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Spatial Development of Muscat / Oman and Challenges of Public Transport

Wolfgang Scholz & Sebastian Langer

Abstract

This article focuses on the current situation of urban planning and mobility in Muscat, Oman. It starts by analysing the proposed planned urban development and its present reality by comparing the physical planning framework developed by Weidleplan in 1990 to today’s situation, derived from recent satellite images and open geospatial data. In a second step it analyses the different modes of transport by user surveys conducted in 2016. As conclusion the article proposes ideas for improvements in urban planning and mobility taking two case studies as examples for detailed studies. The article gives in-depth background information about the legal and administrative framework surrounding the land planning and development. It highlights the issues that are caused by the combination of the natural limitations of the city and the current practices of spatial development. Muscat serves as case study since it is rather a small ordinary city which cannot be compared with Dubai, Abu Dhabi or others following a hyper urbanisation trend. It rather stands for the secondary cities in the Gulf Region and can serve as example for them.

Introduction

The Sultanate of Oman has been undergoing massive changes in the last 50 years. The Gulf State transformed from a very traditional and isolated country into a wealthy, open and modern state. This transition was to the largest part due to the discovery of oil in the late 1950s and the influence of Oman’s Sultan Qaboos on the development of the country. After Sultan Said was enthroned in 1970, the young Sultan Qaboos began to modernise Oman’s economy and started an educational and cultural renaissance, which continues up to these days. Sultan Qaboos, who is still in power, started the exploitation of oil and opened the local economy to the international market.¹ The wealth that came with the oil industry was followed by huge demographic changes and challenges with an increasing population.

Changes could also be observed along the lines of the continuous urbanisation tendencies in the different parts of the country. Especially the Muscat Capital Area (MCA), located in the Al Batinah coastal plain, experienced massive changes. Oman has experienced an era of intensive and rapid modernisation and the Capital Area of Muscat is undergoing an almost unprecedented process of urbanisation. It is fuelled by its capital function as well as being the economic centre of the country and a still less developed and serviced countryside. Over the course of the last 30 years the population of Oman has tripled from 1,557,000 inhabitants in 1986 to 4,654,000 in 2016 including 44% non-nationals while in the MCA even from 350,000 to 1.56 million as of September 2015.

The Muscat Capital Area stretches over a length of approximately 80km from the traditional twin harbour towns of historic Muscat and Mutrah in the east to As Seeb in the west and beyond towards Barka (see figure 1.1). The total city area covers approximately 3,500km². The urban area is delimited by the Gulf of Oman in the north and the Hajar mountain ranges in the South. These natural barriers explain the linear expansion of the metropolitan area between the two aforementioned centres. During the same period, the built up area in this region quadrupled. This massive development of the area which transformed a network of small port towns and oasis settlements into a single metropolitan area required also

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huge adaptations and investments in the infrastructure. Already in 1976, the Development Council declared the provision of infrastructure as a national planning priority.\(^6\)

In 1991, the Twin-City Development Plan of the Weidleplan Muscat Area Structure Plan sketched a comprehensive plan for the urban area which suggested a structured urban planning that focuses on some core areas along main transportation routes.\(^7\) The plan was designed to provide a guideline for the period from 1991 until 2010.

Today, the MCA is characterised by a functional segmentation of the city with industrial areas and extensive residential areas that filled up the space between the traditional port towns and oasis settlements. The new residential areas consist of free standing villas on plots that are usually surrounded by a high-rising wall. This building type ‘[...] stands diametrically opposed to social habits, environmental and climatic responsibility and, ultimately traditional Omani culture’.\(^5\) One effect of this mode of development is the massive use of space which leads to functional segregation and longer travel distances. In turn, this makes transportation infrastructure even more a bottleneck of the social and economic life in the whole metropolitan area.

Transportation projects, like most other infrastructural projects, have a huge variety of social, economic and ecologic effects themselves. They influence the quality of life, social cohesion and economic activities within any given area.\(^8\)

Von Richthofen argues, that Oman’s ‘state-orchestrated measures put the “urban” in the centre of attention’ since 1990.\(^5\) These tendencies, together with the unsustainable way of developing the land – especially in and around the MCA, show the need of conscious spatial planning that will ensure a diversified and sustainable cityscape. Today’s directions for the region will be crucial in terms of social and economic development and has been manifested in the Oman National Spatial Strategy (ONSS).

The Sultanate is aware of the limited oil resources and the revenues that are linked to the oil. Because the oil is still the countries number one economic driver, the government is looking to diversify the economy. Tourism and the creation of large logistics hubs are playing a big role in this diversification.\(^9\) Big projects within those two sectors are already advancing. However, both of these two industries rely heavily on excellent transportation networks. The main focus in the logistics sector is the creation and upgrading of a network of transportation hubs. This includes the Muscat international airport, the harbours in Sohar, Muscat, Duqm and Salalah – which has an important role as the only port between Europe and Singapore, able to serve S-class ships\(^10\) –as well as the creation of a railway between Muscat and Salalah and the integrated, further development of the road network. Especially the latter two are also of great interest for the tourism industry. Oman’s tourism


\(^7\) Weidleplan and Muamir, Muscat Area Structure Plan, 1991.


strategy mainly aims at the development of the upper-class and luxury sector, with high standard hotels along the coasts of Muscat and Salalah. Despite this focus on certain target clients, the natural landscape of Oman has a big touristic potential. However, most natural and cultural heritage sites (like the numerous forts and scenic oasis settlements) are widely dispersed and can only be accessed by longer car travel. The provision of a well-maintained, safe road network is therefore crucial for an integrated development of the tourism industry.

Urban Planning: Institutional Set-up

Most of the Omani administration including the urban planning system has changed during the political transformation process since 1970. With the establishment of the Higher Development Planning Board and the Directorate of Planning and Development in 1972, strong institutions were implemented in order to guarantee a linkage between spatial planning and economic development. Urban planning depends on the economic situation and vice versa. While the Higher Development Planning Board and the Directorate of Planning had a more legislative function to provide a comprehensive planning framework for all sectors, their planning power has been established via a Royal Decree to the Ministry of Land Affairs in 1975. The Ministry of Land Affairs has been the most important planning department in Oman on national as well as on regional and local level and it has been in charge for all planning issues. It declares and lays out plans for residential, commercial and industrial land use, sets up development plans, distributes land to citizens and coordinates the duties between all ministries and departments who are involved in the planning process. Furthermore, the Ministry of Land Affairs develops so-called Five-Year-Plans to guide Oman’s development. Until today, eight Five-Years-Plans were prepared, the last one covered the period from 2011 until 2015. In addition to the Ministry of Land Affairs, the Supreme Committee for Town Planning was established in 1985. This committee was primarily in charge of planning issues on a regional and local level. Seven planning regions and several main centres were defined to guide urban planning on the local level. This ‘general framework for town planning provisions’ led to detailed development or structure plans, combining strategic as well as physical planning approaches. Planning standards and processes were codified in the late 1980s to guarantee a nationwide consistent planning system for the planning regions. Nevertheless, these planning standards were only formally published in 2003 in the Guide to Physical Planning. Today, urban planning is undertaken by the Supreme Council of Planning (SCP), the successor of the Supreme Committee for Town Planning, and the Ministry of Housing, which was formerly part of the Ministry of Land Affairs. Task of the SCP is to guide economic development as well as to define national and urban spatial planning policies whereas the Ministry for Housing is responsible for

14 ONSS. Supreme Council for Planning, “Integration and implications for physical planning and land use,” 2014, 4-5.
land distribution to citizens and companies and urban planning in general. Furthermore, even if the Supreme Council of Planning is in charge for urban planning in general, it has to report and get a confirmation on the plans on regional and urban level from the Council of Ministers. However, every ministry and authority dealing with spatial related issues (e.g. roads, power supply) is also preparing its own sectoral plans which leads to contradictions and uncoordinated interventions.

Until today, the Weidleplan Muscat Area Structure Plan (1991) remains the base for the physical planning of the MCA and the most important source of information for analysis of the urban structure. In its final report, the Muscat Area Structure Plan states at the beginning of the chapter ‘The impact of the Transport Network’ that ‘the road system of any city or town is the most important man-made determinant of future growth and development, both in the short and in the long term.’

The Weidleplan considerations on a road network that would manage the assumed rise of vehicles in the area were based on demographic and economic forecasts. The plan assumed a grand total of between 325,000 and 560,000 vehicles by the year 2010, depending on different scenarios. Compared to the actual numbers these predictions matched more or less the dimension of the developments. According to Islam and Al Hadhrami, almost 756,000 vehicles were registered in Oman in 2009, with a yearly growth of ca. 85,000 vehicles per year. The statistical yearbook of 2015 even notes some 146,000 newly registered vehicles for 2015 alone.

Given these pre-considerations, the Weidleplan proposed a solution on a regional scale with the creation of employment opportunities in vicinity of the newly proposed residential areas and two main highways along the linear layout of the MCA. This was translated into the southern expressway, which was newly developed, and gradually opened in 2011, to complement the Sultan Qaboos highway along the coast. The plan further puts a focus on some highly frequented roundabouts along the Sultan Qaboos highway, like the Burj Al-Sahwa roundabout located at the south-western end of the international airport, and the need to develop a connection between Bowsher and Al Amrat.

Urban Planning: Land Management

One main factor shaping the urban development today is the so-called land lottery. The Ministry of Housing is in charge for the land distribution of plots to individuals and commercial actors. In Oman, all the land belongs to the Sultan who distributes plots to citizens and companies for development of residential, commercial and industrial purposes. Through the policy of land lottery, the government assigns rather randomly every Omani citizen above 23 years a plot in order to build a home. The land lottery system allocates a

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property to every Omani, independent from the current residential location or job location. The plots are cut generously at 600 m² and wide-spread, single family houses in a villa style are the prevailing residential type. The Ministry of Housing guarantees that every plot is serviced with infrastructure before it will be distributed with a land title to the applicant. This system leads to several problems. At first, applicants can only choose the region of their future plot, not the specific location. This random system prevents citizens from being able to plan their own home where they want to. This means that a plot can be distributed far away from the location of the job or their family, which may result in long travel distances. Secondly, not all distributed plots will be developed by the plot owner due to many reasons. For example, a married couple only needs one plot to build a house for the family but both partners might have got a plot already. Or the time of receiving the granted plot is not in line with personal plans, needs or capacities. Some plots are kept free from development due to speculation as the plot owner wants to sell it later on the land market at a higher price. Undeveloped plots are the main problem of the distribution system. Therefore, the population density of Muscat decreased rapidly in the last decades although the urban growth rates remain on a high level. Between 1990 and 2010, all land that was newly made accessible for building in Muscat could have accommodated a total of 800,000 people while only 300,000 residents were living there.

Figure 2.1: Expansion of the urban area between 1990 and 2014. Source: Authors.


These numbers show the large consumption of land and the real development caused by the land lottery system.\(^{22}\) Figure 2.1 displays the huge areas developed in the last decades and Figure 2.2 shows a typical situation of neighbourhood development in the Western parts of the city. Few finished constructions are surrounded by already allocated but not yet developed plots leading to a very low population density. Keeping this land management strategy in mind, the need for highly performative transport networks becomes even more evident.

![Undeveloped plots](image.png)

**Figure 2.2: Undeveloped plots. Source: Wolfgang Scholz**

Research, data sources & data gaps

For the longest time tendencies and characteristics of urbanisation processes in Oman have been under-researched. Scholz presented his research on the urban geography of Muscat in his book ‘Muscat – Sultanate Oman’ in 1990. But apart from that, the topic has not been highlighted in an extensive and comprehensive research, yet. The recent book ‘Urban Oman – Trends and perspectives of urbanisation in Muscat Capital Area’ by Nebel and von Richthofen (eds.) gives insights into the recent developments of the area. Furthermore, the book ‘Regionalizing Oman: Political, Economic and Social Dynamics’ by Wippel (2013) can give some insights into the ongoing processes in Oman. In addition to these books, a number of research papers with different focuses have been published. The authors would like to highlight the dissertation of Al Gharibi (2014) at the Technische Universität Berlin.

\(^ {22}\) ONSS, “Integration and implications for physical planning and land use”, 2014, 16-20.

One reason for the relatively sparse research landscape of studies that focus on Oman and Muscat might also be the lack of consistent, reliable baseline data of parameters linked to urban geography and urban planning. The official records and statistics are sometimes not accessible, incomplete or substantially inconsistent over time. There is some open spatial data on Oman, but it is also incomplete in most cases and not fully enriched, since most contributors to those datasets are not from the Sultanate. An additional obstacle was the re-definition of the administrative boundaries some 5 years ago. While the government uses the newly defined boundaries, they are not publicly available.

Research and statistics about traffic in Oman mainly focus the high number of road traffic accidents. The question if – and to what extent this can be correlated to the structure and layout of the current road network situation in the area will not be treated in this study. Like for many other very fast growing cities around the globe, it is difficult if not impossible to obtain consistent, reliable and complete data about the growth of Muscat over the years. The constantly improving technology in the domain of remote sensing and spatial data repositories can be used to fill this gap. Satellite imagery, aerial imagery and drones can be used to document the growth where official data is not available. Various available platforms offer different advantages. Modern commercial satellite imagery provides spatial resolutions up to 30cm. The most commonly known optical sensors in this category include the US-American programmes Worldview and Quickbird, distributed through DigitalGlobe, the French Pleiades, distributed through Airbus Defense and Space (previously Astrium), and others. But even freely available imagery can be helpful to analyse urban sprawl over time. The imagery provided by the Landsat missions have a spatial resolution of 30x30m. While the spatial resolution is much coarser, the Landsat programme offers a variety of advantages that are mainly due to the consistency within the data over a long period of time. The Landsat programme, offers the longest continuous global record of the earth’s surface. Satellite imagery from Landsat missions is being recorded since Landsat 4 which was launched 1982. Luckily, for the case of MCA this corresponds to the recent 40 years of urban development in the area. The archives of Landsat imagery were made freely accessible since 2007. Another free of charge alternative is the Sentinel-2 mission, which was first launched 2015 and provides imagery in the visible light spectrum with a spatial resolution of 10x10m. The imagery collected by the Landsat and Sentinel-2 missions is available through the online platform earthexplorer by USGS. These data sources are an excellent way for visually analysing the urban sprawl over time.

Von Richthofen and Langer used these freely accessible data to reconstruct the spatial dimensions of the Muscat’s growth over the past 30 years. The analysis used a semi-automated

approach and object based image analysis (OBIA) – based algorithms to detect urban areas.\textsuperscript{24} The reality of road planning and its relation to newly developed neighbourhoods is shown in the case study of Al Khoud by von Richthofen and Nebel. The case study shows, that the actual construction of the road network during the development phase of new neighbourhoods can sometimes seem uncoordinated. The authors furthermore note that ‘until the road-network is complete no effort is made to work on the common outdoor space’.\textsuperscript{25} This is part of the aforementioned policy of the Ministry of Housing to guarantee infrastructure services for each plot prior to its assignment to an applicant of the land lottery. The Muscat Area Structure Plan encouraged the improvement of public transport already in 1991.\textsuperscript{26} However, the implementation of a working network of public transportation is yet to be established. Until recently, only two local bus services by the Oman National Transport Company (ONTC), informal mini busses and taxis were available. In October 2015, the ONTC was re-branded as Mwasalat.\textsuperscript{27} New bus services are now implemented and improve the public transport in the MCA while generating a lively debate amongst passengers and taxi drivers.\textsuperscript{28} The analysis of the newly introduced bus system is presented later.

Road Network

The low density in terms of residential buildings and thus population density is the reason for the great distances for commuting in Muscat and generates a lot of car traffic. There are two important roads in the Muscat area. The most important is the Sultan Qaboos highway, a six-lane highway running through all significant districts from east to west along the coastline. The second main road is the parallel Muscat Express highway. It is an eight-lane highway, which is located more in the south and in the periphery. This highway has the function of a bypass to reduce the traffic load of the Sultan Qaboos highway. The motorised individual transport (MIT) is the most important mode to commute in the whole country and especially in the governorate of Muscat. It seems as if the roads are not much longer able to cope with the population growth of the Muscat agglomeration.\textsuperscript{29} Because of the climate conditions with a yearlong hot temperature the Omanis do not choose walking and biking as their preferred mode of transport. Also, the public transportation system is considered to be unattractive. The high usage of cars causes traffic congestions on the main roads, especially during the peak hours. The population increases yearly by 5% and the number of the cars increases, too.\textsuperscript{30} What also attracts more people to use the car is the

\textsuperscript{24} von Richthofen and Langer, Evaluating the Urban Development and Determining the “Peak Space” of the Muscat Capital Area, 2015.
\textsuperscript{25} von Richthofen “Patterns of Urban Growth and Expansion: The Case Study Al Khoud”, 2016.
\textsuperscript{26} Weidleplan and Muamir, Muscat Area Structure Plan, 1991, 116.
\textsuperscript{27} Mwasalat Oman, Flyer New Bus Routes, 2014.
\textsuperscript{28} Citylab, “Experimenting with Public Transportation in Muscat,” last modified 10.05.2016.
\textsuperscript{29} ONSS. Supreme Council for Planning, “Population, human resources and social infrastructure”, Muscat, 2014, 4f.
free parking policy. A survey undertaken by German and Omani students in January 2016, supervised by the author, highlights the main advantages and problem using a private car. A study to evaluate the road network with respect to the planning advices manifested in the Muscat Area Structure Plan was carried out on the basis of the aforementioned results by von Richthofen and Langer and additionally used open accessible road data from openstreetmap.org. The study finds that 62% of the urbanised areas within the Muscat Capital Areas are within a 500m distance of the primary road network; 78.5% are within one kilometre of the primary road network; 86.6% are within 1.5 kilometres of the primary road network (see figure 4.1). When also considering secondary and residential roads, 94.5% of all urbanised areas are within only 250m distance of the road network.

Since today’s Omani society is very car-centric (especially in the MCA) and distances are still rather big due to the space-consuming character of the planning model in the region and the functional segregation of the space within the study area, the proximity to primary roads is a key indicator for the evaluation of the road network. The results show that the urbanised regions within the MCA are relatively well served by the existing road network. Another fact that underlines this assumption is the high spatial correlation between the density of built up space and the existence of highways. The most densely built-up areas are well connected to the primary road network.
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Figure 4.2 illustrates the distances to the primary – and the complete road network. Visual analyses of the results also show the connection of the industrial zones to the primary-road network. When additional information layers from openstreetmap data is taken into account, further connections between the road network and selected points of interest (POI) can be made. A spatial selection shows that out of the 24 clinics and hospitals mapped in openstreetmap inside the study area, only 5 are further than 500m away from the next primary road. 15 clinics and hospitals are within the 250m buffer. Even more favourable in terms of connection to the primary road network are the locations of cinemas and shopping malls. Out of four cinemas and seven shopping malls, only one of each group was located outside the 250m buffer-zone – but still within the 500m buffer zone. The value of these analyses could be further increased by generating topological correct road network datasets. Such datasets can be used to calculate exact distances (or cost-areas) along the network. They could also serve as a basis for location-allocation analysis. This kind of analysis is often used to assess the ideal locations of infrastructural services. It is best practice to use such analysis on the planning level to optimise the provision of services for the citizens.

Public Transport

The low population density and scattered settlements lead to huge distances which makes it difficult to implement an economically efficient and user friendly public transport system.\(^\text{31}\) The car culture is strongly presented in Oman, so you can call it a car dependent and oriented society where it is a symbol of luxury and wealth to be a car owner. This makes it difficult convincing commuters to use public transport. In addition to that petrol prices are still cheap, which makes it difficult for public transport to compete in terms of

\(^{31}\) MTC (Ministry of Transport and Communication), Public Transport Master Plan, 2015, 167.
Another cultural issue is the gender topic: For women it is often not appropriate to use a mass transport system in the same cabin with other men. During the bus user survey this statement was confirmed as only 16% of 44 bus users were female (bus user survey). Beside the Omani population, mainly using the car, in Muscat 61% of the total urban population are foreigners. While Omani prefer to use their own cars, many foreigners, due to their financial situation or missing recognised driving license, take taxis or shared taxis, called baiza buses, as their main transport mode. In some cases this is more expensive and provides only a limited accessibility. The binary division of the population in Omanis and expatriates is also a challenge for the public transport system. The system should attract all parts of the society in the same way; otherwise it might happen that the public transport is only appropriate for the low income groups which would not solve the congestion and environmental problems. The buses use the same car lanes and are, because of their dependence on the traffic flow, not very reliable in terms of time and do not serve most parts of the city. This is one reason why the citizens seldom use it.

Public Transport: Institutional Set-up

The ministry mainly responsible for the traffic system is the Ministry of Transport and Telecommunication (MTC). Besides, there are offices for the individual governorates, like Muscat, dealing with mobility. There is a widely spread responsibility for transport issues between decision makers. While the responsibility between the Ministry and the Municipalities for road planning is clear (MTC outside and municipalities inside the cities), the responsibilities for the public transport system are not clearly regulated. Therefore, the establishment of a coordinating Public Transport Association (PTA) is planned. The public bus operating organisation Mwasalat which is currently not involved in the public transport planning process will be integrated through the PTA. A clear responsibility is one of the key challenges in the Omani traffic planning system. The current unclear situation leads regularly to overlapping plans, e.g. between the MTC and the Ministry of Housing. Furthermore, reliable data of the use of the current public transport system are missing as well as a long-term plan for the development of the public transport which means that the decisions to invest in this system do not follow a strategic plan. As the interview
with the MTC revealed, in the ministries there is a fear of making mistakes or taking wrong decisions due to unclear responsibilities and the unclear potential for public transport. This leads to a policy of only small steps without being able to tackle bigger problems or to make unpopular decisions (e.g. restrictions for individual transport). On lower levels the organisational structures are also unclear: The minibuses and the taxis are organised in many small, private companies which makes it difficult to communicate and negotiate with all of them.\textsuperscript{41} The Spanish consulting company INECO created a master plan for the public transport system in Muscat to be finished in June 2016. It will cover a development up to 2040.\textsuperscript{42} However, a final version has not been published so far and approval among the ministries might be difficult to achieve.\textsuperscript{43}

**Bus Transport System**

Seven bus lines currently exist in Muscat, all are provided by the new bus operator Mwasalat. Two of the buses are passing through the district of Ruwi. These are small lines only for the inner part of this district to Al Wadi Al Kabir in the south of Ruwi and to Wadi Adai in the west. Partly they use smaller buses, because there is not a high demand. The third bus line, started just recently on the Oman National Day (22.11.2015) from Mabelah via airport to Ruwi, following the Sultan Qaboos highway. This line is the backbone of the public transport system with over 580,000 passengers from November 2015 to March 2016.\textsuperscript{44} Line four and five connect Ruwi with the historical centre of Muttrah and the new development area of Al Amarat in the South since April 2016 respectively. Short connecting lines serve the upper class residential area of the Wave to Seeb and from the central roundabout in Seeb towards Sultan Qaboos University and Al Khoud. Overall, Mwasalat has transported 1.1 million passengers in the period of November 2015 to March 2016 which is beyond expectations.\textsuperscript{45} The busses run each day, every 15 minutes from 6am until 9:15pm. Today the bus is slower than a car. For example, the bus line needs one hour and 40 minutes from Mabelah to Ruwi by car you only need 45 minutes up to one hour. Mwasalat, therefore, is planning to create an extra lane on the Sultan Qaboos highway which, however, still is in its planning stage. Currently there are about 30 stops on this line. In general, Mwasalat has invested about seven million Omani Rial (OM) (16 million €) in new buses and another three million OM for the IT services, design, studies, stops and training costs for drivers.\textsuperscript{46} One ticket is between 100 and 300 baizas (about 0,75€ in 2017). You can use the ticket only one time. When you switch to another bus, you have to buy a new ticket. The bus system has

\textsuperscript{41} Zisopoulou, Transport Planning Expert from the MTC, 11.01.2016.
\textsuperscript{42} cf. Times of Oman, “New public transport plan to make commuting easier in Oman”, last modified 07.11.2015.
\textsuperscript{43} Zisopoulou, Transport Planning Expert from the MTC, 11.01.2016.
\textsuperscript{44} Times of Oman, “Petrol price hike: Oman to fall from ninth cheapest fuel in world to13th”, last modified 11.01.2016.
\textsuperscript{45} Times of Oman, “Petrol price hike”, 2016.
problems to get acceptance in the Omani society, because it is neither serving most parts of the city nor it is independent of the traffic congestion and does not guarantee a safe and quick service. Furthermore, the bus timing is not adjusted to the demand, so there are not more buses available during the peak hours or less during holidays, the buses leave every 15 minutes, every day. A user survey of current bus users displays the advantages of riding a bus (figure 5.1). Main positive aspects were seen in the comfort, low price and speed while the main bottleneck (figure 5.2) was seen in the problem how to get from the bus stop to the final destination.

![Advantages using Public Transport](image)

Figure 5.1: Advantages of using public transport.
Results of field research by the students project 2016, supervised by the author.

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47 Nereim, “Oman plans public transport system to ease traffic woes”, last modified October 23, 2015.
Mini Buses

More frequent and widespread is a system with so-called baiza buses. These are mini buses, which do not have a fixed timetable and designated stops. The buses follow the main roads and stop every time whenever it seems useful or necessary. When you would like to disembark, you have to call the driver so that he stops at the next possible point. It can be compared to shared taxis, but the baiza buses are neither comfortable nor reliable, and privately organised by multiple companies. In addition to that, when travelling by minibuses it is not predictable when you will reach your destination because they depend on the traffic situation as well as on the other passengers, which slow them down.\textsuperscript{48} The high usage of microbuses and taxis – especially along the Sultan Qaboos Street – however, displays the high demand for a public transport system.\textsuperscript{49} Another option to commute are company buses. Sometimes the big construction companies organise buses for the workers (only expats), as well as universities for their staff and students.

\textsuperscript{48} Zisopoulou, Transport Planning Expert from the MTC, 11.01.2016.

\textsuperscript{49} MTC, Public Transport Master Plan, 2015, 11; 167.
Taxis

The taxis – the second most important transport mode in Muscat – have low levels of quality, safety and reliability. There are five different types of taxis. The airport taxis, the hotel taxis, the mall taxis, the Sultan Qaboos port taxis and normal street taxis waiting along streets. The street taxis are unregistered and are concentrated mostly on the Sultan Qaboos highway. There is no uniform system or a company, who manages the various taxi operators. Currently taxi drivers, baiza bus owners and Mwasalat, the public bus transport company, have no coordinated system for interchanges.50 Furthermore, it is important to take the interests of taxi and baiza bus drivers into account. Especially in Muscat this is important, as the group’s taxi driver survey revealed that they are not happy with an enforcement of the public transport, because it might endanger their jobs (own fieldwork). The taxi and microbus operators can be seen as the main opponent group by implementing a public transport system.51 Currently already small protests by the taxi drivers against the bus system took place, e.g. they were blocking bus lanes and stops.52 Although, so far these protests are nonviolent and quite small; a view to Johannesburg and Pretoria in South Africa reminds what can happen if the huge group of taxi drivers is not involved in the public transport system: Taxi drivers organised huge protests, blocked entire roads and also attacked buses with stones.53

Bus Stops

The current design and locations of bus stops do not appeal the use of public transport.54 Missing signs indicating that the stop areas are reserved for buses lead to the problem that other transport parties occupy these areas for example ascar parks.55 Many stops of buses are difficult to access for passengers and are furthermore far away from each other, which makes the buses less attractive. Regarding the bus stops some weaknesses were figured out: The design and features of the stops are different, so most stops do not offer shadowed or air-conditioned waiting areas. The main bus station in Ruwi does not provide as much amenities a modern main bus station should have: Air-conditioned waiting areas, shopping facilities and adequate information about the bus services are missing.

50 Zisopoulou, Transport Planning Expert from the MTC, 11.01.2016.
51 MTC, Public Transport Master Plan, 2015, 11; 167.
52 Interview Mohamed Dalim Al Ghafri 11.01.2016.
54 MTC, Public Transport Master Plan, 2015, 126.
Bus Rapid Transit as a way out?

In order to enhance the quality, speed and reliability of the public transport, there is a need for a more attractive system independent from the current traffic flow. Examples from cities in Latin America has shown that a less costly bus rapid transport system (BRT) can improve significantly the public transport system.\(^{56}\) Taking the current and future demand into consideration (today about 5000 passengers per day along the route on Sultan Qaboos highway), a Bus Rapid Transit (BRT) seems to be a good solution for the main public transport mode (figure 5.3). It can use the existing main road network, first of all the Sultan Qaboos highway. The characteristics of a BRT are separate bus lanes following major urban roads. This makes the buses independent of the traffic situation. Passengers enter the buses via shaded stops, which are located mostly within a distance of 500m to each other, depending the density and demand.\(^{57}\) All in all it ‘provides a cheap and easy way to implement means of improving the mobility in large urban areas’.\(^{58}\) From the user’s perspective the implementation of a BRT, in combination with efficient feeder lines, makes the public transport more attractive than using the private car, because it will be more comfortable, faster and cheaper.

![Figure 34 - Functional characteristics of main modes of public transport](image)

Figure 5.3: Comparison of speed and capacity of different public transport systems

Source: Systra 2009: 123


\(^{57}\) Müller, “Bus Rapid Transit: The Answer to Transport Problems in Megacities? The Example of TransMilenio (Bogota, Colombia)”, 2014, 179.

\(^{58}\) Müller, “Bus Rapid Transit: The Answer to Transport Problems in Megacities? The Example of TransMilenio (Bogota, Colombia)”, 2014, 179; 180.
In order to design a new public transport system, there is the need to analyse the motivation to switch to public transport from private cars as well. The survey revealed that a comprehensive network is the most important issue. The idea of a network compromises the entire trip from home to the final destination and not only the ride on a specific system but also the quality of the so-called first and last mile from home to the station and from the station to the destination.

**The ‘First and Last Mile Problem’ of Public Transport in MCA**

In combination with the mainly long distances to the bus stops this problem situation leads to the first and last mile problem. This describes the difficulty for commuters to get from their location to the next bus stop or from the bus stop to their final destination. Figure 5.4 displays that bus users are walking different distances on the first mile. The walking distances are up to 900m (5min=300m), but it needs to be considered that the survey was taken in winter time, so the climate condition were more walking friendly. However, most commuters only walk up to 600m to their final destination (see figure 5.5). As the first and last miles often are covered by walking, it is mandatory to improve also the pedestrian friendliness, especially around the stops. Obviously there are other options beyond walking like skating, biking, electric assisted devices like ‘hoverboards’. They were not considered here as they are not applicable for all ages and gender in Oman. As the analysis showed one of the main deficits is the missing safety for pedestrians, which can be solved by providing a continuously sidewalk network, including safe crossing possibilities of the streets, e.g. traffic lights or traffic islands. The sidewalks should invite people to spend time in the public areas: Urban furniture like benches or shelters, and other street design elements can enhance the atmosphere as well as the orientation. But all this only works if the problems with high temperatures and strong solar radiation are tackled. To cool the walkways first the direct solar radiation and secondly the indirect solar radiation, heat reflected from hot surfaces, need to be reduced e.g. by the installation of coverings providing continues shadow. The author conducted with German and Omani students in 2016 a workshop on how to design a pedestrian friendly city under these climatic conditions in Muscat. Special attention was given to facilitating positive impacts on the local climate and outdoor comfort, and providing walkable shortcuts for citizens who have to travel short distances without a car.59

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Figure 5.4: Mode and time spent for the first mile. Source: students project 2016, supervised by the author

Figure 5.5: Mode and time spent for the last mile. Source: students project 2016, supervised by the author
Case Studies

In order to address the problem of the first and last mile, a detailed study of two case study areas was undertaken. It covers the mixed residential neighbourhood of Azaiba and the business district of Ruwi, today the final destination of the buses and main commercial area.

Case Study: Azaiba

Azaiba is located in the east of Muscat area next to the Sultan Qaboos highway (see figure 6.1). The northern part is a residential area with mainly single and two-family houses and some space used for commercial sites. The neighbourhood is not built-up very densely. The southern part of the Sultan Qaboos highway is mainly occupied by commercial sites. The transport connections are mainly oriented towards axes of the Sultan Qaboos highway and 18th November Street. There is only one bus route running down the highway. Figure 6.2 displays the current bus stops on this route. The figure reveals the undersupply of the residents by public transportation and the lack of feeder lines to the stops.
The bus stops should not be further away than 250 m walking distance, in order to provide the residents a walkable access to the stops. Figure 6.3 shows the section of the Sultan Qaboos highway, where the few buses are currently running, with the width of the different parts. The medial strip, the generous width of the highway and the green strips provide some space for the implementation of bus lanes. Furthermore, the secondary roads show the potential for feeder lines to be easily connected to the bus stops on the highway. Beside the BRT on the Sultan Qaboos highway, the idea is to implement another BRT on the 18th November Street in the northern part of the area as well. 18th November Street is located in the west and east directed to the Sultan Qaboos highway and is surrounded by residential areas in the eastern direction. Between these two fast BRT routes in the north and the south of Azaiba, small feeder line buses will run in a circuit and will bring the people to the BRT stops so most residents and workers are connected to a bus stop at a maximum distance of 250 metres.
This BRT station plays an important role. It should be accessible by walking, bus, car and taxi in a central location. In addition, figure 6.3 shows the street section on the Sultan Qaboos highway including a BRT station. In order to implement the bus lane, the car lanes were reduced from three to two lanes (figure 6.3). The bus stop in figure 6.3 is located in the middle of the street with a width of 4.4 metres. The stop is further equipped with an air-conditioned waiting area and station facilities, like possibilities to buy food and drinks and free Wi-Fi. Solar panels are built on the bridge and on the station roof to provide shadow and to produce energy for this waiting area. On both sides of the station, buses in both directions stop on a three metre wide lane. Here, passengers can enter and leave the bus on the ground floor on the same level without steps. Passengers leave or enter the BRT bus station in the middle of the highway by taking the elevator or the escalator to the first floor. A shaded pedestrian bridge provides connections to the northern residential or the southern commercial area. Leaving the bridge, the bus users have a direct access to the feeder bus stations and taxis or they can take their car from car parks. This design can serve as example for many other stations along Sultan Qaboos highway.

Figure 6.3: Cross section of Sultan Qaboos highway today and with a BRT station in the centre. Source: Source: students project 2016, supervised by the author.
Case Study: Ruwi

At the beginning of the 1970s, there was the need of an expansion of the historical centre of Muttrah for new commercial buildings. Ruwi provided an ideal area for this expansion. It is located in the north of Al Wadi al Kabir within a flat area. Today, Ruwi is known as a district for banking and businesses, but also a residential area, mostly for low-income residents with a percentage of non-Omani workers of 79%. The main street, Sultan Qaboos highway, is crossing the district from north to south. In most parts of Ruwi the highway just has two lanes for each direction. The special characteristics in the area, such as the narrow streets, mountains, strong transport demand and the high density, need to be considered. They make it more difficult to implement new projects in the area.

As Ruwi is well known for its frequent traffic congestions, especially during the peak hours the buses are often late. This leads to the problem that the bus system is not reliable at all. Furthermore, busses coming from the highway have to drive a detour through small streets to reach the central bus stop in the centre. The main task to make the public transport system more attractive is to strengthen their reliability and speed. In order to achieve these goals, a BRT system, with separated lanes from the cars will address the problem. Furthermore, the buses should not enter the narrow Al Jami Street any more. Instead, a traffic light system on the highway and at Ruwi roundabout guides the BRT busses from the highway to the new main bus station under the highway bridge on the roundabout.

Figure 6.4: Localisation of Ruwi in the MCA. Source: Authors.

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60 cf. Deffner and Pfaffenbach, "Urban Spatial Practice of a Heterogeneous Immigration Society in Muscat, Oman", 2015: 11.
Here, all busses stop and passengers can interchange (see figure 6.5). At this new station, the connection to other destinations in Ruwi is also enabled by a new feeder line system with a suspended railway due to the limited space available for feeder buses. Figure 6.5 illustrates the traffic light system from the highway to the station in detail. Through an extension of the highway to both sides, removal of the emergency lane and a taking of the middle strip, the highway provides space for the BRT lane in the middle of the highway.

Figure 6.5: Draft of the interchange of BRT and suspended railway in Ruwi.
Source: students project 2016, supervised by the author.
Conclusion

The Muscat Capital Area is facing huge problems that are induced by shortcomings in the physical planning of the region as mentioned before. The depletion of the ‘resource’ space within only a few decades will cause new issues. Due to its natural spatial constraints the MCA has limited space to offer. In order to achieve social, economic and ecologic sustainable development the use of space should be planned wisely.\(^6\) Especially the functional and social segregation of residential areas in combination with the loose constellation of single villas is a menace to a sustainable future of the region.\(^6\) Although the physical distribution of highways and the layout of the general road network might cover the area well, the possibilities of improvement will be limited in the future due to the topography and the spatial extension of the city. In fact, the primary traffic axes are frequently congested, already today. Especially the use of large, multi-lane roundabouts along the Sultan Qaboos highway causes regular traffic jams at certain times of the day.

The study reveals the advantages and challenges of private and public transport in Muscat. For a low density city like Muscat, the introduction of a sophisticated public transport system is difficult. Therefore, as a first step the easy and not too costly implementation of a BRT system is proposed. While the wide highways have the potential to construct without technical problems a BRT lane in the middle, emphasis was given to the so-called first and last mile problem: How to access the system and how to reach the final destination? The two case studies exemplify options for a bus station and transfer to other modes of transport. In Azaiba a bus station in the middle of the highway connected to the residential area by a shaded pedestrian bridge providing access to bus feeder lines, integrated taxi services or just walking. In Ruwi, due to the limited space available and higher demand, a suspended railway is proposed. Obviously, the limited survey and a two days’ design workshop conducted by the group of German and Omani students cannot compete with professional studies and cannot provide detailed construction plans. However, the results can support the discussion in Muscat on the need and options for public transport and provide some first feasible ideas.

While in other regions of the world a large number of analyses on the urban phenomena have been carried out, there is still much room for research of Oman’s urban spaces Up until now, it is still difficult to replicate studies that have been conceptualised already decades ago, due to missing or incomplete data. This study also shows how the analysis of ancillary data sources with new methods in combination with field research can paint a relative complete picture.

\(^{60}\) cf. Deffner and Pfaffenbach, “Urban Spatial Practice of a Heterogeneous Immigration Society in Muscat, Oman”, 2015: 11.

\(^{61}\) cf. MTC, Public Transport Master Plan, 2015, 13.
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