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Paper title: Parking management in Saudi Arabia: Is there any solution?

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Abstract (200 words):

With the tremendous and rapid increase in the production of automobile since the 1980s, it has resulted in various influences on people's life style. On one hand, the use of cars has improved the efficiency of travel and productivity. On the other hand, this has created widespread problems in urban areas - spaces for road traffic and parking requirement, both of which are often difficult and costly to be compromised. In many cities, particularly within Central Business District (CBD), parking and parking related problems have been deteriorating with the increase of city traffic and parking demand. Similar to other part of the world, cities in Saudi Arabia also face the challenge in managing parking within its CBDs and even residential areas. Consequently, traffic congestions, parking and other negative impacts induced by the use of motor vehicles are putting pressures on transport systems and the principles of town planning. This paper attempts to address the importance of parking control and management for countries such as Saudi Arabia. The case in the Eastern Province of Saudi Arabia is used as an example to illustrate the common concerns and parking policies. As a result of the study, suggestions on parking control and policy are presented.

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Introduction

Parking and parking related issues continue to be one of the major concerns for government, business operators and individual users. It has been a problem, which is too familiar for both public and private sectors. Cities need to provide organised parking services, including on street and off street parking, to make their established centres fully utilised, and to complement their roads and land uses. Developers want sufficient parking spaces to attract tenants and customers, to make their business profitable and to gain competitiveness. Individual vehicle users need to consider travel time, where to parking their cars and parking costs.

Along with the rapid development in automobile industry since the 1980s, the mass utilisation of cars has resulted in various impacts on people's life style (Young, 1991). The usage of cars has definitely improved the efficiency of travel and flexibility. On the other hand, this has created widespread problems, particularly in respect to the limited land availability in urban areas - spaces for road traffic and parking requirement, both of which are often difficult and costly to be compromised. In many cities, particularly within Central Business District (CBD), parking and parking related problems have been deteriorating with the increase of city traffic and parking demand, more vehicles and more time are spending on looking for parking, consequently increased travel time and traffic congestion. Similar to the other parts of the world, cities in Saudi Arabia also faces the challenge in managing parking within its CBDs and even residential areas. In Saudi Arabia, vehicle ownership is increasing at a speed competing with their economic growth rate. The form of the vehicle ownership variations in Saudi Arabia is obvious different from other countries in the world. They enjoy the benefit of selling oil and cheaper petrol price. The increase of world oil price has played an encouraging role for the flood of vehicles on the streets. It appeared that this trend will continue for years to come. Consequently, traffic congestions, parking and other negative sides induced by the use of motor vehicles are putting pressures on transport systems and the principles of town planning. This paper attempts to address the importance of parking control and management for countries such as Saudi Arabia. In discussing some specific issues, the case in the Eastern Province of Saudi Arabia will be used as an example to illustrate the common concerns and a framework on parking policies. In the case studies, parking related data in the Eastern Province will be presented; current parking and supply situations in Saudi Arabia will be discussed and some proposed solutions will be concluded.

Aspects in parking demand and supply

In general sense, parking in CBDs and even in residential areas should be controlled and managed. In planning and managing parking facilities, a balance between parking demand and supply needs to be achieved and a mechanism in policy to relax parking demand should also be attempted. For instance, some useful guidelines on parking rates for categorised land use can be found from references (Ministry of Planning and Environment, 1987). Considering the impact of dominating transport mode on parking demand for a particular area, two levels of parking demand are often suggested. The first is based on zero public transport provision and the second is the use of private cars plus public transport. In the case of Saudi Arabia, there was no public transport at all and it is unlikely they would develop that in the near future. Where multipurpose land uses exist, the estimation of parking needs should reflect the difference by not adding individual land use demands directly. The

procedures for estimating parking demand for Australian cities is documented by Urban Land Institute (1983) and discussed by Le and Young (1987).

However, in many cities of the developing countries, the above mentioned guidelines have not been implemented. The balance of parking demand and supply therefore needs to be considered together with the other measures in a systematic way (Yue and Young 1993). Especially, the issues of parking planning, control and management should be considered at town and road network planning stage. For existing CBDs and residential areas, parking control and management will be vital important in ensuring sustainable economic development and at the same time to fully utilise the established infrastructure.

This paper will concentrate on the discussion of existing situations. To tackle the problems, a practical example of a case in Saudi Arabia will be used. Similar to other part of the world, cities in Saudi Arabia also face the challenge in managing parking within CBDs. According to the development trend of the cities in Eastern Province of Saudi Arabia, demand for goods and services provided by the CBDs is likely to increase, and shopping facilities will continue to expand. As a result, there is an urgent need to control the way people park within CBDs and to establish a mechanism in managing parking behaviour. To investigate the current parking demand and supply situations and provide a baseline for future parking management, field inspection, data collections and analysis were conducted. By illustrating the land use patterns and parking demand phenomenon in the East Province of Saudi Arabia, the paper attempts to highlight some issues on parking control and management, and provide preliminary ways to minimise the negative impact of car usage on people's daily life.

Study areas

The study areas were located in the Eastern Province of Saudi Arabia. The main cities include Dammam, Al Khobar, Dhahran and Qatif, with a registered population around 2 million (Dammam Municipality, 1997). As shown in Figure 1, the Dammam Area is nearby the Arabian Gulf and hosts the vast petroleum resources of the country, and contains the largest proven reserves in the world. The natural and economic features of the Dammam Area have enabled it to face the challenges of urban sprawl, which extended not only to the main cities, but also to fishing and pearl diving villages on the coast.

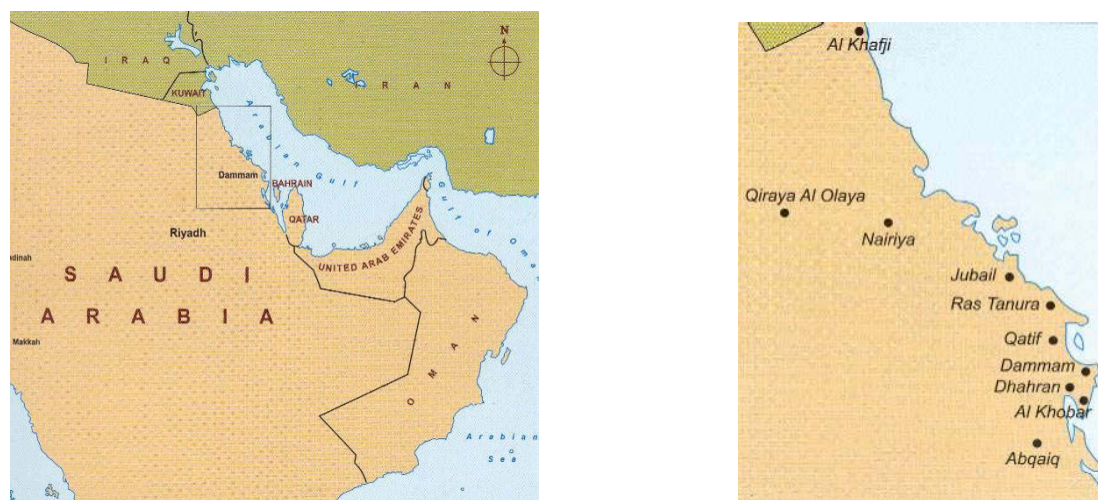


Figure 1 Dammam Areas in Saudi Arabia

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Generally speaking, there are three recognisable factors influencing the growth of parking demand in CBDs – the vehicle ownership in the surrounding areas, the level and form of public transport services and the established land uses. These factors dominate the demand of parking. On supply side, the provision of parking in land use and sufficient spaces are required to accommodate the demand. However, the supply of parking in CBDs is limited in most of the situations due to the continuing growth of population and car ownership. To minimise the possibility of future collapse of the relationship between parking demand and supply, a realistic parking management system needs to be developed. In developing such a system, it is necessary to conduct an assessment on the existing parking demand and supply conditions.

Population factor

In estimating parking supply, the locations and types of major parking generators should be investigated together with the nature and form of the parking needs if a successful parking management scheme is to be achieved. In assessing the parking demand for a city, population of the city may be used as a reference in the estimations. In most of the developed nations, smaller cities with a population less than 100,000, there will be as many as 80 per cent of the population entering CBDs by private cars. This percentage decreases to an average value of 70 per cent in cities of 100,000 to 500,000 and is as low as 40 per cent in cities of 500,000 and over. This estimation is mainly based on the assumptions that the bigger the city the better the public transport services (Yue, 1993). However, in the study areas, this principle may not be appropriate as there was not public transport service.

Table 1 Population Growth from the Year 1991

	1991	1995	2000	2001	2002
Dammam	482,321	553,474	657,354	680,361	704,174
Dhahran	73,791	84,677	100,570	104,089	107,733
Khobar	274,387	314,865	373,961	387,050	400,597
Qatif	392,859	450,815	535,426	554,166	573,562

Note: Population data was calculated based on the 1991 census data at a growth rate of 3.5% annually as instructed by the local officials

As shown in Table 1, up to 2002 the areas of Damman, Dhahran, Khubar and Qatif have a population around 700,000, 100,000, 400,000 and 600,000 respectively. Considering current parking situations and the potential growth, this population base would generate a considerable parking demand within CBDs. However, the principles discussed before may not suit the situations in the Eastern province of Saudi Arabia due to the following concerns:

- There was a mixed land use within CBDs – residential plus commercial;
- Tidal flow phenomenon – greater number of working trips went out of CBDs in the morning and came back in the afternoon;

- Greater number of shopping, dining and entertainment trips occurred in the evening from the newly developed residential areas, for instance, from Al Khobar;
- Private car was the dominating transport mode; and
- The CBDs equipped with a poor public transport system, and there would be no development of public transport provision in the near future.

Vehicle ownership factor

Vehicle ownerships reflect the needs of travel and may be used to estimate the demand for parking within CBDs. As discussed in previous sections, due to the nature of the mixed land use of the CBDs, they produce working trips out of the CBDs and attract commercial trips into the CBDs. This phenomenon may be called as a “parking demand shift” – some working trips plus a small amount of commercial trips form outside CBDs dominate parking demand during daytime and returning working trips plus a large amount of commercial trips dominate the parking demand in the later afternoon to later evening. For such a complicated mix of travel, car ownerships may be used as an indicator only to estimate the future growth of parking demand.

Table 2 2000 – 2001 New Vehicle Registration

Area	2000	2001	Variation %
Dammam	92055	98626	1.1%
Khobar	34561	63264	18.3%
Dhahran	32436	44024	1.4%
Qatif	54657	52404	-1%

Although the accumulated (total) car ownerships for the areas were not known, the latest growth rates could still be estimated from the recent new car registrations. From Table 2, it can be seen that there was a general growth in car ownerships across all the areas as a whole in the year of 2000 to 2001. It was believed that the demand for parking within CBDs would also increase at a similar proportion.

Survey work involved

To cover the vast areas for different parking issues in the Eastern Province, field inspections were arranged during peak, off peak, day and night hours by driving through all the accessible streets through the areas. The objectives of the field inspections were to identify parking conflicting areas and streets. The inspection areas include the four cities and their major CBDs as well as the residential streets adjacent to commercial streets. Once the parking conflicting areas were identified, traffic volume and parking duration surveys were carried out.

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Off street parking

Off street parking facilities in the CBDs in the Eastern province of Saudi Arabia were limited. This is perhaps because that the available free on street parking spaces discouraged the investment on off street parking development. There were a number of off street parking buildings closing to the study areas. Some are accessible for public and some are for office workers only. Perhaps due to the unattractive locations, parking buildings opening for public were seriously under utilised. This evidence may further discourage people investing in parking services industry. It is likely that the future construction of off street parking building will mainly take place out of CBDs due to the limited spaces within the commercial areas. Figure 2 shows a building parking station. It can be seen that not many vehicles parked within the building but on street, even the temperature was extremely high. However, this situation may get improved once controlled on street parking being adopted.



Figure 2 Empty parking building (full on street)

On street parking

On street parking is the most convenient form of parking for users. It was evident through the field inspections that on street parking attracted most of the customers to shops and restaurants even there were off street car parks available but in a short distance. Figure 3 shows that people prefer to use on street parking even when off street parking available.



Figure 3 On street and off street parking

On street parking provides convenience for parkers. However, due to the absence of a management and control mechanism in these areas, on street parking generated a number of negative impacts in commercial and residential areas within CBDs. For instance, abuse of the limited on street parking spaces was often observed along the busy streets, double-parking;

improperly parked and parking on intersection corners caused slow down of traffic and might cause safety concerns. Figure 4 presents these facts.



Figure 4 The inappropriate use of on-street parking

From Figure 4, it can be seen that some people used on street parking spaces for car sales, parked at the corner of intersection and double parking.

Traffic volume surveys

Based on the field inspections, a total of 21 locations were selected for traffic volume surveys employing automatic pneumatic tubes and 5 locations were selected for traffic volume surveys using manual counting from 31st July 2002 to 8th August 2002. Impact of on street parking on these was evaluated using these traffic volume data. The distributions of these locations based on areas are as follows:

Ath Thuqbah – 5 streets

Dammam – 9 streets

Al Khobar – 9 streets

Qatif – 3 streets

These streets covered major commercial streets and local streets adjacent to commercial areas and the approximate traffic volumes could be used as references for the other similar streets in estimating the amount of traffic.

Parking duration survey

Parking duration surveys were conducted from 1st August through to 8th August 2002, a total of 30 street segments were selected which included the main and minor streets within the study areas. The distributions of the locations are as follows:

Ath Thuqbah – 8 streets

Dammam – 8 streets

Khobar – 8 streets

Qatif – 4 streets

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The street segments selected represented most of the common on street parking situations. It included parking on the main streets where commercial activities playing an important role and the side and back streets where mixed need for parking could be estimated. Number plate method patrol survey method was used in getting the durations, and 15 minutes interval was adopted.

Data analysis and results

As on street parking directly competing available road spaces with passing vehicles, causing delays, congestions and even accidents, it is therefore necessary to investigate traffic volumes on different roads/streets for any intended parking studies and parking planning. The objectives of using traffic volumes for this study is to identify peak hour traffic flows and assess the impact of on street parking on traffic flows.

Traffic impact assessment

As vehicle parking and unparking will interrupt normal traffic flow, the gaps in the through traffic equal to or greater than 10 seconds were extracted to form the base for on street parking impact assessment. The following paragraphs summarised the assessment based on each study area.

Ath Thuqbah area: Traffic impact assessment was carried out for four streets in this area. The probability for gaps in through traffic equal to or greater than 10 seconds are 25%, 33%, 43% and 43% respectively. It could be concluded that only the one with 25% had slight impact on through traffic.

Dammam area: Seven streets were selected for the traffic impact assessment. On street parking would generate slight interruption for 5 of them. There would be not interruption for 2 of them.

Khobar area: Seven streets were selected for the traffic impact assessment. On street parking would cause serious interruption to 2 of them and generate slight interruption for 3 of them. There would be not interruption for 2 of them.

Qatif area: Qatif is a historical city. The layout of the streets and the configurations reflected the nature of the land use and township development. From the analysis, it showed that there were less chance for a car to parking and unparking without disrupting through traffic. Three streets were involved in the assessment. Two of them would have serious impact on through traffic, one had slight impact. However, from site inspection, it was noticed that most of the cars parked on the streets belonged to residents living on the streets, therefore no extensive disruption of through traffic was observed.

Parking duration analysis

The objectives of the parking duration analysis are to look into the data and determine the space utilizations, short and long term parking durations and the turnover rates for each street segment. Parking duration may be used to develop control mechanism and turnover rate is a measure of how many times a space is used by a car during survey period. The discussion of the analysis will be area based as the results are considered as general samples from the specific area.

Table 3 Summary of Utilisation and Turnover Rate

Area	Utilisation	Turnover rate
Ath Thuqbath	45% - 80%	2.3 –4.5
Dammam	50% - 80%	1.8 – 3.2
Al Khobar	50% - 75%	2.1 – 3.7
Qatif	50% - 70%	1.5 – 1.8

From Table 3, it can be seen that apart from Qatif the other three areas had a similar parking space utilisation. In general, space utilisation was low in the morning but reached the maximum in the afternoon. The utilisation and the distribution of parking durations could be used to develop management schemes, for instance, time of control and fee structures. For the area of Qatif, it is a historical township and most of the employments are for local services. People might walk to their working places, therefore the turnover rate was relatively low.

Table 4 Summary of Average Parking Duration

Street level	<1 hour	1 – 2 hours	2 – 4 hours	>4 hours
Commercial	59%	18%	7%	16%
Back/side	1%	10%	26%	63%

Table 4 represents the average parking durations for all 4 cities at percentage forms. It can be seen that parking durations on streets with shops are totally different from the back and side streets. It reflects the way people used it.

Although most of the parkers parked less than 2 hours on streets with shops, there were still 16% of users parked for more than 4 hours. This part of spaces could be used to serve more users if a parking time limit is adopted. On back and side streets, more parkers parked for more than 4 hours. It is assumed that the long time parkers could include people live on the

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streets. The other 37% of parkers may use the back and side streets as short term for shopping purposes. This information could be used to develop time limits for streets at different levels to control parking durations.

Parking management and control

In Saudi Arabia, the control of parking in central areas has been a major transport drawback. Poorly regulated parking makes government and road users pay a high cost in terms of travel time and efficiency. The proven evidences for the deteriorated traffic are directly related to the historic development of townships. However, the situations regarding traffic and parking for the areas of Ath Thuqbah, Dammam, Khubar and Qatis in the east province of Saudi Arabia were developing at different phases. Firstly, the transport infrastructure and road network were planned on purpose to accommodate the growing number of motor vehicles. Roads link major centres have sufficient capacity for traffic. Majority of main streets in downtown areas have three lanes in each direction separated by a wide raised medium. Even minor streets in the downtown areas have sufficient road spaces to plan two lanes in each direction. Secondly, public transport has been under developed, in particular, bus transport. Thirdly, the local climate does not encourage people to walk for a substantial distance to their destinations. Consequently, people parked their vehicles near where they carried out working or shopping activities, mostly parked on streets. At the same time, people misused and abused the on street spaces as well. To accommodate the circumstances, some proposals were made to improved the current situation, and it will be discussed in the following sections.

Proposed controls

By looking into the survey data, the information provided by the municipality authorities, and from the site inspections as described earlier, one can conclude that a comprehensive Controlled Parking System for the cities of Ath Thuqbah, Dammam, Khobar and Qatif must be developed. This controlled parking system should consider a PAID PRINCIPLE for on-street parking facilities. The framework of control and policy need to consider parking time limits according to the attraction level of the streets and areas. As mentioned in the previous sections, the impact of on streets parking activities only had slightly interruption on through traffic for most of the survey streets. A paid parking policy would certainly eliminate the abusing behaviour of on street spaces. For instance, 2 hours parking time limit could be used for streets with shops to accommodate more parkers as 77% of users parked less than that a residential on street parking permit could be introduced for back and side streets. The paid principle for parking should be under the provision of having a handful law and enforcement mechanism to ensure its operation. When on street parking is controlled, some users may consider to park in commercial car parks. The use of supplementary off-street parking lots and parking buildings may be stimulated once paid on street parking putting into place. Once such a paid parking is put into practice, it will generate the following benefits for the municipality authorities, general road users and the parking service providers:

- Managed on-street parking will improve traffic flow, reduce long term on street parking, make more spaces available for short term parkers, and most importantly reduce the possibility of having accidents.
- Regulated parking behaviour will increase the amenity of the city centres and encourage more people to utilise the established infrastructures.

- Controlled on-street parking will regulate users' driving and parking behaviour and minimise illegal parking.
- Paid Parking System will also encourage private investors to consider of developing off-street parking lots or parking buildings to accommodate different needs and for different users.
- Vehicular users will have knowledge about where and when parking facilities are available for their trip purposes and the associated parking forms and control types.
- Under a paid principle, long-term parkers will be seeking other forms of parking arrangement and relaxing on street spaces.
- Controlled on street parking will provide the residents on the street a fair chance to have the parking priority.

The development of a parking system, it is not a simple practice to put a few parking meters on the streets and wait for people to feed. Before the introduction of a paid parking concept, the use of various forms through government authorities or community activities to establish an understanding might be equally important as the system itself.

On parking control side, a structure of parking arrangement such as time limit, form of parking, short and long time parking, and for some land uses free parking may need to be considered. For parking management, in particular, in the management of on street parking, a well developed communication channel with government and a framework to ensure government involvement in collecting fines should also be seriously established.

Conclusions

This paper presented the uncontrolled parking practice in Saudi Arabia and attempted to address the importance of parking control and management. In discussing the specific issues, the case in the Eastern Province of Saudi Arabia had been cited as an example to illustrate some common concerns. To form a basis to develop framework for parking management policies, the procedures in achieving that purpose were reported. As a case study, detailed data were collected and analysed for the cities in Dammam area. Traffic volumes were used to assess the impact of parking/unparking on thought vehicles, and the analysis of parking durations could be utilised to form a parking control mechanism. It was expected that these information would be useful in developing parking control and management schemes to minimise abusing parking behaviour within CBDs.

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