Journal of Critical Reviews

ISSN- 2394-5125 Vol 7, Issue 8, 2020

# JEDDAH PLANETARIUM CENTER

**Meera Alhalabi[1], Lobna A. Mostafa[2]**

[1,2]College of Architecture and Design, Effat University, Qasr Khuzam St., Kilo.2, Old Mecca Road. P.O.BOX 34689, Jeddah 21478, Saudi Arabia

Email: [1]mmalhalabi@effatuniversity.edu.sa, [2]lomostafa@effatuniversity.edu.sa

*Received: 20.04.2020* *Revised: 24.05.2020* *Accepted: 15.06.2020*

**Abstract**

Science center is a landmark building where visitors will be exposed to scientific knowledge that helps people develop new skills, solve practical problems and make informed decisions both individually and collectively. This work presents the development of the Jeddah Planetarium Center in Jeddah, Saudi Arabia. For this work, three case studies related to planetarium centers were analysed. Based on the case study analysis, for the proposed planetarium center, the estimated gross area is 11785 m$^2$ and the net area is 7905 m$^2$. The center is comprised of several collective zones such as planetarium, show section, administration and service. In addition, three sites have been proposed for the development of the planetary centre. Therefore, a site evaluation analysis was carried out in order to select the most appropriate site. In addition, weighting factors (WF) were used for the site assessment analysis. Based on the results of the site evaluation analysis, site 1 was selected as the proposed development site as it attained the highest score of 62. The Jeddah Planetarium Center was designed with modern and unique structure. This center is expected to benefit the Saudi Arabian community and enhance its involvement in science and research in astronomy.

**Keywords**-- science center, education, planetarium, Saudi Arabia


DOI: http://dx.doi.org/10.31838/jcr.07.08.106

## INTRODUCTION

Educational public access areas are constantly looking for new and innovative ways to reach and engage the general public in areas such as fine arts, science, literature and history [1]. In addition, field trips to these educational venues provide an interactive stimulus for participants to learn about the content offered there [2].

Since people are used to graphically pleasing, streamlined entertainment venues such as film cinemas and amusement parks, similar experiences such as science centers or museums are also very much in demand [3].

Science centers have an important role to play in the future development of the younger generation [4]. These centers serve as a platform where it encourages people to learn more about science where knowledge is useful for all kinds of things [5].

In addition, science centers allow people to see and interact with the scientific development that has taken place throughout the early existence of the planet Earth and how it has evolved to the present time [6]. Furthermore, the science center will allow users to interact with science and inspire them to help save the environment and well-being [7].

At present, in Saudi Arabia, the government has introduced a vision for 2030 and wants to produce a nation that is well versed in scientific development [8]. In particular, the government wants to venture into the field of astronomy where it intends to fulfil its long-term dream of space exploration. Hence, this requires building a nation that has a strong foundation in knowledge of science and technology.

Therefore, in order to fulfil the vision of the Saudi Arabia government, there need to build an iconic visual science center that would mix education and entertainment to inspire and stimulate social interaction by providing unique experience in delivering scientific knowledge content. Thus, this work proposed the development of Jeddah Planetarium Center at Jeddah, Saudi Arabia.

## CASE STUDIES

In this work, three case studies related to planetarium centers were analyzed and details of each case study are provided as follows.

a. Shanghai Planetarium
b. Planetarium de Montreal
c. California Science Museum

### Shanghai Planetarium

Shanghai Planetarium is located at Shanghai, China (Figure 1). The estimated size of the building is 38 000 m$^2$. This planetarium was designed by Ennead Architects. Shanghai Planetarium is a proposed stargazing and planetary science exhibition hall, which will be a piece of the Shanghai Science and Technology Museum.

The planetarium will be situated in Shanghai's Lingang region, near the focal business region. The planetarium is the second in China, and set to be one of the greatest and most developed planetariums on the planet. Development of the planetarium started in November 2016 and is relied upon to be finished by 2020.The structure is a tribute to China's history of self-governance and its arrangements for future space investigations. The components of the planetarium center track the sun, the moon and the stars through their unequivocal design, impersonating interstellar instruments. The planetarium dome offers a fantastic, non-stop view of the day and night sky. View from the dome focuses on the heavenly bodies and builds on the impact of the planetary star gazing experience. Numerous extended lengths shaped by wide bending lines and the vast interiors of the historic center are an obvious component of the proposed structure.

The zoning of the planetarium center is comprised of meeting room, control room, service room, exhibition area, theater, science mall, office, planetarium, expert lounge, home zone, fire control room, preface hall, cloak room, large meteor observation room, armillary sphere, transformers, starry sky, ticketing and infirmary.

**Figure 1.** Shanghai Planetarium

**Planetarium de Montreal**

Planetarium de Montreal is located at Montreal, Quebec, Canada (Figure 2). It was designed by a group of renowned architects from Saucier + Perrette architects. The structure of the planetarium center is very effective in the design of the showrooms. The building's creativity stems from the fusion of different geometric shapes in a balanced design, both inside and outside. Engineered in alignment with the values of sustainability, the Planetarium is a unique and distinctive architecture component. In addition, the design of the planetarium center also shows consideration in its relationship with other on-site components, such as the bio dome and the Olympic Stadium. The facilities within this center is comprised of theatre , studio, multifunctional spaces, entrance hall, outdoor area, visual space, offices, restaurants, open spaces, service area, workshop area and gallery. Furthermore, the center was designed with clear circulation and there were no wastage of spaces within the center.

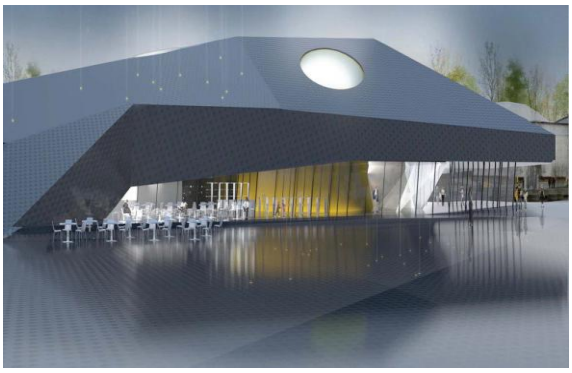

**Figure 2.** Planetarium de Montreal

**California Science Museum**

California Science Museum is located at San Francisco, California, United States of America, USA (Figure 3). The building has an estimated area of 41 000 m².Although it is an academic building, it also has a part for visitors and shows events, so it is both educational and social. This combination will encourage people to learn more about science. The incorporation of sustainable design was a key component of the design philosophy of this science museum. Many of the sustainable design principles used in the reconstruction of the facility were intended as a working exhibition for visitors to view and understand. The green roof is made of steel and concrete, covered and sealed by a waterproof membrane. Greenery is provided by native plant spades which (once established) are resistant to drought and do not require irrigation. Skylights, which are dispersed across the green roof, allow natural light to penetrate the gallery space and are regulated instantaneously to provide air circulation to the spaces below. Beyond the perimeter walls, the green roof becomes a glass canopy providing shade from the sun and shattering rain to visitors to the academy. The canopy, which extends and returns beyond the building's façade, comprises more than 55,000 solar cells extracting electricity from the piazza, centrally located, partly covered by a frosted skylight inside the green roof, and is open to the elements in the centre. The facilities of the science museum include planetarium, African hall, piazza, store, restaurant, exhibition hall, staff entrance, visitor entrance and outdoor garden.

**Figure 3.** California Science Museum

**PROGRAM ASSUMPTION AND SPACE DETAILS**

In this work, for the proposed Jeddah Planetarium Center, the estimated gross area is 11785 m² and the net area is 7905 m². The center is comprised of several zone such as planetarium, show section, administration and service. The measurement details for each zone is shown in Table 1. Figure 4 shows the proposed space diagram for the planetarium center.

**Table 1.** Space details

| Zone | Gross Area (m²) | Net Area (m²) | Percentage (%) |
|---|---|---|---|
| Planetarium | 814 | 670 | 14 |
| Show section | 7745 | 4769 | 42 |
| Administration | 1883 | 1448 | 10 |
| Service | 1343 | 1018 | 34 |
| Total | 11785 | 7905 | 100 |

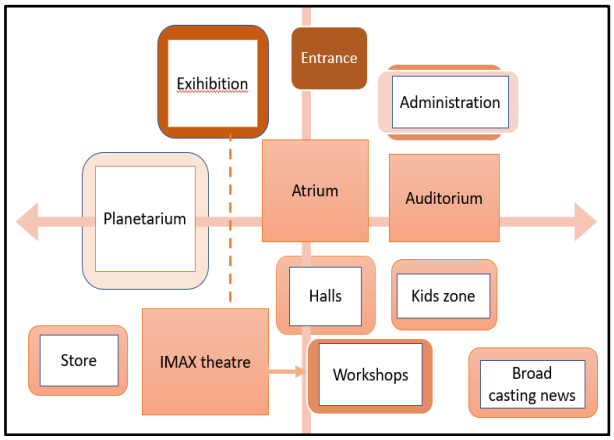


**Figure 4.** Space diagram

**PROPOSED SITE**

**Proposed site: Site 1**

For site 1 (Figure 5), this site is located between Al Kornich road and Prince Faisal bin Fahd street. This site has an area of 20000 m².

**Proposed site: Site 2**
For site 2 (Figure 6), this site is located next to Midan Alnawras and on Prince Faisal bin Fahd street. This site has an area of 18000 m².

**Proposed site: Site 3**
For site 3, (Figure 7), this site is located on Al Kornich road. This site has an area of 17000 m².


**Figure 5.** Site 1

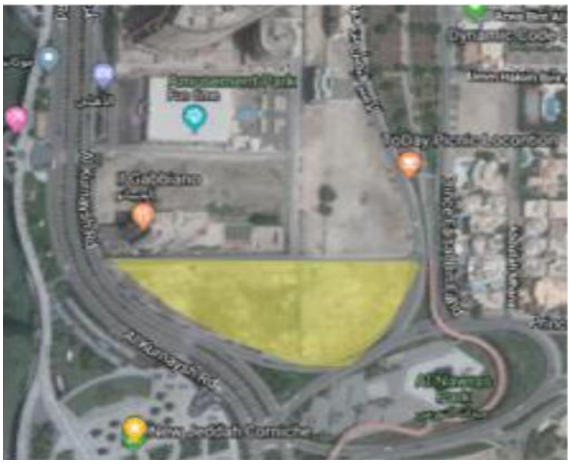

**Figure 6.** Site 2


**Figure 7.** Site 3

**SITE EVALUATION AND ANALYSIS**
Three potential sites for the development of the Jeddah Planetarium Center have been proposed in this work. Thus, site evaluation analysis was carried out in order to select the best site. For the site evaluation analysis, weighting factors (WF) were used, where 1 = not very important, 2 = somewhat important, and 3 = important. This WF were used for each tested criteria. All three sites were analyzed in terms of good view, accessibility, visibility, surroundings, security, and land use. Table 2 exhibits the result of the site evaluation analysis. Based on Table 2, site 1 was selected as the proposed development site, as it attained the highest score of 62.

**Table 2.** Site evaluation

| Criteria | Weighting factors (WF) | Site 1 | Site 2 | Site 3 |
|---|---|---|---|---|
| Good view | 3 | 12 | 6 | 9 |
| Accessibility | 2 | 8 | 10 | 8 |
| Visibility | 3 | 15 | 12 | 9 |
| Surrounding | 2 | 10 | 10 | 8 |
| Security | 1 | 5 | 4 | 5 |
| Land use | 3 | 12 | 6 | 9 |
| Total | - | 62 | 48 | 48 |

The site is easily accessible by Al Kornich Road and King Abdul Aziz Road. Pedestrian can easily access the Attahlia Park and the New Jeddah downtown area from the south. The location of the site has a variety of functions. Furthermore, the major surrounding area to the site from the south and east is the new development area where the New Jeddah downtown project will take place. Gardens and green areas located in front of the site close to the streets and the rest are all residential buildings.

**PROJECT DESIGN**
The main design concept of the Jeddah Planetarium Center is based on the creation of a place for people to practice their natural curiosity in astronomy and enhance their space experiences by involving and developing technology. The concept of design is based on three elements: education, technology and entertainment. These three elements have been chosen because the local community needs educational facilities. Moreover, it is technology that shapes the future of education and the existence of a new era of entertainment technology. In terms of structure, the building was designed with a shell structure system with a dome shape with a ring beam structure supported by four columns with an octagonal dome shape. In addition, the building has incorporated a flat slab structure up to a span of 10 metres, which provides flexibility in changing the function of the building in the future by adding or removing walls. Moreover, the building has a space truss structure system with a span of up to 12 meters to serve the function of the space. Furthermore, an octagonal skin façade pattern is added to the building design to provide adequate light inside the building and provide good ventilation, which is connected to the curtain wall façade system. Likewise, a shell structure system with a dome shape and a ring beam connects the bracelets together and holds the rest of the structure together. Additionally, the building has a ramp design structure supported by 8-metre-high columns. In terms of environmental solution and sustainability, the building is fitted with permeable paving, unique designed roofing that enables the penetration of skylight. Furthermore, solar panels have been installed in the shaded parking area, which will generate electricity. Figure 8 to Figure 11 illustrates the proposed Jeddah Planetarium Center.

**Figure 8.** Main elevation

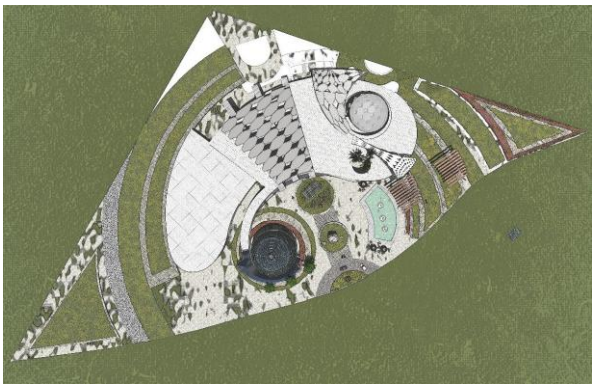

**Figure 9.** Top view

**Figure 10.** Perspective view 1

**Figure 11.** Perspective view 2

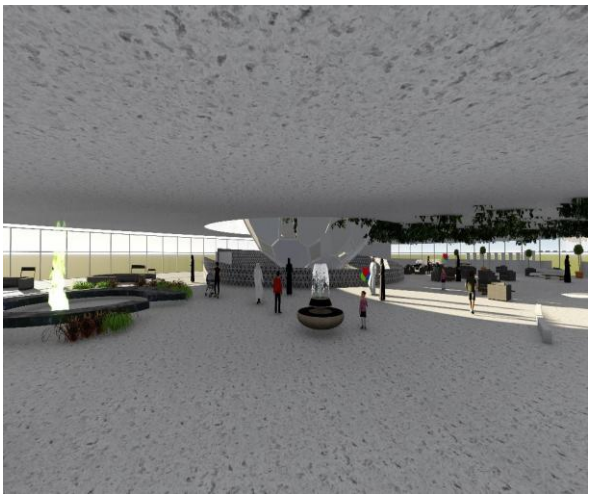

**Figure 12.** Interior view

## CONCLUSION

This work presented the development of the Jeddah Planetarium Center in Jeddah, Saudi Arabia. Hence, for the proposed planetarium center, the estimated gross area was 11785 $m^2$ and the net area was 7905 $m^2$. Furthermore, the center was designed with several zone, which are planetarium, show section, administration and service. The Jeddah Planetarium Center is expected to provide a theater-like venue where visitors can enjoy watching and listening to scientific shows featuring hologram technology, virtual reality gigs and other techniques that stimulate the senses of the user. Furthermore, this center is expected to inspired the Saudi Arabia community in science education and fulfill its long-term vision of space exploration.

## REFERENCES


1. Jensen E A 2016 Evaluating indicator-based methods of 'measuring long-term impacts of a science center on its community' *J. Res. Sci. Teach.***53** 60–4
2. Kilic A 2018 The Role Of Science Experiment Centers In Scientific Gifted Children's Science Education *Asian J. Multidiscip. Stud.***1**
3. Cain V and Rader K A 2017 Science Communication and Museums' Changing Roles *Oxford Handb. Sci. Sci. Commun.* 205
4. Charlesworth R 2015 *Math and science for young children* (Cengage Learning)
5. Ballard H L, Dixon C G H and Harris E M 2017 Youth-focused citizen science: Examining the role of environmental science learning and agency for conservation *Biol. Conserv.***208** 65–75
6. Russell B 2017 *The scientific outlook* (Routledge)
7. Pendergast E, Lieberman-Betz R G and Vail C O 2017 Attitudes and beliefs of prekindergarten teachers toward teaching science to young children *Early Child. Educ. J.***45** 43–52
8. Mitchell B and Alfuraih A 2018 The Kingdom of Saudi Arabia: Achieving the Aspirations of the National Transformation Program 2020 and Saudi Vision 2030 Through Education *J. Educ. Dev.***2** 36