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# The impact of urban arterial cross section on abutting property values and rents

## The case of Riyadh, Saudi Arabia

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There are claims that service roads (frontage roads) reduce the rent and value of adjacent commercial properties. Using Riyadh, the Capital of Saudi Arabia, as a case study, this research has found no statistically significant relationship between the presence of service roads and land values and shop rents. © 1997 Elsevier Science Ltd

*Keywords:* urban arterial cross section, property values, Saudi Arabia

### The problem

The design of the cross section of an urban arterial road needs to reflect its functions. Whilst the main function is to allow the efficient and safe movement of motorised traffic, it may also need to provide access to roadside developments. In many countries, an important decision is whether or not to provide a service road which would allow the segregation of through traffic from that which requires access (Figure 1). This decision is complex and involves a combination of factors which include capacity, delay, priority considerations, land availability and cost, and safety. Clearly, the effects of alternative access characteristics for roadside development, the subject of this paper, are important and have crucial influence on local project acceptability. This research is based on a large database developed for Riyadh in Saudi Arabia and in particular considers how the rela-

tionships between land values and shop rent vary with alternative cross sections layouts. This research is not intended to analyse factors affecting land values; rather its principal aim is to examine whether the presence of service roads affects the value and rent of adjacent properties.

In particular, this paper addresses the claim that service roads negatively impact abutting land values and shop rents in Saudi cities such as Riyadh — everything else being held constant. Riyadh is following the Western path in terms of automobile dependency; the phrase that 'many people have built their way of life around their cars' (Goodwin, 1995) is absolutely true in Riyadh. Most of the trips which are carried out by Saudis are auto-based. About 90% of vehicle trips *for which a car was available* are by private automobile, 8% are by group transport (e.g. school buses), and 2% are by public transport. With regard to non-motorised

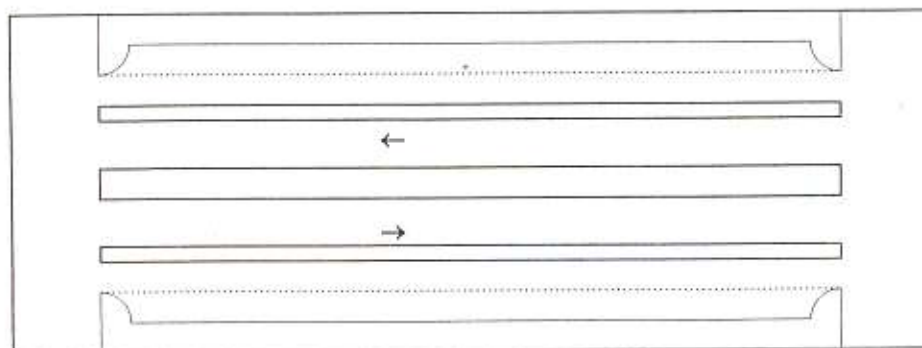


Figure 1 Main road and service road in plan.



trips, data are unavailable and; therefore, the share of these trips—out of all trips—cannot be estimated. Shopping trips are usually more automobile-based and, in Riyadh, people shop wherever their car can gain access.

It is quite common for drivers to stop during a journey to purchase goods or services and where they stop often depends on finding an appropriate stop. This is possible because Riyadh is designed to suit automobile users with wide roads and ample on-street parking. From the point of view of shop owners, a road that carries flows of traffic with immediate access represents a good shopping environment. To many, service roads constitute barriers which deter drivers from stopping and hence reduce turnover. Based on several informal contacts, it was found that many property owners claim that service roads decrease the value of abutting land and reduce the rent of abutting shops as they reduce access and decrease the exposure of abutting shops to passing traffic.

If land values are affected by the presence of a service road, then there is a serious equity problem when planning roads and appropriating rights of way in urban areas. To planners this may constitute a dilemma when preparing master plans and consequently appropriating rights of way. In Riyadh, most of the rights of way which are over 40 meters wide can easily be planned to include service roads. If service roads decrease the economic potential of abutting properties then compensation might be considered. This becomes more apparent when upgrading an existing road to one that includes a service road. Such a problem often occurs in urban renewal projects, where old roads are replanned to ease traffic movement without full consideration being given to what impacts such replanning may have on the economic vitality of the abutting properties.

From a purely theoretical vantage point, one can argue for or against the claim which associates declining land values and property rents with the presence of service roads. The presence of such roads may make parking easier, and therefore automobile based shopping safer. Indeed, these roads might provide for an attractive shopping environment away from the speedy traffic current. On the other hand, other factors may prove the opposite. Service roads may reduce instant access of passing traffic to abutting properties. In addition, service road development is more likely to negatively affect abutting property rents and values if located in newly developed areas rather than well established areas.<sup>1</sup> This negative relationship might be explained by the notion that the presence of service roads in newer areas increase the speed on main roads and thus reduce both the exposure and access of the motorist to abutting shops.

<sup>1</sup>They are established in the sense that enough traffic already passes through them.

This paper will examine the above claim in a city which witnessed tremendous growth and development in the last two decades.

### The study area

The study area is Riyadh, the capital of Saudi Arabia, which, with a population of a little over three million people, is the largest city in the Arabian Gulf. It stretches over an area of about 1881 square kilometres;<sup>2</sup> this area covers all urban centres surrounding the city and all vacant areas in between. The city has witnessed tremendous growth in the last few years. Population has more than doubled in one decade; it grew from 1.389 million in 1986 to over 3 million in 1996. In the same period the net developed area (excluding roads and vacant lands) has grown by about 60% (from about 245 km<sup>2</sup> to about 380 km<sup>2</sup>).

Broadly the land use system in the city has the following characteristics:

- (i) Areas which are exclusively retained for industrial uses; mostly located in the southern section of the city.
- (ii) Residential uses can be developed along any road regardless of its width.
- (iii) Commercial uses can be developed along roads that are 30 m or wider (with the exception of the old part of town, the central area).

Thus roads that are equal to or wider than 30 m (i.e. commercial roads) always have higher land values than narrower roads, everything else being held constant. In general, the most common development along commercial roads is two to three storey buildings where the ground floor is reserved for commercial uses, while the first and second floors are usually developed in the form of multi-room units which can be used either for residential or office purposes. A further requirement is that all such developments must provide on-street perpendicular parking (6 m deep). In this study, all land values shall refer to the values of land plots located along commercial roads and will be called commercial land (i.e. commercial plots). Commercial roads are the ones which carry the majority of local traffic and therefore represent a very important element of the transport system.

The transport system in Riyadh is mainly road based and most of the trips undertaken are by car. The city public transport system is weak, mainly because of the high car ownership rate, lack of pedestrian footpaths, the image of public transport and the sprawling urban pattern and the consequent low residential density—the gross density is about 32 people/hectare (ADA, 1994: 5). About 93% of Saudi households own automobiles; and the car ownership figure is estimated to be 1.5 automobile/household (Alskait, 1993 based on ADA reports, 1988). With regard to other modes of travel,

<sup>2</sup>This area is shown in Figure 2.



such as walking, there are no scientifically reliable studies to refer to. However, the existing land use pattern does not encourage any other mode but the automobile—not by choice, but by necessity.

The first master plan for the city was developed in the 1960s and it is this plan which shaped the transport system of the city. A freeway network and a highway network were suggested. These road networks have been developed extensively by subsequent master plans; the freeway network consists of one major ring road (about 70 km in length) circulating the city, and two freeways (King Fahad Road and Makkah [Mecca] Road) which penetrate the city from north to south and from east to west, respectively. The highway network consists of major arterials spaced at 2 km in a grid form; such a form is quite clear in the northern section of the city. Other sections of the city (e.g. east, west, south) were also developed in a similar fashion but not observing the same spacing. These roads are meant to serve through traffic first and local land uses second. However, since they are (in almost all cases) wider than 30 m, they have become prime targets for mixed-use developments (residential and commercial). In addition, the highway network connects with a network of collector roads which distribute traffic to residential communities via a smaller network of local roads.

### Factors affecting the values of land

There are several factors which can affect the value of land particularly those plots zoned for mixed-uses, commercial plots. In general, these factors can be categorised into two groups: policy factors and physical improvement factors. Government rules, regulations, and directives are among the policy factors. In Seoul and Bangkok, for example, 25% and 90% of the increases of land values (respectively) were attributed to the effect of government policies, such as taxation (Dowall, 1991, p. 6). In Malaysia, government standards and approval procedures were a major factor affecting land values (Dowall, 1991, p. 7). In India, population growth and migration is a continuously growing factor affecting land values. In Kuwait City land prices are high (in comparison with Saudi cities for instance) because subdivision plans are produced at a lower rate. Other factors which affect land values include impact fees and land fills (Nelson *et al.*, 1992), underallocation of urban lands (Hannah *et al.*, 1993), proximity to urban amenities such as highways and retail sites (Waddel *et al.*, 1993).

Several transportation projects have shown positive impacts on land values. The Shore Parkway (New York), the Henry Hudson Parkway (New York), the Gulf Freeway (Houston), the East Shore Freeway, and the Santa Ana Freeway (Los Angeles) have enhanced adjacent land values (Garrison and Marts, 1958). Indeed, recent studies show similar positive impacts.

McDonald has found that about 17% of the increase in residential land values in the vicinity of the new elevated transit link in Chicago was due to such a transit link (McDonald, 1995). This suggests that transportation improvement is one of the major factors affecting land values.

In Riyadh, infrastructure provision was found to be the most important factor. Residential land prices may increase by 90% due to infrastructure provision and road improvement. Electricity will increase land values by about 50% and surface road access will increase the value by about 28%, while the remaining 12% can be attributed to the width of the road where wider roads have higher land values than narrower roads (ADA, 1994: 51).

In addition, other factors which might affect land values in Riyadh include the location of the plot (e.g. type of community—high income or low income), and the ease of getting and leaving the plot (site access), and the relative height of the plot in comparison to other plots in the same subdivision plan.<sup>3</sup>

Furthermore, it is generally believed that two factors greatly influence land values and shop rents—everything else held constant—in Riyadh. The first factor is the location of the property (land or shop) with respect to the direction of the home-work journey. A land or a shop will have higher value or rent if it is located in the direction of the work-home bound. This is the case because of two reasons: first, Riyadh's residents tend to do their shopping after work and on their way home. Therefore, a shop which is located along the traffic bound moving towards residential areas is more attractive to motorists wanting to stop and shop. Second is the fact that most arterials in Riyadh have relatively high medians (primarily cement tile pavements) which constitute strong barriers between both bounds of traffic. These barriers make, for example, a home-bound motorist more hesitant to shop on the opposite side of the road. This might be the case because the motorist has to find an opening in the median, make a U-turn, stop at the shop, look for another opening in the pavement, and make another U-turn to head home. However, the aforementioned factor is stronger in the newly developed areas and its validity weakens with the total development of the area flanking the road. This might be the case because the home-work journey direction develops on both bounds of the road as a result of residential and employment development at either end of the road.

The second factor is the orientation of the land and shop. In general, locations (land or shop) facing east and south have higher value and rent than locations

<sup>3</sup>The relative height of a plot may increase its value because of two reasons: first, ground water (an outcome of water leaks of main networks, leaks of cesspools, and leaks of house gardens) is less likely to accumulate under higher plots and consequently harm the property. Second, higher plots provide better privacy as they are not overlooked by other lower plots.



facing west and north—everything else held constant. This observation is to be expected since the weather in Riyadh is warm most of the year thereby making the sun an unwanted amenity. Western facades of buildings, and to a lesser extent northern facades, face the sun for most of the afternoon in Riyadh when the average daily temperature is at its peak.

## Data

Two types of data were collected—via a survey—for this study: data relating to physical features of the road and data relating to property rents and land value along the selected roads. The units of analysis are road links and the variables include total daily traffic volume, number of lanes, commercial land value per square meter, shop rent per square meter, and mixed-use (apartment/office) rent per unit where a unit consists of 3 bedrooms plus facilities (kitchen and bathroom). Table 1 shows a description of the study variables.

The major criterion for including a road in the study was whether or not it had had a traffic count in the last 5 years, and over 90 roads in the city of Riyadh which have counting stations were targeted. A total of 65 roads were selected—data were not available for the remaining ones. Land value and rent data were collected from real estate offices located along the surveyed roads.

All the selected roads are equal in terms of being served by utility lines and basic infrastructure. In addition, all roads are located within the jurisdictional boundaries of the city and therefore they are subjected to the same building rules and land use regulations. In other words, policy factors as well as physical improvement factors are similar for all cases. Furthermore the crucial factor of infrastructure provision, which can significantly affect land values in Riyadh, is controlled for all these cases.

The data were checked for consistency with other data for the city. For example, the analysis of the collected data shows that the average land value in the northern section of the city (north) is about 50% greater than that of the southern section (south), a finding that is not in conflict with what was found by the Riyadh Land Market Study (ADA, 1994, p. 47). Although the Riyadh Land Market Study was mainly concerned with residential land values while our study deals with commercial/residential land values, the comparison is valid. Commercial land in Riyadh can be developed as mixed-use developments (shops and offices on the ground floor and offices or residential units on the upper floors). The quality of residential units in these developments is parallel to the quality of single family units in the same community; and indeed, residential units located in mixed-use developments are let for higher prices in communities with high land values. This is probably peculiar to Saudi cities and may not be found in Western cities.

However, there are some limitations to the collected

**Table 1** Description of the study variables

Variable	Description
LVALUE	Land value per m <sup>2</sup> in SR (Saudi Riyal)
SHRENT	Annual shop rent per square meter in SR
MRENT	Annual mixed-use rent per unit in SR
SDUMMY	A dummy variable denoting the presence of a service road
SERVICE	Number of lanes in a service road
LANES	Number of lanes in the main road
TLANES	Total number of lanes in the whole road
VOLUME	Daily traffic volume in the road
VPLANE	Daily traffic volume per each lane

data. For example, most of the land values and rents data were collected from real estate brokers who provide their own estimates of the market value of land and shop rents. Occasionally the surveyors found a vacant lot for sale or a vacant shop for rent along one of the surveyed roads and the asking price for either represents the most accurate, available data. The authors acknowledge that transaction prices are better indicators, but they are not available because there is no property tax system in Saudi Arabia, a system which may be the major source for such data in other countries. In other cases there was nothing available for sale and the broker was asked for his current estimate, which is based on achieved market prices for similar parcels in the same area. With regard to shop rents, the broker was always asked about the current market rent (achieved rent) of his own office which represent a typical shop size in Riyadh.<sup>4</sup> It is important to note that in such a case the rent contract is annual and is totally different from rent contracts of larger shops or major multiples; the latter contracts is usually signed for a time period of 8 to 15 years.

Another relevant point which should be clarified here is that most of the surveyed service roads have relatively good spacing of their exits and entries (cross points) to main roads.

## Data analysis

### *Analysis of study variables*

There are nine variables (see Table 1), the analysis of which is the subject of this section. Table 2 shows the correlation matrix for these variables. While service roads provide for safe parking and for a safe residential as well as shopping environment, the analysis of the data shows no significant relationship between their presence and the adjacent land value and shop rent. However, the direction of the relationships suggests that land values (LVALUE) and shop rents (SHRENT)

<sup>4</sup>In Riyadh, most of the real estate offices are located along commercial roads and situated on the ground floor of the property with direct access to the adjacent road. The office sizes are similar, if not identical, to other shops in the same property. A typical property on a commercial road has stores that are, on average, 4 m wide with varying depths. These stores can be used as offices, retail outlets, or service outlets. In this study we call these stores shops.



Table 2 The correlation matrix of the relevant variables

	LANES	LVALUE	MRENT	SDUMMY	SERVICE	SHRENT	TLANES	VOLUME	VPLANE
LANES	1								
LVALUE	-0.01	1							
MRENT	0.462	0.383	1						
SDUMMY	0.17	-0.093	0.296	1					
SERVICE	0.125	-0.047	0.371	0.931	1				
SHRENT	-0.199	0.317	0.056	-0.173	-0.101	1			
TLANES	0.648	-0.042	0.54	0.808	0.837	-0.187	1		
VOLUME	0.121	-0.015	0.346	0.476	0.647	0.063	0.563	1	
VPLANE	-0.188	0.001	0.205	0.416	0.598	0.113	0.355	0.947	1

decrease with the presence of service roads (SDUMMY) and the number of lanes in these roads (SERVICE). Land values and shop rents are negatively correlated with the presence of service roads as well as the number of lanes in these roads. Such correlations are generally, however, weak and insignificant. ANOVA analysis shows that neither the value of a plot nor the rent of a shop differ significantly in the presence or absence of service roads (Table 3).

Mixed-use rent (MRENT), which denotes the rent per unit used for either residential or office purposes, has shown a positive relationship with the presence of service roads. This is probably due to the fact that residential and office units usually benefit from service roads because of a reduction in traffic externalities (e.g. infringement on privacy, noise, etc.). For example, it is certainly more attractive to residents to live along a wide road (service roads add to the width of the road) as opposed to a narrow congested one. In addition, it was found that MRENT correlates positively with the total number of lanes (TLANES), which includes the number of lanes in the main road and the service road. However, TLANES correlates weakly and negatively with both land values and shop rent.

It should be noted here, and before any further analysis is presented, that the study variables do not explain most of the variation in land values (Table 4). This outcome is expected since many of the variables, such as those describing the property and its commu-

nity, are not included in the analysis. Only VOLUME, MRENT, and SHRENT have coefficients which significantly differ from zero at the 10% confidence level, the rest of the variables have insignificant coefficients. When SHRENT is regressed against the same variables including LVALUE the outcome is similar with about 80% of the variation unexplained.

Nevertheless, analysis of the data shows one factor to be the main influence on land values in Riyadh: location. On average, commercial land values in the northern section of the city are 1.5 higher than those in the southern parts of the city (see Figure 2 for location identification). The differences are significant from zero at the 0.05 confidence level (Table 5). Similarly, and on average, mixed use rents in the northern section of the city are 1.6 higher than those in the southern parts of the city; the difference is quite significant (Table 5).

#### Impacts of service roads on land values and shop rents

Examining whether the presence of service roads affects land value and shop rent in either section of the city (north and south), it was found that the mean values of both variables are not sensitive to the presence of service roads. However, mixed-use rent differs significantly in the south (at the 5% level) when controlling for the presence of service roads as shown in Table 6.

In addition, further analyses were employed to examine the three dependent variables. The cases (roads) were classified into two groups based on the total number of lanes: Group I represents roads with less than, or equal to, three lanes; Group II represents roads with more than three lanes. Group analysis (Table 7) shows that there are no differences (in variable means) between the two groups in both north and south when all cases have service roads. When analysing cases with no service roads, we found that there is a significant difference in the rent of shops between the two groups in the north.

In general, the rent of a shop located along a road with a total number of lanes less than or equal to 3 is higher than if the road has more than 3 lanes. Given that many of the roads which have 3 or more lanes are designed to include service lanes, this outcome might suggest that the presence of service roads, which increase the total number of lanes, could support the argument which associates service roads with the decline

Table 3 ANOVA for each of the three dependent variables

	Service road	No service road	P
LVALUE (SR/m <sup>2</sup> )	1965	1695	0.46
MRENT (SR/Unit)	13,131	16,383	0.02
SHRENT (SR/m <sup>2</sup> )	757	605	0.26

Table 4 Linear regression analysis

Variable	Coefficient	T-score
CONSTANT	1050.06	1.264
MRENT	0.120	2.859
SHRENT	0.822	1.974
SERVICE	-285.712	-1.076
LANES	-165.628	-0.592
VOLUME	-0.014	-1.700

R-squared = 0.332, N = 44, F-ratio = 3.785, P = 0.007.



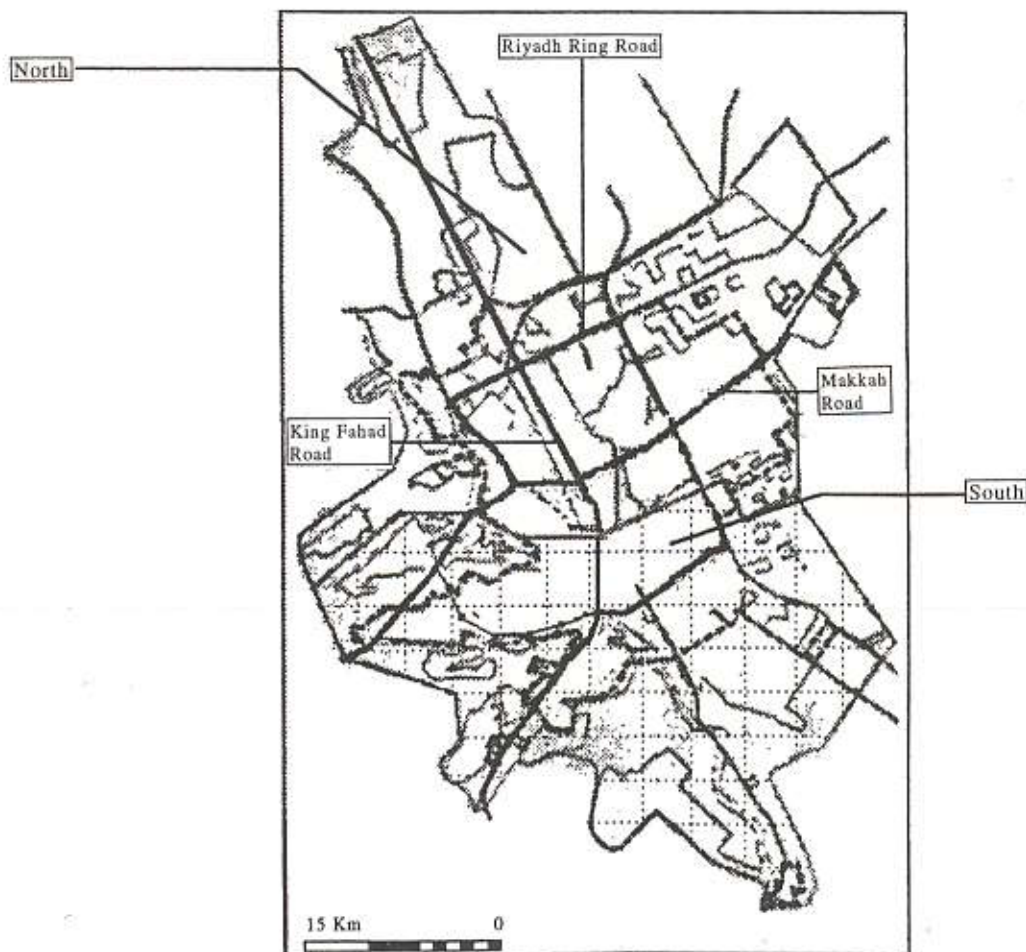


Figure 2 Riyadh map (north and south and major roads).  
Source: Alskait, 1993.

Table 5 ANOVA for land value and mixed-use rent (north and south)

	North (mean)	South (mean)	P
LVALUE (SR/m <sup>2</sup> )	2253	1492	0.027
MRENT (SR/Unit)	17,710	10,789	0.000

of land values and shop rents. Generally speaking, three lanes seems to be the number at which shop rents peak. In the south the significant difference is in mixed-use rent, an opposite pattern to that of the north. The rental income of a unit was found to be higher when there are more lanes and no service roads. Again, this outcome might also support the previous argument of associating service roads with declining land values and shop rents.

#### Traffic volume and property value and rent

While it has been recognised in many other studies (e.g. Sandahl and Lindh, 1995) that shop rent is directly influenced by expected turnover, which in turn is influenced by traffic and pedestrian volumes (exposure), traffic volume in this study failed to correlate meaningfully with shop rents.

This study has found that the daily traffic volume (VOLUME) and the daily traffic volume per lane (VPLANE) have surprisingly weak relationships with both land values and shop rents. Traffic volume was expected to correlate highly with land values and shop rents simply because a higher volume means a higher exposure of shops to automobile users, representing a very important element in advertising the shop. The data in this study did not confirm this expected relation. Indeed, the relation of shop rents and traffic volume per lane was weak whether there was a service road or not. Figure 3 shows that there is no clear pattern between rents and traffic volume. However, there seems to be a logical explanation for the above finding. This may be related to the relatively high traffic volume on the surveyed roads. It is assumed that about 10,000 daily trips are needed to make a selected road commercially viable (Abudulhameed, 1986). The average daily volume on the surveyed roads is about six times this figure. Therefore, one may assume that all of these roads are commercially viable and the variation of their traffic is of little impact since almost all of them carry more than enough traffic to support abutting businesses.

Table 6 ANOVA for land value and rent (north and south)

	North (mean)		South (mean)		P(North)	P(South)
	No service road	Service road	No service road	Service road		
LVALUE (SR/m <sup>2</sup> )	2570	1893	1554	1271	0.14	0.477
MRENT (SR/Unit)	17,279	8200	10,310	12,500	0.62	0.052
SHRENT (SR/m <sup>2</sup> )	714	653	784	509	0.16	0.17

Table 7 Difference in LVALUE, MRENT, and SHRENT between Groups I and II<sup>a</sup>

	North	South
Cases with service roads	No <sup>b</sup>	No
Cases without service roads	Yes	No

<sup>a</sup>Group I ≤ 3 Lanes; Group II > 3 Lanes.<sup>b</sup>No = difference does not exist. Yes = significant difference exist.

Further analysis suggests that the mean shop rents increase, although not statistically significantly, with the increase in traffic volume per lane (Figure 4). Volume per lane was categorised into four groups, as in Table 8, and their relations with the three dependent variables of this study (land value, shop rent, and mixed-use rent) were examined. Land value does not seem to have any specific pattern of association with respect to traffic volume; on the other hand, mixed-use rents seem to decrease with the increase of volume while shop rents tend to increase progressively with volume up to a certain level (in this case 3500–7000 veh./lane/day) then this increase starts to slow down.

In addition, as shown in Figure 4, any increase in traffic after such a level will have a marginal effect

on the rent of a shop. It should be noted; however, that all the aforementioned relationships are insignificant.

### Conclusions and recommendations

With the exception of some indications that the presence of service roads enhances mixed-use unit rents, this research has shown that there is no statistically significant relationship between the presence of service roads and land values and shop rents. In addition, it was found that the location of the property (north vs. south) is the most critical factor influencing land value, in Riyadh, where commercial land (i.e. land zoned for mixed uses) located in the northern section of the city has been found to be about 50% higher in value than those in the southern section. Also, a weak relationship between traffic volume per lane and shop rents was found with the latter rising with increases in traffic. Adversely, mixed-use unit rent (office and apartment) seems to decrease with increases in lane traffic volume.

It is noteworthy that the service roads considered in this study were well designed with adequate access points. Additional studies are recommended, particu-

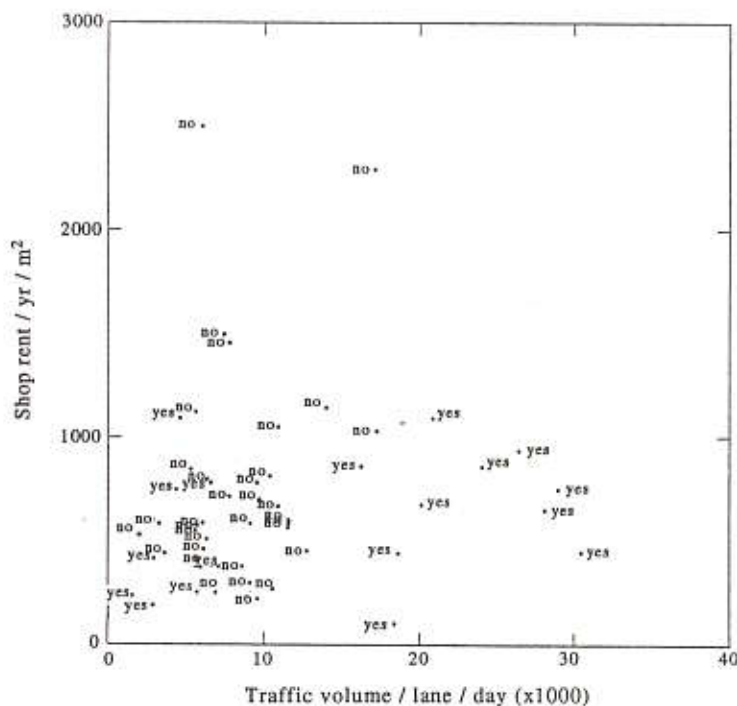


Figure 3 Shop rent vs. traffic volume grouped by service road (service road is present = Y, service road is not present = N).



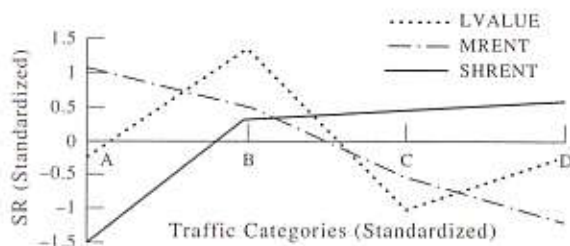


Figure 4 LVALUE, MRENT, SHRENT vs. VPLANE.

Table 8 Mean values of dependent variables classified by traffic categories

Category	VPLANE	LVALUE	MRENT	SHRENT
A = 3500	3557	1634	15,227	505
B = 3500-7000	6000	2382	14,352	725
C = 7000-10,000	8611	1311	12,596	744
D > 10,500	10,898	1676	11,517	766

larly in the form of a *before and after study*, to examine those service roads which have no exits or entries to their main roads except at road junctions. Such experiments may provide additional insights into whether limiting the access only (and not the exposure) has any effect on the value and rent of abutting properties.

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