
GIS-based Decision Support for Public Toilet Site Selection: A Case Study of South Batinah Region in Oman

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1 Introduction

The Sultanate of Oman has been making great efforts to diversify its economy in order to move from its dependence on the oil-industry. These efforts and the rich cultural and natural landscapes that Oman offers, led to a massive growth in the tourism sector, which has become “one of the Sultanate’s most pivotal non-oil sectors, specializing in eco-tourism and first class tourism” (WINCKLER 2007, 221). Oman has experienced constant growth rates over the last decade: the country hosted over 2 million inbound tourists in 2012 (NCSI, 2013), compared to its 3 million strong population (AUSWÄRTIGES AMT 2013). Despite the success in terms of tourist numbers, the tourism infrastructure is largely underdeveloped or even non-existent.

Sanitary facilities such as public toilets are an important part of tourism infrastructure. Their existence and usability – or lack thereof – (seriously) affects individual tourism-related experience (GREED 2003, 296). Oman’s “Lack of Loos” has already caught the attention of the public (JOSEPH 2013).

The Oman’s Ministry of Tourism (MoT) has ongoing projects aiming to improve the tourism infrastructure in Oman, one of which is related to public toilets. This case study focuses on possible scenarios for the selection of locations suitable for public toilets near or at tourist attraction sites using GIS, while minimizing the number of new suggested facilities by using network analysis. The choice of relevant theory and methodology comes mostly from tourism research and GIScience. It is based on scholarly literature (e.g. honeypot approach (RYAN 2003, 116), Community Toilet Scheme (CTS) (HC-CLG 2008), spatial analysis), and follows the requirements of the MoT.

2 Framework for the Case Study

The MoT is aware of the power of GIS when it comes to spatially related issues, particularly to support their decision making processes. Its approach to the planning of public toilets for tourism sites (attractions) is in an initial state, and a GIS-based concept is yet to be fully developed. The task of this case study therefore was to propose a concept, while considering the following criteria required by the MoT: (1) a public toilet needs to serve a tourism attraction site; (2) a respective tourism attraction is visited all year round by

tourists; (3) there are no other public toilets/sanitary infrastructure that can serve this area (sanitary facilities at petrol stations, mosques or schools are not to be considered here); and (4) the planned public toilet is within a walking distance from the site.

Since this case study has opted for a practical solution, we were not only looking into the stand-alone sanitary facilities managed by the MoT, but also considered existing facilities managed by a municipality or private business; the latter would then require a mode of cooperation with MoT to make these available to non-customers and visitors in general. We further looked into minimizing the overall costs by reducing the total numbers of facilities to be constructed in the process. Thus the goals of this case study are specified as follows:

- *Conceptual framework* includes:
 - Definition of the term *public toilet* applicable to the study area.
 - A set of criteria and a key to multi-criteria evaluation for the selection of public toilet locations.
 - Identification of the appropriate GIS spatial analysis functionality.
- *Tourism inventory geodatabase*: update of the existing geodatabase with a layer containing public toilets (existing and planned toilet sites) as well as other objects with sanitary infrastructure that may offer these as services (e.g. petrol stations, mosques, restaurants, shops, etc.), and any attributes needed for the location selection (e.g. distinguishing between seasonal and all-year-round-visited attraction sites, number of visitors per site)
- *Creation of various thematic maps as guideline for decision-makers* showing existing and planned public toilets indicating the location appropriateness, and with all objects with sanitary services that may be used as public toilets

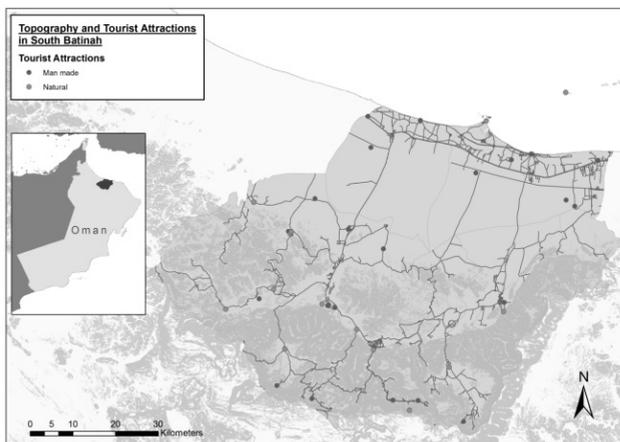


Fig. 1:

Topography and attractions in South Batinah. The geographical diversity includes natural attractions like wadis, hot springs, or the marine reserve Damaniyat Islands, and manmade attractions like the numerous forts and castles, traditional mountain villages, racing tracks, and cultural heritage sites like graves and beehive tombs.

Considering the MoT's interests, the South Batinah governorate was chosen as the case study area (figure 1). The governorate is located in the NW part of the country. It covers an area of 5.270km², consists of 6 Wilayats (counties), and has about 295.000 inhabitants (NCSI, 2012: 77). The Western Hajar Mountains are located in the south, and the big alluvial plains with a lot of farming activity towards the coast in the north.

3 Conceptual Framework

There are different definitions of what a public toilet is, and what could be used as a public toilet (see e.g. (CITY OF PORT PHILLIP, 2012). Figure 2 shows a typology that has been developed for this study.

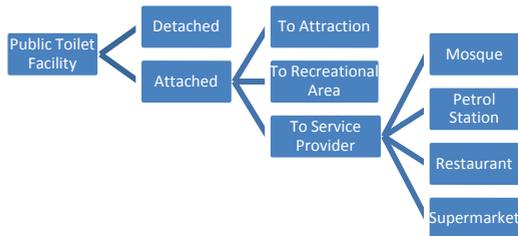


Fig. 2:

Public Toilet – a typology developed for this study. The analysis focused on the “detached public toilets” and the ones that are “attached” to tourist attractions. The “service providers” can be considered for a CTS.

This study focuses primarily on identifying areas that should have a public toilet because due to their distinct use, in our case by tourists (GREED, 2003: 134). Thus, the questions like *Where are the main tourist attractions? Are they equipped with public toilets? If not, where are toilets nearby? What distances are considered as “nearby”? How close do two attractions have to be in order to ‘share’ / be served by a single toilet?* need to be answered. Distances between two toilets or an attraction and the closest facility are central to this study. According to the Public Toilet Plan of the City of Melbourne (2008), “there are no published standards for the maximum distance between public toilet facilities...”. This Plan however states that “500 metres is becoming a standard distance in areas of high pedestrian activity such as a city centre.” Maximum distances between 300m and 1.000m are also proposed (CITY OF PORT PHILLIP 2013, 26) in urban settings, and from 2km (HAMILTON 2011, 14) up to 5 – 35miles along roads in rural areas (GREED 2003, 183f). Since our project focuses on tourist attractions, the 500m distance was chosen to ensure quick reachability from the attraction site. The distance-criterion is considered to be walking-distance (MoT), travelling in Oman though (even for very small distances) means driving by car. Keeping this fact in mind, the walking distance of 500m was transformed into travelling time – 6 minutes (KNOBLAUCH ET AL. 1996).

4 Preliminary Results

The data used in this project originates from the MoT (existing public toilets, hotels, tourist attractions, administrative boundaries, and tourism statistics), openstreetmap (road network), web sources (petrol stations), and the existing Oman tourism database (HERRMANN & CAR 2013). Significant effort was put into clean-up, conversion and integration of the existing data, and collection of missing data (e.g. creation of a topological road network for the test area). Thus we now have an updated Oman tourism database suitable for analysis and planning.

As distance and travel time are crucial for the selection of a public toilet location, network analysis was done with Network Analyst (ArcGIS). Its “Location-Allocation”-tool requires three feature datasets to work with: the road-network (lines), “Demand Points” (points) and

“Facilities” (points). The attraction dataset is used as Demand Points. The Facilities class are points from which the tool will choose the ultimate toilet locations. At this stage and scale of the project the criterion is only that the facilities should be placed along the road and not at specific locations (accessibility and ease of maintenance). Thus the potential locations are the road endpoints, intersections/junctions and points along the roads at a 250m distance (the “Construct Points”-tool is used to create these, (CITY OF PORT PHILLIP 2013, 26)). The resulting point dataset has 14183 evenly distributed candidate-facilities.

This analysis was repeated several times with different input features to look at different situations, depending on the definition of public toilets and the user. In the first cycle, basic analysis calculated ideal locations for public toilets that serve all attractions (maximum driving time = 6 min), while minimizing the total number of facilities. Hence, the analysis aims at clustering demand points that could be served by a common facility. In the second cycle only the existing facilities (data provided by MoT) were taken into account. As a result, all attractions that require more than a 6 min driving time are not to be assigned to a facility. Since the analysis minimizes the facilities, only the ideal ones are chosen if more than one toilet could serve an attraction. So, 6 of the existing facilities already serve 15 attractions leaving 25 attractions with no access to a public toilet. For these attractions the third analysis was conducted, excluding the 15 sites that are now already served. The fourth analysis considered attractions which have toilet facilities that are attached to them. This was not taken into account in the previous steps because those facilities are not open to the general public when the attractions are closed.

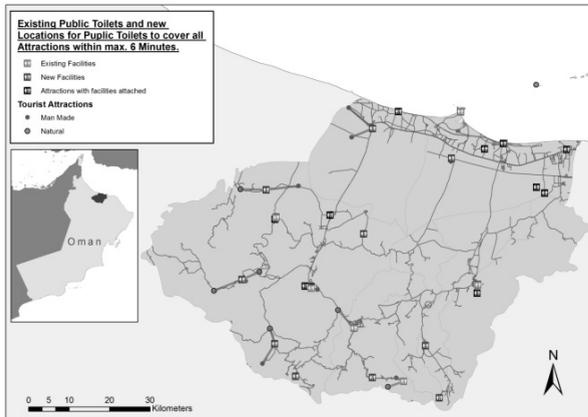


Fig. 3: Existing detached and attached sanitary facilities, and potential locations of new facilities for the remaining attractions located along the road network.

As a result, 39 of the total of 40 attractions will be served by a public toilet (except for the Damanyiat Islands) (figure 3). Out of the 39 remaining attractions, 15 are served by 6 existing facilities. This includes 8 attractions that also have attached facilities. Another 7 attractions also have their own toilets. This leaves 27 attractions that could be served by another 10 public toilets which would have to be built.

5 Summary and Outlook

The case study so far shows that the initial set of criteria (distance i.e. travel time; presence/absence and a type of a facility at an attraction site) and the chosen analysis tool,

together with the updated tourism geodatabase, deliver promising results: a selection of suitable locations for new public toilets to ensure the provision of the needed infrastructure for tourist attractions in the study area.

At this point in time, The Ministry of Tourism is only interested in the sanitary facilities maintained by the Ministry itself. Nevertheless, this case study also considered facilities in the analysis that are managed by other public authorities, or private service providers. This in turn can be used as a basis to develop a *Community Toilet Scheme* (CTS) – a scheme where the MoT would work with local businesses (e.g. coffee shops, restaurants or petrol stations) that make their sanitary facilities open to non-customers (see e.g. CITY OF PORT PHILLIP, 2013: 5). In addition, the use of existing and proposed new public toilets would further be improved through adequate signposting.

In the next step, the proposed analysis will be refined with other datasets collected in this project such as petrol-stations, supermarkets or restaurants. Identification of tourism honeypots, especially popular attractions that attract large numbers of visitors, and infrastructure developed around these incl. sanitary facilities is a further analysis refinement. Surveys among attraction site visitors and tour operators are currently conducted. The combination of preliminary results, additional data, and survey outcomes is expected to broaden the basis for decision making regarding improvements of the existing and development of new tourism infrastructure.

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