# Table of Contents

List of illustrations ........................................................................................................... 3

1 Introduction .................................................................................................................. 4
   1.1 Location .................................................................................................................. 4
   1.2 Population .............................................................................................................. 5
   1.3 Economic situation ................................................................................................. 6
   1.4 Socio economic inequalities ................................................................................... 6
   1.5 History .................................................................................................................... 7

2 Research question ........................................................................................................ 8

3 Theory and method ...................................................................................................... 8

4 Transport in Dubai ........................................................................................................ 9
   4.1 Individual transport ............................................................................................... 9
   4.2 Public transport ..................................................................................................... 9
   4.3 Bus and metro ....................................................................................................... 10
   4.4 Tram and monorail ............................................................................................... 11
   4.5 Marine transport .................................................................................................. 11

5 Community Capital ..................................................................................................... 13
   5.1 Human Capital ..................................................................................................... 13
   5.2 Social capital ......................................................................................................... 13
   5.3 Cultural capital ...................................................................................................... 13
   5.4 Economic Capital .................................................................................................. 15
   5.5 Natural Capital ..................................................................................................... 16
   5.6 Physical capital ..................................................................................................... 18

6 Conclusion .................................................................................................................... 20

References ....................................................................................................................... 22
### List of illustrations

| Illustration 1 | Map of the United Arabic Emirates |
| Illustration 2 | Weather patterns in Dubai |
| Illustration 3 | Distribution of workers by economic activity in the private sector in Dubai in 2006 |
| Illustration 4 | Distribution of establishments, number of workers and worker’s compensation by economic activity in the private sector in Dubai in 2006 |
| Illustration 5 | Increase in bus fleet and number of passengers between 2001 and 2009 |
| Illustration 6 | Dubai metro, monorail and tram network |
| Illustration 7 | Dubai waterbus and abra routes |
| Illustration 8 | Income level of users of marine service |
| Illustration 9 | Top 15 ecological footprints |
1 Introduction

1.1 Location

In 1971 seven former sheikhdoms merged to form the United Arabic Emirates: Dubai, Abu Dhabi, Sharjah, Ajman, Umm al Qairain, Ras al Khaimah and Fujairah. (Pacione 2005, 256) The UAE are located on the Southeast of the Arabian Peninsula. Dubai itself is situated in the northeast of the UAE.

Its geographical location makes Dubai economically attractive since the Gulf States, South Asia and East Africa are easy to reach. The Emirate of Dubai comprises of 3885 km² making it the second largest Emirate. The city of Dubai is about 35 km², excluding the area the artificial islands such as the World or the Palm. The city is divided by the Dubai Creek, which historically formed a trade location and is by consequence the location of the historical parts of Dubai. (Dubai.com, 2010)

Illustration 1: Map of the United Arabic Emirates

Dubai has a subtropical and arid climate. The average temperatures in December, January and February are between 20 and 25 degrees Celsius. From April to November, the average ranges from 30 degrees up to 41 degrees during the summer months. (Dubai.com 2010)

![Illustration 2: weather patterns in Dubai](http://www.dubai-information-site.com/dubai-weather.html)

1.2 Population
In 1900, the population in Dubai was 10 000 and rising to 59 000 in 1968. In the following two decades, the population has increased fivefold. By 1985, there were 370 788 inhabitants. In 2002, there were 961 000 residents in Dubai. (Pacione 2005, 257)

This rapid growth during the recent decades was partly caused by natural population increase, which has its origins in the decline of infant mortality rate. Another contributing factor was a high immigration rate due to the economic expansion. The first wave of immigrants arrived early in the twentieth century and consisted mostly of Arab people of coastal Iran. The second wave of immigrants started to arrive in the early 1960s. The immigrants were mostly labour migrants from Arab states, India, Pakistan, Europe and North America. In 2000, 53 percent of the 862 387 of the Dubai city inhabitants were born abroad. (Pacione 2005, 257).

---

1.3 Economic situation

The UAE have strived to diversify their economy in order to depend less on oil. This trend can also be seen in Dubai since the early 1990s. This development was deemed necessary because the oil production had its peak in 1991. (Pacione 2005, 257) In 1975, crude oil alone was responsible for 68 percent of the total economy. However, this figure had decreased to 22 percent in 1998. (Walters 2007, 78) In 2005, oil accounted for only 10 percent of the GDP (Pacione 2005, 257) Investments were made in different sectors such as real estate and restaurants and hotels. (Walters 2007, 78)

This trend can also be seen in Dubai. As the illustration below shows, the wholesale and retail trade and repair services provide 30 percent of the workforce in the private sector in Dubai with jobs. The second and third biggest job providing sectors are construction with 25.8 percent and manufacturing with 16.1 percent. (Dubai statistics center, 2007)

Illustration 3: distribution of workers by economic activity in the private sector in Dubai in 2006

1.4 Socio economic inequalities

The differences in wages in the private sector are significant. The following table shows the annual average wage of the workers per economic activity in the private sector in 2006. The workers in the transportation, storage and communication activities earned most (AED 96340 or 182347 SEK). On the other end of the social-economic spectrum are the workers in manufacturing (AED 38290 or SEK 72473), hotel and restaurants (AED 29670 or SEK

---

4 These values were calculated with the exchange rate as it was on 22 October 2010: AED 1 = SEK 1.89275.
56157) and construction activities (AED 22800 or SEK 43154). (Dubai statistics centre 2007, 6) These numbers clearly show that there is a considerable socio-economic divide in Dubai. This situation is in parallel with the rest of the UAE. Walters claims that ‘it has been said that 0.2 percent of the UAE population controls 90 percent of the nation’s wealth (2007, 84).

<table>
<thead>
<tr>
<th>Economic activity</th>
<th>Number of establishments</th>
<th>Number of workers(^a)</th>
<th>Workers compensation (000 AED)</th>
<th>Annual average wage (AED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>4,566</td>
<td>160,807</td>
<td>6,022,132</td>
<td>38,290</td>
</tr>
<tr>
<td>Construction</td>
<td>2,887</td>
<td>257,705</td>
<td>5,835,059</td>
<td>22,800</td>
</tr>
<tr>
<td>Wholesale &amp; retail trade and repairing services</td>
<td>36,448</td>
<td>299,817</td>
<td>13,831,027</td>
<td>50,860</td>
</tr>
<tr>
<td>Hotels and restaurants</td>
<td>3,006</td>
<td>67,515</td>
<td>1,953,378</td>
<td>29,670</td>
</tr>
<tr>
<td>Transportation, storage and communication</td>
<td>3,289</td>
<td>80,451</td>
<td>7,750,581</td>
<td>96,340</td>
</tr>
<tr>
<td>Real estate &amp; rentals, and business services</td>
<td>6,098</td>
<td>91,746</td>
<td>6,725,797</td>
<td>73,310</td>
</tr>
<tr>
<td>Social and personal services</td>
<td>4,484</td>
<td>41,928</td>
<td>1,717,822</td>
<td>40,970</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66,778</strong></td>
<td><strong>999,969</strong></td>
<td><strong>43,835,796</strong></td>
<td><strong>43,830</strong></td>
</tr>
</tbody>
</table>

Illustration 4: Distribution of establishments, number of workers and worker’s compensation by economic activity in the private sector in Dubai in 2006\(^5\)

1.5 History

The United Arab Emirates are, as stated by Schvaneveldt, ‘a nation that has come from a desert life of sheep and camels to a highly developed modern nation in only three decades’. (Schvaneveldt 2005, 1). Around the turn of the 20\(^{th}\) century, the pearl trade was the most important source of income for the inhabitants of Dubai. The city with its harbour was the main distribution centre for domestic and foreign trade (Pacione 2005, 256). The discovery of oil in the mid 1930s changed the economic situation. Dubai became involved in air travel and the sale of oil concessions. (Al-Sayegh 1998, 87; 93) In the 1950s, after the economic standstill during the Second World War, Dubai started to improve port facilities which further stimulating trade (Al-Sayegh 1998, 98). The 1970s marked the start of large development projects within for example the housing and communication sector (Al-Sayegh 1998, 99). The trade relations with the other Gulf countries were intensified during the 1980s and early 1990s, resulted in Dubai becoming the busiest port in the region. At the same time, the tourism market began to boom which lead to huge development projects such as the creation

of artificial islands in the form of palm trees. (Al-Sayegh 1998, 100) One can conclude that Dubai has ‘undergone the transition from a pre-industrial over industrial to post-industrial society during a period of only fifty years’. (Pacione 2005, 255)

2 Research question

Dubai has its problems. There are environmental problems such as the disruption of marine environments due to the creation of artificial islands. The demand for water and electricity increases at an alarming rate. Health problems due to a sedentary lifestyle become more and more common and the social divide is widening due to the differences in income. These are merely a sample of the issues Dubai has to deal with.

This paper however focuses on the problems with transportation. This angle was chosen after listening to the experiences of some of our group members in Dubai. The traffic problems are omnipresent. Our aim is to assess how an increase in the use of public transportation can be achieved in order to alleviate problems of traffic congestion. This paper will discuss this problem in relation to five different types of capital: physical, natural, economical, human and cultural. The social and human aspects have been largely neglected in this paper due to the withdrawal of two of our team members. However, these two aspects will be touched upon very shortly in order to provide a full picture of the problem in Dubai.

3 Theory and method

As mentioned above, the assessment of our research question will be linked to the notion of community capital, which is a model to describe sustainable development (Roseland 2005, 4-5). The community capital as interpreted by Roseland consists of natural, physical, economic, human, social and cultural capital.

In order to find relevant information a number of sources were used. Since some members of our group have visited Dubai, their experiences were very useful in directing the scope of this paper. Journal articles were found through the use of databases such as Jstor, Sciencedirect and Google Scholar. This information was further complemented with recent newspaper articles from newspapers such as ‘Gulf News’. The official website of the Road and Transport Authority of Dubai has been equally helpful. Mark Roseland’s book provided the theoretical background (Roseland 2005).
4 Transport in Dubai

4.1 Individual transport

Due to the increase of population, the number of cars has increased significantly during the last decade: from 350 000 in 2004 to 750 000 in 2006. In 2005, the number of daily trips by car in Dubai was 3.1 million a day and was expected to grow to 13.1 million in 2020. This situation causes a lot of congestion, which the Dubai Municipality has tried to alleviate by introducing a toll system on the major routes into the city in 2007 (Bagaeen 2007, 181-182). According to a survey conducted in 2007, the average length of the daily commute to and from work was one hour and 45 minutes in Dubai, which made the city the most congested in the Middle East (Dubai overtakes Cairo 2007). The introduction of the metro system and the further development of the road infrastructure are additional measures to diminish traffic congestion.

4.2 Public transport

Public transportation in Dubai is managed by the Roads and Transport Authority (RTA). The RTA also plans the transport between Dubai and other Emirates and neighbouring countries. The responsibilities of the RTA include the public bus system, the metro system, the tram and monorail systems, the marine transport, taxis, roads engineering, parking facilities, registration and licensing of vehicles, commercial ads along the roads and traffic safety (About RTA 2010).

Illustration 5: increase in bus fleet and number of passengers between 2001 and 2009

4.3 Bus and metro

The public transportation network has increased over the last years as can be seen in the illustration. In 2009, the bus fleet consisted of 1551 busses which daily serve 130 000 passengers (Janahi 2010). The punctuality rate of the busses has increased considerably to 60% in May 2010 compared to 17.2% four months earlier (Janahi 2010). The driverless metro system on the other hand is used by 100 000 people a day. (Janahi 2010) The red metro line, which opened in September 2009, is currently the only functioning metro line in Dubai. The line is 52.1 km long and includes 26 stations (five new metro stations are to be opened in 2010). The public transport usage has increased by 6% over the last year from 6% in 2009 to 12% in 2010. The authorities have the aim of expanding it to 30% by 2020 (Janahi 2010). This increase would be partly established by the opening of the 23-km long green metro line in August 2011. The RTA is also planning two additional metro lines, respectively a blue and a purple one, as can be seen on the map below. The Road & Transport Authority in Dubai is also improving the system of feeder buses, which bring commuters to the metro stations (RTA opens five new metro stations mid-October 2010).

The price of a ticket depends both on the length of trip and on the type of ticket card purchased. The ticket card is called the NOL card and can be used for the metro, public busses, water busses and paid parking zones. The metro park-and-ride facilities are free of charge to public transport users while others have to pay. (Hamdan bin Mohammed endorses 2009) The silver and golden cards for example last five year and contain an e-purse which collects the fare automatically. The latter also give you access to the Gold Class cabins which can be compared with first class. The blue card, which is recommended for frequent travellers, has some extra features such as SMS and e-mail notifications related to the confirmation of services. The last card is the red card, which lasts only 90 days, is intended for tourists and visitors. (Choose your NOL 2009) The prices range from AED 1.80 to 4.00 (SEK 3.4 to 7.5) for travelling within one zone, from AED 2.30 to 5.00 (SEK 4.3 to 9.4) for two zones, from AED 4.10 to 9.00 (SEK 7.7 to 17) for three zones and from AED 5.80 to 13.00 (SEK 10 to 24) for four zones. (Fares and tickets 2009)

---

7 These values were calculated with the exchange rate as it was on 22 October 2010: AED 1 = SEK 1.89275.
4.4 Tram and monorail
The yellow line on the map above is the Palm monorail which is a direct feeder line to the red metro line. The monorail opened in 2009, is about 5 km long and comprises of four stations. It is used by 40 000 commuters every day. The black line that runs almost parallel with the coast is the Al Safouh tramline. The line which comprises of nineteen stations is about 14 km long. As can be seen on the map, the RTA plans to expand the tram network more towards the East. (2dayDubai, 2010)

4.5 Marine transport
The marine transport in Dubai consists of waterbuses and abra transits. According to the RTA homepage, the waterbus is ‘a highly advanced and modern abra service providing luxury, comfort and further designation to its passengers’ (RTA homepage 2010). The water bus serves 1500 commuters daily between 7.00 and 19.00 and includes eight stops (RTA inaugurates water taxi 2010; Waterbus, RTA homepage 2010). Additionally, there is a hop on hop off water bus for the tourists. The cost for a round trip is four dirham (about SEK 7.5) for inhabitants and 50 dirham (about SEK 94) for tourists per roundtrip (Waterbus, RTA homepage 2010).

---

The abra is a traditional wooden boat. The main differences between the abra and waterbus are the level of comfort and service, the fares and the loading capacity. The abra service is run by individual operators in two routes, but the RTA oversees legislation, planning services and licensing (Hassan 2010, p 94). The abras are used by 50 000 commuters per day (RTA inaugurates water taxi 2010). The illustration underneath shows clearly that the abras are used more often by the low-income groups than the waterbus which is mainly due to the fact that the fare for the latter is four times more expensive than the fare for the abra (Hassan 2010, p 101).

Illustration 7: Dubai waterbus and abra routes

Illustration 8: Income Level of Users of Marine Service

---

5 Community Capital

5.1 Human Capital

Roseland states that human capital comprises of health, education, skills, knowledge, leadership and access to services (Roseland 2005, 8). The focus in this paper will be on health issues.

A disturbing increase in obesity and overweight can be seen in the past three decades. This is no different in the United Arabic Emirates as a result of the economic boom. This change can be contributed to a number of factors. The traditional diet with a high fibre and low fat content has been replaced by a more westernized diet, which contains more fat and sugars. The increase in time spent in front of the television or computer can also be seen as a contributing factor. Furthermore, the lifestyle in the UAE has become more sedentary. The increasing availability of cars plays a major role. Relying mostly on transport by car can lead to diminished exercise. Children nowadays take the car to school instead of walking there as was done before. (binZaal 2009, 437-438)

5.2 Social capital

It is unlikely that Dubai has a rich overall social capital since this term includes for example community cohesion, fellowship and compassion. (Roseland 2005, 9) In a city as Dubai where status is so important, creating community cohesion is not one of the main priorities. As a result, Dubai is characterized by an ever-widening socio-economic division which impedes the creation of a rich social capital in the city.

5.3 Cultural capital

Cultural capital, as defined in ‘Towards sustainable communities’, is ‘the product of shared experience through traditions, customs, values, heritage, identity and history’ (Roseland 2005, 11). Since society in Dubai has radically changed during the last 50 years, the cultural capital can be considered exceptionally ‘new’. Walters describes the evolution as follows: ‘the country’s culture and sense of historical pride have begun to disappear into Westernized popular culture and the pornography of excess’ (Walters 2006, 86). For the purpose of this paper, the term cultural capital is therefore interpreted as the lifestyle in Dubai.

---

In May 2010, Gulf News reported that more and more people are leaving their cars at home and use the metro or bus services instead. Nearly a quarter of a million people are using these services every day (Public transport is changing habits 2010). However, the number of cars is still increasing. (Dubai overtakes Cairo in traffic congestion 2007) The weather is considered as one of the reasons for continuing to use one’s own car. The main challenge is by consequence to spread the use of public transport to all layers of society and strengthen the culture of public transportation. One can wonder if the lifestyle in a land of hyperboles and superlatives can change significantly. How does one convince people to leave their air-conditioned cars at home, go out in the heat and take the public transport, especially in a society where image and status are so important?

According to Walker and Salt there are three main drivers for unsustainability: poverty, ignorance and misunderstanding and wilful excessive consumption. (Walker and Salt 2006, 5). However, as has been shown by the study by Hassan, the lower social classes are making most use of the marine transport since they do not have the means to own a car. It would be interesting to compare this with the figures for the socio-economic division of bus and subway users but such figures were unavailable.

As for ignorance, additional awareness campaigns are definitely necessary. Increasing the level of knowledge about sustainable development and all that this concept entails could establish changes in lifestyle. Especially in schools, attention for sustainability is necessary. If children are taught about the consequences of relying on cars as the main means of transport, they are more likely to change their transportation habits later on in life and use public transport more often.

Wilful excessive consumption is definitely a major reason of unsustainability in Dubai and is by far the most difficult to alter. One could think that the problems with congestion in the city would be a good enough to change behaviour. In 2007 a survey showed that the average length of the daily commute to and from work was one hour and 45 minutes in Dubai and yet, the number of cars is still increasing. (Dubai overtakes Cairo in traffic congestion 2007) It has been claimed that there is an improvement in the culture of using public transport by all segments of the community, but since no accurate figures could be found, we assume that the economic elites are less likely to give up the luxury of using their own car. (RTA opens five new metro stations mid-October 2010). Although the existing differentiation between different types of NOL cards could be considered as a good way of stimulating the higher social classes use public transport since holders of a Golden card can access to the first
class metro wagons, there are more opportunities to change the behaviour of the middle and lower classes.

One way to establish this change is by improving the quality of the facilities. The study of marine transport in Dubai shows that an increase in the quality of the waiting areas and toilet and wash facilities could increase the number of users of this mode of transport (Hassan 2010, p. 111). According to the authors, better shading and the introduction of air-conditioning would constitute a significant difference. As mentioned above, the Road and Transport Authority has already installed air-conditioning in all bus shelters (Public transport is changing habits 2010). This might contribute to the increase in use of public transport although it is in itself not a very sustainable measure. Expanding the feeder systems and increasing the number of parking spaces for private cars close to the stations would further facilitate an increase in the use of public transport (Hassan 2010, p. 111-112).

5.4 Economic Capital

Roseland defines economic capital as the mechanisms through which we allocate resources and make decisions about our material lives. To maximise economic capital there must be maximum usage of human and physical capital, which are closely related to economic capital (Roseland 2005, 8). With such a small native population in compression to migrant it is imperative that Dubai attracts the immigrants with the correct attributes in order to maximise the economic capital.

Dubai is a constituent Emirate of the United Arab Emirates, which as a whole is historically dependent on natural resource output but this has been reduced to 25% of GDP by 2010 due to efforts to diversify the economy (CIA, 2010). Dubai in particular has made great efforts to diversify the economic away from oil and gas. Over the last three decades the government of Dubai has become a major business centre. One of the aims for the economic development of Dubai has been to exploit its strategic location between the great western and eastern economic powers, whilst also being at the centre of the largest fossils fuel reserves in the world. The population of the UAE is growing rapidly based on immigration and around 80% of the population in 2009 are immigrants (BBC, 2009). Therefore Dubai is highly dependent on the attractiveness of its lifestyle as it has been attracting new immigrants to the Emirate to further increase its economic capital. Recent downturns in the global economy have taken their toll on Dubai and caused a decrease in the population because of recent immigrants returning to their native countries due to unemployment (BBC, 2009). With a per
capita GDP of 40,615 USD the United Arab Emirates is one of the richest countries in the world (Dubai eGovrenment, 2010).

The government of Dubai has made a point of promoting Dubai’s economic advantages, promoting its current trade links around the world and growing level of international trade (Dubai eGovrenment, 2010). There are several free trade zones in Dubai. These function as areas in which foreigners can own 100% of a business with the advantages of a no tax regime. The numerous free trade zones include financial free zones, media and technology free zones, and Jebel Ali Free Zone (Dubai eGovrenment, 2010). There is a huge diversity of free zones available for a foreign business to set up there, but due to the lack of taxes in the free zones as a whole it is unable to provide specific tax relief to more environmental orientated companies. The government of Dubai describes itself as having a world-class infrastructure, having invested heavily in transportation, telecommunications, energy and industrial infrastructure (Dubai eGovrenment, 2010).

Traffic problems in Dubai and the lack of an integrated public transportation system, although this is now being developed, will have possibly held Dubai back. Recent investment in major public transportation will reverse this trend. As Dubai is very dependent on its perceived quality of life to attract potential migrants to increase its human capital it must invest in public transportation systems to allow for economic development. The current economic situation in Dubai is very business friendly allowing foreign companies to be set up and foreign owned. The integration of the free-trade zones into a comprehensive public transportation system will begin to reduce the pressure being placed on business competitiveness by traffic situation. To use the business expression ‘time is money’ so therefore wasting time in a traffic jam wastes money-earning potentials at work.

5.5 Natural Capital

‘Natural capital refers to any stock of natural assets that yields a flow of valuable goods and services into the future’, Mark Roseland writes in the book ‘Toward Sustainable Futures’ (Roseland 2005, 5). Roseland also explains that the total stock of environmental assets included in the term ‘Natural Capitals’ can be divided into three categories; the first category is non-renewable resources such as fossil fuel and minerals. The second one is the capacity of finite, natural systems to create renewable resources. These are only renewable as long as they are not overexploited, such as food crops, forestland or water supplies. The third one is the capacity of natural systems to absorb emissions and pollutants without side effects, with
heavy costs passing to future generations such as chemicals that deplete the ozone layer and greenhouse gases which may cause serious climatic imbalance (Roseland 2005, 5).

Dubai is situated in the middle of the desert. This means that the availability of category one, ‘renewable resources’ is limited. On the contrary they have a big stock of oil, which is included in category one, non-renewable resources. According to U.S Energy Information Administration (EIA 2009) the UAE has the seventh largest oil reserve in the world. This leads to low prices of gasoline and high usage of it.

Dubai is considered to be among the world’s most wasteful population (Saadeh 2007) and the United Arab Emirate have the world’s largest ecological footprint per capita according to The Living Planet Report (WWF 2010) with a demand of 10,67 global hectares, compared to Germany with only half the footprint (5,09 global hectares) and India with a under a tenth of the United Arab Emirates footprint (0,91 global hectares). The major part of the United Arab Emirate footprint is due to carbon dioxide emissions.

Heavy traffic plays a major part in the fossil fuel burning, and as said in the introduction, Dubai was the most congested city in the Middle East 2007 (Congestion 2007).

Illustration 9: top 15 Ecological footprints

‘The Earth behaves as a single, interlinked, self-regulating system’ (Eds 2001, 5) and the amount of carbon dioxide and other greenhouse gases in the atmosphere on earth is

---

11 WWF, The Living Planet Report, 2010
connected to the temperature. With an increasing amount of this kind of gases in the atmosphere the temperature rises. By burning fossil fuels, carbon dioxide is released into the atmosphere.

Right now Earth is on the verge of having as much carbon dioxide in the atmosphere as can be managed without severe consequences to our planet because of global warming (Monbiot 2006) – the atmosphere does not serve as category three of Roseland’s the environmental assets any more, and by releasing such amounts of carbon dioxide Dubai is contributing to this.

The heavy traffic does not only cause serious, global environmental problems. The air pollution also leads to health issues. The air quality in Dubai is not worse than in some European urban areas, but the levels of certain substances are still high enough to be harmful. There are for example high levels of benzene, sulphur dioxide and nitrogen dioxide (Landais 2009). Benzene is a carcinogenic substance and long-term exposure can cause leukaemia (DHHS 2005). Sulphur dioxide can give impaired lung capacity (ATSDR 1999), the same is said about nitrogen dioxide. It is obvious that the traffic is harmful to the people living in the area. By introducing metro lines the Dubai Government hopes to reduce the traffic and congestion. One of the main reasons is to reduce carbon dioxide emissions and the ecological footprint (Ahmed 2010).

“Two of our eight major goals are directly related to enhance our environment, which are ‘shift from cars to public transport’ and ‘ensuring safety and preservation of environment’. Our plans, projects and practices are all aligned with our strategic goals and hence are environmentally friendly,” said Abu Shehab, director of strategic planning at RTA, Road and Transportation Agency of Dubai (Ahmed 2010). RTA’s action plan also consists of models for non-motorized transport models, such as cycling and walking. To minimize environmental pollution RTA is exploring the possibility to increase rail projects in the emirate up to 2030 (RTA 2009).

One can conclude that Dubai is taking stands for the environment, but with problems as acute as these the question whether they are fast enough remains. That is something only time can tell.

5.6 Physical capital
Physical capital is described by Roseland (2005, 8), as being the “stock of material resources such as equipment, buildings, machinery and other infrastructure that can be used to produce a flow of future income”. Roseland also describes that improving physical capitals includes
focusing on community properties such as public facilities (e.g. hospitals and schools); water and sanitation; safe, quality housing; adequate infrastructure and telecommunications; and efficient transportation, which is the case study chosen for Dubai.

Dubai is a “new” city, with one of highest growth IN population rate in the last few years. Dubai has been developing on a divergent way of how a sustainable community should be created: no natural renewable resources use (e.g. solar power), few green areas, weak public transportation system and no encouragement for city walking with the lack of pedestrian lanes and sidewalks. The metro line, that started to operate in 2009 with the red line, is working but not with its full capacity: some stations are still not completely built. The issue is that even with the whole system working, lots of areas will not be served by this system. A survey was conducted by Gulf Talent’s HR Company and it shows how traffic jams are a real problem to the city: the average of commuting time per day is 1h and 45min for Dubai residents that use cars. (Gulf Talent 2007) The survey also reported that Dubai “tops the list as the city with the most acute shortage of parking space, with nearly half the respondents reporting difficulties in finding parking space near their place of work”. (Gulf Talent 2007)

The municipality has been investing heavily on road infrastructure, even though this has not keeping the same pace with the increase in the number of vehicles, leading to growing problems in traffic congestion. Actually some of the investments in transport infrastructure have amplified the traffic jam problem due to ongoing construction work and road blockages. (Gulf Talent, 2007) This scenario just intensifies another issue suffered by Dubai’s road infrastructure: an originally imperfect road system, with in-built bottlenecks on certain key routes such as the Dubai-Sharjah road. The suggestions to improve the physical capital of transportation system and decrease the traffic jam are not just suggestions to improve the road system and reinforcing the use of cars. It is necessary as well to improve the number of metro lines, trams, buses, sidewalks and cycle lanes. The metro lines that are already working just serve the areas along the Sheikh Zayed road – some of the main malls are along this road, but not the beaches and not the main tourist attractions. Although Dubai’s metro is very stylish, it does not provide a service for most residents. Dubai needs more metro lines. The suggestion would be a parallel line to the red one but on the south, on the other direction rather than close to the beach. This idea seems to be a future plan for Dubai municipality: as shown on Illustration 6, RTA has intention to increase metro lanes in the future. As this plan is a long-term project, a short-term solution would be more buses lines to serve that area. The water transportation showed on the introduction is a very good example on how to use a main of
transportation with all its strengths and qualities: it will not receive much attention for improvement as it seems to be very efficient already.

Dubai is built along the sea shore and is a very spread city: you have to travel some kilometres to reach main points in the city. For example, to go from Dubai Marina to Deira City Center, a person has to travel around 27 kilometres. To use the road system, the driver has to pay a toll fee called “Salik”. The translation for the word ‘salik’ is ‘open’ or ‘clear’: this toll collection system works with no toll booths and no collectors. The system was launched in July 2007 and works with a radio frequency identification technology: each time the driver passes a tolling point – there are four points, the amount of AED 4 will be deducted from a prepaid toll account. (RTA Salik 2010)

A good physical quality that is present in Dubai could increase the use of bikes: the flat ground - there are no hills at all. On the other side, the city was built in the middle of the desert. The temperature can get higher than 50°C during the summer, not ideal conditions for cycling. The illustration 2 shows the monthly average temperature for Dubai. Despite this negative point, bicycles could then be used during the months when the temperature is lower (from October to April). This is the reason why another suggestion is to dedicate one road line just to bicycle traffic.

As conclusion, here are from short to long-term infrastructure suggestions:
1. Create bicycle lanes (dedicating a lane in each road just for cycling)
2. Increase sidewalks and pedestrian lanes
3. Increase toll charge points inside the Dubai municipality and increase the cost
4. Increase the numbers of buses and bus lines
5. Create new tram, metro and waterbuses lines

6 Conclusion

Dubai is a city that is developing in alarming rates, huge population growth, in the middle of the desert with few natural renewable resources and water scarcity. Despite other issues that this city faces, this study presented the main characteristics from Dubai with focus on the transportation issue. Taking into consideration what was presented before, the suggestions that this group has to make in order to develop a sustainable transportation system are classified from short to long-term application:
| Short-term | Action: Adapt school curriculum introducing concepts such as the Sustainable Development one and advertise children about negative consequences of car driving.  
Objective: To create more awareness about this issue.  
Action: Create general awareness campaigns (e.g. to distribute to the inhabitants a certain amount of free tickets for the metro and bus system. This could be made by mail with simultaneously campaign in public places such as shopping malls by handing out more free tickets to by passers)  
Objective: To create more awareness about this issue.  
Action: Create cycle lanes and pedestrian lanes. The suggestion is to turn one lane from the freeways to cycle lane. This does not require any big construction, just small infrastructures adjustments and new signs. On the other hand pedestrian lanes need more time to be built.  
Objective: To develop cycling as a mean of transportation.  
Action: Improve the infrastructure in the waiting area for marine transport (e.g. more washroom facilities and air conditioning)  
Objective: To increase the usage of this system.  
Action: Increase the price of gasoline.  
Objective: With a higher price for gas, people with average income will probably change their mean of transportation from car to public system or cycling when possible, choosing the most convenient and cheap solution.  
Action: Improve the bus feeder system, creating more lanes that reaches and interconnect the metro stations.  
Objective: Make the public transportation system more effective.  
Action: Expand the private vehicle toll system.  
Objective: With a higher price for use of the roads in the main areas, people with average income will probably change their mean of transportation from car to public system or cycling when possible, choosing the most convenient and cheap solution.  
Action: Create additional metro lines where it does not reach nowadays.  
Objective: Make the public transportation system more effective.  
Action: Create parking spaces around the main stations for public transport. This solution comes as long-term for the reason of lack of land availability close to metro stations. This probably would require a high investment from the municipality.  
Objective: To increase the usage of the public transportation system. |

| Long-term | Action: Improve the infrastructure in the waiting area for marine transport (e.g. more washroom facilities and air conditioning)  
Objective: To increase the usage of this system.  
Action: Increase the price of gasoline.  
Objective: With a higher price for gas, people with average income will probably change their mean of transportation from car to public system or cycling when possible, choosing the most convenient and cheap solution.  
Action: Improve the bus feeder system, creating more lanes that reaches and interconnect the metro stations.  
Objective: Make the public transportation system more effective.  
Action: Expand the private vehicle toll system.  
Objective: With a higher price for use of the roads in the main areas, people with average income will probably change their mean of transportation from car to public system or cycling when possible, choosing the most convenient and cheap solution.  
Action: Create additional metro lines where it does not reach nowadays.  
Objective: Make the public transportation system more effective.  
Action: Create parking spaces around the main stations for public transport. This solution comes as long-term for the reason of lack of land availability close to metro stations. This probably would require a high investment from the municipality.  
Objective: To increase the usage of the public transportation system. |
References


RTA (2009a) Hamdan bin Mohammed endorses Unified Fare of Mass Transport in Dubai. Roads and Transport Authority, [cited 2010 October 18]; Available from:
RTA (2009b) RTA outlines environmental & sustainability plan of rail projects 2010. *Roads and Transport Authority*, [cited 2010 October 18]; Available from: http://www.rta.ae/wpsv5/wps/portal/!ut/p/kcxml/04_Sj9SPykssy0xPLMnMz0vM0Y_QjzKLN4g3NhEHSUGYRvRaGKOGCLG5n5QMfMaIV-P_NxU_SB9b_0A_YLc0NCICkdFAAORe0w!/delta/base64xml/L3dJdyEvd0ZNQUFzQUMvNEIVRS82XzBfMzRI?conttype=archived&conntname=Hamdan%20bin%20Mohammed%20endorses%20Unified%20Fare%20of%20Mass%20Transport%20in%20Dubai.


RTA (2010e) RTA opens five new metro stations mid-October, [cited 2010 October 18]; Available from: http://www.rta.ae/wpsv5/wps/portal/!ut/p/kcxml/04_Sj9SPykssy0xPLMnMz0vM0Y_QjzKLN4g3NhBSYGZJkb6kWhijggRX4_83FT9IH1v_QD9gtzQiHJR0UA1fB6wg!!/delta/base64xml/L3dJdyEvd0ZNQUFzQUMvNEIVRS82XzBfMzdf?conttype=latest&conntname=RTA%20opens%20five%20new%20metro%20stations%20mid-October.

RTA (2010f) RTA puts final touches on Green Line stations of Dubai. *Roads and Transport Authority*, [cited 2010 October 18]; Available from: http://www.rta.ae/wpsv5/wps/portal/!ut/p/kcxml/04_Sj9SPykssy0xPLMnMz0vM0Y_QjzKLN4g3NhBSYGZJkb6kWhijggRX4_83FT9IH1v_QD9gtzQiHJR0UA1fB6wg!!/delta/base64xml/L3dJdyEvd0ZNQUFzQUMvNEIVRS82XzBfMzdf?conttype=latest&conntname=RTA


