



## SUSTAINABLE DESIGN IN MODERN FISH MARKET: A CASE STUDY OF MUTTRAH FISH MARKET

<sup>1</sup>Nwokocha Chukwuebuka Gospel. <sup>2</sup>Anthony Enwin.

### **Author Details**

*Author: Nwokocha Chukwuebuka Gospel is currently pursuing a master's degree in Architecture, Rivers State University, Port-Harcourt Nigeria. PH-+234-802-905-5654. E-mail: [whitemangospel@gmail.com](mailto:whitemangospel@gmail.com)*

*Co-Author: Anthony Enwin is an Architect and a senior lecturer at the Rivers State University, Port-Harcourt, Rivers State Nigeria. He is also a member of the Nigerian Institute of Architects (NIA), PH-+234-802-223-4813. E-mail: [anthoneyenwin@gmail.com](mailto:anthoneyenwin@gmail.com)*

---

### **ABSTRACT**

In order to respond to the harsh environmental challenges, buildings are evolving to adapt to meet the needs of the people without harming the environment within its context. This research considers the Muttrah fish market project located in Muscat city, Oman and how it successfully implemented sustainability principles into its design process and construction. Several traditional markets in Oman experienced a great competition from the entrants of modern markets. The traditional markets failed to compete because of poor planning, inconvenient access, overcrowded trading activities, lack of air circulation and poor sanitation, affecting thousands of vendors. The former local market of Muttrah needed a new design to upgrade its commercial operations, in response to this, a more sustainable development model for Oman's traditional markets is proposed based on sustainability and hopefully could become an example of traditional market revitalization in Oman.

**Keywords:** Muttrah, Fish market, Sustainability, Harbor, Development

---

### **Introduction**

According to the World Commission on the Environment and Development, sustainability is “a form of development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” Sustainable design shares that big-picture view of how our choices affect more than the present. (Green Building Solutions, n.d.)

In order to respond to the harsh environmental challenges, buildings are evolving to adapt to meet the needs of the people without harming the environment within its context. This case study research considers the Muttrah fish market project located in Muscat city, Oman and how it successfully implemented sustainability principles into its design process and construction.

## Overview of the Muttrah fish market

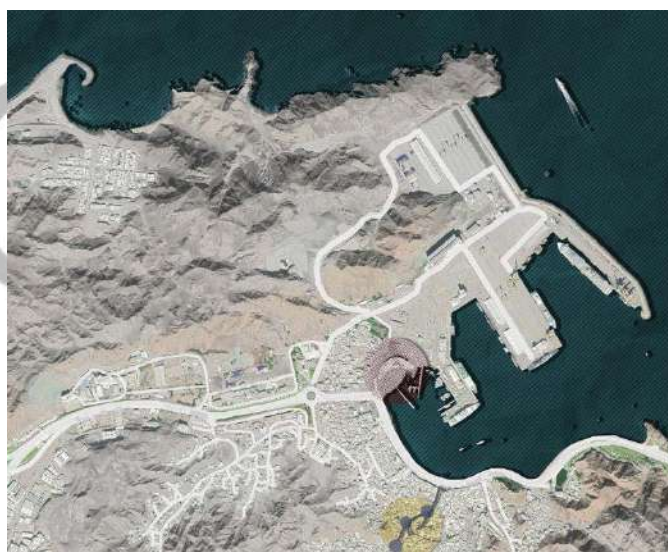
Sitting on the Muttrah corniche, the new fish market in Oman's capital city has become the centerpiece of the city and a focal point for the community. Merging tradition with innovation, the 4,000 square meter fish market is designed to sympathetically unite the old and the new. The design creates a public meeting area where local fishermen and worldly tourist from all over the world meet under the same roof. Muttrah Fish Market is created to serve as a focal point for the community of Muttrah, while simultaneously functioning as a hub for Oman's thriving fishing industry.

The old market building suffered numerous issues caused by the intense heat often prevalent in the area, with the fisherman's hauls often going off quickly in high temperatures. In the design of the new Muttrah fish market the challenge was to deliver a better refrigeration, preparation and packing facilities, along with modern trading spaces and a restaurant. (Rezai, 2019)

The project to create the new fish market complex came from the Municipality of Oman's desire to replace the existing 1960s building with more modern trading spaces. The project was designed by Snøhetta, Buro Happold provided multi-disciplinary services for this landmark development.



**Figure 1.** Map of Oman showing Muscat  
*Source:* <https://www.nc.cdc.gov>



**Figure 2.** Location of the Muttrah fish market in Muscat city.  
*Source:* <https://www.behance.net>

## Brief history

Oman is an island of stability and continuity in a much-disrupted neighbourhood. Unlike all other countries in the region which have been involved in devastating wars during the last half-century, Oman has in fact maintained a neutral political position (both internally and externally) by focusing on its socioeconomic development. Since the 1970s, Oman has been in a new historical phase often called "Renaissance". Three major events marked this new beginning: the discovery of oil (1964) and its exportation (1967 onwards); the end of the Dhofar War (1962–1976); and the ascension to power of Sultan Qaboos bin Said (1970). (Rezai, 2019)

Muscat is the capital, as well as the largest and most congested city in Oman (Benkari 2017). In fact, over 30% of Oman's population lives in a city which covers 5.3% of the total area of the country, i.e. 1,459,249 out of 4,559,963 people (ibid.; Sultanate of Oman's National Centre for Statistics & Information, 2017 data). Muscat has been at the very centre of development plans since the early 20th century. Its urban area has been growing through what scholars define as "sprawl and refills" development (Benkari 2017), i.e. gradual geographical extension alternating with construction of incorporated areas. This strategy began in the 1960s, when Muscat was first linked to Muttrah, then continued in the 1970s and 1980s by spreading over 60 kilometres to the west along the coast, and eventually culminated in the late 1980s when the urban expansion started to fill the gaps between the built-up areas (ibid.).

The district of Muttrah appears as a gem encapsulated in a beautiful seafront corniche, in which traditional merchant houses lean against a mountainous framework. As with the rest of Muscat, and despite a lack of corroborating evidence, there is no reason not to assume that a fishing village existed in Muttrah since prehistoric times and that coastal and possibly long-distance trade took advantage of Muttrah's protected harbour and inland access to Omani markets (Peterson 2007). Yet its historical importance as a fishing hub did not translate into proper port facilities until the late 1960s and early 1970s, when a fish market was also built. While today the old fish market is already demolished to leave space for the Snøhetta designed one, the atmosphere of a fishing centre remains. At the intersection of formality and informality, fishermen continue to sell their fresh products both inside the market and on their boats in the shade of the new Fish Market's iconic canopy. Suspended in an undefined time, the local community made of fishermen, fishmongers and their customers blends with the growing number of tourists attracted by a glimpse of authenticity. (Rezai, 2019)



**Figure 3.** On Site photos of Muttrah fish market.  
*Source.* <https://snohetta.com>



**Figure 4.** View of the market's unloading area  
*Source.* <https://snohetta.com>

## Climatic conditions

Generally, the climate of Oman is considered to be arid and semi-arid, but it differs from one region to another. In Muscat, summers are hot and very long, while winters are warm. As in other locales of the Persian Gulf, annual rainfall in Muscat is relatively low (diurnal precipitation is less than 100 millimeters) and mainly happens between December and April.

## Local Architectural Character

The local architectural character of Muttrah district is dominated by an almost monochromatic palette in shades of white, cream and beige, with traditional merchant houses (mostly rebuilt in the 20th century) and other low-rise buildings complementing the brown and grey of the rocky outcrops. There are no high-rise structures within the community as development are in form of sprawl expansion. The buildings within the study area are characterized by lots of window openings to allow for natural lighting and ventilation. (Rezai, 2019)



*Figure 5. Aerial view of Muttrah district neighbourhood*

*Source: <https://www.gettyimages.com>*

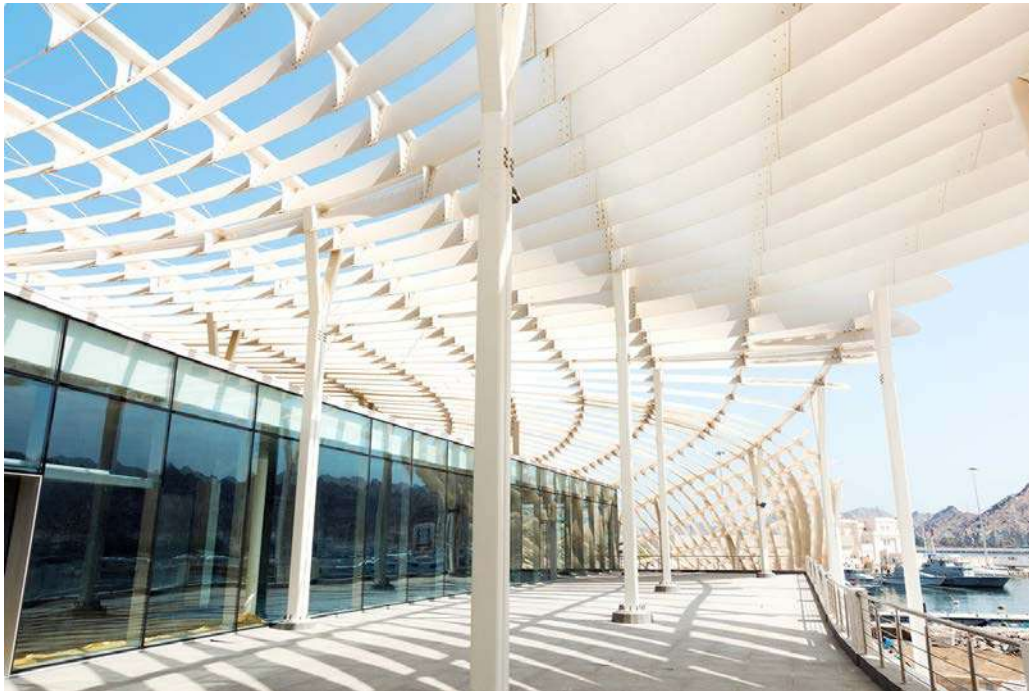
### A. Building description:

The following building assessment were sourced from an onsite review report by Hossein Rezai in 2019.

#### Building data:

The building footprint covers an area of 2,840 square metres on a site of 22,249 square metres. It is two stories high with an overarching roof canopy stretching across the entire building. The ground floor is entirely dedicated to the fish and vegetable markets. Facilities like cooled tables, air-conditioning and spot cooling to support hygiene, as well as features like a screen/wall with varying degrees of perforation to allow air movement and let controlled light in, made out of simple breeze blocks, are all incorporated into the design.

The second level is a roof terrace overlooking the harbour and surrounding houses. There are two enclosed spaces on this level housing a restaurants and cafés to bring people up and into the building. The entire structure is covered with an organically shaped steel-framed roof supported on Y-shaped steel columns. Aluminium lamellae are hung from the underside of the roof to shade both the roof terrace and the building from the western sun. The proportions of the building and the off-white colour of the roof canopy blend the structure into its context while allowing it to stand out – a duality that enriches the site and the neighbourhood.



*Figure 5. Upper floor showing Restaurant and roof terrace*  
*Source: <https://www.gettyimages.com>*

### **Design Attributes:**

#### **1. Response to physical constraints – (siting, climate, plot ratios, etc).**

The project is located at the corner of a larger masterplan, by the water and partially on reclaimed land. The 150-metre-long building, which is orientated in an east–west direction, occupies about 15% of the overall land plot, leaving the rest for landscaping, waterfront promenade and car parking facilities. While the building is successfully completed and operational, these external facilities are yet to be built on site. The freeform, organically shaped roof canopy extends beyond the building footprint to create shaded open spaces around the outside. Highly directional sun-shading lamellae are incorporated into the roof canopy structure to block the western sun and to create a protected and moderated microclimate around the entire building and on the roof terraces. The intention is to invite the public up onto the roof terrace and

to activate the Fish Market building beyond normal operating hours, although this is yet to happen.

## 2. Response to user requirements; spatial organization

The primary spaces of fish and vegetable market, rooftop restaurants and cafés, as well as the services facilities all relate to one another in a clear and readable manner. The hierarchy of the spaces is apparent from the higher headroom in the fish market hall when compared with the vegetable market.

## 3. Form massing, articulation of façades, decorative features, use of traditional motifs, etc.

The overall roof canopy hovers above the spaces below and curves around in a manner that articulates and announces the hierarchy of the spaces. Within such areas, adjacent activities (fish cutting and selling) seamlessly merge into each other. The simple breeze-block façade facing the corniche is masterfully perforated to varying degrees to achieve natural light penetration in a controlled manner along the entire length of the Fish Market. The wall is a reflection of the tiled walls on the opposite side with ceramic-tiled murals of marine and fishery themes.

## 4. Landscaping

External landscaping work is yet to be implemented on site. Some hardscape work is done, but the car park and green landscape are pending resolution of landownership with the port and the revised masterplan for the entire port area which the Fish Market is a small part of.

## Material and Structural Systems

Two distinctively different structural systems are fused together in the overall development. The two-storey enclosed buildings housing the fish and vegetable markets, as well as the restaurant and cafés spaces, are in reinforced concrete. The roof canopy is formed with Y-shaped steel columns supporting primary steel tubes which in turn support secondary and tie beams. This creates a steel grillage from which aluminium sun-shading lamellae are hung to moderate the environment and to protect both the roof terrace and the surrounding areas from the heat. The entire structure is erected on the improved ground, with over 1,500 stone columns installed into the reclaimed land to enhance the bearing capacity of the ground.

## B. TECHNICAL ASSESSMENT

### 1. Functional space usage

The spaces are used for the intended purpose. The movement of fish through the building (from the entrance through the cutting stations and the display trays) is well defined and utilised. The vegetable market is a sealed/air-conditioned box, and well laid out for the purpose.

### 2. Natural Lighting and ventilation

The Fish Market has a controlled and pleasant level of natural light penetration. This is cleverly achieved through a combination of passive and active measures. The building is placed on its site

such that the longer dimension runs in an east–west direction, the roof canopy substantially blocks the western sun, and the perimeter walls in breeze blocks have a controlled and designed level of penetration to allow natural light to filter through. Minimal artificial lights are provided to supplement the natural light and to moderate variations.

### **3. Response to treatment of water and rainfall**

No attempt has been made to harvest, treat or retain rainwater. The little rainwater that the site receives is discharged into the ground and eventually into the corniche.

### **4. Environmental response (adaptation to the natural environment)**

The site context, being a partially reclaimed area of land off the corniche, does not lend itself to integration with native flora and fauna. The entire new masterplan of the port, together with the Fish Market building, can create an ecosystem leading to a micro-ecological civilization. The Fish Market on its own would not be able to have an appreciable impact.

### **5. Choice of materials, level of technology**

Cutting-edge technology is woven into elements of display counters in traditional market spaces. The stainless-steel fish trays are cooled and maintained at a low temperature of  $-4^{\circ}\text{C}$  in display units which retain the relationship between the fish sellers, the fish and the customers.

### **6. Ageing and maintenance problems**

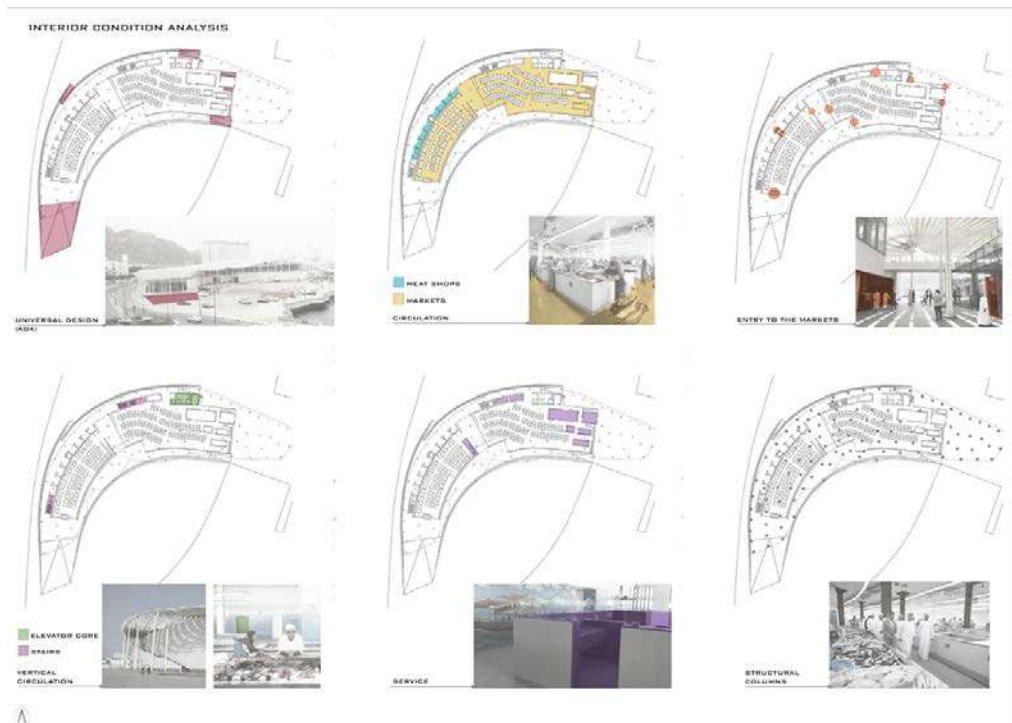
The materials used are long lasting and essentially maintenance free. Steel for the roof canopy, aluminium for the sun-shading lamellae, reinforced concrete for the single-storey buildings, masonry and aluminium screens, folding and sliding doors, as well as ceramic-tiled wall finishes and the cement screed floors are all relatively easy to maintain.

### **7. Durability and long-term viability of the project**

The Muttrah Fish Market replaces an older building to house fishing retail activities which will continue to thrive in this new and much more hygienic place. The new building also sets out to activate this corner of the corniche by drawing more tourists and locals to the restaurants and cafés with a view.

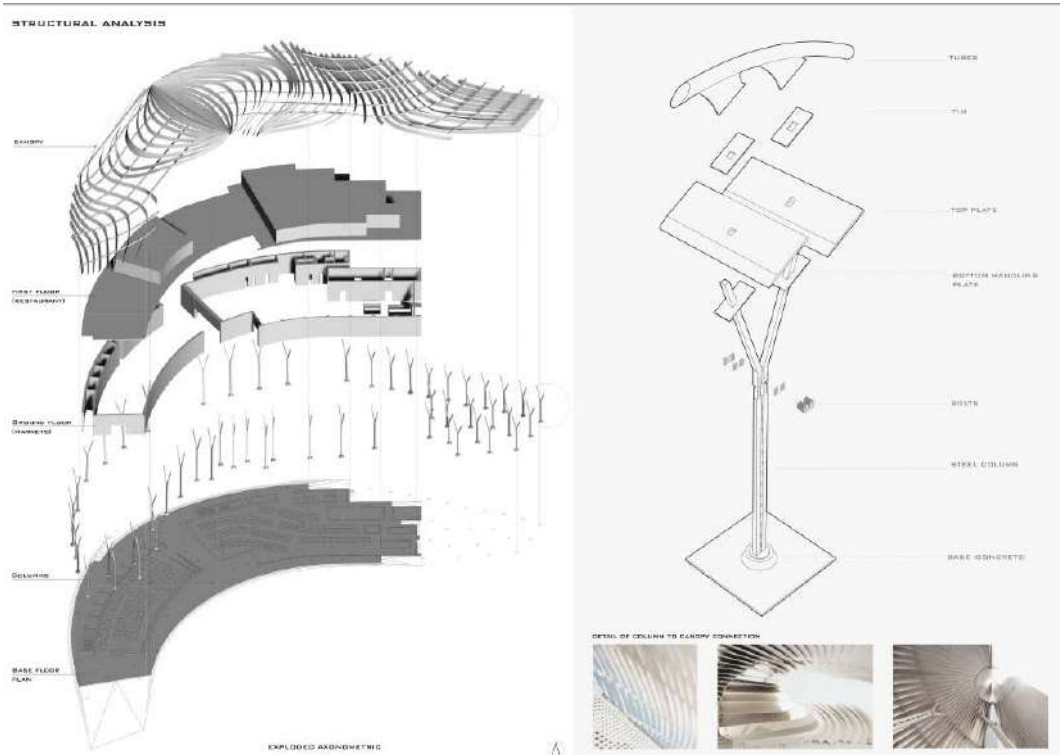


**Figure 4.15** Site plan of Muttrah fish market  
**Source:** <https://www.akdn.org/>

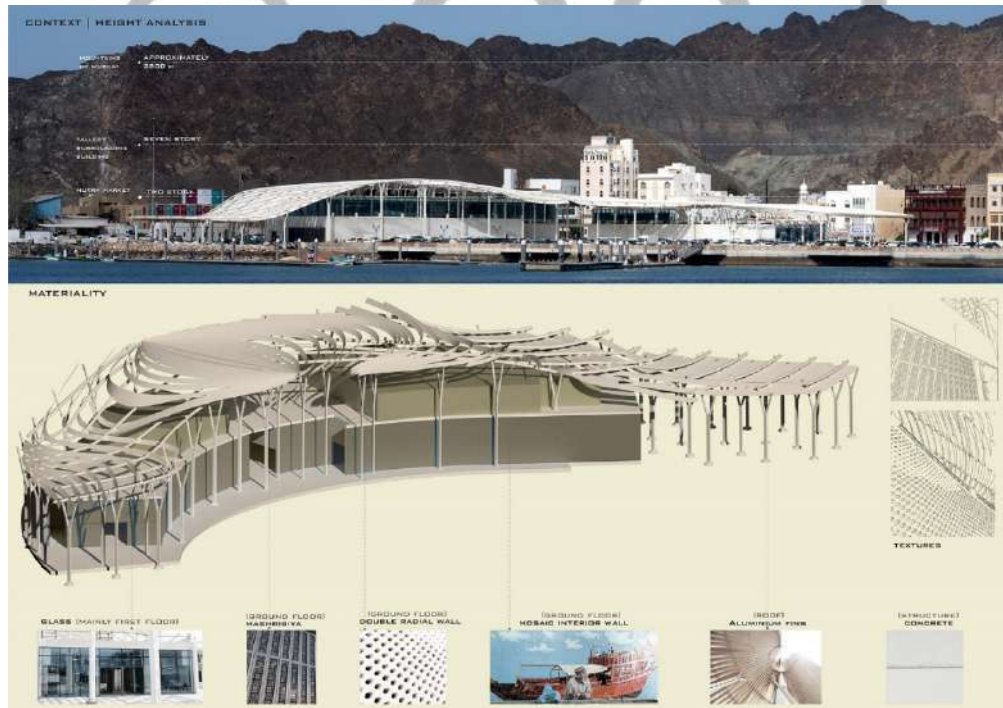


**Figure 4.16** Ground floor plan  
**Source:** <https://www.behance.net>





**Figure 4.16 Building components**  
*Source: <https://www.behance.net>*



**Figure 4.16 Elevation**

*Source: <https://www.behance.net>*

## Conclusion:

From the study of the Muttrah fish market, it can be clearly stated that it was design with a high consideration to sustainability to enable it fully adapt to its local context. Modern technologies and strategies were implemented to solve the design challenges making it stand out within its environment. From the post occupancy assessment, the users are really having a smooth interaction with the provided spaces and the architecture as a whole. In conclusion sustainability is a key factor in the design of a modern fish mark, as this is not only beneficial to the end users but also cuts down the overall cost of the construction phase.

## References:

Green Building Solutions. (n.d.). Sustainable Design. Retrieved from Green Building Solutions: <https://www.greenbuildingsolutions.org/sustainable-design/>

Rezai, H. (2019). Muttrah Fish Market. Archnet, 3-14. Retrieved from <https://s3.us-east-1.amazonaws.com/media.archnet.org/system/publications/contents/14188/original/DTP106572.pdf?1592226472>

Snohetta. (2017). Muttrah Fish Market. Retrieved from Snohetta: <https://snohetta.com/projects/359-muttrah-fish-market>

Aljabri, H., and Smith, H. (2013), "Users' perceptions about planning and design of public open spaces: a case study of Muscat", conference proceedings of the 11th European Architectural Envisioning Association Conference, 141–150.

Benkari, N. (2017), "Urban development in Oman: an overview", WIT Transactions on Ecology and the Environment, 226, 143–156.

Peterson, J.E. (2007), "Historical Muscat. An Illustrated Guide and Gazetteer, Handbook of Oriental Studies", Section One "The Near and Middle East", Vol. 85, Leiden & Boston: Koninklijke Brill NV Publisher.

Richthofen, A.V. (2018), "A critical reconstruction of modern urban settlement patterns in Muscat and

Al Batinah based on military maps", The Journal of Oman Studies, 19, 85–100.

Shepard, W. (2018), "'Five years ago there was nothing': Inside Duqm, the city rising from the sand", The Guardian, 6 August 2018.

Turner & Townsend (2017), "International construction market survey 2017: Oman – Muscat", [https://](https://www.turnerandtowntsend.com/media/2367/oman_muscat_market_pages.pdf)

[www.turnerandtowntsend.com/media/2367/oman\\_muscat\\_market\\_pages.pdf](https://www.turnerandtowntsend.com/media/2367/oman_muscat_market_pages.pdf) (accessed 12 April 2019).