



THE UNIVERSITY
of ADELAIDE

INDUSTRIALISED MASS HOUSING IN SAUDI
ARABIA

A Qualitative and Technological Study

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©

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Abstract

In 2017, the Saudi Arabian Government through its Ministry of Housing, announced that it planned to build 1.45 million affordable houses by 2030. The government will contribute to the cost of the houses to put them within the price range of people with modest incomes. Central to achieving this goal is the use of innovative, high-tech construction methods, mainly 3D printing. Several prototype houses have been constructed and more are planned to give Saudis an opportunity to experience them first-hand before a decision is made to go ahead with the planned rollout. The motivation for this thesis was to better understand the likely success or failure of this ambitious scheme. Early research soon revealed that since the discovery of oil in the kingdom in 1938, there have been many thousands of houses and apartments built through government-sponsored affordable housing projects. All have embodied a mixture of imported western notions of domestic living combined with traditional Saudi cultural, social and religious values and practices. The construction of these large-scale projects has relied on, and to a large extent been driven by, the use of imported construction materials, techniques and expertise. To better understand the current mass-housing plan this thesis, through the study of examples and case studies, explores these projects from both a technological and a qualitative perspective. The aim is to provide insights into their successes and failures in the hope that lessons can be learned that will help guide the current proposal towards a fruitful outcome for the Saudi people for whom the houses are intended.

Prior to 1938, domestic buildings in Saudi Arabia were constructed by local craftsmen using traditional materials and techniques. The first modern buildings were, flat-packed, timber houses manufactured in California and imported by the Standard Oil Company of California (SOCAL) to accommodate their expat oil workers in the rapidly expanding camp at Dammam on the Arabian Gulf. A trickle soon turned into a flood with many thousands of prefabricated timber houses from America and Europe imported into oil compounds all around the country. While these houses were never accepted more widely by Saudis as suitable domestic dwellings the modernist, technological thinking they embodied undoubtedly translated into the first contemporary, non-traditional houses built outside the camps during the 1950s designed by architects and engineers

employed by SOCAL's successor company Aramco. Mass-housing projects for the wider Saudi community soon followed all of which were constructed with heavy concrete construction. The first examples were built in situ however by the 1970s industrialised prefabrication had become established as the dominant method of delivering thousands of identical, affordable houses and apartments. Many were initially unappealing to Saudi house and apartment buyers and stood empty for a number of years. When the houses were finally occupied their new owners expressed their dissatisfaction with the manifestation of imported ideas about how they should live by almost universally carrying out modifications. These range from the relatively minor, raising the height of boundary walls, to major changes including adding a second storey. It is extremely difficult for the untrained householder or the local builder to alter and modify a house constructed of factory-made, loadbearing precast concrete panels and the same will be true for 3D printed houses. For the 1970s precast houses, modifications resulted in a significant number of structural failures leading to abandonment of the house. In addition, eclectic streetscapes emerged consisting of an assortment of styles and building materials some of which attempt to recreate a resonance with vernacular modes of living. Some houses are modelled on the latest trends found in architectural and lifestyle magazines. If minimising this level of modification is accepted as a goal for the proposed 3D printed houses, then a detailed understanding of previous industrialised mass housing schemes is important.

Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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Publications Included in this Thesis*

Abdulaziz Alshabib & Sam Ridgway, “Aramco and Al-Malaz Housing Schemes: The Origins of Modern Housing in Saudi Arabia,” *Histories of Postwar Architecture* 8, (2021, forthcoming).

Abdulaziz Alshabib & Sam Ridgway, “ASA 302 @ Georges Heights: Swedish Timber Prefabs in Australia,” *Fabrications* 30, no: 3 (2020) 323-345, DOI: 10.1080/10331867.2020.1826687.

Abdulaziz Alshabib & Sam Ridgway, “Oil + Architecture,” *Fabrications* 29, no: 2 (2019) 131-153, DOI: 10.1080/10331867.2019.1576491.

Abdulaziz Alshabib & Sam Ridgway, “Prefabricated Concrete Construction in Saudi Arabia’s Early Public Housing Projects,” *Construction History*, (2021, forthcoming).

Abdulaziz Alshabib & Sam Ridgway, “Swedish Prefabricated Houses in the Saudi Arabian Oil Fields,” in *Approaches and Methods in Architectural Research*, Edited by Morgan Andersson, Magnus Rönn, and Anne Elisabeth Toft (Sweden: Nordic Academic Press of Architectural Research, 2019).

* Apart from Chapter Six, each published/submitted chapter contains a preamble that explains how the publication related to the thesis and the overall PhD research. Chapter Six has not been published and therefore has no preamble.

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As a final word, I would like to dedicate this work to the memory of my father, Dakhel Mohammed Alshabib, who sadly passed away in the middle of this research in May 2019, and who would have been so happy and proud to see it change from dream to reality.

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Introduction

There are two very different but prevailing attitudes to technology, in regard to its capacity to innovate and make a difference. The first of these two attitudes is techno-utopianism. Innovators tend to share with entrepreneurs an unbridled optimism. You cannot be an entrepreneur if you are not confident that things will turn out for the better. Beyond a merely positive outlook, techno-utopianism is generally typified by a belief that innovation has an immediate and beneficial impact on society ... In contrast to techno-utopianism, the opposing view, techno-pessimism, is not that prevalent. It is largely limited to domains like literature and philosophy. You have only to think of the condemnation of railways by so many 19th-century writers, or the distrust expressed by 20th-century phenomenologists, such as Martin Heidegger, in the power of technology to improve the human condition.¹

Antoine Picon

Introductory study and background

When study towards this PhD was initiated in 2017, the Saudi Arabian housing sector was at a pivotal and critical stage. The Saudi Government had expressed its commitment to address the current and expected future housing shortages. This was within a context of increasing demand for houses that people on modest incomes could afford,²

¹ Antoine Picon, "Robots and Architecture: Experiments, Fiction, Epistemology," *Architectural Design* (2014): 56.

² Within the Saudi context, housing affordability is often referred to by comparing the average house price to the average annual income. Current data shows that the average housing price is ten times the

unprecedented high construction costs, and low-quality standards within the housing industry. A prevailing mood existed to address these issues through new government policies and strategies, and the deployment of innovative high tech construction techniques. In April 2017, the Saudi government launched the Vision Realization Programs (VRPs) which aimed to achieve the strategic goals of the *Saudi Vision 2030*.³ *Saudi Vision 2030* is a governmental strategic framework, announced in April 2016 that aims to reduce the country's dependence on oil revenue, diversify its economy, and develop its public service sectors such as housing, health, education, infrastructure, recreation, and tourism. Nested within the VRPs, the Housing Program identified an urgent need to build more than 1.45 million affordable housing units by 2030 to meet expected demand.⁴ In Saudi Arabia, there are two main factors driving the need for housing: rapid increase in population, combined with large-scale migration from rural to urban areas.⁵ Over the last few decades, the housing sector has struggled with long construction times, high costs, quality concerns, and consumer dissatisfaction.⁶ In response, the Ministry of Housing⁷ has declared that the best way to address the current demand is to promote the use of modern and innovative construction methods. To achieve this, they have initiated several programs to encourage the construction industry to move in this direction. While it took some time to determine the direction and focus of this PhD, the delivery, construction, and design of industrialised, affordable houses in Saudi Arabia became established as the field of research, including the need to critique and understand this in an historical and theoretical context.

Just prior to commencing this PhD research in May 2017, the Saudi Ministry of Housing organised and hosted a conference and exhibition in Riyadh entitled *Building Technology* to showcase the latest advances in housing construction technologies from

average annual income. The government aims to close this gap by supplying houses at affordable prices. For more see: The Saudi National Transformation Program 2020 (Saudi Vision 2030, 2016).

³ The Saudis' Vision Realization Programs (VRPs), (Saudi Arabian Council of Economic and Development Affairs, 2017).

⁴ The Housing Vision Realization Program (Ministry of Housing, 2017).

⁵ Sadi A. Assaf, Abdulaziz Bubshait, and Fawaz Al-Muwasheer, "Factors Affecting Affordable Housing Cost in Saudi Arabia," *International Journal of Housing Markets and Analysis* 3, no. 4 (2010).

⁶ *Ministry of Housing Seventh Periodical*, (Ministry of Housing, 2017), 17.

⁷ During the time of finalising this thesis, the government has merged two ministries: The Ministry of Housing and the Ministry of Municipal and Rural Affairs. The new ministry became known as Ministry of Municipal, Rural Affairs and Housing. This change has not been reflected in the contents of this thesis, most of which were written and published before this very recent change.

around the world. The exhibition was designed to begin the process of convincing Saudi citizens of the suitability of new construction technologies to local needs and conditions. At the conference, the ministry announced its plans to make modern construction technologies account for more than 90 percent of the new houses built in the country by 2030. To incentivise the Saudi construction industry to be more receptive and adaptive to imported industrialised and modern construction technologies, the ministry launched the Building Technology Stimulus Initiative (BTSI). This initiative was launched to fund the uptake of advanced construction technologies and to lay the foundations for a move from conventional, mainly concrete, construction methods to innovative construction techniques, particularly 3D printing. BTSI imported the world's latest construction technologies and used them to build several prototype houses. Various experimental prototypes have been developed and built in Saudi Arabia in the last three years to allow its citizens to experience the latest advances in the construction industry and to promote these forms of construction for future mass-housing projects. Innovative modular and 3D printing techniques, for example, have been used to build experimental houses in 2018 in Riyadh. Drones were also used recently within the Saudi housing projects to help with excavation and construction surveys. The BTSI is also now establishing and building a new innovation park, a permanent expo to showcase recent residential construction experiments. This park is based on a similar Western project, the Building Research Establishment (BRE) Innovation Park in the UK.⁸ According to the former director of the Building Technology Stimulus Initiative, in order to convince Saudi citizens about the potential of new construction techniques, "we must allow them to see it and touch it themselves before we start explaining its advantages."⁹ The showcase centre, which is being built on one of the busiest streets in Riyadh city, is planned to be replicated in other major cities around the country, to allow all Saudis to experience the latest residential construction technologies.

One of the Ministry of Housing's strategic initiatives in *Saudi Vision 2030* is to adopt and invest in advanced building technology (Industry 4.0) and increase the ability and

⁸ UK BRE Innovation Park is the largest housing park in the world. Supported by the government, this park brings the entire real estate ecosystem together.

⁹ In a brief about the program by Muhab Benten during *the Building Technology and Housing Projects Manufacturers Forum*, which was hosted by Riyadh Chamber of Commerce.
<https://www.youtube.com/watch?v=wXobHfxzcl8>

capacity of local industry to deliver housing projects using innovative technologies.¹⁰ To achieve this, the Ministry initially needed to rely on the skill, expertise, and technology of foreign construction companies. In 2017, as part of Saudi-Chinese cooperation, the Saudi king, King Salman ibn Abdulaziz Al Saud, officiated a memorandum between the Chinese Winsun company and Saudi Al-Mobty Contracting company.¹¹ The subsequent contract between Winsun and Al-Mobty, worth approximately 1.5 billion US dollars, obligated Winsun to lease 100 3D printers to the Saudi company to produce more than three million square metres of 3D printed wall material.¹²

Around this time CyBe, a Netherlands-based, high-tech construction company, had just completed the R&Drone Laboratory project in Dubai for the Dubai Electricity and Water Authority (DEWA). The brief for this building, which will house a drone and 3D printing research facility, required it to be 3D printed. Given this recent experience, the Saudi Government contracted CyBe to construct the 3D Studio 2030, an experimental 3D printed housing unit, in Riyadh, Saudi Arabia.¹³ In November 2018, CyBe successfully completed this experimental 3D printed prototype house, the first in the Middle East (Fig. 1). The experiment was extensively covered by local and international media and was promoted as marking the beginning of a new era of housing construction – an era that will rely heavily on the most recent high-tech and state-of-the-art construction technologies and practices. The prototype is a one-bedroom, single-storey detached house comprising a bedroom, an average sized living room, dining room, kitchen, and bathroom. The total built area is approximately 80 square metres. In reality, the 3D printing technology was not used to produce the entire house. While all walls were printed out using a 3D concrete printer, the concrete footings were constructed using the conventional in situ method. In addition, the roof's hollow-core concrete slabs were prefabricated off-site and then placed and assembled on top of the printed walls. The house consists of 27 interior and exterior 3D printed walls. Once the roof was

¹⁰ The Housing Vision Realization Program, 47.

¹¹ “The construction of sponge cities is on the way,” Winsun, March 2017, http://www.winsun3d.com/En/News/news_inner/id/244

¹² Corey Clarke, “Winsun to lease concrete 3D printers to Saudi Arabia in ‘billion dollar’ construction deal,” 3D Printing Industry, March 21, 2017, <https://3dprintingindustry.com/news/winsun-lease-concrete-3d-printers-saudi-arabia-billion-dollar-constuction-deal-108715/>

¹³ 3D Studio 2030, Cybe, <https://cybe.eu/cases/3d-studio-2030/>

placed using the prefabricated slabs, another 21 parapet walls were printed. Most of the house walls were load bearing. The robotic arm capacity and length which is approximately 2750 mm, determined the design and placement of the walls and the provision of structural integrity to the building.¹⁴ The joints between the printed walls were plastered over manually by tradesmen. The thickness of the walls varied from 25 to 40 centimetres depending on their location. Exterior walls were thicker than interior walls to provide thermal insulation. The printed material extruded through the printer's nozzle was 25 millimetres wide and 10 millimetres deep. The wall panels were stiffened internally with printed material laid down as they were made. This can be seen in Figure 2.

Importing technology and expertise from the Chinese and Dutch was not the only strategy. In addition, to build self-reliance, the ministry aimed to train local Saudi workers to operate the 3D printers. This began with constructing the prototype which was built by two Dutch technicians and five Saudi trainees.¹⁵ Once these Saudis were trained, the ministry purchased and imported the world's largest 3D printer and planned to start producing houses using the same technology with local construction materials and Saudi architects and engineers. This strategy to foster local expertise among Saudi workers and specialist technicians in the application of imported building technologies is not new. The same approach has been used by the Saudi government since the late 1930s. Archival research has revealed that Saudis were trained to construct the lightweight prefabricated houses imported from America and Scandinavia to accommodate expat workers in the oil fields. This same strategy was employed for the construction of precast concrete mass-housing schemes built during the 1970s and 1980s. In this case the industrial production of the systems also took place in Saudi Arabia.

¹⁴ In short description by a working engineer, for more see:

<https://www.youtube.com/watch?v=ukO0Krd9wl4&list=WL&index=4&t=1s>

¹⁵ Yosra K, "First Approach to the Mass Production of 3D Printed Houses in Saudi Arabia," 3D Adept Media, November 28, 2018, <https://3dadept.com/first-approach-to-the-mass-production-of-3d-printed-houses-in-saudi-arabia/>



Figure 1 The Saudi 3D studio 2030 experimental house. Source: Ministry of Housing.



Figure 2 Details of the printed wall. Source: Ministry of Housing

Wallace Neff and the Bubble House

A significant aim of this thesis is to examine the history and trajectory of industrialised mass housing in Saudi Arabia following the discovery of oil in 1937 and the subsequent large scale urban migration. This does not attempt to be a comprehensive study but focuses on examples, case studies, and key moments of transition and change to tell the story. The thesis does not directly critique the current proposal to 3D print many

hundreds of thousands of affordable houses, however, archival research uncovered an analogically similar scheme from the 1940s that offers a salutary lesson on attempts to solve a housing shortage with novel technological solutions.

In the early 1930s, Wallace Neff (1895–1982), the well-known American architect, pioneer of the California Style, and architect for many wealthy, celebrity clients, started to develop and prototype what he hoped would be an affordable form of housing. The Bubble House was to be “his greatest contribution to architecture.”¹⁶ Neff developed a technique he called Airform describing it as “a new type of construction in which a rubber-coated fabric balloon is blown up and then sprayed with concrete or plastic.”¹⁷ In later versions the gunite was sprayed onto a wire mesh frame placed over the balloon (Fig. 3). Neff studied seashell forms and balloon seams to come up with the design and the form, and he experimented with various materials including gypsum.¹⁸ He also built scale models out of clay (Fig. 4). Neff believed that his monolithic dome invention would suit various functions such as houses, oil tanks, hospitals, schools, and mosques (Fig. 5). He claimed that “Airform construction permits the best of modern design for the least money, yet permits building with materials which are plentiful.”¹⁹ The total number of buildings constructed using the bubble method is reported to have reached approximately 2,500, comprising houses, storages, and many other facilities.²⁰ In addition to those built in America, Neff’s Bubble Houses were built in Saudi Arabia, Mexico, Brazil, Portugal, Senegal, South Africa, Egypt, Jordan, Pakistan, and many other countries.

The first ever Bubble House project was in Falls Church, Virginia, in May 1942.²¹ The initial project consisted of twelve houses with the intention to build more as the client was the United States Defense Home Corporation (DHC), which was facing a housing shortage. However, the plan to build more did not proceed and “houses in Falls Church

¹⁶ Jeffrey Head, *No Nails, No Lumber the Bubble Houses of Wallace Neff*, (New York: Princeton Architectural Press, 2011), 13.

¹⁷ “General Outline of Airform Construction,” Undated document, Airform Construction folder, Box 2, Wallace Neff Collection, Huntington Library, San Marino, CA, USA.

¹⁸ Head, *No Nails, No Lumber the Bubble Houses of Wallace Neff*.

¹⁹ “Airform Construction Wallace Neff Architect,” undated document, Airform Construction folder, Box 2, Wallace Neff Collection, Huntington Library, San Marino, CA, USA.

²⁰ Head, *No Nails, No Lumber the Bubble Houses of Wallace Neff*, 158.

²¹ “A New Technique in Home Building,” *National Real Estate Journal*, (January 1942): 32–33.

would remain the agency's most experimental, smallest, and permanent housing project."²² The second notable project following the DHC project was located in Litchfield Park, Arizona. The project was commenced in 1942 and it appeared on various prominent publications under the name of "Desert Colony" as Neff claimed that "the house is ideal for desert country."²³ The Bubble houses in Litchfield Park, in particular, are of interest here due to their connection to the Saudis' first Bubble House experiment.

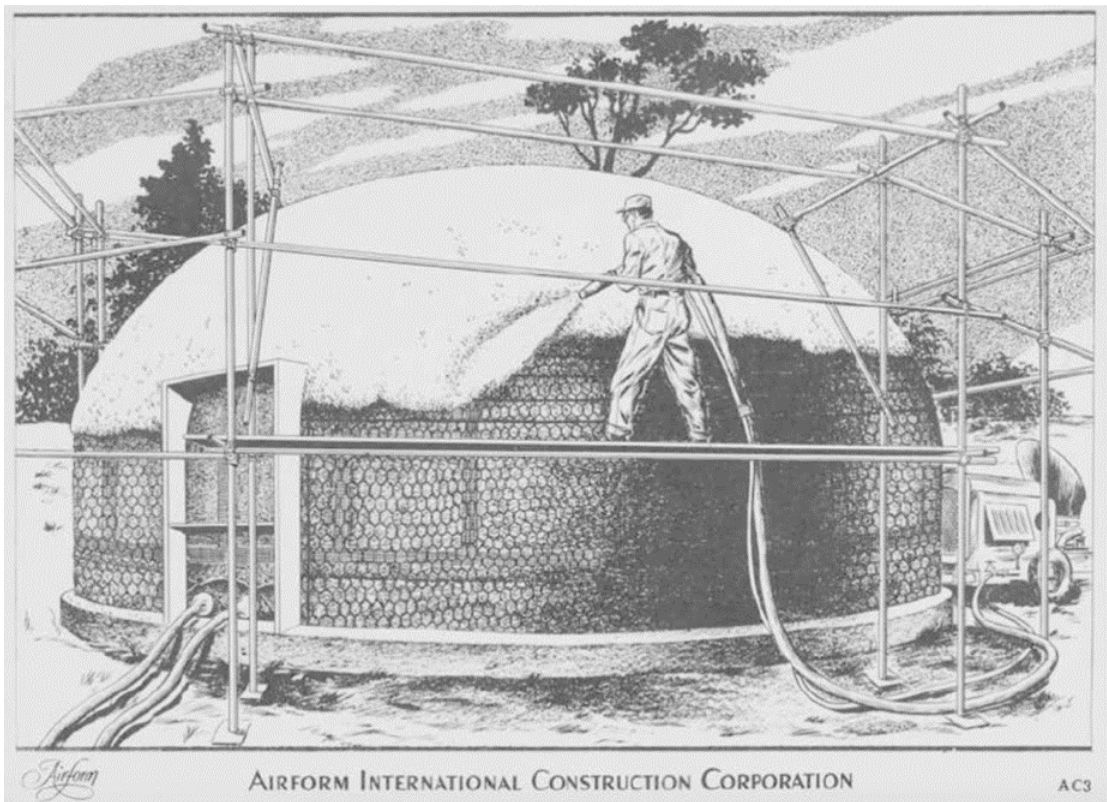
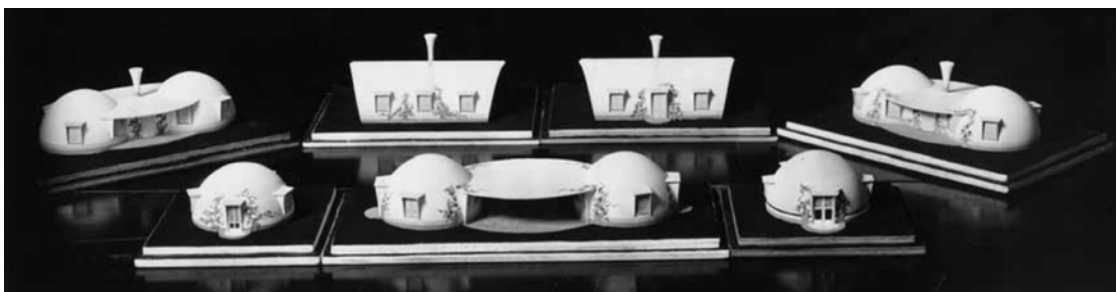


Figure 3 Bubble House construction process. Source: *No Nails, No Lumber the Bubble Houses of Wallace Neff*.



²² Head, *No Nails, No Lumber the Bubble Houses of Wallace Neff*, 36.

²³ "Airform House for a Desert Colony," *Architectural Record* (July 1944): 81–83

Figure 4 Bubble House models created by Wallace Neff. Source: *No Nails, No Lumber the Bubble Houses of Wallace Neff*.

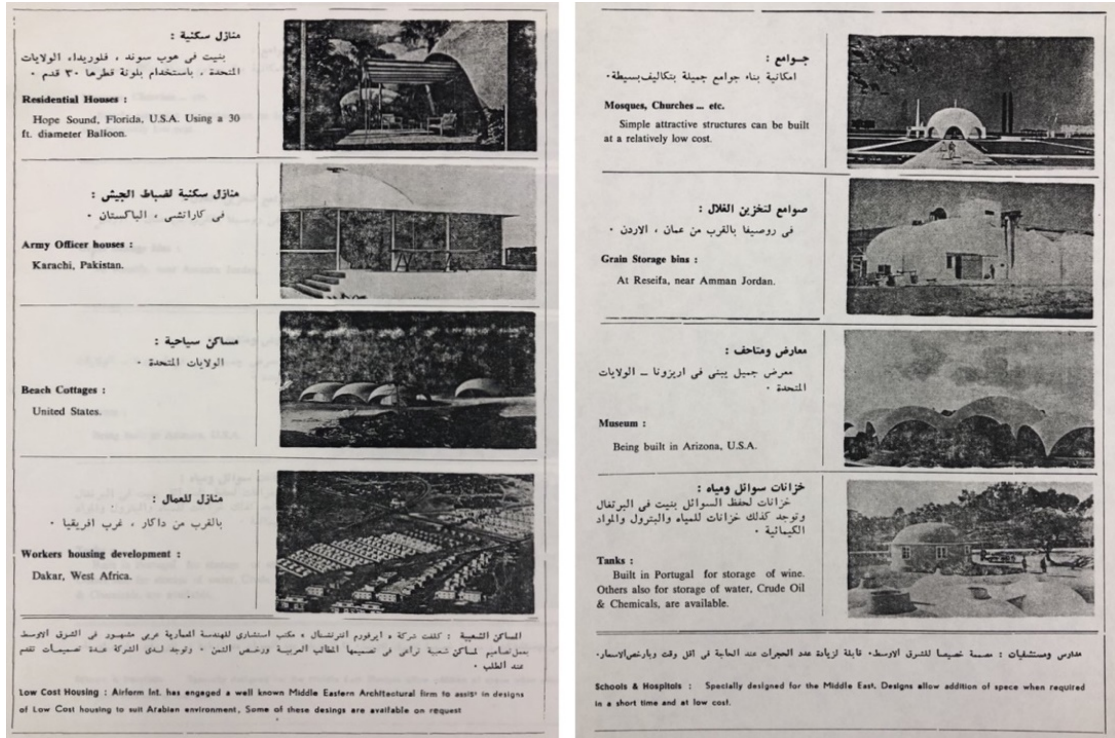


Figure 5 Two pages of a document submitted by Wallace Neff to the Egyptian King in 1949 where he won the Golden Medal. Source: Huntington Library.

In 1945, Wallace Neff made a deal with the Standard Oil Company of California (SOCAL), which was exploring for and extracting oil in Saudi Arabia at that time, to build his houses to accommodate the company’s native workers.²⁴ The Arabian American Oil Company (Aramco), subsequently purchased one of the canvas balloons Neff had used previously on the Litchfield Park project along with the patent licence.²⁵ The first “experimental” Bubble House in Saudi Arabia was constructed by the oil company workers in late 1945 on Gazelle Circle in the heart of the gated American compound at Dhahran (Fig. 6). Dhahran is on the Eastern side of Saudi Arabia and is the place where commercial quantities of oil were first discovered in 1938. Surrounding

²⁴ Head, *No Nails, No Lumber the Bubble Houses of Wallace Neff*.

²⁵ “License Agreement Between Wallace Neff, Architect, and Arabian American Oil Company,” Undated document draft, Airform Construction folder, Box 3, Wallace Neff Collection, Huntington Library, San Marino, CA, USA.

the house were many other imported prefabricated and industrialised timber houses the oil company had already erected to accommodate its rapidly expanding work force (Fig. 7). The house stood in between them as “local marvel.”²⁶ It isn’t entirely clear what plans Aramco had for the Bubble House however purchasing the balloon and the patent licence indicates they were considering it as a large-scale housing option.



Figure 6 The Bubble House in Dhahran 1945. Source: Saudi Aramco.

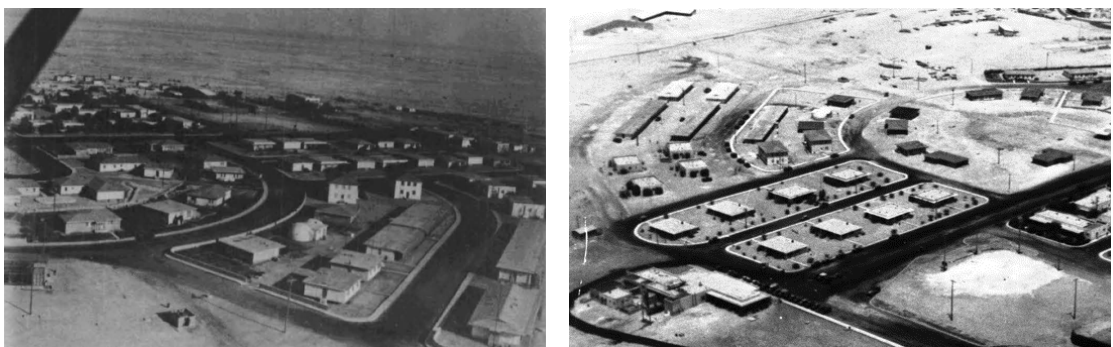


Figure 7 Dhahran’s Bubble House between other imported prefabricated houses. Source: Saudi Aramco.

When the house was built in Dhahran, oil workers thought the idea sounded promising. Paul Mandaville, an Aramco expat, wrote to his wife back in the United States that:

²⁶ “Bubble House,” *Al-Ayyam Al-Jamilah*, Fall 2011, 34.

These houses are really not as bad as they sound, and they will provide quick housing. They are built by blowing up a canvas balloon and spraying concrete over it in layers with a gunite machine. They have used them with excellent results in housing projects at home and they really look nice from the pictures the company has of them. Let's pray it is the answer to our problem.²⁷

However, these optimistic visions soon vanished after the house in Dhahran started to exhibit some functional issues and later cracks in the concrete shell. In the *Arabian Sun*, Aramco's weekly newsletter, William E. Mulligan wrote:

If the portable [he is referring to the imported prefabricated timber houses] was one of Aramco's most successful shelters, the "Bubble House" was the least successful ... the igloo never became a home. The domes were heavy, ominous things, even with bright, splotchy ceilings. They did, however, have one marvellous ability: whispered comments on one side of the room were carried in lovely parabolic arcs into the ears of guests strategically situated across the room.

The irremediable fault on the darn domes was there were no corners and no flat surfaces. Closets and cupboards were vast at the bottom and tiny at the top. Five feet of shoe space was matched by a clothes bar of one foot; you stacked things in cupboards with little items at the back and the big ones in the front. Nothing fitted flush against the walls. The Isfahan brass tray hung down - and out - like a Chinese gong. And that is what it sounded like, reverberating in the hollow dome when you bumped it with your head.²⁸

Dhahran's Bubble House - although it was never used as a house - was the first modern experimental housing unit built in Saudi Arabia. While the house exhibited various problems, Neff's ambitions to sell and construct them in large quantities in Saudi Arabia continued. Archival research revealed that despite the negative reports circulating in

²⁷ "Bubble House Resurfaces," *Al-Ayyam Al-Jamilah*, Spring 2013, 2.

²⁸ William E. Mulligan, "Portables, Sheep Sheds... and the Bubble House," *The Arabian Sun* XXIX, no. 13, 1973, 6.

Saudi Arabia in the late 1940s, the Anglo-Syrian Trading Co., Wallace Neff's representative in the region, was able to sign a contract in 1949 with the Saudi Arabian government to build 15 trial Bubble Houses.²⁹ In order to secure this contract, the representative had to convince the government that they could be "built by inexperienced people" and that "when properly constructed, they did not crack."³⁰ The representative agreed that his company was ready to build two houses as examples to validate his claims. It was anticipated that if they proved to be suitable for the local needs and conditions, the government was willing to build a large number of similar dwellings to house the Muslim pilgrims in Makkah and Madinah.³¹ However, delays in the manufacturing and delivery of the balloons used to construct the houses caused the government to look at other alternatives.³² Thus, the plan to build even the trial houses was not carried out and the house built in the Dhahran Camp remained the only Bubble House built in Saudi Arabia.

In the late 1950s, after experiencing many maintenance issues, Aramco decided to demolish its only Bubble House.³³ Eventually, most of the houses around the world were demolished. Generally speaking, they were not liked and were never widely accepted as suitable places to live. Jeffrey Head, the author of *No Nails, No Lumber: The Bubble Houses of Wallace Neff*, states that "in the United States, no architect, company, or dome-home type was able to successfully transition to widespread cultural use."³⁴ Most people eventually realised that these houses were not suitable for permanent housing. He also adds that "ultimately it was difficult for Bubble Houses to compete with traditional aesthetics and conventional housing of the era. Perhaps a social and cultural stigma also affected consumer perceptions."³⁵

According to Poorang (Amir E.) Piroozfar and Eric R. P. Farr, academics who have investigated the drivers, requirements, and benefits of the deployment of advanced

²⁹ "Letter from Anglo-Syrian Trading Co. to Wallace Neff," 28 March 1949, Airform Construction folder, box 2, Wallace Neff Collection, Huntington Library, San Marino, CA, USA.

³⁰ "Letter from Anglo-Syrian Trading Co. to Wallace Neff," 2.

³¹ "Letter from Anglo-Syrian Trading Co. to Wallace Neff."

³² "Letter from Anglo-Syrian Trading Co. to Wallace Neff."

³³ "Remember the Bubble House?" *Sun and Flare* XIX, no. 48, 1963, 2.

³⁴ Head, *No Nails, No Lumber the Bubble Houses of Wallace Neff*, 22.

³⁵ Head, *No Nails, No Lumber the Bubble Houses of Wallace Neff*, 158.

construction technologies, the industrialisation of building construction addresses “two distinguishable areas: the building materials and the labor.”³⁶ Both the Bubble House and the 3D printed experimental houses in Saudi Arabia address these particular areas. Both projects required fewer than five workers to complete the entire housing unit and for both projects a new lightweight concrete material was developed. Both were advertised as rapid construction techniques – reputedly, both could be constructed in less than two days.³⁷ The use of new construction technologies and workers skilled in the narrow application of a specific technique to manufacture and erect technologically motivated mass housing were central doctrines of architectural modernism. Both the Bubble House and the 3D printed house have their origins in modernist, techno-utopian attitudes to building, particularly towards the provision of affordable mass housing. For example, it is possible to trace a direct lineage not only in the thinking, but also in its manifestation through a construction technique, from one of its most ardent devotees: Le Corbusier. In the 1920s, Le Corbusier began challenging traditional domestic construction practices. In his Pessac Housing from that period, Le Corbusier championed the use of gunite, an early form of sprayed concrete. At Pessac, he experimented with a new method to construct walls using a very expensive and sophisticated concrete gun developed by the American company Ingersoll Rand. He also tried to make deals with industrialists for large orders of standard doors and windows. However, the method he used soon failed and was replaced with concrete blocks made on site. Moreover, the houses stood empty for several years as they failed to attract buyers. The art historian Tim Benton wrote that:

In almost every material sense Pessac was a disaster, running spectacularly over budget and contributing to the bankruptcy of its patron, stimulating powerful opposition from local architects and politicians, failing in all the usual technical ways (drains, windows, terraces, roofs), failing to attract buyers or tenants at the intended

³⁶ Poorang (Amir E.) Piroozfar and Eric R. P. Farr, “Evolution of Non-traditional Methods of Construction: 21st Century Pragmatic Viewpoint,” *Journal of Architectural Engineering* 19, no.2 (2013): 122.

³⁷ The Bubble House was reported to be constructed in less than eighteen hours, for more see: Head, *No Nails, No Lumber the Bubble Houses of Wallace Neff*. According to the Ministry of Housing, the printing of the 3D Saudi 2030 walls took 25 hours.

prices and rents and later failing even to attract the close scrutiny from scholars which it deserves.³⁸

It is well known that, in an effort to promote new construction technologies and new attitudes to houses as “house-machines,” Le Corbusier denigrated traditional architecture and construction. In *Towards a New Architecture*, he claims that “the machine that we live in is an old coach full of tuberculosis. There is no real link between our daily activities at the factory, the office or the bank, which are healthy and useful and productive, and our activities in the bosom of the family which are handicapped at every turn. The family is everywhere being killed and men’s minds demoralised in servitude to anachronisms.”³⁹ Following Le Corbusier’s attempts, technologically driven, architectural research experiments received unprecedented attention. Notable projects included Richard Buckminster Fuller’s Dymaxion House (1930), Konrad Wachsmann and Walter Gropius’s General Panel Packaged House (1940s), Jean Prouvé’s Maison Tropicale (1949) and Plastic House (1965), and Matti Suuronen’s Futuro Houses (1960s).

A critique of twentieth-century utopian architectural visions and modern residential architecture started to develop from the early 1930s and received prominent attention after World War II. In “Nostalgia,” Anthony Vidler writes that:

... philosophers from both the right and left of the political spectrum contributed to this sensibility, from Theodor Adorno to Martin Heidegger, Max Horkheimer to Hans Sedlmayer, which amounted to no less than a concerted attack on the founding premises of modernism, or at least those that seemed to be to blame for the form of the “modern” house, its “geometric cubes” stacked up or laid out in “cement honeycombs.”

Against the prismatic model of the Maison Domino, a modernist primitive hut in the line of many such structural and rationalist types

³⁸ Tim Benton, “Pessac and Lège Revisited: Standards, Dimensions and Failures,” in *Massilia: anuario de estudios Lecorbusierianos*, ed. Josep Quetglas (Barcelona: Edición Fundación Caja de Arquitectos, 2004), 85.

³⁹ Le Corbusier, *Towards a New Architecture*, Translated from the thirteenth French edition by Frederick Etchells (London: Architectural Press, 1946), 277.

since the Enlightenment, these critics advanced the complaint of uninhabitability. As Adorno wrote in 1944, “dwelling in the proper sense is now impossible,” a statement that was echoed by Heidegger seven years later in his "Building Dwelling Thinking."⁴⁰

One of the first to draw attention to the threat to the art of building from manufacturing was Lewis Mumford. In “Mass Production and the Modern House,” an article he published in 1930, Mumford pointed out, somewhat fatalistically, that “the charm of good building, the charm due to the carpenter’s or the mason’s feeling for his material and site, would disappear; but as compensation there would be the austere clarity of good machinery; and since this charm is already a sentimental memory in most of our building, it is an illusion rather than a reality that would be destroyed.”⁴¹ The replacement of handwork with machines and technological instruments has altered how users engage with their built environment. Antoine Picon, professor of the history of architecture and technology at Harvard University, writes about the use of recent robotic technology in the construction industry:

Despite its attempt to distance itself from techno-utopianism, the narrative of the industrialisation of construction remained permeated by utopian concerns such as the desire to reconcile nature and technology, the project to free man of unnecessarily harsh work, or the ambition to enable man to live everywhere on the planet, the latter being especially present in Buckminster Fuller’s approach to industrialisation. In many respects, the advent of robotics in architecture is marked by the emergence of a similar type of narrative. On a certain number of points, this new narrative appears as the direct inheritor of the industrial one. Like its forerunner, it is permeated by utopian themes, some relatively traditional, others without equivalent in the history of industrial ideals. Whereas the project to relieve man of painful tasks is by no means original, the quest for a new

⁴⁰ Anthony Vidler, “Nostalgia,” in *The Architectural Uncanny: Essays in the Modern Un-homey*, Cambridge, (Mass.: MIT Press, 1992), 65. Martin Heidegger, “Building Dwelling Thinking,” in *Basic Writings: From Being and Time (1927) to the Task of Thinking*, ed. David Farrell Krell (New York: Harper & Row, 1977).

⁴¹ Lewis Mumford, “Mass Production and the Modern House, Part I.” *The Architectural Record* 67, (1930): 16.

immediacy based on computation between the designer's mind and the built reality is without precedent.⁴²

Research Approach

This kind of literature highlighted the need to offer a theorised and historically grounded critique of Saudi Arabia's industrialised mass housing projects. This critique should offer a national, international, and cross-cultural understanding of industrialised and prefabricated housing construction. What made this approach particularly appealing was that it was unprecedented and had not been attempted before. Existing studies that explore Saudi prefabricated residential architecture are predominantly technical and quantitative, with research methodologies that rely on large-scale collection of quantitative research data from a large number of residents. Some studies measure the residents' level of acceptance and satisfaction. While valuable information has been gathered, study towards this PhD attempts to place the recorded levels of dissatisfaction, for example, into a historical, cultural, religious, and theoretical context and, in so doing, it is interpreted within this frame.

In a historical context, the origin of prefabricated mass-housing in the Saudi Arabian desert can be traced back to the first attempts at oil exploration in the early 1930s. At that time, both timber and aluminium prefabricated houses were imported into Saudi Arabia mainly from America and Europe. Although their appearance and acceptance were initially limited to isolated oil camps, it was only a matter of time before the Saudi government started using this technological approach to deliver government-sponsored public housing schemes. Yet the validity of using this approach to deliver suitable housing solutions was soon questioned, particularly after many of these housing units were either abandoned or significantly altered by their Saudi residents. Udo Kultermann, architectural historian and the author of *Contemporary Arab Architecture*, states:

⁴² Picon, "Robots and Architecture: Experiments, Fiction, Epistemology," 57.

It is unfortunate that the least successful area of contemporary architecture in Saudi Arabia is housing. With the exception of palaces for members of the royal family and single-family houses, which are often supported by government funds, few attempts have been made in the area of mass housing. One of the most catastrophic attempted in this regard was the Dammam Towers by American Eggers Group (1977-1979); at that time it was advertised as the largest housing project ever built... this experiment in prefabrication was a complete failure because of a host technological mistakes and a total disregard for the lifestyle of the population.⁴³

Kultermann was not alone in his critique of Saudi housing. Several researchers claim that the urgency, time, and limited access to skills and materials have forced the government to import solutions that were considered alien to the local community.⁴⁴ Several examples around the country show that prefabricated and industrialised public-housing developments have often been recognised as less prestigious and less preferred accommodation alternatives for the Saudi community.

Provoked by the Saudi Government's current plans to use new technologies to deliver large numbers of affordable houses over the next ten years, the aim of this research is to reveal new insights into a selection of housing events and experiences that precede this initiative. The research focusses particularly on those that have occurred since the transformative event of the discovery of oil in 1938. A number of examples and case studies are examined to highlight some of the architectural issues that have arisen from the large-scale use of industrialised construction technologies and practices to build prefabricated, affordable public housing.⁴⁵ The research emphasises how the industrialisation of housing construction was – since the discovery of oil in Saudi Arabia – a central element within the government's political and financial agendas. Starting in the 1930s–1940s with the imported prefabricated houses for the oil-workers,

⁴³ Udo Kultermann, *Contemporary Architecture in the Arab States: Renaissance of a Region* (New York: McGraw-Hill Professional, 1999): 163.

⁴⁴ For example, Yousef Fadan, Abdulaziz Al-Mogren, and Tawfiq Abu-Ghazze have all emphasised these points. Their claims have been discussed in more detail in the following chapters.

⁴⁵ In Saudi Arabia the term public housing is used to describe housing sponsored, and partially funded by the government although the houses are usually sold and become owned by private buyers.

followed by the 1940–1950s permanent in situ concrete block housing for the Saudi oil-workers and government employees, and the 1970s–1980s prefabricated concrete apartment buildings and villas for the general public. More recently, there have been calls to rely on modern construction technologies. These are all examples of how the government has been keen to industrialise and modernise the housing sector. The thesis questions whether the use of innovative and prefabricated housing techniques has been an effective approach in overcoming problems of housing shortages and affordability in Saudi Arabia.

As the study deals with historical and cultural events, the research approach has been based on observation and analysis of relevant materials drawn from various sources such as archival manuscripts, published and unpublished literature, official documents and reports, interviews, observations, and historical documents and materials. Because the available literature and resources do not offer a precise image of the history of industrialised mass housing in Saudi Arabia, one challenge has been to articulate a strategy to conduct the research while taking into consideration all the various cross-cultural, social, political, economic, and religious factors. Adopting a wider research strategy allowed the development of a distinct set of critical questions that often yielded new insights leading to new pathways of fruitful exploration. An example of this is evident in chapters two and three where the research discovered the presence of Swedish timber prefabricated houses from the 1950s in Australia. Very similar houses, from the same Swedish manufacturer, were at the same time being shipped to Saudi Arabian oil fields. Each chapter of this thesis has been developed as an individual publishable article which can stand by itself.

Structure of the thesis

In addition to the review of literature and the conclusion, the thesis consists of six core chapters, each of which explores and focuses on different examples and case studies. Dealing with local and international contexts, the literature review needed to cover a wide range of topics and events. The **Literature Review**, therefore, sets out and explores relevant literature and highlights historical studies and debates concerning

architecture, technology, and prefabrication. It is divided to two main areas: literature on industrialised and mass-produced/prefabricated housing, and literature on the history and affordability of Saudi public housing. Each topic highlights and provides insights drawn directly from the available relevant literature.

Chapter one, **Oil + Architecture**, discusses the origins of imported prefabricated housing in Saudi Arabia, which are directly linked to the discovery of oil and to local and global political and economic events. It highlights the importance of the Saudi king's decision to authorise SOCAL to explore for oil in the region which connected Saudi Arabia directly to the West Coast of America with its already well-established architectural culture of lightweight balloon framing and a burgeoning interest in the production of prefabricated, factory-made buildings, particularly houses. SOCAL and its successor company, Aramco parachuted these new-world building technologies, along with a simulacrum of Californian (sub)urbanism, into the Saudi Arabian desert to house expatriate oil workers. While initially viewed with deep suspicion, within a few decades, industrialised and prefabricated construction techniques had become the Saudi government's standard method of delivering enormous numbers of affordable, public houses.

Chapter two, **Swedish Prefabricated Houses in The Saudi Arabian Oil Fields**, draws attention to the case of Swedish prefabricated houses erected in Saudi Arabia and highlights the cross-cultural nature of this exchange. It discusses the history of prefabricated wooden houses in Sweden and links this to the construction of traditional timber buildings. The chapter highlights how the vast wealth that flowed from the discovery of oil, combined with a workforce trained in construction, helped spread the associated architectural and cultural knowledge beyond the oil compounds into wider Saudi society. The chapter also discusses the Swedish timber prefabs that were imported into Australia and points out how each country managed their assembly in a very different cultural context.

Chapter three, **ASA 302 @ Georges Heights: Swedish Timber Prefabs in Australia**, discusses a remnant group of Swedish prefab timber houses located at Georges Heights, NSW. The chapter examines the importation of these houses in the 1950s to accommodate service personnel during the height of the Cold War and in the context of

the political climate of the time. The selection of the Swedish houses was based on extensive research and highlights the high quality of their design and construction. Several European study tours by Australian building experts established that the Swedish houses were of a high quality, particularly in relation to their materials, detailing, interiors, and levels of insulation. The chapter describes the Swedish companies' failed attempt to sell their houses more widely to the Australian public, highlighting a culturally embedded resistance to prefabricated houses which were perceived as for temporary use only.

Chapter four, **Aramco and Al-Malaz Housing Schemes: The Origins of Modern Housing in Saudi Arabia**, focuses on two early housing schemes aimed at providing contemporary housing for Aramco workers and government employees outside the oil compounds. The Aramco Home Ownership Program and the Al-Malaz housing schemes mark a significant transition from traditional forms of housing in Saudi Arabia to modern, contemporary and Westernised housing types. The chapter points out that in contrast to the lightweight prefabricated buildings found inside the oil compounds, Aramco and Al-Malaz houses were constructed using heavy masonry, mainly locally, factory-made concrete blocks and concrete floor slabs poured in situ. It argues that while the Aramco housing program led to the construction of thousands of houses mainly in the eastern, oil-rich regions, Al-Malaz, situated in Riyadh the capital of Saudi Arabia, signified a mainstream, government-sponsored push to modernise Saudi housing and urbanism. The chapter argues that following the Al-Malaz project, the villa as a housing type prevailed all around the country.

Chapter five, **Prefabricated Concrete Construction in Saudi Arabia's Early Public Housing Projects**, explores the design and construction process of the first government-sponsored, affordable, housing project in Saudi Arabia. Constructed using heavy concrete prefabrication techniques, the housing units were intended as a low-cost housing option for Saudi citizens. In particular, the chapter discusses two important housing campaigns: Rush Housing and Villa Prototype. In building these projects, the government planned to create new "model communities" using newly introduced prefabrication techniques. During that time more than 110 international architectural firms were working on housing projects and hundreds of institutional buildings in Saudi Arabia. For example, the large, multi-storey Dammam Rush Housing project was built

by the international company *Overzeesche Gas en Elektriciteits Maatschappij* (OGEM) from precast components that were manufactured in Europe. To do so, it needed to import more than 12,000 tons of precast elements to Saudi each week for a period of 60 weeks. Other foreign companies working on different housing projects established temporary concrete plants and casting yards in Saudi Arabia to produce the prefabricated parts. However, many of these plants were shut down soon after the projects were completed, as there was, at first, limited interest in occupying concrete housing units. The chapter explores the complex, cross-cultural nature of large-scale technology exchange of this nature involving the importation of prefabricated design, construction components and expertise.

In chapter six, **Occupying and Modifying Saudi Arabia's First Prefabricated Villas**, the focus is shifted to highlight cultural resistance and issues surrounding local people purchasing and then living in prefabricated, concrete housing. Research into the Prototype Villa Project revealed that they were at first largely rejected by Saudi buyers. Many were first occupied by foreign soldiers and Kuwaiti refugees during the first Gulf War. Following this, they were slowly accepted by the Saudi people as suitable places to live but not without modifications ranging from small to entire makeovers and substantial alterations. Some of these modifications were aimed at a kind of return to traditional designs and forms of construction. The houses came with a manual which set out how they could be safely modified, usually by adding a second storey using panels supplied by the original prefabrication company. However, most of the foreign precasting plants closed after the initial construction phase forcing residents, who eventually became owners of the houses, to look at other alternatives beyond what was recommended in the house owners' guides. Recent modifications reveal how the residents of these houses combined two different kinds of construction techniques and materials in one architectural setting without the involvement of professional architects. This action in particular resulted in creating a complex and to some extent "eyesore" streetscape.

Inclusion of published materials

Chapters one, two, three, four, and five of this thesis have either been published, are in publication, or are in review prior to publication in refereed journals and a conference proceedings. The contents of these essays have been included in this thesis without any amendments, other than minor formatting changes to match the thesis style. While these essays form a cohesive exploration of affordable, industrialised mass housing in Saudi Arabia each of them has been tailored to suit a particular journal or conference. With the exception of chapters four and five, which are in review at the time of submitting the thesis, the other chapters have been further refined in response to reviewer's feedback. Each chapter progresses the aims and objectives of the research, covers a different aspect of the topic, and engages with different cases studies and examples. However as they are written to be read in their published form in isolation from the other essays that form this thesis, a certain amount of introductory material was required to situate the reader within the scope and nature of the topic. This inevitably meant that there is some repetition of material that contextualises the research, particularly in the introductory sections of each chapter. Each of the published chapters is preceded by a brief preamble that further explains how it contributes to the thesis and also how it has been tailored to align with the aims of the publication to which it was submitted.

Literature Review

Industrialised and Mass-produced/Prefabricated Housing

There is a substantial body of literature covering the topic of affordable housing, particularly affordable housing constructed using industrialised techniques of mass-production including prefabrication. This literature can be divided into two main categories. The first results from historical and theoretical research with reference to society, culture, philosophy, and politics. The second category focuses on affordability and prefabrication from a technical point of view, exploring its engineering, manufacture, and applicability within the built environment. As its title suggests, the focus for this PhD is a qualitative and technological study of industrialised, mass housing in Saudi Arabia, so reference to, and knowledge of both categories of literature was essential. While relevant literature has been discussed in each chapter, this review looks more widely at some of the primary sources that helped inform the study.

Essential reading for any study of prefabricated housing are the two books written by Gilbert Herbert: *Pioneers of Prefabrication*, published in 1978, and *The Dream of the Factory-Made House*, published in 1984.¹ In both, Herbert examines the historical developments of prefabrication in the nineteenth and twentieth centuries. He links such developments to technological, industrial, and most importantly, colonial factors, as he notes that, “in a sense, the history of prefabrication in the early days is the record of a successful response to the challenge of recurring crises”² and that:

It is difficult to understand what generated this enthusiasm for the concept of the factory-made house, what kept the dream alive. The fundamental motivation, the challenge of finding a technical means of solving the housing crisis, was the obvious spur to much thought and

¹ Gilbert Herbert, *Pioneers of Prefabrication: The British Contribution in the Nineteenth Century* (Baltimore: The Johns Hopkins University Press, 1978); and Gilbert Herbert, *The Dream of the Factory-Made House: Walter Gropius and Konrad Wachsmann* (Cambridge: MIT Press, 1984).

² Herbert, *Pioneers of Prefabrication*, 2.

action in the field of prefabrication. But it is hard to conceive of this being a sufficient explanation of the passion and perseverance that marked the movement ... there were obviously other, deeper satisfactions in tackling the problems of industrialised building, which separately or in conjunction helped stoke the fires of enthusiasm.³

While both books were published several decades ago, they are still recognised as foundational reading for anyone interested in the history of prefabricated housing.

A deeper understanding of technology, derived from the philosophy of technology, is important to a study of this nature, suggesting that while technology is often considered only as an instrument, this ignores its deep enculturation. In his work, Don Ihde challenges the limited instrumental view of technology, arguing that technologies are often culturally embedded and that they “may be variably embedded; the ‘same’ technology in another cultural context becomes quite a “different’ technology.”⁴ He notes that “Islamic countries are especially interesting in this respect. On the one hand, most of these countries are midrange in development and are striving for technological upgrading. On the other, crucial cultural elements are in conflict with those of the West.”⁵ Saudi Arabia, as an Islamic country, is an excellent example of this because importing advanced and industrialised construction technologies has been the main method of modernising Saudi Arabia since the late twentieth century. Cultural interpretations of imported, prefabricated, construction technologies reveal significant differences in how these technologies are understood in the Saudi context compared to their country of origin.

In 2007, William Braham and Jonathan Hale published *Rethinking Technology: A Reader in Architectural Theory*,⁶ a reference book examining the technological nature of architecture. Braham and Hale examine key texts in recent literature on technology and architecture, most of which have been written by prominent architects and writers

³ Herbert, *The Dream of the Factory-Made House: Walter Gropius and Konrad Wachsmann*, 5.

⁴ Don Ihde, *Technology and the Lifeworld: From Garden to Earth* (Bloomington: Indiana University Press, 1990), 144.

⁵ Ihde, *Technology and the Lifeworld: From Garden to Earth*, 138.

⁶ William Braham and Jonathan Hale, *Rethinking Technology: A Reader in Architectural Theory* (New York: Routledge, 2007).

who examine the field of architecture through a technological lens. Among the essays and books are the work of Frank Lloyd Wright, “The Art and Craft of the Machine,”⁷ Le Corbusier, “Architecture: The Expression of the Materials and Methods of our Times,”⁸ Ludwig Mies van der Rohe, “Technology and Architecture,”⁹ Konrad Wachsmann, *Seven Theses*,¹⁰ Alan Colquhoun, *Symbolic and Literal Aspects of Technology*,¹¹ and more recently *Surface Architecture* by David Leatherbarrow and Mohsen Mostafavi.¹² Within their book, Braham and Hale argue that:

Architects have always been concerned with technology, but since the effects of the first industrial revolution became widespread in the early nineteenth century, the technology encountered by architects has changed in scope and kind, becoming a restless and accelerating process of transformation. To rethink technology at the beginning of the twenty-first century means reconsidering the strong claims made about technology – utopian and dystopian – by the modernist and postmodernist architects and historians of the twentieth century, as the actual impacts of that technology were encountered.”¹³

Studying these profound claims allows for a deeper understanding of the impact of technology on traditional architectural and social practices.

Barry Russell’s work *Building Systems, Industrialisation, and Architecture*, published in 1981, offers some relevant sociological insights about the topic. He notes that “with each medium man uses there arises a different set of social relations between the human

⁷ Frank Lloyd Wright, “The Art and Craft of the Machine,” *Brush and Pencil* 8, no. 2 (1901).

⁸ Le Corbusier’s “Architecture: The Expression of the Materials and Methods of our Times,” *Architectural Record* 66, (1929).

⁹ Ludwig Mies van der Rohe, “Technology and Architecture,” in *Programs and Manifestoes on 20th-century Architecture*, edited by Ulrich Conrads (Cambridge, MA: MIT Press, 1970).

¹⁰ Konrad Wachsmann, “Seven Theses,” in *Programs and Manifestoes on 20th-century Architecture*, ed. Ulrich Conrads, (Cambridge, MA: MIT Press, 1970).

¹¹ Alan Colquhoun, *Essays in Architectural Criticism: Modern Architecture and Historical Change* (Cambridge, MA: MIT Press, 1981).

¹² David Leatherbarrow and Mohsen Mostafavi, *Surface Architecture*, (Cambridge, MA: MIT Press, 2002).

¹³ Braham and Hale, *Rethinking Technology: A Reader in Architectural Theory*, XIII.

and the technological systems.”¹⁴ Furthermore, he explains how the advocates of modern architecture in Europe in the twentieth century subscribed to technology without any condition. He argues that:

In placing such confidence in technology to solve human problems or answer human needs many of these attempts now seem to curiously ignore or narrow human response. When appealing, through machine technology, to the greater social good they were relinquishing part of their responsibility – that responsibility was somehow to be embodied by ‘the machine,’ whether it be a technological system or an organisational system. In subscribing to this philosophy they were doing a great deal less than architects had hitherto done, and in eschewing responsibility in this way they were given support by the view of Marx. His view that the means of production formed the foundation of society and all other endeavour was but a super(ficial)-structure encouraged, curiously, a fatalistic view. Such an argument claimed that all developments were historically determined anyway and whatever we do can only faithfully express this underlying truth. This Marxist view of deterministic social change was closely coupled to industrial inevitability. This proved a potent drug in that, in itself, it freed its proponents from the necessity of considering their specific human responsibility in each situation, and to each other as individuals. In placing the level of responsibility at the level of the collective or social body it followed that the solutions would also be on that level. Mass production technology fitted perfectly with this, as did its architectural counterpart – building systems. For the solutions here also lay at the level of collective rather than at that of the individual. The searching for the new architectural norms was carried out through one set of spectacles, one approach. The more propositions and the building conformed to this ideal view of technology, the more they were hailed as the new world. Under these

¹⁴ Barry Russell, *Building Systems, Industrialisation, and Architecture* (London: John Wiley & Sons, 1981), 100.

circumstances it is no surprise that the ideal machine style that resulted was subsequently found wanting in human terms.¹⁵

He attributes the relative success of post-war prefabricated housing phenomena to the involvement of governments:

The post-war enthusiasm for prefabrication gave rise not only to hopes amongst architects in local authorities ... but also throughout the whole private sector.... In housing it is clear that as soon as the direct government support for housing was withdrawn both in the form of directives and finance, the prefabricated house building systems began to wane dramatically. Some local authorities continued to erect small numbers from commercial firms but the market quickly demonstrated that such expensive experiments could not survive without government subsidy, in spite of the apparent logic that had been built up around the myth of the production line.¹⁶

The argument Russell builds here could be challenged, particularly when exploring prefabrication in some Scandinavian countries. While government involvement has been fundamental, it has existed within a context of cultural acceptance. Prefabricated houses in Sweden have always been linked to traditional timber buildings and their construction materials and detailing practices. In his book *The Prefabricated Home* Colin Davies states that:

Swedish house manufacturers collaborate with one another to the extent of building show houses on shared permanent exhibition sites. The HusExpo at Skondal on the outskirts of Gothenburg, for example, displays more than 60 houses, representing about 30 manufacturers, only slightly more densely laid out than they would be in a typical Swedish suburb. Walking among these houses, what strikes an English visitor is their relatively uncorrupted vernacular style. There are occasional eruptions of 'architecture' – a triangular window or a showy balcony – but for the most part the national building tradition

¹⁵ Russell, *Building Systems, Industrialisation, and Architecture*, 100–101.

¹⁶ Russell, *Building Systems, Industrialisation, and Architecture*, 223.

holds sway and the result is a pleasing consistency, not only of construction but of colour, texture, proportion and detail. These industrially produced and mass-marketed houses are still just recognizable as the descendants of early twentieth-century workers' houses, such as those in the Landala residential quarter of Gothenburg.¹⁷

In Sweden, prefabrication is used on four out of every five detached timber houses.¹⁸ Rasmus Waern, in his essay "Scandinavia: Prefabrication as A Model of Society" adds that "prefabricated systems continue to proliferate. Today Norway, Sweden and Finland enjoy a large surplus of mature forests, which has spurred[sic] the development of new building technologies that employ massive wood elements to create both large-scale and small-scale structures."¹⁹

Ray Batchelor in *Henry Ford: Mass Production, Modernism and Design*, published in 1994, seeks to draw attention to how mass production has changed contemporary life. In regard to public housing and the use of it as a political agenda, Batchelor notes:

In public housing, an attempt was made to close the gap between ideal and technological reality, and in doing so, to realise much of what had been rehearsed by some modernist practice – in Germany, Austria and Scandinavia, especially – and much modernist rhetoric before the Second World War. Through the mass production of building components the power of industry was to be put at the service of the masses – or electorate, as they might more properly be termed in this context. This was an attractive political prospect at a time when, after the irrationality of war, the 'making-over' of the world according to rational criteria had widespread appeal.²⁰

¹⁷ Colin Davies, *The Prefabricated Home* (Reaktion Books, 2005), 158.

¹⁸ Dale Steinhardt and Karen Manley, "Adoption of Prefabricated Housing – the Role of Country Context," *Sustainable Cities and Society*, 22 (April 2016): 126–35.

¹⁹ Waern Rasmus, "Scandinavia: Prefabrication as A Model of Society," in Barry Bargdoll and Peter Christensen eds., *Home Delivery: Fabricating the Modern Dwelling* (2008): 31.

²⁰ Ray Batchelor, *Henry Ford: Mass Production, Modernism and Design* (Manchester and New York: Manchester University Press, 1994), 117

A year later, in 1995, another notable author Brenda Vale, published a book about the History of prefabricated housing in the UK entitled *Prefab: The History of the UK Temporary Housing Programme*. In her book, Vale hopes to “understand why this technological advance in housing provision (in terms of production and materials) received little acknowledgement in the architectural press either at the time or since.”²¹ To emphasise the importance of the houses that were actually built, she talks about how many UK residents became very attached to their post-war prefab houses. Vale claims that the “single-storey form and detached layout produced a type of housing that allowed the occupier control” and that “what mattered was not the technology used to construct them but the chance offered to make some kind of home.”²² This clearly relates to how much in need of housing those residents were at that time.

In the last two decades, research and publication in the field of the history and theory of prefabricated housing has declined. The work of Colin Davies is an exception. In *The Prefabricated Home*, Davies dedicates three chapters to the history of prefabrication and three chapters to its theorisation. He believes that “architects have found it hard to come to terms with the idea that the products of their art might be made in a factory.”²³ He also points out, however, that “while architecture has been struggling to find the true artistic expression of industrial production, construction has been quietly industrialising itself behind architecture’s back.”²⁴ In this regard, David Leatherbarrow argues that “originality of conception in contemporary architectural design is constrained by the fact that most of the parts of a building that will make it liveable already exist before the process of designing actually begins”²⁵ and that this assumption is “true not just of the practices based in Western industrialised countries, where this use seems to have originated and flourished, but also to varying degrees in those located elsewhere, throughout the world.”²⁶ According to Leatherbarrow:

²¹ Brenda Vale, *Prefab: The History of the UK Temporary Housing Programme* (London: Routledge, 1995), Preface.

²² Vale, *Prefab: The History of the UK Temporary Housing Programme*.

²³ Davies, *The Prefabricated Home*, 9.

²⁴ Davies, *The Prefabricated Home*, 9.

²⁵ Davide Leatherbarrow, *Uncommon Ground: Architecture, Technology, and Topography* (Cambridge: MIT Press, 2000), 119.

²⁶ Leatherbarrow, *Uncommon Ground: Architecture, Technology, and Topography*, 120.

The ‘orders’ of contemporary architecture are not types of columns, but purchase agreements for the production of shop-made elements. Orders for contemporary construction obtain their finish apart from the building site, in a workshop or on an assembly line, which is a way of making things that is quite distinct from traditional labor practices, not because industrial production is repetitive, but because it is autonomously and finally so. The factory-made house is still a dream and is likely to remain so, regardless of the hopes and claims of the descendants of Fuller and Wachsmann, and of our continued willingness to see the house as something like a Ford or Honda.²⁷

More recently, the focus has narrowed to specific residential architectural spaces and components. Literature that discusses the history of prefabricated interior components such as bathrooms, kitchens, and other services has appeared. For example in 2012, Deborah Schneiderman published a book examining the interior of prefabricated houses,²⁸ and in 2015 she co-authored another book that discusses the history of prefabricated bathrooms.²⁹ In *The Prefab Bathroom: An Architectural History*, Deborah Schneiderman and Bishakh Som note that:

As one of the three significant regions of the prefabricated interior, along with the kitchen and modular furniture, the bathroom offers valuable insight into important design considerations of prefab architecture. The knowledge required to design a bathroom is unique, with the room’s inherent ties not only to the realm of hygiene, but also more broadly to culture. It is a room that must function as sanitary space while also serving as a sanctuary for relaxation ... the bathroom evolved to become the ideal prototype and testing site for prefabrication technologies.³⁰

²⁷ Leatherbarrow, *Uncommon Ground: Architecture, Technology, and Topography*, 120–121.

²⁸ Deborah Schneiderman, *Inside Prefab: The Ready-made Interior* (California: Princeton Architectural Press, 2012).

²⁹ Deborah Schneiderman and Bishakh Som, *The Prefab Bathroom: An Architectural History* (Jefferson, North Carolina: McFarland & Company Inc., 2014).

³⁰ Schneiderman and Som, *The Prefab Bathroom: An Architectural History*, 1.

As mentioned earlier, in Saudi Arabia the history of housing prefabrication has not been discussed or studied extensively. Most research investigates the potential demand, limitation, and barriers for the technique and process of producing prefabricated housing. *Shelter in Saudi Arabia*, a book written by Kaizer Talib, a former architecture professor at the University of Petroleum and Minerals, Saudi Arabia, briefly discusses the change of housing patterns in Saudi Arabia and the development of prefabricated housing in the region. In his book he explores the emergence of the prefabricated housing in Saudi Arabia within the oil camps built for expat workers:

One of the most striking features of the contemporary housing scene is the extent to which foreigners in the Gulf countries live separate lives, often confined to their compounds. Most compounds are located on the periphery of the urban centres.... Such compounds vary in size, but most of them are built with prefabricated systems. The use of prefabricated components to build compounds quickly suggests that they are constructed as a temporary measure; however, several such compounds have existed for as long as thirty or forty years, and in some cases their ownership has changed several times.³¹

Prefabrication was a central element in the creation of these compounds. Hundreds of timber prefabricated houses were imported from the United States and Scandinavia. In his book *The Prefabrication of Houses*, published in 1951, Burnham Kelly writes that “major purchasers of actual houses exported from the [United States] were likely to continue to be United States companies operating abroad. For example, in 1947, all the 275 prefabricated timber houses exported had such destinations: 180 went to a United States business firm in the Dominican Republic, 40 to the Saudi Arabia Oil Company, and 55 to other identifiable commercial customers.”³² Similar to other post-war suburban communities built within the United States such as the Levittown, the prefabricated houses erected in the Saudi camps were designed in accordance with common and traditional American characteristics, even though they were manufactured off-site and based on modern construction techniques. In *America Town: Building the Outposts of Empire*, Mark Gillem suggests that American camps outside the United

³¹ Kaizer Talib, *Shelter in Saudi Arabia* (London: Academy Editions, 1984), 130.

³² Burnham Kelly, *The Prefabrication of Houses* (New York: Technology Press of the Massachusetts Institute of Technology and Wiley, 1951), 366.

States “incorporate familiar building patterns but are also transformed by local conditions. They bring together diaspora communities searching for spatial familiarity. The buildings and neighbourhoods both expose and obscure economic, political, and social priorities” and that they are “exported from the homeland, replete with auto dependency, isolated uses, and low net densities.”³³

Literature exploring the history of prefabricated housing in Saudi Arabia is very limited. Useful information concerning the prefabricated houses that have been imported into Saudi Arabia since the 1930s has been found in newspapers of the period and other media coverage. In addition, a period of fieldwork helped define and understand the nature of both early prefabricated timber houses imported into the oil camps, and also later affordable housing schemes that employed prefabricated concrete construction techniques on a large scale. While the history of housing prefabrication in Saudi Arabia has not been widely covered, the evolution of Saudi residential architecture is well represented within the literature and this has been helpful to support research towards this PhD.

History and Affordability of Saudi Public Housing

Affordable housing refers to housing that allows lower-income households to secure appropriate housing without encountering financial hardship.³⁴ Recently the term “affordable housing” has been more often used to refer to other forms of housing such as social, public, and low-cost housing.³⁵ To arrive at a context-related definition for “affordable housing” there is a need to look at social, political, and economic factors to fully understand the term. What could be considered affordable in one context might be

³³ Mark L. Gillem, *America Town: Building the Outposts of Empire* (Minneapolis and London: Minnesota Press, 2007), XV.

³⁴ Judith Yates, “Housing Affordability for Lower-income Australians: National Research Venture 3: Housing Affordability for Lower-income Australians, Plan,” (Melbourne: Australian Housing and Urban Research Institute, 2004).

³⁵ Michelle Gabriel, Keith Jacobs, Kathy Arthurson, Terry Burke, and Judith Yates, “Conceptualising and Measuring the Housing Affordability Problem: Collaborative Research Venture 3: Housing Affordability for Lower-income Australians: Background Report,” (Melbourne: Australian Housing and Urban Research Institute, 2005)

luxurious in another. In addition to cost, construction materials, appearance, and size are some of the other factors that contribute to the difference between affordable housing in various cultures and countries. A 'one-size-fits-all' approach is often promoted as a way of achieving affordability. Many architects harshly criticised this approach, some have argued that it "will lower standards and leave future generations with the unintended consequences."³⁶ Within the Saudi context, imported, prefabricated, affordable housing designs and industrial advancement have indeed changed living standards. However, affordable housing in Saudi Arabia does not necessarily mean living in a small housing unit. For example, the average floor size of "affordable housing" units built from the 1970s and onward in Saudi Arabia is 250 square metres, whereas the average floor size for an attainable (mid-income) detached three-bedroom housing unit built in Australia in 1984, was 162.4 square metres.³⁷ One of the main ways of making such large houses affordable is with substantial government subsidies.

Before discussing the topic of housing and its affordability in Saudi Arabia, it is important to gain an understanding of the history of Saudi's residential architecture. Saudi residential architecture has received significant attention within academia. The resulting literature has examined the rapid and enormous shift from traditional to contemporary housing that took place after the discovery of oil. Researchers have explored various aspects of this architectural phenomenon, such as socio-cultural, historical, economic, environmental, and structural issues, and more. Geoffrey King in his book, *The Traditional Architecture of Saudi Arabia*, writes that "Saudi Arabia encompasses a greater variety of architectural styles than any other country in the Arabian Peninsula. The buildings of the coastal, mountain, and plains regions are entirely distinctive and local in their character."³⁸ He also claims that "prior to the full flow of its oil economy, Saudi Arabia's architecture and architectural styles had not changed for centuries. But with oil and development came the wholesale rebuilding and expansion of towns and cities leading to the marginalisation of the country's

³⁶ Paul Karakusevic, "A New Era of Social Housing: Architecture as the Basis for Change," *Architectural Design*, (2013).

³⁷ Stephen Clune, John Morrissey, and Trivess Moore, "Size matters: House size and thermal efficiency as policy strategies to reduce net emissions of new developments," *Energy Policy* 48, (2012): 657-667.

³⁸ Geoffrey King, *The Traditional Architecture of Saudi Arabia* (London: I.B.Tauris, 1998), x.

architectural heritage.”³⁹ Geoffrey King lived in Saudi Arabia in the 1970s and 1980s when the Saudi government was supplying the housing market with enormous quantities of mass-produced, prefabricated housing units. He lived there for the first time between 1972 and 1975, and then again between 1980 and 1987. Throughout his book, King tries to document the Saudi vernacular building traditions as he feared that “within a few years most of it will be lost.”⁴⁰ Unfortunately, his fears were well founded, particularly in relation to residential architecture. Since the 1940s, housing, and the construction techniques and practices used to produce it, have not arisen directly from traditional vernacular residential buildings.

The Saudi Arabian government has played a central role in shifting the country’s architectural styles and construction methods from the traditional to the contemporary. The first formal involvement occurred in the early 1950s with two well-known housing projects: the Aramco Home Ownership Program and the Al-Malaz Housing Project.⁴¹ These two projects represent the main shift in residential architecture. Some of the early studies that discussed these two specific projects include the PhD dissertations of Saleh Al-Hathloul in 1981⁴² and Yousef Fadan in 1983⁴³ (both studied at Massachusetts Institute of Technology) and Ali Bahammam in 1987⁴⁴ at McGill University and in 1992⁴⁵ at The University of Michigan. Their studies explored the changes in residential architecture in Saudi Arabia and attributed this to the government’s intervention in the early 1950s. Al-Hathloul writes that “both the Aramco plans and Al-Malaz used and emphasised the villa as their only single-dwelling type.”⁴⁶ Fadan claims that the “large-scale housing programs constructed in both the eastern and central regions marked the

³⁹ King, *The Traditional Architecture of Saudi Arabia*, x.

⁴⁰ King, *The Traditional Architecture of Saudi Arabia*, x.

⁴¹ Faisal Mubarak, “Cultural Adaptation to Housing Needs: A Case Study, Riyadh, Saudi Arabia.” *The IAHS Conference Proceedings*, (San Francisco, USA, (June 1–7, 1999)).

⁴² Saleh Al-Hathloul, “Tradition, Continuity, and Change in the Physical Environment: The Arab-Muslim City,” (PhD diss., Massachusetts Institute of Technology, 1981).

⁴³ Yousef Fadan, “The Development of Contemporary Housing in Saudi Arabia (1950–1983): A Study in Cross-Cultural Influence Under Conditions of Rapid Change,” (PhD diss., Massachusetts Institute of Technology, 1983).

⁴⁴ Ali Bahammam, “Architectural Patterns of Privacy in Saudi Arabian Housing,” (Masters diss., McGill University, 1987)

⁴⁵ Ali Bahammam, “An Exploration of the Residents’ Modifications: Private-sector Low-rise Contemporary Housing in Riyadh, Saudi Arabia,” (PhD diss., The University of Michigan, 1992).

⁴⁶ Al-Hathloul, “Tradition, Continuity, and Change in the Physical Environment: The Arab-Muslim City,” 256.

beginning of public commitment to the living conditions of the citizens in general and the oil company's employees in particular."⁴⁷ The role of the government was not limited to these two massive projects. In the mid-1970s, due to the high demand for housing, the government implemented massive public housing projects in several cities around the country. What was interesting about these projects was that for the first time there was a significant reliance on construction technology. The majority of these projects were built using prefabricated concrete panels. The total number of housing units built during this time exceeded 25,500. However, in his discussion about these projects, Fadan highlights the failure of the housing units to become a suitable housing alternative, and attributes this failure to the lack of coordination between relevant governmental agencies as he argues that:

Instead of using data to plan and to cooperate in their work, the ministries vie with one another to spend their allocated budgets on competitive, uncoordinated, prestigious housing projects, with no coherent reference to local characteristics and needs. The most disturbing result is the use of inappropriate standards and values in the development plans. Extemporaneous decision making on housing projects has led to the depressing current situation, where the advantages of a highly sophisticated building technology are allowed to outweigh the social disadvantages.⁴⁸

It is evident that the houses built between the 1970s and 1980s were constructed to the highest quality and standards of prefabrication, construction, insulation, and finishing; however, they lacked cultural – and to some extent architectural – meaning. In regard to the high-rise buildings built through the Rush Housing Program between 1977 and 1980, Al-Mogren states that:

The short time of construction was one of the main justifications of the prefabricated high-rise housing strategy. Others were the high quality of the sophisticated buildings, reducing the horizontal expansion requirement for the sewage, electrical and water systems,

⁴⁷ Fadan, "The development of Contemporary Housing in Saudi Arabia (1950–1983): A Study in Cross-Cultural Influence Under Conditions of Rapid Change," 103.

⁴⁸ Fadan, "The development of Contemporary Housing in Saudi Arabia (1950–1983): A Study in Cross-Cultural Influence Under Conditions of Rapid Change," 344–345.

and saving the land. However, these projects are an example of the complete, direct involvement of the government in the housing supply....

The government, by trying to solve the problem of housing without knowing who are the needy people and to whom these units will be distributed, made the problem worse by adding 4,752 vacant apartments to the government responsibility. Even though these apartments are located on three of the most (if not the most) attractive sites in the country, they are still questionable in terms of their compatibility with cultural, social, and environmental conditions of Saudi Arabia.⁴⁹

And in regard to the 10,500 prefabricated semi-detached villas built through the Villa Prototype Housing, he continues:

It appears that in building the large numbers of residential units under different programs in different times and cities, the Saudi government did not try to evaluate some earlier projects in order to improve the others, but instead just kept constructing the housing projects regardless of any past experience.⁵⁰

The government did not only play a role in changing residential architecture but also had previous interventions within the housing market. Through these interventions the design process became more “institutionalised”, as Al-Naim suggests.⁵¹ Construction and its materials were also impacted as builders started to rely more on imported, modern, and industrialised construction materials and practices. In this way, Bahammam suggests that the design of Saudi houses became a product rather than an ongoing experience.⁵²

⁴⁹ Abdulaziz Al-Mogren, “Housing Surplus in Saudi Arabia: Observations, Recommendations, and Alternatives for the Use of the High-rise Public Housing Projects,” (Masters diss., The University of Pennsylvania, 1987): 28–30.

⁵⁰ Al-Mogren, “Housing Surplus in Saudi Arabia: Observations, Recommendations, and Alternatives for the Use of the High-rise Public Housing Projects,” 34.

⁵¹ Mashary Al-Naim, “Identity in Transitional Context: Open-Ended Local Architecture in Saudi Arabia,” *ArchiNet-JAR* 2, no.2 (2008): 138.

⁵² Bahammam, “An Exploration of the Residents’ Modifications: Private-sector Low-rise Contemporary Housing in Riyadh, Saudi Arabia,” 231.

Despite the efforts of the government and private enterprise to provide mass housing projects in Saudi Arabia, there is substantial evidence of a growing housing affordability problem. It would be surprising to many that one of the wealthiest countries in the world is facing this issue. The main reason for the housing shortage is a large increase in the urban population resulting from waves of migration from rural to urban areas in the second half of the twentieth century, since the discovery of oil.⁵³ Rather than studying this migration and the resulting increase in urban populations, this thesis has focused on the industrialised mass housing projects the Saudi government initiated to accommodate the rising urban population. To oversee and administer these housing projects, in 1974–1975 the government established the Real Estate Development Fund (REDF). Al-Hathloul and Edadan argue that:

The establishment of REDF, with an initial capital of 250 million Saudi riyals (US\$ 71 million), to provide long-term, interest-free loans is the single government initiative that changed the structure of the housing market in the Kingdom. The performance of the REDF has been exemplary; after 1975 it had distributed 88.4 billion Saudi riyals (US\$ 23.5 billion) for the construction of 440,446 housing units by the end of the 1987–1988 fiscal year, against a planned target of 331,000 units. This comprised as much as 76 percent of the total private housing units built during 1970–1990. While the REDF loans have proved to be the most popular vehicle for house ownership, they have resulted in a speculative construction boom, which in turn has resulted in a rapid escalation of residential land prices. Many cities in Saudi Arabia, such as Riyadh, Dammam, and Jeddah, became the most dynamic land markets in the world during the 1970s.⁵⁴

In the mid-1990s, the REDF had financed more than half of all houses built in Saudi Arabia. The REDF home ownership loan was available to all citizens of the Kingdom

⁵³ Abdualelah Al-Mayouf and Abdullah Al-Khayyal, “Provision of Public Housing in Saudi Arabia: Past, Current and Future Trends,” *J. King Saud University, Architecture and Planning* 23, no: 2 (2011): 59–68.

⁵⁴ Saleh A. Al-Hathloul & Narayanan Edadan, “Housing stock management issues in the kingdom of Saudi Arabia,” *Housing Studies* 7, no.4 (1992): 272.

irrespective of their level of wealth. However, to be eligible for the REDF first-home ownership loan, the citizen had to own a piece of land. This led many low and middle-income households to seek cheap land around the periphery of cities. As the REDF did not means test applicants as to their level of income and wealth, it became clear that every Saudi household was eligible for an interest-free housing loan from the government. This resulted in many citizens applying for a loan, resulting in the REDF having a very long waiting list. At one stage there were more than 480,000 applicants waiting for a housing loan. On average, the applicants waited for more than twelve years to receive their loans. Many citizens preferred to wait for the interest-free loan rather than trying to secure a house with loans available through local banks and other financial alternatives.

As the waiting list started to gradually expand in the early 1990s, the prefabricated public houses built in the 1970s and 1980s by the government were distributed to the REDF beneficiaries, who preferred to secure a house rather than wait for the loan. In a short time, many of these beneficiaries started to modify the houses using conventional construction methods, or simply sold the house on the market. The level of modifications and additions attracted a considerable amount of research.⁵⁵ The first research study was a PhD conducted by Rayed Al-Dakheel in 1995,⁵⁶ and the most recent one was a Masters thesis in geography completed by Iman Al-Khuraif in 2015.⁵⁷ All of these studies share relatively similar aims, with the focus mainly on the residents' level of satisfaction. In conducting these studies, large groups of residents were contacted, and some were interviewed, to determine their level of satisfaction. Surprisingly, most agreed that the housing units were largely acceptable, and the residents were mostly satisfied. Ali Bahammam, who studied Saudis' modifications in Riyadh City, states that

Although some of the residents' modifications have a negative effect on the architectural appearance of the dwelling and are considered 'violations' of municipal rules and regulations, these modifications,

⁵⁵ The relevant studies are discussed in detail in chapter eight.

⁵⁶ Aldakheel, "Residents' Satisfaction with Public Housing; The Case of Buraidah Public Housing Development in Saudi Arabia."

⁵⁷ Iman Al-Khuraif, "Al-Jazeera housing modifications and its underlying factors in Riyadh city, Saudi Arabia," (Masters Diss., King Saudi University, 2015).

nonetheless, are important indicators of the inhabitants' level of satisfaction or dissatisfaction with their contemporary dwellings. Despite the illegal nature of the modifications, the residents defiantly undertook them. This clearly indicates the magnitude of the problem and presents vigorous evidence of the failure of the recent official constraints which make most of the residents' improvements considered as 'violations'. The modifications are not only examples of what users want their dwellings to be, but they also represent the residents' solutions to some of the existing problems and can be used as an instrument to identify the incompatibilities that caused them.⁵⁸

In regard to reasons behind these levels of modifications, he argues that "some of the residents' modifications are the outcome of experimental factors which are enhanced by the available visual media and opportunities to travel the world. Imitation of 'good' architectural examples is another reason behind some of the residents' modifications. Visual media and traveling the world have opened new channels for Saudi people to see and experience different 'well' designed examples of residential architectural spaces and elements. Some residents make changes just to have 'elegant' spaces or elements similar to those they have seen, visited, or lived in for a while. It is very interesting that many residents imitate these elements for reasons of fancy more than for their functional purposes."⁵⁹ Yet, with the introduction of the internet and the advancement of education and industry, Saudis currently do not need to travel to explore the meaning of "good" architecture.

The level of modification and alteration made to the Saudi prefabricated houses indicates that there is a need to look beyond the level of satisfaction and include other perspectives such as those found within theories of architectural modifications and additions. Nathaniel Rogers argues that "the anthology of critical literature on additions is surprisingly slim. At the same time, however, the addition has also proven to be terrain for comparatively more focused accounts; the library of literature on adaptation

⁵⁸ Bahammam, "An Exploration of the Residents' Modifications: Private-sector Low-rise Contemporary Housing in Riyadh, Saudi Arabia," 328–29.

⁵⁹ Bahammam, "An Exploration of the Residents' Modifications: Private-sector Low-rise Contemporary Housing in Riyadh, Saudi Arabia," 336.

is vast and correspondingly amorphous.”⁶⁰ One of the influential theorists on the project as a “modification” is Vittorio Gregotti (1927–2020). In his essay “On Modification,” Gregotti suggests that the notion of belonging to a culture, a tradition, or a place, always “accompanies modification.”⁶¹ He frames two methods of modification. In the first, “the answer is mimetic, stylistic, seeking conciliation,” and in the other the answer is “rather juxtaposition.”⁶² On the other hand, Steven W. Semes, an architect, educator at the Notre Dame School of Architecture, and the author of *The Future of the Past: A Conservation Ethic for Architecture, Urbanism, and Historic Preservation*, frames additional approaches to include “literal replication,” “intentional opposition,” “invention within a style,” and “abstract reference.”⁶³ While Semes’ categories are mainly linked to additions and restorations of historical buildings, they are still relevant when looking at the Saudi prefabricated houses’ additions and modifications.

Conclusion

The provision of affordable housing is often reduced to delivering a technological solution which relies on the predisposition of industry to mass produce identical, prefabricated building components which are then assembled on site. The key to its affordability is repetition. Housing projects built in Saudi Arabia since the 1950s and the current proposal by the Saudi government to build nearly 1.5 million affordable housing units by 2030 fall into this category. The current proposal also conforms to the affordability axiom of deploying the latest innovations in construction technology to achieve its goals. In this case 3D printing is the technology of choice and is being promoted by the Saudi Government as a utopian vision for the future of housing. What a study of the literature reveals, however, is that mass housing projects driven by overtly technological imperatives often fall well short of providing people with meaningful places to live. In texts oriented towards a theoretical and philosophical critique of the technological approach, it is exposed as deficient. This often centres on how the housing

⁶⁰ Nathaniel Rogers, "Literature Review." *Change Over Time* 2, no. 2 (2012): 202–218.

⁶¹ Vittorio Gregotti, *Inside Architecture*, (Cambridge, Mass.: MIT Press, 1996), 69.

⁶² Gregotti, *Inside Architecture*, 69.

⁶³ Steven W. Semes, *The Future of the Past: A Conservation Ethic for Architecture, Urbanism, and Historic Preservation* (New York: W.W. Norton, 2009), 172, 186, 208, 222.

is a poor fit with cultural and social, norms and practices. There are also issues of the introduction of unfamiliar housing styles and types into existing traditional urban fabric and the bypassing of traditional construction skills and knowledge. Examples and case studies discussed in the literature, such as the Pessac, the bubble house, and Bijlmermeer, similarly expose the harsh reality of the necessity of large shifts and changes in behaviour required to live in technologically driven mass-housing projects. This is certainly true of the projects that were studied as part of the research for this thesis, which included both text-based research positioned in relation to the literature and a period of fieldwork spent exploring the built projects in Saudi Arabia.

Chapter One | Oil + Architecture

Preamble

Early research revealed that the origin of the industrialised construction techniques employed to construct affordable housing in Saudi Arabia since the 1950s can be linked to the discovery of oil in 1938. To explore this key event, the research began to investigate imported prefabricated housing used in the oil compounds. When writing this chapter in 2018, *Fabrications*, the Journal of the Society of Architectural Historians, Australia and New Zealand, issued a call for papers titled Industry + Architecture: National Narratives/International Forces, which raise the question “how has industrialisation modified our experience of urban and rural spaces?” It was timely to submit this chapter to the journal as its themes corresponded to the journal’s call for papers. The reviewers’ comments mainly asked for more reference to specific texts and the inclusion of material we had initially considered to be beyond the scope of this PhD. The essay was published in the special issue and this chapter is the paper as published. The content has not been altered, other than to align with the thesis formatting style.

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Contribution to the Paper: Supervision, editing, and administration.

Signature:

Date: 13 July 2021

Abstract

Drilling of the deep-test oil well Dammam No. 7 began in Saudi Arabia in December 1936. In March 1938, at a depth of 1,440 metres it punctured the reservoir and began to produce a commercial quantity of crude oil. Geopolitical, entrepreneurial, financial, and exploratory events leading up to this momentous emanation from the desert are complex, but it was Standard Oil of California (SOCAL) that in 1933 gained a concession to explore for oil in the Kingdom. The Saudi King's choice of SOCAL connected oil exploration and extraction directly to the west coast of America with its already well-established architectural culture of lightweight balloon framing and a burgeoning interest in the production of prefabricated, factory-made buildings, particularly houses. SOCAL and its successor company, Aramco parachuted these new-world building technologies, along with a simulacrum of Californian (sub)urbanism, into Saudi Arabian desert compounds to house expatriate oil workers. While initially viewed with deep suspicion and confined behind wire and gates, within a few decades, industrialised and prefabricated construction techniques had become the Saudi government's standard method of delivering enormous numbers of affordable houses.

Walled and Gated

Since the discovery of oil in 1938, gated residential compounds for expatriates have become very common in Saudi Arabia, built to accommodate an influx of foreign professional people into the country. To maintain a secure environment and to prevent cultural conflicts, the Saudi government encourages large companies to build such developments.¹ In the capital city, Riyadh, for example, there are more than fifty gated residential compounds, and housing within these gated developments represents more than ten per cent of the total housing stock in the city.² The origins of these gated compounds for expatriates are traceable to the development of the Dhahran Camp, the first American fenced colony in Saudi Arabia. Inside the Dhahran Camp, also known as the American Camp, in the centre of Dhahran city on the Arabian Gulf coast, is an uncanny replica of Californian suburbia, complete with neat rows of houses, schools, shopping malls, tree-lined streets, and, perhaps most importantly, its own rules and laws. Outside the compound is the conservative society of Saudi Arabia. Before oil exploration and extraction came to the area, it was sparsely populated and Dhahran, now a city of more than 130,000 people, did not exist. The prefabricated, factory-made houses erected in the camp, no less than the drilling rigs and other apparatus of oil extraction, were an alien, technological incursion into the traditional Saudi world and the hitherto low-tech inhabitation of the desert landscape by the Bedouin.

While Dhahran Camp was initially born out of necessity, with its flat-packed houses imported from California, it very quickly developed into a large, gated community based on the model of an American suburb. It is important to keep in mind however that while it may contain many suburban qualities and features it is not a suburb but rather a gated town that exists in isolation. It is not connected to a culturally analogous urban or city centre; it is an outpost. As Mark Gillem points out in his compelling account of American military base architecture, when the outpost is situated adjacent to or within a local urban area, it draws attention to the “spatial implications of exporting American

¹ The Saudi government requires that companies employing more than fifty expatriate professionals must provide housing for their crews.

² Georg Glasze and Abdallah Alkhayyal, “Gated Housing Estates in the Arab World: Case Studies in Lebanon and Riyadh, Saudi Arabia,” *Environment and Planning B: Planning and Design* 29, no. 3, (2002): 321-336.

suburbs,” particularly the “gluttonous use of foreign land.”³ While this spatial extravagance is evident in the Dhahran camp – it currently occupies approximately fifty eight square kilometres of land – when the camp was established it was built in a very sparsely populated area. More importantly for this essay, which offers a historical overview of the impact of the oil industry on subsequent Saudi housing and suburbanism, is that this spatiality translated into numerous, government-supported and privately instigated housing developments. In combination with the uptake of imported house designs and construction methods, this represents a dramatic change from traditional modes of making houses, towns, and cities.

Research in the archive of SOCAL’s successor company Aramco and the University of California’s Santa Barbara Library has revealed a fascinating record of how these new-world building technologies, along with a simulacrum of Californian suburbanism, were parachuted into the Saudi desert to accommodate expatriate oil workers. Visits to Dhahran, the first oil compound in Saudi, and to large housing developments constructed from the early 1950’s to the present, revealed that while initially viewed with uncertainty and confined behind wire and gates, in less than two decades, industrialised and prefabricated construction techniques had become the Saudi government’s preferred method of delivering enormous numbers of affordable houses.

The story of the Dhahran Camp began with the second attempt at oil exploration in Saudi Arabia. The first attempt took place after the Sultan of Najd and later King of Saudi Arabia, King Abdulaziz ibn Saud, gave concession rights to Major Frank Holmes, a New Zealand mining engineer, in 1923.⁴ Holmes brought with him Dr Arnold Heim, a well-known Swiss expert in geology, to explore the concession area. Dr Heim quickly reported that the land of Al Hasa in eastern Saudi Arabia relatively close to the Dhahran Hills had no potential for oil.⁵ As a result, in 1927, the concession was cancelled. With other discoveries of oil around Saudi Arabia, however – oil was discovered in Iran in

³ Mark L. Gillem, *America Town: Building the Outposts of Empire* (Minneapolis and London: Minnesota Press, 2007), XV, XVIII.

⁴ Harry St John Bridger Philby, *Arabian Jubilee* (London: Robert Hale, 1952).

⁵ Scott McMurray, *Energy to the World: The Story of Saudi Aramco* (Houston: Aramco Services Company, 2011).

1908, in Iraq in 1927, and in Bahrain in 1932 – the King renewed his efforts to make a similar find in Saudi Arabia. In mid-1933, King Abdulaziz granted Standard Oil of California Company (SOCAL) the right to prospect for oil in the eastern region of Saudi Arabia. The Saudis' interest in the American company was driven by the fact that the US government had no "imperial designs" and the belief that the US was "so far away"⁶ that it could have no permanent interest in the Kingdom. As the king desired sustained access to foreign capital and expertise to develop and strengthen his kingdom, he gave concession rights to SOCAL for sixty years, despite the presence of other interested parties. The US oil company agreed to make the Saudi government an interest-free loan and to obey Sharia and Islamic law. Soon after obtaining the concession rights, the California Arabian Standard Oil Company (CASOC) was established to explore for oil in Saudi Arabia on behalf of SOCAL. A few years later, on 31 January 1944, the Arabian American Oil Company (Aramco) succeeded CASOC's operations in Saudi Arabia. Since 1988, Aramco has been fully owned by the Saudi Arabian government.

In late 1933, American geologists set up a camp of Bedouin tents near the Dammam Dome, the first domal geological structure identified near the Dhahran Hills, and began exploring the eastern region of Saudi Arabia.⁷ Drilling equipment and construction materials arrived in the region in 1934, through the ancient port of al-Uqayr, 80 kilometres from the Dhahran Hills. The first documented American construction work in the region occurred when the company built a new pier closer to the Dammam Dome to replace the remote port of al-Uqayr. The new pier was located in the coastal town of Al-Khobar, ten kilometres from the Dhahran Hills. Many local Bedouin and native Arabs were hired by the American company to help in the construction of the pier, even though they had no experience or skills in construction work at that time and their input was limited to lifting and carrying. However, skilled Bedouins were also hired by the company to help the oilmen explore the vast desert. Among these men was Khamis ibn Rimthan, who worked as a guide for most of the first oil-exploration trips.

The American crew soon left the temporary camp to move to the town of Jubail, 120 kilometres north-east of the Dhahran Hills, where they established the company's first

⁶ Marquis Childs, "All the King's Oil," *Arabian Sun* 1, no.27 (December 31, 1945), 2.

⁷ Wallace Stegner, *Discovery!: The Search for Arabian Oil* (Beirut: Middle East Export Press, 1971).

headquarters. After drilling started at the Dammam Dome, a decision was made to build a permanent camp in the same area, although the geologists initially were advised to set up their permanent offices in Al-Hofuf town, 130 kilometres south-west of the Dhahran Hills.⁸ Fred Davies, a former SOCAL director, wrote that:

The isolation of the site and the extreme summer heat required that the company undertake a dramatic housing program – a small town in the desert – far more elaborate than the bare minimum that might be the norm for such camp facilities. The initial community was to consist of living quarters, a cookhouse, a mess hall and a recreation room. In addition to these living and recreational quarters, an adequate number of offices and a geological laboratory were required.⁹

Exploratory drilling continued at the Dammam Dome, and other eastern regions of Saudi Arabia were also surveyed. In June 1934, Walt Haenggi, SOCAL's construction foreman, started to build the first imported factory-made bunkhouse in the Dhahran Camp. In the middle of 1936, after promising signs during exploration, SOCAL headquarters in San Francisco decided to bring more crews into the field. This meant that more housing and more supporting facilities and infrastructure were required. In response, the company in San Francisco shipped four more two-bedroom, air-conditioned, prefabricated bunkhouses to add to the one that Haenggi had built earlier.¹⁰ Later in the same year, the company sent several air-conditioned cottages suitable for family living (Fig. 1.1). The first expatriates' wives arrived in 1937,¹¹ after these cottages were assembled.

The residential camp was erected in a flat area near the Dammam Dome. Having worked previously in Bahrain lands, Haenggi along with his construction team knew the most

⁸ Distance to oil wells and health concerns in Al-Hofuf were the main drivers behind not establishing the company offices in AL-Hofuf. See Joseph William Walt, "Saudi Arabia and the Americans," PhD diss. Northwestern University, 1988, 113.

⁹ McMurray, *Energy to the World: The Story of Saudi Aramco*, 73.

¹⁰ Stegner, *Discovery!: The Search for Arabian Oil*.

¹¹ Annette Rabil and Nellie Carpenter were the first spouses that accompanied their husbands in 1937.

suitable siting and orientation for the camp's buildings. As a result, most of the Dhahran Camp's buildings were oriented east–west to prevent the entrance of the sun's rays.¹²



Figure 1.1 First air-conditioned, two-bedroom houses shipped from the US in 1936 and erected in the Dhahran Camp in 1937. Photograph by M. Steineke, Courtesy of Saudi Aramco.

In 1938, oil was finally discovered in Saudi Arabia. Dammam Well No. 7 was identified as a commercial oilfield, and as other wells also showed encouraging signs, and the Dhahran Camp was dramatically expanded. The community became more liveable, with more recreational facilities, services, and landscaped streets with many of the trees and seeds brought from Lebanon, Europe, and the USA. By this stage, the camp had been fenced, both to keep the company people inside and to prevent others from entering without permission.

The idea of enclosed and secluded communities was not a new phenomenon in the Arab region.¹³ Many traditional Arab towns were walled and gated, among them Al-Hofuf town, which was initially recommended as a suitable place for the geologists' accommodation and offices.¹⁴ The settlement was named Al-Hofuf in the fifteenth

¹² Stegner, *Discovery!: The Search for Arabian Oil*.

¹³ Glasze and Alkhayyal, "Gated Housing Estates in the Arab World: Case Studies in Lebanon and Riyadh, Saudi Arabia," 321-336.

¹⁴ Mashary Al-Naim, "The Dynamic of a Traditional Arab Town: the Case of Hofuf, Saudi Arabia," *Proceedings of the Seminar for Arabian Studies* 34 (2004): 193–207.

century,¹⁵ and during the Ottomans' first occupation from 1550 to 1670¹⁶, the city's defensive walls were constructed.¹⁷ A British officer, George Forster Sadleir, visited the town in 1819 and wrote:

Its walls are of mud, and about fifty feet high, surrounded by a deep dry ditch. It has two gates; the houses within the fort are mean; to the east is an open village, interspersed with cultivated grounds and date plantations. [Al-Hofuf] and its suburbs do not contain fifteen thousand inhabitants.¹⁸

The Dhahran compound fence was erected in part to keep people in and limit their influence on the surrounding areas. This inversion, from keeping people out, the purpose of traditional defensive walls, to keeping them in, was driven by the fact that the Americans showed little interest in local traditions, norms and religious beliefs. Although it has been claimed that “company policy makers wisely determined to get along with the Arabs by scrupulous observance of their customs and practices, and by appearing as inoffensive and inconspicuous as possible,”¹⁹ many scenes of the expatriates' early life in Saudi Arabia reveal the opposite, especially with the increased quantity of imported American goods.²⁰ In contrast, the Bedouins were considered to be very conservative, and resisted any foreign involvement in their lands. Indeed, one report stated that one of the main reasons for the departure of Dr Arnold Heim's geological expedition from Saudi Arabia was their treatment by the Bedouins.²¹ It seems that the oil compounds were fenced and gated to suit both Saudi and American requirements. In his book *Spaces of Global Cultures*, Anthony King writes that the Saudi oil compounds “are based on reasons of privacy and identity.”²² It became clear

¹⁵ Al-Naim, “The Dynamic of a Traditional Arab Town: The Case of Hofuf, Saudi Arabia,” 193.

¹⁶ Mohammed Nakhla, *The Political History of Al-Hasa* (Kuwait: Dhat Al-Salasil, 1980), 7.

¹⁷ Mohammed Al Abdul Qadir, *Tuhfat Al-Mustafid Bi-Tarikh al-Ahsa Fi Al-Qadim Wa-Al-Jadid* (Saudi Arabia: al-Amānah al-‘Āmmah lil-Ihtifāl bi-Murūr Mi’at ‘Ām ‘alā Ta’sīs al-Mamlakah, 1999), 37.

¹⁸ George Forster Sadleir, *Diary of a Journey Across Arabia: From El Khatif In The Persian Gulf, To Yambo In The Red Sea, During The Year 1819* (Bombay: The Education Society's Press, 1866), 72.

¹⁹ Walt, “Saudi Arabia and the Americans,” 115.

²⁰ Many newspaper articles have indicated and illustrated that the Americans were celebrating Christmas and other religious holidays inside Saudi. For more details see the first issues of *Sun and Flare* newspapers.

²¹ McMurry, *Energy to the World*, 17.

²² Anthony D. King, “Suburb/Ethnoburb: The Making of Contemporary Modernities,” in *Spaces of Global Cultures: Architecture Urbanism Identity* (London and New York: Routledge, 2004), 109.

very early on that it would suit both sides if the path to prosperity and the secure supply of oil were not complicated by the kinds of conflict that would have inevitably occurred if the two very different cultural groups had not been segregated.

The geopolitical imperatives and consequences of finding and extracting Saudi Arabia's vast oil supplies have been the subject of much debate and scholarship. The buildings and oil compounds themselves can be seen as outposts of American Imperialism, and as a manifestation of the spread of Western, technological thinking which, in contrast to a more traditional, pre-modern, worldview, is typified by an understanding of the earth as a vast array of resources waiting to be exploited.²³ What has been less studied are the astonishing medium and long-term consequences for Saudi domestic architecture of importing a Western, and particularly Californian, technological mode of house design and building, into the oil compounds. Relatively quickly, in a matter of just a few decades, traditional housing and building techniques outside the compounds were replaced with imported designs and construction techniques. The origins of this way of thinking and building can be traced back to the technological incursion of oil exploration and extraction. While the early buildings were primarily lightweight, prefabricated and timber-framed, once Saudi's started to build their own houses, initially designed by American architects, the predominant material changed to concrete. In later government schemes that resulted in the construction of many thousands of affordable houses across the country, concrete was again the dominant material in the form of standardised, factory-made, precast concrete panels. Interestingly, Margaret Crawford points out in her book *Building the Working Man's Paradise*, that while precast and monolithic concrete was experimented with as a low-maintenance, hygienic, fire-proof and cheap construction material for workers' housing in the USA during the early twentieth century, its unrelieved use, for example, in the "steel town of Morgan Park, Minnesota, ... gave the settlement a grey and grim appearance."²⁴ Its austere and stark appearance was "a visible symbol of the economics

²³ Martin Heidegger, "The Question Concerning Technology," in *The Question Concerning Technology and Other Essays*, trans. William Lovitt (New York: Harper and Row, 1977), 44–35. In this seminal essay, Heidegger names this understanding of the earth as a "standing reserve" of resources waiting and available to be exploited and used.

²⁴ Margaret Crawford, *Building the Working Man's Paradise: The Design of American Company Towns* (London and New York: Verso, 1995), 94.

of industrialised efficiency.”²⁵ As a result concrete houses were unpopular with workers and “never became part of the architectural vocabulary of the ‘new’ company town.”²⁶

California to Dhahran

During the first half of the twentieth century, California, the home of SOCAL, was a hub for the development of prefabricated/industrialised buildings, particularly houses.²⁷ Migration to the US increased dramatically, particularly to the West Coast. Enormous housing projects were under development, and hundreds of thousands of mail-order houses were shipped all around the US.²⁸ Many new, industrialised construction techniques were developed to tackle the ever-increasing demand for housing. At the same time, developers were building many new suburbs that combined housing with all the necessary supporting facilities, such as schools, shopping malls, and recreational facilities, to attract home buyers. Lakewood, California, is an excellent example of such a suburban area. This was the period in which suburban residential developments reshaped the West Coast of the US.

Many well-known architects saw this as an opportunity to put their ideas about factory-made, prefabricated housing into practice. They used innovative technologies in their residential experiments and also advocated their use to address the housing shortage during the 1930s and 1940s. Gilbert Herbert in his book *The Dream of the Factory-made House: Walter Gropius and Konrad Wachsmann* describes some of their approaches:

This is the period when the great masters, Le Corbusier, Gropius, Frank Lloyd Wright, found it necessary to deal with the technological imperative and social ideology of mass housing, when each in his

²⁵ Crawford, *Building the Working Man's Paradise*, 95.

²⁶ Crawford, *Building the Working Man's Paradise*, 95.

²⁷ Barry Bergdoll and Peter Hewitt Christensen, *Home Delivery: Fabricating the Modern Dwelling* (New York: The Museum of Modern Art, 2008).

²⁸ Richard Harris, “The Talk of The Town: Kit Manufacturers Negotiate the Building Industry, 1905–1929” *Journal of Urban History* 36, no. 6 (2010): 868–896.

own manner – Wright romantically, Le Corbusier ideologically, Gropius totally and with deep commitment – explored the potentials of industrialised building.²⁹

In Burbank, California, on the US West Coast, Konrad Wachsmann worked with Gropius to establish the General Panel System. They believed the solution to the housing problem should not be the factory production of a range of house styles, but rather a rationalised, prefabricated building system that could be combined and erected in different configurations using unskilled labour.³⁰ Indeed, with the General Panel System – after many years of design and development – this is what they achieved. However, the factory had difficulty competing within the American housing market due to post-World War Two market resistance³¹ and the availability of factory-made and mail-order houses that were more ‘traditional’ in appearance.³²

Although their attempts to influence people via experimental designs and innovative solutions during the 1930s and 1940s were limited, modernist architects persisted. Many organisations supported their utopian ambitions to achieve their dreams of a rationalised form of industrially produced housing. The Case Study Houses, for example, were sponsored by *Art & Architecture Magazine* between 1945 and 1962.³³ A number of architectural entrepreneurs also designed and built unique experimental houses which they imagined could be duplicated in large quantities. For example, Buckminster Fuller designed the Wichita House, and Wallace Neff built the Bubble House.³⁴ Instrumental and technological thinking prevailed during this period, and the availability of ready-made architectural materials and systems altered the processes of creativity and novelty within contemporary architectural practice. The qualities of site and place became less relevant: what worked in one place, it was thought, should work the same way in any other, regardless of cultural and social differences.

²⁹ Gilbert Herbert, *The Dream of the Factory-made House: Walter Gropius and Konrad Wachsmann* (Cambridge and London: The MIT Press, 1986), 5.

³⁰ Herbert, *The Dream of the Factory-made House: Walter Gropius and Konrad Wachsmann*.

³¹ Sam Ridgway, “Being Technological: Heidegger and Mass-Produced Houses,” *Architectural Theory Review* 2, no.1, (2009): 98–121.

³² Colin Davies, *The Prefabricated Home* (London: Reaktion Books, 2005).

³³ Esther McCoy, *Case Study Houses: 1945–1962* (United States: Hennessey and Ingalls, 1977).

³⁴ Head Jeffrey, *No Nails, No Lumber the Bubble Houses of Wallace Neff* (New York: Princeton Architectural Press, 2011).

In the early twentieth century, bungalows were the most affordable option in many new Californian suburban towns, more than sixty of which were developed at the beginning of the last century to address rapid population growth.³⁵ Use of the bungalow by developers when erecting suburban communities also helped promote this style in other surrounding areas. Eventually, the bungalow became very popular throughout the US because it was one of the most affordable housing options. The simplicity of its configuration also allowed many manufacturers to commercialise ready-cut versions of the bungalow.³⁶ Companies like Sears, Aladdin, and Pacific Ready-Cut Homes sold and shipped thousands of these mail-order houses all around the US and even overseas. In 1919, Standard Oil of Indiana built a new company town in Carlinville, Illinois, made completely out of Sears' mail-order homes.³⁷ Other oil companies shipped similar houses to their overseas operational fields. During the 1930s, however, the Californian bungalow fell out of fashion after being the dominant residential style throughout California for many years.

As the bungalow's era faded, a new domestic architectural style emerged. Henry H. Saylor, editor of the *American Architect*, described this type of residential architecture in 1925 while he was reviewing recent buildings on the Pacific Coast:

There was still another type that stood out from the medley of jumbled styles, lack of styles, or mere affectations, and that was the California ranch house. Apparently it just grew, naturally, inevitably, a logical result of meeting definite needs in the most direct, workmanlike manner possible with the materials at hand. It borrowed none of the finery of other architectural styles; it sounded no blatant note of self-advertisement; it never, so far as I know, laid claim even to a name, and yet there it stands, a vernacular that is as unmistakably

³⁵ John Mack Faragher, "Bungalow and Ranch House: The Architectural Backwash of California," *Western Historical Quarterly* 32, no. 2 (2001): 149–137.

³⁶ Robert Winter, *The California Bungalow* (United States: Hennessey and Ingalls, 1980).

³⁷ Harris, "The Talk of The Town: Kit Manufacturers Negotiate the Building Industry, 1905–1929," 877.

a part of its California foot-hills as the stone house of eastern Pennsylvania betoken that great treasure store of mica schist.³⁸

The California ranch house gained popularity in the 1930s. Untrained architect Cliff May sold more than 18,000 house plans both in the US and all around the world.³⁹ By the 1940s, the California ranch house had become the most dominant dwelling type across the US.⁴⁰ Many manufacturers produced a variety of prototypes that could be mass-produced, based on May's and other architects' designs, and many California ranch tract housing projects were developed. Unlike the bungalow, the California ranch house embodied many modernist ideas, especially those related to industrialisation and efficiency.⁴¹

Traditionally designed mass-produced housing solutions, such as the ranch house, were more popular than the severe industrialised modern houses designed by well-known architects. Being financially and economically driven, most oil companies considered the design, material and style of employees' housing quarters as minor factors compared to minimising cost and delivery time. The most viable method of achieving this for the oil companies was the use of what was available and had a strong established market: ready-made bungalows and ranch houses.

Building the First Oil Camp: The Dhahran Compound

When SOCAL geologists began exploring the Saudi Arabian desert in 1933, they initially lived in traditional forms of temporary dwelling: Bedouin tents and *barastis*, simple structures built from woven palm leaves and reedy wooden frames (Fig. 1.2). Living in these structures was a completely different experience for them compared to living in modern houses in the US. Such fundamental differences in living standards,

³⁸ Cliff May, *Western Ranch Houses* (San Francisco: Hennessey and Ingalls, 1946) 20.

³⁹ Joseph Giovannini, "The Man Behind the Ranch House," *New York Times* (Jul 3, 1986).

⁴⁰ Greg Hise, *Magnetic Los Angeles: Planning the Twentieth-Century Metropolis* (United State: Johns Hopkins University press, 1999)

⁴¹ Faragher, "Bungalow and Ranch House: The Architectural Backwash of California."

along with the scarcity of building materials, led the company to quickly import factory-made and prefabricated houses from California.



Figure 1.2 A *barasti* structure between oil drilling rig facilities. Similar to other *barastis* around the area, this locally built unit was used by Western and Arab workers. Photograph by Ray Clark, Courtesy of Saudi Aramco.

Accommodation was one of the main concerns the company focused on from the beginning. In fact, according to a documentary made by SOCAL in 1948, out of every two dollars invested in the oil concession, one dollar was allocated for housing and other facilities needed to establish a liveable environment for expatriates.⁴² Once promising signs of oil were found in 1936, the company started to ship industrialised, air-conditioned housing units to Saudi Arabia to accommodate geologists and their soon-to-arrive families in one of the hottest, most arid climates in the world. The first prefabricated houses were ready to be occupied by 1937, even before oil was being produced in commercial quantities. To alleviate homesickness through familiarity and

⁴² Jeff Quitney, "Saudi Arabia: 'Desert Venture' circa 1948 Standard Oil; King Ibn Saud & ARAMCO," YouTube video, 27:55, April 29, 2016, <https://www.youtube.com/watch?v=4YEtOUWfluc>

to offer living conditions acceptable to US oil workers, the company created a replica of a Californian suburb in the desert.⁴³

The first houses shipped from the US to Dhahran were bunkhouses and Californian ranch houses selected from kit house catalogues.⁴⁴ Photos of the Dhahran Camp in 1936 show many of these buildings during the construction stage. Some were built using framing techniques in which all parts were factory-made and then packed up and shipped to Saudi Arabia (Fig. 1.3), while others were based on prefabricated panels (Fig. 1.4). This was completely new technology to local Saudis and left many Americans with memorable stories of Saudis' perceptions of these completely unfamiliar buildings. One of the expatriates' wives recalls:

We moved into the first house that was finished, and as we moved in, they were putting up the curtain brackets and doing finishing, and the Arabs were absolutely astounded. Many of them had never seen a white woman, much less one with her face completely uncovered, and I had Anne in a wooden Dutch Cleanser box. When they heard the baby cry they really got excited. So they unloaded all of our stuff and they carried kitchen stuff into the bathroom, and other stuff into the kitchen. It was a great sorting out, but we finally got settled.⁴⁵

A key selling point of industrially produced, packaged houses was that their assembly did not require highly trained tradesmen. Soon after oil was discovered, many Bedouins arrived in the Dhahran Hills looking for a job or a new source of income. Early in the 1940s, a decision was made by the company to use this unskilled workforce for construction tasks. The Dhahran camp witnessed a tenfold expansion to accommodate the increasing number of foreign and local workers.⁴⁶ During this expansion two types of residential buildings appeared. Those for the American camp were fully imported,

⁴³ For further discussion about American towns in Italy, Japan, and South Korea, see: Gillem, *America Town: Building the Outposts of Empire*. For more details about American relations in Saudi Arabia and Japan see Fred J. Harsaghy, *The Administration of American Cultural Projects Abroad* (New York: New York University, 1965).

⁴⁴ Stegner, *Discovery!: The Search for Arabian Oil*.

⁴⁵ McMurray, *Energy to the World: The Story of Saudi Aramco*, 171.

⁴⁶ McMurray, *Energy to the World: The Story of Saudi Aramco*, 77.

with high use of industrialised and prefabricated construction materials and techniques. In contrast, the buildings in the Saudi camp were constructed with local earthen materials and traditional construction practices.



Figure 1.3 Californian timber framed construction in the Dhahran Camp in 1936. Photographer unknown. Courtesy of Special Research Collection, UC Santa Barbara Library, Saudi Arabia Oil Photograph collection, Bernath Mss 366.



Figure 1.4 Houses built using modular, prefabricated panels in the Dhahran Camp in 1936. Photographer unknown. Courtesy of Special Research Collection, UC Santa Barbara Library, Saudi Arabia Oil Photograph collection, Bernath Mss 366.

To work within the oil industry, Saudi construction workers had to quickly adopt and learn new technical skills, using new industrialised techniques, and imported and standardised materials (Fig. 1.5).⁴⁷ The interaction with American workers and the opportunity to use their “advanced” construction equipment rapidly altered the way Saudi workers understood their built environment. However, when the workers built their own residential buildings outside the American Camp, issues of available resources and cultural and social beliefs complicated the adoption of new techniques. The construction techniques the Saudi workers used to erect their houses and mosques were simple, traditional, and well-known in the region. Any new technologies or attempts to industrialise these well-established practices were simply rejected and hard to implement. Solon T. Kimball, stated that the Arab camp was “neither planned nor welcomed” and he added “these settlements represent the attempt by Arabs to establish a type of community life with which they are familiar.”⁴⁸

In the period of the establishment of the oil industry, two types of vernacular architecture existed in the eastern coastal region: one similar to the well-known Arabian courtyard houses, and the other, the *barasti*, a simple, affordable dwelling. *Barastis* are often single-family units that feature low-pitched roofs and were the only kind of domestic houses to be built during the Dhahran compound development. Most *barastis* were erected adjacent to the well-maintained American camp.⁴⁹ While the construction of both the California ranch house and *barasti* were based on framing techniques, the cultural and technological differences between them were stark. The Californian ranch house comes from a long history of the industrial production of building materials and houses, whereas *barastis* are a result of long-lasting inherited traditions of construction that rely on local and unprocessed materials.

⁴⁷ Stegner, *Discovery!: The Search for Arabian Oil*.

⁴⁸ Solon T. Kimball, “American Culture in Saudi Arabia,” *The New York Academy of Sciences* 18 (1956): 472.

⁴⁹ Jon Parssinen and Kaizir Talib, “A Traditional Community and Modernization: Saudi Camp, Dhahran,” *JAE* 35, no.3 (1982): 14-17

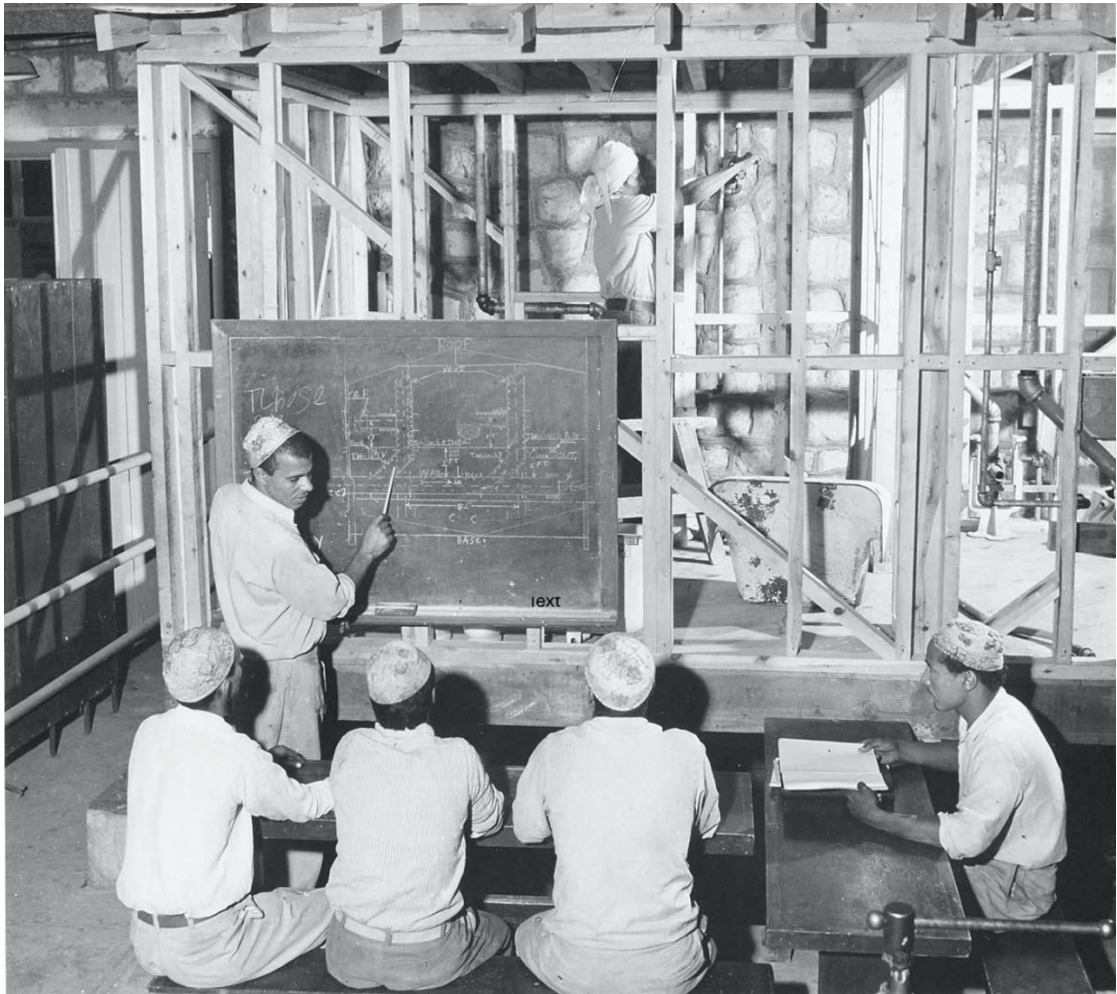


Figure 1.5 Saudi workers during a construction training program. Most of Aramco's Saudi workers were part of the construction workforce. Photographer unknown. Courtesy of Saudi Aramco.

As Aramco expanded its operations in the region, more residential buildings were built, and the compound/suburb was expanded dramatically. Large numbers of Saudis were also trained and educated by the Americans. Interest in further educating the Saudi people was shown by both the oil company and the Saudi government, and the company opened its first Saudi school in May 1940 using a rented mud-brick house in Al Khobar town. This was followed by another school in a *barasti*-style building within the Saudi workers' camp.⁵⁰

⁵⁰ McMurray, *Energy to the World: The Story of Saudi Aramco*, 111.

In contrast to the aims of the factory-made housing industry to assemble prefabricated components efficiently using unskilled labour, many Saudi workers became highly skilled.⁵¹ Within a few years of the discovery of oil and following their training by the Americans, Saudi workers became capable of efficiently completing sophisticated construction projects. For example, in 1952 Saudi construction crews were able to build Swedish duplexes in 5,300 labour-hours, close to the world average at the time of 5,000 labour-hours.⁵²

In addition to Saudi workers, Aramco's construction crews often included prisoners of war or refugees. For example, in 1944 more than 1,000 Italian craftsmen were brought to the area after being released from the former Italian colony of Eritrea, to support the company's construction team.⁵³ The Italian workers' trade skills were influential for many Saudis as well as for the Americans. These craftsmen helped build many facilities, including the still-standing Dhahran Dining Hall (Fig. 1.6).

In addition to constructing a large number of conventional factory-made buildings, Aramco also conducted novel experiments to house its ever-increasing workforce, Wallace Neff's Bubble House and Swedish portable houses for example. At the end of the Second World War, Wallace Neff invented the "Airform" housing concept, consisting of dome-shaped structures built by spreading concrete over an inflated air balloon. In 1945, Neff partnered with Aramco to design and construct several Bubble Houses;⁵⁴ the first (Fig. 1.7) was built in 1945 and stood for almost 20 years, although it was not used as a dwelling unit, before it was demolished due to maintenance complications.⁵⁵

⁵¹ The company established many new schools and sent many Saudis aboard to gain new knowledge and skills. See Ismail I. Nawwab, Peter C. Speers, and Paul F. Hoye, eds., *Saudi Aramco and its World: Arabia and the Middle East* (Dhahran: Aramco 1980).

⁵² "Around the Districts," *Sun and Flare* 7, no.11 (March 19, 1952): 5.

⁵³ McMurray, *Energy to the World: The Story of Saudi Aramco*, 116.

⁵⁴ Jeffrey, *No Nails, No Lumber the Bubble Houses of Wallace Neff*, 122.

⁵⁵ "Pleasant Days," *Al-Ayyam Al-Jamilah* (Fall 2011): 34.



Figure 1.6 Italian workers completing stone facades of the Dhahran Dining Hall in 1948. Photograph unknown. Courtesy of Saudi Aramco.



Figure 1.7 Bubble House built in the Dhahran Camp in 1945. The house had two bedrooms and a circular plan living room. Acoustic and insulation issues were the main reasons for the project failure. Photograph by George Fobes. Courtesy of Saudi Aramco.

In 1948, 40 out of 275 wooden prefabricated houses that were exported from the US were shipped to Saudi Arabia.⁵⁶ In the 1950s, however, the company shifted its housing focus from the US to Scandinavia. The company made a deal with a Scandinavian government to supply it with portable and prefabricated housing in order to pay off some of the debt incurred through purchasing oil from Aramco for many years.⁵⁷ The Swedish portable houses were ready to be occupied in 1952.

In 1976, Aramco turned back to America and this time to the east coast, after seeing successful examples in several states of whole residential quarters constructed of prefabricated buildings, such as Levittown in New York state.⁵⁸ Although the Dhahran camp was developed before Levittown, it has been called “Aramco’s Levittown” because of its perceived similarity to that development, and to the associated American

⁵⁶ Burnham Kelly, *The Prefabrication of Houses*, (New York: Technology Press of the Massachusetts Institute of Technology and Wiley, 1951), 366.

⁵⁷ McMurray, *Energy to the World: The Story of Saudi Aramco*, 194.

⁵⁸ Joan Kron, “Plug-In House: American Dream Homes in Saudi Desert,” *New York Times* (September 15, 1977): 73.

standard of living.⁵⁹ Modular and mobile prefabricated residential houses from the US east coast have been sold in large quantities to the Saudi oil company since that time (Fig. 1.8).



Figure 1.8 A New York Times article, published in 15 September 1977, discusses Aramco's manufactured houses. Source: Joan Kron, "Plug-In House: American Dream Homes in Saudi Desert," New York Times, (September 15, 1977): 73

⁵⁹ Nathan Citino, "Suburbia and Modernisation: Community Building and America's Post-War II Encounter with the Arab Middle East," *The Arab Studies Journal* 13/14, no. 2/1 (2006): 39-64. See also Pascal Menoret, "The Suburbanisation of Islamic Activism in Saudi Arabia," *City & Society* (2017):162-186.

Housing provided for the oil industry combined with the vast wealth resulting from the sale of oil marked the beginning of dramatic changes to Saudi construction and architecture. According to the philosopher Don Ihde, technologies are culturally embedded, and he suggests that indigenous societies' responses to newly imported technologies vary.⁶⁰ In his book *Technology and the Lifeworld: From Garden to Earth*, Ihde divides this variation into four broad categories:

(1) There are what I shall call “monocultures” of the traditional type, which – virtually no matter what response they take – are overwhelmed by the incoming group; (2) there are middle, compromise adaptations which entail taking selected technofacts into the indigenous culture – these technofacts either may be adapted to a new cultural context or only part of their previous embedded role may be accepted; (3) there are cultures that can successfully resist most of the elements of the incoming group's technologies, although these are rare exceptions to most cross-cultural exchanges; and finally, (4) there are cultures that adopt, sometimes even enthusiastically, what is new from the incoming group and modify themselves in some approximation of that group's cultural shape.⁶¹

While Saudis were initially highly resistant to imported technological building techniques, the influence of these techniques was ultimately profound. According to Ihde's classifications, Saudis have, on various occasions, exemplified both (3) and (4), depending on relevant factors such as cultural and religious beliefs. Since the 1950s, governmental agencies have strongly supported and advocated the adoption of imported building materials and techniques over local and conventional construction techniques. As a result of this cultural and technological exchange, many traditional characteristics of Saudi architecture have been modified or all but disappeared.

⁶⁰ Don Ihde, *Technology and the Lifeworld: From Garden to Earth* (Bloomington: Indiana University Press, 1996).

⁶¹ Ihde, *Technology and the Lifeworld: From Garden to Earth*, 151.

Contemporary Saudi Residential Architecture

As the oil industry in Eastern Saudi Arabia expanded during the 1950s, residential quarters multiplied. The American camp grew in a planned way whereas the Saudi camp was randomly organised. Solon T. Kimball described the Saudi camp, after it was occupied by many non-Aramco employees, as:

...one that was neither planned nor welcomed. To Western eyes it is reminiscent of the Hooverville of depression days. Houses have been constructed of every conceivable kind of scrap material with a scattering of more traditional palm-leaf native *barastis*, and an occasional substantial building of concrete block. These settlements represent the attempt by Arabs to establish a type of community life with which they are familiar. Here the employees, mostly Saudis, may bring their families.⁶²

Both Aramco and the Saudi government were unhappy with the unplanned expansion of the Saudi camp and its unsafe and poor facilities. As a result, an agreement was made between the company and the government to develop planned living communities for Aramco's Saudi workers in what was called Aramco's Home Ownership Program.⁶³ After the company launched the program, that aimed to provide Saudi crews with permanent housing through interest-free loans, Saudis began to ask their American architect and builder colleagues, who often worked for the oil company, to design their new contemporary houses. At that time, there were no Saudi architects, and under the conditions of the program, any new house had to comply with the company's mostly American building standards.⁶⁴ Most Saudi houses during that time were designed and supervised by T. Coleman, a Californian building contractor who worked for Aramco.⁶⁵ The houses' architectural concept and form, along with the quality of the construction,

⁶² Kimball, "American Culture in Saudi Arabia," 472.

⁶³ Saleh Al-Hathloul, "Tradition, Continuity, and Change in the Physical Environment: The Arab-Muslim City," PhD diss. Massachusetts Institute of Technology, 1981.

⁶⁴ Yousef Fadan, "The Development of Contemporary Housing in Saudi Arabia (1950–1983): A Study in Cross-Cultural Influence Under Conditions of Rapid Change," PhD diss. Massachusetts Institute of Technology, 1983.

⁶⁵ Carleton S. Coon, "Operation Bultiste: Promoting Industrial Development in Saudi Arabia," in *Hands Across Frontiers*, ed. Howard M. Teaf Jr. and Peter G. Franck (Ithaca: Cornell University Press, 1955), 342.

were appreciated and admired by many Saudis, perhaps because of the novelty of the architectural style and reinforced concrete construction methods (Fig. 1.9). Additionally, the new construction materials and techniques allowed Saudis, for the first time, to live in houses with spacious rooms and large windows, as well as modern amenities.

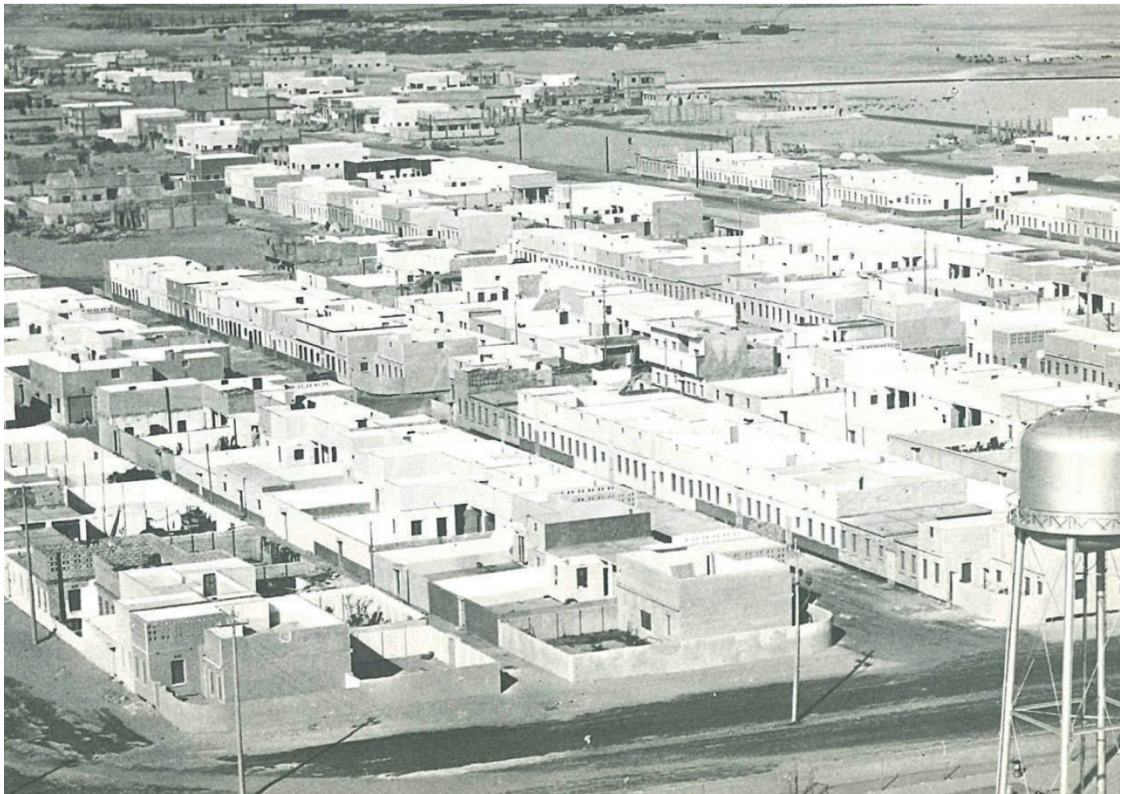


Figure 1.9 The first contemporary houses using imported styles and construction techniques built under Aramco's Home Ownership Program early in the 1950s near the Dhahran Camp. Photographer unknown. Courtesy of Saudi Aramco.

After the completion of the first Saudi oil-workers' housing program, reliance on external architectural services became the norm. By 1999, the number of houses built under Aramco's home ownership program had increased to more than 41,000 housing units,⁶⁶ whereas the number of existing courtyard and *barasti* houses had dramatically

⁶⁶ Faisal Mubarak, "Cultural Adaptation to Housing Needs: A Case Study, Riyadh, Saudi Arabia," *IAHS Conference Proceedings* (San Francisco: 1999).

decreased. The result of this reliance on foreign architects directly affected Saudis' cultural and social activities. Mashary Al-Naim, architectural critic and professor, believes that Saudis "suddenly found themselves in a completely different physical environment"⁶⁷ after accepting new Westernised housing concepts. During the second half of the twentieth century, Saudis continued to rely on foreign firms and architects to design their residential buildings. Tawfiq Abu-Gazze, a professor of architecture, argues that most contemporary Saudi Arabian architecture is "culturally destructive" due to the use of foreign expertise.⁶⁸ This claim suggests that Saudis have passively adopted the foreign interpretation of their culture, ignoring the importance of embedded cultural values within their built environment.

While some traditional social values and practices once associated with housing are nowadays considered old-fashioned and are declining, there are many examples that have endured, and which have resulted in modifications to the introduced house types. A good example is the manner in which male guests arrive and are accepted into a house which is discussed later. The changes to Saudi residential architecture can largely be attributed to the discovery of oil. The oil industry and the influx of technology and wealth dramatically altered and modified Saudis' experience of the built environment and more specifically of residential architecture. Following the discovery of oil, there was increased interest in modern, innovative, industrialised housing that would transition many Saudis from traditional to modern modes of dwelling.

Comparisons between traditional courtyard houses and the first generation of Saudi contemporary houses built through the Aramco Home Ownership Program in the 1950s show early shifts in Saudi residential architecture. Design and construction of traditional houses were free from any formal regulations and governmental policies, whereas the first contemporary houses were built in accordance with newly established rules and regulations set by the government and Aramco. The construction technology used in traditional houses was conventional and based on available materials, resulting in

⁶⁷ Mashary Al-Naim, *Political Influences and Paradigm Shifts in The Contemporary Arab Cities: Questioning the Identity of Urban Form* (Milano: Universita Cattolica del Sacro Cuore, 2005): 40.

⁶⁸ Tawfiq Abu-Ghazze, "Vernacular Architecture Education in the Islamic Society of Saudi Arabia: Towards the Development of an Authentic Contemporary Built Environment," *Habitat Intl.* 21, no.2 (1997): 229-253.

limited long spans and small spaces. The building technologies used in the first contemporary houses were more durable, making use of new imported technologies and materials.⁶⁹ Budget was a challenge for most Saudis before the discovery of oil. In contrast, the wealth created by oil, and government assistance in securing land to build on, allowed many Saudi Aramco employees to construct contemporary houses that included expensive amenities and features. These characteristics resulted in a different understanding of the dwelling unit. For example, traditional courtyard houses were seen as a dwelling experience in which the house expanded in accordance with occupants' needs. In contrast, contemporary houses were seen as a finished end product.

House size is another area of comparison. Housing expert and architecture professor, Ali Bahammam, has studied the spatial differences between traditional Saudi dwellings and contemporary houses.⁷⁰ His study reveals that the total built area for contemporary Saudi houses is more than double that of the traditional courtyard house. Additionally, the number of rooms has swelled in contemporary houses to more than twelve per household, where previously it averaged six rooms per household in courtyard houses.

Along with these more tangible changes comes the question of intangible values within the Saudi dwelling experience. It is obvious when comparing the two different types of houses that sociocultural values and other traditional norms have changed. Within Saudi culture, segregation between male and female guests is fundamental, considering that female family members cannot expose their faces or sit with a male guest who is not their *mahram*.⁷¹ Therefore, in a traditional Saudi courtyard house, a male guest room was usually located on the first floor, and male guests were often welcomed in a small entry hall, after which they moved to the reception area upstairs via a narrow staircase located next to the entrance. This arrangement was the result of two main factors. First, it was believed that the upper floors would cool down faster than the lower floor, thus

⁶⁹ For more detail about changes in Saudi residential architecture see: Yousef Fadan, "The Development of Contemporary Housing in Saudi Arabia (1950-1983): A Study in Cross-Cultural Influence Under Conditions of Rapid Change," PhD diss. Massachusetts Institute of Technology, 1983.

⁷⁰ Ali Bahammam, "Factors Which Influence the Size of the Contemporary Dwelling: Riyadh, Saudi Arabia," *Habitat Intl.* 22, no. 22 (1998): 557-570.

⁷¹ *Mahram*, unmarried kin in Islam, is an Arabic term that describes a man's relationship to a woman. A *mahram* to a woman in Islam is any male relative that cannot marry the woman. Parents, grandparents, siblings, siblings of parents are a few examples of women's *mahrams*.

ensuring guests' comfort. Second, the ground floor was considered more family focused and contained most of the house's functional spaces, such as the kitchen and pantry, which were usually occupied by women and girls. This arrangement ensured privacy for the female family members. When American architects began to design contemporary Saudi houses, the first-floor reception space was relocated adjacent to the front door on the ground floor, showing a different architectural understanding of privacy and the reception of guests. The reception room was then separated from other family spaces by a permanent dining room. This form of space allocation has become the norm in contemporary Saudi residential architecture. The knowledge, equipment, and technological thinking that were brought by the discovery of oil have fundamentally altered Saudi domestic architecture and created new forms of dwelling that include altered social and cultural practices.

Conclusion

The discovery of oil began a process of almost inconceivable change in Saudi Arabia's architecture and built environment. There are numerous studies examining the impact of the discovery of oil on social, economic, and cultural life but few have explored the impact of the oil industry on domestic architecture and its construction practices. The story of the Dhahran Camp and its complex housing history reveals the oil industry's role in constructing a totally new understanding of dwelling and domestic architecture for most Bedouins and native Arabs. Placing the story of the Dhahran Camp in the context of the wider twentieth century phenomenon of industrialised, factory-made housing highlights how imported, and industrialised building technologies changed well-established, traditional architectural values and building construction. From 1936, Aramco imported factory-made houses from California and Scandinavia into the Dhahran Camp. While the company flirted with ideologically and technologically motivated industrialised housing, in general they imported and constructed housing styles that were familiar to their American workforce in an effort to make them feel at home despite being in an extremely unfamiliar cultural, climatic and geographical environment.

While the Americans and their unfamiliar culture and advanced technology might have initially been viewed with deep suspicion and isolated in gated compounds, their presence in the Kingdom was, at least initially, based primarily on mutual commercial interests rather than colonial or imperial exploitation. As we all now know, this resulted in almost unimaginable wealth flowing into Saudi Arabia. Relatively quickly, the combination of financial abundance and access to imported building technology and overseas trained architects and builders dramatically changed Saudi Arabia's architecture, towns, cities, and suburbs. Aramco's Home Ownership Program and the Al-Malaz residential development⁷² in the 1950s as well as the general housing programs⁷³ early in 1970s were pivotal in changing Saudi residential architecture.⁷⁴ These projects were financed, designed, and constructed under governmental control using imported industrialised construction techniques and skills. Traditional house designs and construction were abandoned and replaced with house designs, construction technology, and their associated cultural values, imported from overseas. Local building materials were ignored in preference to more durable imported materials, particularly concrete. This trend continues with current plans by the Saudi government to build more than one million prefabricated, affordable houses over the next few years.

⁷² By 1957 the Saudi government transferred its ministries from Jeddah and Makkah to Riyadh city, the capital of Saudi Arabia. To attract its employees a massive housing program was launched in the mid-1950s. See Abdulrahman Alangari, "The Revival of the Architecture Identity: The City of Arriyadh," PhD diss. University of Edinburgh, 1996.

⁷³ For more detail about Saudi's General Housing Projects see Ahmad Al-Saif, "Residents' Satisfaction on Low-Middle- and Upper-Middle Income Contemporary Saudi Housing Environments: The Case of Riyadh," PhD diss. Cornell University, 1994.

⁷⁴ For example, Saleh Al-Hathloul, Yousef Fadan, Abdulrahman Alangari, and Ali Bahammam have all emphasised the importance of these developments in constructing the contemporary residential architecture in Saudi Arabia.

Chapter Two | Swedish Prefabricated Houses in the Saudi Arabian Oil Fields

Preamble

This chapter explores further the Swedish prefabricated timber houses briefly discussed in Chapter One, that were imported into the Saudi oil compounds in the 1940s and 1950s. As the chapter deals with a Swedish case study and was part of a larger research project, an abstract of this chapter was submitted to The Nordic Association of Architectural Research (NAF/NAAR) 2019 Symposium titled *Approaches and Methods in Architectural Research*. The paper was accepted and subsequently presented in June 2019 at the symposium held at Chalmers University, Gothenburg, Sweden. The proceedings are now in publication and due for release in mid-2021. The houses were manufactured quite near to Gothenburg in the small town of Åmål and a visit to the town after the symposium unearthed valuable research material.

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Contribution to the Paper: Conceptualisation, research, fieldwork, investigation, data collection, structuring, analysis, writing, paper submission and administration.

Certification: This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.

Signature:

Date: 13 July 2021

Name of Co-Author: Sam Ridgway

Contribution to the Paper: Supervision, editing, and administration.

Signature:

Date: 13 July 2021

Abstract

In 1948, a shipment of Swedish, flat-packed, prefabricated timber houses were off-loaded in the recently-constructed port of Al-Khobar on the Arabian Gulf coast of Saudi Arabia. The houses were destined for the Dhahran oil compound where ten years earlier oil had been discovered in the deep-test well Dammam No. 7. The Arabian American Oil Company (Aramco) had ordered the houses to accommodate its rapidly expanding workforce.

The oil camps attracted many local Bedouins looking for work and the Swedish, Scottish and English architects and builders who accompanied the prefabricated houses, both supervised their construction and trained locals in carpentry and other building trades so they could assist. Within the context of Saudi Arabia's seismic shift from traditional to modern forms of architecture, the arrival of the Swedish houses, and also others from the west coast of America, can be understood as a crucial event. The vast wealth that flowed from the discovery of oil combined with a workforce trained in construction helped spread the associated architectural and cultural knowledge beyond the oil compounds to Saudi society more widely.

This paper discusses the Swedish prefabricated houses and the architectural changes they helped establish in Saudi Arabia. The paper has been developed as a part of a PhD research that aims to theorise and historically contextualise the Saudi government's current initiative to build more than one million affordable houses by 2030 using industrialised construction methods.

Introduction

Studying the Swedish prefabricated timber houses, imported into the Saudi Arabian oil fields in the early twentieth century, is part of a larger PhD research project at the University of Adelaide in South Australia. This PhD focuses on the current Saudi government scheme, announced in 2017, to build more than one million prefabricated and affordable houses by 2030. The discovery of oil and the importation of prefabricated timber buildings, particularly houses, into the oil compounds is an important part of this story. The Arabian American Oil Company (Aramco) imported thousands of houses, of various styles and technologies, into the vast Saudi Arabian desert to house its large, mainly expatriate workforce. Initially ready-made bungalows and ranch houses were sourced from the west coast of the United States. Following World War II, with the growing reputation of the Swedish prefabrication industry and as part of a contra deal to repay an oil debt, the company started to import Swedish prefabricated timber houses.

Since the 1930s, Saudi residential architecture has undergone profound changes. Urban fabric has been transformed from traditionally designed courtyard houses and narrow and irregular streets to contemporary modern villas built in urban areas that have been planned in a gridiron pattern. This fundamental change has been examined by a number of architectural scholars. Some have linked the discontinuity of traditionally and culturally formed urban fabric to the discovery of oil in the 1930s.¹ For example, Geoffrey King, in his book *The Traditional Architecture of Saudi Arabia*, writes that “prior to the full flow of its oil economy Saudi Arabia’s architecture and architecture styles had not changed for centuries.”² As the urban population grew rapidly due to increased migration from rural areas, the need for affordable housing grew.

Since the 1950s, the Saudi government, in response to the demand for housing, has introduced many initiatives and projects to tackle this issue. The first governmental effort was documented in the early 1950s with a number of in situ built houses in Riyadh

¹ Mashary Al-Naim, “Identity in Transitional Context: Open-Ended Local Architecture in Saudi Arabia,” *International Journal of Architecture Research* 2 (2008): 125.

² Geoffrey King, *The Traditional Architecture of Saudi Arabia* (London: I.B.Tauris, 1998).

city. As the number of citizens and migrants continued to increase, the government turned its attention to prefabrication techniques. The first government affordable housing project to use these techniques was launched in the early 1970s.³ Companies from Europe, South Korea, and Saudi Arabia were hired to complete a large national housing project. However, once completed, many of the housing units were not occupied for many years. For several decades following the completion of this project, public housing projects continued to be built using conventional precast, reinforced concrete panels.

With the recent increased demand for affordable housing, the Saudi Ministry of Housing re-introduced the use of technology and prefabrication as the main approach to satisfy this demand. In 2017, the ministry introduced its new housing vision and strategic plan. One of the vision's main objectives is to provide more than one million housing units for Saudi citizens within the next few years. According to the ministry plan, a key strategic factor to the achievement of this goal is related to the use of new high-tech, industrialised construction methods, as well as imported and local lightweight construction materials. Since 2017, the ministry has been keen to introduce new imported housing solutions and many international companies have been invited and hosted. Companies from the United States, China, Turkey, the Netherlands, and Bahrain have already built housing prototypes and experiments within the ministry's lands. Saudi Arabia is currently considered as a country where new, utopian and experimental, technological housing dreams and solutions can be implemented. For example, the 3-D printed house, built by a Dutch company, is one of the latest experimental housing prototypes built in Riyadh.⁴

Swedish Wooden Prefabs Arrive in Saudi Arabia

In the last week of May 1948, a small group of building specialists from Europe and the UK arrived at the Dhahran oil compound in Saudi Arabia to oversee the assembly of

³ The Rush Housing Campaign was the first major housing project in Saudi Arabia. The campaign includes more than 14,000 units located in major Saudi cities.

⁴ The prototype house was built in 2018 in Riyadh city by the CyBe firm based in the Netherlands.

flat-packed, prefabricated timber houses from Sweden.⁵ The group had just supervised the offloading and transportation of the houses from the recently constructed port of Al-Khobar 10 kilometres away on the Arabian Gulf coast. Jack Ross from Kirkcaldy, Scotland, Tom Hulme from Shrewsbury, England, and Gunnar Backsell and Axel Strom from Stockholm, Sweden had arrived from the cool climates of the north into one of the hottest and driest countries on earth. Travelling from Al-Khobar through the vast, treeless desert to the isolated oil camp was a shock. On reaching it, they passed through the chaotic and unplanned Saudi workers' camp and were then amazed to find the American camp; a small, well-organised "Californian" suburb in the desert. Eventually, when it expanded to an enormous scale, later observers referred to it as an Arabian "Levittown."⁶

On arrival in Saudi Arabia, the group's mission was clear: they were responsible for the offloading and assembly of the Swedish prefabricated houses. In addition, during their relatively short stay, they were required to train the Arabian American Oil Company's Arab workers, including local Bedouin, in the construction and assembly skills necessary to complete this mission. These newly skilled workers would then be available for the inevitable expansion of this and other camps. Despite the relative order and familiarity of buildings in the American camp, in the early years of the oil industry conditions in the desert were clearly difficult. Gunnar Backsell, who had a PhD in architecture and who left Saudi Arabia on 7 July 1948, described his short stay as "a little warm and a little rough after [my] own cool countryside."⁷

The influx of expatriate workers into the Dhahran Camp following the discovery of oil created a serious shortage of suitable housing. The mainly American workers, crucial to the successful exploration and extraction of Saudi Arabia's oil wealth, were prepared to rough it for a while, living in tents and sheds,⁸ but Aramco was keen to provide more familiar accommodation in an effort to create a stable workforce. The importation of prefabricated timber houses from the west coast of America, and then from Sweden,

⁵ St. John, "Construction Report," *Sun & Flare, Publishers Weekly*, 30 May 1948.

⁶ Nathan Citino, "Suburbia and Modernisation: Community Building and America's Post-War II Encounter with the Arab Middle East," *The Arab Studies Journal* 13/14, no. 2/1 (2006): 39–64.

⁷ St. John, "Construction Report," *Sun & Flare, Publishers Weekly*, 07 July 1948, 3.

⁸ Wallace Stegner, *Discovery!: The Search for Arabian Oil* (Beirut: Middle East Export Press, 1971).

into the oil compound was a pragmatic, commercial decision to fulfil this need. There was a strong belief, still evident today that containing foreign workers, and the imported houses and western cultural and technological thinking that came with them, in compounds would limit their influence on Saudi society. While gated compounds did limit conflict between the oil workers and the local population, it could be argued that the architecture and building technology imported into the compounds were the beginning of profound changes in Saudi architecture, and to some extent, in the cultural practices associated with domestic architecture.

Prefabricated Wooden Houses in Sweden

The most common building material used in Swedish domestic architecture is wood. As Colin Davies explains in his book *The Prefabricated Home*, in Sweden, unlike in the UK:

There is no timber frame versus brickwork debate, no awkward compromises, no ideological agonising. The balloon or platform frame has been the standard technology for low-rise housing ever since it took over from the log building vernacular in the early twentieth century.... In the 1950s and 1960s, sawmills began to diversify into the production of house components, such as roof trusses and wall panels, taking advantage of timber frame's natural aptitude for prefabrication. Soon the industry had settled into a tripartite structure: the factory itself; a marketing operation producing advertisements and brochures, including pattern books; and a network of builders to assemble the individual houses on site. Dozens of small companies now operate in this way. It has become the normal method of housing provision in a country where almost half of households live in privately owned detached houses.⁹

⁹ Colin Davies, *The Prefabricated Home* (London: Reaktion Books, 2005), 157

Wooden houses account for more than 90 percent of the housing market share in Sweden, Finland, and Norway.¹⁰ Since the 1940s, Sweden has been seen as a world leader when it comes to timber construction and prefabrication. Rasmus Waern suggests in his essay “Scandinavia: Prefabrication as A Model of Society” that the history of wooden house prefabrication in Sweden can be divided into three categories: the pioneer age, the mass-production age, and the customisation and design age.¹¹ The pioneer age started at the end of the nineteenth century with many preliminary experiments, but without massive production. A key figure in the early development of timber prefabrication was Fredrik Blom, who was born in 1781. Blom was an architect and a colonel in the Corps of Naval Engineers and is considered to be the first Swede to recognise the potential of prefabrication within the timber industry.¹² He conceived and produced the basic wall as a series of panels that could be assembled and then dismantled as needed. By 1840, more than 140 of the houses he designed were being produced,¹³ and during this period Sweden also began exporting these prefabricated houses. In 1849 the firm of Siwers and Wennberg from Stockholm shipped the first movable house to California.¹⁴

The pioneer age was followed by the mass-production age; a time when production reached its limit. Early twentieth century housing shortages, resulting from World War I, were a key motivator for the expansion of wooden house prefabrication. Within Sweden, the government recognised the increase in demand by publishing many standardised drawings to help maintain higher housing quality standards. The Borohus company seized the opportunity to publish the first Swedish prefabricated houses catalogue in 1924.¹⁵ A key marketing strategy for the company was that their houses could be delivered anywhere in Sweden. By the end of the 1930s, there were at least 20

¹⁰ Sven Thelandersson, et al., “New Timber Construction in Nordic Countries” (keynote speakers at the World Conference on Timber Engineering, 2004).

¹¹ Waern Rasmus, “Scandinavia: Prefabrication as A Model of Society.” in *Home Delivery: Fabricating the Modern Dwelling*, edited by Barry Bargdoll and Peter Christensen (2008).

¹² Peter Gössel, et al., *100: One Hundred Houses for One Hundred European Architects of the Twentieth Century* (Taschen, 2004), 262.

¹³ Rasmus, “Scandinavia: Prefabrication as A Model of Society,” 27.

¹⁴ Rasmus, “Scandinavia: Prefabrication as A Model of Society,” 27.

¹⁵ Annaliese Carolina Mirus, et al., “Prefabrication: New Zealand’s Golden Ticket?” in P. Rajagopalan and M.M. Andamon (eds), *Engaging Architectural Science: Meeting the Challenges of Higher Density*, Proceedings of the 52nd International Conference of the Architectural Science Association (Melbourne, The Architectural Science Association and RIMT University, 2018), 417–423.

different companies offering ready-made houses that could be selected from catalogues.¹⁶ During this time, the number of prefabricated houses produced annually reached 5,000.¹⁷ In the middle of the twentieth century, the Swedish economy became more established and regulated and the government began providing many welfare services, including housing. The National Swedish Housing Board (Bostadsstyrelsen) was created for this purpose. International conflicts and wars, such as the Winter War, helped the Swedish market to expand rapidly and the country became a world-leading manufacturer of wooden houses. In 1947, Sweden produced more than 17,500 prefabricated houses.¹⁸ Hugh Anthony in his book *Houses: Permanence and Prefabrication*, argues that construction quality was one key factor for this success:

Although the average floor area of small Swedish houses is less than in England, far more attention is paid to thermal insulation, to double windows and proper heating ... House equipment, too, such as stoves, cookers, plumbing, built-in cupboards, etc., has been more highly and rationally developed and is better designed than in this country.¹⁹

The production of high-quality prefabricated wooden houses and furniture occurred mainly in the central and southern regions of Sweden.²⁰ Many sawmills and housing manufacturers with international reputations were located within these regions. As the global demand for Swedish prefabricated houses grew, the Swedish housing industry established a new entity, Svensk TrähusExport (STEX), to manage and control orders from foreign countries. In the late 1940s, Swedish prefabricated houses appeared in many countries including the United States, Britain, Finland, Saudi Arabia, Kuwait, and Australia.²¹ To counter the negative connotations associated with prefabricated houses in some of these countries, where they were seen as second-best and only for temporary use, STEX promoted their acceptance and success in Sweden. For example, in Britain in March 1944, *Picture Post* published an article in which they asked “why should

¹⁶ Rasmus, “Scandinavia: Prefabrication as A Model of Society,” 27.

¹⁷ Renee Mathieu, “The Prefabricated Housing Industries in The United States, Sweden and Japan,” *Construction Review* 33 (1987), 2.

¹⁸ Rasmus, “Scandinavia: Prefabrication as A Model of Society,” 28.

¹⁹ Hugh Anthony, *Houses: Permanence and Prefabrication* (London: Pleiades, 1945).

²⁰ Ingrid Persson, “Prefabricated Wooden Houses in The Swedish Welfare State” (Universitet Siegen, 2015).

²¹ Swedish prefabricated houses were shipped to the UK in 1944, Saudi Arabia in 1948, and Australia in 1950.

English prefabricated houses look like wooden huts while the Swedish ones have the appearance of pleasant homes?”²² As Bernard Cox writes in his book *Prefabricated Homes*, the story of prefabricated housing in Sweden is indeed “a simple and happy one.”²³

Swedish prefabricated houses are quite distinctive. Most twentieth century examples have external walls clad with solid vertical, approximately 125 millimetre wide, timber boards. Living rooms are prioritised in terms of size, whereas bedrooms are usually smaller. Each bedroom comes with built-in fittings and closets. Ornamental features almost vanished with more emphasis on high quality fittings and fixtures, which seems to be an influence of the modern movement. More attention was paid to providing heat insulation to deal with the extreme cold during winter. By 1945, the Swedish prefabrication industry was well recognised internationally for promoting architectural input into the prefabrication process.²⁴ A significant amount of the design of factory-produced housing within Sweden was carried out by architects.

Driving through the Swedish countryside and walking through the suburbs of Gothenburg and Stockholm, and the town of Åmål on a research trip in 2019, the centrality of timber construction to domestic architecture over many generations is unequivocal. It is no surprise, given the ubiquity of the vernacular language of Swedish timber houses, that when the transition to industrialised prefabrication occurred, it replicated this consistency. Prefabricated houses are no longer produced in Åmål but photos taken inside the ÅSA factory in the 1950s and those we took on our visit to the A-hus factory south of Gothenburg bear remarkable similarities (Fig. 2.1). On the surface, the main difference appears to be the transition from using hand tools and manual labour to a hybrid system of manual work and machine production, such as automated nailing, for example. There are, no doubt, many other changes between the 1950s and contemporary production, but there is still a strong resonance with pre-modern vernacular buildings, particularly the use of vertical boards as external cladding.

²² *Picture Post*, 18 March 1944, 3.

²³ Bernard Cox, *Prefabricated Homes* (Paul Elek, 1945), 22.

²⁴ Cox, *Prefabricated Homes*, 32.



Figure 2.1 Swedish prefab manufacturing process in the past and present. The image at the top was taken in 1951 inside Åmåls Sågverks Aktiebolag, whereas the one below was taken in 2019 inside A-hus Factory.

Swedish Wood and Saudi Oil

Following World War II, there was high demand for Swedish prefabricated houses from both the domestic and international markets. Manufacturers focused heavily on export with most producing special catalogues of standardised designs to market their houses to international clients.²⁵ Interestingly however, a careful examination of the Aramco house designs and the Swedish manufacturers' catalogues reveals that while the houses shipped to Dhahran and other oil camps were no doubt based on designs from a catalogue, they were customised according to instructions from Aramco. Differences can be identified when examining the size of the houses, thermal specification, wall thickness, roofs, and finishing.

By 1948, when the first Swedish houses arrived in Dhahran, Aramco had already imported a number of prefabricated houses and other buildings from America. The first, an air-conditioned, two-bedroom, prefabricated bunkhouse imported from California, was erected in 1937. It is not entirely clear why Aramco turned to Sweden as a source of housing in addition to their American suppliers. However, with the end of World War II in 1945, shipping houses from Europe became safer and it was closer and therefore faster. In addition, a contra deal was made with Sweden to deliver houses to clear an oil debt that had been accrued during the war. Bader Biltagi, a native Palestinian who worked for Aramco between 1950 and 1991, stated during an interview conducted by Aramco that the company at that time “had lots of money ... [which] they couldn't collect ... [so] they took the portables in exchange and built us the intermediate camp.”²⁶

Of the many manufacturers operating in Sweden in the late 1940s, the Arabian American Oil Company ordered houses from two different manufacturing companies. These orders were made through the company of Svenska Trähus A.B.,²⁷ which was an agent and marketing organisation for ten different Swedish sawmills. Research has

²⁵ Most manufacturers had more than two housing catalogues. Some of these catalogues were specifically for exportation purposes.

²⁶ Scott McMurray, *Energy to the World: The Story of Saudi Aramco* (Houston: Aramco Services Company, 2011), 194.

²⁷ *Dagens Nyheter*, 14 May 1948, 6.

revealed that a company connection in the town of Gävle led to awarding some of the oil company's orders to Korsnäs Sågverks A.B, located in Gävle.²⁸ Korsnäs Sågverks A.B produced more than 75 large, prefabricated houses for Aramco in 1948. The second company to receive a special order from Saudi Arabia was Åmåls Sågverks Aktiebolag, located in the small town of Åmål.²⁹ Both companies shipped prefabricated houses to the oil camps between 1948 and 1952. The oil company requests were highly valued and were reported in many local and international Swedish newspapers.

A review of archival material has revealed that the first documented orders from Sweden occurred in the mid-1940s.³⁰ Following this in 1948, Aramco signed a 2.5 million Swedish Krona contract with STEX to deliver approximately 50 portable wooden houses, 50 single-family prefabricated houses, and seven apartment buildings.³¹ Each of the portable houses contained at least two to three bedrooms and the family houses, or duplexes, had two bedrooms, a living room and kitchen. The apartment building incorporated seven different dwelling units. It is likely that other types of Swedish prefabricated houses were shipped to Aramco's oil compounds, however to date, research has not been able to locate documentation confirming their existence.

The Swedish Duplex located in the Dhahran Camp (Fig. 2.2) is an excellent example of the imported Swedish prefabricated timber houses. There were more than 120 duplexes within the oil company's camps. Each dwelling unit size was 9.6 metres by 9.6 metres; thus the total size of the duplex was 19.2 metres by 9.6 metres. The house is well recognised for its architectural style, which is simple and compact in shape. This allowed for a relatively simple relocation and transportation process. Prior to being relocated, the duplexes would be first separated and eventually moved from one camp or city to another as needed. Once relocated, the houses were re-joined, repaired and repainted as the transportation process usually caused some minor damage to the house. Figure 2.3 shows one of the duplexes being prepared for relocation.

²⁸ *Dagens Nyheter*, 23 October 1948, 12.

²⁹ *Dagens Nyheter*, 6 April 1950, 14.

³⁰ "Looking Back: Roses in the Desert," *Alaela Family*, no.3 (Spring/ Summer 2011).

³¹ *Dagens Nyheter*, 14 May 1948, 6.

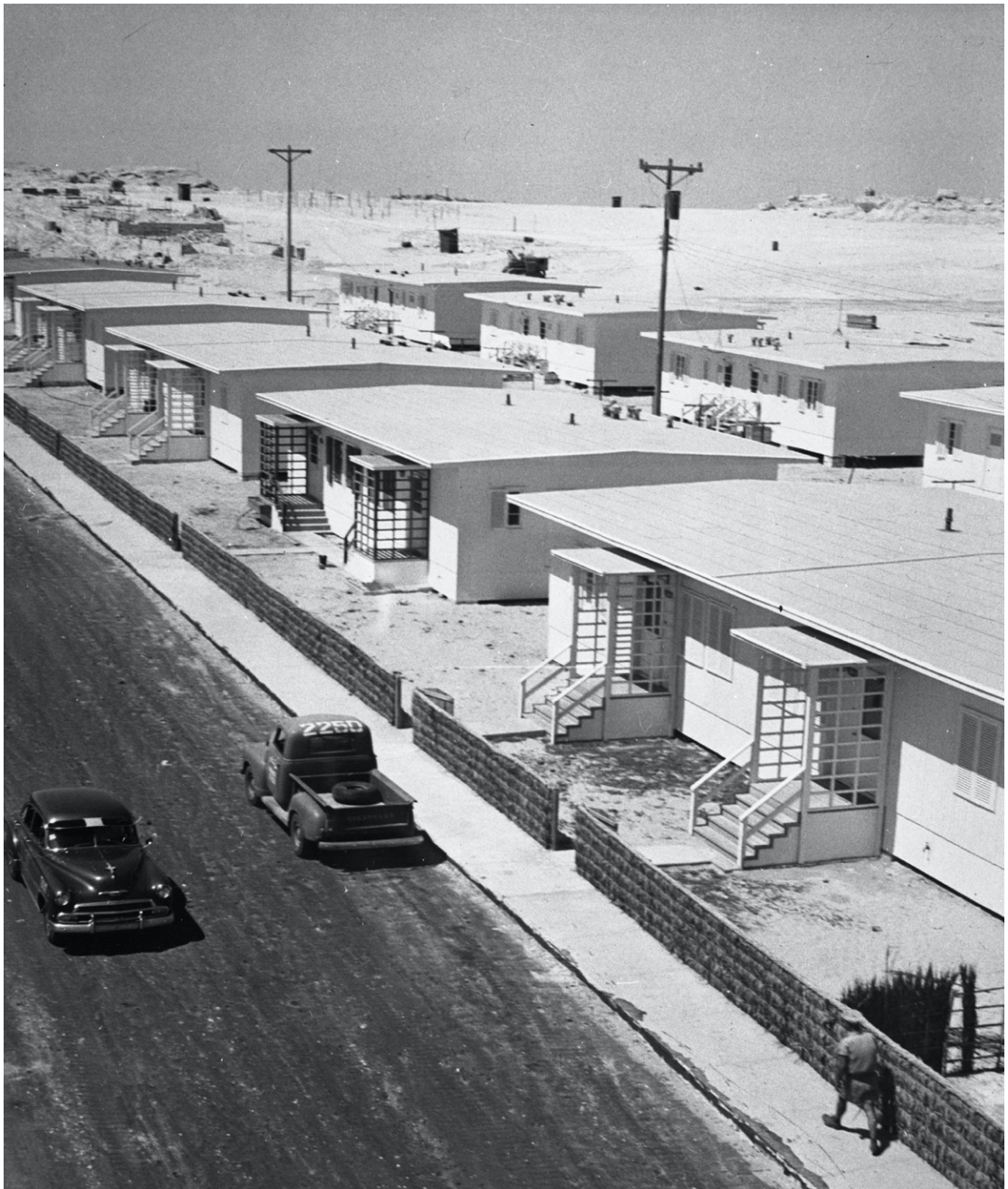


Figure 2.2 The Swedish duplexes as they appeared in Dhahran Camp in the 1950s. Most of these houses were built by Saudi workers. Photographer Unknown. Courtesy of Saudi Aramco.



Figure 2.3 A Swedish duplex being prepared for relocating. Photographer unknown. Courtesy of King Abdulaziz Foundation for Research and Archives (Darrah).

While the houses were customised according to Aramco’s instructions, they were still definitely Swedish, built with high-quality Swedish materials, detailing and architectural features. In terms of form, the houses featured a low-pitched gable roof showing some consideration of the differences between Scandinavian and Arabian weather. However, gabled roofs are not common in Saudi Arabia as the majority of courtyard houses, the most dominant house style in the Middle East, feature flat roofs (Fig. 2.4). The doors and windows were selected from ready-made catalogues and the interior and exterior walls were made from prefabricated wooden panels, all of which were in accordance with Swedish building standards, dimensions, and proportions. In addition, some of the houses feature an entry porch with timber lattice detailing. To highlight how keen Aramco was to provide the mainly American workforce with familiar surroundings, after some of the houses were erected and occupied, the exterior walls were re-clad with timber shingles imported from the United States (Fig. 2.5).³²

³² The cladding was placed after the erection of the houses. It appears to be imported from America.

From 1948, prefabricated house orders from Aramco continued and the number of shipped houses dramatically increased. The houses came from all over Sweden and the number of wooden houses in the oil company camps reached one thousand.³³ Various types of houses were designed and manufactured with many destined for remote camps in the eastern regions of the country. They were shipped to Dhahran, Ras Tanura, Abqaiq, Qaisumah, Turaif, and other newly established Tapline towns.³⁴ When houses arrived at a camp, construction teams, by now very familiar with the process of erecting these buildings, soon had the footings in place and the prefabricated kit of parts assembled and ready to be occupied. The benefits that followed the construction of prefabricated houses in the camps were enormous. Before 1948, most oil workers, especially those in remote areas, lived in sheds and tents. Bader Biltagi recalls that the company replaced their tents with portable houses that contained “air-conditioned rooms” and it also built recreational facilities such as “a swimming pool, an open theatre, a recreation centre, a library, and a decent cafeteria” using prefabricated timber buildings.³⁵ This represented a big improvement in living conditions, especially for low- and middle-income earners.



Figure 2.4 Riyadh city in the 1950s consisted of many flat-roof courtyard houses. Photographer Daniel van der Meulen. Source: *Dutch Envoys in Arabia: Photographic Impressions 1880–1950*.

³³ “The Carpenters of Dhahran,” *Aramco World*, January 1960.

³⁴ Many of Aramco’s expats have unforgettable memories about the houses’ transportation during the 1940s and 1950s.

³⁵ McMurray, *Energy to the World: The Story of Saudi Aramco*, 194.



Figure 2.5 Swedish duplex after some modifications. The original external walls were covered in shingles. Photographer unknown. Courtesy of King Abdulaziz Foundation for Research and Archives (Darah).

While one of the modern movement's utopian dreams for prefabricated and factory-made housing was to reduce the reliance of on-site skilled labour, in reality the assembly and erection of these buildings is a job that requires a high level of skill and training. Aramco did not engage a foreign, skilled workforce for this but instead, from the mid-1930s, employed a relatively small number of foreign building professionals to train Saudi tradesmen. Training programs included instruction in carpentry, plumbing, and sheet metal work. The first Californian prefabricated houses were built during 1936 and 1937 in Dhahran Camp and photographs of the construction site from 1936 show that Saudis did participate in this project (Fig. 2.6). By the time the Swedish houses and building team arrived in 1948, the Saudi workforce was already skilled in erecting the prefabricated, timber-framed houses that had come from the west coast of America. What was new to them in relation to the Swedish houses was the significantly higher level of prefabrication and the challenge to complete the construction within the world

average time. After many attempts and more training, the Saudi team was able to assemble the houses within the world average time, overcoming many cultural and knowledge obstacles and boundaries. In March 1952, the Saudi team was able to assemble one of the Swedish prefabricated duplexes in less than 5,300 labour-hours, whereas the world average at that time was 5,000 labour-hours.³⁶



Figure 2.6 Saudi workers participating in a Californian timber frame construction in Dhahran Camp in 1936. Photographer unknown. Courtesy of special research collection, UC Santa Barbara Library, Saudi Arabia Oil Photograph collection, Bernath Mss 366.

Aramco established many carpentry shops to deal with the increasing number of wooden houses within the oil company camps. In 1960, Dhahran Camp's carpentry crew ranged from 100 to 115 men in the shop and on the site.³⁷ The carpentry foreman at that time, Hillal bin Ali, was a Saudi, as were the rest of his crew. Their tasks included repairing and making windows, doors, cabinets, and bookshelves for houses within the camp (Figs. 2.7 and 2.8). They were also responsible for all residential maintenance and

³⁶ *Sun & Flare, Publishers Weekly*, 19 March 1952, 5.

³⁷ "The Carpenters of Dhahran," *Aramco World*, January 1960.

repair requests such as wall insulation, roofing, and floor surfacing. In 1960, the team were hired to add an extra bedroom to existing two-bedroom wooden houses in Dhahran Camp. To qualify for a carpentry job within Aramco required a high level of knowledge and skills. This meant undertaking a long apprenticeship and work experience. One of the Saudi carpenters explains his journey by stating that “first [he] worked as an office boy, then as a timekeeper; then [he] became a gang-pusher (labour foreman); in 1941 [he] started as a carpenter’s helper; then served as head carpenter up to August 1948,”³⁸ after that he moved to a contracting business where he was responsible for the completion of a number of construction projects. The carpentry skills of the Saudis were much appreciated at that time; however, Saudi wealth and new education opportunities meant that these skills were not passed on to the following generation. Nowadays, most of these types of projects are outsourced and carried out by foreign workers, mostly from Pakistan, India, and other Arab regions.

A recent visit to Aramco’s Dhahran Camp revealed that some of the Swedish houses, erected almost 70 years ago, are still occupied and in relatively good condition. However, the use of some of the houses has been changed to other work-related uses in response to the availability of other alternative houses built in recent years. Surviving all these years could be related to the fact that maintenance requests are managed by highly trained Aramco personnel. Additionally, preventive repairs and regular check-ups and inspections conducted by the housing team could be other important factors contributing to this achievement. In contrast, other concrete housing projects around the country have not survived due to the lack of appropriate repairs and maintenance.

³⁸ Carleton S. Coon, “Operation Bultiste: Promoting Industrial Development in Saudi Arabia,” in *Hands Across Frontiers*, edited by Howard M. Teaf Jr. and Peter G. Franck (Ithaca: Cornell University Press, 1955), 332.



Figure 2.7 Saudi carpenters constructing a timber frame house model in an effort to fully understand its construction techniques and specifications. Photographer unknown. Courtesy of Saudi Aramco.

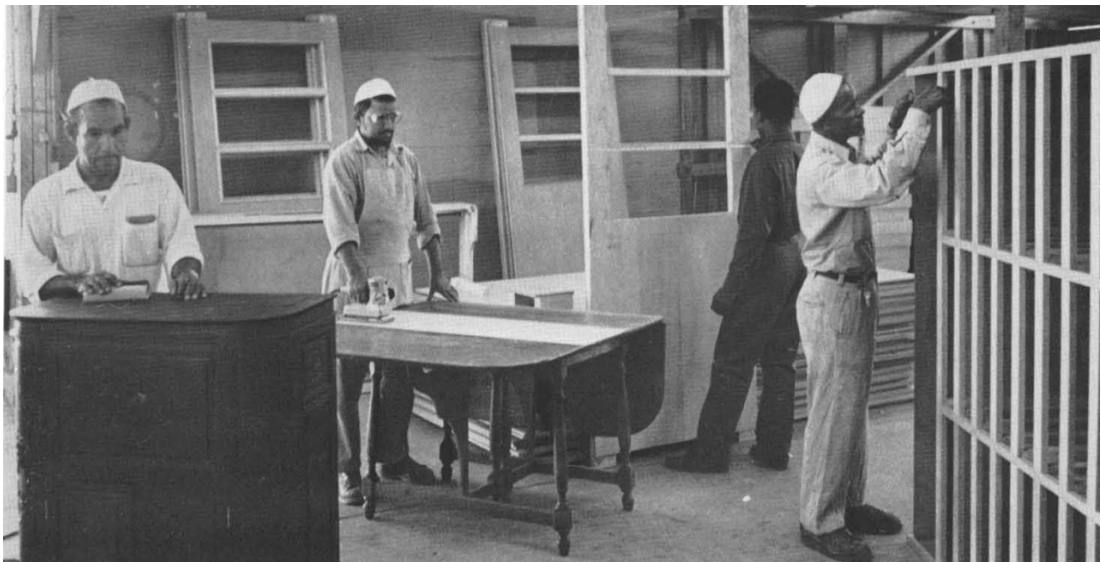


Figure 2.8 Saudi carpenters making tables, doors, and windows at Dhahran's carpentry shop. Photographer unknown. Courtesy of Saudi Aramco.

Swedish Prefabricated Wooden Houses: The Australian Connection

In studying the Swedish prefabs in Saudi Arabia, it has become clear that there is a significant Australian element to the story. In the early 1950s, at the same time Aramco was importing Swedish houses into its oil camps, the Australian government began importing them into Australia in an effort to alleviate an acute post-war housing shortage.³⁹ In 1950, Åmåls Sågverks Aktiebolag (ÅSA) received two large international orders. The first was from Aramco, in order to house its expanding oil workforce, and the second was made by the Australian government. Åmåls Sågverks Aktiebolag was able to manufacture the houses and ship them to both Saudi Arabia and Australia in the early 1950s. In both cases the houses were customised. The Saudi houses were modified by American experts working for the oil company and the Australian house designs were modified by architects employed by the Australian federal government in Canberra.

Both the Australian and the Saudi Swedish prefab houses consist of two to three bedrooms. The living room is located to the right of the entrance in both cases. On average, the Australian houses are 13.7 metres in length, 6.9 metres in width, and 2.7 metres in height, whereas the Saudi houses are 12.2 metres in length, 9.6 metres in width, and approximately 3 metres in height. As the analysis revealed, both houses' designs were based on a module of 1.2 metres, with the layout organised around a central corridor running along the length of the house. The construction and thermal insulation techniques are similar in both the Saudi and Australian examples. Exterior walls were made of vertical timber panels known in Sweden as '*Småbloc*' construction.

Australia ordered 2,000 prefabricated houses from Åmåls, Mo & Domsjö, and Svenska Trähus sawmills in March 1950 during a tour by the Commonwealth delegation to Britain and Scandinavia.⁴⁰ During this tour, the Australian members of the delegation examined a number of prefabricated houses in several European countries. After touring factories within Europe and England, the mission concluded that prefabricated houses from Scandinavian countries were the best in terms of quality within the examined

³⁹ *Dagens Nyheter*, 6 April 1950, 14.

⁴⁰ *Dagens Nyheter*, 21 March 1950, 16.

region. This aligns with the British conclusion mentioned above and seems to be the basis of the decision by the Australians to place the order.

The number of houses shipped to Saudi Arabia exceeded 200 houses. All of these houses were erected within Aramco's camps in eastern Saudi Arabia. Like the Australian government, Aramco sent some of its experts to Sweden. Bjorn Bjornson, an Aramco employee who worked in Saudi Arabia, returned from Sweden in June 1948 after checking the first housing shipments.⁴¹ The Australians were concerned about the required workforce to assemble the houses therefore their selection of manufacturers was related to the company's ability to both supply and assemble the houses in Australia. Interestingly, in 1951 a large group of Europeans with trade skills immigrated to Australia from Europe, the same year the houses were delivered. The group migration process was simplified because their help was needed in assembling the 3,050 imported prefabricated houses that the government had ordered from various European countries.⁴² Once they had finished the project, a large number of the group remained and settled in Australia. In contrast, Swedish prefabricated houses in Saudi Arabia were built by many local people trained specifically for such projects.

These two different forms of cultural and technological exchange and understanding had a quite diverse impact on architecture and construction practices within both countries. The philosopher of technology, Don Ihde, states that "the adaptation of a transferred technology – at least at first – depends on its being able to fit into an extant praxis. But even when it is adapted, the context of significations may differ quite radically relative to the sedimented type of praxis in the recipient culture."⁴³ In Australia, with its strong connections to Europe, the Swedish houses fitted quite neatly into its existing building practices and into Australian culture more generally. For many, these houses would have been not only familiar, but also a step up in quality, representing a European approach to detailing and other design elements. In Australia at that time, many young architects were encouraged to tour Britain and Europe. The Australian architect Alan Graham Hamilton, for example, returned from a trip in 1951,

⁴¹ St. John, "Construction Report," *Sun & Flare, Publishers Weekly*, 07 July 1948.

⁴² *Queensland Times*, 26 April 1951, 5.

⁴³ Don Ihde, *Technology and the Lifeworld: From Garden to Earth* (Bloomington and Indianapolis: Indiana University Press, 1991), 127.

after visiting the US, Britain, and Sweden. He reported that within these countries “any type of prefabricated house can be built, but it must be simple in shape. Americans favour the flat roof, but Britain and Sweden have got away from that.”⁴⁴ He extends his enthusiasm about using imported industrialisation techniques within architecture by suggesting that “[Australians could] get workmen from England, Sweden, Germany, or elsewhere, to come and do the fabricating in Australia.”⁴⁵

In contrast to the Australian experience, and despite the fact that there is a traditional precedent for framed lightweight domestic buildings in Saudi Arabia called *barastis*, the walls of which are constructed using reedy wooden stick uprights through which palm leaves are woven, Swedish and American lightweight construction techniques and associated residential forms never migrated out of the gated compounds. Saudis viewed them with suspicion which may be partly because although *barastis* were common in the early twentieth century they were associated with subsistence living and rejected as second-best once concrete and masonry buildings started to appear. On the other hand, imported masonry construction techniques and materials such as concrete blocks were accepted and used within a short time as the main alternative to traditional mudbrick. The shift to concrete block, in situ concrete, and later precast concrete panels fitted very well into the Saudi “sedimented ... praxis” of constructing heavyweight buildings made from local mudbrick and stone.

In regard to the Swedish houses’ current heritage value, Saudis and Australians approached this quite differently. As the houses did not stem from traditional Saudi residential architecture or its construction practices, they were never valued by Saudi people, even though they were occupied by Saudi oil workers at various times. For example, many of the houses were used to accommodate workers on the Trans-Arabian Pipeline, which was closed in 1967. Afterwards they were relocated to settlements along the pipeline and thus became accessible to native Saudis and Bedouins around the country. Despite this visibility, Saudis never constructed their own houses using lightweight timber prefabrication techniques. Generally, the Swedish houses in Saudi Arabia have always been owned and maintained by the oil company and they are yet to

⁴⁴ H. J. Summers, “Pre-fabrication Homes is Normal Practice Overseas – Why Not Here?”, *The Courier-Mail*, 15 March 1951, 2.

⁴⁵ Summers, “Pre-fabrication Homes is Normal Practice Overseas – Why Not Here?,” 2.

be considered as national heritage buildings. In contrast, the Swedish prefabricated timber houses we discovered in Sydney, that were imported into Australia in 1951 to house military personnel, despite falling into disrepair over many years and being earmarked for demolition, were eventually saved and restored. These houses were manufactured by Åmåls Sågverks Aktiebolag and were erected in the now prestigious Sydney suburb of Georges Heights. Following a heritage study conducted in 2003 that correctly identified their Swedish origins, they were saved from demolition and restored by the Australian Government. They are now long-term rental properties.

Construction Materials and Affordable Housing in Saudi Arabia

Historically, the use of imported lightweight construction materials within the Saudi context faced many challenges. Saudi oil workers resisted the use of imported timber as a construction material when building their own camps within the oil fields, preferring to adhere to their own traditional building practices. Solon T. Kimball in his journal article, “American Culture in Saudi Arabia,” describes the camp’s houses as being “constructed of every conceivable kind of scrap material with a scattering of more traditional palm-leaf native *barastis*, and an occasional substantial building of concrete block. These settlements represent the attempt by Arabs to establish a type of community life with which they are familiar.”⁴⁶ The appearance of such a camp was not appreciated by the Saudi government and Aramco and this was at least partly the reason why the Saudi Workers Home Ownership Program was launched in 1951.

This program allowed many Saudi Aramco workers to build their own houses with financial assistance from both the government and the oil company. The houses they built followed the American oil company guidelines and safety standards. With the limited availability of Saudi architectural and construction knowledge and expertise at that time, the houses were designed and built mainly by the oil company’s architects and builders. Most of the houses were built in the international and modern styles. For

⁴⁶ Solon T. Kimball, “American Culture in Saudi Arabia,” *The New York Academy of Sciences* 18 (1956): 472.

the first time outside the oil compounds, Saudis witnessed the use of imported construction materials, such as Portland cement and concrete, to construct their houses. In fact, all building and construction materials, except for sand, were imported.⁴⁷ Cement came from different areas such as Europe, England, and the United States; steel came from England and the United States. Wooden rafters (*chundal*) were cut on the African coast (west of Madagascar) and *bamboo withes* or *purlins*, which are placed over the *chundal*, came from Iraq and India. Flush toilets were brought from Lebanon, India, and Kuwait.

The Saudi government, Aramco, and the Saudi workers all appreciated the houses that were built through the Home Ownership Program and within a few years, this style of imported, masonry, residential architecture became the norm in the eastern region. However, while the first houses built for individual workers and their families were well accepted and liked, when they were later mass-produced, through national housing programs, there were some concerns about their suitability and, as a result, a large number of the houses were not occupied for some time. The increase in migration to urban areas from the 1960s to the 1980s, created a severe housing shortage and, as mentioned earlier, large scale housing projects were introduced to alleviate this shortage. The first major governmental affordable housing project using prefabrication techniques was rolled out in the 1970s by foreign companies in several cities across Saudi Arabia. The villas that were built introduced new architectural concepts and spatial arrangements and the houses were constructed using precast concrete panels. This was the first use of this construction technique in an affordable housing project. The introduced houses and their construction technique and material were highly criticised by Saudis. The houses' limited social acceptance was related to the new construction characteristics and their monotonous appearance. The project also featured many new architectural and construction elements that Saudis were not familiar with, such as the use of precast panels and slabs.⁴⁸ As a result, some of the houses were empty for many years before being occupied by US military personnel and refugees during the first Gulf War, and, when the war ended, by Saudi citizens who were in desperate need of housing.

⁴⁷ Coon, "Operation Bultiste: Promoting Industrial Development in Saudi Arabia," 343.

⁴⁸ Raeyd Aldakheel, "Residents' Satisfaction with Public Housing; The Case of Buraidah Public Housing Development in Saudi Arabia," (PhD Thesis, The University of Michigan, 1995), 83.

Within the Saudi government's most recent affordable housing initiative introduced in 2017, the use of alternative and innovative construction materials and techniques has been encouraged. However, it is noticeable that even with the success of the Swedish and American prefabricated wooden houses within Aramco's camps, timber has not been considered as an option for affordable housing projects. A review of recently proposed materials shows that the use of timber was minimised in preference to the use of materials perceived to be more durable, such as steel and light weight concrete, which were found to be the most culturally acceptable materials. There are still concerns about timber as a construction material: it is not considered suitable due to the scarcity of the material in Saudi Arabia and other concerns such as acoustic and thermal insulation. Jon Boon argues, in his essay exploring the impact of legislation and policy on house forms and residential patterns in Saudi Arabia, that no matter how complex, cost effective, fast, and innovative the introduced housing project will be within the Saudi context, related social and cultural factors will play a crucial and sensitive role in the acceptance of the introduced housing solutions.⁴⁹ Thus, materials used for the construction of affordable houses – wood, steel, or precast concrete – are significant when it comes to social acceptance of the completed houses. As in the past, this is likely to be a determining factor in the success of the current housing initiative with its emphasis on the introduction of new industrialised construction techniques. These factors have led to some of the Saudi public houses being unoccupied for more than 45 years.⁵⁰

Conclusion

The story of Swedish prefabricated timber houses in Saudi Arabia is significant in terms of their role in the development of the oil industry. The Swedish prefabrication industry

⁴⁹ Jon Boon, "Legislative Grounds and Housing Policy as Determinants of Dwelling Form and Residential Pattern in Saudi Arabia," in *Housing: The Impact of Economy and Technology*, edited by Oktay Ural and R. Krapfenbauer (New York: Pergamon Press, 1981).

⁵⁰ Hundreds of housing units within the Mecca Public Housing Project, which was built in the 1980s, are still vacant and uncompleted.

was very popular and productive in the middle of the twentieth century. Once the value of these houses was recognised by the American oil company, they started to be imported and first appeared in Saudi Arabia in 1948. While being familiar with the construction of prefabricated houses from their previous experiences with houses from California, the Swedish prefabs presented a challenge for the Saudi carpenters due to their higher level of prefabrication and European quality materials, detailing, fittings and fixtures. With training and practice, the Saudi carpentry team was able to construct Swedish prefab duplexes in near world average record times. With increased wealth and education in Saudi Arabia following the discovery of oil, perceptions about manual work changed. This led to trade skills not being transferred to the next generation. Nowadays, most carpentry and steel work jobs are carried out by foreign workers from different countries.

While Swedish prefabricated houses were considered successful examples in alleviating housing shortages in many different countries such as Britain and Australia, their presence in the Saudi oil camps did not translate more widely into the modern Saudi urban environment. This could be linked to resistance caused by the perception that timber is a temporary and second-class material and to the scarcity of timber in the region, as well as the availability of other masonry alternatives. From the beginning, Saudi public housing projects were built using concrete and steel as the main construction materials. While the recently proposed housing scheme encourages the use of new technologies and imported lightweight materials, wood has not been considered.

This paper has been developed as a part of ongoing PhD research that aims to theorise and historically contextualise the Saudi government's current initiative to build more than one million affordable houses by 2030 using industrialised construction methods and lightweight construction materials. Materials and construction techniques seem to be the focus for the current housing plan, with limited emphasis on the importance of architectural values and cross-cultural technological exchanges.

Chapter Three | ASA 302 @ Georges Heights: Swedish Timber Prefabs in Australia

Preamble

The field trip to Åmål allowed me to further investigate the Australian connection to the story. Moreover, the opportunity to conduct fieldwork in Sydney to investigate the Swedish ASA 302 houses reinforced the decision to focus on this intriguing Australian connection. This chapter explores the last remaining ASA houses in Australia and highlights how these prefabricated houses were not accepted into the mainstream housing market as they were in Sweden. The chapter was submitted to *Fabrications* the Journal of the Society of Architectural Historians, Australia and New Zealand, and was published in the Volume 31, No. 3. The reviewers suggested the paper would be strengthened by referring to some key texts to contextualise the Swedish houses within, postwar, prefabrication internationally. Their comments were taken into consideration and more references to relevant key texts was incorporated within the chapter. The content here has not been altered, other than to align with the thesis formatting style.

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Contribution to the Paper: Conceptualisation, research, investigation, data collection, fieldwork, structuring, analysis, writing, submission and administration.

Certification: This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.

Signature:

Date: 13 July 2021

Name of Co-Author: Sam Ridgway

Contribution to the Paper: Supervision, structure, editing, and administration.

Signature:

Date: 13 July 2021

Abstract

Partially hidden by bushland in the Sydney suburb of Georges Heights sit five unassuming, prefabricated timber houses. Saved from demolition in 2003 and now restored, these houses were manufactured in the early 1950s in Sweden by Åmåls Sågverks Aktiebolag (ASA). They were erected in 1951 for the Australian Navy and are some of the last remnants of thousands of prefabricated houses imported by the Federal and State Governments to alleviate the post-war housing shortage. By the end of 1951, approximately 70,000 prefabricated houses had been imported into Australia. While the importation of prefabricated houses was driven by urgent need, questions of quality and suitability to Australian conditions were considered important enough to warrant considerable research. Several European study tours by building experts established that the Swedish houses were of high quality, particularly in relation to their materials, detailing, and levels of insulation. In nineteen fifties Australia, this implanted example of sophisticated Swedish design would have represented a quite different cultural frame for household living. Despite their obvious quality, these prefabricated houses were not accepted into the mainstream housing market as they were in Sweden and Ormal Construction Pty Ltd, the company ASA established in Melbourne in 1950, lasted only a few years.

Introduction

In 2003 the Sydney Harbour Federation Trust (SHFT) developed a plan to enhance the recreational value of a section of native bushland in the Sydney suburb of Georges Heights about halfway between Georges and Middle Head. Georges Heights sits adjacent to a much-loved coastal section of the Sydney Harbour National Park which contains highly valued remnants of Sydney's military history. Part of the plan was to demolish eight dilapidated timber houses (Fig. 3.1) to "achieve the vision of a landscape entry to the Trust lands and to reveal the terrain of the site."¹ Since the houses were listed on the Register of National Estates, as Riley-Newsome CA1 prefabricated houses from the UK, before proceeding, the Trust engaged the architectural firm of Robertson & Hindmarsh to conduct an assessment of their heritage value. The architects discovered that the houses were not British imports but were made by the Swedish sawmill company Åmåls Sågverks Aktiebolag's (ASA) in Åmål, a small regional town in Sweden situated about 170 kilometres north of Gothenburg. The Architectural Heritage Assessment concluded that "the cottages are culturally significant because they are extremely rare survivors of their type, there being only one other group listed on the Register of the National Estate at (Ingleburn Village, Sydney) which is, however, in the process of being demolished."² As a result of this finding, the Trust restored and renovated five of the original eight houses which are now rental properties.

Åmål sits on the edge of Vänern, Sweden's largest lake. The ASA factory, part of which is still standing, was located on the edge of the lake, now the scene of recreational boating and fishing. As a part of our research, in June 2019 we visited the town. It was an eerie feeling standing in the grounds of the former ASA factory which, during the 1950s and 1960s, had been the place where so many prefabricated timber houses had started their journey; by rail to Gothenburg and then by ship to distant shores, to fulfil very different functions within unfamiliar cultures.

¹ Scott Robertson, "Heritage Assessment of Former Navy Cottages at George Heights" (A report for Sydney Harbour Federation Trust, 2003), 67.

² Robertson, "Heritage Assessment of Former Navy Cottages at George Heights," V.



Figure 3.1 Above: One of the ASA Georges Heights houses in 2003 prior to restoration. Photograph: Roberson & Hindmarsh Pty. Ltd. Courtesy of Sydney Harbour Federation Trust. Below: One of the ASA Georges Heights houses photographed in 2019 following restoration. Photograph by authors.

How these houses, prefabricated on the other side of the world in Scandinavia, ended up in Australia is a tale that reveals familiar themes embedded within the cross-cultural exchange of building and other technologies. The Georges Heights houses appear in the 1951 ASA catalogue, the third catalogue with English text produced by the company, as Type 302 (Fig. 3.2). The houses within this catalogue were designed and constructed for what ASA hoped would be an expanding and lucrative international market, particularly in the United States of America and Australia. During the late 1940s, ASA had exported hundreds of flat-packed timber houses to Saudi Arabia as accommodation for workers in the oil fields. In the Saudi desert, along with houses from California and other places, ASA houses were assembled by specially trained Saudi workers in the oil compounds to house expatriate, mainly American, oil workers.³ Prior to this there were very few, if any, contemporary buildings in the Kingdom. Eventually the compounds grew to include thousands of houses and many other buildings and facilities arranged into simulacra of typical American suburbs. In the carefully controlled environment of Aramco's oil compounds, many ASA houses have been well maintained and are still occupied.

In Australia, the houses met a different fate. While a seemingly more familiar cultural setting than Saudi Arabia, the houses were used mainly for accommodating service personnel and were never accepted as mainstream housing. The ASA 302 houses at Georges Heights were imported by the Australian government in the early years of the Cold War as "married officers' accommodation for National Service instructors working at the adjacent Naval base, HMAS Penguin."⁴ While Saudi Arabia and Australia represented two completely different contexts for these imported technological artefacts, the common denominator is one of the practical and urgent requirement for accommodation which was isolated from the mainstream supply of housing. In both countries, these and other imported and locally made prefabricated buildings were characterised as temporary, and while they were highly valued as filling an immediate need, they never became widely accepted as permanent, mainstream housing. For the ASA houses, this stands in contrast to their country of origin, where for centuries, distinctive and stylistically consistent timber houses have constituted a

³ Abdulaziz Alshabib & Sam Ridgway, "Oil + Architecture," *Fabrications* 29, no:2 (2019): 131–153, DOI: 10.1080/10331867.2019.1576491

⁴ Robertson, "Heritage Assessment of Former Navy Cottages at George Heights," 61.

major, much-loved, and well-maintained part of the housing stock. In addition, from the early twentieth century, the prefabrication of stylistically “traditional” timber houses has been well accepted in Scandinavia. Prefabrication and off-site construction techniques account for more than 80 percent of new single-family houses in Sweden,⁵ and on average more than five thousand prefabricated houses get erected there every year.⁶ If we compare this to the Australian and the Saudi Arabian contexts, prefabrication accounts for less than three percent of the total domestic residential buildings.⁷ In line with Swedish statistics on the acceptance of prefabricated timber houses as perfectly acceptable permanent homes, in Åmål there are numerous examples of ASA houses.

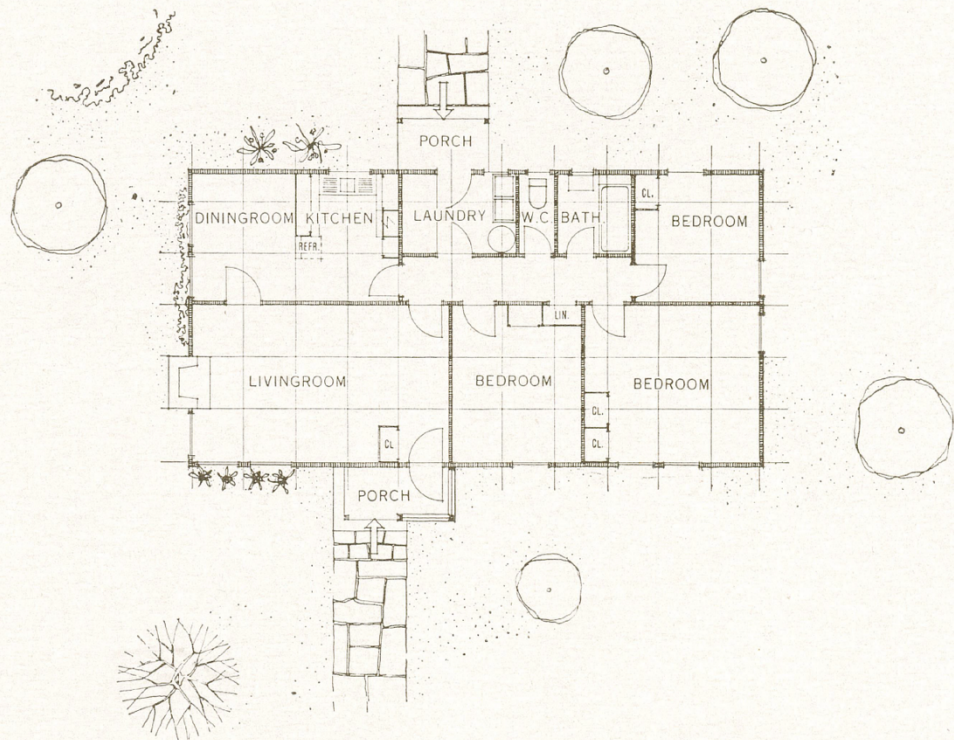
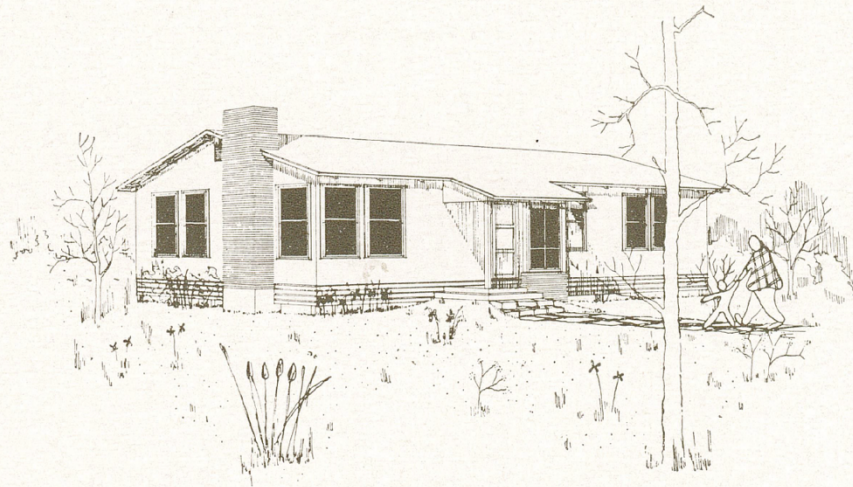
This essay explores the ASA houses at Georges in the context of cross-cultural technology exchange. This is achieved in several ways. For example, it places the seemingly technical and practical issue of erecting houses which were manufactured in a country that used the metric system, in a country that still measured and made things using imperial measurements, in a cultural context. We also propose that, despite ASA’s early enthusiasm for gaining a market foothold in Australia, its failure to do so was based on a culturally based resistance to prefabricated houses, rather than on technical issues or cost. While prefabricated timber houses were, and still are, highly valued in Sweden, the same or very similar houses, when imported and erected in Australia, were not accepted as suitable long-term, permanent dwellings.

⁵ Dale. A. Steinhardt and Karen Manley, “Adoption of Prefabricated Housing – the Role of Country Context,” *Sustainable Cities and Society* 22 (April 2016): 126–135.
<https://doi.org/10.1016/j.scs.2016.02.008>.

⁶ “Husstatistik Byggfakta,” The Swedish Federation of Wood and Furniture Industry, accessed 3 February 2020, <https://www.tmf.se/siteassets/statistik/branschstatistik/trahus/smahus/sokta-bygglov---dec-2019.pdf>.

⁷ Jemma Green and Peter Newman, “Building a housing industry from the relics of a car industry,” *The Conversation*, accessed 2 February 2020, <https://theconversation.com/building-a-housing-industry-from-the-relics-of-a-car-industry-23195>.

TYPE ASA 302



GROSS-AREA 94.1 M² 1012.6 SQ FEET FEET 4 3 2 1 0 4 8 12 16 20 24 28 32
 PORCH 5.8 M² 62.4 SQ FEET
 MET. 10 5 0 1 2 3 4 5 6 7 8 9 10

AMALS SAGVERKS AKTIEBOLAG
 AMAL, SWEDEN
 CABLES AND TELEGRAMS "ASABOLAGET", AMAL

Printed in Sweden

Figure 3.2 The Australian ASA house, or Type ASA 302 as it appears in the ASA 1951 Catalogue. Source: ASA 1951 Catalogue. Courtesy of Åmål Industrial Museum.

Background

In the first half of the twentieth century, there was a lot of enthusiasm for industrialising and prefabricating the production of houses particularly in Europe and the USA. In his widely read book, *The Dream of the Factory-made House* the title of which alludes to the oneiric nature of this phenomenon, Gilbert Herbert writes that:

It is difficult to understand what generated this enthusiasm for the concept of the factory-made house, what kept the dream alive. The fundamental motivation, the challenge of finding a technical means of solving the housing crisis, was the obvious spur to much thought and action in the field of prefabrication. But it is hard to conceive of this being a sufficient explanation of the passion and perseverance that marked the movement ... there were obviously other, deeper satisfactions in tackling the problems of industrialised building, which separately or in conjunction helped stoke the fires of enthusiasm.⁸

Exploring the motivation behind these “deeper satisfactions in tackling the problems of industrialised building” has, over the past five decades, generated a great deal of academic research. Before he published *The Dream of the Factory-made House*, Herbert had already written *Pioneers of Prefabrication*.⁹ More recently Brenda Vale’s book, *Prefab: The History of the UK Temporary Housing Programme*,¹⁰ explored how many UK residents became very attached to their post-war prefab houses. Even more recent are Colin Davies’ *The Prefabricated Home*;¹¹ Barry Bergdoll and Peter Christensen’s *Home Delivery: Fabricating the Modern Dwelling*;¹² and Christine Wall’s *An Architecture of Parts: Architects, Building Workers and Industrialisation in*

⁸ Gilbert Herbert, *The Dream of the Factory-made House: Walter Gropius and Konrad Wachsmann* (Cambridge: MIT Press, 1984), 5.

⁹ Gilbert Herbert, *Pioneers of Prefabrication: The British Contribution in the Nineteenth Century* (Baltimore: The Johns Hopkins University Press, 1978).

¹⁰ Brenda Vale, *Prefab: The History of the UK Temporary Housing Programme* (London: Routledge, 1995)

¹¹ Colin Davies, *The Prefabricated Home* (Reaktion Books, 2005).

¹² Barry Bergdoll and Peter Christensen, *Home Delivery: Fabricating the Modern Dwelling* (New York: The Museum of Modern Art, 2008).

Britain 1940–1970.¹³ Wall draws attention to the social nature of construction practices in the United Kingdom and the value of construction worker’s skills within this process. She highlights how the construction sites of prefabricated buildings in the United Kingdom became messy as they were organised according to pre-existing social and traditional construction practices rather than those of manufacturing and the factory. Relevant to the cross-cultural element of our study of the ASA houses at Georges Heights, Bergdoll and Christensen highlight the success and acceptance of prefabricated houses in Scandinavia and Japan. In his essay, “Scandinavia: Prefabrication as A Model of Society,” Rasmus Waern argues that “just as the place of car’s production is no longer important to the consumer, it will not take long before globalization strikes the last truly domestic sector – the home.”¹⁴ Davies believes that “architects have found it hard to come to terms with the idea that the products of their art might be made in a factory.”¹⁵ He points out however, that “while architecture has been struggling to find the true artistic expression of industrial production, construction has been quietly industrializing itself behind architecture’s back,”¹⁶ One of the key themes this literature reveals is that while the production of prefabricated houses is widespread internationally, their acceptance and value as permanent dwellings by the house-buying public varies greatly.

Historically, the rejection of Australian-made prefabricated houses as a suitable, long-term solution to the post-war housing shortage was both a cultural and political issue. Following World War II, the prefabrication of houses had started to gain momentum. According to the November 1949 issue of *The Australian Women’s Weekly*, twenty factories were mass producing approximately 3,540 houses a year.¹⁷ At that time, however, it was estimated that more than 100,000 prefabricated houses were required to alleviate the housing shortage.¹⁸ Towards the end of the war, to fill the shortfall, various government sponsored and private sector schemes emerged. For example, in Melbourne the state and federal Labour governments, through the Beaufort Division of

¹³ Christine Wall, *An Architecture of Parts: Architects, Building Workers and Industrialisation in Britain 1940-1970* (New York: Routledge, 2013).

¹⁴ Waern Rasmus, “Scandinavia: Prefabrication as A Model of Society,” in *Home Delivery: Fabricating the Modern Dwelling*, edited by Barry Bergdoll and Peter Christensen (2008). 31.

¹⁵ Davies, *The Prefabricated Home*, 9.

¹⁶ Davies, *The Prefabricated Home*, 9.

¹⁷ “Mass-Produced Houses,” *The Australian Women’s Weekly*, 12 November 1949.

¹⁸ “100,000 New ‘Prefabs’ Are Needed Here,” *The Newcastle Sun*, 12 January 1950.

the Commonwealth Department of Aircraft Production (DAP) and the Victorian Housing Commission, developed and began producing the Beaufort prefabricated house. During the war, DAP had produced about 700 twin engine Beaufort bombers. The Beaufort House was designed by the architect Arthur Baldwinson who, after finishing his training at the Gordon Institute in Geelong, had spent some time during the 1930s in London, where he met and worked briefly with Walter Gropius and Maxwell Fry.¹⁹

Despite its traditional pitched roof and rejection of the free plan, the Beaufort house is otherwise a product of modernism's utopian vision of the future, Le Corbusier's "House-Machine."²⁰ Composed of modular, factory-made steel-framed and steel-clad panels arranged on a 3 foot by 3 foot universalising grid, with a functional, "scientifically" designed kitchen, electrically heated water and many built-in, labour-saving appliances, it was designed to be a mass-produced, affordable home;²¹ an egalitarian answer to the housing shortage. When the Victorian Labour government was defeated in the October 1947 election, the incoming Liberal government, elected on a strong, anti-socialist platform, promptly cancelled production of the Beaufort House. Robin Boyd writes that:

Pledged to oppose socialism, the government stopped the Beaufort. At this discrimination there was a public outcry of sorts, apparently sufficient to concern the government. Not in a mood to argue, it cancelled the Myer House as well. Thus large-scale complete prefabrication in Australia was nipped in the bud. It had not been a method of construction so much as a political issue.²²

In the literature, the Myer and Beaufort Houses are often discussed together. They were developed during the same period and were both produced in factories that previously

¹⁹ Walter Bunning "A Tribute to Arthur Baldwinson," *Architectural Science Review* 12, no. 4 (1969): 122-123.

²⁰ Le Corbusier, *Towards a New Architecture*, Translated from the thirteenth French edition by Frederick Etchells (London: Architectural Press, 1946), 227.

²¹ Tim Reeves and Alan Roberts, *100 Canberra Houses: A Century of Capital Architecture* (Canberra: Halstead Press, 2013), 74.

²² Robin Boyd, *Australia's Home: Its Origins, Builders and Occupiers* (Melbourne: Melbourne University Publishing, 1952), 263.

made aircraft. The Myer House was a project initiated by Norman Myer from the prominent Myer family and it was marketed and sold through Myer stores. In contrast to the production of the Beaufort House, which was state-sponsored and therefore easy for the newly elected liberal government to close down, the Myer House project was initiated by business interests. In concert with the Federal Labour Government, the state government used the scarcity of steel to curtail its construction. Combined with a lack of demand, this caused the demise of the Myer House project.

In 1948, in an effort to alleviate the ongoing housing shortage, the Commonwealth Government indicated that it would conduct international research to investigate what new construction materials and techniques were available in the international market. Early in 1949, Ian Langlands, the director of Building Materials Research Division in the Council for Scientific and Industrial Research (CSIR),²³ toured the United States and Europe to explore materials and construction methods which could be imported and used in Australia. Of Swedish construction he wrote that “the quality of the rendering in Stockholm was the best I have seen anywhere ... all masonry and concrete buildings are rendered and I saw little or no cracking or crazing ... as is to be expected, great attention is paid in Sweden to insulation materials.”²⁴ Following his return, in June 1949, Nelson Lemmon, the Minister of Works and Housing from 1946 to 1949, announced that the Commonwealth Government was considering the purchase of more than 1,000 prefab houses from Britain or Scandinavia.²⁵ However, the high cost of freight for the imported houses compared to locally built houses delayed the importation process, as Lemmon claimed that “in my opinion Australian manufacturers could produce a prefabricated type house at least £400 cheaper than the imported.”²⁶

In December 1949, against a backdrop of the developing Cold War and a growing anxiety about the spread of communism, the Liberal Country Coalition under Robert

²³ The Council for Scientific and Industrial Research was established in 1926 and then renamed as the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in 1949. CSIRO continues to undertake scientific and industrial research since then. Ian Langlands was the chief of the building research division from 1944 to 1971. As a construction engineer Mr. Langlands worked also as lecturer in Timber construction at the University of Melbourne and as Deputy-Chancellor of Monash University.

²⁴ Ian Langlands, “Overseas Building Materials,” *Decoration and Glass* 15, no.1 (1949): 44.

²⁵ “£2 Million Prefab. Deal Likely,” *The Sunday Herald*, 12 June 1949.

²⁶ “Cost of Imported Pre-Fabs Too High,” *Brisbane Telegraph*, 9 December 1948.

Menzies won the federal election. Rather than supporting state-sponsored production of prefabricated houses the Menzies government continued searching for overseas manufacturers who could help alleviate the ongoing housing shortage. In March 1950, a Commonwealth delegation, consisting of practitioners and Commonwealth housing officials, toured Britain, Western Europe, and Scandinavia.²⁷ Their mission was to explore and examine housing prefabrication in more detail. It was clear from a statement made by the minister that the trip was for research only and not to place orders. In Sweden, after visiting factories in England, Scotland, and Vienna, the mission met with Svensk Trähusexport (STEX), a Swedish business that managed exportation of Swedish prefabricated wooden houses. They also met with other manufacturers in Sweden including Åmåls Sågverks Aktiebolag.²⁸ Reinforcing the earlier views of Langlands and the CSIR, the Commonwealth delegation observed that prefabricated houses from Scandinavia were of the highest quality, but it was not feasible to rely on the Scandinavians to erect the houses in Australia considering their high rate of employment.²⁹ Instead, during the post-war years, the Commonwealth Government adopted a scheme whereby overseas companies supplying prefabricated houses also supplied the tradesmen to erect them. According to a May 1951 statement titled “Success of Imported Prefab Programme,”³⁰ by Lord Richard G. Casey, the influential member for La Trobe (1949–1960), federal Minister for Works and Housing (1949–1951) and a great advocate for the CSIR:

Ten thousand imported prefabricated houses in 1951 will bring the total number of homes erected for the year to the all-time record of about 70,000 compared with 61,000 in 1950 and 53,000 in 1949 ...

Over 20,000 prefabricated houses are now on order under the Commonwealth subsidy scheme. In addition to the 10,000 imported houses that will arrive this year, imports of building materials should exceed £35,000,000.

²⁷ “Search for Prefabs,” *The Sydney Morning Herald*, 22 March 1950.

²⁸ Australian Housing Mission, *Report to the Right Honourable R.G. Casey, Minister for the National Development*, 10 June 1950, Appendix III.

²⁹ Australian Housing Mission, *Report to the Right Honourable R.G. Casey, Minister for the National Development*, 1950.

³⁰ Richard Casey, “Success of Importing Prefab Programme,” *Building and Engineering*, 24 May 1951.

About 70 percent of the prefabricated houses ordered overseas will be erected by migrant labour brought to Australia by the contractors. This percentage is expected to rise as all recent contracts require overseas suppliers to bring their own labour.

As a result of the encouragement the Commonwealth has given to British and European building firms to set up their organisations in Australia, there are now overseas prefabricated housing firms operating in every state, and a constant stream of inquiries from overseas firms is arriving.³¹

At the time, the Lord Mayor of Newcastle, Frank Purdue commented that “this seems to be a very good method of getting migrants settled,”³² suggesting that this scheme was linked to the permanent settlement of European migrants in Australia. Casey also wrote in 1950 that the houses were to be erected by “Australian contractors, employing Australian workmen, assisted by overseas technicians and new Australians.”³³

The story of the ASA houses in Australia begins in the late 1940s. During that time Australia was producing about a thousand, in situ houses per week. According to Casey, double this rate of production was required to alleviate the housing shortage.³⁴ In April 1950, a decision was made to allow all prefabricated houses and their fittings to be imported free of tariffs, and in July 1950, the Commonwealth Government announced a plan to purchase 2,000 prefabricated houses from overseas to house married soldiers of the armed forces.³⁵ Following the Commonwealth delegation visit, Swedish prefab manufacturers including ASA, had begun negotiating deals with the Commonwealth government. On 20 March 1950, ASA’s chief architect Elmer Tuvert arrived in Sydney to discuss importing and constructing more than 2,000 two- and three-bedroom prefabricated timber houses for the New South Wales Housing Commission.³⁶ During

³¹ Casey, “Success of Importing Prefab Programme,” 61.

³² “Send Prefab Homes with Migrants,” *The Newcastle Sun*, 31 July 1951.

³³ “£4½m. Authorised for Prefabs,” *The Sydney Morning Herald*, 3 June 1950.

³⁴ “Plan to Import Houses,” *The Mercury*, 18 February 1950.

³⁵ “2,000 More Prefab Houses to Be Ordered,” *Queensland Times*, 18 July 1950.

³⁶ “Prefab home expert arrives,” *The Daily Telegraph*, 20 March 1950.

that time, ASA erected samples of its houses in Australia.³⁷ On 22 March 1950, *Svenska Dagstidningar*, a Swedish daily newspaper, reported that Australia was currently negotiating with Swedish sawmills to order more than 2,000 ready-made wooden houses. Three companies were mentioned as being the potential suppliers for the houses: Svenska Trahus, Mo & Domsjo, and ASA.³⁸ On 3 June 1950, the Commonwealth Government stated that contracts for 1,500 prefab houses had been signed. A thousand of these were to be imported from Sweden and were to be shared equally between Victoria and New South Wales. On 22 June, the same year, another article in the Swedish newspaper *Svenska Dagbladet* reported that ASA had signed a contract with the Australian government for the delivery of 500 prefabricated timber houses.³⁹ Other evidence suggests that the actual number of houses supplied was 600.⁴⁰

As a result of this order, ASA opened its first overseas office under the name of Ormal Construction Pty. Ltd. in Melbourne in June 1950. The office was managed by W. Hough who supervised the erection of the ASA houses and also managed ASA's government contracts. In addition to selling houses to government-sponsored programs, ASA tried, unsuccessfully, to enter the local housing market. They advertised through local and national newspapers and had plans to build a factory to prefabricate houses in Australia.⁴¹ Model and demonstration houses were erected in various locations including the Melbourne suburb of Ringwood.⁴² While they succeeded in selling some of their houses, such as the one erected in Collins Street, Brighton,⁴³ they did not sell in large quantities. Perhaps a comment by B. A. Helmore, a Newcastle solicitor, published in the *Newcastle Morning Herald and Miners' Advocate* in January 1950, typifies public sentiment and resistance to this form of building. "I hope Australia never adopts prefabs, once they erect these 'short-term' houses, it would be impossible to get rid of them."⁴⁴ He need not have worried. A combination of low orders from the domestic market and capricious ordering patterns from state governments spelled the end for

³⁷ "Swede Offers Thousands of Prefab. Homes," *The Age*, 14 March 1950.

³⁸ "2,000 Svenska Trähus till Australien," *Svenska Dagstidningar*, 22 March 1950.

³⁹ "£4,500,000 for Oversea Prefabs," *Advocate*, 3 June 1950.

⁴⁰ "Opportunities for Business," *Construction*, 1 July 1953, 9.

⁴¹ The ASA company had a plan to open a factory in Australia as import restriction were very complicated. For more details, see: "Prefabs for Australia?" *Sunday Times*, 23 March 1952.

⁴² "New Designs in Prefabs," *Barrier Miner*, 11 November 1952, 5.

⁴³ "It began as a 'prefab'," *The Herald*, 5 November 1954, 12.

⁴⁴ "To-Day's Topics," *Newcastle Morning Herald and Miners' Advocate*, 4 January 1950.

Ormal Construction. For example, in August 1951, the Tasmanian Government placed an order for 500 prefab houses;⁴⁵ a month later, without further explanation the order was cancelled.⁴⁶ In July 1954 the company started to sell its prefab houses and timber stock at auctions,⁴⁷ and within a year they had closed. Research material held in a small archive in the Åmål library and also in a local community-run museum, reveals that ASA's focus on international markets to sell its houses played a major role in the closure of its factory in the town in 1969.

ASA 302 houses at Georges Heights

Although at this stage no direct evidence to support this claim has been found, it seems most likely that ASA 302 was (re)designed in the Sydney branch office of the Commonwealth Department of Works and Housing by the architect A. B. Armstrong.⁴⁸ Despite this, ASA 302 is still distinctly Swedish. Armstrong did design the very similar, Riley-Newsum CA1 prefabricated house, which was built in England using Swedish timber from the ASA sawmill.⁴⁹ Thousands of Riley-Newsum CA1 houses were imported into Australia and the similarities with the ASA 302 are obvious. The most notable Swedish detail used in both houses is the external, vertical timber cladding fixed to a timber stud frame. It is described in the ASA catalogue as “vertical shiplap,” (Fig. 3.3) and it mimics the traditional timber cladding detail, using flat timber boards butted together with a narrower cover board nailed over the joint to make it weatherproof and to slow down the movement of air and heat through the wall. In Australia, particularly in Victoria and South Australia, weatherboard cladding on a timber frame was a common and highly valued form of construction in the early twentieth century, however, the boards were usually fixed horizontally and lapped to shed water. From the

⁴⁵ “State to Spend £3,000,000 On Housing,” *The Mercury*, 3 August 1951.

⁴⁶ “Day by Day,” *The Mercury*, 18 September 1951.

⁴⁷ “Advertising,” *The Age*, 20 July 1954, 11.

⁴⁸ Robertson, “Heritage Assessment of Former Navy Cottages at George Heights.” Further support of this claim is the ASA's CEO statement about the possibility of building any design the client requires. For more details, see: Åmåls Sågverks Aktiebolag, *Catalogue* 51.

⁴⁹ For more information see: HMSS 0410 Frank Rule's Riley Newsum Prefab Houses Project collection available at ACT Heritage Library Manuscript Collections.

outside, another detail that stands out is the corner window detail in the living room. At the time the ASA 302 was one of the few imported prefab houses with this feature, and it points to a different cultural understanding of how the living space of the house was used and inhabited. The room's corner became a focus and a portal for connecting with external activities, and for establishing an understanding of place.

Internally, the ASA 302 was also distinctive. The careful design of the kitchen for example, which was supplied “knocked down and primed,” with “flush lip doors provided with chromium-plated hardware of Swedish standard.”⁵⁰ The door to the pantry cupboard included a fold-down ironing board which added another function to the kitchen. The kitchen and dining space were contained in one large room and divided from the living room with a wall and door. In the early 1950s, ASA's export manager, Torsten Bratt, came to Australia and pointed out that “most Swedish householders are working-class families who eat as well as cook in their kitchen. Our architects have realised that the kitchen is the focal room and are now making it almost as large as the living room. All cupboards are built in and light colours give an illusion of space.”⁵¹ This fitted with trends in house design of the period and represents a cross-cultural confluence and alignment between the design by the Australian architect and the Swedish manufacturer. Following subsequent trends in house design, some houses were later modified by removing the wall between the dining and living rooms to create a large L-shaped living, dining, and cooking space. Figure 3.4 shows the floorplan of one of the ASA 302 houses before and after this modification. While perhaps more obvious to the trained architectural eye, the houses at Georges Heights were clearly made in a culture where timber buildings and quality detailing are valued. From the front doors of the houses, which appear to be a modified ASA entrance door with evenly spaced vertical timber ribs, to the interior timber doors with their clear finished composite timber faces, to the fine – if inexpensive – window and door hardware and hinges, the houses exhibit a sense of enculturated design sensibility (Fig. 3.5).

⁵⁰ Åmåls Sågverks Aktiebolag, *Catalogue 51*, (Karlstad, Nermans Trycksaker: 1951), 10.

⁵¹ “Kitchen Most Important in Swedish Homes,” *The Sydney Morning Herald*, 14 March 1950.

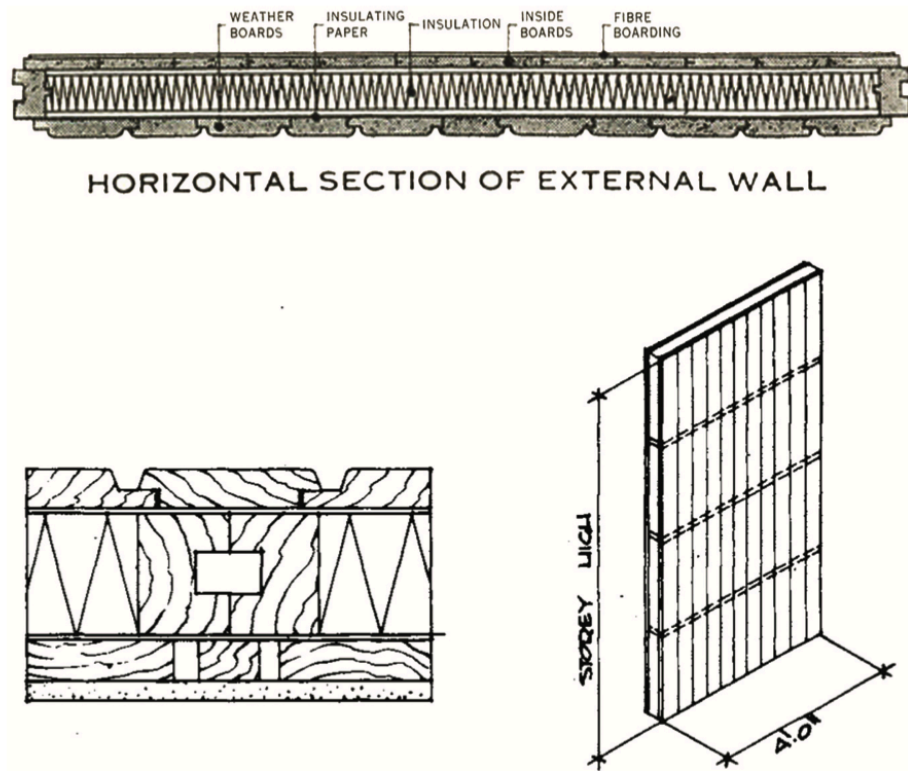


Figure 3.3 Drawings that show the vertical timber cladding and the joint between the exterior wall panels on the ASA 302. Source: ASA 1951 Catalogue. Courtesy of Åmål Industrial Museum.

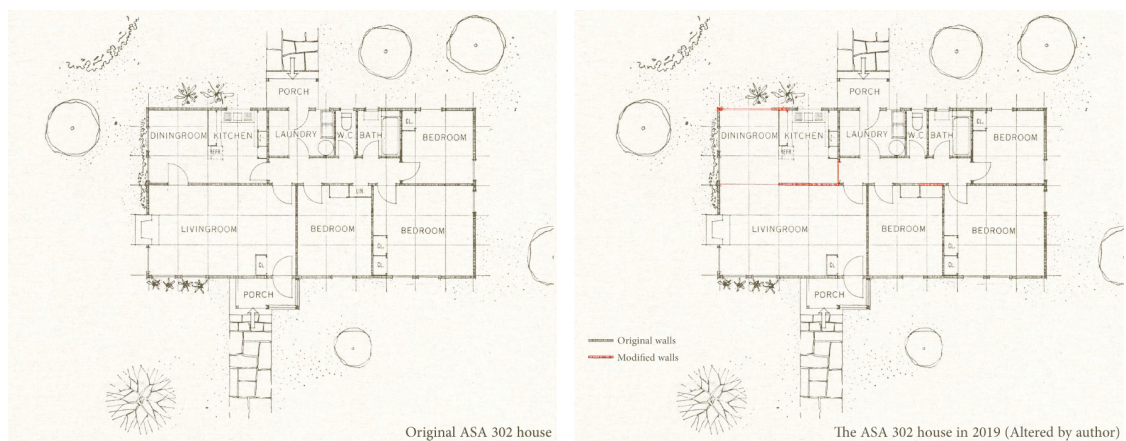


Figure 3.4 Left: the ASA 302 as it appeared on the company catalogue. Right: the same houses after modification. Source: ASA 1951 Catalogue. Courtesy of Åmål Industrial Museum.



Figure 3.5 Left: The modified Australian entrance door. Photograph by author. Right: The original ASA standard doors. Source: ASA 1951 Catalogue. Courtesy of Åmål Industrial Museum.

Between 500 and 600 prefabricated houses, manufactured by Åmåls Sågverks Aktiebolag, were imported into Australia in the 1950s to house young men completing their compulsory military training as part of the National Service Scheme.⁵² In New South Wales, in addition to Georges Heights, these houses were erected at the army base in Ingleburn. A group of more than twenty ASA 302 houses for workers at the Lithgow Small Arms Factory were also erected in Littleton, a suburb of Lithgow in

⁵² “500 svenska trähus till Australien,” *Svenska Dagbladet*, 22 June 1950.

New South Wales. A number of these houses are still occupied and in good condition. Interestingly, many houses in Littleton are made of timber, which may account for the acceptance and continued occupation of the prefabricated Swedish houses erected there. The ASA 302 houses were also shipped to other locations around Australia. Almost a third of the first shipment were sent to Adelaide and another 50 houses were sent to Melbourne. On the 11 April 1951, a photograph from *The Barrier Miner* shows the arrival of the flat-packed ASA houses at Adelaide's Outer Harbour (Fig. 3.6).⁵³ The house package included both prefabricated and pre-cut components. Of the pre-cut components, some were longer than required to allow for exact fitting on site; matchboard ceilings, for example. Others, like floor and ceiling joists, were supplied pre-cut to exact dimensions. All the modular interior and exterior walls were fully prefabricated, insulated, and finished in the Swedish factory, including the fitting of windows and hanging of doors.



SMALL PIECES of timber in this bundle held by a waterside worker, Mr. H. C. Woodhead, at Outer Harbor, are essential parts for one of the 100 Swedish prefabricated houses which arrived for S.A. in the Ledaal

Figure 3.6 A worker carrying Ormal prefab houses parts. Source: *The Barrier Miner*.

⁵³ "Part of prefabs," *Barrier Miner*, 11 April 1951.

By 2003 when SHFT initiated its project to restore the five ASA houses in Sydney, many hundreds around the country had already been demolished and others were awaiting demolition by the army, so their sites could be redeveloped. This was “despite requests by ‘Heritage’ to keep them.”⁵⁴ The Sydney houses had not been occupied for some years and were considered dated. Lack of maintenance had resulted in their general deterioration including caved-in ceilings and broken windows. Photographs show that they had been reclad in horizontal “asbestos cement wall cladding.”⁵⁵ Nationally, prior to 2003, very few of these buildings had heritage status and therefore lacked protection from demolition. Despite the lack of community concern about their historical importance, they were identified as significant through the heritage assessment carried out by Robertson & Hindmarsh Pty. Ltd. and consequently saved and restored. Interestingly, the heritage report partly attributes their importance to being a “physical representation of the National Service Scheme”⁵⁶ with its heavy use of standardised designs and prefabrication. This highlights the point made earlier concerning a key cultural difference between Australian and Swedish architectural culture. Unlike in Sweden, in Australia lightweight, prefabricated buildings, no matter how sophisticated their design and fabrication, are generally considered suitable only for temporary use, or for occupation by transient populations.

Riley-Newsum & ASA 302

Most of the army establishments which contain the ASA houses also include other imported prefabricated houses. For example, British-made Riley-Newsum houses were erected in Georges Heights near the ASA houses and in the settlement built to house workers of the Lithgow Small Arms Factory in Littleton. Similarities between the ASA and Riley-Newsum are remarkable, particularly in relation to the houses’ layout, size, detailing, and materials. The similarities also include the houses’ form, height,

⁵⁴ Robertson, “Heritage Assessment of Former Navy Cottages at George Heights,” 60.

⁵⁵ Robertson, “Heritage Assessment of Former Navy Cottages at George Heights,” V.

⁵⁶ Robertson, “Heritage Assessment of Former Navy Cottages at George Heights,” 62.

construction technique, and assembly process (Fig. 3.7). These similarities resulted in the ASA houses at Georges Heights being wrongly categorised as Riley-Newsum CA1 houses. The author of the heritage assessment report Scott Robertson, attributes this to the houses' floor plans being "indistinguishable to the lay person."⁵⁷

Despite the fact that the Riley-Newsum houses were fabricated by H. Newsum, Sons and Co in Lincoln, Britain,⁵⁸ research has revealed that the ASA Company in Åmål supplied the H. Newsum Company with Swedish timber for their houses. Additionally, Frank Rule, who worked for the Commonwealth Department of Works in Sydney as a maintenance supervisor, travelled to England in 1951 to ensure that the manufacture of the Riley-Newsum houses was in accordance with Australian specifications. He also visited ASA in Åmål to check their timber and inspect the Australian demonstration house which had been erected in the factory yard (Fig. 3.8).⁵⁹ In June 2019 we visited Åmål to look at the site where the ASA factory had been located and to examine archival material, mainly catalogues and some historical photos from ASA which had been saved and kept in the local library. The obliging librarian thought she knew where we could find more material and made a call to the community-run museum which was just a short walk from the library. In typical Swedish fashion, the museum's elderly custodian met us there and opened up the aging, red-painted timber building, allowing us to spend as long as we needed for an unsupervised viewing of its dusty remnants of industrial artefacts, including an assortment of ASA catalogues and other printed material (Fig. 3.9). Copies of this material became invaluable in the quest to unravel the story of the ASA houses in Georges Heights and also, to some extent, to better understand the origins of the houses sent to Saudi Arabia.

⁵⁷ Robertson, "Heritage Assessment of Former Navy Cottages at George Heights," 28.

⁵⁸ Reeves and Roberts, *100 Canberra Houses: A century of Capital Architecture*, 78.

⁵⁹ HMSS 0410 Frank Rule's Riley Newsum Prefab Houses Project, ACT Heritage Library.

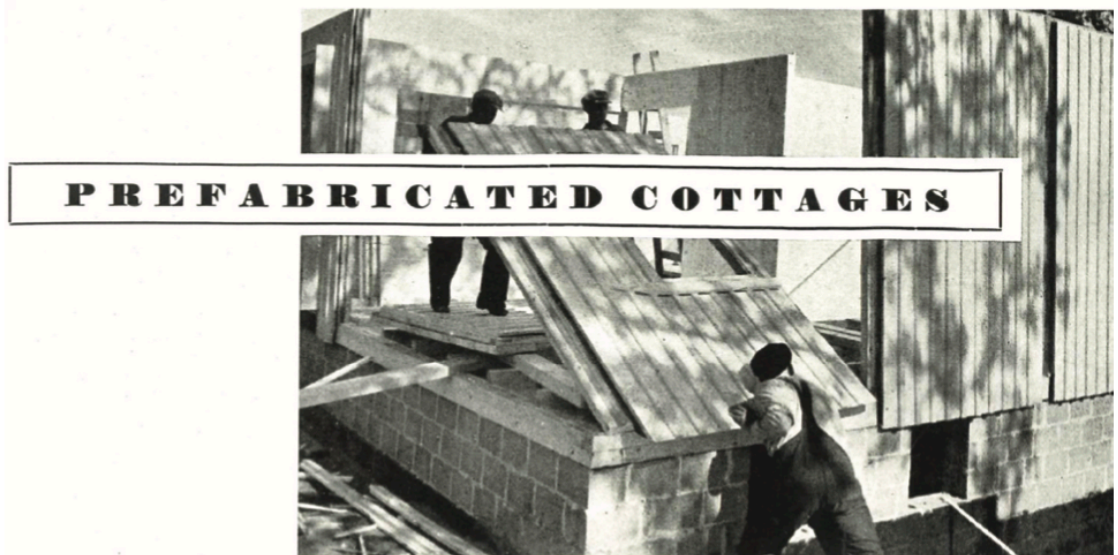


Figure 3.7 Above: The Riley-Newsum houses during assembly in the early 1950s. Source: *Australian Houses of the Forties & Fifties*. Below: Swedish prefabricated assembly system. Sources: *Sweden Builds: Its Modern Architecture and Land Policy; Background, Development and Contribution*.



Figure 3.8 The prototype Australian house erected at ASA factory in Amal, Sweden. Photograph: Francis Eugene Rule. Courtesy of the ACT Heritage Library Manuscript Collections.

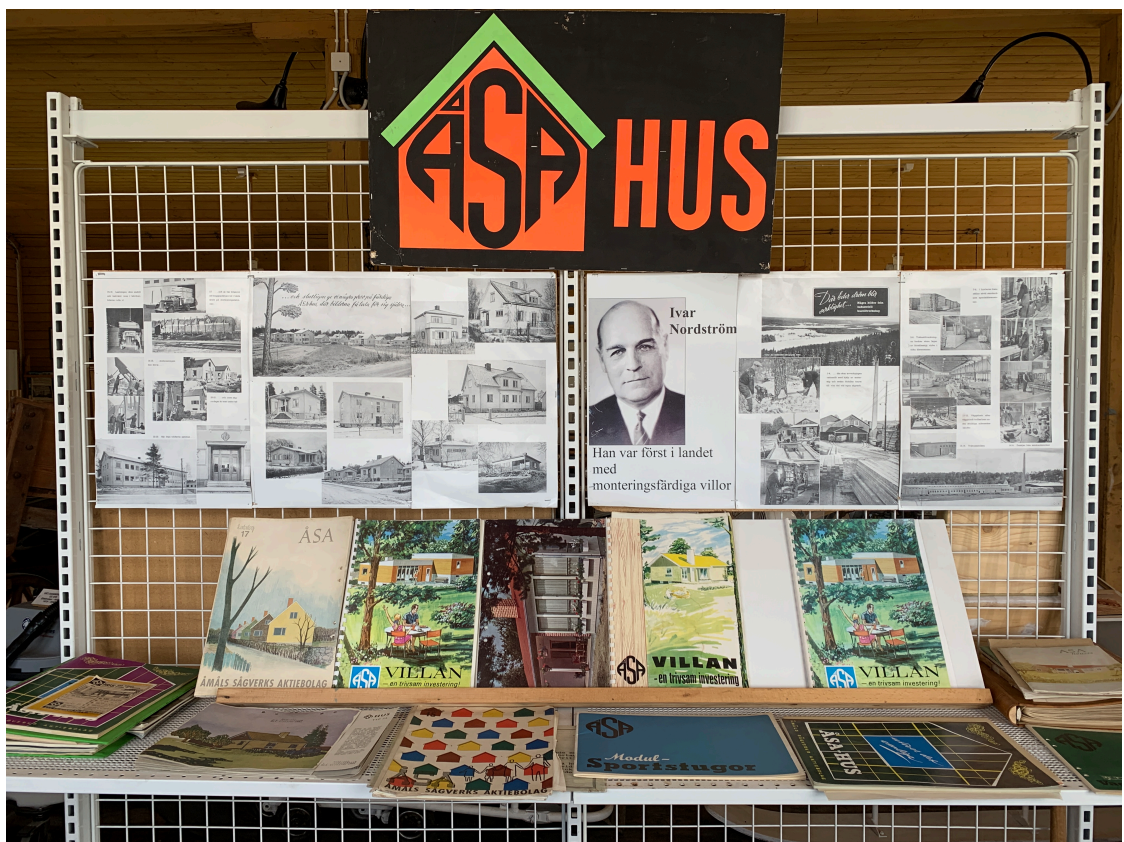


Figure 3.9 ASA's archival documents and catalogues found in Åmål Industrial Museum. Photograph by authors.

Manufacturers of all prefabricated buildings transported across borders must deal with the issue of the cultural embedding of systems and methods of measurement. ASA had already shown a willingness to adapt to imperial measurements when it exported houses to Saudi Arabia in the late 1940s.⁶⁰ Sweden had adopted the metric system in 1889, whereas Saudi Arabia used the British Imperial system until 1964. The Arabian American oil company that imported the houses into Saudi Arabia, created American enclaves within its gated compounds, so it was natural that they would insist on buildings designed, prefabricated and erected using the imperial system.⁶¹ The entire system of oil exploration and extraction was based on the same system. Even though the Australian Government had made use of the metric system legal in Australia in 1947, it did not officially convert until 1970.⁶² Some countries still maintain multiple measurement systems. Since 1909, Japan, for example, has had three different systems: metric, traditional Shaku, and the US customary units.⁶³ In an article titled “Stopping Metric Madness,” Stewart Brand, the editor of *Whole Earth Catalog*, comments that conflict between systems arose as the Japanese “architects design in metric and the contractors blithely build (even skyscrapers) by the traditional shaku-sun measure.”⁶⁴

Use of imperial measurements in all prefabricated houses imported into Australia appears to have been mandated and regulated by the Commonwealth government.⁶⁵ ASA was not alone in converting to the imperial system. Other foreign companies such as *Puutalo Oy* from Finland, used the imperial system in its experimental houses built in the Commonwealth Experimental Building Station in 1948.⁶⁶ The commonwealth’s insistence on using the imperial system, even after legalisation of the metric system

⁶⁰ Abdulaziz Alshabib and Sam Ridgway, “Swedish Prefabricated Houses in the Saudi Arabian Oil Fields,” in *Approaches and Methods in Architectural Research*, 2019, Gothenburg.

⁶¹ Alshabib & Ridgway, “Oil + Architecture.”

⁶² Department of Industry, Technology and Commerce - Commonwealth of Australia, “Metrication in Australia” (A review of the effectiveness of policies and procedures in Australia’s conversion to the metric system, 1992.)

⁶³ “Metrication in other countries,” The US Metric Association, accessed 5 February 2020, <https://usma.org/metrication-in-other-countrie>.

⁶⁴ Stewart Brand, “Stop Metric Madness,” *New Scientist*, 30 October 1980.

⁶⁵ A Review of most available drawings of imported prefabricated houses in the early 1950s shows that none of the houses had been drawn with the use of metric measurement system.

⁶⁶ The Commonwealth Experimental Building Station imported six houses from Scandinavia in 1948. One was from the Finnish company: *Puutalo Oy*. For more details, see, Reeves and Roberts, *100 Canberra Houses: A century of Capital Architecture*, 78.

from 1947, seems to be linked to its enculturation within the building industry and the housing market.⁶⁷ Being made in the UK, Riley-Newsum houses' components were standardised to imperial measurements (Fig. 3.10). The ASA houses on the other hand, were made using components standardised to metric units which were simply converted to imperial units in their catalogues. The excerpt from the ASA catalogue in Figure 5 shows doors dimensioned in both millimetres and feet and inches. While this saved ASA the considerable cost of resetting its manufacturing jigs and machinery and the process of (re)educating its workforce, it must have caused some amusement and possibly consternation among the Australian carpenters responsible for their assembly on site. For example, the standard imperial door width is 2 feet 8 inches, whereas ASA's standard metric door was 826 millimetres wide, which is dimensioned in the catalogue as 2 feet 8½ inches, an unfamiliar dimension and an approximation which would have been noted. Nowadays, 50 years after the official conversion to SI units, most tape measures used on domestic building sites in Australia still include both millimetres and feet and inches, however in the 1950s this would not have been the case.

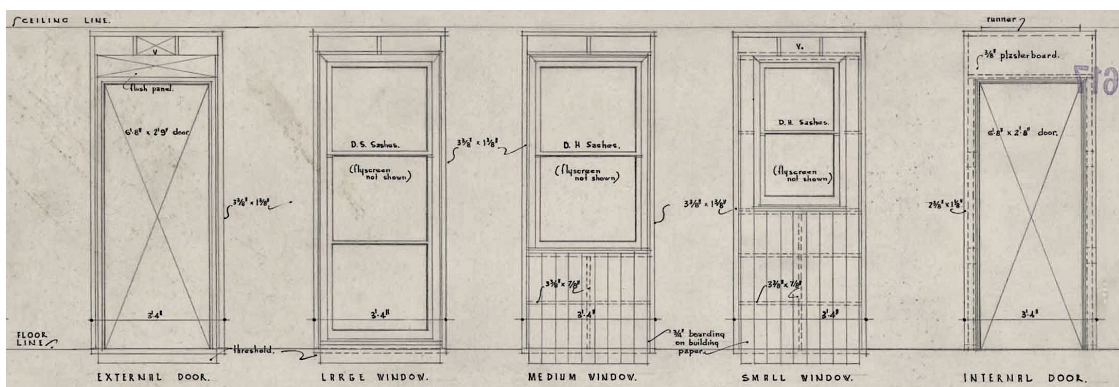


Figure 3.10 Riley-Newsum houses components dimension. Source: National Archives of Australia.

⁶⁷ Department of Industry, Technology and Commerce - Commonwealth of Australia, "Metrication in Australia."

Even though all of the ASA 302 houses' structural, cladding, and finished components were manufactured in the Swedish factory, there was still a considerable amount of on-site building work to make footings and build masonry fireplaces, for example, which required a cross over between imperial and metric dimensioning. In this regard the dimensions of the modulating grids are worth noting. Despite their similarities, the Riley-Newsum CA1 and the ASA 302 used a different grid and module dimension. Riley-Newsum CA1 house was based on a 3 feet 4 inches module and panel system into which they fitted their standard doors and windows. The ASA 302, on the other hand, was described as a 4 feet module and panel system.⁶⁸ However, this is not the case. The actual panel dimension is 1,200 millimetres, leaving a 19 millimetre difference which had to be accommodated on site.⁶⁹ Roof trusses and ceiling details in the two houses are also different. Roof trusses in the ASA 302 house were designed to be centred at 48 inches, however, on site measurements showed that they were centred at 1,250 millimetres (49.2 inches). The Riley-Newsum CA1 trusses are centred at 2,032 millimetres (80 inches). The Riley-Newsum CA1 trusses were manufactured and jointed in the factory, each truss being divided into two sections that were then hinged together to minimise packing space and to help with the assembly process. In contrast, the roof truss members in the ASA 302 were pre-cut and packed to be joined on site. The roof structural differences go beyond that to include the eaves and the way they were lined. The eaves at the Riley-Newsum CA1 house were flat and lined with asbestos cement boards, and the eaves at the ASA 302 house were sloping and unlined, leaving the steel roof sheeting exposed from underneath.⁷⁰

Conclusion

The ASA 302 houses at Georges Heights came perilously close to demolition but were eventually saved and restored. Their heritage value rests partly on their connection with the Australian Defence Force's response to a time of heightened Cold War tensions,

⁶⁸ Åmåls Sågverks Aktiebolag, *Catalogue 51*.

⁶⁹ Robertson, "Heritage Assessment of Former Navy Cottages at George Heights."

⁷⁰ Robertson, "Heritage Assessment of Former Navy Cottages at George Heights."

which saw a focus on preparing to face a military threat. While they did successfully fulfil the function of housing military personnel, they are also relics of a failed attempt by ASA to establish a market for their prefabricated houses within the wider Australian community. This was not due to their cost, or to technical or practical issues, which seem to have been largely overcome, but to a rejection of lightweight, prefabricated timber houses as a culturally valued or acceptable mode of permanent dwelling. They were generally understood as temporary accommodation only. This is despite the fact that the ASA houses were made to high Swedish standards and there were already many traditionally constructed timber houses in Australia in the 1950s.

Chapter Four | Aramco and Al-Malaz Housing Schemes: The Origins of Modern Housing in Saudi Arabia

Preamble

After discussing imported timber prefabricated houses to house expat-workers in the previous three chapters, it was the time to explore the first housing schemes for Saudi workers outside the oil compounds. The two housing projects discussed in this chapter have been well studied over the years. What is new here is that these two projects are revealed as the first modern housing in the country that was to set the scene for the subsequent rapid shift from traditional housing to contemporary, westernised forms of housing and urbanism. This chapter aligned with a call for papers for the journal *Histories of Post-war Architecture* titled *Impatient Cities of the Gulf: Post-oil Architecture in Flux*. The chapter was submitted to the journal in December 2020. The journal's guest editors suggested there was the need to consider the wider audience of the journal. The paper was slightly revised to reflect this point and is now in full peer review. The submitted manuscript, which is now in peer-review, has not been altered here, other than to align with the thesis formatting style.

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Contribution to the Paper: Conceptualisation, research, investigation, structuring, analysis, writing, paper submission and administration.

Certification: This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.

Signature:

Date: 13 July 2021

Name of Co-Author: Sam Ridgway

Contribution to the Paper: supervision, editing, and administration.

Signature:

Date: 13 July 2021

Abstract

This paper examines two influential, modern housing schemes outside the oil compounds in Saudi Arabia. The first, Aramco's Home Ownership Program from the early 1950s, built houses for Saudi oil workers and their families. The second, the Al-Malaz Housing Project, sponsored by the Saudi Government in the late 1950s, produced houses for government employees. These two schemes mark the beginning of the dramatic and widespread overturning of vernacular building traditions in Saudi Arabia. In contrast to the prefabricated lightweight buildings inside the oil compounds these houses were constructed using heavy masonry, mainly locally-made concrete blocks and concrete floor slabs, and they were built in situ. Nevertheless, they are strongly linked to the imported architectural design and construction techniques found inside the compounds.

For Aramco, the need to provide better accommodation for Saudi workers was highlighted by the vastly different conditions for expats and local Saudi workers. Inside the camps, expats lived in modern, imported, prefabricated timber buildings laid out in neat suburbs. Local workers lived outside the fence in ramshackle "Coolie Camps" made up of traditional *barastis*, tents and other structures put together from salvaged materials. While the Aramco program led to the construction of thousands of houses mainly in the eastern oil-rich regions, Al-Malaz, in the capital of Saudi Arabia, signified mainstream acceptance of modern housing design and construction by the Saudi government. Al Malaz was the first of numerous government-sponsored and developer-led housing schemes using modern, non-traditional designs and heavyweight in-situ, and later prefabricated concrete construction.

Introduction

In the early days of oil exploration and extraction in Saudi Arabia, from the mid-1930s to the early 1950s, the Arabian American Oil company (Aramco) established American-style expat residential gated compounds populated with neat rows of imported, prefabricated timber houses. Surrounding the compounds, outside the fence, the Saudi and Arab workforce built themselves ramshackle squatters' camps. American workers used to call these camps the "coolie camps"¹ and the "slums of Aramco."² In every oil field around the eastern side of Saudi Arabia during the 1940s, whether it was in Dhahran, Ras Tanura, or even Abqaiq, two communities could be recognised: the Americans and the Arabs. For example, in 1946, the residential compound of the Dhahran oil field, the first to be established in the Kingdom, was divided into two main communities: the planned, neat, gated, and well-maintained American camp, home to about 370 Americans, and the unplanned "eyesore"³ Saudi Camp of more than 3,300 Saudi workers (Fig. 4.1).⁴ Hamad A. Juraifani, a former Saudi employee of Aramco, described the two communities located in Ras Tanura's oil field during that time, commenting that the Americans "had the community, you know, with the nice houses and so on, on the beach. And they housed the expatriates. The Saudis, they were divided in two levels. Those that are higher grades are put into homes with fans, but no air-conditioners. And the rest are put in tents. And I remember, four people to a tent."⁵

Most shacks built in the Saudi camps were modelled on traditional, single-roomed *barastis* which were made from light wooden members and reeds using a kind of weaving technique. This building type was replicated using scraps and waste or discarded building materials (Fig. 4.2). The windows, if there were any, were covered by makeshift wood shutters. Dirt floors were covered with mats. While Saudis living in

¹ Robert Vitalis, "Wallace Stegner's Arabian Discovery: Imperial Blind Spots in a Continental Vision," *Pacific Historical Review* 76, no. 3 (2007): 423.

² Loring M. Danforth, *Crossing the Kingdom: Portraits of Saudi Arabia* (Oakland, California: University of California Press, 2016), 44.

³ Jon Parssinen and Kaizir Talib, "A Traditional Community and Modernization: Saudi Camp, Dhahran," *JAE* 35, no.3 (1982): 15.

⁴ Roy Leblich, *Aramco and World Oil* (New York: R.F. Moore, 1952); and John B. Philby, *Arabian Jubilee*, (London: Robert Hale Ltd., 1952).

⁵ Scott McMurray, *Energy to the World: The Story of Saudi Aramco* (Houston: Aramco Services Company, 2011), 168.

these camps were familiar with the imported, prefabricated houses and an implanted Westernised way of living inside the compounds, they did not have the means or the desire to replicate this in their own camps. Over time, the “Coolie camps” expanded and conditions deteriorated as more locals were drawn to the sites of oil production, either to work directly in the oil industry or to benefit from the economic activity it generated. The huge disparity between living conditions of the expats and those of the local Saudi workers pushed the Saudi oil-workers to start demanding better housing and working conditions. Aramco and the Saudi government realised they needed to step in after two strikes over working and housing conditions in the early 1950s.⁶



Figure 4.1 Conditions in the Saudi camps. Left: Saudi camp in Dhahran. Source: Photograph Fahmi Basrawi in Munira Khayyat, Yasmine Khayyat, and Rola Khayyat, “Pieces of Us: The Intimate as Imperial Archive,” *Journal of Middle East Women’s Studies* 14, no. 3 (2018); Right: Saudi Camp in Abqaiq. Source: Photographer unknown in *Abqaiq: Plants and People*, (Khobar: Almohtaraf, 2016).

⁶ Helen Lackner, *A House Built on Sand, a Political Economy of Saudi London*, (London: Ithaca Press, 1978).



Figure 4.2 Housing conditions in the Saudi Camps. Left: A ramshackle house within the Saudi Camps. Source: King Abdulaziz Foundation for Research and Archives (Darah); Right: Saudi houses during a fire in early 1950s. This fire was one of the main reasons to ask for better living conditions. Source: Photographer unknown in *Abqaiq: Plants and People*.

It became clear very early on in the rapid transformation of Saudi Arabia, following the discovery of oil, that Saudis were fiercely determined to protect and maintain their national and cultural identity and their Muslim religion. Before the Dhahran Camp became a gated compound, the Saudi workers tried to establish their identity and challenge what they saw as a foreign cultural and religious invasion.⁷ At Dhahran, the Saudi government and the local community worked together to build a mosque, now known as Dhahran Mosque, and to set up a school for local children. Architecturally, the mosque followed Ottoman architectural principles with 73 domes. It was built with mostly raw local materials, such as limestone and mortar, with no imported tools or lightweight construction materials and techniques (Fig. 4.3).⁸ Construction of the mosque allowed the Muslim community working for Aramco to worship and it also attracted other Saudis from the area. While the mosque was built from scratch, the school that Aramco opened in the Dhahran Camp in the mid-1940s was housed in one

⁷ This sense of alienation has been voiced by many writers in the field of Muslim cities and Saudi architecture. See Yousef Fadan, “The Development of Contemporary Housing in Saudi Arabia (1950–1983): A Study in Cross-Cultural Influence Under Conditions of Rapid Change,” (PhD diss., Massachusetts Institute of Technology, 1983).

⁸ Mohammad Zami and Abdulaziz Bubshait “Enhancing the Importance of Conservation of Architectural Heritage in Saudi Arabia: A Case Study of Dhahran Mosque,” Paper presented at the *3rd International Architecture Conservation Conference and Exhibition*, Dubai, 2012.

of the existing *barastis*. The mosque, the school, the abundance of water within the camps,⁹ and the availability of work encouraged large numbers of rural migrants looking for new job opportunities in the oil industry to settle within the Saudi camp.

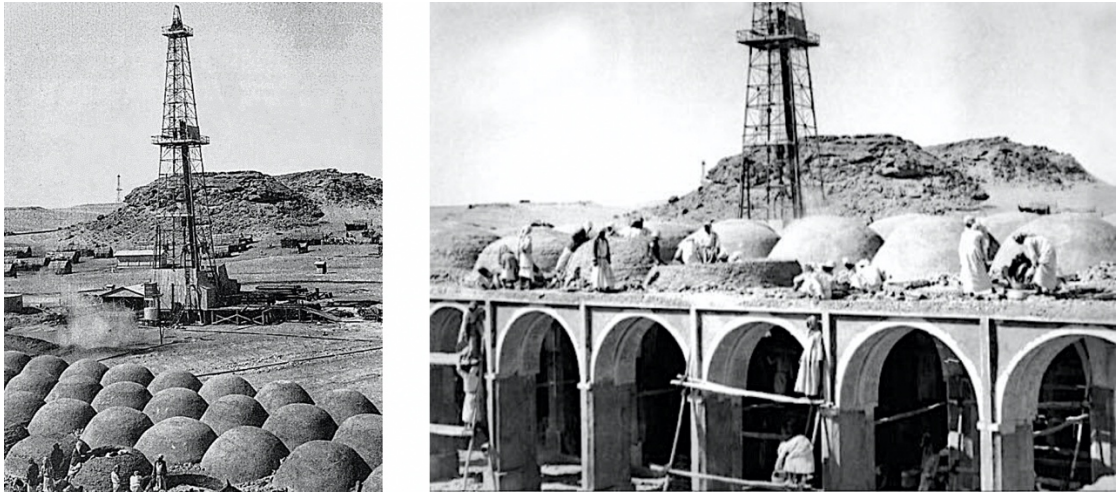


Figure 4.3 Dhahran Mosque during construction. Source: Saudi Aramco.

Seeds of Change

While gradually becoming more open to interaction with foreigners during the late 1940s, Saudi workers continued to be very protective of their families and their traditional cultural and religious practices. Initially, most Saudi workers came to the camps without their families, partly because there was no proper housing, but also to maintain a separation from the expat community. However, as Frank Jungers, the former president and CEO of Aramco pointed out, this “posed a tremendous problem” particularly for education and healthcare for women and girls: “they were out in the villages, and they couldn’t travel alone.”¹⁰ This practice was a way of limiting direct

⁹ There were many water wells dug by Aramco in the late 1930s in the Saudi eastern region.

¹⁰ Frank Jungers, “From Construction Engineer to CEO and Chairman of Aramco, 1948–1978,” an oral history conducted in 1992 by Carole Hicke, in *American Perspectives of Aramco, the Saudi-Arabian Oil-Producing Company, 1930s to 1980s*, (Berkeley, California: Regional Oral History Office, The Bancroft Library, University of California, 1995), 54.

interaction between women and non-relative men without the presence of the *mahram*.¹¹ Jungers furthers his explanation about the work-related issues associated with this social practice by stating that “the [Saudi] employee had to go home when he heard about an illness and get the family and bring them to the [camp’s] hospital, try to get the women taken care of, and take them back home. We lost a lot of employee time doing this.”¹²

To address both issues of the poor conditions in the “coolie camps” and the need for workers’ families to live close by, the government and Aramco agreed that the best option was to rebuild existing towns and also to establish new towns near to the oil fields. They also agreed to improve conditions in existing oil field camps. Dammam and Al-Khobar were the closest towns to the Dhahran oil wells and were the first towns to be planned using Western urban planning techniques, particularly the layout of housing using orthogonal urban grids and zones.

Over time, Aramco and the Saudi government urged transformation of the country to become more receptive to industrial changes and modernisation. In their paper, “A Traditional Community and Modernization: Saudi Camp, Dhahran,” Jon Parssinen and Kaizir Talib reflect on the importance of the transformation of the Saudi “eyesore” camp in this process.¹³ Several years after Aramco established the Dhahran Camp, the company began helping local workers to transform the Saudi Camp into a more permanent settlement. In 1950, for example, Aramco helped its Saudi oil workers build sixty 22-man dormitories. Local available construction materials, such as stone and gypsum plaster, were used to build these dormitories. Non-Aramco employees also built several houses around the mosque. The houses they built, although they were not particularly well made, were unique in terms of their building methods and physical forms. The imported, prefabricated timber construction materials and techniques used within the American camp were eschewed. Interestingly, the houses employees built for themselves combined local building design principles with newly introduced heavyweight building materials (Fig. 4). Internally, the organisation of spaces reflected

¹¹ *mahram* – unmarried kin in Islam – is an Arabic term that describes a man’s relationship to a woman. A *mahram* to a woman in Islam is any male relative that cannot marry the woman. Parents, grandparents, siblings, siblings of parents are a few examples of women’s *mahram*.

¹² Jungers, “From Construction Engineer to CEO and Chairman of Aramco, 1948–1978,” 54.

¹³ Parssinen and Talib, “A Traditional Community and Modernization: Saudi Camp, Dhahran.” 15.

privacy and climatic concerns. Spaces were divided according to gender roles and functions and were often centred around a courtyard. The courtyard was basically a mixed-use space for cooking, washing, relaxing, and playing. These houses were attached and arranged in a more traditional and irregular fashion. There were no regular setbacks from the street for example. This way of clustering and attaching houses together reduced heat gain through the sides of the houses. Moreover, each housing block was subdivided by small alleys, “which gave the appearance of an old, traditional Arab community,”¹⁴ and created shaded sidewalks. Based on this form of growth the Saudi Dhahran camp “thrived” with its residents having “no barriers in [their] community.” As one of the residents explained “when there is a birth we are happy together, when there is a death we mourn together ... there are no secrets, and we share everything.”¹⁵ Surprisingly, people who lived and grew up in these camps believed at the time that they would not “have any role in [the] modernisation”¹⁶ of Saudi Arabia. In reality, however, they were part of pioneering the country’s contemporary residential architecture, particularly with their use of industrially produced construction materials.



Figure 4.4 Permanent houses in Dhahran Saudi Camp before and during demolition in the early 1980s. Source: Photographer Kaizir Talib in Jon Parssinen and Kaizir Talib, “A Traditional Community and Modernization: Saudi Camp, Dhahran,” *JAE* 35, no.3 (1982).

¹⁴ Parssinen and Talib, “A Traditional Community and Modernization: Saudi Camp, Dhahran,” 15.

¹⁵ Parssinen and Talib, “A Traditional Community and Modernization: Saudi Camp, Dhahran,” 16

¹⁶ Parssinen and Talib, “A Traditional Community and Modernization: Saudi Camp, Dhahran,” 15.

In contrast to the lightweight and prefabricated construction materials available within the oil camps, heavyweight building materials, particularly concrete blocks, suited the Saudis culturally and technologically, perhaps due to the analogical relationship with traditional earth-building techniques. In the mid-1940s, the Saudi royal family had already started to use new, imported construction materials to build their palaces and offices. Portland cement and concrete blocks were used in the second phase of building Al-Murabaa Palace¹⁷ between 1942 and 1946.¹⁸ Al-Ahmar Palace¹⁹ is considered to be the first Saudi palace built using reinforced concrete and Al-Nasriyah Complex,²⁰ which included royal palaces and more than 70 housing units, was built using similar construction techniques. Mudbricks and earth-based construction materials were largely abandoned from the early days of the newly established Kingdom. The emergence of middle-class families in the early fifties also played a major role in changing Saudi society, economy and culture, and consequently building. Many Saudis became businessmen, contractors, and entrepreneurs. As an example, Saudi businessman Yousef Al-Zuawawi opened his masonry plant in the early 1950s. He toured Europe searching for new machines and equipment that could be imported to Saudi, stating that “on February 22, 1951, I went to Europe on a buying trip ... in Germany, I bought cement block-making machines; they are on their way now.”²¹ From the government’s perspective, the benefits of supporting this transformation from traditional to modern construction were enormous. It allowed the government and Aramco to take advantage of post-World-War-II industrial and technical achievements within the field of construction. Additionally, it allowed many Saudis to establish new businesses, which in turn helped the government to hire local contractors instead of relying on

¹⁷ Al-Murabaa, which is King Abdulaziz’s first palace outside the Riyadh walls, was initially built in 1938 using mudbrick and wooden materials. In 1942, the palace was expanded using newly introduced materials represented by factory-made concrete blocks.

¹⁸ Abdulrahman Alangari, “The Revival of the Architecture Identity: The City of Arriyadh” (PhD diss., University of Edinburgh, 1996).

¹⁹ Al-Ahmar palace is a mansion built by king Abdulaziz for his son King Saud in 1943.

²⁰ Al-Nasriyah is King Saud’s family palace and was opened in the mid-1950s. The palace complex also included more than 70 large and small villas which were also built using the same construction materials.

²¹ In an interview conducted by C. S. Coon on 10 February 1952, Al-Zuawawi spoke English fluently and almost without accent. See: Carleton S. Coon, “Operation Bultiste: Promoting Industrial Development in Saudi Arabia,” in *Hands Across Frontiers*, ed. Howard M. Teaf Jr. and Peter G. Franck (Ithaca, New York: Cornell University Press, 1955), 332.

international companies, as these tended to be more expensive and time consuming. It also meant more exchange between Saudis and foreign people.

Aramco Home Ownership Program

To show commitment to improving Saudi housing, Aramco, with help from the government, launched its Saudi Home Ownership Program in 1951.²² The company offered to financially help Saudi employees with interest-free loans to secure or build houses near its camps in the recently established, government-owned municipalities. The program started slowly, and its impact was not significant as the unplanned communities surrounding the American camps continued to grow. However, following the strikes in 1953, the Saudi government, through a government decree, recommended that some improvements to the program should be made by Aramco to alleviate the Saudi workers' housing crisis.²³ The company agreed to pay for 20 percent of each house built under its Home Ownership Program. At that time, the program policy made it clear that no loan was to be approved if the house did not meet Aramco's American-based standards.²⁴ This condition clearly limited a Saudi worker's ability to take advantage of the program, since there were no trained local architects familiar with American company housing standards. As a result, Saudi employees started, with the company's permission, to contact the company's architects, contractors, and engineers with requests to help and assist with design and construction. In fact, to ensure the execution of the program as planned, and to help Saudi workers, Aramco opened three regional offices located in the company's three main camps: Dhahran, Ras Tanura, and Abqaiq. The offices handled the paperwork, legal concerns, and payments. They also ensured design and construction were according to Aramco's standards (Fig. 4.5). Yousef Fadan, a Saudi architecture professor, describes the offices' main tasks:

²² Roy Leblicher, *Aramco handbook*, (Dhahran: Arabian American Oil Company, 1960).

²³ Lackner, *A House Built on Sand: A Political Economy of Saudi Arabia*.

²⁴ Fadan, "The Development of Contemporary Housing in Saudi Arabia (1950–1983): A Study in Cross-Cultural Influence Under Conditions of Rapid Change."

These offices were set up to provide technical advice to employees and to attract their attention to the practical aspects and economics of the building materials they ought to use, as well as to inform them of the most modern house designs and encourage them to install modern housing equipment such as electricity, running water, air conditioners and sanitary facilities. The last and most important role of these offices was to implement the obligatory rule of building the houses according to plans designed and drawn by licensed architects.²⁵

Many Americans became involved in the company's home ownership program. Their roles varied based on the project's needs. T. Coleman, a Californian building contractor who worked under Aramco's Arab Industrial Development Division (AIDD), played a fundamental role during the first stages of the program. He was assigned to meet with the Saudi workers and translate their ideas into architectural sketches which were then drawn by a Sudanese draftsman. His role was also extended to include negotiating with potential contractors, acting as a building inspector during construction, and overseeing the whole project. In addition to Coleman, there were many other American architects, engineers, and field representatives who participated in the program during its various stages. For example, Donald M. Bammes, who received a BSc. in architecture from Kansas State College in the late 1930s, worked as head architect in 1951, and as manager in Aramco's Home Ownership Program in 1954.²⁶ Darrold A. Wagner, John Forbes, George Tweedy, and E.D. Gelinis worked as field representatives for the same program in the mid-1950s. Their roles varied from overseeing the construction progress to handing over the units and houses to their new owners. This form of involvement and relationship between the Saudis, as homeowners, and the American architects and engineers indeed strengthened the Saudi workers' trust in their American colleagues.

²⁵ Fadan, "The Development of Contemporary Housing in Saudi Arabia (1950–1983): A Study in Cross-Cultural Influence Under Conditions of Rapid Change," 124.

²⁶ "Donald M. Bammes," *Al-Ayyam Al-Jamilah* 6, no. 1 (March 1962).



Figure 4.5 An Aramco engineer presenting a house model to a housing program beneficiary. Source: Saudi Aramco.

Eventually, because of the time it took and the cost of designing and building an individual house for every Saudi worker, Aramco decided to offer a small number of designs to choose from. Workers were only allowed to ask for minor changes to these standard house designs.²⁷ This approach limited the non-oil-related workload of the design team. A study conducted in 1974 by Candilis Metra International Consultants, a French planning firm which prepared the plans for several cities in the Saudi Eastern region, states that between 15 and 25 percent of the first houses built under the program were identical and shared the same architectural characteristics.²⁸ A type of domestic architecture completely new to Saudi Arabia – the standard single-family detached villa – evolved from this project. Carleton S. Coon, a professor of anthropology at the University of Pennsylvania, who carried out several research trips in the Middle East

²⁷ Saleh Al-Hathloul, “Tradition, Continuity, and Change in the Physical Environment: The Arab-Muslim City,” (PhD diss., Massachusetts Institute of Technology, 1981).

²⁸ Candilis Metra Int., Eastern Region Plan, Existing Conditions, Dammam, (June 1974).

from 1924, visited Saudi Arabia in February 1952 and described one of the houses (Fig. 4.6):

The house consisted of a wall surrounding the lot of land, rooms for family use facing on the inner court, except for one room, the *mejlis*, or men's sitting room, which was separate. Each bedroom opened separately onto the court; there were no inside doors. In some houses, rooms were built on the roofs as a second story, and in others one or more rooms on the roof provided maximum air circulation during the hot summer. Throughout the house inside walls were built with horizontal slits to permit air movement without impairing privacy. The toilets were all water closets of the Eastern or squatting type.²⁹

While initially more than 100 of these standard villas were built, the prototype designs soon changed, abandoning any references to traditional mudbrick courtyard houses and embodying a much more modern, Westernised approach. The company's architects had been educated in the United States during the first half of the twentieth century so it was to be expected that they would disregard local, vernacular buildings and precedents and set about fulfilling a modern, "functional" agenda.³⁰ The new houses were basic cubic forms placed on a gridiron pattern of streets laid out in the Saudi desert (Fig. 4.7). In contrast to the inward facing courtyard house, in the new house designs spaces were arranged within an enclosed form in which all windows opened to the exterior, public space of the street or onto a yard surrounded by a low fence. This was a dramatic change in the understanding of how houses functioned, particularly in relation to traditional concepts of privacy. Modern design principles and space arrangements became the central focus. Once the owners moved in, they often modified their house by increasing the height of the fence surrounding the yard, for example. New spaces, such as a designated dining room, were introduced and other traditional spaces, like the interior courtyards and multi-use rooms, were left out. The newly introduced dining room, in

²⁹ Coon, "Operation Bultiste: Promoting Industrial Development in Saudi Arabia," 343.

³⁰ American architects during that time hoped for full use of modern technology and often applied scientific approaches in programming, planning, and designing the built environment in order to sufficiently understand the users' needs and translate them architecturally. See: Catherine Bauer Wurster, "The Social Front of Modern Architecture in the 1930s," *Journal of the Society of Architectural Historians* 24, no. 1 (1965): 48–52.

particular, was often not furnished with a dining table and chairs as the act of eating on a table was, according to religious custom, considered a showing-off act.³¹ While this shift in prioritising the house spaces and arrangements and introducing new elements reflects international architectural trends, it also indicates Aramco's commitment to rapid modernisation of housing in the Kingdom. During the late 1960s, postmodernism influenced the houses built by the program and also regional, cultural, and religious factors started to have more impact on the designs (Fig. 4.8).

In addition to introducing Westernised house designs and urban planning through their Home Ownership Program, Aramco adopted and refined the use of heavyweight concrete construction. Concrete blocks had been used in the first wave of owner-built house construction outside the camps, mentioned earlier, however this was taken to a new level. Factory-made concrete blocks were used in both exterior and interior walls of the houses and concrete slabs for floors and roofs became standard (Fig. 4.7 and 4.8). Externally the concrete blocks were rendered and internally a plaster finish was applied. There was more reliance on the use of imported, industrially manufactured fitting and fixtures, Western-style toilets and bidets, taps, and door and window hardware, for example (Fig. 4.9). This rapid change effectively sidelined many traditional master-builders and tradesmen who, up until this time, had been largely responsible for the construction of Saudi traditional houses. Despite their high level of hands-on skill and knowledge of traditional building techniques, once professional architects, engineers, and contractors became available, local master-builders were bypassed by both the company officials and house owners.³²

³¹ Jamel A. Akbar, "Support for Court-yard Houses Riyadh, Saudi Arabia," (Master diss., Massachusetts Institute of Technology, 1981).

³² Fadan, "The Development of Contemporary Housing in Saudi Arabia (1950–1983): A Study in Cross-Cultural Influence Under Conditions of Rapid Change."



Figure 4.6 Aramco's first houses in the early 1950s. Source: Saudi Aramco.



Figure 4.7 Aramco's housing during and after construction in the mid-1950s. Source: Saudi Aramco.



Figure 4.8 Aramco's houses in the late 1960s. Source: Saudi Aramco.

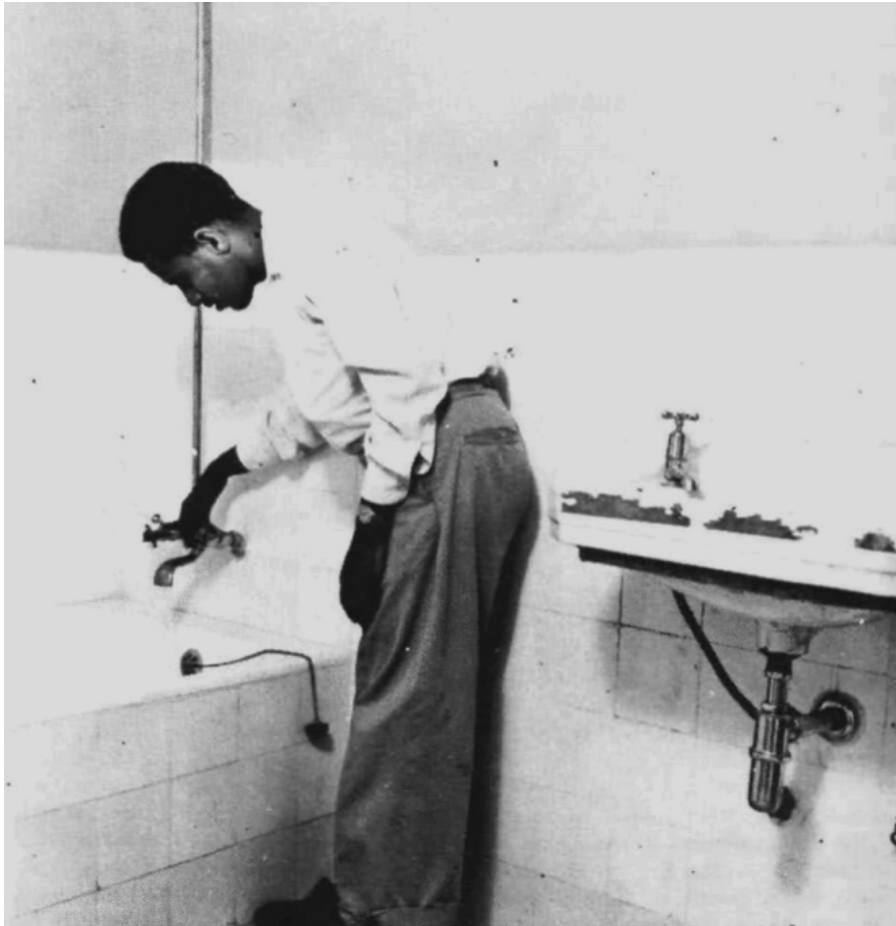


Figure 4.9 A resident checking bath fixtures in his new house in 1958. Source: Saudi Aramco.

Instead of engaging master-builders to construct their houses, the company aimed at increasing the capacity of the local building industry by training local builders in the knowledge and skills required to build with modern construction materials and methods. In March 1951, the first contract to build eleven identical houses through Aramco's Home Ownership Program was awarded to five local contractors.³³ Distributing this relatively small project in this way allowed Aramco to better understand the local capacity to build new Western-style houses. Aramco trained and mentored these local contractors and entrepreneurs, much as it did with its own Saudi oil-industry workforce providing financial, material and technical support. This method of handling the program benefited and helped the local economy. Less than a year later in February

³³ Coon, "Operation Bultiste: Promoting Industrial Development in Saudi Arabia."

1952, Aramco awarded a new contract to build another 300 houses, identical to the eleven already built, to a single local contractor, Abdallah Bin Darwish Fakroo, who used to be called the “Levitt of Arabia.”³⁴ Mr. Fakroo had already secured high-capacity, block-making machines and other construction equipment by that time and this ensured his capacity to complete the project. As Aramco expanded over the years, the program gained more popularity among the company’s Saudi workforce. By 1959, more than 2,100 houses, mainly versions of the standard, single-family villa, had been built under this program.³⁵ Looking back, it is clear that Aramco’s Home Ownership Program played a leading role in the Kingdom’s transition from traditional modes of house design and construction to a completely new type of Saudi residential architecture.³⁶

Al-Malaz Housing Project

In 1957, the Saudi government’s administrative offices and ministries were transferred from Makkah and Jeddah, in the western region of Saudi Arabia, to Riyadh city, in central Saudi Arabia.³⁷ This move created a need to accommodate government employees and the government announced a new housing project in an area called Al-Malaz outside the main city boundaries and close to the new ministries’ buildings. At the time the project was called the “Employees’ City.”³⁸ Since there was no specialised governmental agency for housing at that time, the Ministry of Finance initiated and administered this housing project. Using the Aramco Home Ownership Program as a model of success, the Saudi government sponsored the Al-Malaz housing project using a similar approach.³⁹ The Ministry, being new to this kind of building project, sought

³⁴ Coon, “Operation Bultiste: Promoting Industrial Development in Saudi Arabia.”

³⁵ Lebkicher, *Aramco handbook*.

³⁶ Anis-ur-Rahmaan, Bushra A. Rahmaan and A. Al-Shaye, “Innovation Diffusion in Housing: A Conceptual Probe in Saudi Arabia,” *J. King Saud University: Architecture and Planning* 2 (1990): 3–21.

³⁷ William Facey, *Riyadh, the Old City: From its Origins Until the 1950s*, (London: Immel, 1990).

³⁸ Suliman Alhudaithi, “Madinat Almoadafeen Qabel 65 Aam: Iskan Bltaqseet mn Almoratab” [Employees City 65 years ago: Housing with free-interest loans,” *Aleqtisadiyah*, 11 January 2019.

³⁹ Al-Hathloul, “Tradition, Continuity, and Change in the Physical Environment: The Arab-Muslim City.”

professional help, particularly from American architectural and engineering consulting firms, some of whom had previously worked with Aramco.⁴⁰ Three local contractors, all with different experience and history, were engaged to design and construct their version of the contemporary Saudi house. In total, the project consisted of 754 houses and three apartment buildings. Archival research has identified some of Western and Arabian engineers and workers who became involved in the project. For example, Professor Ahmed Sidiqi, an Egyptian architect who was commissioned by the Egyptian government to work in Saudi Arabia, was the main architect for the Arabian Engineering Company, one of the companies appointed by the Saudi government to work on the Al-Malaz project. During that time, Sidiqi also designed a number of royal palaces for Saudi princes and businessmen (Fig. 4.10).⁴¹

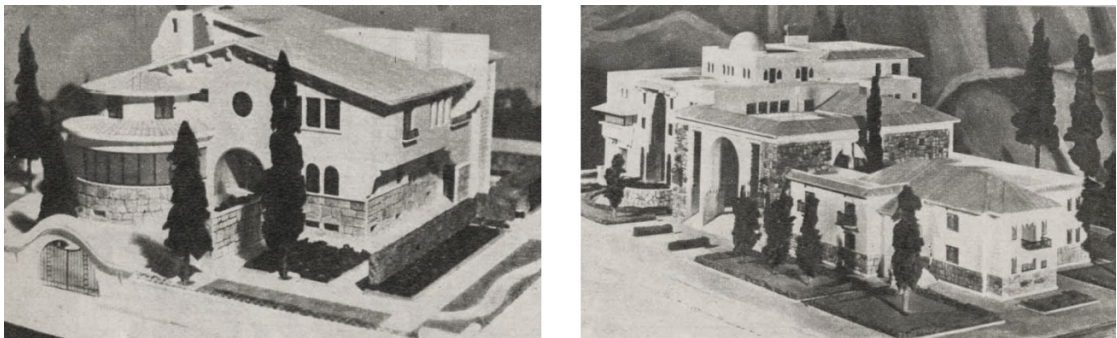


Figure 4.10 Two palace models designed by the Arabian Engineering Company, an Egyptian architecture firm, for the Saudi royal family. Source: *Almosawar*.

At Al-Malaz, the three contractors designed and constructed three versions of the modern Saudi family house (Fig. 4.11), a double-storey house for the senior leadership and managers and a single-storey house for lower status employees. Using Aramco’s Home Ownership Program as the model, all the Al-Malaz houses were built using concrete blocks and reinforced concrete slabs. In relation to their design, the houses introduced new concepts in interior layout which were quite unfamiliar and very different to traditional domestic architecture in the central region of Saudi Arabia. The

⁴⁰ Alangari, “The Revival of the Architecture Identity: The City of Arriyadh.”

⁴¹ “*Jazerat Al-Arab Tusabiq Alalam fi Alnahdah Alomraniah*” [The Arabian Peninsula is competing the world with its urban development] *Almosawar*, 1954.

spaces and functions of the house were contained within one closed block form, usually centred around the living room. The houses were set back from their site boundaries, as a result of new regulations, and windows in the lower floors of the four house facades opened onto a yard enclosed by a high wall. Windows on the upper floors were often positioned at the centre of the room and opened to a balcony. A designated dining room was introduced, along with new cooking equipment, a refrigerator, an inside toilet/bidet, and a bathtub. The house was designed to function with Western-style furniture such as sofas and dining chairs and tables. Externally, balconies and terraces overlooking the yard replaced the courtyard and rooftop which had traditionally been used as sleeping space at various times throughout the year.

The urban planning of Al-Malaz was without local precedent and followed a Western gridiron pattern with intersecting streets dividing the housing into residential blocks. Once it was completed, Al-Malaz became known as “*Riyadh Al-Jadidah*” (the New Riyadh), an indication of the new, modern way of living the community embodied. While the houses were not the first to be built using new construction materials, architectural styles, and modern urban planning forms – houses built through Aramco Home Ownership Program and Al-Nasriyah complex were built several years earlier – it is believed that the Al-Malaz housing project had the most effect on Saudi residential architecture. Saleh Al-Hathloul, a Saudi architecture professor and the former Deputy Minister for Town Planning at the Saudi Ministry of Municipal and Rural Affairs (MOMRA), in his PhD titled *Tradition, Continuity and Change in the Physical Environment: The Arab-Muslim City*, explored why Al-Malaz’s residential units became the prototype of future residential types in Saudi Arabia. His research concludes that because the project was sponsored by the government for its employees it became an authoritative example of a modern neighbourhood. The project reflected the government's vision on how fast-growing cities around the Kingdom should be planned and built and it became the model for most Saudi cities from that time.⁴²

⁴² Al-Hathloul, “Tradition, Continuity, and Change in the Physical Environment: The Arab- Muslim City.”

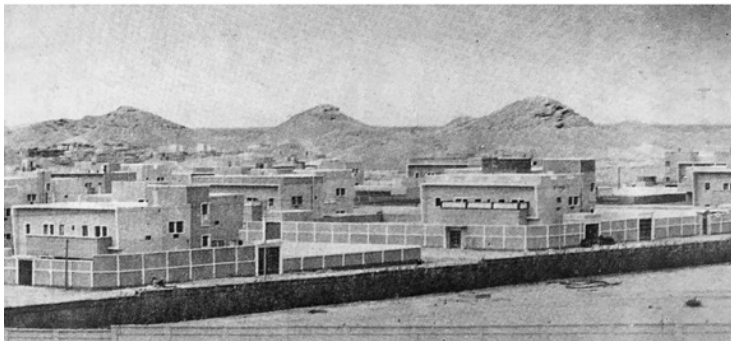


Figure 4.11 Three different types of housing built by the government in Al-Malaz. Source: Riyadh During King Saud Reign.

Once the new gridiron planning form was established at Al-Malaz, it became the model for future expansion of the city boundaries. In 1968, the government engaged the highly influential Greek architect and planner Constantinos Doxiadis to prepare an Ekistics-style master plan for Riyadh city, now Saudi Arabia's capital city. Doxiadis was also commissioned to provide master plans for other cities in the central and northern regions of the country.⁴³ Similarly, in the early 1970s Robert Matthews & Partners planned cities in the western regions, and Candilis Metra and Kenzo Tange did the same for the eastern region.⁴⁴ To some, the decision to invite Doxiadis to provide a plan for Riyadh,

⁴³ Initially it began with Doxiadis' new master plan for Riyadh City. See: Deborah Middleton, "Growth and Expansion in Post-war Urban Design Strategies: C. A. Doxiadis and the First Strategic Plan for Riyadh Saudi Arabia (1968–1972)," (PhD diss., Georgia Institute of Technology, 2009).

⁴⁴ Fahad Al-Said, "Territorial Behaviour and the Built Environment: The Case of Arab-Muslim Towns, Saudi Arabia," (PhD diss., University of Glasgow, 1992).

which was seen as “a traditional, almost sleepy, Arabian small town,” was extremely strange.⁴⁵ In response, and to emphasise the importance of the old Arabian village, the master plan Doxiadis prepared for Riyadh was based on dividing the growing city into superblocks of 2 x 2 kilometres, in which each block would represent a semi-independent urban area with a set of religious, shopping, educational, and health facilities. Yet while significant attention was given to traditional urban development, the gridiron approach with its superblocks was considered foreign to Saudi culture and tradition, which led many to question what they saw as a “non-traditional approach.”⁴⁶ In particular, it shifted the urban focus away from mosques and other religious buildings and precincts. Mohammed Eben Saleh, a former architecture professor at King Saud University, suggests that:

This type of urbanization disrupted the urban fabric and weakened the compactness between neighbours and the security and safety of residents.... This necessitates the search for urban solutions and alternatives, which increase the density, reduce the cost of infrastructure, revive the social communications in the built environment, and encourage the pedestrianization and daily marketing.⁴⁷

Reflecting on this, in 1992, the Saudi Ministry of Municipal and Rural Affairs contracted two local planning consultants to redesign the 2 x 2 kilometre superblocks while taking into consideration vernacular and traditional Arab planning principles and characteristics. The planners developed new hybrid forms that disrupted traffic flow within residential areas and included traditional urban forms with narrow alleys and dead ends (Fig. 4.12). Their proposed plans were primarily pedestrian dominated to reawaken the old town. The mosques for Friday prayers were prioritised and provided with large areas for religious and ceremonial activities. These mosques were within walking distance of the new housing. Housing lots were arranged in groups and each group of housing was clustered around a semi-private area which was often exclusively

⁴⁵ Charles L. Choguill, “A Survey of Saudi Arabian Urban Problems,” *J King Saud University: Architecture and Planning* 20, (2008): 4.

⁴⁶ Choguill, “A Survey of Saudi Arabian Urban Problems,” 5.

⁴⁷ Mohammed Eben Saleh, “The Evolution of Planning & Urban Theory from the Perspective of Vernacular Design: MOMRA Initiatives in Improving Saudi Arabian Neighbourhoods,” *Land Use Policy* 18, (2001): 186.

accessible to the residents and their visitors only. However, as preferences changed after the building of the Al-Malaz housing project, even some of MOMRA's new proposed plans were challenged by the elite and land speculators as this group wanted wider streets which increased land value. However, the modified 2 x 2 kilometre superblocks remained the model for city expansion in Saudi Arabia from the late 1990s.

Doxiadis' Riyadh master plan, with its squared and rectangular housing blocks was soon populated with villa-style houses that had been introduced in the Aramco Home Ownership Program and the Al-Malaz housing project. As this new residential form gained popularity during the 1960s and 1970s, the conflict between the old and the new, traditional versus modern, and regional versus international began in relation to Saudi residential architecture.⁴⁸ Scholars, who have studied post-oil Saudi society,⁴⁹ point out that the Saudi villa did not evolve from Saudi residential and vernacular architecture. Abdullah Al-Ghathami, a professor of criticism and theory at King Saud University, suggests that the story of modernity in Saudi Arabia is unique, as it occurred when the society was divided into two different groups: conservatives and modernists.⁵⁰ He notes how the extreme conservative *Imams* (prayer leaders) used *Khutbat Al-Jum'ah*, which is the talk that precedes the Friday prayers, to warn people about the dangers of modernity and its advocates. However, he argues that the phenomenon is revealed in various social practices and norms. For example, the change manifested itself within the basic construction material as it changed "from mud with its direct connection to the earth – where human and culture meet – to concrete, the industrialised material with its total separation between the environmental factors and the memory of place."⁵¹ According to Al-Ghathami, because of this there is now "a monstrous union between the new place and the human."⁵² Eben Saleh highlights that in contrast to its contemporary, consistently modern form, Saudi traditional architecture "was a result of a complex interaction between multiple variables and took place within difficult

⁴⁸ Mashary Al-Naim, "Identity in Transitional Context: Open-Ended Local Architecture in Saudi Arabia," *International Journal of Architecture Research* 2, no.2 (2008).

⁴⁹ Professor Mohammed Eben Saleh, Yousef Fadan, Saleh Al-Hathloul, Ali Bahammam and Abdullah Al-Ghathami to name some.

⁵⁰ Abdullah Alghathami, *Hekayat Al Hadaathah fi Al-mamlakah Al-Arabiya Al-Saudia* [The Story of Modernism in the Saudi Arabia] (Casablanca: The Arab Cultural Centre, 2004).

⁵¹ Alghathami, *Hekayat Al Hadaathah fi Al-mamlakah Al-Arabiya Al-Saudia*, 164.

⁵² Alghathami, *Hekayat Al Hadaathah fi Al-mamlakah Al-Arabiya Al-Saudia*, 173.

circumstances. Such variables include economic, political, religious, cultural and physical constraints.”⁵³

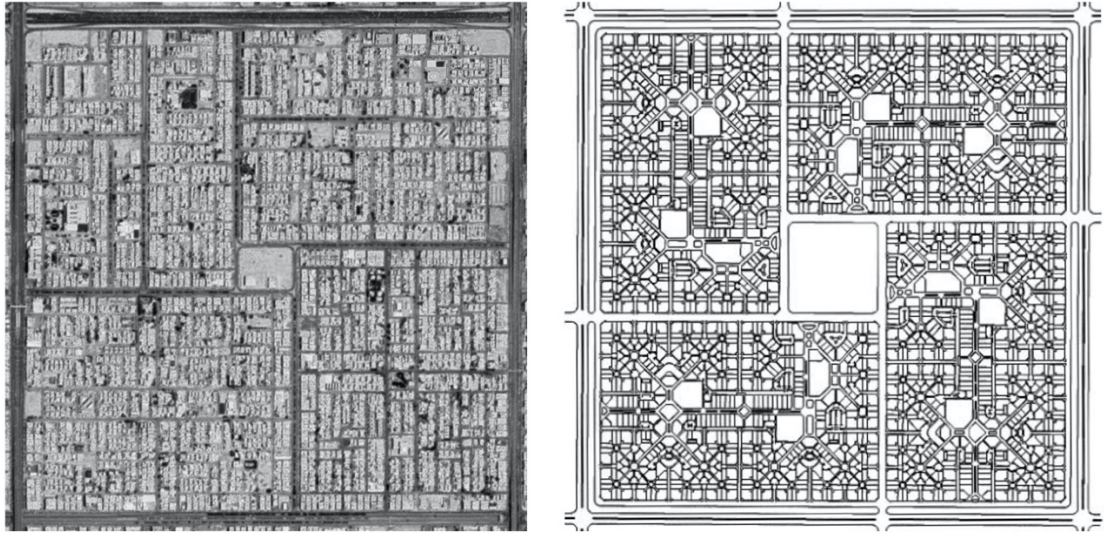


Figure 4.12 A comparison between Doxiadis' superblock and one of MOMRA's proposed new superblocks. Left: a google maps screenshot showing one of Doxiadis' superblocks in Riyadh city. Source: Google Maps. Right: one of MOMRA's proposed variation of the 2 x 2 superblocks. Source: Mohammed Eben Saleh, "The Evolution of Planning & Urban Theory From the Perspective of Vernacular Design: MOMRA Initiatives in Improving Saudi Arabian Neighbourhoods," *Land Use Policy* 18, (2001)

Conclusion

The Aramco and Al-Malaz housing projects were the vanguard of a rapid move from traditional lightweight *barastis* and heavyweight earth houses to modern, Western-style houses made predominantly of concrete. The choice of concrete, initially concrete blocks and concrete slab floors, as the preferred construction material is notable given that most of the houses imported into the oil compounds were lightweight and made of prefabricated timber. It was these prefabricated timber houses that were the first modern buildings that most of the local oil-workers would have been exposed to. When it came to building their own houses, initially in the squatter camps that spread out from the

⁵³ Mohammed Eben Saleh, "The Development of Energy Efficient Building Systems and Techniques for Housing the Masses in Hot Dry Climates with Special Emphasis on Saudi Arabia," (PhD Diss., University of Michigan, 1980): 51.

gated oil compounds, where possible, the building material of choice was always concrete. It is not clear why this was the case but historically in Saudi Arabia earth-made buildings were more highly regarded and prestigious than lightweight structures. There is a direct analogical relationship between concrete and earth building and this may have influenced the choice. Despite some resistance from local people, from the early 1960s the cities and suburbs of Saudi Arabia were rapidly populated with modern, Western-style concrete housing and other buildings.

In 2019, research visits to some now uninhabited houses⁵⁴ in both the Aramco and Al-Malaz projects revealed a remarkable and widespread phenomenon. Most of the houses were significantly modified by their owners after moving in. This seems to indicate that the new houses were not a particularly good fit with the social, religious and cultural customs of their new owners. It seems that most were in fact not given much choice “but to adopt [the] new spatial concepts and organisations.”⁵⁵ Some of the houses still retain their original architectural features, but most have been significantly altered and remodelled (Fig. 4.13). Exploring the interior of one of the abandoned houses revealed some of the architectural elements and features that would have been very unusual and unfamiliar at that time. External walls were thin and lacked appropriate insulation, which made the houses gain heat easily in summer. Unlike traditional, load-bearing earth construction, the houses had a structural concrete frame which was visible since the columns were thicker than the walls. The toilets and bathrooms were located in the centre of the house instead of in their traditional corner locations⁵⁶ which required their doors to be labelled in Arabic (Fig. 4.13). The position and orientation of the toilets and bidets followed religious requirements, as the person should not face or turn their back to Makkah, Islam’s holiest city, while using the toilet. Electrical outlets in the houses followed US codes. While the use of US codes and electrical fittings was very common internationally at that time, their use in Saudi Arabia was only associated with Aramco and government-sponsored housing projects, revealing the level of involvement of the US companies who supervised both projects. Parapet walls were short, which most residents did not like as the roof was traditionally used as a sleeping area several times

⁵⁴ During the research visit we located several uninhabited houses. The one visited in Al-Malaz is located in Al-Jamiah Street, a busy street located in the centre of Riyadh city.

⁵⁵ Al-Naim, “Identity in Transitional Context: Open-Ended Local Architecture in Saudi Arabia,” 141.

⁵⁶ Akbar, “Support for Courtyard Houses, Riyadh, Saudi Arabia.”

over the year during hot weather. Within a short time after moving in, most increased the parapet wall height using various light and heavy construction materials. Some of the original occupants personalised and modified their houses, while others did not occupy the houses for very long. Increased wealth in particular enabled some to buy large blocks of land and build more prestigious houses within a relatively short time. Interestingly, the houses they built were also “modern” with almost no reference to traditional and regional influences, which seems to indicate an acceptance of the inevitable modernisation of Saudi housing.



Figure 4.13 Photos of the current condition of the Arabian Engineering Company (Aren) prototype house built for government employees in Al-Malaz. Photograph by author.

Chapter Five | Prefabricated Concrete Construction in Saudi Arabia's Early Public Housing Projects

Preamble

This chapter explores the government-sponsored, mass-housing projects of the 1970 and early 1980s, particularly their reliance on heavyweight, prefabricated concrete construction. By the mid-1980s, thousands of prefabricated houses and apartments were ready for occupation in Saudi Arabia, most of which were built by foreign companies. The focus on construction aligned this chapter with the aims of the Construction History Society located in the Department of Architecture at Cambridge University and was submitted for consideration in their *Construction History* journal. This chapter is the manuscript that has been submitted to the journal in December 2020 and which is now in peer-review. The content has not been altered, other than to align with the thesis formatting style, more specifically to follow the Chicago Manual of Style.

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Certification: This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.

Signature:

Date: 13 July 2021

Name of Co-Author: Sam Ridgway

Contribution to the Paper: Supervision, editing, and administration.

Signature:

Date: 13 July 2021

Abstract

The oil price boom in the early and mid-1970s allowed the Saudi Arabian government to import the latest prefabricated construction technologies to address the country's housing shortage. In 1978, more than fifty Saudi companies were agents for imported prefabricated concrete building systems, and several other Western companies had the rights to sell their prefabricated systems within the kingdom. In 1979, 110 international architectural firms were working on housing projects and hundreds of institutional buildings in Saudi Arabia. This huge influx of construction technology and architectural expertise raised questions among recently-graduated Saudi architects about how this new style of architecture related to existing traditional and vernacular buildings. By the mid-1980s, more than 25,000 prefabricated housing units were ready for occupation. With differing levels of success, all of them attempted to translate traditional and regional architectural influences into this entirely new architectural typology, built using imported prefabricated construction techniques. At a time when the Saudi government has announced a new plan to build more than one million affordable houses by 2030 using industrialised construction methods, it is timely to look back and reflect on previous projects with very similar goals.

Introduction

During the 1970s, revenue from oil poured into Saudi Arabia and the country witnessed a rapid and widespread process of industrialisation. Central to this wave of industrialisation was the construction of large-scale prefabricated concrete housing projects. For the Saudi government and its housing agencies, the Ministry of Public Works and Housing (MPWH) and the Real Estate Development Fund (REDF) established between 1974 and 1975,¹ promoting industrially produced mass housing became a central priority. During the 1970s, the Saudi government encouraged many international concrete prefabrication companies to work in Saudi Arabia on its housing projects. With the support of these international companies, the Saudi government decided that the escalating demand for housing could only be met through the construction of mass-housing projects using prefabricated concrete. Consequently, most housing campaign initiated and sponsored by the Saudi government during the 1970s and 1980s relied heavily on prefabricated concrete construction. Before this, between the early 1950s and the early 1970s, mass housing had been built using mainly industrially produced concrete blocks and poured in situ concrete structural frames and floor slabs. This essay explores two of the most recognisable prefabricated Saudi housing schemes built during the 1970s: the Rush Housing and the Villa Prototype campaigns.

When the Saudi government turned to concrete prefabrication as the technology by which they would deliver thousands of housing units during the late 1970s and 1980s, its use was already well established. In 1978, for example, a construction contract was awarded to a Swiss/West German consortium for the production of precast concrete units for King Saud University in Riyadh City (Fig. 5.1). A concrete plant, at the time one of the largest precasting yards in the world, was erected near Riyadh to produce 800 cubic metres of precast panels per day.² By the end of 1978, a further 30 foreign-owned factories were licensed to manufacture prefabricated building elements in Saudi

¹ Mohammed Alhussayen, "Building Problems in Saudi Arabia: The Need for Building Research, and the Development of Building Research Approaches," (PhD thesis, The University of Michigan, 1980), 99.

² For more on the King Saud University project and the Saudi 1970s prefabrication market see: Nancy A. Shilling, *Prefabricated Housing in The Arab World* (Dallas: Inter-Crescent Publishing Company, 1987), 25.

Arabia, and approximately 50 Saudi-owned companies were agents for imported construction systems.³ Most of these prefabrication companies were working with the government on housing projects using the latest construction techniques to produce contemporary houses for the Saudi people. In addition to precast concrete panels, other building materials and prefabricated elements were either imported or manufactured in Saudi Arabia. Paint and ceramic tiles were made locally (Fig. 5.2) and American-designed, fully prefabricated bathrooms, known as “Unettes,” started to be produced in Saudi Arabia in 1978⁴ (Fig. 5.3).



Figure 5.1 King Saud University during construction. Source: “The Sand Runs Out: Working in Saudi Arabia,” *RIBA Journal* (1985).

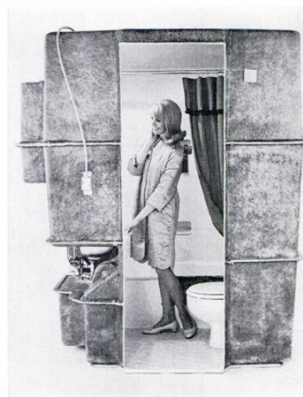
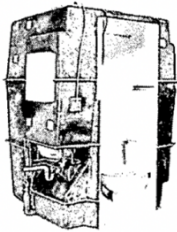
³ Many South Korean, European, and American firms were involved in the Saudi housing projects. For more, see: “The Adventures of Harry Barber in OPEC Land,” *Progressive Architecture* (Oct. 1976), 56.

⁴ *Architectural Record* (February 1978), 145.



Figure 5.2 Saudi tile factory in the early 1970s. Source: *Alqafilah*, Saudi Aramco.

FIBERGLASS BATHROOM / The "Unette," a complete modular fiberglass-reinforced plastic bathroom, is now being manufactured in Dammam, Saudi Arabia, as well as in the United States. Requiring a minimum of installation time, the *Crane Unette* exceeds commercial requirements as specified in ASI standards for bath tubs, shower stalls, and sanitary ware. Either right- or left-hand plumbing adapts for back-to-back piping installations. ■ Heritage Building Systems International, Houston, Texas.
circle 334 on inquiry card



INSTANT BATHROOM

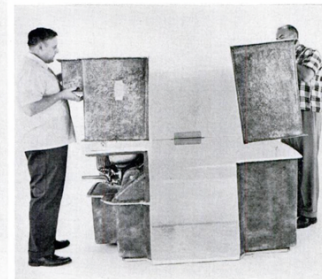


Figure 5.3 The "Unette" instant bathroom. Source: *Architectural Record* (1978).

In its second development plan (1975–1980), the Saudi government aimed to “create new model communities, including housing, in the large and in some of the medium cities of the Kingdom.”⁵ Under the General Housing scheme, the Ministry of Planning aimed to “alleviate local housing problems, upgrade the appearance and standard of cities, and set an example for private developers.”⁶ In 1978, the first “model community,” known as the *Iskan Alkharj*, or Al-Kharj Housing project, was constructed 20 kilometres from the centre of Riyadh. The Al-Kharj Housing project (Fig. 5.4) consisted of several multi-storey apartment buildings and single-storey, semi-detached housing clusters, totalling 5,031 dwelling units. The construction of the project marked the beginning of what is known as the Villa Prototype Campaign. The Al-Kharj Housing

⁵ Saudi Arabia Ministry of Planning, *Second Development Plan 1975–1980*, 1970, 494.

⁶ Saudi Arabia Ministry of Planning, 494.

project was the only one to include multi-storey apartment buildings and semi-detached villas together. Through the Villa Prototype Campaign, the government planned to build six semi-identical mega housing estates around the country.



Figure 5.4 Some of the apartment buildings and villas built in Al-Kharj Housing project. In addition to the apartment buildings, the development included 2633 prefabricated semi-detached villas. Left: Photo, Ricci Roedder. Right: Photo, Robert Johnson.

In 1977, a year before the commencement of the Villa Prototype Campaign, the government signed a contract with *Overzeesche Gas en Elektriciteits Maatschappij* (OGEM), a Dutch multinational energy company, to design and build multi-storey apartment buildings in the city of Dammam.⁷ Known as Dammam Rush Housing it marked the beginning of the Rush Housing Campaign, and all of its approximately 168,000 precast elements were manufactured in Europe and then shipped in containers to Saudi Arabia for erection.⁸ Following the OGEM contract, the government signed with a South Korean company to build similar multi-storey housing in Riyadh, and with a French company for another housing project in Jeddah. Completion of the Rush Housing Campaign was considered urgent to address a sharply increased demand for housing and was completed in less than three years. All housing units provided through the Rush Housing Campaign were ready for occupation in the early 1980s.

⁷ *New York Times* (11 August 1977), 66.

⁸ Allan R. Kenney, "Concrete Housing in Saudi Arabia," *Concrete International* 6 (1984), 19.

Unsurprisingly, many Saudis who were in dire need of housing nevertheless found it difficult to move from well-known and deeply enculturated modes of dwelling, to new, multi-storey, Western-style apartment living constructed primarily of precast concrete. Consequently, the high-rise Rush Housing blocks in all cities stood empty for several years. A study conducted by Candilis-Denco in the early 1980s revealed that at that time only 3 percent of Saudi families were willing to live in apartment-type housing.⁹ Writing about the Rush Housing apartments in 1981, Jon Boon, a former architecture professor at King Fahad University of Petroleum and Minerals, stated “it is paradoxical that while Saudi Arabia is demolishing its traditional centres, and building sprawling suburbs and high-rise apartment blocks, these same models are being increasingly rejected in the West, from where they derived.”¹⁰ Just before the Saudi government’s decision to construct these multi-storey housing projects, between 1972 and 1976 the infamous “Pruitt-Igoe” housing project in the American city of St. Louis was being demolished. In the Netherlands, where the Dammam Rush Housing concrete panels were being produced, about half of the Bijlmermeer high-rise district, which was hailed as the “City of the Future” but became known as “the drain of Dutch society,” was demolished soon after its completion.¹¹ The Villa Prototype houses were initially not well received either and most remained vacant for years after they were built. Many were first occupied during the early 1990s by refugees from Kuwait and US soldiers during the first Gulf War.

Dammam Rush Housing: From Rotterdam to Dammam

At the end of 1976, the Rush Housing Campaign began when a turnkey contract was negotiated between the Saudi Ministry of Public Works and Housing and OGEM to design, prefabricate, transport, and erect Saudi Arabia’s first high-rise, mixed-use

⁹ Candilis-Denco, “*Madinat Al-Jubail Al-Sinaiya-Master Plan Update*,” 1983.

¹⁰ Jon Boon, “Legislative Controls and Housing Policy as Determinants of Dwelling Form and Residential Pattern in Saudi Arabia” in *Housing: The Impact of Economy and Technology*, ed. Oktay Ural and Robert Krapfenbauer (United States: Pergamon Press, 1982), 865.

¹¹ Frank Wassenberg, *Large Housing Estates: Ideas, Rise, Fall and Recovery – The Bijlmermeer and Beyond*, (Amsterdam: IOS Press, 2013), 143.

housing project.¹² This first project was located near Dammam City and was intended to serve and house more than 10,000 people. The total floor area exceeded 700,000 square metres and the total cost was estimated at two billion Saudi riyals, the equivalent of approximately 535 million US dollars. In March 1977, the same ministry hired the Danish engineering company of Birch & Krogboe Overseas as consultants to evaluate the project and oversee factory production and component assembly from start to finish. Based on the consultant's initial evaluation and advice, the ministry officially signed the final contract with OGEM on 21 May 1977. The site was handed over to the contractor on 6 June 1977 and the contract specified that the project must be completed and handed over to the Saudi ministry no later than 6 June 1979.¹³

Initially, most of the 1970s housing units were specified and sketched by recently graduated Saudi architects working for the government. They were then subsequently redesigned and documented by architects employed by foreign contractors to align with their manufacturing capabilities and construction techniques. The 1970s housing campaigns were an opportunity for many young Saudi architects to gain employment and experience and also to encourage recognition of regional architectural influences in the design of the housing projects. Window awnings and patterns, which were very common in Saudi traditional residential architecture, were extensively used in the 1970–1980s housing projects. Among the young architects who gained experience on the housing projects was Saud Abdullah Lingawi, who graduated from University of California Berkeley in 1962 with an undergraduate degree in architecture, and in 1964 gained a master's degree in urban planning from The University of Southern California.¹⁴ When the 1970s housing campaigns commenced, Saud Lingawi had become Deputy Minister of the Saudi Ministry of Public Works and Housing. Although he had larger administrative and management roles, he was involved in every detail of the design and construction of these projects.¹⁵

¹² Abdulaziz Al-Mogren, "Housing Surplus in Saudi Arabia: Observations, Recommendations, and Alternatives for the Use of the High-rise Public Housing Projects" (Master's thesis, The University of Pennsylvania, 1987).

¹³ Thyge Thygesen, "Huge Prefabricated Housing Scheme: Dammam, Saudi Arabia," *Arkitekten* 82, no.51, (1980): 136-141.

¹⁴ Personal communications with Sattam Lingawi, the son of Saud Lingawi.

¹⁵ Thygesen, Dammam, (Note 14), 139.

When Dammam Rush Housing project was awarded to the Dutch contractor of OGEM, the height of the buildings, apartment size, and organisation of the interior spaces were all laid down by the ministry and more specifically by its in-house architects, led by Mr Lingawi.¹⁶ However, as the Saudis' specifications were simply considered as a guideline rather than a complete design, OGEM commissioned the Eggers Group, an American architectural firm based in New York City, to redesign and finalise the project drawings.¹⁷ The Dammam Rush Housing project included 32 identical residential towers grouped in eight clusters (Fig. 5.5) with a total number of 1,664 apartments anticipated to house approximately 10,000 people. Each tower consisted of seventeen floors and each floor had four, seven-room apartments. The average area of each apartment was 232 square metres. Referring to this project, Ada Louise Huxtable, in an article titled "When Americans Design Abroad" and published in the *New York Times*, wrote:

Style has always been transported from one country to another. The British brought European classicism to India with the Empire; prefabricated 19th century iron gingerbread was shipped around the Horn. Some very strange buildings have been dropped into some very exotic places, with varying degrees of adaptive success.

I had a spooky feeling of familiarity with the Eggers Group's housing in Damman[sic], Saudi Arabia – eight rigidly clustered groups of 17-story towers on podiums containing parking and shopping that looked like an update of Queens, for which 12,000 tons of precast elements were shipped to Damma[m] weekly for 60 weeks. That's exporting an image and a technology with a vengeance. The disembodied and discredited clichés keep right on rolling along.¹⁸

The exporting of architectural technologies and styles "with a vengeance" was also highlighted in Jeffrey W. Cody's book *Exporting American Architecture*.¹⁹ In a chapter

¹⁶ Thygesen, Damman, (Note 14),139.

¹⁷ "Saudi Plans Public Housing Mega-complex at Damman," *Architectural Record* (Jan. 1978): 37.

¹⁸ Ada Louise Huxtable, "Architecture View: When Americans Design Abroad," *New York Times* (Jan. 1981), 25.

¹⁹ Jeffrey W Cody, *Exporting American Architecture 1870–2000* (New York: Routledge, 2003).

titled “The American Century’s Last Quarter: Exporting Images and Technologies with a Vengeance, 1975–2000,” he states:

However, American architects’ presence abroad, and the spaces or forms they have helped erect in their quest for profit and invigoration, have also led increasingly vocal, anti-globalization critics to charge that American architects are colluding with capitalist clients in bringing American paradigms to non-American contexts.²⁰

This was at least partly influenced by the downturn in the US economy during the last quarter of the twentieth century. In an anonymised *Progressive Architecture* article²¹ titled “The Adventures of Harry Barber in OPEC Land,” an American architect, who had been working in Saudi Arabia, stated that “the economic ‘downturn’ of 1974–1975 forced me to make a dramatic decision. Our professional and personal lives had been a year in the hands of our creditors when I decided to take leave of our comfortable New York office and journey to the unknown lands of the Middle East. Of all the places to look for prospective clients, I reasoned that either Saudi Arabia or Iran would be the most promising.”²² He continued, “the factor that impressed me the most about Saudi Arabia was the sheer size and magnitude of developments taking place there.”²³

²⁰ Cody, *Exporting*, (Note 20), 171.

²¹ The article and its characters were anonymised to circumvent the problem of confidentiality. This was because of sensitive architect-client relationships in the Arab region.

²² “The Adventures of Harry Barber in OPEC Land,” 56.

²³ “The Adventures of Harry Barber in OPEC Land,” 60.

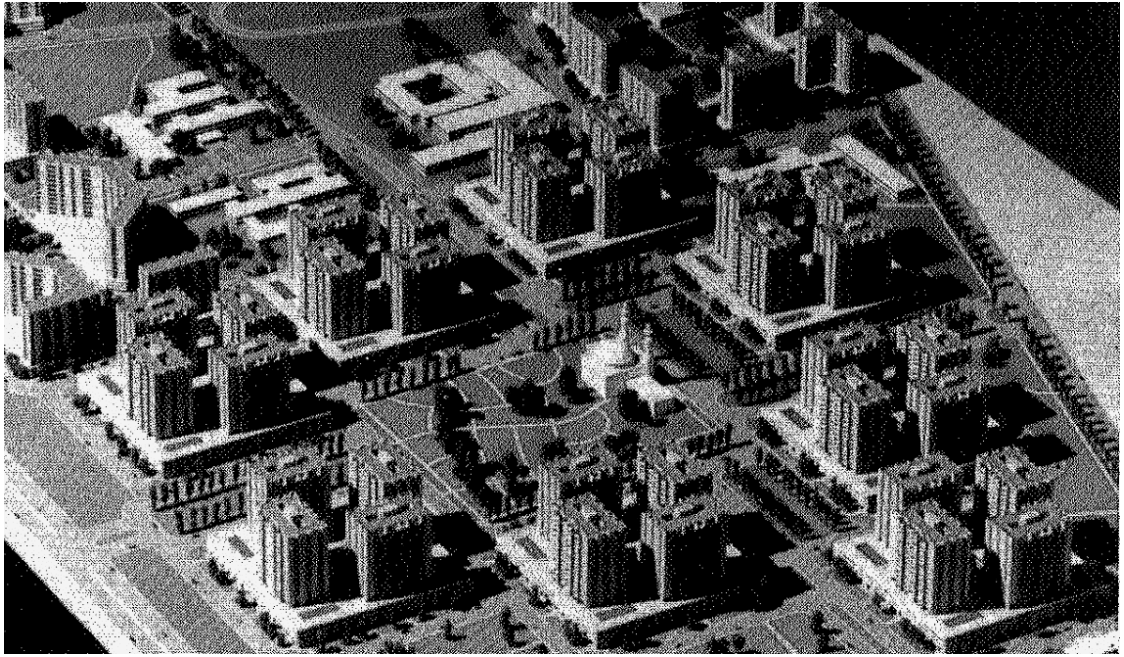


Figure 5.5 Dammmam Rush Housing in models and after being constructed in the early 1980s. Upper: Source: *Architectural Record*, 1978. Lower: Source unknown.

Vast wealth resulting from the sale of oil allowed the Saudi government to engage approximately 110 international architectural practices during 1979 to work on various projects.²⁴ Foreign architects working in Saudi Arabia at that time, often preferred to

²⁴ *Engineering-News Record* (31 July 1980), 27.

work with contractors who shared similar cultural backgrounds. As one of the American architects who secured a hotel job in Saudi Arabia at that time wrote “I wanted to get an American builder to take charge of the project. Although large construction and engineering firms were plentiful, they usually preferred to subcontract to architects with whom they had done business in the past.”²⁵ This clearly was not the case for the Dammam Rush Housing project. As an indication of the extent and nature of foreign architectural and construction investment in Saudi Arabia during this time, according to Thyge Thygesen, a Danish architect who worked on the project as a consultant, the relationship between the American architectural practice the Eggers Group, and the Dutch contractor OGEM developed from a chance encounter on a flight to Saudi Arabia. Representatives from each company were heading there to explore and hopefully secure new business related to the construction of buildings and infrastructure. Ironically, OGEM paid off the American architects soon after engaging them and securing the government construction contract.²⁶ According to Thygesen, this was probably related to the contractor’s assumption that “architectural work is something one could purchase complete off the shelf and thus can be carried out by the firm’s purchasing team.”²⁷ Thygesen stated that the contractor’s action forced the supervision team to utilise a clear, report, and fact finding (CRF) report system, as the contractor continuously attempted to reduce the quality of construction.²⁸ From the government side, the only way to ensure quality was to be involved in every detail of construction and to only release funding when the contractor had met all requirements and specifications. For example, the payment of 11 million Saudi riyals for the floor tiles in Dammam Rush Housing project was held up as five of the 7 million floor tiles, did not meet the quality standards. The payment was not released until the five tiles were replaced.²⁹ Sample tests and quality checks on construction details, such as prefabricated panels and concrete mixes (Fig. 5.6) as well as finishing details like doors, cupboards, gates, shelves, and nails and screws, were done on regular basis.

²⁵ “The Adventures of Harry Barber in OPEC Land,” 62.

²⁶ Thygesen, Damman, (Note 14).

²⁷ Thygesen, Damman, (Note 14), 138.

²⁸ Thygesen, Damman, (Note 14).

²⁹ Thygesen, Damman, (Note 14).



Figure 5.6 Sample tests were done by the contractors and the ministry. Left: An engineer and a group of ministry personnel running testing on a concrete sample. Right: One of the contractor engineers checking a precast column. (Photo: Left: Allan Kenney; Right: W.de Vries).

A notable success for the project was the organisation of logistics which resulted in delivering the buildings on time without extended delays. The extensive production of prefab components for the Dammam project began early along with logistical planning and coordination of the components' transportation through the Mediterranean Sea. The decision to import ready-made concrete elements from Europe rather than establishing a concrete precasting factory in Saudi Arabia was made early. This seems to have been driven by issues of cost and quality control. It was decided that, rather than establishing a factory in Saudi Arabia and importing all the materials required to make the concrete panels, it was cheaper and easier to control quality and ensure delivery of panels made in Europe, mainly the Netherlands. Factories in Belgium, Germany, France, Italy, and Portugal also contributed to the production of the prefabricated parts. More than 800,000 tons of prefabricated concrete panels were produced for the project. All parts

were shipped from Rotterdam harbour to the port of Dammam. Elevators and sanitary ware came directly from the United States. To meet the strict schedule, a ship loaded with prefab concrete panels was dispatched from Rotterdam to Dammam every nine days between 3 September 1977 and 31 October 1978. Once unloaded in the port of Dammam, the prefabricated elements were then transported by trucks, either to storage near the assembly site, or to the construction site for direct assembly (Fig. 5.7). At the time the housing was constructed, it was reported that it was the largest turnkey contract spanning two continents³⁰ and the largest housing project ever built.³¹

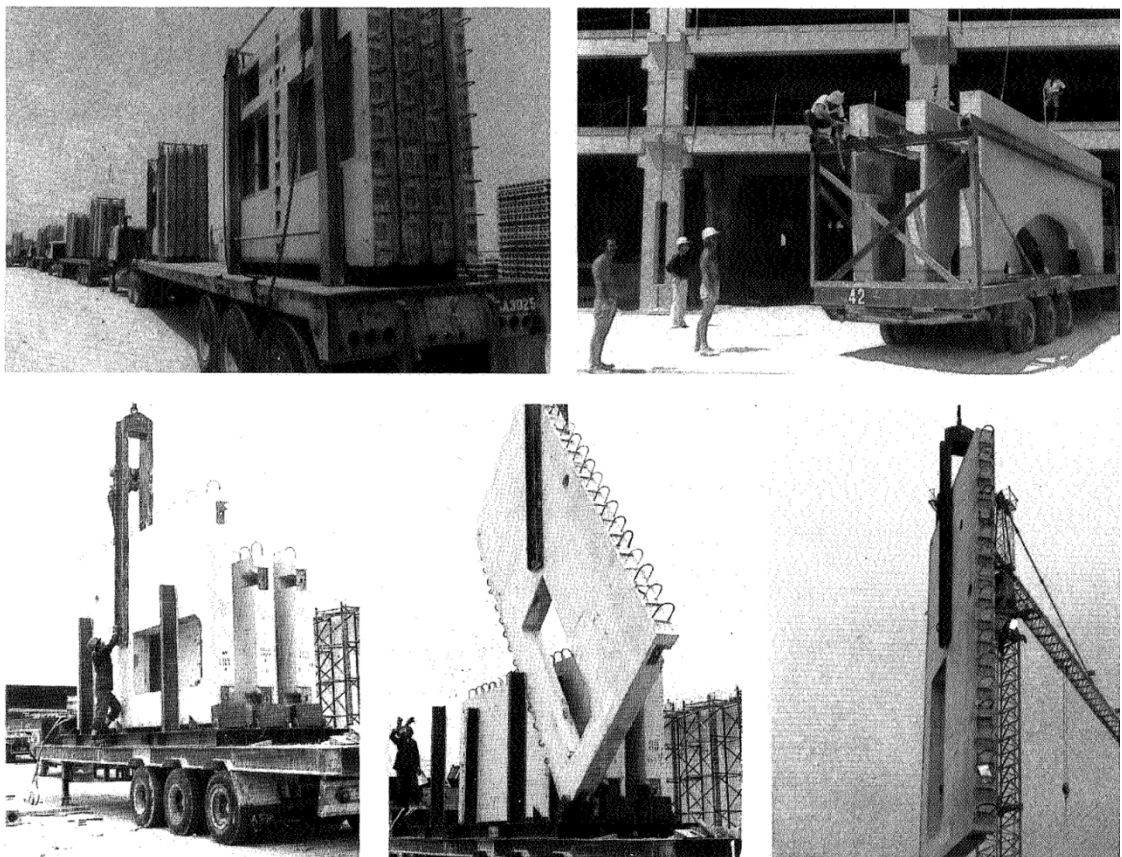


Figure 5.7 Prefabricated components being transported from Dammam port to the construction site. Photo: J.H.Köhne

³⁰ Thygesen, Dammam, (Note 14).

³¹ Udo Kultermann, *Contemporary Architecture in the Arab States: Renaissance of a Region* (New York: McGraw-Hill Professional, 1999).

Assembly of the prefabricated parts, once they arrived on site, followed a specific order to minimise costly mistakes. The towers were constructed using internal and external load-bearing wall panels. The height of the wall panels matched the floor height. Floors were constructed using precast slabs. (Fig. 5.8). To move the project cranes between the different high-rise buildings, the company constructed a temporary steel track (Fig. 5.9). The cranes were moved along the tracks from one building to the next. The 32 towers were constructed in groups of four. A four-storey podium that contained shops and parking was assembled around the base of the towers after they were constructed. (Fig. 5.10). The project construction process lacked human craft as the work of the construction workers was a matter of assembling industrialised construction parts and attaching them together (Fig. 5.11). From the exterior, the high-rise buildings had a clear industrialised and monotonous appearance due to the heavy use of precast heavyweight concrete panels. Even though they were coloured with light and dark sandy colours, these prefabricated panels revealed a, locally unprecedented, brutalist architecture (Fig. 5.12).



Figure 5.8 One of the towers under construction. Panels height and slabs are jointed at the floor level. Source: mapio.net

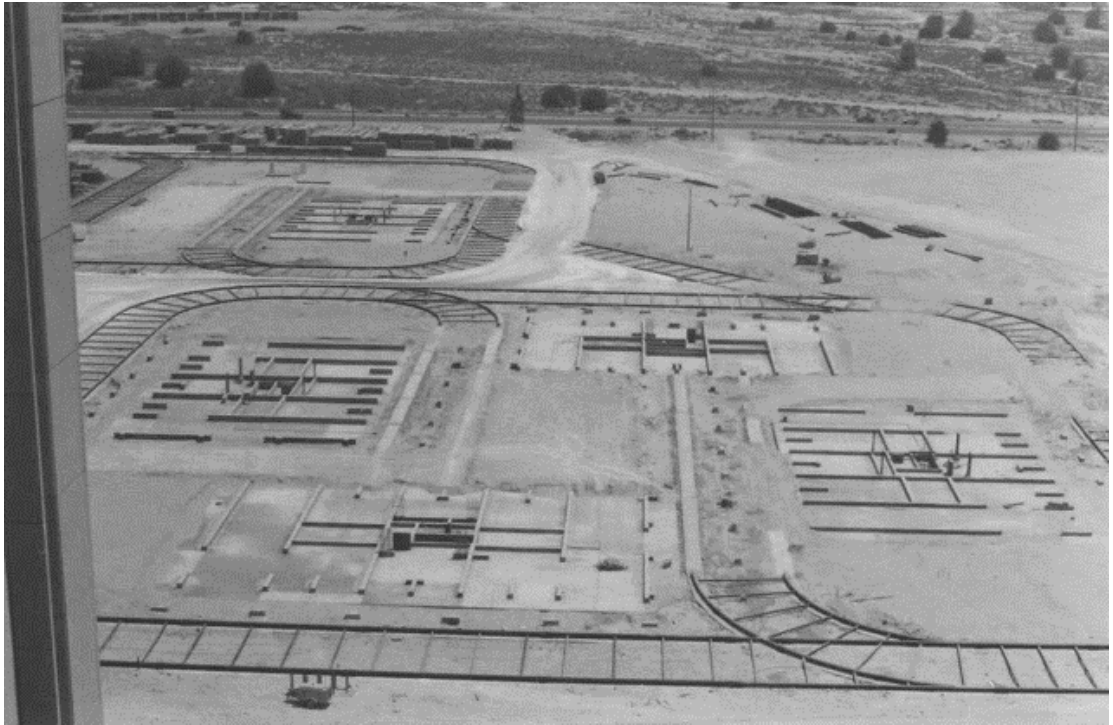


Figure 5.9 Temporary crane track. Above: the track was constructed from early on. Below: crane sitting on the track during construction. Source: mapio.net



Figure 5.10 One of the clusters before and after the podium assembly. Source: mapio.net



Figure 5.11 Construction men loading one of the heavyweight prefabricated components. Source: mapio.net



Figure 5.12 Dammam Rush Housing from the top of one of the towers. Source: Getty Images.

As the site was remote, three different housing compounds were erected near the project location to accommodate the workers and the management for the project. The OGEM company built two of these housing compounds for its employees and the third was built by the Saudi ministry to house the Danish consultant team. The construction of the camps took six months and was completed while the prefabricated components for the high-rise apartments were being manufactured in Europe. The first compound (Fig. 5.13) was a fenced and guarded, neat suburban town in the middle of the desert with paved streets and gardens. This camp was built to house OGEM's administrative teams,

who were mostly from the Netherlands. Most came along with their families which forced the government and the OGEM to provide them with essential educational, health, and recreational services. Within the compound, standard-type prefabricated wooden houses (Fig. 5.14) were erected along with a school, mini hospital, supermarket, restaurant, gym, swimming pool, cinema, and business centre. The camp accommodated more than 1,000 people and had a French chef working in the restaurant. The second camp was erected to house several thousand construction workers who came mainly from South Korea, Thailand, India, Pakistan, Egypt, Lebanon, and Sudan. It was reported that the compound housed more than 3,000 workers who came from twelve to fifteen different nations. The third camp was to house the Danish consultant and supervision team which comprised over 50 people. Similar to the Dutch workers, some of the Danish consultants brought their families with them. Therefore, the Saudi ministry erected single-family houses for them along with a Danish school, which was run by two Danish teachers. The camp also included a recreational facility, swimming pool, play area, and library. The creation of these various compounds reveals how the government was keen to provide the workforce with all its essential needs within this remote location.

Because the project workforce consisted of people coming from the Netherlands, Denmark, Germany, America, South Korea, Lebanon, Egypt, Sudan, Pakistan, and many other nations, information signs placed around the construction site were written in many languages. Thyge Thygesen, as a field supervisor in the project, wrote that the signs “were the only thing that reminded [them] on a daily basis of the simultaneous presence of many different nationalities in a relatively small area.”³² This diverse workforce performed together to deliver what was believed at the time to be the most suitable housing units for Saudi families.

³² Thygesen, Damman, (Note 14), 138.

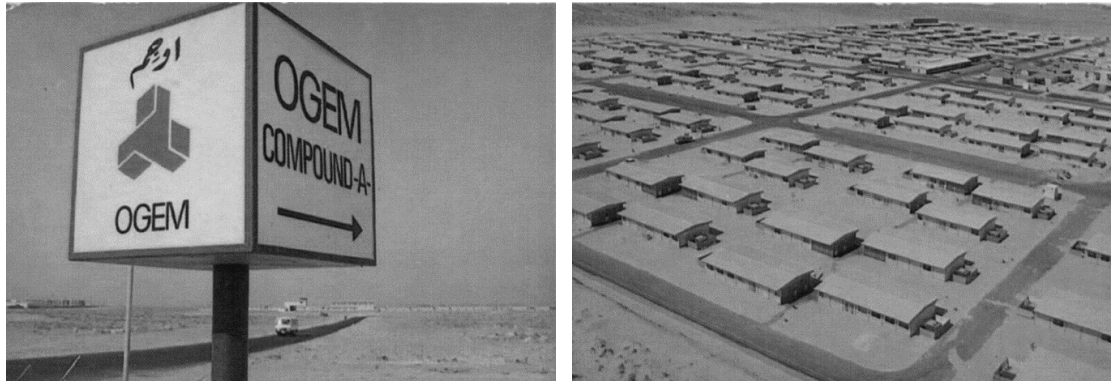


Figure 5.13 OGEM workers' camp. Source: mapio.net



Figure 5.14 OGEM workers' houses. Source: mapio.net

The Dammam Rush Housing, with its “disembodied” feeling is used here as an example. However, it was replicated, with slight variations, in both Jeddah and Riyadh. The slight variations were due to the fact that these projects had different contractors with different cultural backgrounds (Fig. 5.15). Surprisingly, vernacular differences between the various Saudi regions were not incorporated in the design of these projects despite the fact that Saudi architects had already tried to emphasise their importance.³³ Tawfiq Abu-GhazzeH states that “imported design concepts of many recently built projects, such as the Rush Housing projects built in Riyadh, Jeddah and Damam,

³³ Saudi architects at that time tried to make a clear definition of their built environment and its regional characteristics. It was at that juncture that calls for regionally and culturally influenced residential architecture were noted. In 1977, Mohammad Mousali, Farid Shaker, and Omar Mandily published a book titled *An Introduction to Urban Patterns in Saudi Arabia* in an attempt to “provide an opportunity for foreign consultants working on major development projects for the Saudi Government to develop a better understanding and appreciation of the indigenous architecture.” For more see Mohammad Mousali, Farid Shaker, and Omar Mandily, *An Introduction to Urban Patterns in Saudi Arabia*. (London: Art and Archaeology Research Papers, 1977).

contained spatial norms that were derived, inappropriately, from Western culture. Such norms determined physical designs, shapes and sizes that were neither adequate nor appropriate to the culture of the Saudi society. Therefore, most modern architecture in Saudi Arabia is seen to be culturally destructive.” All of these projects lacked appeal and were not valued by the wider community, with the result that most towers stood empty for several years.



Figure 5.15 Striking similarities between Dammam Rush Housing (left) and Jeddah Rush Housing (right).

Buraidah Villa Prototype Campaign: Design and Construction

In 1978, a year after the Rush Housing Scheme was inaugurated, the Saudi government began the Villa Prototype Campaign, the aim of which was to build large numbers of single-storey, semi-detached, affordable houses. Between 1978 and 1986, approximately 10,500 almost identical, precast concrete houses were built in six diverse cities and regions across the Kingdom. It had become clear even at this early stage, as detailed in the report prepared by Candilis-Denco mentioned earlier, that despite the dire housing shortage, Rush multi-storey apartment living would not be popular with

people used to living in traditional houses. The government's answer to this was the Villa Prototype Campaign. Designed to accommodate the average Saudi family of two adults and four to five children, the prototype villa (Fig. 5.16) was replicated in large numbers to create new suburbs. In the country's interior Najd region, known for its mud courtyard houses, 4,840 villas were built; the western Hijaz region, with its diverse architectural forms and stone-built houses, received 4,660 villas; and finally, 1,000 were built in the eastern Ahsa region, known for its limestone houses, that take advantage of passive cooling techniques.³⁴

There are similarities in the layout of the housing units built in the 1970s and 1980s, whether it was an apartment located on the sixteenth floor of the Rush Housing high-rises or a single-storey, semi-detached villa built through the Villa Prototype Campaign. The housing unit is divided into zones for guests, living, and sleeping; the zones being linked by a main corridor divided with several doors to maintain privacy. Figure 5.17 shows the level of similarity between the apartments built in the Rush Housing Campaign and the villas built through the Villa Prototype Campaign.

Similar to the Rush Housing Campaign, the final design phases for the Villa Prototype Campaign were carried out by foreign architectural firms with help from in-house Saudi architects. For example, the Buraidah Public Housing project, one of the projects built under the Villa Prototype Campaign, was awarded to 3D/International, an American architectural firm based in Houston, Texas, for redesigning and master planning work.³⁵ At that time, 3D/International was already working on several architectural projects in Saudi Arabia (six new towns for Aramco, several hotels, conference centres, and the refurbishment of palaces). William Bonham, an entrepreneurial American architect who joined the firm in 1978 to manage foreign projects, believed that "architecture and engineering – at least as they have been practiced for the past fifty years in the US – are sort of dinosaurs" and that 3D/International, at that time, was "developing a new breed of cat – good architects and good engineers who think like businessmen."³⁶ This

³⁴ Ministry of Public Works and Housing, "Residents' Opinion about the Saudi Housing Projects," 2001.

³⁵ "3D/I Sharpens Mideast Focus, Business Skills to Score Big," *Engineering News-Record* (9 February 1978).

³⁶ *Engineering News-Record* (9 February 1978), 18.

statement is somehow manifested in Buraidah Public Housing with its monotonous feeling, where the focus was on good project and construction management, not good architectural outcomes. Once the Buraidah project was designed and documented, the contract to construct the project was awarded to Dong Ah, a South Korean building contractor, specialising in the prefabrication and assembly of buildings.³⁷ In addition, the architectural firms of Dar Al-Riyadh from Saudi Arabia and Rhein-Ruhr from Germany provided consultation services for the ministry.³⁸ All of these companies worked together to deliver 949 semi-detached villas at Buraidah.



Figure 5.16 One of Buraidah’s prototype villas just after finishing assembly work. Source: REDF Buraidah.

³⁷ “Saudi Arabia Shifts Housing Program to Villas,” *Engineering News-Record’s Newsletter of Construction, Planning, Finance and Design* 14, no.18, (1982).

³⁸ Reviewing the project’s shop drawings reveal this information.



Figure 5.17 Similarity in the layout of the apartment in the Rush Housing Campaign and villa housing units built under the Villa Prototype Campaign.

Like all villas built through the campaign, those at Buraidah Public Housing were designed as single-storey houses with a habitable roof. The high parapet wall, designed to make the rooftop a private space, was sometimes mistaken for a second storey. The three-bedroom villa had a floor area of 211 square metres and was placed on a square lot of 400 square metres (20 x 20 metres). The villa included a designated male guest reception area – the so-called *majlis* –, a dining room, living room, and kitchen. Internally the house layout followed a basic functional approach. The dining room, for example, was linked to the kitchen and the guest room, and the living room was accessed from the main foyer. The plan increased the habitable area by integrating the central corridor into the living areas. As mentioned above, the house was divided into three main zones: a guest area, family living, and sleeping. Zones were linked by a central corridor.

The Villa Prototype Campaign was not conceived purely as a means of providing affordable mass housing, but as an opportunity to introduce many new, modern, functional and technological architectural services and conveniences. As the housing units were all identical, they were assigned specific numbers to distinguish one from another for both the residents and their visitors. Additionally, each house was provided with a labelling space next to the house front door for the resident's name. For the first time in Saudi Arabia, a mailbox was attached to the prototype houses' main door. Until

then, the idea of a mailbox attached to a house in Saudi Arabia was uncommon as most residents still relied on local post offices. The villa also introduced a new method of collecting and disposing of household garbage.³⁹ The garbage bin was placed in a collocation box that could be opened either from the inside of the yard for dumping, or the adjacent street sidewalk for collection (Fig. 5.18). This method was designed to eliminate the need for the women members, in particular, to go out of the house to place household waste in the bin.



Figure 5.18 Waste bin box in the prefabricated villa boundary wall. Source: REDF Buraidah.

Like traditional Saudi houses, privacy and segregation of male guests and members of the family was a central concern in the design of the villas. There was a specific entrance, reception room, toilet, and dining room allocated only for male guests. Circulation patterns within the house were also planned very carefully. Movement between the rooms was via a central circulation route that looped around the staircase. This also helped to avoid interaction between guests and the rest of the family members. It also allowed the designers to save space, which resulted in saving construction components and materials as well. To maintain privacy, the prototype contained eighteen internal doors. Hallway doors featured hydraulic door closers to keep them shut when not in use. The roof deck's high parapet walls eliminated visual exposure to

³⁹ Ministry of Public Works and Housing, *Buraidah Housing Project: Residents' User Guide*, 1991.

the neighbours' roof and yard, and at the ground level the villa was surrounded by a 2.5-metre-high boundary wall to block visual exposure from the sidewalk and neighbours.

In consideration of the extreme hot weather in Saudi Arabia, the design and documentation team also implemented various strategies to eliminate heat gain and loss. In the prototype's envelope, there was a play of contrasts between solid and void which helped to provide shade to some façades. The varied façades, along with the window awnings, created maximum shading of interior and exterior spaces. The design of the house prevented direct sunlight from entering the interior spaces. All windows included external foldable screens made from aluminium. The size of the windows was minimised, which helped slow heat gain from direct sunlight. Saudi families traditionally utilised the roof as an outdoor seating and sleeping area,⁴⁰ so the roof featured a canopy to provide a shaded outdoor area. Ventilation and thermal insulation were also taken into consideration. Where possible, two windows were placed to ensure good cross-ventilation. Air conditioners were positioned above the windows and hidden and shaded from the outside by the windows' exterior awning, which helped protect them from direct sun. Exterior walls were thermally insulated with a 4 centimetre polystyrene sheet inside the prefabricated concrete panels (Fig. 5.19).⁴¹

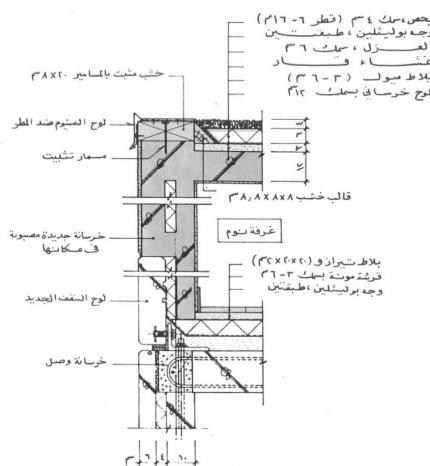


Figure 5.19 Details showing the insulation thickness and proposed second floor addition. Source: REDF Buraidah.

⁴⁰ Mashary Al-Naim, *The Home Environment in Saudi Arabia and Gulf States* Vol.1. (Milano: EDUCatt-Ente per il diritto allo studio universitario dell'Università Cattolica, 2006) 209.

⁴¹ *Buraidah Housing Project: Residents User Guide* (Note 39).

In relation to the vast wealth and new building technologies that flowed into Saudi Arabia during this period in its history, it is interesting to note how the size of houses changed. The average floor area of a traditional courtyard house constructed of mudbricks was about 190 square metres. In the Al-Malaz Housing project, one of the first to introduce in situ concrete construction and completed almost 30 years before Rush Housing and the Villa Prototype projects, the average floor area increased dramatically to approximately 440 square metres.⁴² The floor areas of villas built during the Villa Prototype Campaign almost halved to between 211 and 225 square metres. It is not entirely clear what prompted this huge fluctuation in the floor area of the houses, but it seems that in the later projects the government perceived a more urgent need for housing and it adopted a technological and industrialised means of achieving this, combined with reducing floor area, which allowed more houses to be built more quickly. In the process many social and cultural principles embodied in traditional houses were lost. There was little understanding of how a transition from traditional construction to building with precast concrete would be interpreted and embraced or rejected by Saudi people.⁴³

It appears that culturally sensitive design was less important than utilising a construction method that would allow strict control of the project's quality and completion timeframe. The government needed a design that incorporated construction thinking into the design phase to minimise construction time and material waste. One strategy to achieve this was to eliminate the structural frame and make the precast walls loadbearing. Sidney Freedman, who at the time was the director of Architectural Precast Concrete Services, an expert in architectural precast concrete, and co-editor of *Architectural Precast Concrete Journal*, stressed in his article "Loadbearing Architectural Precast Concrete Wall Panels" that:

⁴² Ali Bahammam, "Factors Which Influence the Size of the Contemporary Dwelling: Riyadh, Saudi Arabia," *Habitat Intl.* 22, no. 4 (1998), 557–570.

⁴³ In his PhD study, Yousef Fadan investigated the evolution of Saudi contemporary houses. He suggested that the urgent housing need deflected the government's attention from realising the importance of the social-norms within architectural design. See: Yousef Fadan, "The Development of Contemporary Housing in Saudi Arabia (1950–1983): A Study in Cross-Cultural Influence Under Conditions of Rapid Change," (PhD thesis, Massachusetts Institute of Technology, 1983), 346.

Architectural precast concrete's full potential as loadbearing walls can be realized when the entire design or design/build team – architect, engineer of record, mechanical engineer, contractor, and precaster – has the opportunity to develop a project jointly starting at the project's preliminary design stage. Finish types, shapes, repetitive use efficient and economical precast concrete modules, joint locations, access or site restriction, erection procedures and sequencing, all become important considerations for a project's successful completion.⁴⁴

In 1984, civil construction engineer Allan R. Kenney, who worked on many of Saudi Arabia's public housing projects during the 1970s and 1980s, claimed that "today, some of the world's finest precast panel and architectural cast-in-place concrete construction is being done in the Kingdom of Saudi Arabia. Architects, contractors, consultants, and engineers travel there from all over the world to participate, contributing their talents and expertise to this vibrant concrete construction market."⁴⁵ Kenney was president of Precast Systems Consultants Inc., a consulting company based in Florida, and had worked previously in Saudi Arabia with Concrete Associates, a small American company. At that time, Concrete Associates was providing the Saudi government with laboratory services on concrete mix design and processing for construction projects worth several billions of dollars. Concrete Associates also provided the Saudi government and other design firms working in Saudi Arabia, including Skidmore, Owings & Merrill, 3D/International, and Hellmuth, Obata + Kassabaum (HOK), with a 50-page book titled *Saudi Arabia: Concrete Construction and Influencing Factors*. This provided details on concrete specifications as well as potential work-related issues including logistical and trading issues of importation, labour conditions, and complications due to the hot climate. The company's director James Shilstone believed that "concrete is the modern stone, and if the Greeks could achieve that kind of lasting beauty and stature, we certainly can do it with modern technology."⁴⁶ The admiration

⁴⁴ Sidney Freedman, "Loadbearing Architectural Precast Concrete Wall Panels," *PCI Journal* 44, no. 5 (1999), 111.

⁴⁵ Allan R. Kenney, "Concrete Housing in Saudi Arabia," *Concrete International: Design & Construction* 6 (1984), 18.

⁴⁶ "Taking Concrete Technology from Texas to Saudi Arabia," *Engineering News-Record* 26, (May 1977).

of concrete had its influence on Saudi government housing schemes, as prefabricated concrete became the most common construction material in Saudi Arabia.

Typically, each villa contained 136 to 154 precast concrete elements. The size and dimensions of the prefabricated panels were not determined by adhering to a universalising grid or module but were derived from the design of the villa itself. The aim was to minimise the number of joints visible from inside the villa prototype. The biggest loadbearing wall panel was approximately at 6,500 millimetre length and the smallest one was at 2,000 millimetre length. From the inside, all interior panels were smooth, plastered, and painted with almost no visible joints. On the other hand, the exterior panels were “chemically retarded exposed aggregate panels,”⁴⁷ and while the joints between the panels were invisible, the actual size of each panel was visible. Concrete work along the vertical joints received careful attention as shown by the aggregate uniformity and high quality (Fig. 5.20). The method of exposing aggregate, known as Mo-Sai and Shockbeton, was first used in the US in 1932 in the Baha’i Temple.⁴⁸ Since then, the method has gained popularity and has become available in almost all countries.



Figure 5.20 Ministry supervisor inserting his fingers in the invisible panel joint. Photo: Allan Kenney.

⁴⁷ Kenney, *Concrete*, (Note 44), 20.

⁴⁸ Allan R. Kenney and Sidney Freedman, “Architectural Concrete” in *Concrete Construction Engineering Handbook*, ed. Edward G. Nawy (Boca Raton: CRC Press, 2008).

As the Villa Prototype Campaign scope was massive and was built over very different locations, many international construction companies and consortia became involved in the project's construction. Korean, Turkish, and French companies built more than 10,500 semi-detached villas. The Korean companies Samho, Dong Ah, and Daelim worked on the Riyadh and Buraidah projects in central Saudi Arabia, and the Turkish companies Soyak and Kutlutas Insaat Ve Tic San worked on the Makkah and Medina projects in the western region of the country. The French company Société Auxiliaire d'Enterprises (SAE) worked on Al-Qatif and Al-Ahsa projects in the eastern region. Each contractor built their own plant to prefabricate the prototype panels and other concrete structural elements for the foundations. For example, the Dong Ah company, that built the Buraidah Public Housing, cast the concrete panels in a plant located in Riyadh City, where raw materials were available, and then hauled them to Buraidah, 300 kilometres north of Riyadh.⁴⁹ While varied in their cultural backgrounds, all of these companies replicated the same housing prototype using their own construction equipment and instruments. Work on the Al-Kharj project started in 1978 and was completed in 1985. Figure 5.21 shows some of the construction work for the villas in the early 1980s. Most of the other developments were ready to be occupied by the mid- and late 1980s, except the Makkah and Medina projects which did not commence until 1982. In fact, the Makkah project was not executed as planned, as more than 1,236 villas of the project have never been finished.⁵⁰ In 2012 the government, represented by the REDF, tried to sell these units to local people,⁵¹ however, a recent visit to the project showed that hundreds of units are still unoccupied, thus turning approximately half of Makkah's Prototype Villa housing development into a ghost estate (Fig. 5.22).

The Makkah housing project's vacancies and the level of modifications made to thousands of the occupied prototype villas raise questions concerning the cultural acceptance of industrialised, prefabricated residential architecture. The new suburbs of concrete houses were placed in relatively remote areas up to 20 kilometres outside city

⁴⁹ Raeyd Aldakheel, "Residents' Satisfaction with Public Housing; The Case of Buraidah Public Housing Development in Saudi Arabia" (PhD thesis, The University of Michigan, 1995), 176.

⁵⁰ Real Estate Development Fund, *Incomplete Makkah Housing: A Guide for Future Expansion*, 2011.

⁵¹ Fahad Aldos and Jaman Alkinani, "This Afternoon: Auction Will Commence in Makkah Housing Project," *AlRiyadh*, (Jun. 2012).

boundaries and optimistically designed to blend into the anticipated urban growth that would eventually surround them. However, they have remained largely alien to Saudi people and have never been accepted into the mainstream housing market. One of the main reasons for the alienation was the construction method with its reliance on the assembly of industrialised and prefabricated concrete components. According to residents, who did live in the houses from when they were first released onto the market in the early 1990s, these houses, and the neighbourhoods they were located in, were often looked down on and disparaged⁵²



Figure 5.21 Prototype villas under construction. Source: Allan Kenney and REDF Buraidah.

⁵² In an interview with one of Buraidah Public Housing residents.



Figure 5.22 Some of Makkah’s villas that have never been inhabited. Photos: authors.

Conclusion

The creation of new “model communities” in the 1970s using introduced prefabrication techniques revealed the government’s ambition to address housing shortages in the shortest possible timeframe. The size of the developments and the business opportunities they created in Saudi Arabia attracted leading architectural practices and international construction companies from all around the world. Saudi architects, on the other hand, tried to establish a clear explanation of vernacular and regional architectural characteristics in the hope that they would influence the design and construction of the apartments and houses. While the housing units built within each community exhibited various regional characteristics, they were very different to, and remained incompatible with, surrounding traditional residential architecture, due to their heavy reliance on prefabricated components and their Westernised design. The Saudi public housing projects built during the 1970s and 1980s did not attract many Saudi buyers. Many were first occupied during the first Gulf War by American soldiers and Kuwaiti refugees in the early 1990s. Interestingly, after this initial occupation, Saudi citizens became more interested in the houses and apartments and occupancy rates rose. Many of the Prototype Villas were subsequently heavily modified by their owner occupiers. In fact, the villas were sold with an instruction manual indicating how they could be extended and modified, however, this proved complicated as modifying precast concrete panels using hand tools is difficult and beyond most DIY builders.

Chapter Six | Occupying and Modifying Saudi Arabia's first Prefabricated Villas

Abstract

Neither the villas nor the apartments, highlighted in the previous chapter, were initially well accepted by the Saudi people for whom they were intended, and many remained unoccupied for several years following their completion. As a result, the campaigns did not continue and the mainly foreign building contractors who built them closed their concrete casting yards and left the country. Many of the villas were first (temporarily) occupied by American soldiers and Kuwaiti refugees, who came to Saudi Arabia during the first Gulf War in the early 1990s. When the soldiers and refugees departed, the villas became more desirable to local people and occupation rates increased. Perhaps anticipating the desire by Saudis to modify the villas, particularly by adding a second level, two user guides were prepared. The first detailed how to use the modern fixtures and fittings in the villas, and the second set out how they could be modified by adding a second level. This chapter looks at early experiences of living in the prefabricated concrete houses and then explores some recent modifications carried out by their owners. Despite the availability of a modification manual, these vary widely in their quality and function. They reveal, among other things, the difficulty homeowners faced when attempting to modify the tough and unforgiving prefabricated concrete construction.

Background

Between 1975 and 1985, the Saudi government built more than 25,500 housing units to alleviate the housing shortage that resulted from large-scale urban migration.¹ To achieve this they employed prefabricated concrete construction techniques to speed up delivery of these housing projects and to enhance their affordability. Apartments and semi-detached villas were provided through two main housing campaigns: Rush Housing and Prototype Villa. Both the apartments and villas shared a similar layout, in which the total liveable space ranged between 211 and 237 square metres. Each unit included three bedrooms as well as a living room, *majlis* or reception room, dining room, and kitchen.

After the apartments and the semi-detached villas were built, they stood empty for several years. There are several possible contributing factors for this. Some suggest that the government could not find an equitable way of allocating the housing units.² Another claim is that Saudi citizens did not like the design and construction of these units as it “posed a strong clash with the cultural traditions and religious beliefs.”³ In this regard the academic Yousef Fadan argues that:

If we measure the effectiveness of government housing policy in terms of increased number of housing units, then the Saudi policies have been successful; they did construct in a remarkably short period of time the highest number of residential units ever known in Saudi Arabia. But if the national effort is measured by its ability to provide

¹ *Dirast nataeg estetlaa araa alsakneen fi mashariee aleskan* [Residents’ Opinions About the Saudi Housing Projects] (Riyadh: Ministry of Public Works and Housing, 2001).

² Abdulaziz Al-Mogren, “Housing Surplus in Saudi Arabia: Observation, Recommendations, and Alternatives for the Use of High-rise Public Housing Projects,” (Master diss., The University of Pennsylvania, 1987).

³ Raeyd Aldakheel, “Residents’ Satisfaction with Public Housing; The Case of Buraidah Public Housing Development in Saudi Arabia,” (PhD thesis, The University of Michigan, 1995), 14. Also, see Major Christine Carbone Sandoval, “Strategic Military Intelligence Support,” in *Leaders in War: West Point Remembers the 1991 Gulf War* Ed. Frederick Kagan and Christian Kubik (Abingdon: Frank Cass, 2005), 92.

a decent home and a culturally suitable environment for every Saudi family, then much remains to be accomplished.⁴

The government was focused on producing large numbers of houses and apartments, and since there was no model or typology existing at that time in Saudi Arabia on which to base this, they chose a Westernised design model and construction method that had been used elsewhere in the world. Understandably, this met with market resistance from people who were very unfamiliar with this style of living.⁵ It is worth mentioning that, in addition to being constructed on the periphery of cities, during construction the new housing projects were surrounded by wire fences. While this is a standard practice in the West, it did add to the perception that the projects were isolated and separate from mainstream housing in the city's suburbs.⁶ At the time the housing projects were being completed, Saudi Arabia faced political and economic uncertainty and in the early 1990s the first Gulf War distracted the government from the housing shortage. Promoting the benefits of the new style of housing to the Saudi population was not a high priority.⁷

Modifying the Villas for American Soldiers and Kuwaiti Refugees

Many of the housing units were, in fact, first occupied in the early 1990s by Kuwaiti refugees and coalition forces during the first Gulf War.⁸ Surprisingly, it was commonly believed at the time that some of the 1970s Saudi prefabricated housing projects were built to “house allied troops during the Carter administration in the event that an invasion of Iran became necessary during the [Iran] Hostage Crisis.”⁹ This belief was

⁴ Yousef Fadan, “The Development of Contemporary Housing in Saudi Arabia (1950–1983): A Study in Cross-Cultural Influence Under Conditions of Rapid Change,” (PhD diss., Massachusetts Institute of Technology, 1983), 344.

⁵ “The Adventures of Harry Barber in OPEC Land,” *Progressive Architecture* (October 1976).

⁶ Based on an interview in 2019 with one of the long-term residents.

⁷ The Gulf War as an example started in August 1990.

⁸ Kim Murphy, “Iraq Bars Kuwait Men from Fleeing with Families, Slowing Departures: Exodus: Troops order males out of cars trying to cross the border into Saudi Arabia,” *Los Angeles Times*, 18 September 1990, <https://www.latimes.com/archives/la-xpm-1990-09-18-mn-600-story.html>

⁹ Chris Miller, “Life in Tent City,” *Operations Desert Shield and Desert Storm* (blog), 28 May 2006, <http://airlifter.us/storm/tentcity.html>

reinforced when United States Military coalition forces were accommodated in the unoccupied Kharj housing development, completed in the early 1980s. When the first Gulf War began, the Saudi government authorised the use of these unoccupied housing projects to accommodate both the American military and hundreds of thousands of Kuwaitis who flooded into the country. The Kuwaiti refugees were welcomed by the Saudi government and many public buildings were used to house them. Public school facilities, as an example, were used as temporary shelters. Additionally, the prefabricated housing developments at Buraidah, Qatif, Riyadh, Khobar, and Jeddah hosted thousands of Kuwaitis refugees for almost twelve months during the war. Before they moved in, the Saudi government furnished the housing units and installed air-conditioners.¹⁰ However, coming from a similar cultural background to most Saudis, the refugees did not fully grasp the idea of modern dwelling as “cooking fires were often built on the floor in rooms other than the kitchen, which damaged floor tile and interior paint.”¹¹ Traumatized by the war and worried about their future, the Kuwaitis did not look after the prefabricated housing units and “they left approximately one in five dwellings in poor condition.”¹² When the refugees returned to Kuwait, these houses and apartments required major repairs and renovations.

Kharj housing development, one of the first prefabricated housing developments built in the 1950s and located in an outer suburb of Riyadh, was – and some of it still is – a home for United States military personnel. While these army personnel generally only stay for short periods, living in the prototype villas within the gated compound clearly made a lasting impression. Lance Brender, who stayed for a few months in Eskan Village, which is a small part of the Kharj housing development and has been used as an American military compound since the Gulf War, writes that:

There seemed to be a spirit moving down the streets and in between the villas. It was a vague but very real melancholy. The room I am in right now seems to be filled with it. The diffuse equatorial sun coming

¹⁰ Murphy, “Iraq Bars Kuwait Men from Fleeing with Families, Slowing Departures: Exodus: Troops order males out of cars trying to cross the border into Saudi Arabia.”

¹¹ Aldakheel, “Residents’ Satisfaction with Public Housing; The Case of Buraidah Public Housing Development in Saudi Arabia,” 26.

¹² Aldakheel, “Residents’ Satisfaction with Public Housing; The Case of Buraidah Public Housing Development in Saudi Arabia,” 26.

through the window is muffled by the heavy, dusty curtains and the hum of the air conditioner, which are the only breaks in the otherwise cathedral-like hush of the villa. It's just like this all over the compound ... It's not that those places weren't beautiful, rather, it's that they were irrevocably complete. Nowhere in any of those places was there room for anyone to create anything new.¹³

These thoughts and feelings are perhaps the result of the monotony and sameness of the housing project, and also with the soldiers' "collective sadness, loneliness, and arrogance combined with the choking dust and the burning sun."¹⁴

A more positive experience of living in a prototype villa was recounted by one of the expat soldiers:

One beauty part of the house design was the roof. It was flat with a three-foot wall all around it. This made it possible to spend a lot of time on the roof sunbathing, playing catch, or whatever else you could come up with to kill time. There was also a small tower on each hootch we referred to as the "prayer tower", since it resembled the towers on the mosques throughout the country. Its real purpose was to hold the water heater as high as possible to allow the hot water to gravity feed into the house. We used to enjoy climbing the prayer tower during SCUD missile attacks in order to watch the light show when the Patriots took out the incoming missiles. One of the hootches even went so far as to build a swimming pool on their roof by making a ring of sandbags and lining it wit[h] canvas cut from a defunct tent.¹⁵

Despite the design of the villas being based on a Western model, they needed to be modified to accommodate the incoming soldiers and service men and women, some of whom brought their families with them. Cultural differences required the compound's management to make several modifications mainly to the inside layout of the houses

¹³ Lance Brender, "Eskan Village," *Swords and Pens* (blog), 5 March 2015, <http://yobousensou.blogspot.com/2015/03/eskan-village.html>

¹⁴ Brender, "Eskan Village."

¹⁵ Miller, "Life in Tent City."

and the way the units' spaces were organised and used. As most Americans preferred open plan living, the prefabricated house's living spaces needed to be opened up to each other. For example, what was originally designed as a designated closed male guest room was opened to the dining room by demolishing the wall between the two spaces. The new space became the living/dining area (Fig. 6.1). The original living room became an open kitchen (Fig. 6.2) with a middle island and breakfast bar. The original kitchen was reused as a laundry room. Additionally, one of the three bedrooms became a closet/office space. These are just some of the modifications made to the villas to suit the Americans' needs.

For the Americans and Kuwaitis, living in a prefabricated villa or apartment was a unique experience that did not last very long. However, their stay opened Saudi people to the opportunities this new form of housing offered. As a result, once the war ended and most of the Americans left and the Kuwaitis returned home, many Saudis started to purchase the houses and apartments, and occupancy levels rose significantly.



Figure 6.1 The new living/dining space inside one of the houses in the Eskin Village. Photograph by Kyrie Juchemich.



Figure 6.2 The original living space as it has been used by Saudis and Americans. Left: it became an American open kitchen with an island and a breakfast bar. Photograph by Kyrie Juchemich. Right: The Saudi living space with low-height seating. Photograph by Author.

User Guides & Manuals

To help Saudi families understand the benefits of the prototype villas, and to convince them of their suitability to the Saudi modern family, the government issued two different user guides and distributed them to the new Saudi occupants. In a similar fashion to the manuals that come with a new car, white goods and electronic equipment, the first manual, *Dalil Alskan Alirshadi* (The Resident's User Guide), comprehensively and precisely described the layout of the house, its method of construction, amenities, and other electrical and plumbing details (Fig. 6.3). Reading through the guide it is clear it was intended for people who had limited knowledge of modern housing and the technological systems within which it is produced and operates once built. After introducing and describing the neighbourhood, the user guide explains the prototype layout and spaces. Many pages are then devoted to teaching the residents how to use the light switches, air conditioners, washing machines, TV cables, water pumps, and sanitary wares. According to the housing authority, these newly introduced modern housing services and features offered in the prefabricated villas required detailed

explanation.¹⁶ For example, chapter three describes how the resident could turn on and off the water pump, air conditioner, and washing machine (Fig. 6.4). The guide also gave residents information on how to clean, repair, and change some of the house's appliances.



Figure 6.3 The two user guides distributed with the housing units. Left: *Dalil Alskan Alirshadi* [The Resident's User Guide]. Right: *Altamadud Almostaqbali Lvilla* [Future Expansion Plan]. Courtesy of REDF Buraidah.

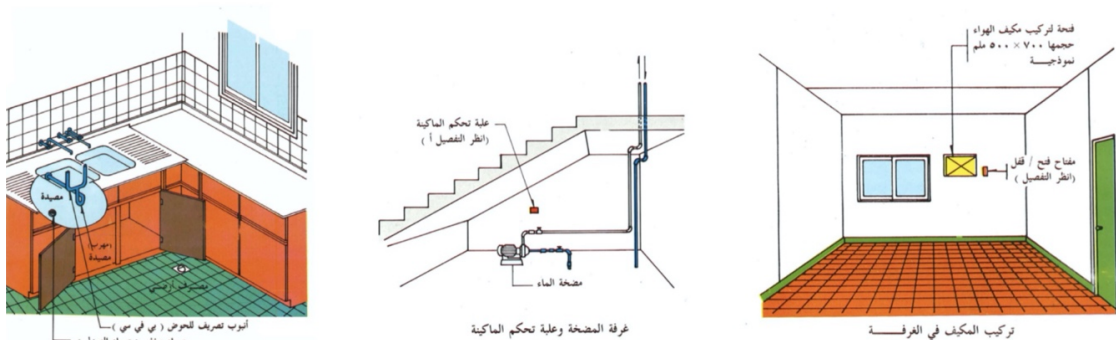


Figure 6.4 Examples of the descriptions within the Resident's User Guide. Source: *Dalil Alskan Alirshadi* [Resident's User Guide] (Riyadh: REDF, 1991).

¹⁶ Real Estate Development Fund, *Iskan Makkah Gir Almoktamil: Dalil Tawsiaat Aldar Fi Almostaqbal* [Incomplete Makkah Housing: A Guide for Future Expansion] (Makkah: REDF, 2011)

The second user guide, *Altamadud Almostaqbali Llvilla* (Future Expansion Plan), explains the method of precast concrete construction employed to build the villas, particularly their structural system, which was given special attention. The villas were constructed of prefabricated concrete components and approximately 90 percent of the wall panels were load bearing. This construction method and structural system were quite new in Saudi Arabia at that time, so were unfamiliar to most Saudis. Since the majority of the villa's prefabricated wall panels were load bearing, major alterations and additions to the villa layout needed to take this into account and the manual indicated that they should be minimal. The guide proposed that the semi-detached unit could be extended vertically by giving up the roof deck and building two bedrooms, a living room, and a bathroom as a second floor. According to the proposed layout, all walls built on the second floor must be placed on top of the load-bearing walls located on the ground floor (Fig. 6.5). The total living area was planned to increase from 225 square metres to 310 square metres. The additional storey was designed from the exterior in a way as to match the prototype style and ensure the continuity in the houses' façades (Fig. 6.6).

The guide aimed to ensure stability of the structure if a resident decided to expand the unit by providing structural and construction recommendations and guidelines. Yet to give some freedom of choice, and in an anticipation of potential scarcity of similar prefabricated construction components, the government supplied the residents with three different construction methods as alternatives for the future additions. The first used prefabricated panelling, the second in situ reinforced concrete, and the third lightweight, autoclaved, aerated concrete blocks which would be used to build load-bearing walls. These three alternatives shared the same design and layout and were to be followed in order to obtain modification and expansion permits.

Levels of (Dis)satisfaction

In 2002, the Ministry of Public Works and Housing conducted a national study to investigate the success of the Rush and Prototype Villa housing campaigns.¹⁷ The study investigated the residents' attitudes to the villa's user guides, revealing that approximately 75 percent of the people surveyed, which represented about ten percent of the total number of the residents of both Rush Housing and Prototype Villas, had used and benefited from information in the user guides.¹⁸ However, looking at the residents' modifications and extensions to their housing units reveals a different story. Many additions were built with no regard to the suggested construction method or architectural style. Rayeed Aldakheel, who investigated the residents' satisfaction in the Buraidah Public Housing Project, in 1995, claimed that:

Most satisfied informants agreed that the prototype was only flexible in material-related alterations (i.e., changing yard tile or bathroom fixtures), or adding a partial second floor within the framework of planned expansion guidelines set by the original designers ... Nonetheless, these informants did not follow these guidelines in their actual modifications.¹⁹

Since the houses became inhabited by Saudis in the early 1990s, many local architects and researchers have taken the opportunity to conduct architectural and socio-cultural studies. Seven different studies of the Villa Prototype Campaign and its various housing developments have been identified. The first study was a PhD dissertation conducted by Rayed Aldakheel in 1995,²⁰ and the most recent one was a Master's thesis in

¹⁷ The selected sample represented 10 percent of the overall 25,500 housing units the ministry built. Considering that Makkah and Madinah project were not included, more than 600 of the 6000 semi-detached prefabricated houses were surveyed and observed. For more see: *Dirast nataeg estetlaa araa alsakneen fi mashariee aleskan* [Residents' Opinions About the Saudi Housing Projects] (Riyadh: Ministry of Public Works and Housing, 2001).

¹⁸ *Dirast nataeg estetlaa araa alsakneen fi mashariee aleskan* [Residents' Opinions About the Saudi Housing Projects].

¹⁹ Aldakheel, "Residents' Satisfaction with Public Housing; The Case of Buraidah Public Housing Development in Saudi Arabia."

²⁰ Aldakheel, "Residents' Satisfaction with Public Housing; The Case of Buraidah Public Housing Development in Saudi Arabia."

geography completed by Iman Al-Khuraif in 2015.²¹ Aldakheel lived in the Buraidah Public Housing Project for six months just to study the residents' level of satisfaction after occupying and residing in the prototype villa for nearly two years. He found that about 70 percent of residents preferred their prefabricated, semi-detached villa over their previous traditional houses. His study also found that slightly more than 80 percent had already altered and expanded their houses within their first two years of occupancy.²² In 2001, Ali Bahammam, a Saudi architecture professor who specialises in housing studies, published a journal article about Riyadh's Prototype Villa projects, located in the Al-Kharj and Al-Jazeera neighbourhoods.²³ His study found that 25 percent of residents had modified the exterior of their houses in order to distinguish them from their neighbours. Around 90 percent of households surveyed revealed that their door was often mistakenly knocked on least once every month. To further Bahammam's study, a year later, Latifah Al-Mazroa studied Al-Kharj housing development in more detail, and her study showed that about 75 percent of the residents conducted various levels of modification to their houses.²⁴ The prototype villas at Al-Ahsa city were also surveyed and studied by Mohammed Al-Yousef in the same year.²⁵ He arrived at a similar conclusion to Aldakheel's study, finding that more than 88 percent of the houses in Al-Ahsa have been modified.

The concerns of scholars, architects and other social commentators about the level of (dis)satisfaction leading to modification within the various Prototype Villa housing developments were confirmed when the Ministry of Public Works and Housing published its national study in 2002. In regard to the Villa Prototype Campaign, the ministry study covered four different cities.²⁶ The study revealed that more than 70

²¹ Iman Al-Khuraif, "Al-Jazeera Housing Modifications and Its Underlying Factors in Riyadh City, Saudi Arabia," (Master Diss., King Saudi University, 2015).

²² Aldakheel, "Residents' Satisfaction with Public Housing; The Case of Buraidah Public Housing Development in Saudi Arabia," 184.

²³ Ali Bahammam, "The Residents' Alterations of their Dwelling Units' Appearance: The Case Study of Al-Jazeera Neighbourhood Housing Project and Al-Kharj Road Housing project, Riyadh, Saudi Arabia," *Journal of King Abdulaziz University: Engineering Sciences* 13, no. 2 (2001).

²⁴ Latifah Almazroa, "Public Housing in Riyadh City: Studying Residents' Satisfaction with Regard to their Housing Needs and Demands," (PhD Diss., King Saud University, 2002).

²⁵ Mohammed Al-Yousef, "Government Housing in Al-Ahsa, Saudi Arabia," (Geographical Diss., Kuwait University, 2002), 95.

²⁶ Makkah and Madinah cities were not included as they were not fully occupied when the ministry study was commenced

percent of the residents believed that the height of fencing and boundary walls was too low.²⁷ This in particular led to the majority of housing residents increasing the height of boundary walls using concrete blocks or corrugated metal sheets once they moved in.²⁸ The study also revealed that 66 percent of the residents did not appreciate having their units attached to their neighbours. This seems contradictory since traditional Saudi mudbrick courtyard houses were often adjacent and attached to each other on at least one side. Despite these concerns, the study revealed that the overall satisfaction level was high at 73 percent.²⁹

A few years later, and as the number of modified houses rapidly increased, researchers returned to question the residents' level of satisfaction and the Makkah housing development was also studied in 2011 after being partially occupied in the early 2000s.³⁰ In all of these focused research studies, several quantitative research methods can be found. For example, all of the studies aiming to explore the residents' satisfaction levels used quantitative research approaches by collecting data from a large group of residents without focusing on the prototype design or method of construction. Additionally, most of the studies attempted to identify common themes within residents' attempts to modify their houses without investigating the underlying causes for these modifications. The studies did not try to understand the residents' struggle to build onto and extend unforgiving precast concrete construction using low tech, on-site construction techniques. Nor did they approach the research from a theoretical point of view, for example by questioning how the widespread modifications could be seen and understood as an attempt to make industrialised mass housing more culturally appropriate.

²⁷ *Dirast nataeg estetlaa araa alsakneen fi mashariee aleskan* [Residents' Opinions About the Saudi Housing Projects].

²⁸ Bahammam, "The Residents' Alterations of their Dwelling Units' Appearance: The Case Study of Al-Jazzera Neighbourhood Housing Project and Al-Kharj Road Housing Project, Riyadh, Saudi Arabia."

²⁹ *Dirast nataeg estetlaa araa alsakneen fi mashariee aleskan* [Residents' Opinions About the Saudi Housing Projects].

³⁰ Yasser Qaffas, "User-Initiated Transformations of Public Housing in Kingdom of Saudi Arabia: A Case Study of King Fahad Housing Project in Makkah," (Master Diss., Heriot-Watt University, 2011).

Modification of Villas by Saudis

Modifications began almost as soon as Saudis started to occupy the villas. When they moved into the houses, they found them in need of modifications for cultural reasons, especially related to privacy. For example, the villas were designed with only one entrance from the street. Most residents immediately began dividing the house yard in two by building a wall, with a door in it (Fig. 6.7), to create a separation between male and female guests entering the house. In 2019 during a research visit to the Buraidah housing development, it was found that most houses which had a wall dividing their yard had the street door in the boundary wall open, a traditional sign of welcome. The second door placed in the dividing wall was usually closed to give privacy to the women's outdoor area when the street door was open (Fig. 6.7). The boundary and parapet walls of many houses had been raised to maintain privacy for women and girls when moving around the house yard and to ensure security. Compared to the sophisticated high-tech prefabricated concrete panels, the material used for these additions were low-tech and available locally. Residents mainly used hollow core concrete blocks or lightweight corrugated metal sheets (Fig. 6.8).



Figure 6.7 An example of the dividing wall. Photo by author.



Figure 6.8 Some houses which have raised the height of their boundary wall. Photos by author.

Residents' need, motivation, and creativity, combined with a lack of architectural training and building knowledge, also produced more complex housing extensions than were originally planned or expected. A recent visit to various Villa Prototype Housing projects revealed that a multitude of stylistic modifications, many built without approval from local municipalities, had been applied to the exterior of the villas (Fig. 6.9). As a result, the monotony created by replicating the same villa design to create neighbourhoods had been loosened up.³¹ The resulting additions created complex streetscapes with some houses still in their original condition and others being significantly altered. Moving around the developments, one could see very interesting additions to the original villas. Figure 6.9 shows some of residents' attempts to build additions to their houses.

Culturally driven modifications can also be observed in relation to toilets and bathrooms. In his study two decades ago, Aldakheel revealed that half of the surveyed sample at the Buraidah housing project changed their toilets from Western-style toilet

³¹ Municipalities were not satisfied with these unauthorised modifications and they have asked residents to demolish them. In some cases there were some disputes between residents and the municipalities. See: Mohammed Suliman, "*Inha Azmat 355 Mwatnana Khalifo Nizam Albina fi flal Aleskan* [Closing the case of 355 residents who have violated the building regulations in Makkah housing project]," *Al-Madina*, 23 May 2011, <https://www.al-madina.com/article/85923>.

to Eastern-style, squat toilets that most Saudis were more familiar with at the time.³² However, based on recent observations, the squat toilets have subsequently been replaced with Western-style toilets indicating a shift in attitudes to ablutions, bathrooms and toilets. Additionally, as the guest area originally lacked a suitable washing area outside the toilet, residents converted the small courtyard adjacent to the entry into an area for handwashing by installing vanities and basins (Fig. 6.10). Often water and wastewater pipes were exposed as it was almost impossible to conceal them inside the existing precast concrete panels.



Figure 6.9 Discontinuity of style. Within the housing developments one could easily see two semi-detached houses where each one would have different style and material. Photos by author.

³² Aldakheel, “Residents’ Satisfaction with Public Housing; The Case of Buraidah Public Housing Development in Saudi Arabia.”



Figure 6.10 Many residents installed these basins in the foyer to allow guests to wash hands without entering the toilet. Photo by author.

Functional retrofitting and alterations were also noted. For example, lack of storage space in the villa and unfamiliarity with the concept of a roof canopy led many residents to convert the canopy into a storage space, or an additional bedroom. To do so, they needed only to build two walls on the two remaining sides and a window on the building façade (Fig. 6.11). In many cases, a *Malhaq*, a room mainly used as a winter sitting area because it often contains a *Najdi*-style fireplace, was built in the small garden area located in the yard. While the *Malhaq*, as a living space was only introduced in Aramco’s Home Ownership and the Al-Malaz housing programs in the 1950s,³³ it was often the place where nostalgic feelings for the past were expressed. Its concrete walls were sometimes plastered with a mud-like render decorated in traditional patterns (Fig. 6.12). Some residents of the semi-detached villas even went to extremes in this regard as they painted the entire outside walls of their prefabricated houses with a special modern paint that resembles mud-render (Fig. 6.13).

Of the 10,500 villas built during the Prototype Villa Campaign, very few remain in their original condition. Having stood empty for several years after completion, many were initially altered by building contractors employed by the government to accommodate

³³ Mohammed Alshraim, “Annexes Phenomenon Within Residential Building: Establishment and Evolution,” *Journal of Architecture and Planning - King Saud University*, (2007).

US soldiers and other military personnel, and to house Kuwaiti refugees during the first Gulf War. This first wave of modifications was mainly to the interiors, for example opening up and changing the use of spaces and installing Western-style kitchens for the military personnel. For the Kuwaitis, minimal modifications were done before their arrival, mainly installing air conditioners and commissioning services and appliances, but significant repairs were required when they went home after the war. When Saudis started to occupy the villas soon after this, they almost immediately began another process of modification. For some this was minimal, raising the boundary wall or building a new wall in the yard to provide more privacy and a separate entrance for male guests. Others have been so extensively changed that the original villa is almost unrecognisable.



Figure 6.11 Two semi-detached houses. The one on the right converted the canopy to an additional room whereas the one on the left kept it as it is. Photo by author.



Figure 6.12 A resident accepted having his main guest room without windows just to have a *Malhaq* with traditional *Najdi*-style fireplace. Photo by author.



Figure 6.13 A prefabricated villa modified to look like a traditional mud-brick house. Straw is usually mixed with the paint to give the exact look of the mud houses. This paint became very popular in recent years in Saudi Arabia. Photo by Abdulaziz Alqahtani.

The second user guide, *Altamadud Almostaqbali Llvilla* (Future Expansion Plan), produced for the Saudi house owners which proposed designs for expanding the villa by adding a second level, was largely ignored. The guide also suggested three kinds of construction could be used for this upper-level extension. The first of these, precast panels produced by the factories that cast the original panels, was not an option as they had closed and the international companies that operated them had left the country after the initial build was complete. The two other recommended forms of construction; load-bearing walls made of poured in situ reinforced concrete or lightweight, autoclaved, aerated concrete blocks, were also mostly ignored. Most additions were built of poured in situ reinforced concrete frames infilled with locally available hollow concrete blocks. The system of load-bearing walls made of precast concrete panels was poorly understood by local builders and residents who mostly resorted to providing a reinforced concrete structural frame to support upper floor extensions. Reinforced precast concrete is also a particularly difficult material for the domestic and home builders to alter, by removing walls to open up spaces, for example. In contrast, the frame and infill form of construction was relatively widespread at the time and had become popular following its use in Aramco's Home Ownership Program in the late 1950s. Columns, beams, floors, and roofs were constructed from in situ reinforced concrete. Walls were made by infilling the concrete frame with hollow core, and in some cases, insulated concrete blocks. Columns were located in the corners of the spaces below as residents did not grasp the concept of load-bearing walls (Fig. 6.14). Additions of this type made many houses experience wall cracks and some houses became structurally unsound.



Figure 6.14 Example of the frame and infill system used which is relatively similar to one of the options advised by the government. Photos by author.

When the Buraidah housing project residents were asked about their use of construction materials they answered that the in situ construction method used for their additions was the only one available locally and that it was by far the cheapest and simplest option. The abundant supply of construction materials combined with the increasing affluence of the homeowners played a decisive role in how the villas were modified. Closure of the concrete casting yards meant that owners relied on available alternatives without considering the user guide's advice and instructions. Using precast for the additions would also have meant adhering to the designs proposed in the user manuals. When the residents were asked about the design of the addition, most revealed that it was designed by them with help from the contractor and without any involvement of a professional, practising architect. Curiously, many local architects and engineers were reluctant to modify and alter a prefabricated house. During the research fieldtrip some of the house owners did reveal that the residents had turned down a proposal from a national concrete prefabrication company which had proposed a mass-renovation plan to help the residents with their additions. In the early 2000s, the company proposed a plan to start producing matching precast concrete panels for residents to use during their additions. To make this viable, the company required that in order to start mass production of panels, at least ten households within each housing block needed to build the same additions at the same time. Residents rejected the company's proposal. There was a further attempt to help residents with their additions when a local architect Kamal Al-Qobali designed and constructed an expansion plan using load-bearing walls to prove that the technique proposed in the user guide, was achievable and could be cost-effective.³⁴ Al-Qobali in fact had already experimented in his approach on one of Madinah's prototype villas (Fig. 6.15). However, many residents did not like the design as it proposed a continuity of style and consequently perpetuated the monotony and sameness of the housing. Instead, the house owners continued with their individual approaches and designs. The houses presented in Figure 6.16 illustrate some of the ongoing modifications which were visited during the field work. In all of them, the owner was the main designer, site manager, and quality controller.

³⁴ "A Proposal to Establish a Real-estate Development Company to Construct Additions to the Housing Villas," *Aleqtisadiah*, 1 May 2009.

Changes and modifications made to the villas were quite different in nature to the continuous process of modification that has taken place in European cities and towns, over centuries, in some cases millennia. In reference to the latter, the Italian architect and theorist Vittorio Gregotti (1927–2020) wrote that “no new architecture can arise without modifying what already exists.”³⁵ According to Gregotti in relation to the European experience, the project as modification “tells us that each situation offers a specific truth, to be sought and revealed as the essence of the goal, and as the truth of both the site and the geography that embodies the site’s particular history,”³⁶ and that modification “must re-establish the original and symbolic act of making contact with the earth, with the physical environment, with the idea of nature as the totality of all existing things, through the constitution and reconstitution of a principle of settlement.”³⁷ Thus, the notion of belonging to a culture, a tradition, or a place, as he suggests, always “accompanies modification.”³⁸ In Saudi Arabia, building and urban traditions have an equally long history however the prototype villas and the new suburbanism that accompanied them, embodied a new and imported mode of living that created a rupture with the past. Initially at least, modifications to the villas tended to be tinged with nostalgia, harking back to more traditional times. In addition, some of the modifications were simply to allow continuity of and conformity with cultural and religious practices, particularly in relation to privacy and the traditional separation between male guests and the women and girls of the house. Gregotti frames two methods of modification. In the first, “the answer is mimetic, stylistic, seeking conciliation,” and in the other, the answer is “rather juxtaposition.”³⁹ Several residents tried to mimic the villa’s exterior style during their modifications, while the majority ignored it. Some went to extremes and added a completely new style and materials. What was interesting with all of their additions was the residents’ attempts to reconcile two different construction methods and materials in one setting: the existing prefabricated components and the in situ additions.

³⁵ Vittorio Gregotti, *Inside Architecture*, (Cambridge, Mass.: MIT Press, 1996), 67.

³⁶ Gregotti, *Inside Architecture*, 67.

³⁷ Gregotti, *Inside Architecture*, 71.

³⁸ Gregotti, *Inside Architecture*, 68.

³⁹ Gregotti, *Inside Architecture*, 69.



Figure 6.15 Al-Qobali's proposal to add a complete second floor. Courtesy of Al-Qobali Firm.



Figure 6.16 Examples of some ongoing modifications. Photos by author.

As a rule, most Saudis do not stray far from their family. Many extended families live together under one roof. This pattern of extended family living together in the same house or close by has been a key factor in most of the prefabricated houses' additions. The majority of residents have recently added a complete second floor to accommodate their expanding families. One claimed that "the only reason for the extension was to have my recently married son live with me in the house. I had to come up with a design solution to allow him to have the privacy he desires while having him around me."⁴⁰ To obtain this level of privacy, the owner added a second staircase adjacent to the exterior walls. The staircase was built using in situ reinforced concrete. The design approach and the use of heavyweight material clearly had impacted the quality of light and ventilation inside the house, as all windows were blocked from direct light and fresh air (Fig. 6.17). In contrast, another owner, who had a similar reason for his modification, approached this differently as he built a lightweight steel staircase in a different location and two metres away from the exterior walls, in the space originally nominated as the carpark. He then linked the new staircase to the existing roof level via a small bridge (Fig. 6.18). Caring for his family caused one of the residents to move from the villa as he stated, "I am currently building a new house to allow my son, who got married recently, to live in this house, as I would rather not to sell it to anyone."⁴¹ The resident had become very attached to his prefabricated house after living in it for more than 30 years. He claimed to be the first person to move into the neighbourhood and the first resident to add a second storey.

Affordability and financial struggles seem no longer to be an issue for the current residents, most of whom acquired the house approximately thirty years ago. Many have used very expensive materials to upgrade and modify their houses. Some of these materials were even more expensive than ordering customised prefabricated elements similar to the original precast concrete panels. The house presented in Figure 6.19 is an excellent example of the extent to which residents are prepared to modify their houses. The owner demolished one of the three bedrooms to expand the house yard and flipped the functions of the spaces to make the house layout works for him. Original bedrooms

⁴⁰ Based on an interview in 2019 with one of the long-term residents.

⁴¹ Based on an interview in 2019 with one of the long-term residents.

became sitting areas and the original living room became a dining area. The kitchen, dining area, and guest areas were opened to each other to create a single open space (Fig. 6.20). The exterior façade was covered with stone and marble. Large windows were inserted just for decorative purposes, as only less than 25 percent of its size was an actual bathroom window, the rest was fake. When the resident was asked about the inspiration for his attempt to modify the house, he stated that he tried to copy a house façade he had found online (Fig. 6.21).



Figure 6.17 Staircase blocking light and air on the house's ground floor. Photos by author.



Figure 6.18 Another resident who built an external staircase with use of light-weight materials to avoid blocking ground floor windows. Photos by author.



Figure 6.19 A prefabricated house covered by local stone and marble. Photo by author.



Figure 6.20 Living room is opened to the dining room and kitchen. Photos by author.

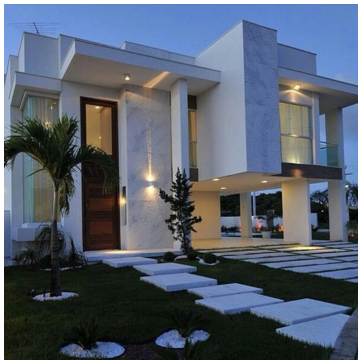


Figure 6.21 The source of inspiration for the resident. Source: homify.in

Conclusion

During the 1970s and 1980s, the Saudi government employed the latest international construction technologies to deliver a number of mass-housing projects. Companies from the US, Netherlands, Belgium, Germany, France, Turkey, and South Korea helped deliver more than 25,500 public housing units for the “average” Saudi family. However, once these housing developments were completed, they stood empty for several years. Initial resistance to purchasing and living in the prefabricated villas in particular, reveals how Saudis perceived imported housing models and forms, and the severe prefabricated construction from which they were made. The many failures of modernist mass housing, particularly its material nature, have been well theorised and documented. For example, the art historian Tim Benton has written a detailed critique of the two housing estates at Lège and Pessac in Bordeaux designed by Le Corbusier for the industrialist Henri Frugès during the 1920s. Benton suggests that “failure” is the word most often used to

describe Pessac as it was a disaster in “every material sense.”⁴² He suggests that “the estate provides visual evidence to this day of two apparently contradictory values: Modernist formal perfection and messy adaptability to human use.”⁴³ In the 1920s, Corbusier was attempting to overturn traditional ways of living and building. At Pessac for example, he trialled a method of wall construction using a new, highly specialised and very expensive gun developed by the American company Ingersoll Rand to spray concrete onto reusable timber shuttering. This technique caused many problems and was soon abandoned. In the end most of the houses were built of concrete breeze blocks manufactured on site and then carefully rendered by skilled tradesmen to achieve a “machine-made look.” Actual industrial production and prefabrication of the houses was minimal: they were mainly built by hand. There are of course many other modernist agendas evident at Pessac that revolve around Le Corbusier’s vision of standardising and industrially producing the family home.

While many analogies can be drawn between Pessac and the prototype villas in Saudi Arabia there are also many differences, particularly in relation to the cultural context of the projects and their construction methods and techniques. In the fifty years between Pessac and the Prototype Villa Campaign, industrialised construction techniques had progressed significantly. Le Corbusier could only have dreamed of using the precast concrete casting technology available to the Saudis. Also while there was no doubt the Saudi government saw the Prototype Villa and Rush Housing campaigns as a means of providing modern houses and apartments and creating modern cities and suburbs, their motivation lacked the ideology of the radical reform of society, apparent at Pessac. Another significant difference is that when the Saudis started to occupy the villas, they were provided with a manual setting out how they could be extended. While the extensions recommended in the manual were largely ignored, it effectively encouraged the house owners to think about how the villas could be changed to accommodate their desire to make them more in tune with their notions of house and home. At Pessac, altering and extending, particularly the exterior of the house, was discouraged. Despite this, significant alterations took place and as Tim Benton points out:

⁴² Tim Benton, “Pessac and Lège Revisited: Standards, Dimensions and Failures,” in *Massilia: anuario de estudios Lecorbusierianos*, ed. Josep Quetglas (Barcelona: Edición Fundación Caja de Arquitectos, 2004), 85.

⁴³ Benton, “Pessac and Lège Revisited: Standards, Dimensions and Failures,” 65.

The estate at Pessac today presents fascinating contrasts of decay and conservation, of adaptation to satisfy owners' needs and tastes (flexibility or vandalism?) or upholding of the architect's vision (keeping the faith or sterile formalism?)... It is impossible to visit ... without engaging in the polemics of Modernism. Is it a success because Le Corbusier's Modernist vision is now finally being vindicated? Or is it more successful as a demonstration of the ability of Modernism to respond flexibly to popular taste and individual needs? Was it a victory for standardisation or for individualisation?⁴⁴

A similar sentiment could be expressed when visiting the prototype villas thirty five years after they were constructed. Some are in original condition whereas the majority have been transformed by their Saudi owners to a greater or lesser extent. In addition to making alterations to accord with cultural and religious requirements, many modifications have been made to personalise and differentiate their house from its neighbours. Understandably, given the tough and unforgiving precast construction of the original building, most modifications built by local builders with locally available materials and without professional input from an architect, subverted the dominating uniformity of villas. These modifications created complex streetscapes with references to and sampling of many other buildings both vernacular and contemporary.

⁴⁴ Benton, "Pessac and Lège Revisited: Standards, Dimensions and Failures," 86.

Conclusion

Research towards this PhD was initially motivated by the desire to better understand current plans by the Saudi government, issued through the Ministry of Housing, to build nearly 1.5 million affordable, public houses over the next few years. The centrepiece of this housing strategy is the deployment of high-tech construction techniques, with 3D printing as an example. To this end, prototype display houses have been printed, and more are planned, to give Saudis the opportunity to experience, albeit briefly, what it would like to be to live in a house of this nature. Given the high stakes of this venture, it is important to try to understand how 3D printed houses will be received by the house-buying Saudi public. To achieve this, it seemed sensible to look back at the origins and history of previous technologically motivated housing projects in the Kingdom. The obvious place to start was with the discovery of oil in the late 1930s, just over 80 years ago. Before this momentous event, houses were constructed according to long-standing traditional methods by local builders and craftsmen. They embodied regional differences and a strong connection to place. Since then, Saudi housing and urbanism have been largely transformed and bear little resemblance to traditional modes of building and city planning. Regional differences are also no longer distinguishable in buildings, towns, and cities; they are predominantly modern and contemporary. This is in no small part due to government initiatives to build large-scale, affordable public housing projects. As this thesis has revealed, this has not been straightforward and there are many lessons to be learnt from studying key schemes, projects, and threshold moments from both technological and qualitative perspectives. While these housing projects may not account for the majority of the housing in Saudi Arabia, they paved the way for the uptake of non-traditional and largely imported housings types, styles, and construction methods.

The thesis revealed that providing public housing in Saudi Arabia that is liked and accepted is complex and its success requires an understanding of many issues beyond the purely technological. As some of the case studies examined in this thesis show, the focus on innovative construction as the main consideration for delivering housing projects limits the ability to provide houses that are culturally appropriate, and which embody architectural qualities beyond what might be called function and practicality. They also demonstrate that historically, reliance on imported designs and construction techniques may decrease acceptance and take-up of the housing. The slow acceptance of previous schemes indicates that Saudis have been sceptical about housing that has embodied imported ideas about how they should live, and have distrusted imported construction techniques and materials, including prefabrication. While the Saudi experience is unique, there is value in placing it within an international context, allowing it to be understood within broader geopolitical trends and forces. The thesis also places the design and construction of affordable, industrialised housing in Saudi Arabia within the larger architectural frame of European, North American and Australian trends and movements, particularly architectural modernism and its obsession with the industrialisation of housing construction.

This thesis is the first substantial body of research that reveals a close link between the importation of prefabricated buildings into the oil compounds and the subsequent dramatic changes that occurred in housing and urbanism beyond the compound fences. Until now, the proliferation of modern, contemporary housing in Saudi Arabia has not been linked to the influx of imported housing technology and the modernist thinking of which it is a manifestation. This is probably because the imported houses were made of lightweight materials, mainly timber, and regarded as for temporary use only, whereas all housing subsequently built outside the compounds was either in situ or prefabricated concrete construction. Nevertheless the link with the architecture of the oil fields is unequivocal, it was Aramco and their American architects who initiated the first modern housing outside the compounds through the Aramco Home Ownership Program. The government-sponsored Al-Malaz scheme soon followed and this opened the floodgates for the rapid construction of thousands of public houses, which in turn set the scene for the design and construction of housing more generally within the country. The Al-Malaz housing became the model for contemporary Saudi residential architecture.

Saudi Arabia's towns and cities are now unrecognisable compared to their traditional predecessors of less than a century ago.

While Al-Malaz, as a new model for housing and the (sub)urban forms and layouts that accompanied it, was reasonably quickly accepted, Saudi's first heavyweight prefabricated housing schemes, were not. This included both high-rise apartments and single storey semi-detached villas. When Saudis eventually occupied the villas, they very soon began to modify them to suit their cultural, social, and religious needs. In anticipation of this, houses came with a manual which, among other things, described how they could be modified by adding a second storey. Generally, recommendations in the manual, which took into account the loadbearing structure of the building and its precast concrete construction, were ignored and modifications varied widely in their plan, structure, and construction materials and methods. One option for adding a second storey was to order new panels designed and manufactured for this purpose by the company that built the original house. However, by the time modifications began most of these companies had closed their precasting yards and left the country, so this was not an option. Instead, owners and residents designed the additions and alterations themselves and used local builders and locally available materials. Poor understanding of the loadbearing nature of the existing prefabricated walls led to additions being made by building columns, beams, floors, and roofs using in situ reinforced concrete, and walls using hollow-core concrete blocks. As a result, some houses became structurally unsound and were abandoned. Some are now in ruins. In addition, modifications display a disconcerting assortment of styles and construction materials including attempts to (re)introduce traditional and vernacular elements. Visiting and walking through Saudi's 1970s–1980s housing neighbourhoods is to experience a collection of incongruous architectural styles and materials, dotted with ruins and incomplete additions and modifications.

Research for this thesis has highlighted and acknowledges the difficulty of providing culturally and socially appropriate, industrialised mass housing in Saudi Arabia on the vast scale required to alleviate housing shortages. It suggests caution when promoting a technologically utopic solution based on lower costs, speed of construction, efficiency, and the reduction in labour required for construction. The history of attempts to make houses in factories and to industrialise their production has many examples of

schemes of this nature which have failed. The language and optimism of companies and specialists currently promoting 3D printing as the solution to the global housing shortage is remarkably similar to those involved in previous attempts do the same thing since the early twentieth century. Such schemes are understandably resisted by the house-buying public who are naturally cautious about living in a building that is a technical novelty, without familiar architectural qualities with which they can identify.

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