

Alexander Houses x 7: Steel Prefab in the Low Desert

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ABSTRACT: In an age of increasing globalization, there is a rising need for affordable, livable and humane sub- and non-urban housing. The intent of this research is to uncover the principles, strategies, methods and material means of the Alexander Houses, seven mid-century modern houses in the low desert of the Coachella Valley in California, in an effort to re-establish novel solutions for addressing the need for durable, low-maintenance, economical and inspired housing.

KEYWORDS: Prefabrication, Steel, Housing, Modern

INTRODUCTION



Figure 1: Prefabricated Steel Erection and Construction, Steel Houses, Donald Wexler, 1962

In 1962, architects Donald Wexler and Richard Harrison in collaboration with structural engineer Bernard Perlin of Calcor introduced a novel all-steel system for the prefabrication of thirty-eight 1,400sf (130 sm) affordable houses suitable for a low desert ecology. The planned tract of 38 prefabricated houses was never completed. Shortly after the first seven 'models' were built, the price of steel increased and the builder cancelled the project. During the 1970's and 80's, the all-steel houses were largely forgotten and fell into disrepair. In the 1990's, the houses were rediscovered and in 2001 were granted Class 1 Historic Site status. Through historical research and recent field visits, this paper suggests the Alexander Houses have much to teach us about integrated design, affordability, and construction of modestly-sized, low-cost, low-maintenance, highly durable houses.

1.0 EARLY PREFAB INFLUENCES FROM CHICAGO

1.1 Howard T. Fisher

Howard T. Fisher, FAIA (1903-1979) was born in Chicago, the son of Walter Fisher, Secretary of the Interior under President Taft. A graduate of the Asheville School in North Carolina (1922), Fisher attended Harvard College and then enrolled in the School of Architecture at Harvard University, graduating in 1928.¹ Three years later Fisher opened a solo practice, and in 1932, founded General Housing, Inc., a pioneering firm in the development of prefabricated housing. The firm designed, sold and erected low-cost, high-quality prefabricated homes using mass production methods that integrated design, manufacturing, and marketing of simple houses in a single package.

General Houses, Inc.'s first house was erected in 1933. A typical General Housing steel two-bedroom house cost \$4,500 (\$110,000 today). Fisher's original patented construction system used pressed-steel panels for walls, roofs, and floors, set on a concrete foundation². After the foundation was cured, a crew of unskilled laborers could put a house together in about two weeks.³ The houses were composed of a coordinated system of prefabricated steel-framed modular panels, of which there were eight kinds: solid, small window, large window, glass, entrance door, kitchen door, double doors, and a fireplace. All of the panels were four feet wide and all were nine feet high except for the fireplace panel, which was taller. A garage door panel

was the same height as the other panels but twice the width. As modules, the panels could be assembled in a wide variety of configurations to suit individual clients and specific sites.⁴ General Housing was invited to display two model homes at the 1933 Chicago World's Fair whose theme was "A Century of Progress," celebrating innovations in architecture, science, technology and transportation. Fisher's prefabricated "steel cottages" attracted thousands of visitors.

1.2 Homes of Tomorrow



Figure 2: Promotion, Homes of Tomorrow



Figure 3: General House, Chicago World's Fair, 1933

At the 1933 Chicago World's Fair, twelve model houses demonstrated modern building methods, materials and techniques in the "Homes of Tomorrow" Exposition. The exhibition was one of the most noteworthy exhibits of the Chicago World's Fair, showcasing modern innovations in architecture, design, and building materials. Prefabrication and the use of new building materials were intended to showcase affordable house options to families with limited means. Several architects and firms used the model homes to demonstrate their prefabrication techniques and use of new materials. All but two houses featured flat roofs and at the time were considered "radically contemporary." In one case, Rostone, a type of manufactured masonry composed of limestone, shale and alkali that could be molded into specific shapes and produced in various colors, demonstrated affordable and durable home construction options.

Twelve Houses Showcased in Exhibition

Weiboldt-Rostone House	Armco-Ferro House	General House
Stran-Steel House	House for Brick Manufacturers	Design for Living Home
House of Tomorrow	Florida Tropical House	Cypress Log Cabin
Masonite House	American Forest House	Universal Houses' Country Home

After the exposition ended in 1934, developer Robert Bartlett purchased five of the houses: the Wieboldt-Rostone House, the House of Tomorrow, the Florida Tropical House, the Cypress Log Cabin, and the Armco-Ferro House. He then proceeded to load them on barges and floated them across Lake Michigan to Beverly Shores, Indiana. The five houses continue to reside on the shores of Lake Michigan in what is now called the Century of Progress Architectural District.⁵

1.1 Edmund Lindop

Edmund Lindop (1901-1968) was born in Chicago and like his father worked in the real estate business. Lindop became aware of the work of architect Howard Fisher and his 1930's prefabricated steel house manufacturing company, General Houses, Inc. Hoping to become a developer, Lindop took his "development dreams" and his family to Los Angeles in 1936. Soon thereafter, he acquired a tract of land in the Coachella Valley where he hoped to develop a neighborhood of steel houses.

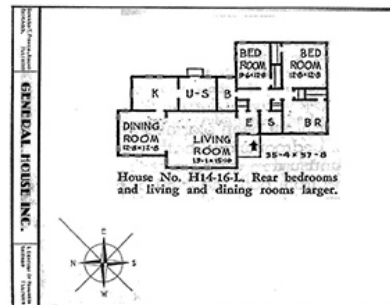


Figure 4: Edmund F. Lindop Residence, Prefabricated Steel House, Howard Fisher, Architect, 1937

Lindop built a single 3 bedroom, 2 bath steel-frame, factory-built model home consisting of 1,750sf (165 sm). On November 20, 1936, an article in The Desert Sun entitled, "Steel House Now Being Erected," described the unveiling:

"Every part of the house is made by mass production in the factory. The steel frame bolted together and compressed asbestos panels on the outside as well as heat and cold resisting fireproof materials for the roof, form a building that is both earthquake proof and fireproof. Inside walls are of plyboard and both inside and outside walls are finished in any color desired."

But the single-family "model house" was not a financial success. The Lindop family used the model home as a weekend residence until it was sold in 1946 to Charles Stern who commissioned a compatible garage addition to the property in 1947. Beginning in the 1980s the home was owned by Barbara Black, former wife of architect Michael Black. The Lindop House changed hands most recently in 2010.

2.0 THE LOW DESERT

2.1 Context, Climate and Site

Palm Springs, California lies at the foot of Mount San Jacinto, which rises to 10,804 feet (3,293 meters) in the Coachella Valley of southern California, located 100 miles east of Los Angeles. The area was originally inhabited by Cahuilla Indians and known to the Spanish as Agua Caliente or "Hot Water" for its hot springs. By 1872 Palm Springs had become a stage stop between Prescott, AZ and Los Angeles, CA. The dry climate produces 300 days of sunshine and around 4.83 inches (122.7 mm) of rain annually. In 1884 Judge John Guthrie McCallum established the Palm Valley Colony on the site, which later developed as a model desert resort with vast recreation areas for swimming, tennis, golf, hiking, and skiing. Today, the city has a population of approximately 48,000 residents and includes within its boundaries parts of the Agua Caliente Indian reservation.

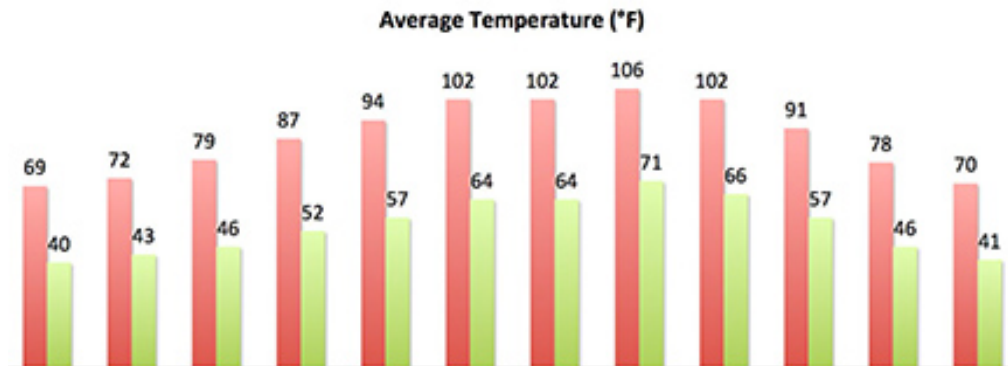


Figure 5: Average Temperatures, High and Low, Palm Springs, CA

The winter months are warm, with a majority of days reaching 70 °F (21 °C) and in January and February days often see temperatures of 80 °F (27 °C) and on occasion reach over 90 °F (32 °C), while, on average, there are 17 nights annually dipping to or below 40 °F (4 °C). Summer often sees daytime temperatures above 110 °F (43 °C) coupled with warm overnight lows remaining above 80 °F (27 °C). The mean annual temperature is 74.6 °F (23.7 °C). There are 180 days with a high reaching 90 °F (32 °C), and 100 °F (38 °C) can be seen on 116 days.

3.0 ARCHITECTS IN THE LOW DESERT

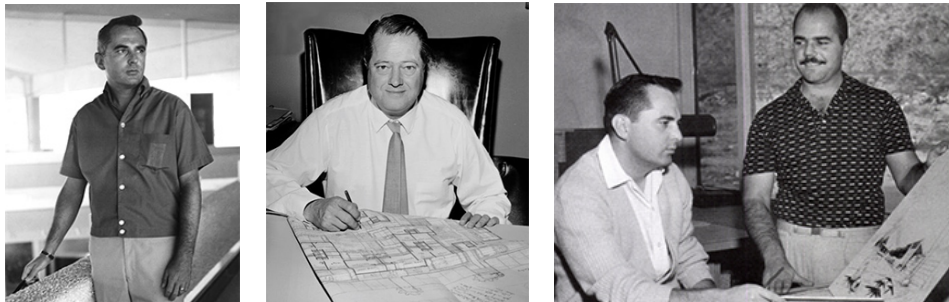


Figure 6: Donald Wexler, William Cody, and Wexler and Harrison

3.1 Donald Wexler

Donald Wexler, FAIA (1926-2012) was born in Sioux Falls, South Dakota. He moved to and was raised in Minneapolis, Minnesota. After serving in the Navy from 1944 to 1946, he attended the University of Minnesota on the G.I. Bill and graduated in 1950 with a degree in architecture. Following graduation, Wexler moved to Los Angeles and worked as a draftsman for Neutra & Alexander. It was here under the tutelage of Richard Neutra that Wexler learned modern design derived from its responsiveness to dynamic environmental, technological, and material conditions. For Wexler, adaptability and flexibility became prominent values inherent in the conception of architectural space, systems, and materials. Working with Neutra & Alexander is where Wexler first gained interest in working with steel framing.⁶ Wexler would soon become one of the mid-century pioneers in the exploration of prefabricated all-steel modular design in the low desert. After working for Neutra & Alexander, Wexler took a job with architect William Cody.

At Cody's office, Wexler did the working drawings for a country club in Rancho Mirage. According to Wexler, "It was a job with Bill Cody working on Tamarisk Country Club. Once that project was over I didn't want to leave. I just fell in love with the community -- this was in '52. It was a very small community at the time, maybe 7,000 people. It closed down for four months in the summer -- there was nothing here. There were no doctors, no dentists. The first year there was one restaurant open. In the middle of July the safest place in the world to go to sleep would have been in the middle of Palm Canyon Drive at high noon."

3.2. William Cody

William Cody, FAIA (1916-2078) was born in Dayton, Ohio. His mother was an interior designer who had a passion for art and architecture. In 1930, the Cody family moved to Los Angeles and Cody would later enroll in the College of Architecture and Fine Arts at the University of Southern California, graduating with a degree in architecture in 1942. A year later, Cody worked for Kaiser Steel on the design of modular steel institutional buildings. In 1944, Cody worked for Cliff May on his "Pace Setter House," one of many exhibition houses sponsored by House Beautiful that proposed a new "livable modernism" for postwar America. Cody won a commission to design the Del Marcos Hotel in Palm Springs, and shortly thereafter set up practice there in 1950. Working in William Cody's office is where Wexler met Richard Harrison.

3.3 Richard Harrison

Richard Harrison, FAIA (1924-2012) was born in Los Angeles, California. Like Cody, Harrison is an architecture graduate of the University of Southern California. Following graduation and travels to Mexico and Canada, Harrison accepted a job to work for William Cody in Palm Springs, where he met and worked side by side with Donald Wexler.

3.4 Wexler & Harrison

In 1952, Donald Wexler and Richard Harrison formed Wexler & Harrison, an architectural firm that operated through 1961. The office designed schools, banks, offices and houses. The Lilliana Gardens Glass House of 1954 was the first custom house by Wexler & Harrison.⁷ Wexler was 28 years old. The distinguishing architectural elements of the house included wood beams that run the length of the house, high windows that flood the space with light and a central atrium filled with cacti and succulents, assuring that famous "indoor-outdoor" feeling.

4.0 STEEL AT WORK



Figure 7: Perlin and Wexler, Steel School, 1958



Figure 8: Perlin Residence, 1960

4.1 Steel Schools

The first steel-framed systems produced by Wexler & Harrison consisted of light-gauge structural steel frame, steel roof decking and insulated wall panels for schools. These elements comprised the basic structural modules which, when bolted to a concrete slab, formed the permanent structure. Since the units were lightweight and structurally independent, they could be relocated. The wall panels were designed in 8-foot modules, allowing flexibility in the placement of doors and windows, and feasibility of expanding the size of the structure. This pre-fabricated modular classroom system was later expanded and used with houses. While there were many factors for building lightweight steel-frame buildings for residential purposes, it was the need to create housing for veterans in the postwar period combined with the desire of the steel industry to break into the residential housing market that eventually made it feasible to produce pre-fabricated modular steel-framed houses on a large scale. As U.S. demand for more than one million new houses each year, wood-frame construction was insufficient to meet the demand. The first steel-framed house attempted by Wexler & Harrison was the Bernard and Adele Perlin Residence of 1959-1960 in Los Angeles.

4.2 Bernard Perlin

Engineer Bernard Perlin was working for Calcor, a Los Angeles-based steel company, and knew of Wexler's steel schools. Perlin commissioned Wexler to design his own steel house on a hillside site in Los Angeles. The single-story, 3,500-square-foot house was almost entirely steel and glass, supported by structural steel panels that also served as walls. Steel beams support the steel roof decking and are used for both structure and cladding. According to Perlin, "There's nothing that's not steel in our house other than the cabinets. It's relatively maintenance free. Pictures are hung using magnets, not tacks. I painted it twice."

4.3 Alexander Houses

The completion of the Perlin residence was followed by a decision to expand the concept to develop a subdivision of thirty-eight single-family steel 'tract' houses in Palm Springs.

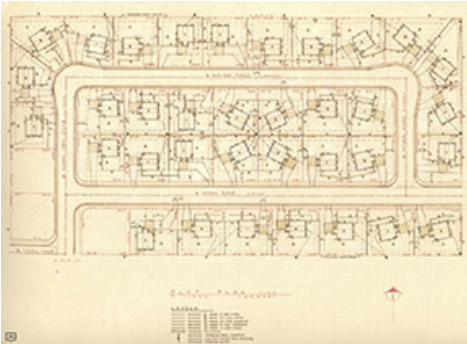


Figure 9: Early Site Plan, 1959



Figure 10: Aerial View, 2017

Originally known as the Calcor Prefabricated Homes, the all-steel houses took one month to build. The tract was to be developed in stages. Between 1961-1962 seven houses were constructed through a joint research program involving Wexler and Harrison, Perlin, a sponsorship by the Columbia-Geneva Division of U.S. Steel, and Alexander Construction Company. The system used light-gauge structural steel and prefabricated panels and flat or folded roofing. U.S. Steel and Bethlehem Steel were hoping to develop new markets for their products, especially in the housing sector. The single-level prefabricated affordable steel houses consisted of floor-to-ceiling windows and glass sliding doors that united indoor and outdoor spaces.

4.4 Rheemetal Steel Home System

The Alexander Houses employed the Rheemetal Steel Home System, including exterior walls, roofs, fascia, and trim. The package was trucked to the site and assembled by the Alexander Construction Company.



Figure 11: Rheemetal Steel Home Construction System

Fewer than 30 days were required to assemble, from breaking ground to completion. The curing of the concrete slab and the interior finishes took more time than the assembly of the metal shell. All rooms featured full-height sliding glass doors that opened onto exterior living spaces and swimming pools. Cantilevered overhangs afforded by the steel construction provided necessary shading.

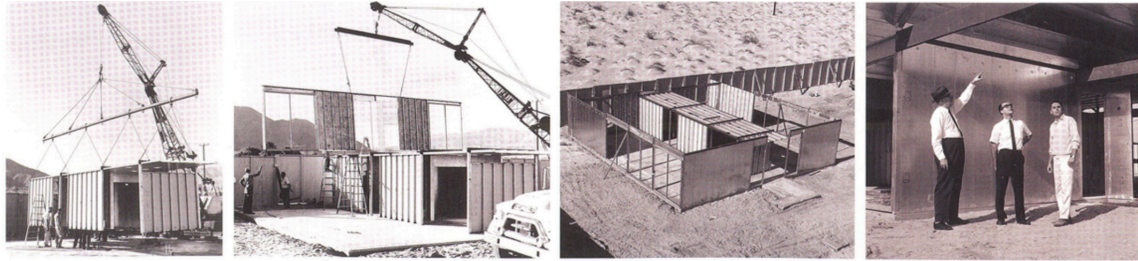


Figure 12: Prefabricated Steel Erection and Construction, Steel Houses, Donald Wexler, 1962

4.5 Calcor

With U.S. Steel and Bethlehem Steel partially funding the project as part of a concerted effort to expand into the residential market, the wall modules consisted of an outer layer of light-gauge galvanized steel, a hollow core with gypsum board and fiberglass insulation, and drywall.

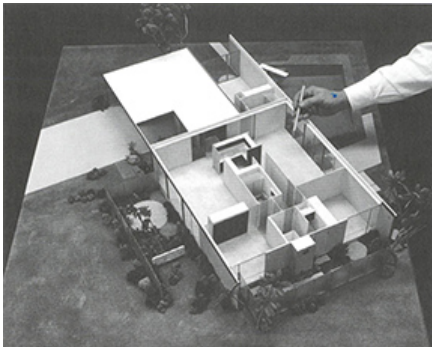


Figure 13: Alexander House, Model

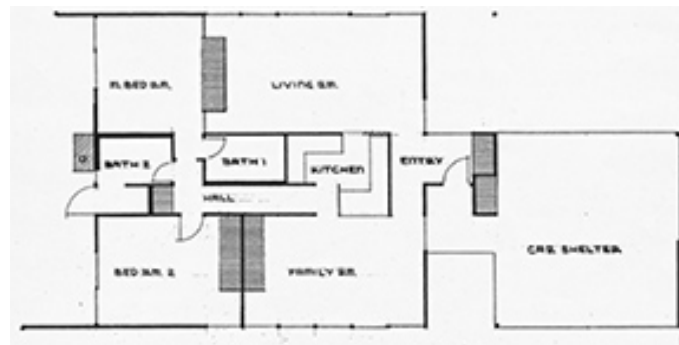


Figure 14: Alexander House, Floor Plan (2 bed, 2 bath)

The 9-by-36-foot central core (kitchen, bathrooms, laundry room, central hallway, and mechanical runs (electrical, ductwork) were prefabricated off-site, trucked to the site, and lowered onto a concrete slab by crane. The outer rooms were assembled around the core using the prefabricated steel panels, which were fit into a track template in the slab, interlocked, and bolted. The roof, also light-gauge steel, was then overlaid and bolted, supported both by the central core and the outer load-bearing steel panels. Each major room featured 8-foot-high sliding and stationary glass panels. Outer structural assembly took 3 days. Calcor's kit of parts used interlocking 16-inch wide steel panels ranging from 18-22 gauge with 3-inch flanges or ribs at each end. The panels, typically spanning 13 feet, were screwed, pop-riveted or bolted together and placed into a steel channel raceway inset into the concrete floor slab to hold the walls. Identical roof panels received steel tabs every three panels to hang ceilings and mechanical runs. Where columns were needed at openings or corners, instead of electing more expensive hot-rolled structural steel, Calcor employed the systems galvanized cold-rolled steel for hollow square tubes with 3/16-inch thick walls. The tubes were also used to drain roof water, which would be prohibited today due to fire rating regulations. Insulation consisted of drywall pieces set into the cavities overlaid with fiberglass batt and an added 1/2-inch thick drywall, which deadened the sound of the light metal building. The exterior walls and factory-built 9-by-36 foot core of the two bathrooms and a kitchen supported the roof, permitting flexible interior configurations. Wexler & Harrison animated the site plan by flipping floor plans and orienting the houses differently. Different roof configurations further individualized the modest orthogonal buildings.



Figure 15: Steel House #1: Construction Photo and Completed House from Simms Road

4.6. Principles, Strategies, Methods and Materials

The experimental Alexander Houses offer numerous advantages to home construction standards and quality measures as compared with more conventional uses of on-site, wood-framed construction with high labor costs, poor and uneven construction quality, low durability, high maintenance and high building depreciation. The manner in which Wexler & Harrison conceived, designed and built the seven all-steel houses hold several valuable characteristics as robust prototypes for the design of future urban and sub-urban housing:

Construction Characteristics

Pre-engineered Design
 Off Site Prefabrication
 Quick On Site Erection Time
 Highly Durable Materials
 Very Low Maintenance
 Economical, Value Appreciation

Design Characteristics

Integrated Design
 Indoor and Outdoor Relationships
 Daylight and Shade
 Adaptable and Flexible
 Structure and Form
 Precision and Modest

Impervious Characteristics

Heat
 Warping
 Rotting
 Swelling
 Termites
 Fire

But the question remains: If the all-steel prefabricated system has all of these positive characteristics, why haven't more all-steel houses been produced since the mid-60's? There may be several reasons: 1) profit margins – as demand for wood construction rises, the construction cost drops and profit margins rise; 2) unions – powerful construction unions are typically averse to prefabricated systems in the housing market; 3) new techniques – novel construction techniques are difficult to overturn conventional norms.

5.0 Alexander Houses Today

(photos by C Jarrett)



Steel House #1: 290 E. Simms



Steel House #2: 3125 Sunnyview



Steel House #3: 3133 Sunnyview



Steel House #4: 3165 Sunnyview



Steel House #5: 300 E Molino



Steel House #6: 330 E. Molino



Steel House #7: 3100 Sunnyview

6.0 CONCLUSION

The all-steel Alexander Houses represent an important chapter in the history of American modern architecture. They demonstrate an effort to re-establish novel solutions for addressing the growing need for durable, low-maintenance, economical, low-rise, light-weight, and inspired prefabricated housing. According to author and critic Alan Hess, the steel houses "moved beyond a custom expression of the modern machine to actually incorporate the assembly line processes and mass production that were the essence of modern technology." In 2001, all seven steel houses were registered Class 1 Historic Property status. In 2012, U.S. Department of the Interior recognized Steel House No. 2 in the National Register of Historic Places, making it the first midcentury structure in Palm Springs to be so designated.

In 2000, Donald Wexler sold his firm to WWCOT, based in Southern California, with offices in Riverside, Los Angeles. In 2004, Wexler was named a Fellow of the American Institute of Architects. Five years later, in 2009 Wexler was the subject of a documentary titled *Journeyman Architect: The Life and Work of Donald Wexler*. In 2010, with increasing numbers of mergers and acquisitions during the recession, WWCOT merged with the large mid-west firm DLR Group. In 2015, the DLR Group won the commission to design the new football stadium at UNC Charlotte.

REFERENCES

¹ Who's Who in America, 40th edition, 1978-1979

² The General Houses, Inc. building system was the subject of U.S. patent 1,969,125 issued August 7, 1934.

³ Fisher's company was considered the "Next Big Thing."

⁴ "Our Homes," advertising brochure published by General Houses, Inc., editors J. Eugene Armes, Ruth Fisher, and P. D. Paddock, Chicago 1934. One house built by General Houses was built on the side of a hill, three stories, with the living room on the topmost floor to best enjoy the view.

⁵ In 1986, the houses were added to the National Register of Historic Places, collectively known as the "World's Fair Houses." They are currently being restored through a partnership between the National Park Service, the Indiana Landmarks Commission and private individuals. It is reported that as visitors passed through the houses during the World's Fair, many purchased plans of these prefabricated houses and erected the designs in other states.

⁶ Neutra's 1929 Lovell Health House is considered to be the first steel-frame residence in America.

⁷ Wexler & Harrison later teamed with Cody to design the 1958 Palm Springs Spa Hotel, and would subsequently be commissioned to design the open-air Palm Springs Airport.