 1 in 1,000. This new limitation might be applied at a later stage, perhaps at the beginning of the next century.

Table 9.1 Number of times of performing the pilgrimage.

No. of times on Pilgrimage	No. of Pilgrims	%
1	360	71.0
2	76	15.0
3	23	4.0
4	8	1.6
5	10	2.0
More than 5 times	30	6.4
	507	100.0

Source: Fieldwork, 1989

4. Other recommendations

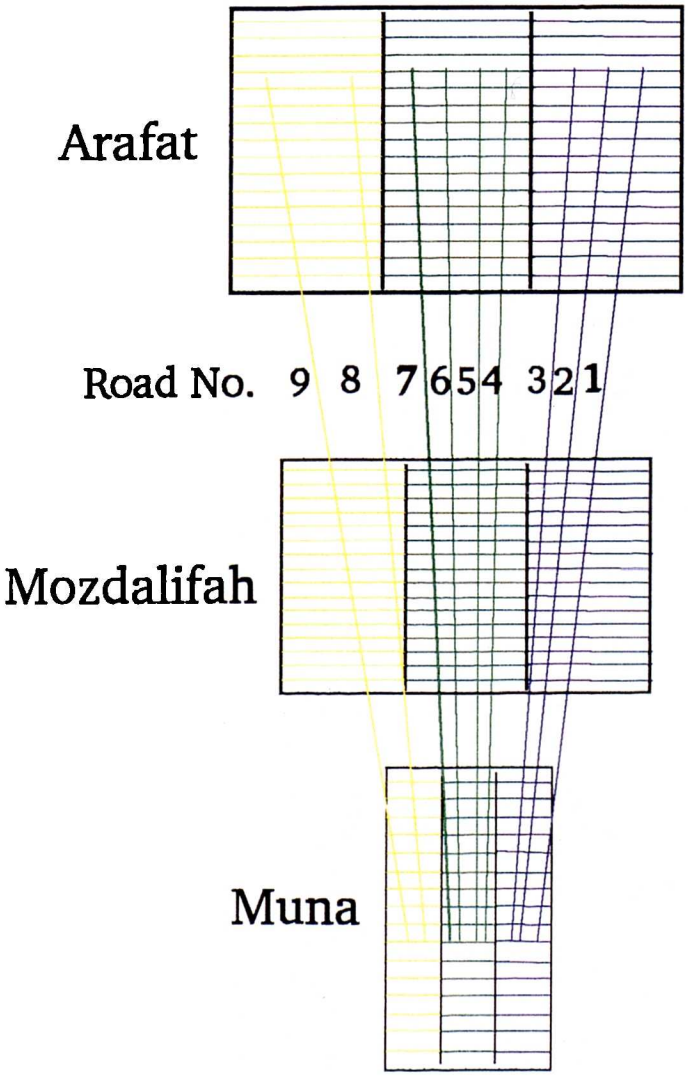
One of the significant points which should be considered is a plan to preserve the balance of flow between and within the Holy Places. It has been found that the imbalance of traffic movement on the nine roads is one of the negative factors creating congestion problems for vehicles particularly during the Nafrah. Some roads suffer

greater pressure than others (see sections 7.4 and 8.3.1). In order to relieve this problem, it might be suggested that the whole valley of the Holy Places (Arafat, Mozdalifah and Muna) can be subdivided into three districts: district No. 1 might be located on the left hand side of Arafat; No. 2 in the middle and No. 3 on the other side. Districts should be linked to each other by specific roads and distinguished by colour. Thus: Roads No. 1, 2, 3 and 4 could be allocated to district No. 1 (blue for instance) along the valley of the Holy Places; Roads No. 5, 6 and 7 might be connected with District 2 (green); and Roads 8 and 9 could link with District 3 (yellow) (see Figure 9.14). Thus distribution of pilgrim accommodation and transportation facilities (vehicles), roads, and parking in the Holy Places should also be colour coded to match with their districts. During the Hajj movement, the vehicles of each district should be forbidden to transfer to another district. If a shuttle system were to be applied (see section 7.4), one road in each district could be restricted for the return of vehicles collecting more passengers from Arafat.

In order to prevent the vehicle pedestrian conflict, the prohibition of vehicles entering overcrowded places such as Al-jamarat and sacrifice areas should be introduced (see section 7.5.1).

However the most important recommendations which might be taken up at the present time to relieve congestion problems have been listed in section 8.3.1.

Figure 9.14 A concept of dividing the Holy places into three districts by colours



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Conclusion

Through this research, it has become clear that the most important factors influencing the movement and transport of pilgrims are time-space constraints, the infrastructure of road networks, numbers of vehicles, the volume and characteristics of pilgrims and government policy towards the Hajj movement.

With regards to transport facilities on roads, the development of the road network in Saudi Arabia seems to be well underway. The basic structure of the Kingdom's road network is now generally complete. All the cities and many rural areas are connected by expressway or dual carriageway, providing good access for pilgrims to Makkah and Madinah in the Hajj region.

In Makkah, however, the move to build more roads may stimulate investment and property development which would lead to settlement, the expansion of Makkah and a consequent increase in its volume of vehicles and traffic movement. A corollary of this is that Makkah will find it increasingly difficult to function as a religious centre. It is important to recognise that a small city is better able to cope with an event like the Hajj than a large, sprawling city. Thus, when one considers that the historical and essential function of Makkah is spiritual, serving the religious seasons and the Hajj, then it would seem appropriate to restrict the growth of the city in general, and the number of vehicles in particular.

The essential factor which has overwhelmingly affected the transport of pilgrims in Makkah is the number and type of vehicles involved in the Hajj movement. The

administrative region of Holy Makkah is ranked first in the Kingdom in terms of vehicle volume during the non-Hajj period. The number of vehicles in the Makkah and Madinah regions represents sixty per cent of all vehicles in the Kingdom. Fifty nine percent of vehicles in the Makkah region were private cars (Chapter 4). Buses and taxis comprised less than two per cent of the vehicle fleet, which means that vehicles of public road transport in the Hajj region form a very low proportion of the overall.

Although the volume of public transport modes (buses) increases during the Hajj activity, its percentage of this type of transportation did not exceed 21 per cent of the total vehicles used in the Hajj movement of 1989. Moreover, the statistics of GDT show that, between 1983 and 1988, the growth of private cars was forty per cent, while public road transport increased by only thirty per cent. It is important initially to consider the problem of increasing numbers of vehicles as a result of the increase in the number of residents. This might prompt the introduction of rules limiting the numbers of private cars in Makkah and the encouragement of public transport use during the Hajj period particularly amongst those who live around the Holy Places (see section 4.3.1.2).

Public transport services in the Hajj region are provided by a paratransit system or by SAPTCO. During the Hajj period, in addition to this, the GSC is responsible for transporting external pilgrims. Although SAPTCO is the only public road transport company for the whole Kingdom of Saudi Arabia, it has faced a constant decline in passenger numbers since 1983, particularly on the non-Hajj services. This issue should

be taken into consideration in the planning of the type of public transport systems which would be best suited to the Hajj.

A principal problem experienced by the GSC is that their buses remain essentially unutilised throughout the non-Hajj period of the year, being brought into use only when the pilgrims start arriving in the Kingdom. In terms of the supply and demand of public transport modes, there is a massive disparity between the Hajj period and the non-Hajj period. This may emphasise the fact that the mode which can be suggested to serve pilgrims should be flexible and able to deal with these problems. The bus fleet could, for example, be hired in part from neighbouring countries during times of peak demand in Hajj movement: at present, this is impossible with the train system.

In 1989, only sixty three per cent of all GSC's transport companies' buses were used to transport pilgrims between the Holy Places (Chapter 4), i.e. the demand upon the bus companies was less than the supply. Competition from private sector cars available in Makkah can be considered a main reason for the low demand for buses.

Apart from the vehicle numbers entering and leaving Makkah in 1989, those which remained in the city during the Hajj period totalled 40,143. The addition of these numbers to the number of existing vehicles owned in Makkah results in the total volume of about 147,458 vehicles, which leads to great complexities of traffic movement during the Hajj movement in Makkah.

The need to minimise the number of vehicles entering Makkah during the Hajj period is considered an urgent requirement in order to avoid the effect of regional movement

upon local movement and consequently to reduce traffic congestion and pollution in Makkah. This might be developed by the following actions:

1) raising the minimum permitted passenger capacity from 9 to 12 seats. As with small cars, the entry of vehicles with a seating capacity of fewer than 12 could be forbidden;

2) The policy of granting permission for small cars to enter needs re-regulation by the responsible departments in order to reduce the issue of permits as much as possible;

3) Establishing procedures to guarantee the supply of food, goods and drinking water within Makkah before the Hajj period state (see Chapter 6).

However, the transport problems of the Hajj movement between the cities of the region were not as complex as those in the Holy Places in and around Makkah. The alternative pattern for the regional movement has been developed in order to reduce the pressure on Jeddah airport during the Hajj (Chapter 9).

As regards the patterns of movement of pilgrims between the Holy Places, the departure from Arafat (Nafrah) at sunset constitutes one of the largest movements of vehicles and people over a short time span. Although the average length of time spent travelling from Arafat to Mozdalifah during Nafrah was approximately half an hour, it took eleven per cent of the pilgrims more than two hours. The rise in vehicle numbers leading to overcrowding and congestion were the main factors causing this problem. An additional contributing factor here may be the unequal distribution of traffic on the nine roads linking the Holy Places (see Chapter 6).

Regarding pedestrian movement, research revealed that the travelling time of pedestrians between the Holy Places was sometimes shorter than for pilgrims who travelled by automobile. About twenty per cent of mobilised pilgrims arrived at Mozdalifah after midnight, whilst only 4.2 per cent of pedestrians did so.

In addition to the disadvantages resulting from the overuse of motor vehicles in the Hajj movement, the complexity of the pilgrim characteristics in terms of nationality, demography, education, language and group formation may create multiple and complicated problems for the system of movement and transport in the Hajj region. This should be borne in mind by anyone attempting to solve the Hajj movement problems and by anyone dealing with pilgrims. More precisely, the major problems which pilgrims face have been specified in section 8.3. The survey revealed that fifty four per cent of respondents considered the transport provision in Makkah to be good, and twenty seven per cent thought it was satisfactory. Although only ten per cent on average considered transport services on Hajj movement routes in general to be poor, the average of those who made critical comments about the shortcomings of transport provision was thirty four per cent. Pilgrim dissatisfaction expressed itself in complaints about traffic congestion, the condition of vehicles used to transport pilgrims, fares and roadside facilities.

Traffic, in particular, attracted the highest number of complaints: more than fifty per cent of the total comments concentrated on congestion and long traffic jams between the Holy Places. Such problems are long-standing and, from a pilgrim's point of view, represent the major difficulties of movement. In fact such problems cannot be solved exclusively by building more roads and providing more vehicles. It has been found

that Hajj movement in Makkah is subject to a series of time-space constraints; time is too short and land is often not available. These limitations of time-space on an increasing number of pilgrims and vehicles involved in the Hajj were essential elements in the creation of traffic congestion.

Therefore any system or solution for transport problems of the Hajj movement particularly in Makkah should consider the time-space concept of the Hajj activity. All the elements involving the movement and transport of pilgrims can be changed except for time and space factors. With the exception of the latter, the other factors must be harmonised with the time-space capacity of the Hajj activity. (See figure 9.7). This can be achieved by strategic planning of the contraction of the volume of changeable elements of the Hajj movement. Their plan might be considered as an alternative system and it consists of few fundamental elements: (1) using high occupancy vehicles; (2) encouraging pilgrims to walk; (3) continuing to establish and implement a quota system; (4) a plan to preserve the balance of flow between and within the Holy Places and the prohibition of vehicles entering overcrowded places such as Al-jamarat and the sacrifice areas, should be implemented (see Chapter 9).

Finally, the movement and transport of pilgrims can involve vast areas of possible research for geographers and non-geographers alike. It is not possible given the time and resource limitations of this study to cover all disciplines pertaining to the Hajj movement. There are many aspects related to the movement of pilgrims which need to be examined and analysed by researchers: the movement and transport of internal pilgrims within the Hajj Region, particularly in Makkah, and the geographical distribution of their origin; the relationship between external and internal pilgrims in

terms of a time-space model of the Hajj; the impact of using roadsides of the Holy Places for accommodation purposes on the Hajj and external movement in particular. All of these need extensive investigation and examination in order to attain a comprehensive understanding of the Hajj movement.

In addition, the data about Hajj movement which is provided by the Central Department of Statistics (CDS) may need to be improved to give a more finely segregated classification of pilgrims, and of their vehicles in particular. For example, to enable researchers to gain a more accurate and detailed picture of the Hajj movement, such information as geographical distribution, the demographic and social characteristics of pilgrims, the classification of vehicles entering Makkah and the volume of vehicle flow in the main areas of the Hajj region, are all needed. Consequently, more finely segregated data would assist planners and social scientists in finding the most convenient and accessible solutions for problems that arise during the Hajj, and in the development of the transport systems for pilgrims.

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Appendices

Appendix 1 وزارة التعليم العالي

Ministry of Higher Education,
Imam Muhammad Ibn Saud Islamic University
Faculty of Social Sciences
Department of Geography, Riyadh,
Classified Vehicle counted
The First Period 0-15 minutes

جامعة الامام محمد بن سعود الاسلامية
كلية العلوم الاجتماعية ـ قسم الجغرافيا ،الرياض
العد التصنيفي للسيارات
الفترة الزمنية الأولى (صفر ـ ١٥) دقيقة

الاتجاه Direction	الموقع Location	وقت بداية العد Time of start	التاريخ Date
سيارة صغيرة خمسة راكب Small car, 5 passengers			
صالون ٩-١٢ راكب Statio-wagon 9-12 pass.			
حافلة نقل الحجاج Pilgrim bus			
حافلة النقل الجماعي دورواحد Public bus			
حافلة النقل الجماعي دوريين Public bus (double-decker)			
حافلة صغيرة Minibus			
سيارة نقل البضائع Truck			
وايت Waite			
اخرى Other			

Appendix 2

KINGDOM OF SAUDI ARABIA
MINISTRY OF HIGHER EDUCATION
IMAM MUHAMMAD IBN SAUD
ISLAMIC UNIVERSITY
FACULTY OF SOCIAL SCIENCES
DEPARTMENT OF GEOGRAPHY
RIYADH

وزارة التعليم العالي
جامعة الامام محمد بن سعود الاسلامية
كلية العلوم الاجتماعية
قسم الجغرافيا
الرياض

استبيان حركة ونقل الحجاج
لحج عام ١٤٠٩هـ - ١٩٨٩م

QUESTIONNAIRE OF MOVEMENT AND TRANSPORT OF PILGRIMS IN HAJJ REGION IN 1989

- ٢ -

- TIME : .... : الزمـــن
- DATE : .... : التاريخ

(4-5) ١) الجنسية : .... NATIONALITY

ضع علامـة (✓) في المكان المناسب : TICK MARK (✓) WHERE APPROPRIATE

(6) ٢) الجنـــس : ذكـــر [1] MALE
انثى [2] FEMALE

(7) ٣) كم عمرك ؟ ٠ ـ ١٥ [1] 0 - 15 (HOW OLD ARE YOU
١٥ ـ ٢٥ [2] 15 - 25
٢٥ ـ ٣٥ [3] 25 - 35
٣٥ ـ ٤٥ [4] 35 - 45
٤٥ ـ ٦٥ [5] 45 - 65
اكثر من ٦٥ [5] MORE THAN 65

(8-9)٤) اسم الدولة التى تقيم فيها : COUNTRY OF RESIDENCE
....

(10-14)٥) تاريخ وصولك المملكة للحج DATE OF ARRIVAL IN SAUDI
هذا العام : ..... ARABIA FOR HAJJ

(15) ٦) ما هى وسيلة قدومك الى المملكة HOW DID YOU TRAVEL TO
للحج هذا العام ؟ SAUDI ARABIA FOR HAJJ
الجـــو [1] AIR
البـــر [2] LAND
البحـــر [3] SEA

(16) ٧) اسم المدينة التى دخلت فيها ENTRY POINT IN SAUDIA
المـــملكة ؟ ..... IA

- ٣ -

(17) ٨) IF BY LAND, WHAT KIND OF THE VEHICLE ?

اذا كان قدومك بطريق البر ما نوع المركبة ؟

COACH	[1]	حافلة كبيرة
PUBLIC BUS	[2]	حافلة النقل الجماعي
MINI BUS	[3]	حافلة صغيرة
PRIVATE CAR SALOON	[4]	سيارة خاصة كبيرة (صالون)
PRIVATE SMALL CAR	[5]	سيارة خاصة صغيرة
OFFICIAL CAR	[6]	سيارة رسمية
TAXI	[7]	سيارة أجرة
WANETTE	[8]	وانيت
PICK UP	[9]	بيك آب

(18) ٩) DOES THE CAR HAVE AIR CONDITION ?

هل السيارة مكيفة ؟

YES	[1]	نعم
NO	[2]	لا

(19) ١٠) NAME OF LAST MAJOR TOWN OR CITY THAT YOU PASSED THROUGH :

اسم آخر بلدة ريفية أو مدينة مررت بها قبل وصولك مكه :

JEDDAH	[1]	جده
MADINAH	[2]	المدينة المنورة
AL-TAIF	[3]	الطائف
AL-LITH	[4]	الليث
OTHER	[5]	أخرى

- ٤ -

(20-21) ١١) وسيلة سفرك منها الى مكه ؟) MODE OF TRAVEL FROM THERE TO MAKKAH

PILGRIM BUS	[1]	حافلة نقل الحجاج
COACH	[2]	حافلة كبيرة
(SAPTCO) PUBLIC BUS	[3]	حافلة النقل الجماعي
MINI BUS	[4]	حافلة صغيرة
PRIVATE BIG CAR (SALOON)	[5]	سيارة خاصة كبيرة (صالون)
PRIVATE SMALL CAR	[6]	سيارة خاصة صغيرة
TAXI	[7]	سيارة أجرة
OFFICIAL CAR	[8]	سيارة رسمية
WANETTE	[9]	وانيـــــت
PICK UP	[10]	بيـــــك آب
MOTOR CYCLE	[11]	دراجة نارية
OTHER	[12]	أخـــــرى

(22) ١٢) هل السيارة مكيفة ؟ DOES THE CAR HAVE AIR CONDITION ?

YES	[1]	نعم
NO	[2]	لا

(23-24) ١٣) ما هى أصعب المشاكل التى واجهتك في السفر (ان وجدت) الى مكه ؟) WHAT WAS THE BIGGEST PROBLEM (IF ANY) IN TRAVEL TO MAKKAH

....

(25) ١٤) متى ذهبت الى عرفات؟ WAHT TIME DID YOU GO TO ARAFAT?

BEFORE 9 TH OF D.H	[1]	قبل يوم ٩ ذو الحجه
ON 9TH OF D.H.BEFORE 12A.M	[2]	في يوم ٩ ذو الحجة قبل ١٢ ظهرا
ON 9TH OF D.H.AFTER 12A.M	[3]	في يوم ٩ ذو الحجه بعد ١٢ ظهرا

(26) ١٥) من أى الاماكن جئت الى عرفات ؟) WHICH PLACE DID YOU COME TO ARAFAT?

MINA	[1]	منى
MAKKAH CITY	[2]	جـده
OUT SIDE MAKKAH	[3]	من خارج المملكة

- ٥ -

DID YOU FACE ANY PROBLEM IN TRAVEL TO ARAFAT ?

(27) ١٦) هل واجهتك مشكلة في السفر الى عرفات ؟

YES [1] نعم
NO [2] لا

IF "YES" WHAT'S IT ?

(28-29) ١٧) اذا " نعم " ما هي ؟

.....
.....

.....
.....

WHAT DO YOU THINK ABOUT TRANSORT SERVICES :

١٨) ما رأيك في خدمات النقل في كل من :

	UNKNOWN لا تعرف	BAD سيء	INTERMEDIATE متوسط	GOOD جيد	
AH	[4]	[3]	[2]	[1]	(30) جده
INAH	[4]	[3]	[2]	[1]	(31) المدينة
AH	[4]	[3]	[2]	[1]	(32) مكه
PLACES	[4]	[3]	[2]	[1]	(33) المشاعر

WHAT DO YOU THINK ABOUT SERVICE OF TRANSPORT COMPANIES ?

(34) ١٩) ما رأيك في خدمات شركات النقل ؟

GOOD [1] جيد
INTERMEDIATE [2] متوسط
BAD [3] سيء
UNKNOWN [4] لا أعرف

WHAT DO YOU THINK ABOUT WALKING BETWEEN FOLLOEING PLACES ?

(35) ٢٠) ما رأيك في المشي بين الأماكن الآتية :

	DO NOT KNOW لا أعرف	DISAGREE لا اتفق	AGREE متفق	
AT - M.	[3]	[2]	[1]	(35) عرفات ـ مزدلفه
- MUNA	[3]	[2]	[1]	(36) مزدلفه ـ منى
AM - MUNA	[3]	[2]	[1]	(37) منى ـ الحرم
- ALHARAM	[3]	[2]	[1]	(38) الحرم ـ منى

- ٦ -

(39) ٢١ اذا كنت تاخرت في المغادرة من عرفات أذكر سبب التاخر ؟ IF YOU WERE LATE IN ARAFAT WHAT REASON FOR THAT ?

THE CAR WAS LATE	[1]	تاخر السيارة
BREAKING OF CAR	[2]	تعطل السيارة
OVER CROWDING	[3]	زحـــــام
OTHERS	[4]	أسباب أخرى

(40) ٢٢ الى أى الأماكن ذهبت بعد الانتهاء من مزدلفة ؟ AFTER MOZDALIFAH, WHICH PLACE DID YOU GO ?

MUNA	[1]	منـــــى
AL-JAMARAT	[2]	الجمرات
AL-HARAM	[3]	الحـــرم
SACRIFICE AREA	[4]	احدى المجازر للتضحية

— ٧ —

٢٣) ماهي الوسيلة التي استخدمتها في تنقلاتك بين الأماكن الآتية ؟ (ضع رقم الوسيلة أسفل)

WHAT KIND OF MODE DID YOU USE IN YOUR TRANSPORT BETWEEN THE FOLOWING PLACES?

WALK	[1]	ماشيا
(SAPTCO) PUBLIC BUS	[2]	حافلة النقل الجماعي
PILGRIM BUS	[3]	حافلة نقل الحجاج
COACH	[4]	حافلة كبيرة
MINI BUS	[5]	حافلة صغيرة
PRIVATE BIG CAR (SALOON)	[6]	سيارة خاصة كبيرة (صالون)
PRIVATE SMALL CAR	[7]	سيارة خاصة صغيرة
TAXI	[8]	سيارة أجرة
OFFICIAL CAR	[9]	سيارة رسمية
WANETTE	[10]	وانيت
PICK UP	[11]	بيك آب
TRUCK	[12]	سيارة شحن
OTHER	[13]	أخرى

غير مكيفة AIR IND.	مكيفة AIR COND.		نوع الوسيلة MODE	من — الى From — To
		(53)		(41-42) ١) مكة أو منى — عرفات 1) MAKKAHA OR M - ARAFAT
		(54)		(43-44) ٢) عرفات — مزدلفة 2) ARAFAT -MOZDALIFAH
		(55)		٣) مزدلفة — منى (45-46) 3) MOZDALIFAH - ARAFAT OR أو
		(56)		(47-48) ٤) مزدلفة — الحرم 4) MOZDALIFAH - HARAM
		(57)		(49-50) ٥) منى — الحرم 5) MUNA - HARAM
		(58)		(51-52) ٦) الحرم — منى 6) HARAM - MUNA

— ٨ —

(59) ٢٤) هل السيارات التى نقلتك بين المشاعر مريحة ؟ DID THE VEHICLE WHICH YOU USE CONFORTABLE?

YES [1] نعم

NO [2] لا

(60) ٢٥) اذا لا حدد الأماكن التى تنقلت بينها بوسيلة غير مريحة ؟ IF NO,PLEASE SPECIFY THE PLACE WHICH YOU TRANSPORTED BY USING MODE OF UNCONFORTABLE?

ALL [1] كلها

SOME [2] بعضها

(61) اذا بعضها .. ما هي ؟ IF SOME , WHAT IS IT ?

....

....

(62) ٢٦) هل المقاعد كانت كافية في نقل الحجاج بين المشاعر ؟ WERE THE SEATS ENAGH TO TRANSPORT THE PILGRIMS BETWEEN HOLY PLACES ?

YES [1] نعم

NO [2] لا

- ٩ -

٢٧) حدد لو سمحت وقت وصولك ومغادرتك الاماكن الآتية :
) PLEASE, SPECIFY TIME OF ARRIVAL AND DEPARTURE OF THE FOLLOWING PLACES :

المكان PLACE	وقت الوصول (63) TIME OF ARRIVAL	وقت المغادرة (64) TIME OF DEPATURE
عرفات ARAFAT	١) قبل الساعة ١٢ ظهرا يوم الثامن BEFORE 12 Noon OF 8 D.H	قبل الساعة السابعة BEFORE 7 P.M
	٢) بين ١٢ ظهرا يوم الثامن الى فجر يوم التاسع 12 Noon OF 8D.H-4A.M OF 9D.H	بين ٧ - ١٠ TWEEN 7 - 10 P.M
	٣) بين ٤ صباحا - ١٢ ظهر يوم التاسع 4A.M-12 Noon OF 9 D.H	بين ١٠ - ١٢ TWEEN 10 - 12
	٤) بعد ظهر يوم التاسع AFTER Noon OF 9 D.H	بعد منتصف الليل AFTER MID - NIGHT
مزدلفه MOZDALIFAH	(65) ١) قبل الساعة ٧ مساء يوم التاسع . BEFORE 7 P.M OF 9D.H	(66) قبل الساعة العاشرة من اليوم التاسع BEFORE 10 P.M OF 9D.H
	٢) بين الساعة ٧ - ١٠ مساء يوم التاسع BETWEEN 7-10 P.M OF 9.D.H	بين ١٠ - ١٢ من اليوم التاسع WEEN 10-12P.N OF 9D.H
	٣) بين الساعة ١٠ - ١٢ ليلا BETWEEN 10 - 12M.N	بين ١٢ ليلا - ٤ صباحا اليوم العاشر TWEEN 12-4 AM OF 10 D.H
	٤) بعد منتصف الليل AFTER MID-NIGHT	بعد فجر يوم العاشر AFTER FAJAR OF 10 D.H

- ١٠ -

تابع للسؤال ٢٧ cont Q27

	وقت الوصول (63) TIME OF ARRIVAL	وقت المغادرة (64) TIME OF DEPATURE
منى MUNA	(67) ١) قبل منتصف الليل من اليوم التاسع BEFOR MID-NIGHT OF 9D.H	(68) بعد منتصف الليل وقبل فجر يوم العاشر TER MID-NIGHT - 4A.M
	٢) بعد منتصف الليل وقبل فجر يوم العاشر AFTER MID-NIGHT -4 A.M	بعد فجر يوم العاشر AFTER FAJAR OF 10 D.H
	٣) بعد فجر يوم العاشر AFTER FAJAR OF 10 D.H	في اليوم الحادى عشر ON 11 D.H

٢٨) ما هى أصعب المشاكل التى واجهتك (ان وجدت) في كل من : WHAT WAS THE BIGGEST PROBLEM (IF ANY) IN TRAVEL FROM:

(69-70) ١) النفرة من عرفات الى مزدلفة : ARAFAT TO MOZDALIFAH
لا يوجد / يوجد / ماهي NOT EXIST/EXIST/
.....
.....

(71-72) ب) الانتقال من مزدلفة الى منى MOZDALIFAH TO MUNA
لايوجد / يوجد / ما هي NOT EXIST / EXIST /
.....

(73) ٢٩) هل زرت الحرم يوم١٠ ذو الحجه ؟ 29) DID YOU VISIT THE HARAM ON 10 D.H.

نعم [1] YES
لا [2] NO

(74) ٣٠) اذا كانت الاجابة لا متى زرت الحرم للحج ؟ IF (NO) WHEN DID YOU VIST THE HARAM ?

في اليوم الحادي عشر [1] ON 11 D.H
في اليوم الثاني عشر [2] ON 12 D.H
في اليوم الثالث عشر [3] ON 13 D.H

— ١١ —

31) FROM WHICH PLACE DID YOU COME TO GO TO THE HARAM?

(75) ٣١) من اى مكان جئت عندما ذهبت الى الحرم ؟

FROM MOZDALIFAH	[1]	من مزدلفة
FROM MUNA	[2]	من منـــــى
FROM THE JAMARAT AREA	[3]	من منطقة الجمرات
OTHER PLACE	[4]	مكان آخر

32) WHAT TIME DID YOU ARRIVE TO THE HARAM ؟

(76) ٣٢) متى وصلت الحرم

BEFORE MID-NIGHT OF D.H	[1]	قبل منتصف ليلة العاشر من ذى الحجه ٠
BETWEEN 1 - 4 A.M.	[2]	بين الساعة ١ - ٤ ليلا
BETWEEN 4-12 Noon OF 10D.H	[3]	بين ٤ -١٢ ظهر يوم العاشر
AFTER Noon OF 10 D.H.	[4]	بعد ظهر يوم العاشر
OTHER TIME, SPECIFY	[5]	وقت آخر حدده

33) WHAT TIME DID YOU LEAVE THE HARAM? ؟

(77) ٣٣) متى غادرت الحرم

BEFORE FAJER (ON 10 D.H)	[1]	قبل فجر يوم العاشر
BETWEEN 5-12 N (ON 10 D.H)	[2]	بين الساعة ٥ - ١٢ صباح يوم العاشر
BETWEEN 12A.M - 12 P.M (10 D.H.)	[3]	بين ١٢ ظهرا - ١٢ ليلا من اليوم العاشر
BETWEEN 12 M.P - 5 AM (11 D.H.)	[4]	بين ١٢ ليلا - فجر يوم الحادى عشر
AFTER 5 A.M.(11 D.H.)	[5]	بعد فجر يوم الحادي عشر
OTHER TIME, SPECIFY.....		وقت آخر ٠٠ حدده

34) WHAT TIME DID YOU ARRIVE BACK IN MUNA ?

(78) ٣٤) متى وصلت عائدا الى منى ؟

BEFORE FAJER (ON 10 D.H)	[1]	قبل فجر يوم العاشر
BETWEEN 5-12 AM.(ON 10 D.H.)	[2]	بين الساعة ٥ ـ ١٢ صباح يوم العاشر
BETWEEN 12Noon -12M.N (10 D.H.)	[3]	بين ١٢ ظهرا - ١٢ ليلا من يوم العاشر
BETWEEN 12M.N-5AM (11 D.H.)	[4]	بين ١٢ ليلا ـ فجر يوم الحادي عشر
AFTER 5 A.M (11.D.H.)	[5]	بعد فجر يوم الحادي عشر

— ١٢ —

(79) ٣٥) هل واجهتك مشكلة في الانتقال DID YOU FACE ANY PROBLEM IN
من منى الى الحرم ؟ TRANSPORT FROM MUNA TO HARAM

YES [1] نعم

NO [2] لا

(80) ٣٦) اذا كانت الاجابة نعم ما هي ؟ IF "YES" WHAT'S IT ?

.....

.....

(4) ٣٧) متى غادرت منى في اليوم (ON 12 D.H.) WHAT TIME DID YOU
الثاني عشر ؟ LEAVE MUNA ?

قبل الفجر BEFORE FAJER [1]

قبل الزوال BEFOER MID-DAY [2]

قبل الغروب BEFORE SUNSET [3]

صباح اليوم الثالث عشر 13 D.H. IN THE MORNING [4]

مساء اليوم الثالث عشر 13 D.H. IN THE EVENING [5]

(5) ٣٨) الى اى الاماكن ذهبت بعد AFTER MUNA, WHERE DID YOU
الانتهاء من منى؟ GO ?

الحرم AL-HARAM [1]

مدينة مكه المكرمة MAKKAH CITY [2]

مكان آخر OTHER PLACE [3]

(6-7)٣٩) وسيلة قدومك بعد الانتهاء من AFTER MUNA, HOW DID YOU
منى الى هناك . TRAVEL FROM MUNA TO THERE?

حافلة كبيرة COACH [1]

حافلة النقل الجماعي (SAPTCO) PUBLIC BUS [2]

حافلة نقل الحجاج PILGRIM BUS [3]

حافلة صغيرة MINI BUS [4]

سيارة خاصة كبيرة (صالون) PRIVATE BIG CAR (SALOON) [5]

سيارة خاصة صغيرة PRIVATE SMALL CAR [6]

سيارة أجرة TAXI [7]

سيارة رسمية OFFICIAL CAR [8]

وانيـــت WANETTE [9]

بيـــك آب PICK UP [10]

ماشيا WALKING [11]

- ١٣ -

(8) ٤٠ بعد الانتهاء من أعمال الحج في مكه الى اين ذهبت ؟ 0) AFTER MAKKAH ACTIVITIES WHERE DID YOU GO ?

JEDDAH	[1]	جـــده
MADINAH	[2]	المدينة المنورة
AL-TAIF	[3]	الطائف
AL-LITH	[4]	الليث
OTHER	[5]	مكان آخر

(9-10)٤١ ما هي وسيلة السفر من مكة الى هناك ؟ 1) MODE OF TRAVEL FROM MAKKAH TO THERE ?

COACH	[1]	حافلة كبيرة
(SAPTCO) PUBLIC BUS	[2]	حافلة النقل الجماعي
PILGRIM BUS	[3]	حافلة نقل الحجاج
MINI BUS	[4]	حافلة صغيرة
PRIVATE CAR (SALOON)	[5]	سيارة خاصة (صالون)
PRIVATE SMALL CAR	[6]	سيارة خاصة صغيرة
TAXI	[7]	سيارة أجرة
OFFICIAL CAR	[8]	سيارة رسمية
WANETTE	[9]	وانيـــــت
PICK UP	[10]	بيـــــك آب
MOTOR CYCLE	[11]	دراجة نارية

(11) ٤٢ هل وسيلة النقل مكيفة ؟ 2) DOSE THE MODE OF TRAVEL HAVE AIR CONDITION?

YES	[1]	نعم
NO	[2]	لا

(12-16)٤٣ متى تنوى الرجوع الى بلدك ؟ 3) WHEN WILL YOU RETURN YOUR COUNTRY ?

....

(17) ٤٤ هل زرت المدينة المنورة ؟ DID YOU VISIT MADINAH ?

YES	[1]	نعم
NO	[2]	لا

"NO" GO TO QUESTION NO 50 اذا كانت الاجابة (لا) انتقل الى السؤال رقم ٥٠ .

- ١٤ -

(18) ٤٥ متى وصلت المدينة المنورة؟ (5)WHEN DID YOU ARRIVE IN MADINAH?

قبل اكمال الحج [1] BEFORE THE HAJJ

بعد اكمال الحج [2] AFTER THE HAJJ

(19) ٤٦ ما هى المدة التى مكثتها في المدينة ؟ (6) HOW LONG DID YOU STAY IN MADINAH ?

اقل من ٧ أيام [1] LESS THAN 7 DAYS

٧ - ١٤ يوم [2] 7 - 14

اكثر من ١٤ يوم [3] MORE THAN 14

(20-21)٤٧ما هى وسيلة سفرك الى المدينة ؟ (7) MODE OF TRNSPORT TO MADINAH?

PLANE	[1]	طائرة
COACH	[2]	حافلة كبيرة
(SAPTCO) PUBLIC BUS	[3]	حافلة النقل الجماعي
PILGRIM BUS	[4]	حافلة نقل الحجاج
MINI BUS	[5]	حافلة صغيرة
PRIVATE CAR (SALOON)	[6]	سيارة خاصة (صالون)
PRIVATE SMALL CAR	[7]	سيارة خاصة صغيرة
TAXI	[8]	سيارة أجرة
OFFICIAL CAR	[9]	سيارة رسمية
WANETTE	[10]	وانيـــــت
PICK UP	[11]	بيـــــك آب

(22) ٤٨ هل واجهتك مشكلة في تنقلك أو سفرك الى المدينة ؟ (8) IS THERE ANY PROBLEM IN TRANSPORT TO MADINAH?

نعم [1] YES

لا [2] NO

(23-24)٤٩اذا كانت الاجابة (نعم) ماهي : (9) IF "YES" WHAT'S IT

....

(25) ٥٠ هل دفعت أجرة رسوم التنقلات الى مكتب الوكلاء الموحد ؟ (10) DID YOU PAY THE COST OF TRANSPORT TO THE OFFICE OF UNITED AGENCIES?

نعم [1] YES

لا [2] NO

— ١٥ —

51) IF YES DID YOU AVAIL YOURSELF OF THE SERVIES PROVIDED BY THE TRANSPORT COMPANIES IN ALL YOU JOURNEYS IN THE HAJJ ?

(26) ٥١) اذا نعم هل استفدت من خدمات شركات النقل في جميع تنقلاتك لأداء الحج ؟

YES [1] نعم

NO [2] لا

52) IF NO, SPECIFY THE POINTS WHERE YOU DID NOT MAKE USE OF THE SERVICES PROVIDED BY THE TRANSPORT COMPANIES?

(27-36)٥٢) اذا لا حدد النقاط (اسفل) التي لم تستفيد من خدمات شركات النقل مع ذكر السبب ؟

CAUSE السبب (37-38)

JEDDAH- MAKKAH	جده ـ مكه	(27)
MAKKAH - JEDDAH	مكه ـ جده	(28)
JEDDAH - MADINAH	جده ـ المدينة	(29)
MADINAH - JEDDAH	المدينة ـ جده	(30)
MADINAH - MAKKAH	المدينه ـ مكه	(31)
MAKKAH - MADINAH	مكه ـ المدينه	(32)
MAKKAH - ARAFAT	مكه ـ عرفات	(33)
ARAFAT - MOZDALIFAH.....	عرفات ـ مزدلفه	(34)
MOZDALIFAH - MUNA	مزدلفة ـ منى	(35)
MUNA - MAKKAH	منى ـ مكه	(36)

53) IF YOU TRAVELLED BY PRIVATE HIRE COULD YOU GIVE DETAILS AS BELOW?

٥٣) اذا كنت تنقلت بأجرة خاصة حدد مكان التنقل والاجرة المدفوعة ونوع وسيلة النقل ؟

	(44-45) وسيلة النقل MODE	(41-43) الاجرة المدفوعة COST	(39-40) مكان التنقل PLACE OF TRAVEL	
1)	.....	.....	.....	(١
2)	.....	.....	.....	(٢
3)	.....	.....	.....	(٣
4)	.....	.....	.....	(٤

54) TOTAL EXPENSCE IN SAUDI ARABIA REGARDING: (46-50)٥٤كم مجموع ما انفقته في السعودية بالنسبة الى :

FOR THE HAJJ IN GENERAL..... الحج بصفة عامة
FOR TRANSPORT ONLY ..... التنقلات بصفة خاصة

51) WAS THIS ONLY FOR YOUR SELF ؟ (51) ٥٥ هل انفقته على نفسك فقط

YES [1] نعم
NO [2] لا

56) IF NO THEM FOR HOW MANY ؟ (52-53)٥٦اذا لا كم عدد من انفقت عليهم
PERSONS?

.....

1) MARITAL STATUS : (54 ١) الحالة الاجتماعية :

مطلق	متزوج	أعزب
DIVORCED	MARRIED	SINGLE

2) CURRENT WORK STATUS (55) ٢ الوضع الحالى للعمل :

ربه منزل	متقاعد	لا يعمل	يعمل
HOUSEWIFE	RETIRED	UNEMPLOYED	EMPLOYED
طالب	طفل		
STUDENT	CHILD		

3) WHAT IS YOUR OCCUPATION : (56-57)٣الوظيفة أو المهنة :
.....

4) YEARS OF EDUCATION : ..... (58-59)٤عدد سنوات التعليم :

5) MOTHER TONGUE : .....؟ (60-61)٥ما هى لغتك القومية

READ IT? YES نعم NO لا (62) هل تقرأ بها :

WRITE IT? YES نعم NO لا (63) هل تكتب بها :

— ١٧ —

6) OTHER LANGUAGES : ٦) اللغات الاخري :

اسم اللغة NAME	فهم UNDERSTAND	محادثة SPEAK	قراءة READ	كتابة WRITE
ARABIC العربية (64-67)				
ENGLISH الانجليزية (68-71)				
FRENCH الفرنسية (72-75)				

7) HOW MANY TIMES HAVE YOU PERFORMED HAJJ BEFORE THIS HAJJ? ٧) (76-77) كم مرة أديت الحج من قبل ؟

.....

8) HOW MANY PEOPLE OF YOUR RELATIVES AND FRIENDS ARE MAKING HAJJ WITH YOU THIS YEAR? ٨) كم عدد الذين أدوا الحج معك هذا العام من الاقارب والاصدقاء ؟

	عدد الاناث (4-5) NUMBER OF FEMALES	عدد الذكور (78-79) NUMBER OF MALES	
RELATIVES			اقارب
FRIENDS	(8-9)	(6-7)	اصدقاء
TOTAL		(10-11)	المجموع العام

Appendix 3

Data of Multipal Regression Model (1985)

Country		No. of pilgrims	No. of pilgrims per million Muslim population	Income per capita	Distance as the crow flies (miles)	No. of Muslim population (000)	Cost of return ticket	time of travel - return trip (hours)
1.	North Yemen	43512	5306	550	523	8200	1354	2.30
2.	Pakistan	92305	1011	350	1938	91264	3084	8.48
3.	Egypt	98606	2156	760	812	45724	2500	3.04
4.	Turkey	54624	1082	1110	1600	40470	2956	7.28
5.	Indonesia	59172	391	490	4878	151424	7140	19.40
6.	Nigeria	29899	414	640	1258	72170	4794	14.10
7.	Syria	15803	1681	1570	867	9396	2114	4.44
8.	Algeria	28093	1336	2590	2583	20608	4384	11.08
9.	Sudan	28724	1589	320	185	18080	1422	2.20
10.	Libya	14509	3796	6000	1861	3822	2812	10.10
11.	India	39344	336	290	2379	117210	3508	16.10
12.	Morocco	22912	1072	590	3121	21375	3850	13.20
13.	Jordan	17165	5240	1540	750	3276	1960	4.24
14.	Malaysia	26043	2941	1830	4200	8855	6542	19.16
15.	Bangladesh	13631	165	160	2530	82560	4320	18.0
16.	Tunisia	6887	967	1140	2191	7125	3906	11.20
17.	South Yemen	6852	3210	470	712	2134	2258	3.12
18.	Kuwait	8308	4615	13890	766	1800	1772	2.56
19.	Thailand	1685	801	810	3987	2104	5784	17.52
20.	Oman	12804	9849	4980	1263	1300	2636	5.40
21.	Somalia	4487	824	280	1487	5445	3048	5.32
22.	Amarat	6549	4677	14680	1123	1400	1846	5.10
23.	Mauritania	1243	697	420	3634	1782	6704	14.20
24.	Singapore	1873	6500	7410	4300	442	6542	19.30
25.	Philippines	1323	210	560	5250	6303	6774	20.34
26.	Senegal	2501	400	420	3735	6256	6740	17.28
27.	Niger	1465	246	260	2515	5940	6140	13.0
28.	Mali	2092	306	180	3397	6840	5830	15.0
29.	South Africa	2498	1933	1850	2815	1292	6940	21.30

Appendix 4

Estimation of Muslim Numbers of the Main Countries Sending Pilgrims to Makkah

Country		Number of Muslims (000)			
		1986	**1990**	**1995**	**2000**
1.	North Yemen	8200	9253	10738	12461
2.	Pakistan	91264	1000099	112211	125788
3.	Egypt	45724	51558	59782	69317
4.	Turkey	40470	43708	48078	52885
5.	Indonesia	151424	158813	168500	178778
6.	Nigeria	72170	82043	96072	112500
7.	Syria	9396	10790	12791	15164
8.	Algeria	20608	23172	26775	30938
9.	Sudan	18080	20155	23047	26354
10.	Libya	3822	4349	5099	5978
11.	India	117210	127149	140627	155533
12.	Morocco	21375	23564	26580	29982
13.	Jordan	3276	3791	4536	5436
14.	Malaysia	9955	9673	10790	12036
15.	Bangladesh	82560	91377	103576	117403
16.	Tunisia	7125	7778	8668	9660
17.	South Yemen	2134	2377	2716	3103
18.	Kuwait	1800	1977	2220	2493
19.	Thailand	2104	2232	2402	2585
20.	Oman	1300	1473	1718	2004
21.	Somalia	5445	6111	7046	8124
22.	Amarat	1400	1506	1649	1806
23.	Mauritania	1782	1976	2245	2551
24.	Singapore	442	468	503	540
25.	Philippines	6303	6945	7830	8828
26.	Senegal	6256	6926	7854	8906
27.	Niger	5940	6655	7656	8808
28.	Mali	6840	7527	8472	9535
29.	South Africa	1292	1405	1559	1729
30.	Bahrain	409	449	503	564
31.	Qatar	297	328	371	420
32.	Iraq	15808	18008	21141	24819
33.	Lebanon	1625	1762	1948	2153

Country		Number of Muslims (000)			
		1986	**1990**	**1995**	**2000**
34.	Afghanistan	18428	20329	22951	25911
35.	Iran	48456	54464	62906	72656
36.	Brunei	144	160	182	207
37.	Sri Lanka	1289	1365	1467	1576
38.	Ethiopia	15724	17208	19238	21508
39.	Chad	2621	2880	3236	3635
40.	Guinea	3322	3650	4100	4606
41.	Other	59990	66349	75140	85096
		912710	1001802	1124923	1258403