

Commentary

Understanding the Willingness to Make the Modal Shift to the New Metro in Riyadh

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Abstract

Riyadh, Saudi Arabia's capital and main financial hub, is currently facing substantial urban growth pressures. The city suffers from serious traffic congestion, especially at peak hours. Owing to the city's high level of urbanization, travel demands are expected to increase. This demand cannot be met through car-based infrastructure development alone. Therefore, the Saudi government has introduced a proposal for a new metro rail system in the city. As this will be the first metro system in Riyadh, residents' perceptions of this new development are not yet clear. This study attempts to understand travelers' willingness to change their mode of travel to the new metro system. The Arriyadh Development Authority (now called the Royal Commission for Riyadh City) conducted a questionnaire survey in 2013 to collect data on respondents' current mode of transportation. The survey also collected their travel details and socioeconomic characteristics, which were considered the major factors influencing their mode choice. The Authority also included a stated preference (SP) component in the survey to gauge respondents' willingness to shift modes by framing different scenarios. Descriptive statistics were applied to understand respondents' preference shifts. Owning a car, the purpose of a trip, the walk time, the travel time and transfer requirements were found to be critical to potential modal shifts.

Introduction

Public transport plays a major role in urban mobility (Banister 2001). For instance, in some Asian and Western cities, public transport accounts for more than 51% of all travel modes. By contrast, it accounts for less than 10% of travel in car-oriented cities in the United States (U.S.) and Gulf region (UN-HABITAT 2010). Riyadh, as one of the most populous cities in Saudi Arabia, has 1,121 square kilometers (km²) of developed land (UN-HABITAT 2016) and a population of eight million people (GaStat 2016). With its high level of urbanization and increasing travel demands, the city suffers from traffic congestion, especially at peak times. Only 2% of residents' eight million daily trips are made by bus (Al-Fouzan 2012; Alqahtani, Al-Badi, and Mayhew 2012). In the last 50 years, Riyadh has experienced dramatic growth in urban development and motorization (Al-Hathloul 2017). According to the Royal Commission for Riyadh City (RCRC), which before 2019 was the Arriyadh Development Authority (ADA), the city is highly reliant on private cars, which are used for over 92% of daily trips (ADA 2015). As a result, the city routinely experiences traffic congestion, a high car fatality rate as well as social, economic and environmental impacts. The increased availability of alternative options, such as public transport, can limit private car use, which may result in fewer negative consequences. Accordingly, the RCRC introduced a new investment project worth US\$22.5 billion to build a new public transit system, including metro rail and bus transit. However, the vast majority of Riyadh residents have never used public transport, and they have built their way of life around private cars. Economic solvency due to the oil boom in the 1970s and rapid urbanization have led to widespread car ownership, which has determined the structure and behavior of Saudi families (Al-Fouzan 2012). Consequently, this study attempts to understand and comment on residents' willingness to make modal shift decisions in response to the introduction of new transport alternatives in Riyadh.

Data and methods

This study used stated preference (SP) survey data collected by the ADA in November 2013. SP is a survey tool that helps with forecasting decisions by asking respondents questions about their possible choices in hypothetical situations given a specific set of conditions. In this case, each respondent was asked to consider nine situations (the situations are illustrated in Appendix B) and to decide, based on these scenarios, whether to make a modal shift to the metro. Diadro Consulting was commissioned to administer this survey. The survey considered mode-specific attributes, such as in-vehicle time, one-way travel costs, walking time and waiting time, to understand respondents' willingness to switch to the metro. A sample of 520 respondents across Riyadh were recruited. The main questionnaire was divided into six sub-questionnaires, denoted as D1, D2, D3, D4, D5 and D6, by current mode of transport and transfer requirements. The D1, D2 and D3 sub-questionnaires were given to respondents who used cars. D4, D5 and D6 were given to taxi, company bus and private bus/van users, respectively. Descriptions of the sub-questionnaires are provided in Table 1.

This paper applied a descriptive statistics analysis approach to explore users' potential willingness to shift transport modes due to the introduction of the new metro in Riyadh.

Table 1. Description of sub-questionnaires.

Type of questionnaire	Mode users	Shift to
D1	Car	Metro (without transfer requirement)
D2	Car	Metro (with transfer requirement)
D3	Car	Bus
D4	Taxi	Metro
D5	Company bus	Metro
D6	Private bus/van	Metro

Results and discussions

Willingness to shift by current mode use

Table 2 (in Appendix A) elucidates the willingness of Riyadh citizens to switch to the metro from their current transport mode. According to the survey, about 56% of respondents were car users, either drivers or passengers. As can be seen in Table 2, about 42.2% of current car drivers intended to shift to the proposed metro, whereas 35% of current car passengers planned to switch under situation 1. The results also show that non-car users had the highest shift intention across all situations, as expected. According to the survey, car users

spent about 7 Saudi riyals (SAR) per one-way trip, while non-car users spent about 30 SAR — except for those taking free company buses. The proposed metro will offer fares between 3 SAR and 7 SAR for one trip. Therefore, it is reasonable that non-car users would have a higher intention to shift to the metro.

Willingness to shift by personal attributes

Table 3 (in Appendix A) describes the variation in the willingness to adopt a modal shift based on personal attributes. Households with more than one car were more likely to choose the metro. This is probably because household members who use the second or third car are expected to use the metro to reduce vehicle operating costs. As shown in Table 3, respondents were more likely to switch to the metro for their work commutes than for trips made for other purposes. This is because time-related reliability is a high priority for work commuters, and the metro will likely be better able to meet this need than cars or other modes of transport. In general, the distance between residential areas and work locations is long because of low-density development in Riyadh, and serious traffic congestion adds more uncertainty to work commutes. Metro services may become a more time-reliable alternative to driving a car.

Over 70% of housewives expressed their willingness to choose the metro if it became available. Women in Saudi Arabia were not allowed to drive at the time the survey was conducted, and therefore, they were able to be car passengers only, meaning they were dependent on another male driver. To avoid this dependency and to travel independently, most housewives surveyed expressed their intention to shift to metro use. Employed and retired persons also showed a significant interest in taking the metro. Over 80% of respondents who lived with unrelated individuals (rather than family members) were likely to move to using the metro. According to the 2013 SP survey, only 1.2% of this sample owned a car, and only 7.8% of this 1.2% made trips by car. Therefore, the majority of this group either traveled by company bus or private bus/van. Hence, most of this group intended to shift to the metro, as also demonstrated in the earlier discussion of Table 2. It seems that elderly people intend to use the metro more than other age groups, as the metro would be more convenient for them than driving a car. The natural ageing process is accompanied by physiological changes that can have significant consequences for mobility. Consequently, older people tend to make fewer journeys than other adults, and they may be more willing to change their transport mode.

Shift likelihood by current travel time

Figure 1 (in Appendix A) shows the likelihood of respondents embracing a modal shift to the metro by the variation in their current travel times. The results reflected a higher likelihood of shifting for trips that had comparatively longer travel times (e.g., >30 minutes) with their current mode. As shown in Table 2, private bus/van users were more likely to move to the metro than those who used other modes. As seen in Figures 1a and 1b, a transfer requirement resulted

in a lower likelihood of modal shift. For instance, about 60% of trips with over 50 minutes of travel time were likely to shift modes if no transfer is required, whereas this likelihood is reduced to about 25% when a transfer is required. A transfer requires extra time on top of in-vehicle travel time, and this may be the reason for the reduced likelihood of modal shifts under the transfer scenario. For private bus/van trips, most private bus/van lines are very crowded, especially at peak times. Therefore, private bus/van travelers tend to choose the metro to get a better service and avoid congestion.

Shift likelihood by current wait time

As there was no wait time for car users, the likelihood by the variation of wait time was not estimated (Figure 2, Appendix A). For the other modes of transport, the results showed a higher modal shift intention if the wait time was five minutes or longer. Taxi users had shorter waiting times than passengers of company buses or private buses/vans. For example, the longest acceptable wait time for taxi users was five minutes, and more than 60% of them intended to choose the metro. Company bus and private bus/van travelers generally accepted longer waiting times (even more than 20 minutes), which motivated them to shift to the metro.

Shift likelihood by current walk time

When the current walk time was more than 10 minutes, the likelihood of a shift became very high for car users (Figure 3a, Appendix A). By contrast, a transfer with the same walk time (>10 minutes) for car users (Figure 3b, Appendix A) resulted in a lower likelihood of modal shift, meaning that if a transfer is required in addition to more walk time, the likelihood of shifting is decreased. Private bus/van users with over 10-minute walk times were most likely to shift to the metro.

Pedestrian accessibility to transit is well recognized as an important factor in determining ridership (Wibowo and Chalermpong 2010). Within a reasonable walking time, i.e, 5–10 minutes, a quality walking environment can make walking to the station/stop more attractive, thereby inducing a modal shift to transit. Having transit stations/stops that can be reached within about 10 minutes (e.g., Riyadh metro offers about 10- to 12-minute walk times where necessary) from the surrounding neighborhood could be the main issue in egress trips. Walking is one of the basic modes of transportation, and it constitutes an important component of the transportation system, especially in public transportation. The concept of transit accessibility is therefore associated with a certain threshold in terms of walking time or distance.

Conclusions

This paper discusses and comments on the willingness of Riyadh residents to change their current mode of transportation to metro transit using the SP survey data. The study illustrated this willingness based on specific individual factors (car ownership, trip purpose, occupation, family type and age) as well as mode-specific attributes (travel time, walk time and wait time). It is important to gain a better understanding of the

implications of the newly introduced metro service for urban transformation in a highly urbanized and motorized city like Riyadh.

The introduction of the Riyadh metro is expected to significantly enhance the overall transport system within the travel corridor it serves. The scale of its positive influence depends, of course, on the introduction of parallel policies supporting metro operations. Such policies would include, for example, implementing transit-oriented development, station parking strategy/availability and park-and-ride initiatives. Moreover, any attempt to increase metro ridership may also require action to discourage the use of private cars. At this point, the low-cost elasticity of auto and road pricing or even a complete ban on private cars along a few lanes of a corridor, along a whole corridor or within a specific area can be considered. A number of free lanes could be used to upgrade the quality of pedestrian movements while the remaining could be used exclusively by bus rapid transit in an effort to improve bus travel times, and thus substantially increase bus ridership. This study identifies the following significant insights into the willingness of Riyadh residents to shift to the metro:

1. *Car vs. non-car users.* Most non-car users were expected to shift to the metro. However, car users also expressed their intention to change their mode choice to the metro.
2. *Work vs. non-work trips.* Respondents were more likely to move to the metro for their work commutes than for other trip purposes.
3. *Housewives vs. other occupations.* Over 70% of housewives expressed a willingness to choose the metro, followed by employed and retired persons. It should be noted here that women were not allowed to drive in Saudi Arabia at the time the survey was conducted. However, as of 2018, women are now allowed to drive; this change is not reflected in our analysis.
4. *Older vs. younger.* Elderly people were more likely to shift modes than younger people.
5. *Transfer vs. non-transfer requirement.* The transfer requirement is an important factor in the modal shift choice: People are far less likely to shift transport modes if a transfer is needed.
6. *Lower vs. higher travel time.* Intention to switch is, rationally, higher for trips that involve long travel times (e.g., >30minutes) via the current mode.
7. *Walk time less than five minutes vs. over five minutes.* Trips that require over five minutes of walk time with the current mode trigger travelers to use the metro.

Finally, this paper highlighted the importance of factors that affect modal shift, which may contribute to achieving sustainable urban mobility in Riyadh. However, the study underscores the challenge of identifying the dynamics behind modal choice behaviors. The shift is intrinsically complex, involving many interrelated factors that determine the likelihood of achieving

a notable level of modal shift. These include personal and societal factors as well as a lack of understanding of the system-level effects of certain measures to encourage greater patronage. As a result, it is imperative to adopt a holistic approach that considers the needs of all involved stakeholders, including policymakers, public transport operators, industrial partners and travelers.

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Appendix A

Table 2: Willingness to adopt a modal shift to metro by current transport mode.

Mode (sample)	Current use (%)	Willingness to shift (%)								
		S1	S2	S3	S4	S5	S6	S7	S8	S9
Car driver (249)	47.88	42.17	35.34	34.94	37.75	37.35	30.12	48.59	45.38	41.77
Car passenger (40)	7.69	35.00	37.50	20.00	20.00	25.00	17.50	55.00	32.50	27.50
Taxi/limousine (50)	9.62	76.00	56.00	40.00	50.00	22.00	38.00	60.00	62.00	46.00
Company bus (51)	9.81	82.35	37.25	54.90	58.82	23.53	56.86	72.55	72.55	64.71
Bus or private van (130)	25.00	72.31	68.46	71.54	66.92	62.31	69.23	73.08	71.54	71.54

Table 3: Willingness to shift to metro by personal attributes.

Attributes	Values	Willingness to shift (%)								
		S1	S2	S3	S4	S5	S6	S7	S8	S9
Car ownership	1	49.01	42.08	39.60	37.62	34.16	33.17	56.93	48.02	46.04
	2	51.81	44.58	32.53	45.78	37.35	39.76	55.42	54.22	49.40
	3–8	50.38	40.46	41.22	42.75	38.17	32.82	47.33	48.09	38.93
Purpose	Work	62.40	50.00	52.80	52.00	46.00	50.80	64.00	60.80	58.40
	Shopping	50.54	41.94	43.01	39.78	36.56	37.63	59.14	49.46	48.39
	Personal business	45.83	41.67	41.67	37.50	20.83	33.33	66.67	45.83	20.83
	Social and recreation	43.75	40.63	31.25	53.13	40.63	31.25	48.44	50.00	43.75
	Medical	50.00	50.00	20.00	40.00	20.00	50.00	40.00	50.00	40.00
	School	58.33	41.67	41.67	29.17	20.83	29.17	37.50	45.83	45.83
	Job related	56.25	37.50	43.75	43.75	37.50	37.50	50.00	50.00	56.25

Attributes	Values	Willingness to shift (%)								
		S1	S2	S3	S4	S5	S6	S7	S8	S9
Occupation	Employed	55.87	45.92	47.45	47.45	41.33	44.39	60.71	57.14	57.14
	Student	56.82	44.32	35.23	39.77	31.82	29.55	52.27	48.86	48.86
	Housewife	81.82	72.73	72.73	72.73	72.73	81.82	81.82	72.73	72.73
	Retired	50.00	66.67	50.00	50.00	16.67	50.00	66.67	50.00	50.00
	Looking for work	54.55	36.36	36.36	54.55	36.36	36.36	36.36	40.91	40.91
	Not looking for work	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Family type	Single person	60.19	41.67	44.44	43.52	36.11	39.81	60.19	58.33	58.33
	Nuclear family	49.54	43.77	40.73	42.86	37.69	37.69	54.71	49.85	49.85
	Extended family	67.50	52.50	55.00	50.00	47.50	45.00	55.00	60.00	60.00
	Shared housing with unrelated individuals	89.47	71.05	76.32	81.58	60.53	86.84	92.11	86.84	86.84
Age group	16–25	51.18	44.71	40.00	43.53	35.29	37.65	52.35	49.41	49.41
	26–35	59.02	44.39	45.85	47.80	44.39	43.41	58.54	59.02	59.02
	36–45	58.65	50.96	52.88	49.04	41.35	46.15	68.27	55.77	55.77
	46–55	54.55	36.36	45.45	51.52	30.30	45.45	60.61	60.61	60.61
	55+	75.00	87.50	50.00	50.00	37.50	50.00	62.50	50.00	50.00

Figure 1. Likelihood of modal shift by travel time and current mode choice.

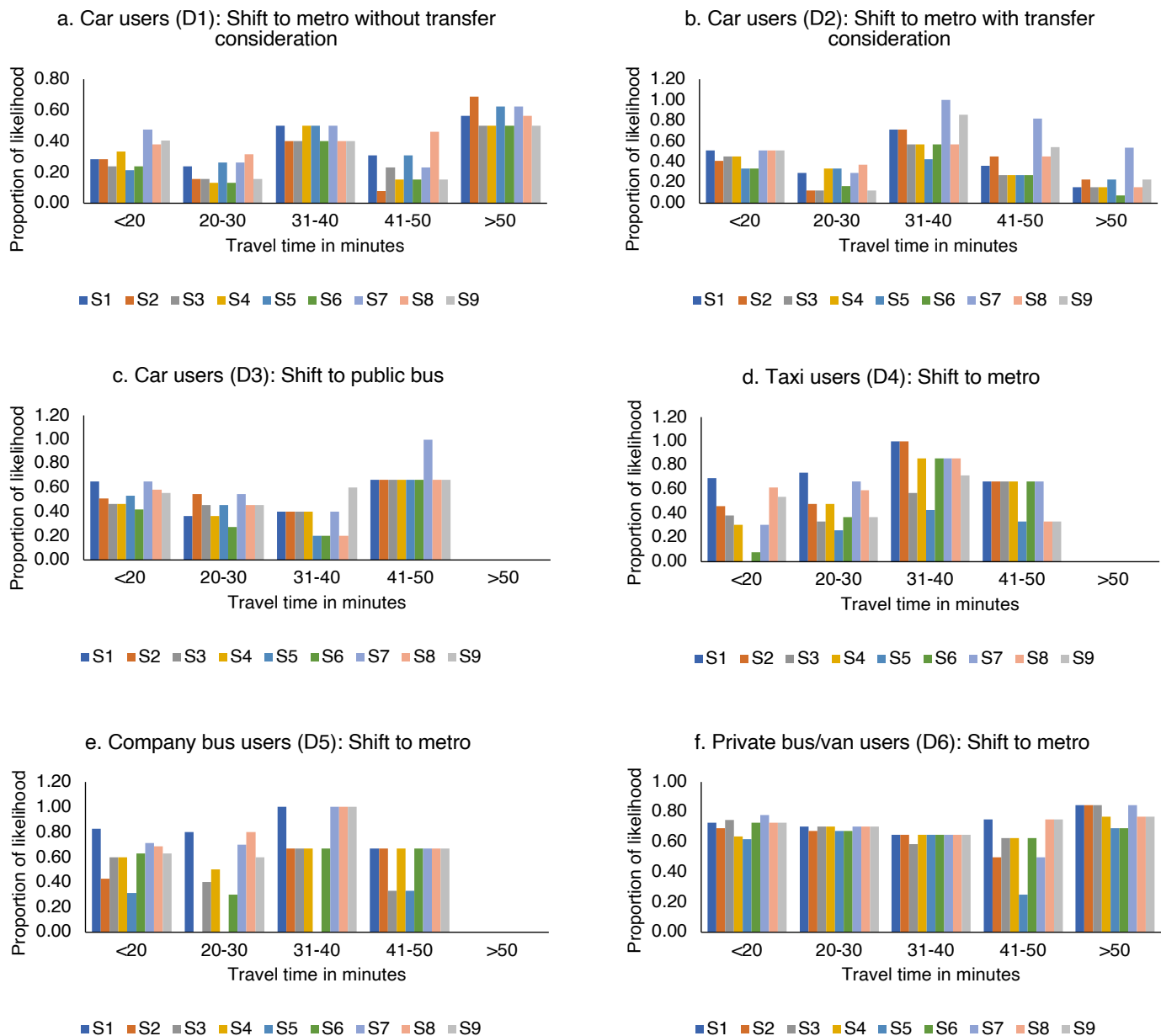


Figure 2. Likelihood of modal shift by wait time and current mode choice.

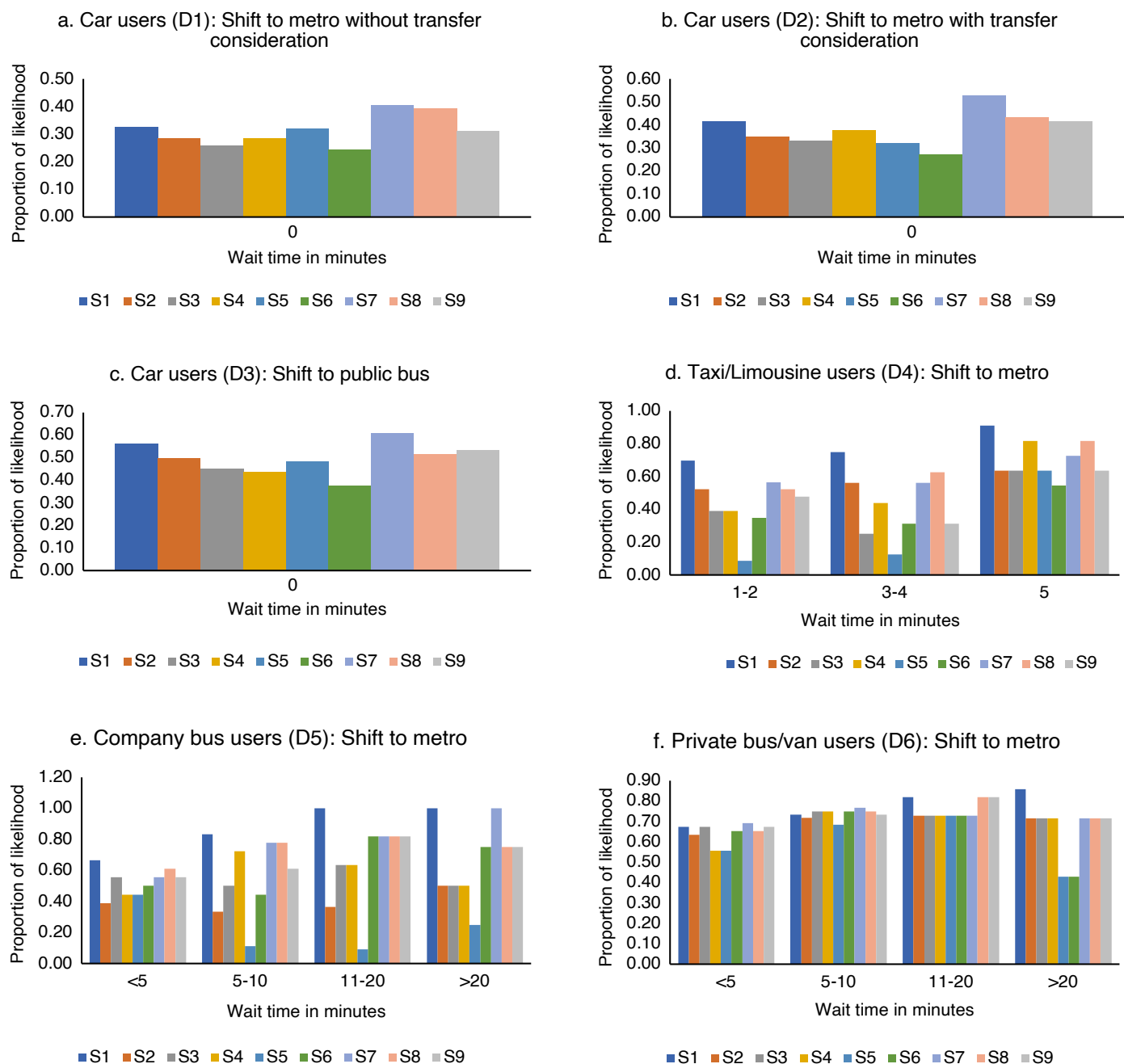
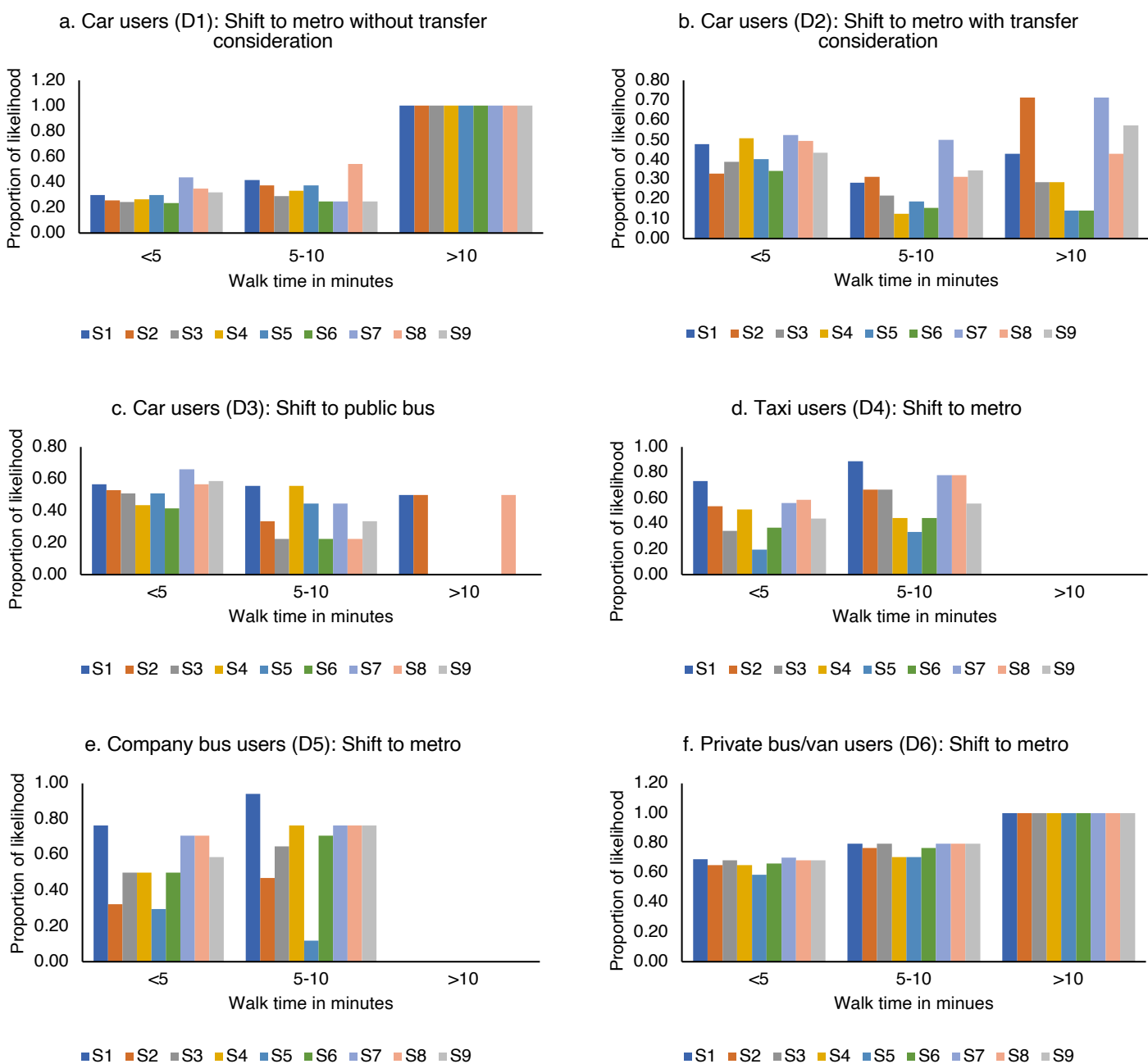


Figure 3. Likelihood of modal shift by walk time and current mode choice.



Appendix B

A Spanish consulting firm, Diadro Consulting Espana, was commissioned to administer the SP survey to evaluate metro preferences. Diadro used six questionnaires, denoted as D1, D2, D3, D4, D5 and D6, and each questionnaire contained nine unique situations. Accordingly, there were a total of 54 situations, as shown below:

		Card type D1: Car users (SP: Car to metro without transfer consideration)																	
Attributes	S1		S2		S3		S4		S5		S6		S7		S8		S9		
	Metro	Car	Metro	Car	Metro	Car	Metro	Car	Metro	Car	Metro	Car	Metro	Car	Metro	Car	Metro	Car	
Fare/parking fee	3 SAR	Free	5 SAR	10 SAR	3 SAR	Free	7 SAR	Free	7 SAR	Free	7 SAR	Free	5 SAR	10 SAR	3 SAR	Free	5 SAR	10 SAR	
Wait time	7 minutes	None	7 minutes	None	4 minutes	None	2 minutes	None	7 minutes	None	4 minutes	None	2 minutes	None	2 minutes	None	4 minutes	None	
Travel time	Last trip - 15 minutes	Same as last	Last trip - 8 minutes	Same as last	Last trip - 8 minutes	Same as last	Last trip - 8 minutes	Same as last	Last trip - 5 minutes	Same as last	Last trip - 15 minutes	Same as last	Last trip - 15 minutes	Same as last	Last trip - 5 minutes	Same as last	Last trip - 5 minutes	Same as last	
Walk time	Same as last	Same as last	Last trip + 5 minutes	Same as last	Last trip + 3 minutes	Same as last	Same as last	Same as last	Last trip + 3 minutes	Same as last	Last trip + 5 minutes	Same as last	Last trip + 3 minutes	Same as last	Last trip + 5 minutes	Same as last	Same as last	Same as last	

		Card type D2: Car users (SP: Car to metro with transfer consideration)																	
Attributes	S1		S2		S3		S4		S5		S6		S7		S8		S9		
	Metro	Car	Metro	Car	Metro	Car	Metro	Car	Metro	Car	Metro	Car	Metro	Car	Metro	Car	Metro	Car	
Fare/parking fee	5 SAR	Free	7 SAR	10 SAR	3 SAR	Free	3 SAR	Free	7 SAR	10 SAR	5 SAR	Free	5 SAR	Free	4 SAR	Free	5 SAR	Free	
Wait time	7 minutes	None	7 minutes	None	7 minutes	None	2 minutes	None	2 minutes	None	2 minutes	None	7 minutes	None	5 minutes	None	2 minutes	None	
Travel time	Last trip - 12 minutes	Same as last	Last trip - 5 minutes	Same as last	Last trip - 12 minutes	Same as last	Last trip - 5 minutes	Same as last	Last trip - 12 minutes	Same as last	Last trip - 12 minutes	Same as last	Last trip - 5 minutes	Same as last	Last trip - 8 minutes	Same as last	Last trip - 5 minutes	Same as last	
Walk time	Same as last	Same as last	Same as last	Same as last	Last trip + 5 minutes	Same as last	Same as last	Same as last	Last trip + 5 minutes	Same as last	Same as last	Same as last	Last trip + 5 minutes	Same as last	Last trip - 2 minutes	Same as last	Last trip + 5 minutes	Same as last	
Transfer required	No	None	Yes	None	Yes	None	No	None	No	None	Yes	None	No	None	No	None	Yes	None	

		Card type D3: Car users (SP: Car to public bus)																	
Attributes	S1		S2		S3		S4		S5		S6		S7		S8		S9		
	Public bus	Car	Public bus	Car	Public bus	Car	Public bus	Car	Public bus	Car	Public bus	Car	Public bus	Car	Public bus	Car	Public bus	Car	
Fare/parking fee	3 SAR	Free	5 SAR	10 SAR	3 SAR	Free	6 SAR	7 SAR	6 SAR	7 SAR	6 SAR	7 SAR	5 SAR	10 SAR	3 SAR	Free	5 SAR	10 SAR	
Wait time	2 minutes	None	2 minutes	None	8 minutes	None	4 minutes	None	2 minutes	None	8 minutes	None	4 minutes	None	4 minutes	None	8 minutes	None	
Travel time	Last trip + 10 minutes	Same as last	Last trip + 5 minutes	Same as last	Last trip + 5 minutes	Same as last	Last trip + 5 minutes	Same as last	Same as last	Same as last	Last trip + 10 minutes	Same as last	Last trip + 10 minutes	Same as last	Same as last	Same as last	Same as last	Same as last	
Walk time	Same as last	Same as last	Last trip + 2 minutes	Same as last	Last trip + 5 minutes	Same as last	Same as last	Same as last	Last trip + 5 minutes	Same as last	Last trip + 2 minutes	Same as last	Last trip + 5 minutes	Same as last	Last trip + 2 minutes	Same as last	Same as last	Same as last	

Card type D4: Taxi/limousine users (SP: Taxi to metro)																		
Attributes	S1		S2		S3		S4		S5		S6		S7		S8		S9	
	Metro	Taxi	Metro	Taxi	Metro	Taxi	Metro	Taxi	Metro	Taxi	Metro	Taxi	Metro	Taxi	Metro	Taxi	Metro	Taxi
Fare	3 SAR	Same as last	5 SAR	Same as last	3 SAR	Same as last	7 SAR	Same as last	7 SAR	Same as last	7 SAR	Same as last	5 SAR	Same as last	3 SAR	Same as last	5 SAR	Same as last
Wait time	7 minutes	Same as last	7 minutes	Same as last	4 minutes	Same as last	2 minutes	Same as last	7 minutes	Same as last	4 minutes	Same as last	2 minutes	Same as last	2 minutes	Same as last	4 minutes	Same as last
Travel time	Last trip - 13 minutes	Same as last	Last trip - 7 minutes	Same as last	Last trip - 7 minutes	Same as last	Last trip - 7 minutes	Same as last	Last trip - 4 minutes	Same as last	Last trip - 13 minutes	Same as last	Last trip - 13 minutes	Same as last	Last trip - 4 minutes	Same as last	Last trip - 4 minutes	Same as last
Walk time	5 minutes	Same as last	8 minutes	Same as last	12 minutes	Same as last	5 minutes	Same as last	12 minutes	Same as last	8 minutes	Same as last	12 minutes	Same as last	8 minutes	Same as last	5 minutes	Same as last

Card type D5: Company bus users (SP: Company bus to metro)																		
Attributes	S1		S2		S3		S4		S5		S6		S7		S8		S9	
	Metro	Company bus	Metro	Company bus	Metro	Company bus	Metro	Company bus	Metro	Company bus	Metro	Company bus	Metro	Company bus	Metro	Company bus	Metro	Company bus
Fare	3 SAR	None	5 SAR	None	3 SAR	Same as last	7 SAR	None	7 SAR	None	7 SAR	None	5 SAR	None	3 SAR	None	5 SAR	None
Wait time	7 minutes	Same as last	7 minutes	Same as last	4 minutes	Same as last	2 minutes	Same as last	7 minutes	Same as last	4 minutes	Same as last	2 minutes	Same as last	2 minutes	Same as last	4 minutes	Same as last
Travel time	Last trip - 10 minutes	Same as last	Last trip - 5 minutes	Same as last	Last trip - 5 minutes	Same as last	Last trip - 5 minutes	Same as last	Same as last	Same as last	Last trip - 12 minutes	Same as last	Last trip - 10 minutes	Same as last	Same as last	Same as last	Same as last	Same as last
Walk time	Last trip - 12 minutes	Same as last	Last trip - 5 minutes	Same as last	Same as last	Same as last	Last trip - 12 minutes	Same as last	Same as last	Same as last	Last trip - 5 minutes	Same as last	Same as last	Same as last	Last trip - 5 minutes	Same as last	Last trip - 12 minutes	Same as last

Card type D6: Bus/private van users (SP: Private bus/van to metro)																		
Attributes	S1		S2		S3		S4		S5		S6		S7		S8		S9	
	Metro	Bus/private van	Metro	Bus/private van	Metro	Bus/private van	Metro	Bus/private van	Metro	Bus/private van	Metro	Bus/private van	Metro	Bus/private van	Metro	Bus/private van	Metro	Bus/private van
Fare	3 SAR	Same as last	5 SAR	Same as last	3 SAR	Same as last	7 SAR	Same as last	7 SAR	Same as last	7 SAR	Same as last	5 SAR	Same as last	3 SAR	Same as last	5 SAR	Same as last
Wait time	7 minutes	Same as last	7 minutes	Same as last	4 minutes	Same as last	2 minutes	Same as last	7 minutes	Same as last	4 minutes	Same as last	2 minutes	Same as last	2 minutes	Same as last	4 minutes	Same as last
Travel time	Last trip - 10 minutes	Same as last	Last trip - 5 minutes	Same as last	Last trip - 5 minutes	Same as last	Last trip - 5 minutes	Same as last	Same as last	Same as last	Last trip - 10 minutes	Same as last	Last trip - 10 minutes	Same as last	Same as last trip	Same as last	Same as last	Same as last
Walk time	Last trip - 12 minutes	Same as last	Last trip - 5 minutes	Same as last	Same as last	Same as last	Last trip - 12 minutes	Same as last	Same as last	Same as last	Last trip - 5 minutes	Same as last	Same as last	Same as last	Last trip - 5 minutes	Same as last	Last trip - 12 minutes	Same as last

About the project

This study is part of the ongoing project, “KAPSARC Spatial Urban Energy System (KSUES).” It comprises two components: an (i) urban energy model (UEM) and (ii) a spatial economic mode (SEM). The project has three objectives: (i) to achieve energy efficiency through transit-oriented development (TOD) in the transportation and electricity sectors, (ii) to gain additional efficiency by realizing the potential opportunity of innovative and smart technologies offered by TOD, and (iii) to investigate the energy and economic impact (including real estate development) of Riyadh transportation, land use and urban planning interventions. This Commentary falls within the first component and addresses the first objective. The energy efficiency gains through TOD are directly related to land use changes and a modal shift to public transport. Knowing residents’ willingness to make a potential modal shift is an important step in implementing the public transport infrastructure project. Therefore, it has become imperative to obtain a better understanding of the factors that might impact travelers’ intentions to embrace a modal shift in transportation in a highly urbanized and motorized city like Riyadh.



About KAPSARC

The King Abdullah Petroleum Studies and Research Center (KAPSARC) is a non-profit global institution dedicated to independent research into energy economics, policy, technology and the environment, across all types of energy. KAPSARC's mandate is to advance the understanding of energy challenges and opportunities facing the world today and tomorrow, through unbiased, independent, and high-caliber research for the benefit of society. KAPSARC is located in Riyadh, Saudi Arabia.

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