Urban Growth in Muscat
from Patchwork to Sustainability

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Urban growth in Muscat is characterized by the following attributes:

- Extreme land consumption;
- Low densities particularly at peripheries;
- Private automobile dependency with absence of viable public transport;
- Fragmented open space, wide gaps between development and scattered appearance;
- Lack of choice in housing types and prices;
- Separation of uses into distinct areas;
- One to two story buildings as a default form of development;
- Large lots;
- Commercial buildings surrounded by acres of parking and
- Lack of public spaces and community centers
- Life style patterns are oriented towards the single villa on a walled plot as the most favourite residential building type. These trends however meet limited resources mainly related to land.
Since the oil revolution, 40 years ago, Muscat, the capital of the Sultanate of Oman has been under of **massive waves of rural migration** because of better employment vacancies, better services, and better lifestyles.

Urbanisation in the whole country has reached 84 % in 2009 according to UN statistics. (United Nations Population Division 2001).

Territory size shows the proportion of all extra people that will start living in urban areas between 2002 and 2015.

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<th>Rank</th>
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<th>Value</th>
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<td>Gaza Strip &amp; West Bank</td>
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<td>3</td>
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<td>10</td>
<td>Afghanistan</td>
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Source: UN statistics
Though the total area of Muscat is merely 1.3%, the second smallest area in Oman.
Total Population by Governorate & Region  
(Mid - Year Estimate 2009)

- Muscat: 30%
- Al Batinah: 26%
- Musandam: 13%
- Al Batinah: 10%
- Al Dahirah: 10%
- Al Dakhliyah: 10%
- Al Sharqiyah: 4%
- Al Wusta: 1%
- Dofar: 1%

It holds nearly one third of the total population of the Sultanate.
And the highest population density in Oman with 243.5 person/sq.km
Urban Transformation in the whole country emerged by three categories

- Economical transformation
- Social transformation
- Urban form transformation
Before oil age

- 70% of economic depended on agriculture and fisheries,
- Most People worked at agriculture and fish sector.
- 70% of products were local
Since oil revolution

- More than 80% depend on oil incomes and 2.6% for agriculture
- Most of national workforce are in public sector.

Oil and Gas= 81%
Non-Oil= 19%

Source: Annual Data 2006 Review of the Economy of the Ministry of National Economy, Sultanate of Oman

Muscat where it contained better technology and basic infrastructure received the most massive flows of local immigrants.

The rapid immigration happened in 1980s and 1990s to Muscat incorporated with a lot of urban and environmental problem.
At less than 40 years, the population of Muscat has doubled more than 32 times.

According to the last 2 years population growth rate, in 2030, population of Muscat will reach approx. 2 m.

Source: Ministry of National economy, Oman
Most families include cousins, aunts and uncles were living together aside of parents with their children forming an ‘extended family’. They were all living in one house sharing all its domestics. They were also sharing their work and their production forming a very strong cooperative society.

Since the oil revolution, the extended families have changed dramatically into a smaller families forming a ‘Nuclear families’. Every family now has their own life and living in a single detached house.

Currently Average local family structure in Oman 8.2 person(in urban 8.0, in rural 8.8)

*Source: Ministry of National Economy, 2009*
The dramatic change in family structure followed also by the change of the plot size. The size of the plot was not exceeding 150 m² before the oil revolution, but now it is reaches 1200 m². It is clear now of how much lands are consumed. The rapid profitable demands on lands caused to invading the farmlands which were the only source of food with fish before the oil revolution.
Economical transformation > Social transformation > Urban form transformation

Plot transformation

Large lots
With security reason, this form was developed because of the need for all destinations to be within a reasonable walking distances.

As Islamic city, old Omani city characterised as a “CENTRALIZED CITY”.

It had been characterized by a small, dense environment, often walled and generally not being much more than five kilometres from one end to the other.
The traditional buildings in Oman were built stacked to each other forming an integrated urban form.

This built form ensures the maximum protection against climatic conditions such as high or low temperature.
Adobe constructions
- Shades
- Outdoor space

Adobe houses are closed-built structures which allow saving energy.
- The single unit is consisted of multiple rooms and terraces which form a climatically homogeneous model.
- The terraces are used as sitting and sleeping areas in fair climate.
- The concept of various massing heights is to create shading areas to be used as outdoor living space.
Traditional Compacted Dwellings

Hot air circulation

Before oil Revolution  Built form transformation

- The external walls exposed to the air flows are kept as minimal.
Built form transformation

Before oil Revolution External wall

Traditional building external wall

The width of external wall is not less than 50 cm to delay the heat transmission to the interior in Summer time and delay the warming loss to outside in winter time.

40-60 cm wide
Lack of thermal insulation in buildings leads to more energy consumption.

Economical transformation > Social transformation > Urban form transformation

Built form transformation

After oil Revolution External wall

- The 20cm-wide concrete wall without thermal insulation cannot protect interior space from heat flows without A/C.

- The heat flows tend to go through the inner space in short time in summer while the heat gain inside can be easily lost to outside in winter time.

Lack of thermal insulation in buildings leads to more energy consumption.
Economical transformation > Social transformation > **Urban form transformation**

From compact high density urban form

To patchy high low density urban form

Notice that the pictures taken with the same scale
Economical transformation > Social transformation > Urban form transformation

Built form transformation

Before oil Revolution  Coastal cities

Plan

Farm  House  Sea

Section

Muscat Green Days
Built form transformation

Before oil Revolution  Interior cities

- PLAZA [SAHA]
- COMMUNITY PLACE [SABAH]
- FARMS
- HOUSING

Economical transformation > Social transformation > Urban form transformation
Economical transformation > Social transformation > Urban form transformation

Before oil revolution  Built form transformation

Interior cities

This open space leads to narrow streets-locally called *sikka*.
Economical transformation > Social transformation > Urban form transformation

Before Revolution  Built form transformation  Interior cities

Mostly, these passages were sheltered by palm fronds and leaves to cast shadows at the day time.
Economical transformation > Social transformation > Urban form transformation

**After oil Revolution**  Built form transformation

- The open public space—locally called “Saha”—was always centered in the neighborhood where people gathered every early morning before they went to their work.

- The spatial hierarchy is viable.
Economical transformation > Social transformation > Urban form transformation

**After oil revolution**  
**Built form transformation**

- In contrast the modern built form layout ignores the common public space which was working as a collective social space at every traditional neighborhood.

- The spatial hierarchy is absent.

The Planning Authority established a sort of planning framework to regulate the property and its relationship with the surrounding public spaces such as roads and neighborhood houses:

- The house must be a central unit on its plot;
- Specified set-backs for the house from its boundary walls according to the plot area;
- Restricted floor heights, and
- A limited built up area for each plot according to the plot area.
Economical transformation > Social transformation > Urban form transformation

After oil Revolution  Built form transformation

- In contrast, the contemporary built form which is mainly a single family detached house is completely failing to defeat harsh climate.

- This free standing cubic house is only habitable with powerful air-conditioning.
- Thus, the energy and water consumption are extremely high especially when we realize that this building is placed in a very low density area.
In 1970’s and 1980’s the plot layout was characterized by an area of 324m² (18mx18m) as a standard dimension.

Most of building design in this period was typical, the rooms were in one half of the plots where as the other part remained as a courtyard to be open to air and sun.

In front of the room, a space called locally ‘Liwan’ means lounge. The whole house surrounded by a compound wall with height ranged from 2-2.5 m.
Most people plant a big tree in the middle of the courtyard which created shadows in the afternoons and people tended to spend much time under this tree enjoying the breeze and fair weather.

In this period people rarely used air-conditioning although it was viable in every house. They preferred gathering in the courtyard and sometimes sleeping at evening time particularly at fair weather.
Economical transformation > Social transformation > Urban form transformation

**After oil Revolution**  Built form transformation

- The disadvantage of this type of housing design is the planning layout which all housing are separated from each other by a 5 meter-wide gap.

- This gap—locally called ‘Sikkah’—is a wasted area (about 90m² for each gap) and sometimes are used as garbage places.

- This gaps are neither used for car parks nor public spaces because of narrow width.
In the 1970s and 1980s, Economical transformation led to Social transformation, which in turn caused Urban form transformation. After the oil revolution, Built form transformation was evident, with people adopting window-air-conditioning types. Environmentally, this kind of building model affects the macro ecosystem, as most people use window-air-conditioning type systems where hot air is exhausted into a 5-meter gap, creating an extreme hot zone. This hot air infiltrates to other parts of the district, leading to an increase in local temperature and increased energy consumption.
Economical transformation > Social transformation > Urban form transformation

**After oil Revolution**  Built form transformation

- This period is characterized by a luxurious period because the plot layout has been under a lot changes in relation to size and the built form.

- The plot’s area has exceeded from 324m² to an average of 600m², whereas some plots’ areas reach more than 2000 m².

- The house is often laid at the centre of the plot and surrounded by 2-2.5 meter high compound wall to ensure the maximum level of privacy.

- The court yard now becomes a short of left-over space between the wall and the building.
RESULT

Rapid land consumption

2001
RESULT

Rapid land consumption

2008
RESULT

Contemporary fragmented Dwellings

Hot air circulation
RESULT

- Higher temperature
- More depletion of natural resources
- More energy consumed
- More air-conditioning
“Extreme Hot Island” >> increase energy consumption
Production and Consumption of Energy

*Source: 2006 Review of the Economy of the Sultanate of Oman, Ministry of National Economy
ENERGY CONSUMPTION IN OMAN BY SECTOR IN 2006

- Residential: 55%
- Commercial: 18%
- Industrial: 7%
- Governmental: 17%
- Others: 3%

RESULT
Very low spatial quality

- Only car accessible-
- Public spaces are not emphasized..
- The pedestrian and cycling paths are not emphasized.
RESULT

Water Degradation

Desertification

Drought
Patchy urban layout.

Such urban development makes its residents highly dependent on the private car.
RESULT

Dispersal development
RESULT

Very low density
RESULT

Land consumption on automobile pathways
RESULT

Patchy urban form, Seduction of automobile industries and cheap Gasoline
Increase in private vehicle ownership which could lead to
- changes in land use,
- more transport-related air pollution.
- Longer travel times
- poor traffic safety,
- increased energy use, and
- degradation of the urban quality of life.

Number of vehicles change in 1995-2005

Increase of private vehicle ownership in Oman

Source:
RESULT

Traffic jam
RESULT

- Each year there are about 10,000 car crashes in Oman resulting in 680 deaths and 7550 injuries.

- Oman’s road traffic death rate is 28 per 100,000 population which is far higher than the global average of 19 killed per 100,000.
  

- In 2005, Private vehicles ownership in Muscat 38,608 (per 100,000 persons)
  

- In 2005, 731 accidents (per 100,000 persons) occurred in Muscat
Urbanization can destroy the basis of life for the whole region if not well managed in both environmental and urban levels.
From patchy to smart growth

• Employ intelligent methods
  – Generate energy by renewable sources.
• Adapting the notion of ‘Compact City’
Generate energy by renewable sources

1. Wind Power

- Wind power generation increases with higher altitude. In Oman, mountains reach 8000 feet high, cover 15% of total area.

- Offshore wind speed is ~90% greater than that of land [1]
Generate energy by renewable sources

Wind Power

- Batinah Region
- Dakhliyah Region
- Sharqiyah Region
- Musandam
- Oman Sea
- Muscat
- Buraimi
- Dahirah Region

Height up to 8000 feet

15% mountains

Views of the Earth, Copyright © 2007 by Christoph Hormann http://earth.imagico.de

Muscat Green Days
Generate energy by renewable sources

2. Solar energy

• Most daytimes are clear shiny sky
Generate energy by renewable sources

3. Tides power

Energy in water can be harnessed and used. Since water is about 800 times denser than air.[1]

- 3200 km long coasts

Compact development for smart growth

- Encourage Mix land uses

This diagram shows the typical **mixed use** and **high density** with efficient **Public transport** and **comfortable cycling and pedestrian paths**.
Range of housing opportunities and choices

Apartments with various size

Villas

Two Bedroom Town House, The Wave, Muscat
Compact high density building design
- Attractive communities with sense of space.
- Preserve open space, green areas, natural places,
Creating pedestrian paths which can encourage walking.

- **Walkable neighborhoods**

  They should be shaded by trees or shelter
Provide a variety and viable public transportation.
Strengthen and direct development towards existing communities
Assume 5ha of communal area/400 dwelling at 2.2 persons per dwelling is 42ha of communal space/7,500 persons

Gross development density of 50 people per hectare
- 7,500 people
- No clear centre
- Doctor
- Park
- Shop
- 50% are over 500m from centre and may tend to drive for local
- Difficult to justify bus
- Large land take
- Dispersed facilities
- Bus may not be viable
- Population to support good neighborhood facilities

Bus service begins viable

Gross development density of 100 people per hectare
- 7,500 people
- No clear centre
- Doctor
- Park
- Shop
- 31% are over 500m from centre and may tend to drive for local
- Reduce land take
- Clear central facilities
- Bus should be viable
- Good public transport needs adequate density

Bus service fully viable

Gross development density of 150 people per hectare
- 7,500 people
- No clear centre
- Doctor
- Park
- Shop
- 13% are over 500m from centre
- Further reduction in land take
- Everyone can walk
- Usage of local facilities increases
- Bus routes are more regular
- Everyone should be able to walk in their local centre

SOURCE: Urban Task Force, UK
20 min. walk
City/town centre

The neighborhood
Local hub

Population over 50,000
25,000-50,000
5000 – 10,000
2,000 – 3,000

The town or city
The urban district
The neighborhood
Local urban community

SOURCE: Urban Task Force, UK
- Unique design of the sustainable city has to save the cost of living. People have to live adjacent to their work, education, worship places and recreational places to limit their movement costs and reduce the burden of natural resources.
- Encourage community and stakeholder collaboration in development decisions
• THAK YOU....