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## Mass Housing and Prefabrication in Modernist Architecture

Regine Hess, Inbal Ben-Asher Gitler, Tzafrir Fainholtz, Yael Allweil (eds)

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*Edited by*

*Regine Hess, Inbal Ben-Asher Gitler, Tzafrir Fainholtz,*

*and Yael Allweil*

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Published with the support of the KU Leuven Fund for Fair Open Access and the Israel Science Foundation

Published in 2024 by Leuven University Press / Presses Universitaires de Louvain / Universitaire Pers Leuven. Minderbroedersstraat 4, B-3000 Leuven (Belgium).

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Regine Hess, Inbal Ben-Asher Gitler, Tzafrir Fainholtz, and Yael Allweil (eds.), *Between Conventional and Experimental: Mass Housing and Prefabrication in Modernist Architecture*. Leuven: Leuven University Press, 2024. (CC BY-NC-ND 4.0)

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ISBN 978 94 6270 404 6 (Paperback)
ISBN 978 94 6166 551 5 (ePDF)
ISBN 978 94 6166 609 3 (ePub)
https://doi.org/10.11116/9789461665515
D/2024/1869/47
NUR: 648

Layout: Crius Group
Cover design: Theo Van Beurden
Cover illustration: I.M. Goodovitch, S. Ben-Avraham, J. Versano, The Saddle System for Reinforced Concrete Structures (Ashtrom Engineering, Israel) as implemented in Hatzeva, Israel, in the 1970s. Photograph by Ran Arda.

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## PART 3 — EXHIBITIONS AND PROTOTYPES: ARCHITECTURAL MEDIATION THROUGH PREFABRICATION

# Foreword

The conference "Conventional to Experimental—Mass Housing and Prefabrication" on which this volume is based was hosted by the Technion-Israel Institute of Technology, DOCOMOMO Israel, DOCOMOMO Germany, and the EU COST-Action Middle Class Mass Housing (MCMH-EU) and held online on June 14 and 15, 2021. Mass housing and prefabrication are both recurring themes in architectural academic research and discourse, as well as prominent subjects in the daily debates on housing shortages and possible solutions for providing affordable and quality lodging in the near term. Today, the connection between prefabrication—a field of engineering—and mass housing worldwide is as real as it was in the early days of the modern movement in the interwar period. As early as in the 1920s, prefabrication was one of the solutions proposed by modern architects to answer the housing shortage and to provide affordable homes in Europe after World War I.

At the same time, prefabrication was an experimental field for architects and engineers looking for new materials and technologies for building private homes, who often demonstrated their exploration in design competitions and exhibitions. The 1933 *Homes of Tomorrow* exhibition, in which George Fred Keck presented the *House of Tomorrow*, was part of the Chicago World's Fair. In 1945, a Case Study House Program geared toward "using as far as is practicable, many war-born techniques and materials best suited to the expression of man's life in the modern world" was announced in the magazine *Arts & Architecture*.[1] Most of those Case Study Houses built from 1945 to 1966 were constructed using industrially produced steel and glass.

Large-scale production of private homes predated these types of experimental programs and exhibitions. Wooden prefabrication in Germany started in the early years of the nineteenth century with military construction and grew in the century's last two decades through the efforts of several companies, among them the famous Christoph & Unmack firm in Niesky with Konrad Wachsmann as the lead architect from 1926 to 1929.[2] Still, after World War I, Germany remained a country of massive (brick) houses, primarily because from 1914 to 1920, the prices of construction woods increased twentyfive-fold. In consequence, from 1926 on Walter Gropius and the Bauhaus promoted mass housing and prefabrication that utilized massive building materials as a rational approach in the building industry. Famous examples of Gropius's work are the housing estates in Dessau-Törten that were built from 1926 to 1931 using large slag concrete hollow bricks and reinforced concrete beams. Similar settlements were constructed with moderate heights of three to four stories, accessible without a lift, in many German cities such as Berlin, Frankfurt, and Magdeburg; these served as models for the housing estates built after World War II. In the United States, Sears, Roebuck & Co. and the E. F. Hodgson Company designed traditional wooden kit homes in the 1930s, which were famously caricatured by Buster Keaton in his film *One Week*.[3] Several publications, including *Prefab* and *Das Haus für alle*,[4] documented the diverse history of prefabrication from the early nineteenth century on, and large architecture exhibitions brought the topic back into the contemporary discussion. Especially noteworthy are *Home Delivery* in 2008 at the Museum of Modern Art in New York and the 2010 exhibition at the Architecture Museum of the Technical University of Munich entitled *Wendepunkte im Bauen*, the title being a reference to Wachsmann's well-known 1959 book.[5]

Different types of prefabricated wooden, steel, and aluminum elements for framing private homes were reintroduced as successful fast housing solutions after World War II.[6] New developments such as Levittown in the United States (1947–1959) arose, and in the United Kingdom temporary prefab bungalows were built and nicknamed "Palaces for the People," as described by Elisabeth Blanchet in *Prefab Homes*.[7]

In parallel, precast concrete systems were developed in both the West and the East, which allowed for the building of large multistory housing estates from the 1950s on to solve the huge postwar housing shortage. Many of these constructions were designed for a short lifetime, to be replaced after twenty-five to thirty years.[8] Several generations of prefab systems were developed, for example, in Russia.[9] The Belgrade School in Serbia developed spatially optimized and flexible layouts for small apartments to provide each family with outdoor spaces, often lit from two sides.[10] In common to all of these postwar approaches was that prefabrication for mass housing was supposed to be *Wohnen für alle* (Housing for all) as part of the effort to provide equal standards of living and to solve the societal challenge of the time with "a wealth of social and spatial intentions."[11] Later, in the 1960s and 1970s, and under the influence of futuristic and metabolist theories, prefabrication was also used for experimental purposes, such as Kisho Kurokawa's Nakagin Capsule Tower (1972) in Tokyo in which the prefabricated units were "designed and marketed as 'business capsules,'"[12] and not for permanent occupancy.

Looking at these historic twentieth-century developments with their high standards and success with prefabrication for both private homes and large housing estates, it is surprising that there is still considerable mistrust and a perceived market resistance toward more prefabrication in mass housing construction in Europe. Despite the many positive examples, prefabricated mass housing estates in both the Eastern and the Western world have suffered from technical problems and mistakes, in particular, the penetration of moisture, inadequate services, and acoustical and/or structural issues. Other problems have been social in nature, engendered by inappropriate cubatures and layouts, such as tower blocks for young families without suitable common spaces, broken lifts that deny access for the elderly and disabled, and insufficient or missing maintenance.

The urgent need for the rehabilitation of existing—often prefabricated—mass housing estates and neighborhoods worldwide invites us to rediscover and study past concepts, cases, and best practices, properly framed in their historical-political context. The program of the DOCOMOMO Israel-Germany Conference 2021 tackled these different aspects and challenges in a keynote address and in contributions from fourteen countries, which dealt with the spatial and technological, socioeconomic, and political dimensions of prefabrication in several sessions that now also guide the content of the present book:

– Prefabrication: Materials and Typologies
– Prefabrication for Nation Building and Disaster Relief
– Prefabrication at Exhibitions
– Prefabrication and Urbanization

DOCOMOMO International and its national working parties have been pioneering in the promotion of the study of modern building materials such as glass, concrete, metal, and plastic, and also of new and experimental construction technologies. It is a pleasure to see how this book sheds light on links among different disciplines and on the history of prefabrication and its relationship with modernist architectural design concepts and current societal challenges. The joint conference should serve as a kickoff for this new field, the first event in a series that will include further talks, conferences, and articles relating to the challenges involved in the rehabilitation and upgrade of existing mass housing and in constructing more affordable homes by making use of modern technologies. Kieran and Timberlake complain that "today's architects don't fully exploit transfer technologies,"[13] and suggest that, instead, we should start from where our modern forerunners stopped and combine their knowledge with our current innovative and digital practices.

Despite the proven economic and environmental advantages of large housing estates, prefabrication in many countries focuses on private homes. The "Dream of Owning a Home" is still dominant, although criticized owing to its increased energy consumption and land sealing compared to multistory housing. The potentials of prefabrication are not limited to optimized construction; rather, prefabrication "generally leads to fewer deliveries [...] and well-managed sites using prefabricated components can significantly reduce the impact of transport."[14] Furthermore, "prefabrication [also] offers an opportunity to […] improve both efficiency and sustainability" in "a new way of doing business in prefabricated buildings with CE [circular economy] integration."[15]

This book approaches the many aspects of prefabrication through a primarily socioeconomic lens with social equity, quality of life, and functioning neighborhoods as recurrent parameters of analysis. While acknowledging the historical and political context in which prefabrication has often played a crucial role, this aspect is not the focus of the current volume. The vision of affordable housing and good living conditions for all is central in the construction of the modern movement, which has continued to be as vibrant and as relevant as it was in the pre-, inter-, and postwar periods of the twentieth century.[16] The challenge confronting contemporary planners, architects, and engineers is to place the concept of prefabrication within the larger construct of the United Nation's Sustainable Development Goals (SDG) linked to climate change, resource efficiency, and equality in addressing the planetary problems and providing housing for all.

*Uta Pottgiesser*
*Berlin, February 1, 2024*

## Notes

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# Acknowledgments

This book was made possible by generous grants from the Israel Science Foundation (Grant #131/24), the Eidgenössische Technische Hochschule (ETH) Zurich, the Technion Institute of Technology, Sapir Academic College, and the KU Leuven Fund for Fair Open Access. The Israel Science Foundation operates as an independent entity, free from political or governmental control. It does not represent any particular sector or viewpoint within Israeli society and is solely committed to academic integrity and independence. The editors would like to thank Liran Duani and Bar Leshem for their invaluable editorial assistance and Evelyn Grossberg for the book's language editing. Further, we would like to thank our Leuven University Press acquisitions editor, Mirjam Truwant, and the team of Leuven University Press. We are most grateful to the authors for their contributions, to Uta Pottgiesser, president of DOCOMOMO International, for her support of the book as well as of the conference that engendered it, and to Silke Langenberg for her patronage and her forward-looking concluding text. Finally, we very much appreciate the efforts of the colleagues who were involved in the peer review process for their comments and in-depth evaluations.

# Introduction

*Regine Hess, Inbal Ben-Asher Gitler, Tzafrir Fainholtz, and Yael Allweil*

Architectural prefabrication has engendered many of the social ideas and designs that characterize modern mass housing. Indeed, the concept of this book is based on the idea that prefabrication in mass housing brought about social change in specific historical situations. Thus, the present collection provides a history of different construction systems in diverse contexts but, more than that, it is an attempt to demonstrate the relevance of prefabrication history for a cultural and material history of the built environment.

It seems that the history of prefabrication, its relationship to modernist architecture, and its global spread have remained somewhat at the margins of contemporary scholarly debate, perhaps because scholarly works in architectural history rarely deal with prefabrication. It is an issue that is not addressed in depth either in studies of iconic cases, such as private residences or single apartment buildings by renown architects, or in research of the everyday products of industrialized architecture. Moreover, other aspects of relevant research lie in the field of engineering, rather than history. There is no standard work on the history of architectural prefabrication, certainly not in the form of a global study. Another issue is the multilingual nature of the research. For example, significant German-language publications on prefabrication in housing construction are largely overlooked in English-language research.[1] We have attempted to bring these branches of study closer together and to shed some light on the current state of research in the field.

The present book compiles studies that explore the connection between prefabrication and mass housing, focusing largely on postwar Europe and Israel. It is the outcome of the conference "From Conventional to Experimental: Mass Housing and Prefabrication," a collaboration between the Israeli and German chapters of DOCOMOMO International for the documentation and conservation of the Modern Movement, which was hosted by the Technion Faculty of Architecture and Town Planning in Haifa in June 2021. The conference, organized by the editorial team, sought to explore the still somewhat unknown connections between prefabrication and mass housing worldwide. Toward this end, we invited new research that would enhance our understanding of the inherent and crucial link between the revolutionary advances in prefabrication, which characterized the modern era, and their impact on design. Exploring the field of modernist architecture, we solicited contributions on both "conventional" and "experimental" conceptualizations, production methods, and buildings.

Before addressing the book's theme, we should offer a definition of mass housing. We understand mass housing as a twentieth-century scheme for housing large populations in standardized, serial, and modular houses and apartment blocks—both low- and high-rise. Mass housing was generally built in rapidly growing cities, so it usually embodied key aspects of urban design. Politically and culturally, mass housing emerged as state authorities assumed the responsibility to provide housing for all citizens. These concepts emerged from earlier "social housing" designs and evolved into a global phenomenon that took root in disparate political regimes and economic systems.[2]

The selected contributions included in the present volume explore the role of prefabrication within this phenomenon. They showcase constructions, transfer of knowledge and building systems, urban patterns, labor, and materials in moments when mass housing was needed, be it because of reconstruction, crisis, catastrophe or—on a political level—the building of a nation, the welfare state, and the capitalist consumer society or the socialist classless society. "Conventional" we understand here as having to do with the origins of prefabrication since the eighteenth century, as past production methods continue to be used. Conversely, "Experimental" represents innovative approaches employed from around the 1920s, whose use peaked in the 1960s/1970s. As some of the examples in this book demonstrate, this chronology has to be approached with flexibility and certain cases complicate it. The "pioneers of prefabrication," as Gilbert Herbert called them, were experimentalists.[3] It is rather the modernist outlook that characterizes their products as more in line with the conventions of the architecture of the time, translating building types into a new construction method but not into a new style. Some of the essays address the question of whether they created new models of coexistence or even expressions of the period's social order.

The contributors discuss the role of mass prefabricated housing in Scandinavia, Poland, Greece, France, the United Kingdom, Israel, the Soviet Union, Germany, Italy, and Yugoslavia. They explore the national and international use of prefabricated systems as means for nation-building and disaster relief, addressing internal housing needs as well as international diplomacy.

Today, mass housing is problematized by heritage studies and monument preservation and threatened by destruction and neglect. Moreover, focusing on prefabrication broadens the scope of the currently much-used term "identity," understood here as the construction of the self or of a collective in relation to the habitat and the society that created it. This view underscores the fact that the users of mass housing were rarely owners but mostly tenants who, with few exceptions, had no influence on the design of their surroundings. Through this interpolation, the agency of the actors charged with design and construction is emphasized: who were the builders, engineers, architects, contractors, politicians, and owners of construction companies and sawmills? As prefabrication technology represents an unprecedented level of rationalization in construction, some of the chapters are, in effect, studies of transdisciplinary collaboration in architecture.

The book's theme is very relevant today: the present climate crisis calls for developing sustainable housing and large-scale reuse of existing buildings, while mass migrations require speedy construction. Further, the COVID pandemic posed new challenges for prefabricated and standardized structures that provide for disaster relief. A vast global and historical phenomenon, prefabricated mass housing developments are also presented in this volume as unique social objects in their urban settings. The essays deal with mass prefabricated housing as a global phenomenon of export and import, as well as a local cultural asset worth conserving. They open ways to examine the diversity of this widespread phenomenon and call for both its scholarly appreciation and its preservation.[4]

The international scope of this collection corresponds to the global spread of prefabrication and industrialization, which crossed national borders and the Cold War blocs and was fueled by political collaboration and architectural and infrastructural modernization. As such, the book provides new perspectives on global exchanges of engineering and technical knowledge and introduces new actors, building techniques, urban layouts, sites of operation, and social orders. Thus it adds to recent publications that have analyzed prefabrication in nation-building, postcolonialism, and disaster relief, as well as to literature on socialist and capitalist Cold War era of mass housing.[5]

This collection of essays seeks to reintroduce the term "prefabrication" into the vast and multifaceted study of mass housing and to offer a conceptual history that transcends geographies and time periods. It considers the significance of prefabrication for mass housing on multiple scales, from assembly line details to modes of habitation; from technological appropriation to its application on the domestic scale; from traditional design following established conventions to groundbreaking, experimental schemes. The various chapters explore prefabrication as a vessel for the transfer of professional and technical knowledge, as well as a means of introducing dwelling cultures and lifestyles, which involved cultural translations and reflected conceptions of heritage and national collective identity. They reconstruct seemingly peripheral processes that question or enrich existing accounts, which is the reason that countries that are usually understood to have played a pivotal role in the story of architectural prefabrication, such as Japan, and France, are afforded a relatively minor treatment.

## The Architectural History and Historiography of Prefabrication

As the present volume comprises a collection of essays that engage specific locales and case studies, a brief introduction regarding the architectural history and historiography of prefabrication is in order. In short, modern prefabrication can be identified as having emerged in colonial conditions, which throughout the nineteenth century were enabled by prefabrication techniques, infrastructure, and logistics of knowledge and materials. Herbert demonstrated how these factors enabled the colonization that created the British Empire.[6] Simple timber-cut, wood-framed huts were transported overseas into West Australia and South Africa. American industries, themselves with a tradition in settling the West, intermingled in that business, when in 1772 Clarke and Hodgdon of Portsmouth, New Hampshire, built a 50-x-18-ft wood-framed house for shipment to the Isle of Grenada. Essential novelty came with the Manning Portable Colonial Cottage, developed by H. Manning in London, for settlers in Australia and New Zealand. With the first replicable prefabricated house, architecture embraced industrialization and served the evolution of mass society in the nineteenth century.

In the first half of the twentieth century, Konrad Wachsmann was a central figure in paving the way to such functionalist aspects of architectural modernity as infrastructural imperialism.[7] Kenny Cupers has demonstrated how standardized, not prefabricated, farmsteads in the Heimatschutz style by Paul Fischer were used to colonize the previously Polish provinces of West Prussia and Poznan (Posen) (today part of Poland).[8] Further, Itohan Osayimwese claims that although this housing regime was fundamental in the development of modern architecture, it has been largely neglected by architectural history.[9]

The connection between prefabrication and mass housing has been dated to the beginning of the twentieth century. Florian Urban addresses this link in *Tower and Slab: Histories of Global Mass Housing*. He underscores the difficulty of defining the multifaceted phenomenon of prefabrication and of exactifying how we explain it as applied to modern mass housing. After all, prefabricated elements for house construction have existed for hundreds of years, and production via assembly lines is not a twentieth-century invention.[10] To tackle this issue, Urban underscores that "industrialized construction […] as practiced by modernist architects in the early twentieth century refined both prefabrication and streamlining of procedures to an unprecedented degree and wedded them to their vision of a new society built on social equity."[11]

In Israel, for example, the vision of a new society was an integral part of nation-building. There, as in many postwar nation-states, prefabrication was a means for economizing construction. As discussed by engineer Asher Allweil, significant strides in prefabrication were made in the field of housing, extending production from the basic unit of the concrete block to three-dimensional concrete elements produced in a factory or on site.[12] Although the basic concrete block remains the favored prefabricated system in Israel, uniquely creative systems—such as Israel Goodovitch's Saddle System for Ashtrom Co., illustrated on the cover of this volume—allowed for production and assembly on site and were widely circulated in professional media.[13]

Once the connection between prefabrication and mass housing was established, an additional phenomenon, which also surfaced in the years following World War II, was the unprecedented need for housing, which further engendered significant transformations in materials and typologies. Influential postwar architects utilized simple wooden prefabs for emergency housing in destroyed cities. After the war, Austrian architect Roland Rainer further developed his famous housing type, Ebenerdige Wohnhäuser (Ground Level Dwellings).[14] He discussed its development from industrialized structures, barracks, weekend huts, rural small houses, export houses (a name also used in the colonial building industry), and even trailers.

Prefabricated materials and prefabrication methods were also featured in the work of influential postwar architects, including Alison and Peter Smithson and Le Corbusier, among others.[15] The outcome of the expansion of prefabrication during the postwar years was the consolidation of mass-housing typologies as well as innovative connections among prefabrication, urbanism, and the individual home.

In approaches similar to Urban's interlinking of prefabrication and modernist design principles, several scholars have examined the relationship between them in detail. A common thread is the historiography of the manufactured—or factory-built—residence, examined chronologically from the conventional cottage-like house to experimental prototypes to mass-produced homes for populations in the five-digit range.[16]

The reciprocation between prefabrication of mass housing and the urban and rural scales has also been addressed. During the years that saw intensive postwar developments, architects in many countries of the Northern Hemisphere designed settlements based on ground-level houses situated in remote areas, far from city centers. Here, the formulation of a new understanding of settlement and architecture emerged: ubiquitous and interchangeable, not bound to the ground, quickly adaptable, nonrepresentational, almost an anti-architecture.[17] In the German Democratic Republic (GDR), for example, housing was even more subject to a top-down regime intended to produce a modernist environment for the new citizen-worker.[18]

Other historic turning points that have been researched include the preparations for industrialized mass housing via model houses and house-building programs, such as Winston Churchill's Temporary Housing Program, a framework that accounted for the construction of 156,000 units. As the program progressed, it became apparent that under certain conditions, traditionally built houses cost less but the new settlements provided speedy construction and offered their residents a new lifestyle based on community living.[19] The coexistence of masonry construction and rationalization also characterized postwar housing construction in the Federal Republic of Germany (FRG). From 1950 to 1982, the Neue Heimat (New Home) company erected more than 460,000 homes, most of them rental apartments, but also some owner-occupied terraced and prefabricated houses.[20] Neue Heimat was Europe's largest nongovernmental company and is a prime example of how the first step was to adopt the serial production techniques of the early twentieth century, then develop them further, and finally try to implement them on a larger scale. As a result, system building gained importance, for with a manageable number of standardized building elements, industrial prefabrication with subsequent assembly on the building site became a favored approach.[21] In the GDR, the so-called Plattenbau helped resolve the housing crisis in the aftermath of World War II. By 1990, some 60 percent of the apartments were state-owned and, as Philipp Meuser reminds us, rents were controlled, remaining at the 1936 rates. However, in this gigantic welfare program, the state could not renovate the building stock, resulting in increasingly lower standards of living, which destabilized the GDR's political system.[22] Many additional mass-housing projects, wherein prefabrication was crucial to both design and social concepts, have not been subject to in-depth research, and the present volume brings some of these to light.

Globalizing prefabrication, a key aspect of professional knowledge transfers that extend and build upon public mediation, has recently been studied by Łukasz Stanek, who demonstrates how prefabricated housing, among other architectural typologies, became the focus of diplomacy. Taking recent scholarship on worldwide mobilities of architecture as a starting point, Stanek steers away from the "architects-only" perspective often adopted in many Western architectural histories and analyzes the exchanges of the Global South with the socialist countries in the East.[23] He shows that in the framework of the urban expansion of southern metropolises, such as Lagos and Baghdad, achieved by the development of housing, social facilities, industrial plants, and infrastructure, it was often prefabricated modules that enabled the material exchanges between the Eastern bloc and the South. The experience gained from designing mass-housing in the Soviet Union and other socialist states formed the basis of these transfers.

Pedro Ignacio Alonso utilized a different perspective and method for analyzing the globalizing of prefabrication. He and his students studied sixty systems and modeled them in axonometries, tracing their worldwide production, dispersion, and application between 1926 and 1984. Some, such as Camus and Balency, are also referenced in the present volume. Thus, the prefabricated panel became part of the vocabulary of high modernity on major construction sites worldwide, effortlessly "skimming" the boundaries of continents and political systems. Alonso supports this claim by citing Natalya Solopova's thesis, according to which "the existence of panel systems depends on the conditions of a centralized state and of its centrally planned economy," which allows the exchange in the first place.[24] But systems that were considered generic and inflexible were stripped down from the international to the regional level and transformed into hybrids in the realities of the worksite.[25] Mass housing and prefabrication on a global scale were also addressed in the impressive overview offered by the exhibition catalog *SOS Brutalism*. The case studies in that volume included "120 buildings in 120 regions," most devoted to regionally adapted examples made largely of in situ concrete and custom-made modules.[26]

The preservation, conservation, and display of twentieth-century prefabrication-based design for current developments and debates have not generally been addressed by architectural historians or by scholars of monument preservation, practicing architects, engineers, or sociologists. Exceptional in this regard is the recent publication *System und Serie*. There the authors examine the entire range of Swiss prefabricated buildings erected in the second half of the twentieth century in the context of architecture and construction history and address their embodiment of social structure and their place in preservation practice and theory.[27] The authors distinguish between "system building" and "building system."[28] Moreover, they reveal communication formats such as company brochures that architectural firms and construction companies use to communicate with clients, residents, and/or critics. Architectural mediation thus becomes an element of the prefabricated building, an interpretation that is useful for clarifying questions regarding the ways these buildings are being represented.

The present volume similarly discusses communication as part of a building system, recognizing that it is primarily through exhibitions that architects act as mediators of their work and mission. As early as the period of "national romanticism," German farmhouses were publicized and exhibited at national architecture exhibitions, which facilitated a broader discourse; industrialized prototypes were displayed at the MoMA's *House in the Garden* exhibition series and the *Portal Bungalow* in the Tate Gallery in London in 1944.[29] Several other important exhibitions devoted to prefabricated houses were discussed by Barry Bergdoll and Peter Christensen in their groundbreaking exhibition catalog, *Home Delivery: Fabricating the Modern Dwelling*.[30] Joachim Trezib and Sigal Davidi researched the exhibition of copper houses by Walter Gropius at the *Deutsche Bauausstellung* (German Building Exhibition) in Berlin in 1931 and their subsequent exportation to Palestine and how they were publicized there.[31]

Research also addressed the MERO building system's lightweight prefabricated constructions, shown in a stunning hall and tower at the *International Building Exhibition 1957* and its accompanying *Interbau Industrial Fair* in Berlin arranged by Frei Otto and Günther and Barbara Günschel, to note but a few examples of such exhibitions.

Displays of this kind were common curatorial practices within the broader context of introducing a new era of housing to the public. This finding is reinforced if one considers that exhibition architecture was often prefabricated in order to reflect the ephemeral and experimental character of world or building exhibitions. Exhibitions thus helped to prepare the ground for the acceptance of prefabricated architecture in the twentieth century.

Architectural historiography and criticism have also recently addressed the reuse and preservation of prefabricated mass housing. The success and necessity of both have long been the subjects of scholarly and professional debate. It is striking that discussions dealing with, for example, the Grands Ensembles in postwar France, have evolved into an assessment of the failure of politics and urban planning while at the same time underscoring architectural quality.[32] Nevertheless, those discussions have paved the way for thinking about reuse and preservation schemes.[33] Relevant debates extend beyond the academic sphere and are very much present in public platforms, where they are subject to local in-depth study. In Germany, for example, researchers engaging the history of architecture and urban planning in the GDR use oral history and other nonacademic material to record the legacy of the built heritage, including, of course, the critical voices of 1980s architects, arguing against the loss of historic buildings and their substitution with Plattenbau.[34]

The impact that prefabricated mass housing of the early and mid-twentieth century has had on current developments continues to be a central issue. As Oliver Elser points out, the decline of the centralized welfare state and the beginning of neoliberalism coincided with the triumph of Brutalist construction. Yet, as he surmises, individual analyses show the complexity of the transition from prefabricated mass housing to the era of expensive "sculptural customization."[35]

Finally, considering the present digital age, Barry Bergdoll's concise overview analyzes the state of research with a view toward digital prefabrication,[36] an approach that Silke Langenberg develops further in the present volume, not proposing new parametric construction but rather suggesting the repairing of factory-made structures with digitally generated components.

## Between Conventional and Experimental

The contributors to this volume address a broad range of research questions, which arise from international discourse as well as from their original research. Their essays are organized into three sections: (1) Housing as Architecture for All; (2) Conventional and Experimental in New Neighborhoods; and (3) Exhibitions and Prototypes: Architectural Mediation through Prefabrication. The afterword addresses current questions of prefabrication, preservation, and the future of building.

In the first section, Maryia Rusak deals with an example of the relationship between prefabrication and typology from Norway, where a streamlined, flexible, and modular wooden prefabricated system for assembling homes was developed in the 1960s. These houses created a specifically Norwegian mass-housing typology while allowing the users to participate in the process of construction, which offered a unique alternative to conventional prefabrication of the postwar period.

The international spread of prefabricated housing vis-à-vis nation-building is discussed by Mia Åkerfelt, Tzafrir Fainholtz, and Anna Wilczyńska in their study of Finland's massive production and export of prefabricated wooden detached houses in the decades following World War II. By examining these exports to Poland in the aftermath of the war and to Israel as it faced the post-independence mass immigration, the authors demonstrate how bilateral diplomacy, local politics, and crisis management turned the prefab house into a tool for reconstruction of the national home in both the manufacturing and receiving countries.

Daphna Levin and Liat Savin Ben Shoshan present an example of housing as architecture for all in their study of the Ramat HaNasi neighborhood in Bat Yam, Israel, built in the late 1960s. There, an innovative construction method wherein precast elements were manufactured in an on-site field factory was utilized. The authors analyze contemporary government-led transformations in the Israeli prefabricated housing industry, arguing that Israeli-French collaboration on this project, coupled with direct institutional construction by the Ministry of Housing, served the purposes of nation-building through the dissemination of foreign rather than local knowledge.

Tamara Bjăzić Klarin deals with the challenges that Yugoslavia faced following the devastating 1963 earthquake in Skopje. She discusses how prefabricated and standardized structures provided disaster relief and demonstrates how the need for housing was a factor in the development of the Yugoslavian national prefabrication industry. She shows how imported and donated houses from such countries as Finland and Sweden exposed local designers and manufacturers to advanced methods and standards and how the variety of assembled houses, schools, and healthcare buildings turned Skopje into a living display of housing prefabrication and urban design, as well as a model for reconstruction in the wake of natural disasters.

The second section, which is devoted to new neighborhoods, opens with Inbal Ben-Asher Gitler and Yael Allweil's study of the broad range of prefabricated components used in Israel. They demonstrate their application in two quite different projects—the Kiron Estate and Ramot Polin. They argue that beyond its advantages of efficiency, speed, and low cost, prefabrication embodied the modernist and avant-garde aspirations of nation-building. Moreover, these new neighborhoods represented the significant impact of prefabrication on Israeli society through design, engaging locality, creating communal identities, and responding to privatization processes.

A phenomenon that characterized the so-called socialist city was the ubiquity of the high-rise residential buildings constructed from prefabricated blocks that were assembled on site. Angelo Bertolazzi analyzes the example of Soviet mass housing and draws conceptual connections from the end of the 1930s to the beginning of the 1950s, investigating the major building systems developed in the Soviet Union and exploring the links among politics, architecture, and construction. He challenges accepted analytical constructs by contending that despite the ideological issues that marked Stalinism and the Khrushchev era, their prefabricated architectural experiments served as the basis of 1960s development of the new Soviet mass-housing program.

In the United Kingdom, the community of Thamesmead near West London provided a telling experiment in prefabrication during the late 1960s. Alberto Franchini discusses how, in the process of abandoning the French Balency and Schuhl prefabricated system (also used in Israel), spine blocks were cladded with prefabricated panels to reproduce a similar idea of modernity and industrial efficiency. Reflecting on Thamesmead in its urban settings, he identifies the contradiction between regarding the project's prefabricated appearance as crucial to the idea of a "Town for the 21st Century," and the negative publicity that it attracted—publicity that unjustly projected on Thamesmead's broader urban issues.

The third section is devoted to exhibitions and prototypes and focuses on the role of display and mediation in the development of prefabrication, as well as the importance of one-off experiments. Regine Hess returns to the nineteenth-century roots of housing prefabrication. She examines the role of prefabrication in mass housing and ephemeral architecture at large exhibitions, identifying the latter as sites that offered advanced constructions of halls, "huts," and houses. These represented the strength of European empires and their achievements, as well as their colonial subjects. As such, world fairs and big building exhibitions highlighted the industrialization of construction and its relationship to modernization, urbanization, and colonization.

Ilaria Giannetti and Stefania Mornati examine the Milan Triennale exhibitions in postwar Italy, held between 1947 and 1960. They argue that although there was a fragmentation in national planning, experimentation and cultural debate on industrialization in the Italian building sector remained intense, with the three Triennales playing a key role. They focus on three events: the Milan QT8 experimental district that was part of the 1947 Triennale, the 1954 Triennale, and the competitions for industrialized school buildings held at the 1960 Triennale.

Although prefabricated materials and systems were favored in mass housing, significant experimentation took place on the smallest scale—that of the single home or even the typology of the vacation home—usually smaller than a permanent residence. Maria Tassopoulou discusses Le Corbusier's unique contribution to such prefabrication in his design for the Cabanon in the early 1950s. She analyzes Le Corbusier's conception of this cabin as a prototype and its development from design to assembly to on-site construction. She reflects on the renowned architect's pioneering approach to vacation housing—an approach that integrated speed of construction with comfort—by pushing this design typology to its limits.

In her afterword, Silke Langenberg revisits a question posed in the 1920s, a time of innovative experimentation in prefabrication, that has not lost its urgency: How to build? The seriousness of climate change and the enormously high consumption of resources by the building industry, as well as the constant shortage of housing, justify arguing for retrofitting rather than replacing. Langenberg contends that criteria beyond established positions of preservation are needed and discusses requirements for future monuments and the potential of the digitization of architecture.

Whereas the present collection underscores the key role of prefabrication in mass housing, any such engagement with the modernist project invites further thoughts on its future, as proposed in Uta Pottgiesser's foreword and in Silke Langenberg's afterword. The international and broad technological scopes of the various chapters in this volume contribute to the unfinished global architectural history project. Their reexamination of the role of prefabrication in housing—a key sphere of design for the masses—reveals the complex production systems, as well as crucial dissemination channels, that underlie the modularity and flexibility of this typology. The chapters' emphases on knowledge transfers and national projects and policies, as well as on communities and identities, posit important perspectives that go beyond an architect-focused discussion or a technological one. The volume reveals how prefabrication profoundly affected dwellers, providing a framework for relationships among people and their homes, neighbors, and environment.

## Notes

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6. Herbert, *Pioneers of Prefabrication*, 1978.
7. Osayimwese, *Colonialism and Modern Architecture in Germany*.
8. Kenny Cupers, "The Invention of Indigenous Architecture," in Irene Cheng, Charles L. Davis II, and Mabel O. Wilson, eds., *Race and Modern Architecture: A Critical History from the Enlightenment to the Present* (Pittsburgh: University of Pittsburgh Press, 2020), 194.
9. Osayimwese, *Colonialism and Modern Architecture in Germany*.
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15. Allweil, *Construction Methods in Israel*, 1983.
16. Cf. Barry Bergdoll, "Home Delivery: Viscidities of a Modernist Dream from Taylorized Serial Production to Digital Customization," in Barry Bergdoll and Peter Christensen, eds., *Home Delivery: Fabricating the Modern Dwelling*, ed. Ron Broadhurst, exhibition catalog (New York: The Museum of Modern Art, 2008), 12–26.

17. Rainer, *Ebenerdige Wohnhäuser*, 6.
18. Cf. Regine Heß, "(Re-)Building Nations: Housing Regimes in Postwar Israel and Germany," in Yael Allweil and Regine Heß, eds., *Housing Regimes: New Approaches to a State-Citizen-Relation*, Kritische Berichte, 48, no. 2 (2020), 48–60.
19. Elisabeth Blanchet, *Prefab Homes* (Oxford: Shire Publications, 2021), 45. See also Nick Bosanquet and Andrew Haldenby, "Churchill's Push for Prefabs: Real 'Homes for Heroes,'" April 18, 2023, https://winstonchurchill.hillsdale.edu/bosanquet-haldenby-prefabs/.
20. Hilde Strobl, "Hohe Häuser, lange Schatten: Die Bauten des Gewerkschaftsunternehmens Neue Heimat," in Andres Lepik and Hilde Strobl, eds., *Die Neue Heimat, 1950–1982: Eine sozialdemokratische Utopie und ihre Bauten*, exhibition catalog (Munich: Architekturmuseum der TU München, 2019), 8–19.
21. Silke Langenberg, "Von konventionell bis rationell: Zur Bautechnik der Neuen Heimat," in Lepik and Strobl, *Neue Heimat*, 2019, 56–65.
22. Philipp Meuser, ed., *Vom seriellen Plattenbau zur komplexen Großsiedlung. Industrieller Wohnungsbau in der DDR 1953–1990*, 2 vols. (Berlin: DOM Publishers, 2002), vol. 1, 25. See also Philipp Meuser and Dimitrij Zadorin, *Towards a Typology of Soviet Mass Housing: Prefabrication in the USSR, 1955–1991* (Berlin: DOM Publishers, 2015).
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28. Ibid., 5.
29. Barbara Miller Lane, *National Romanticism and Modern Architecture in Germany and the Scandinavian Countries* (Cambridge: Cambridge University Press, 2000); Blanchet, *Prefab Homes*, 2021, 8–9.
30. Bergdoll and Christensen, *Home Delivery*, 2008.
31. Joachim Trezib, "Humble Homes and Copper Castles: Early German Prefabs on Their Way to Palestine," in *Zmanim – A Historical Quarterly* 96 (2006), 68–75. (Hebrew); Sigal Davidi, "Housing Ideas at Building Exhibitions in Eretz Israel, 1934–1944," in Allweil and Heß, *Housing Regimes*, 2020, 26–35.

32. Kirsten Wagner, "Von den Akteuren des Wohnungsbaus zu den Akteuren des Wohnens. Philosophische und soziologische Bestimmungen des Wohnens in den 1950er- und 1960er-Jahren," in Regine Heß, ed., *Architektur und Akteure: Praxis und Öffentlichkeit in der Nachkriegsgesellschaft* (Bielefeld: Transcript 2018), 45–62.
33. See Joseph Abram, "Modernity and Housing Production in France after WW II," *Docomomo Journal* 33, no. 65 (July 2021): 8–15.
34. Arnold Bartezky, Nicolas Karpf, and Greta Paulsen, *Architektur und Städtebau in der DDR. Stimmen und Erinerungen aus vier Jahrzehnten* (Berlin: DOM Publisher, 218).
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PART 1

# Housing as Architecture for All

CHAPTER 1

# Toward a Democratic Architecture

## Norwegian Experiments in Timber

*Maryia Rusak*

Imagine that a house customized to your individual needs could be ordered through an iPhone application and delivered neatly packaged to your door, accompanied by a set of comprehensive instructions for self-assembly. The Urban Village Project, developed in 2019 by IKEA's Space 10 Design Lab in collaboration with EFFEKT architects, proposed a customized version of such "livable, sustainable and affordable homes" as an alternative to contemporary rigid and alienating models of mass housing.[1] To achieve this vision, the project's creators suggested harnessing the possibilities of mass production. All the building components would be designed according to a set modular framework, produced in local timber, and reused and recycled as needed. With the system of prefabricated timber panels assembled in standardized modules within a large three-dimensional grid in Cross-Laminated Timber (CLT), the dwellers could "edit their homes as they see fit," introducing user-based flexibility in design.[2] The resulting clusters of low-rise high-density housing would reconcile the benefits of private living and vibrant community life, offering a range of shared facilities and communal services in a radical alternative to today's unsustainable building practices.

While this utopian promise of an amicable collective of individualized desires unified by a system of industrially produced components appears to be a brainchild of the current times, its social aspirations and formal language find their roots in the 1960s Nordic experiments with new typologies of mass housing. In fact, the 2019 Urban Village Project, designed by Danish architects for a Swedish company, shared many similarities with large housing developments built by the Norwegian prefabrication company Moelven Brug in the Oslo region in the late 1960s. Driven by a similar ambition to reconcile the pragmatism of mass production and the flexibility of individual choice, the company designed a system of prefabricated timber elements that could accommodate different plan layouts and house designs in the context of mass housing. All building elements produced from local timber were unified by a single modular network, delivered as large flat elements on site, and assembled in just a couple of days. Future dwellers could choose from among the many spatial potentialities and adjust and modify their homes as their family needs changed.

Although Moelven, the company behind this building system, is well known in Norway for its prefabricated catalog homes, few are aware of its midcentury experiments with flexible mass housing.[3] In this chapter, I attempt to correct this lacuna while telling a story of a specifically Norwegian alternative to the postwar European model of mass housing. A system of light prefabricated timber elements not only allowed the company to lower production costs but offered an economical solution to the decades-long architectural dream of flexible housing. Originally driven by the pragmatics of scaled production, in the 1960s Moelven's prefabrication system capitalized on a curious intersection with a changing architectural discourse that favored decentering the role of the architects and delegating design agency to future dwellers. The planners of flexible housing projects in the early 1970s captured the spirit of Nordic pragmatism, negotiating the embedded cultural tension between individual choice and collective good and the apparent dichotomy between economical construction and good architecture available for all. While it is true that, as the volume's editors note, tenants rarely have any impact on the design of their surroundings, the opposite was true for the nonfigurative 1970s generation of Norwegian mass housing, in which flexibility and user choice were largely afforded by and through the materiality of timber.

The story of Moelven's large-scale housing projects fits within the broader ambition of the present volume to discuss not only the individual case studies of prefabrication but also the ways new industrial construction systems were coupled with aspirations for social change and visions of alternative modes of social organization. Through a brief historiography of Moelven's projects, this essay investigates seemingly anonymous and everyday built environments of large social housing estates in fact harbor a wealth of cultural histories and idealistic aspirations of better, more egalitarian architecture accessible to all and a more democratic society based on horizontal decision-making.

## A Celebratory House Number 1000

A photograph from the May 10, 1971, issue of *Arbeiderbladet*, a popular daily Norwegian newspaper, pictured Gunder Runde with his two young children—a seven-year-old son, Geir, and a three-year-old daughter, Ålov—as they moved into their brand-new row house Number 91 on Smiuveien in Skjetten, a new commuter suburb some twenty kilometers northeast of Oslo (fig. 1.1).[4] On the right of the image, Jan F. Reymert, a managing director of Ringsakerhus, the company behind the construction, is shown welcoming the family into their new home. The Runde's row house, designed specifically for a sloping terrain, was produced in a factory, shipped, and assembled on site over a couple of days. With an overall floor plan of 103 m$^2$, it featured a 35-m$^2$ living room and a spacious kitchen on the ground floor and three bedrooms, a bathroom, a toilet, and a storage room on the first floor. A massive pine staircase connected the two levels. The house was built nearly entirely of timber, and both the southern and northern facade walls had large panoramic windows.

**Fig. 1.1.** Jan F. Reymert of Ringsakerhus (on the right) welcoming Gunder, Geir, and Ålov Runde to their new home in Skjetten. Newspaper clipping, 1971, public domain.

However, it was not the house design specifically that drew the attention of the national press. Runde's family move-in was celebrated because their home was a commemorative Number One Thousand completed by Ringsakerhus in a large twelve-hundred-unit housing project for Skjetten town. The project was the result of a 1965 architectural competition that called to "reconsider the common housing types," won by the Danish architect Nils-Ole Lund, who proposed a dense structure of atrium-type clusters.[5] Three young architects, Erik Hultberg, Jan Resen, and Einar Throne-Holst, received second prize for the design of individual houses. Eventually, the prize winners formed a team, and thirteen architects, engineers, and planners worked together under the name of Skjettenprosjektering IS.[6] It was the first and the largest project in the country that aspired to *totalprojektering*—a turnkey development that took responsibility for the entire building process from land acquisition to final finishes.[7] It was also the largest single order in Norwegian prefabrication history, worth over 90 million NOK, which went to Ringsakerhus, a subsidiary of Moelven Brug.[8]

Skjetten is well known within Norwegian architectural historiography, as it was the largest project to offer substantial design flexibility on the scale of mass housing. The development was set up in row houses on elongated plots 6.4 m in width and 25–30 m in length. The houses were designed based on cubic modules of 3 × 3 m made from prefabricated timber panels, which could be added or taken apart as the users' needs changed. All of the building elements, including walls, floors, load-bearing members, doors, and windows, were designed based on a standardized planning network and prefabricated.[9] Load-bearing external walls allowed for flexible internal arrangements, while a system of laminated posts and beams visible throughout the house marked the difference between the structure and the infill. Non-load-bearing partitions could be dismantled, and movable cupboards and doors could be added to accommodate different arrangements of internal spaces. Theoretically, even the external wall panels—each around 150 kg—could be disassembled and moved if necessary.[10]

Although the system allowed for more than thirty-four hundred house types, eventually, owing to the complex procedures involved in house allocations within a cooperative framework, only twenty-nine variants were actually offered (fig. 1.2).[11] Nevertheless, the house was thought of as a toolkit of structural elements, where different spatial arrangements could be achieved with a limited number of components.[12] According to Margrethe Dobloug, one of the project's architects of Skjetten, this system was chosen both for its constructive rationality and the inherent ability to accommodate changing requirements, wants, and needs in the long term.[13] Timber elements were both cheap to produce and familiar to most Norwegians experienced with DIY constructions.[14] Jens Bjørneboe, another of the project designers, maintained that the planners

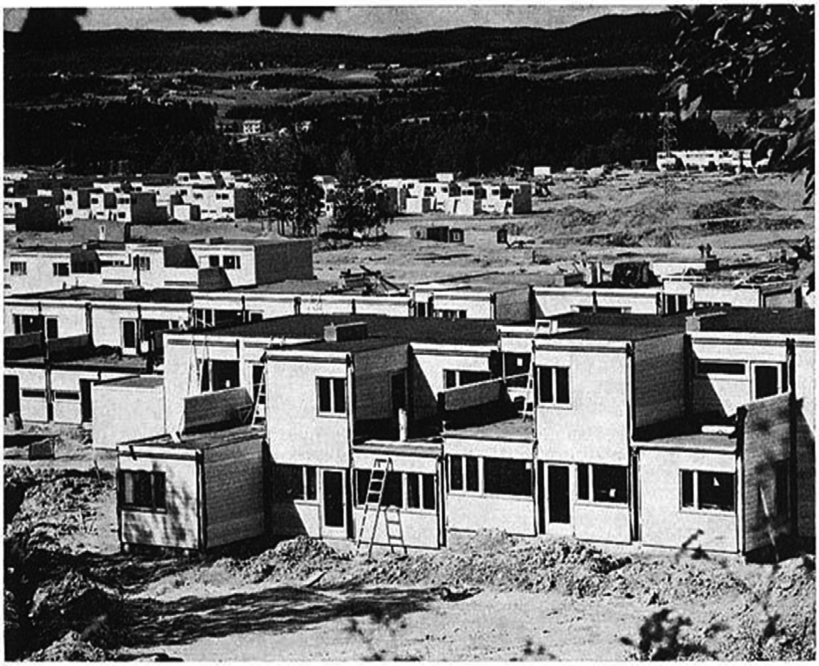

**Fig. 1.2.** Skjetten under construction. Newspaper clipping, 1970, public domain.

"did not want to force anything on anyone" and "wanted to define as little as possible so that the dwellers would define as much as possible."[15]

Thus, the Skejtten dwellers, and not the architects, were supposed to put these ideas of flexibility into practice. To explain the technical ins and outs of the project, Skjetten planners devised a comprehensive 120-page housing manual that was given to all first-time dwellers (fig. 1.3). Through a series of isometric drawings and system diagrams, it featured step-by-step pedagogic instructions for handling different aspects of construction. For example, the manual described the planning and constructive principles, detailed components, and technical fixtures of the house and offered instructions on internal and external finishes and garden arrangements and planting.[16] It also included pre-filled-out building permit forms so that Skjetten dwellers could adjust and modify their homes as their family needs changed over time—borrowing much of its visual iconography from the Whole Earth Catalog, popular at the time.[17]

Although Skjetten is well represented in Norwegian architectural history—multiple accounts position its flexible modular design within the low-rise high-density movement, international architectural avant-garde, and Nordic housing politics—its industrial origins remain largely overlooked.[18] I suggest

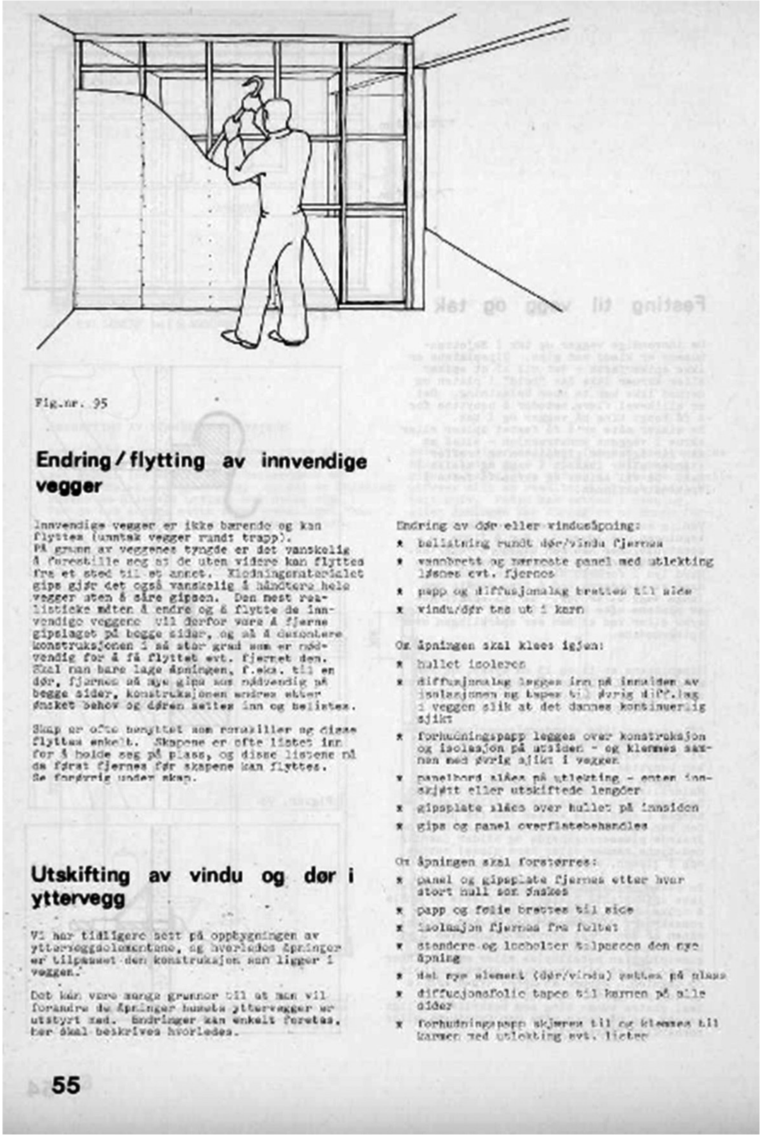

Fig.nr. 95

**Endring / flytting av innvendige vegger**

Innvendige vegger er ikke bærende og kan flyttes (unntak vegger rundt trapp).
På grunn av veggenes tyngde er det vanskelig å forestille seg at de uten videre kan flyttes fra et sted til et annet. Kledningsmaterialet gips gjør det også vanskelig å håndtere hele vegger uten å såre gipsen. Den mest realistiske måten å endre og å flytte de innvendige veggene vil derfor være å fjerne gipslaget på begge sider, og så å demontere konstruksjonen i så stor grad som er nødvendig for å få flyttet evt. fjernet den. Skal man bare lage åpningen, f.eks. til en dør, fjernes så mye gips som nødvendig på begge sider, konstruksjonen endres etter ønsket behov og døren settes inn og belistes.

Skap er ofte benyttet som romdeliller og disse flyttes enkelt. Skapene er ofte listet inn for å holde seg på plass, og disse listene må da først fjernes før skapene kan flyttes. Se forøvrig under skap.

**Utskifting av vindu og dør i yttervegg**

Vi har tidligere sett på oppbygningen av ytterveggselementene, og hvorledes åpninger er tilpasset den konstruksjon som ligger i veggen.

Det kan være mange grunner til at man vil forandre de åpninger husets yttervegger er utstyrt med. Endringer kan enkelt foretas, her skal beskrives hvorledes.

Endring av dør eller vindusåpning:

* belistning rundt dør/vindu fjernes
* vannbrett og nærmeste panel med utlekting løsnes evt. fjernes
* papp og diffusjonslag brettes til side
* vindu/dør tas ut i karm

Om åpningen skal klees igjen:

* hullet isoleres
* diffusjonslag legges inn på innsiden av isolasjonen og tapes til øvrig diff.lag i veggen slik at det dannes kontinuerlig sjikt
* forhudningspapp legges over konstruksjon og isolasjon på utsiden – og klemmes sammen med øvrig sjikt i veggen
* panelbord slåes på utlekting – enten innskjøtt eller utskiftede lengder
* gipsplate slåes over hullet på innsiden
* gips og panel overflatebehandles

Om åpningen skal forstørres:

* panel og gipsplate fjernes etter hvor stort hull som ønskes
* papp og folie brettes til side
* isolasjon fjernes fra feltet
* stendere og losholter tilpasses den nye åpning
* det nye element (dør/vindu) settes på plass
* diffusjonsfolie tapes til karmen på alle sider
* forhudningspapp skjæres til og klemmes til karmen med utlekting evt. lister

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**Fig. 1.3.** A page from Skjetten manual, offering advice on possible alterations. From *Håndbok 2 etg rekkehus og hage: Til og for folk i Skjettenbyen*, 1972, public domain.

looking at Skjetten not as an exception, a "sophisticated peak" of postwar Norwegian architecture, but rather as an example of a particularly Nordic alternative to the European model of mass housing that sought to harness possibilities offered by prefabrication and empower individual dwellers to shape their homes as they saw fit. Skjetten was just one of the many housing projects of the Ringsakerhus factory, founded in 1965 by Moelven Brug and OBOS (Oslo Bolig og Sparelag), the largest housing cooperative in Oslo.[19] It is precisely through the history of Ringsakerhus production that one can trace the development of this alternative mass housing model.

## The Small-House Revolution

Affordable housing was one of the fundamental aspects of the Norwegian Labor Party's *fellesprogrammet*—a long-term program established to create a better, more just society.[20] In the postwar period, affordable housing in urban areas was developed by housing cooperatives—OBOS being the largest and most important in the area of the capital. Living in OBOS flats was nearly synonymous with living in multistory apartment buildings, whose share of the total construction volume grew from 20 to 45 percent between 1953 and 1963. As housing cooperatives dominated the housing market, construction of single-family housing decreased dramatically in the same period.[21]

Being a member of the cooperative did not just mean living in a high-rise apartment. It also presupposed a certain "OBOS mentality" based on a specific ownership model positioned somewhere between an owner and a tenant.[22] Dwellers not only shared the costs of cooperative living and maintenance but also had to follow a set of rules and regulations that structured responsibilities for the upkeep of all the communal spaces. But this did not always fare well in a country where the majority of the population traditionally lived in single-family homes, often with no neighbors in sight.[23] In a 1959 letter to the OBOS magazine, one reader even wondered whether a desire to move to a smaller-scale house could be considered "one of the basic human instincts."[24] A small-house revolution was in the works.

As middle-class welfare grew toward the "golden 1960s," OBOS members also grew increasingly tired of prescriptive communal rules, which fostered a new desire for urban small-house living.[25] Smaller-house typology offered closer contact with the ground and was more flexible for long-term family needs. There was also a perceived inequality in the way housing typologies were distributed across social classes—wealthier citizens were able to afford more expensive urban row houses. The members of the growing middle class also wanted their share of affordable smaller-housing typologies.[26] This desire for a new housing type resonated with the OBOS management: in 1962, the OBOS director Odvar B. Solberg visited Paris, where he was astonished by the giant colossi of social housing next to motorways. Upon his return, he was convinced that urban development in Oslo had to go a different way.[27]

However, implementing a small-house revolution within a cooperative framework was difficult. In the 1960s, single-family homes comprised only 7 percent of all OBOS's building volume,[28] which was primarily a result of cost considerations: single-family houses required significant investments in land development shared across fewer dwellers. This meant that overall construction costs often exceeded the maximum limit imposed by the Norwegian State Housing Bank for properties eligible for a state-guaranteed loan.[29] To actually initiate the "small-house" revolution, OBOS would have to partner with an industrial producer to maintain close control of the design and production process. Moelven Brug, a former sawmill that had already turned to prefabrication and had been building economically priced timber houses in and around Oslo for nearly a decade, seemed to be the most suitable candidate for such a partnership.

Although Moelven had been delivering system-built schools, offices, and storage facilities since the mid-1950s, the company was initially reluctant to engage with housing prefabrication as that would require significant and risky investments in the changing politics of the Norwegian housing market.[30] However, cooperation with OBOS would mean a steady stream of commissions, clearings in the bureaucratic jungle, prime access to available land, and an all-around comfortable ride hitched on the back of the Leviathan. It is not surprising then that when Solberg approached Moelven's director Mageli in 1964, the deal was quickly sealed. The new joint factory opened a year later with a planned capacity of at least six hundred houses a year and the possibility of a two- or threefold expansion.[31] In addition to deliveries for OBOS, Ringsakerhus would sell prefabricated row houses for other cooperatives and developers at a profit for both partners.[32]

## Elemental Housing

Ringsakerhus's primary goal was the delivery of good but affordable mass housing based on smaller-scale typologies. In practice, this meant models for single- and two-story timber row house that allowed for a certain degree of variation and flexibility in their layouts. The house types were designed for nuclear families and were developed so that the buildings could be clustered together, reducing land development costs. Ringsakerhus factory production was based on serial orders made for larger construction companies, cooperatives, and private developers. To be profitable, the factory had to deliver series larger than fifteen units and build at least 1,000 houses annually.[33]

Design flexibility was achieved through a system of flat prefabricated timber elements initially developed by architect Hans Grinde and produced in the factory. With Ringsakerhus production, around 60 percent of the construction process happened at the factory. The timber panels were large: 2 to 3 m high and up to 6 m wide. They arrived from the factory with some interior and exterior finishes, but a significant part of the final work had to be completed on-site. Since the external walls were load-bearing, the internal partitions could be quite flexible, allowing for a wide range of room layouts. With all the structural elements—walls, floors, and ceilings—prefabricated as individual construction units assembled on conveyor belts, this system heralded a new approach to building that British architectural historian Christine Wall called the "architecture of parts."[34]

The Ringsakerhus factory employed some fifty workers, divided into teams in charge of different building parts.[35] Production of a wall element required two people; twelve two-person teams were needed to complete all the walls for a single house. Floor and ceiling elements were produced on two conveyor belts. Frames and beams were nailed together by a team of two or three workers and then layered with sponge plates, insulation, and plastic foil as the conveyor belt advanced.[36] Elements of the same type and configuration could be produced in series, and precise element dimensions and configurations varied depending on project specifications. Thus, while Grinde developed the original constructive system, outside architects of large housing projects could "customize" their orders, requesting specific panel configurations and dimensions. So, both technical equipment and the production process had to be flexible enough to accommodate different element dimensions. At the end of the production line, finished pieces were picked up by two large traverse cranes and stored, flat-packaged, and delivered to the site in the order of assembly (Fig. 1.4).[37]

Utilizing the Ringsakerhus elements significantly sped up the construction process. If the foundation was already in place, three or four workers could assemble one housing unit a day with the help of a building crane. Since there were no cranes in Norway to assist with this task, Moelven had to design and build a telescopic crane in the in-house mechanical workshop. According to firsthand witness accounts of construction, it was "quite impressive" for nonprofessional people to observe the process: "At 7 a.m., the foundation has started. At 14.15, the house is already in place, and the internal finishes can begin."[38] Ringsakerhus's production thus heralded the long-awaited transformation of house construction from building to assembly: standardized prefabricated elements saved on on-site construction work, sped up delivery, and

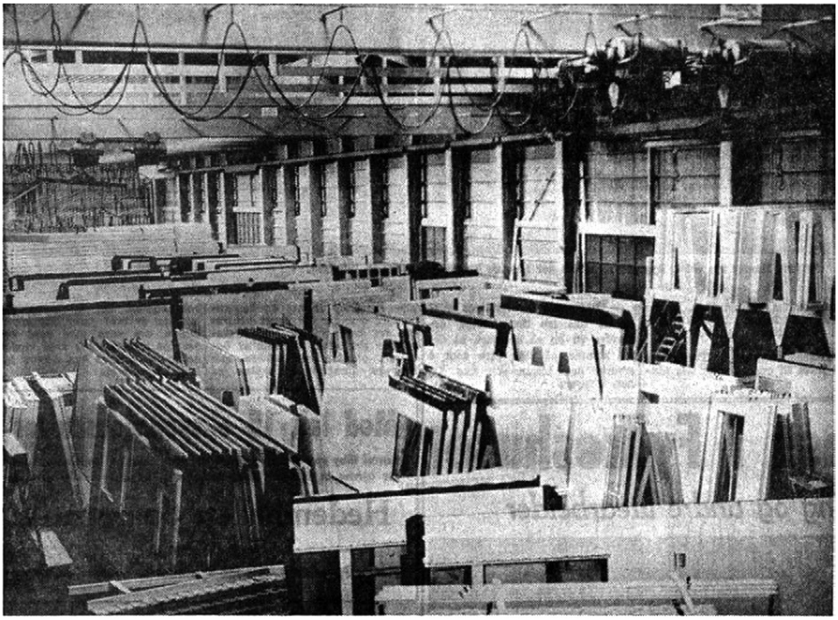

**Fig. 1.4.** Interiors of Ringsakerhus factory, a storage unit for prefabricated panels. Newspaper clipping, 1967, public domain.

resulted in a general reduction in cost. Most importantly, element-based construction introduced design variation within a standardized factory production framework.

## Lifestyles of the Future

From the beginning, OBOS's director Solberg envisioned that the Ringsakerhus factory would not just reproduce existing building types but would develop new typologies that could anticipate their dwellers' future lifestyle changes.[39] Most often, outside architects collaborated on a project design with Moelven planners and engineers. Housing layouts and designs would then be "processed" and adapted for factory production by Moelven's usual collaborators, the architectural office of Helge Abrahamsen, Hans Grinde, and René Philipp. The first major projects delivered by Ringsakerhus were OBOS row houses in Stovner, social housing for the Ski Municipality, and a large project in Nittedal developed for the Oslo Police Union. As they were different in ambition and scale, a brief study of these three projects provides an insight into the possibilities and limitations of Ringsakerhus production.

In the summer of 1967, Stovner became Moelven's first housing project for OBOS. The delivery consisted of 192 two-story, flat-roofed houses with four-room apartments of two different types: type A was a typical row house and type B was adapted to a sloping terrain. The designs were first drafted by the NBBL cooperative housing architects' office and then adapted for Ringsakerhus production by Moelven's in-house architects.[40] Rather conservative in design, the houses featured a conventional layout with an entrance, a kitchen, and a living room on the ground floor and bedrooms on the first floor.[41] Nevertheless, the Stovner development provided a successful alternative to OBOS's multistory apartment buildings—an affordable row house.

The first project to be designed entirely in-house by Abrahamsen, Grinde, and Philipp was a social housing project for the Ski Municipality. Three two-story row houses built on a single foundation plate without cellars accommodated fourteen apartments sized between 89 and 95 $m^2$.[42] Since the project was designed by Moelven's architects, who were quite familiar with the entire production system, the Ski development fully utilized the system's structural advantages. The gable walls were divided into four elements, while each floor had just one structural joint. Bathrooms and toilets arrived as ready-made "wet boxes" that served as stabilizing components together with stair blocks. In addition to the social housing part of the project, Ringsakerhus also erected three more-expensive apartments for Ski Electricity workers. Those units had flexible internal partitions that allowed dwellers to divide the space according to their needs.[43] With a price tag of just 77,250 NOK, the project was well-publicized, received many positive reviews, and proved that good-quality housing could be constructed at a low cost in just under seventy-five days.[44]

Another large serial order was carried out for members of the Oslo Police Cooperative. The Nittedal project at Tøyen Gård, thirty kilometers north of Oslo, consisted of 130 row and terraced two-story buildings. With apartments of 92 and 96 $m^2$, the Nittedal houses were arranged in clusters of four placed along the sloping terrain. Flat-roofed and clad in dark-brown vertical timber panels, they offered a local take on modernist forms adapted to the local materials and specific site conditions. Unlike Stovner and Ski, the Nittedal project was built to a slightly higher standard for a private entrepreneur. At a cost of 91,000 NOK each, the double-facing apartments featured hardwood floors, modern kitchen equipment, three bedrooms, a bathroom, a toilet, two storage areas, and a laundry room.[45] Designs were drawn specifically for the project by the Yugoslavian architect D. Trifunovic and had a "very tasteful execution."[46] These first three Ringsakerhus projects—Stovner, Ski, and Nittedal—illustrate how the Ringsakerhus modules could be adapted to different price and quality categories, with designs that varied from those of state architects working within limited budgets and minimum-standards regulations to custom-made projects drawn by international architects.

Quite quickly, in addition to producing elements for individual projects, Ringsakerhus set out to develop fixed house types that would be marketed to municipalities and entrepreneurs through catalogs and developed by Moelven Consult—a subsidiary established for land development.[47] The idea was to create a clustered single-family house type that could offer the advantages of a single house but be serially produced and competitively priced.[48] By the mid-1960s, atrium- or corner-house types were becoming extremely popular as they allowed for several buildings to be grouped together, which optimized the land utilization—an essential factor in view of increasing costs of infrastructural development. However, as atrium-type houses required customized structural solutions that put them beyond the maximum-cost framework, Moelven set out to develop a budget alternative.

In 1968, Ringsakerhus unveiled the so-called outdoor space house—*uteromshus*, or U89A type—with the Swiss architect René Philipp in charge (fig. 1.5).[49] This single-floor "outdoor" house was based on a rectangular footprint of 20 × 4.5 m, with all the windows facing in the same direction. Each house had a 3 × 4.5-m storage shed positioned at a 90-degree angle to the back of the house so that, despite a linear design, each house boasted a private garden space shielded from prying eyes. Large windows along one side of the facade allowed direct contact between the house and garden—satisfying the wishes of the new generation of homeowners. Moelven's "outdoor space" house offered a practical and economic realization of the "small house revolution" at affordable cost. With an overall gross floor print of 108 m$^2$, the house cost around 65,000 NOK—an "outrageously" cheap offer at the time. With a creative utilization of simple geometric volumes, the "outdoor" house thus offered all the advantages of the atrium type without the structural complications and at a much lower cost.

U89A was built entirely from Ringsakerhus elements, one story high, up to 6 meters in length, with windows and doors preinstalled. The houses were set on a concrete foundation slab without cellars to make construction cheaper and faster.[50] If the groundwork was already completed it took a team of four men a single day to assemble each house. With a living room, a kitchen, three bedrooms, a bathroom, and a washroom, this model allowed for more than ten different plan layouts from which future dwellers could choose.[51] Narrow rectangular volume conditioned by the width of prefabricated rear walls introduced certain limitations and required some unconventional planning solutions. For example, an 11-meter corridor between the master bedroom and bathroom, lack of oversight of the children's room, and the south-facing kitchen were met with a certain skepticism on the part of architecture professionals.[52]

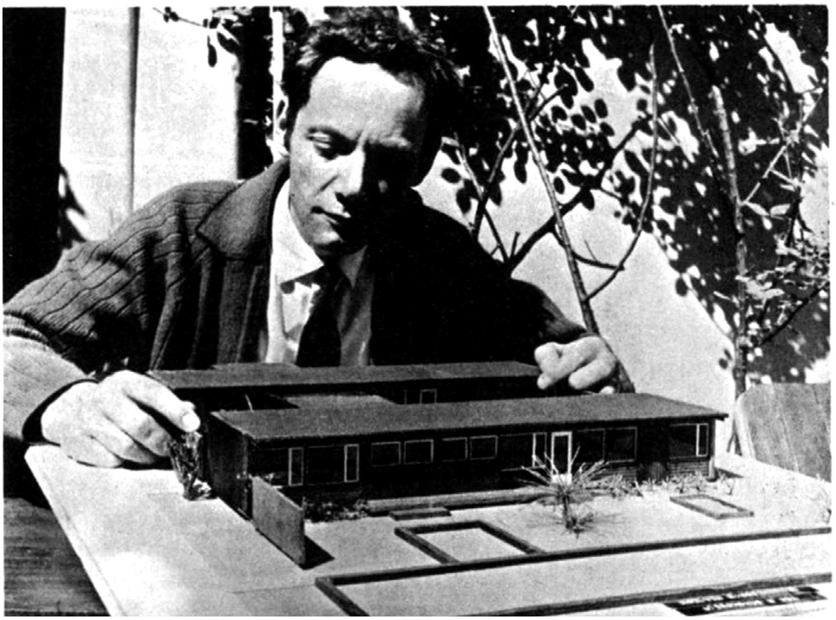

**Fig. 1.5.** Swiss architect René Philipp with a U98A type house. Newspaper clipping, 1970, public domain.

Nevertheless, when the house was first presented at the *Bygg reis deg* exhibition in 1967, it met with an overwhelmingly positive response, from both the professional audience and the general public. The fact that the total price for such a house, including groundwork, was under 100,000 NOK was considered a "record in itself."[53] By the summer of 1968, there was already a half-year waiting time for delivery of this type of house.[54] In 1970, Bonytt named the project the best "ready-made house of the year" in the category of concentrated small-house types.[55] Among several other significant housing developments throughout the 1970s, some 182 houses of this type were built in Grålumåsen in Tune, Løken Nordre in Svelvik.[56] This "outdoor space" type was a small-house revolution put into practice. It represented the "good and reasonably priced" architecture for ordinary people that Ringsakerhus was trying to deliver.[57]

## Northern Systems, Southern Typologies

Ringsakerhus modules were not used solely as price-conscious solutions. Norwegian architects were particularly drawn to the range of spatial potentialities offered by a limited set of modular components. In particular, Paul

Cappelen and Thorbjørn Rodahl, two young practitioners and outspoken advocates of prefabrication, explored the possibilities of the Ringsakerhus structural system in a Sankthansfjellet housing project (fig. 1.6). Designed for OBOS in 1969–1971, the development consisted of 183 atrium houses on 9 × 13-m plots.[58] The most distinguishing characteristic of the project, however, was its placement on a sloping terrain. Inspired by North African urban morphology patterns, the buildings were arranged in stepped, back-to-back clusters, which allowed for spacious outdoor terraces, good views, and screened gardens.[59] With an overall 92-m$^2$ floor space, each house had three bedrooms, a large living room, a spacious kitchen, and several washrooms. Two-story flat-roofed houses were decisively modernist in their clean geometric volumes. At the same time, clad in vertical dark-timber panels supporting the heavy horizontality of a roof cornice, carefully situated within the hilly terrain, and imbued with scrupulous attention to landscaping, these houses offered a particularly Norwegian interpretation of the modernist form language.

Cappelen and Rodahl designed another project for OBOS whose structural logic was derived from Ringsakerhus prefabricated elements. The Kringsjå development at Sognsvann, north of Oslo, was constructed with the same cubic typology and stepping volumes that clearly marked the difference between private and public areas. Outer load-bearing walls constructed with Ringsakerhus elements allowed for flexible plan layouts and more spacious interiors: future dwellers could choose the optimal arrangement of rooms according to their particular needs. A typical plan featured a large corner living room, four bedrooms, spacious washrooms, a cellar, and a garage.[60] With its panoramic windows and large terraces that offered impressive views of Lake Sognsvann, the development was considered one of the most attractive residential areas in the city. When completed, the houses were allocated to municipal functionaries rather than ordinary OBOS members, which caused a heated public debate over the perceived unfair correspondence between housing quality and social class.[61]

Curiously, both of these projects had their origins in Cappelen and Rodahl's travels to North Africa, especially Morocco and Egypt, where "little Arabic villages with their peaceful introverted atmosphere" seemed to offer an alternative to the straight-jacket, modernist slab block, providing a different model of the local community.[62] Moreover, although Cappelen and Rodahl were not the only architects inspired by the Mediterranean vernacular, few Norwegian practitioners explored the way industrial prefabricated elements could accommodate these new community-based housing types.[63] These two Ringsakerhus projects—Sankthansfjellet and Kringsjå—show how inspiration from "vernacular" urban morphologies that found their way into the architectural discourse of the 1960s was adapted through available industrial solutions,

**Fig. 1.6.** Sankthansfjellet housing project, Moelven Industrier. From *Moelven Brug i forvandling og vekst: En jubileumskavalkade 1899–1974*, public domain.

namely prefabricated timber elements, to offer a specifically Norwegian alternative to the dominant European model of mass housing. These two projects showcase how technological advances in prefabrication allowed the architects to meet the growing demand for better, more adaptable housing and also provided a physical form to meet the new generation's aspirations for a nonhierarchical architecture governed by systems and patterns of association.

By the end of the 1960s, these new architectural debates, which were particularly concerned with reconciling the individual and universal, made their way onto the pages of Norwegian architectural magazines, starting with the famous 1966 "Order and Variation" article by Christian Norberg-Schulz.[64] Quite unexpectedly, the low-rise high-density housing projects of a company best known for its cheap prefabricated homes shared many similarities with the new typological innovation of the European avant-garde—large, horizontal landscape-like structures of MAT-buildings.[65] Ringsakerhus projects, built with prefabricated components that could be added or taken apart depending on the users' needs, managed to put the often visionary aspirations of proponents of flexible architecture into practice. Industrial actors, such as Ringsakerhus, that could mass-produce adjustable building components fit particularly well into this unique moment of convergence between social democratic politics and emerging antimonumental aesthetics.[66]

Ringsakerhus's building system thus provided a pragmatic and economical solution to the 1960s search for new nonhierarchical architectural typologies. This new architecture was supposed to counteract the grim monotony of anonymous high-rise towers, reconcile individual and universal, and empower dwellers with a new level of design agency. Arising from the broader critique of paternalistic planning, similar developments found a place in other Scandinavian countries. For example, the Albertslund South development in Copenhagen (1963–1968), with its experimental atrium-house typologies built from prefabricated concrete elements and a possibility of future extensions, became a "mecca" for many Norwegian architects.[67] According to urban design historian Tom Avermaete, these late 1960s housing projects built with prefabricated industrial components managed to reconcile the inherent tension between "collective frames and individual autonomy" fundamental to the Nordic model of social democracy in a pragmatic manner.[68] Thus, Nordic low-rise high-density housing projects represent a specific regional contribution to postwar European models of mass housing.

## The Age of Systems

Ringsakerhus's system of prefabricated elements utilized for a new typology of mass housing ushered in a wave of low-rise high-density housing projects and heralded the new age of system-based planning. By the mid-1960s, ideas of "flexible housing" made their way into the mainstream discourse, appearing in the OBOS magazine in 1965, in the popular Norwegian magazine *Forbrukerrapporten* in 1968, and even in a televised debate in 1968.[69] In the 1970s, ideas of user participation and democratic planning principles grew to become essential elements of any planning brief and were extensively covered in reports produced by the Norwegian Building Research Institute (NBI).[70]

Skjetten's planners—for example, Jens Bjørneboe—continued to work with these ideas, but now in a more systemic fashion, trying to introduce them within a planning policy framework. Constructive kits-of-parts developed by industrial producers such as Ringsakerhus delivered something of a "budget version" of Skjetten's experimental architectural flexibility by allowing future dwellers to select from a range of different spatial configurations for their future homes. The concentrated small-house typology not only made its way into Norwegian everyday life but managed to harness the somewhat countercultural ideas of participatory architecture to the optimal and most profitable approach to new suburban developments.

In the spring of 1973, soon after the Skjetten project was completed, Ringsakerhus collaborated with the architects behind that project to develop an "off-the-shelf" comprehensive industrial building system. A limited number of dimension-coordinated components provided housing typologies of different scales, orientations, and relationships to the site.[71] The resulting "Ringsakerhus-system" (or RH-system for short) was very similar to that used in Skjetten. It consisted of load-bearing external walls and a series of laminated poles and beams set throughout the house on the same 60-cm modular network. House dimensions were optimized in accord with the NBI studies. A façade breadth of 7.5 m was chosen to maximize the variety of internal layouts.[72] The houses could be delivered 40, 50, or 65 percent prefabricated, with different amounts of work and finishes done in the factory. The system design also accounted for various modes of cooperation among the owners, builders, and developers. From the autumn of 1975 to 1978, some thirteen hundred houses were built with the RH-system, which, according to Ringsakerhus engineer Odd Bergli, served "as an efficient planning tool for private and cooperative developments."[73]

The RH-system finalized this shift toward "an architecture of parts." Houses could now be designed by choosing the right combination of industrially made elements from a catalog of parts and following the comprehensive instructions for self-assembly. At the same time, although produced with the most sophisticated technology, buildings constructed with the RH-system appeared rather conventional. Built in timber with pitched roofs and balconies, they little resembled the abstract architectural experiments of the late 1960s. Yet, by the early 1970s, how these houses looked was less important. What mattered more was how they were assembled. System-building was considered a pragmatic compromise between industrial rationality and architectural expression and an affordable way to incorporate the user's voice.[74]

Moelven was not the only company to develop a building system: the Norwegian housing market, managed through centrally imposed spatial standards and cost limits, was particularly susceptible to this ascendancy of systems. In 1973, the Norwegian State Housing Bank, the main subsidiary for all housing construction in the country, presented its own building system for houses that offered "better spatial qualities and higher land utilization" and incorporated user input into a modular design.[75] The same year, the architect Bjørn Larsen, together with students from the Oslo School of Architecture and

Design, started working on an "open-source" catalog on Norwegian building systems, *Systembyggehåndboka*, which was intended to provide a comprehensive overview of different aspects of system-building in Norway and "democratize" this technology for popular use.[76] In this way, what Ringsakerhus products offered from the mid-1960s—the possibility of choice in industrial production—became an essential paradigm of housing provisions with the 1970s shift that favored user participation and the democratic horizontality of all decision-making processes.

## How Will We Live Together?

The Seventeenth International Architecture Exhibition in Venice held in 2021 questioned, "How Will We Live Together?" Different Arsenale exhibits explored new typologies of mass housing that negotiated private and public spaces, individual expression, and the pragmatism of a mass-production system. Elements of the Urban Village Project with its low-rise high-density housing clusters nested among the forest greenery are reflections of the EFFEKT architects' stand "Ego to Eco."[77] Today, seen through the lens of the contemporary global climate emergency, rapid urbanization, and rampant real estate speculation, the promise of industrial building systems to reconcile both individual and universal and private and public at a low cost seems more relevant than ever.

Many of the contemporary projects that turn to prefabrication—particularly those with Scandinavian origins—are undoubtedly indebted to the late-1960s Nordic experiments with a new typology of flexible mass housing. Beyond a formal language of restrained modernist aesthetics, these projects often rely on prefabricated components and systems of production, a technology that in itself carries over a set of implicit ethical and ideological assumptions. It seems that to answer our contemporary questions regarding the future of housing, we might have to revisit some of the projects developed by the last generation of architects who grappled with social concerns before architecture retreated from social engagement in the 1990s. As noted in the introduction to this volume, the many cultural and material histories behind large, prefabricated mass-housing projects of the previous generations are still to be explored. Designs of prefabricated systems and components ultimately serve as a reflection of their time and are closely tied to political regimes, economic systems, and material and labor circulation networks. They are never designed in a vacuum and, as I showed in this essay, are a result of a collective agency of a wide array of decision-makers—architects, industrial and material producers, politicians, bureaucrats, and entrepreneurs. Often driven by pragmatic concerns regarding production, prefabricated designs travel across geographies and draw from a wide range of sources, presenting as curious cultural hybrids—as seen in the case of Ringsakerhus Morocco-inspired timber homes. Architectural histories of prefabricated housing projects offer a unique insight not only into transnational and transdisciplinary histories but also into idealistic aspirations for a more egalitarian future society, which defined their designs. However, obscured by the inconspicuous appearance and the patina of everyday life, these idealistic aspirations at the core of prefabricated mass-housing projects of the 1960s are hard to read for an untrained eye.

Many Ringsakerhus housing projects are still around today and have far outlived the grim predictions of their harshest critics. Often, their quality is directly related to contemporary commitment to maintenance and the upkeep of infrastructure. Although built in timber, they have seen several generations of happy dwellers who often know little to nothing about the avant-garde architectural ideas of democratic participation that went into their creation. Some, such as Sankthansfjellet and Kringjå, retain their upmarket position to this day and, often slightly refurbished, sell for nearly a million euros.[78] Others, such as Skjetten, provide homes for many families, having lived through generations of alterations and additions—albeit, perhaps, not the way the project's architects originally envisioned them.[79] Moreover, although in Scandinavia, prefabricated timber architecture might still evoke associations with low-quality "social" housing when seen from the outside, these experiments with a new typology of mass housing, which offers good but affordable architecture for ordinary people—like that of Ringsakerhus—seem to offer specifically Nordic answers to the question of how we might live together.

## Notes

1. See the description of "The Urban Village Project" at Urban Village, accessed May 20, 2022, https://www.urbanvillageproject.com/.
2. Ibid.
3. By the end of the 1980s, more than 85 percent of the Norwegian population had some knowledge of Moelven products. See Oddvar Hemsøe, *Moelven 1899–1999* (Moelv: Moelven Industrier, 1999), 76.
4. "Bolig nr. 1000 er levert av A/S Ringsakerhus til OBOS," *Arbeiderbladet*, May 10, 1971, 13.
5. *Norske Arkitektkonkurranser*, no. 116 (1965), unpaginated.
6. Skjettenprosjektering IS refers to the collective professional enterprise of architects and engineers that worked together on the Skjetten project. See *Romerikes Blad*, May 28, 1970, 1.
7. *Nationen*, August 18, 1970, 9.

8. Equal to about contemporary 80 million EUR. See Inflation Tool, acessed May 20, 2022, https://www.inflationtool.com/norwegian-krone/1971-to-present-value, for historical currency exchange rates.
9. Margrethe Dobloug, "Skjetten. A User's Manual," *Nordic Journal of Architecture* 2, no.1 (2012): 30.
10. Nils-Ole Lund, "Skjetten Town Norway" (1973), *Nordic Journal of Architecture* 2, no. 1 (2012): 26–27.
11. Erik Hultberg, "Systemgrunnlaget for rekkehusene i Skjettenbyen," *Byggekunst* 52, no. 4 (1970): 147.
12. *Arbeiderbladet*, September 5, 1969, 27.
13. Dobloug, "Skjetten. A User's Manual," 34.
14. Jens Bjørneboe, "Brukernes Medvirkning på Skjetten," *Byggekunst* 53, no. 4 (1971): 136.
15. Ibid., 135–37; *Aftenposten*, October 16, 1970, 7.
16. Dobloug, "Skjetten. A User's Manual," 30–37. See also Margrethe Dobloug, *Håndbok 2 etg rekkehus og hage: til og for folk i Skjettenbyen* (Oslo: I/S Skjetten-prosjektering, 1972).
17. Dobloug, "Håndbok," 2. The Whole Earth Catalog was an American counterculture magazine and product catalog published between 1968 and 1972 that focused on self-sufficiency, ecology, and DIY culture.
18. See Jon Guttu, "'Den gode boligen': Fagfolks oppfatning av boligkvalitet gjennom 50 år" (PhD thesis, Arkitekthøgskolen i Oslo, 2003), 230, 284; Ulf Grønvold, "Norsk strukturalisme," *Byggekunst* 65, no. 2 (1983): 60–63. See also the entire volume of *Nordic Journal of Architecture* 2, no. 1 (2012), devoted to Skjetten.
19. OBOS was founded in 1929 after a Swedish cooperative model, and by 1934 it was entrusted with the responsibility for all housing provision by Oslo Municipality. Closely aligned with the ideology of the Labor Party, the cooperative's goal was to provide good and secure mass-housing of a reasonable standard. For more information on OBOS, see Arnfinn Guldvog et al., eds., *Oslo bolig- og sparelag: 1929–1954* (Oslo: OBOS, 1954), 66; Per Otto Riis, *OBOS og boligmarkedet: En analyse av transaksjoner med andeler i borettslag tilknyttet Oslo Bolig- og Sparelag* (Oslo: Universitetet i Oslo, 1975), 2. See also Johan-Ditlef Martens, *Norsk boligpolitikk fra sosial profil til fritt marked* (Oslo: AKP, 1982), 66.
20. Jon Skeie, *Bolig for folk flest: Selvaagbygg 1920–1998* (Oslo: Tano Aschehoug, 1998), 61.
21. Knut Selberg and Vegard Hagerup, *Husbanken former Norge: Den norske stats husbank: innflytelse på arkitektur og tettstedsutvikling 1946–1980* (Trondheim: Norges tekniske høgskole. Institutt for by- og regionplanlegging, 1981), 35; Halvdan Buflod, *Teknologisk endring av småhusbyggingen: en analyse av drivkrefter og samfunnsmessige konsekvenser* (Oslo: Norsk institutt for by- og regionforskning, 1985), 44.

22. Riis, *OBOS og boligmarkedet*, 5.
23. Johan-Ditlef Martens, *Norwegian Housing* (Oslo: Norsk arkitekturforl., 1993), 7.
24. *OBOS bladet*, no. 4 (1959).
25. Riis, *OBOS og boligmarkedet*, 7, 24; *OBOS bladet*, no. 4 (1959): 23–24; *OBOS bladet*, no. 6 (1960); *OBOS Årsmelding og Regnskap* (1974), 7.
26. "Konsentrert småhusbebyggelse: innlegg i debatten," *Artikler og foredrag samlet av Treopplysningsrådet* (Oslo: Treopplysningsrådet, 1972), 2.
27. Bjørn Bjørnsen, Anne-Kristine Kronborg, and OBOS, *Hele folket i hus: OBOS 1970–2009* (Oslo: Gaidaros, 2009), 42–43.
28. *OBOS bladet*, no. 6 (1960).
29. For more on the role of the State Housing Bank on the formulation of housing politics, see Selberg and Hagerup, *Husbanken former Norge*; Elsa Reiersen et al., *De tusen hjem: Den norske stats husbank 1946–96* (Oslo: Gyldendal, 1996).
30. In the 1965 electoral "number war," the center-right coalition unexpectedly outbid the Labour Party on their home turf, promising forty thousand new houses a year. New political powers set forth a new housing and construction agenda, including changes to the planning and building law. See *Arbeiderbladet*, March 18, 1964, 14; *Gudbrandsdølen*, June 5, 1964, 5.
31. *Bergens Tidende*, June 9, 1965, 8; *Arbeiderbladet*, October 8, 1965, 3.
32. *Aftenposten*, June 10, 1965, 11.
33. *Ringsaker Blad*, September 25, 1965, 1; *Moelven Bedriftavis*, no. 12 (1972): 9–10; *Arbeiderbladet*, March 18, 1964, 14.
34. Christine Wall, *An Architecture of Parts: Architects, Building Workers and Industrialization in Britain 1940–1970*, Routledge Research in Architecture series (London: Routledge, 2013), 100–101.
35. *Bedriftavis,* no. 12 (1972): 9–10.
36. Ibid., 13.
37. *Ringsaker Blad*, September 1, 1966, 1; Moelven industrier et al., *Moelven 1899–1999* (Moelv: Moelven Industrier, 1999), 48.
38. *Nye bonytt: Norsk spesialblad for hus, hjem og boliginnrednin* 31, no. 7 (1971): 5–10.
39. *VG*, June 9, 1965, 19.
40. NBBL refers to Norske Boligbyggelag Landsforbund, a Federation of Norwegian Housing Cooperatives. See *Arbeiderbladet*, August 2, 1967, 6. On Stovner, see also Bjørn Bjørnsen and OBOS, *Hele folket i hus: OBOS 1929–1970* (Oslo: Boksenteret, 2007), 203.
41. Anne-Kristine Kronborg, *OBOS: 100 borettslag 1929–2013* (Oslo: Forlaget Press, 2014), 182.
42. *Lillehammer Tilskuer*, April 18, 1967, 3; *Hamar Arbeiderblad*, September 5, 1967, 8.
43. *Aftenposten*, August 31, 1967, 9.
44. *Romerikes Blad*, August 31, 1967, 5; *Hamar Arbeiderblad*, September 5, 1967, 8.
45. *Gudbrandsdølen*, May 11, 1967, 4. See also *Varingen*, May 26, 1967, 1.

46. *Ringsaker Blad*, May 11, 1967, 1, 2.
47. *Aftenposten*, November 18, 1966, 12; *Oppland Arbeiderblad*, November 21, 1966, 5.
48. *Sarpsborg Arbeiderblad*, October 4, 1968, 6–7.
49. *Ringsaker Blad*, July 20, 1968, 3.
50. *Sarpsborg Arbeiderblad*, October 4, 1968, 6–7.
51. *Ringsaker Blad*, July 20, 1968, 3.
52. *Morgenbladet*, June 9, 1970, 4.
53. Ibid.
54. *Ringsaker Blad*, July 22, 1968, 2.
55. *VG*, June 1, 1970, 8; *Bonytt* 31, no. 7 (1971): 79–82.
56. *Sarpsborg Arbeiderblad*, October 4, 1968, 6–7.
57. *Hamar Arbeiderblad*, June 1, 1968, 2.
58. *Byggekunst*, 49, no. 6 (1967): 161.
59. *Byggekunst*, 52, no. 3 (1970): 484.
60. *Dagbladet*, June 6, 1969, 9.
61. Ibid.
62. *Byggekunst*, 49, no. 6 (1967): 161; Susanne Villadsen, "History behind Munkerudsletta Hhousing Cooperative," Mukerdsletta, accessed October 10, 2020, https://munkerudsletta.no/?p=12047, accessed October 10, 2020.
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67. Guttu, "Den gode boligen," 278–79.
68. Tom Avermaete, "Designing for the Anonymous Collective: The Architectural Culture of the 1960s," *Nordic Journal of Architecture* 2, no. 1 (2012): 53, 56.
69. *Tidens Krav*, June 24, 1958, 10; *Rana Blad*, June 24, 1968, 7; *OBOS-bladet*, no. 5 (1965): 13; *Forbrukerrapporten*, no. 9 (1968).
70. *Tæt lav–en boligform. Eksempelsamling*, SBI-rapport 75 (København: Statens byggeforskningsinstitut, 1971); Jens Bjørneboe, *Vurderingskriterier for rekkehus: En utredning for Den norske stats husbank*, Arbeidsrapport 75 (Oslo: Norges byggforskningsinstitutt F-3003, 1975).
71. "RH Byggesystem for konsentrert småhusbebyggelse. A/S Ringsakerhus, Moelv.," *Byggekunst*, 58, no. 4 (1976): 104–8.

72. See Jens Bjørneboe and Asbjørn Nedrebø, *Vurderingskriterier for rekkehus: En utredning for Den norske stats husbank* (Oslo: Norges byggforskningsinstitutt, 1975). See also Anne Sæterdal, Jens Bjørneboe, and Asbjørn Nedrebø, *Grunnlag for planlegging av boliger* (Oslo: NBI, 1972).
73. Odd Bergli lecture, *Konferanse om: Byggesystemer og hustyper for konsentrert småhusbebyggelse: 24.–26. september 1979* (Fagernes: Norske sivilingeniørers forening NIF, 1979). Among large developments built with the Ringsakerhus system was the Øreåsen development, where 153 houses were built using this particular system. See *Byggekunst* 63, no. 4 (1976): 14; *Byggekunst* 61, no. 6 (1979).
74. Guttu, "Den gode boligen," 236.
75. *Husbankens prosjekteringssystem for småhus* (Oslo: Den Norske stats husbank, Arkitektkontoret, 1973), 4; Buflod, *Teknologisk endring av småhusbyggingen*, 25.
76. Bjørn Larsen, "Vi trenger en systembyggehåndbok," *Byggekunst* 55, no. 1 (1973): 13–15; Larsen, *Åpen systembygging: Om teori og praksis* [Open system building: On theory and practice] (Oslo: Arkitekthøgskolen, 1977).
77. "Ego to Eco" project by EFFEKT Architects, accessed May 20, 2022, https://www.effekt.dk/velux.
78. See the history of sales in Sankthansfjellet Borretslag with apartment interiors at Bolig.ai, accessed October 14, 2022, https://www.bolig.ai/no/adresse/haugerudveien-19-oslo-285704438/1987216.
79. On the postoccupancy evaluation of Skjetten see Nils-Ole Lund, "Skjetten Town Norway" (1973) and "Looking Back at Skjetten" (2010), a later discussion of the disconnect between the architects' aspirations and the reality of Skjetten flexibility, *Nordic Journal of Architecture* 2, no. 1 (2012): 22–29.

CHAPTER 2

# Assembling a Home

## Politics, Trauma, and the Finnish Export of Prefabricated Homes

*Mia Åkerfelt, Tzafrir Fainholtz, and Anna Wilczyńska*

*The great reconstruction missions became the foundation of our [Finnish] prefabricated wooden housing industry.*[1]

In the postwar decades, there was a critical need to provide housing in the countries seriously affected by World War II. Displaced communities searched for new places to live, and governments struggled with finding affordable housing solutions for reconstruction. In this context, the development of prefabricated housing saw a quick rise in popularity both within national policymaking and in the architectural field. The prefabricated housing industry grew rapidly in Finland. During the postwar years, Finland's export of wooden housing developed from a marginal industry in the 1920s and 1930s to become a major global export, as noted in the headline of an article on the prefabrication company Puutalo Oy's twenty-fifth jubilee cited in the epigraph.

The rapid growth was due to the need for reconstruction following the two wars with the Soviet Union between 1939 and 1944 and having to provide new housing for four hundred thousand Karelians who had to be relocated owing to the loss of the Karelian Isthmus. On the one hand, these demands fostered the development of type planning and prefabrication but, on the other, the domestic market for prefabricated housing was not a significant one until the 1960s. Export became the main market for Finnish prefabricated houses, partly because such housing was an important commodity for paying war-reparations to the Soviet Union. After the timber industry had paid off its share of the reparations in 1948, global markets became the targets for Finnish prefabricated housing and the houses were often used as currency in international trade (fig. 2.1).[2]

Two of the countries that imported "Finnish houses," as they often were called locally, were Poland and Israel. Their reasons for importing the houses were vastly different, but thousands of Finnish houses were erected in both countries during the reconstruction period in Poland after World War II and during the period of massive migration, *Alia ha-Aamonit*, to the newly founded

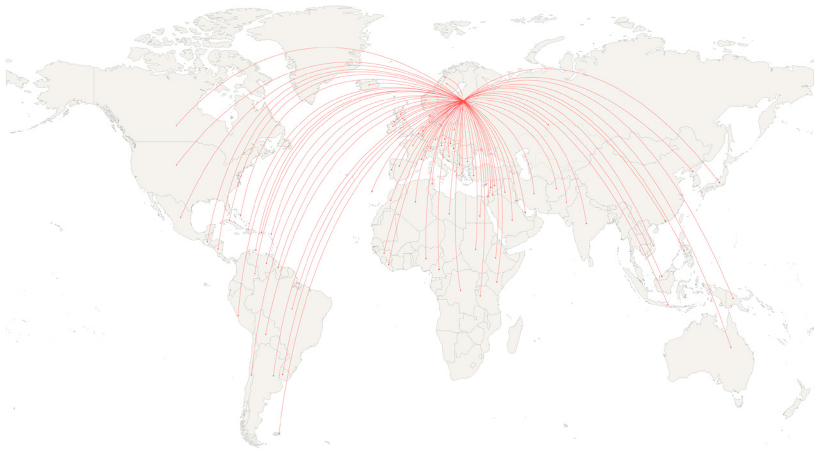

**Fig. 2.1.** Between 1940 and 1970, Puutalo oy exported houses to a vast number of destinations globally. Graphics based on Puutalo Oy archival materials, graphics by Anna Wilczyńska.

State of Israel. Though foreign commodities and temporary housing solutions, these houses touched the lives of many and became embedded in local memory. Thus, they provide a good case study for exploring their role in reconstruction contexts and in the discourse on national architectural heritages. Finnish prefabricated housing exports were part of a dramatic shift from the conventional wooden architecture of the Nordic countries to a modern and experimental industry using wood to produce housing on different scales, from the private house to neighborhoods and villages.

The present chapter is based on research conducted within the project "Housing, Prefabrication and Export – Architecture of Reconstruction in Times of Crises."[3] The project is an interdisciplinary study of mechanisms of housing fabrication, export, and construction, and the adaptation and appropriation of exported/imported housing for reconstruction. The aim is to examine the way exported prefabricated housing architecture can be understood in the context of architectural cultural heritage in Finland, Poland, and Israel. The principal questions concern how the buildings and their architecture were given meaning, by both the governments and the housing communities, as well as in what ways the buildings can play a part in the local discussions on cultural heritage. The primary source for this exploration is archival data: documentation on export, drawings, and photographs from the Puutalo Oy archives in Finland and from national and local archives in Israel and Poland. The context and ideas associated with the housing export are also tracked via articles in national newspapers and journals. The results are interpreted through theoretical perspectives on national architecture and cultural heritage.

## Architecture and Cultural Heritage

When it comes to definitions of architectural cultural heritage, the types of buildings exported by Puutalo Oy seldom come to mind. In the postwar decades, they were not included in the architectural discourse in the three countries of interest but rather were generally mentioned in terms of buildings, constructions, or products. There is a set of criteria often used when deciding on what kind of architecture can be deemed "cultural heritage." Traditionally, easily measurable features, as advanced age, architectural quality, and connections to well-known architects or historical individuals have been typical traits that can help transform a building into an object of value in the discourse on cultural heritage. Furthermore, significant periods in a nation's history are often chosen as points of departure for the cultural heritage discussion. In this context, reconstruction after wars or disasters can be seen as a time worth remembering. In more recent years, there has been a shift toward focusing on typicality and everyday architecture, which includes the history of ordinary people and noncanonical architecture.[4] However, reconstruction architecture such as the Puutalo houses is often at odds with the factors considered in determining a cultural heritage. Owing to the intended temporality of the structures, temporary housing and shelters in general are rarely discussed from that perspective. Previous research on temporary housing and cultural heritage has focused primarily on preserving acknowledged built cultural heritage, such as churches, mansions, and old structures after crises.[5] In some cases, temporary housing is considered for possible inclusion within cultural heritage discourse, but the field can best be described as emerging.[6]

Is there then a reason to explore or even include prefabricated exported architecture in this discourse? In general, prefabricated wooden detached houses have received limited interest within architectural history as such. But with the turn toward interest in everyday architecture, prefabrication, and globalism, the simple houses exported from postwar Finland can be understood as part of a narrative on reconstruction and the rebuilding of homes and nations in the aftermath of crises.

Architecture often plays a significant role as a backdrop for expressing the values and identity of a group of people. Here, a central question is how architecture can be understood to reflect a national meaning, which is one of the ways prefabricated housing could be included in local heritage. In one of the classical works on the theme, Lawrence J. Vale contends that architecture can be understood as a means of conveying meaning on nationality in two directions—on one hand, the meaning intended by the designer and commissioner, and on the other, the meaning the building is given by the people who interact with it and what they think it symbolizes.[7] This approach is helpful in understanding how the Finnish houses were given meaning in both local and national contexts.

In regard to the stylistic meanings, the understanding of modernism and its role in nation-building in the twentieth century is also a topic for analysis in relation to the Puutalo exports. Modernism was often used in the architectural discourse when there was a need to focus on the future. In countries with a troubled past, the new style could serve as a clean-slate effect when constructing public buildings, since it was generally not associated with any conflicts or competing groups and their aesthetic preferences.[8] These points of view have generally been brought to bear in connection with high-profile architecture and monuments. However, the methodology involved in examining both the stylistic choices and the reception of the buildings can also be applied to the Puutalo houses in order to gain an understanding of their role in a national cultural heritage context.

## The Prefabricated Housing Industry as a Local and a National Identity in Finland

Industrial prefabrication of wooden houses emerged in Finland in the late nineteenth century, mainly focusing on temporary barracks, summer villas, and exposition architecture. One of the more noteworthy examples of early prefabricated structures was the Finnish pavilion in the 1900 Paris exhibition.[9] In the 1920s and 1930s, smaller companies such as Mansio Oy exported prefabricated houses to other European countries, North Africa, and the Levant, but it was the postwar decades that saw that export market grow into a global business. The forest industry, which had always been one of Finland's main industries, was an important part of the reconstruction period's economy as well. When the Puutalo Oy sales organization was founded in 1940, it joined with twenty-one sawmill companies to create large-scale standardization for prefabricated wooden detached housing.[10] Owing to a shortage of materials, the houses in the 1940s and 1950s were of a modest standard with a simplistic modernist design. Puutalo developed a continuously growing set of standardized wall units that could be assembled either as the models shown in the catalogs or modified for specific needs, often in larger building units or within the export trade (fig. 2.2). The Finnish houses were of a modest standard compared with the models favored in the Western commodity market. Therefore, early on, the company decided to focus on deals with reconstruction areas and

**Fig. 2.2.** Puutalo Oy had created a network of factories all over Finland, in which the export houses were produced and assembled for transportation like in the Puutalo factory in Riihimäki, 1953. Photographer: Pekka Kyytinen, in the Museovirasto collections, CC BY 4.0 license.

later with areas experiencing swift political changes.[11] The trade was coordinated via the Finnish Ministry for Foreign Affairs, which arranged for the houses to be used as war reparations to the Soviet Union and as currency in international trade. The building types were designed in Finland, often in collaboration with the importing countries. At their destination, the buildings either formed separate blocks or housing areas within blocks or were sent to more remote industrial locations.

In Finland, the reconstruction period and the type-planned houses became part of the national narrative on coping with the aftermath of the wars and on reconstruction through changing the local architecture to something new. The houses built for war reparations were to follow strict quality regulations. Soviet inspectors visited the sawmills regularly and discarded lots that were built of wood that did not meet the standards.[12] These lots could then be bought by local residents who managed to put together homes from the second-rate building parts, which was an opportunity to significantly upgrade homes that were built in accord with the previous standards.

In general, modernizing Finnish housing in the countryside had been an important issue in the country's social politics since the turn of the twentieth century. During the postwar years, the possibility of using type-planned drawings for modernist wooden detached houses or prefabricated homes increased and also introduced modernist architecture in the periphery of the country. In the narrative of reconstruction and modernism, the efficient and modern home became a central symbol that contributed to giving the Finnish people an idea of the developing, modern nation.[13] The so-called war-veterans house was an iconic type of architecture in the postwar decades, and it regained popularity in the early 2000s. Today, those houses are considered part of the Finnish architectural cultural heritage and engage dwellers and homeowners who connect on dedicated forums on the Internet. There has also been a new reengagement among architects in developing modern versions of the building type.[14]

Those houses also played a role in coping with the aftermath of the war on a national level. On one hand, they were used as currency in the previously mentioned trade, in which houses were exchanged for coal, coffee, tobacco, and citrus. On the other hand, that trade became a means of cultural diplomacy, a way for the Finnish government to reach out and form connections to the Western sphere without angering the Soviet Union.[15] The houses for private use were often named in Finnish, as *Finnland* or after cities as *Lahti*, *Viipuri*, and *Kotka*, which also contributed to their branding as something Finnish in their destinations—especially in brochures or articles aimed at the general public.[16] Furthermore, there were many similarities between the trade in prefabricated houses and the Scandinavian design movement at the time. For both fields, the international exhibitions were important hubs for networking, which facilitated developing cultural diplomacy through trade in seemingly mundane objects, such as houses and industrial design artifacts.[17] By exporting wooden detached modernist-style housing, Finland reflected an image of a nation that was reestablishing its international connections after the war.

### Poland—Prefabricated Resurrection

Poland was a major importer of Finnish houses. The large-scale destruction of the country's cities and industries in World War II and its relationship with the Soviet Union played a critical role in the extensive trade in detached houses. Some of the earliest Finnish houses that arrived in Poland were gifts from the Soviet Union, which had acquired the buildings as war reparations from Finland. Those houses reached Poland in 1945 and several hundred wooden buildings were distributed to three locations. One of the first neighborhoods, Osiedle Jazdów, was built in the center of Warsaw, close to a park that had belonged to a royal palace. The houses were designated for the workers of

Warsaw Reconstruction Office (Biuro Odbudowy Stolicy), who were engaged in rebuilding the city.[18] Unlike the later Soviet gift of the Palace of Culture and Science, which was erected in the center of Warsaw and dominated the city's skyline, these humble wooden houses could be viewed as a manifestation of soft power, a shelter in times of need.

The next large shipment of Finnish houses, which came in 1947–1948, was in answer to the housing needs of Poland's coal mining industry. The first colony was created in the north of the country in Wrzeszcz, for the workers of the Maritime Transshipment Department (Centrala Zbytu Produktów Przemysłu Węglowego). The ninety houses were received favorably and were thought to be comfortable and aesthetically pleasing.[19] The next colonies were built in the mining areas in Silesia. At first, the local authorities tried to use existing buildings and renovated dwellings that had been damaged during the war. However, the great demand could not be met solely by local means, and by the end of 1948 thousands of Finnish houses had been sent to Silesia.[20] The prefabricated houses for the coal mining industry were purchased directly from Finland and were assembled by the Construction Bureau of the Coal Industry (Biuro Budowlane Przemysłu Węglowego w Zabrzu), which was under the CZPW (Centralny Zarząd Przesmyłu Węglowego), the center for delivering material for the coal mining industry.[21]

As the first houses that came to Poland were part of the Finnish war reparations to the Soviet Union, they were made of high-quality materials, and were mostly models for domestic use or developed for the needs in Soviet Union. A later shipment to Katowice included two building types specifically designed for the Polish market: Puutalo types OK 284 in 1947 and type 295 in 1948 (fig. 2.3). The types sent to Poland were based on the OK system that was designed for a Northern and Central European climate.[22] The exterior was a typical example of simplistic Finnish modernism with no ornamentation, only vertical weatherboarding, and minimal casing around windows and doors. The plan for the main floor was constructed around the central chimney, which provided heating for all the rooms both on the main floor and in the attic. The foundations and chimneys were built on location based on Finnish drawings.

In Silesia, where stone houses were more common, the wooden ones were considered a good choice for the unstable terrain around the mining areas. They could be rebuilt quickly and were touted as being clean and practical in an effort to counter the traditional belief that wooden houses are for the poor and that, moreover, they are difficult to maintain.[23] In the north and in Warsaw, the local press described the Finnish houses as solid and beautiful, a luxury at the time.[24] Some of the houses were later modified by their inhabitants for aesthetic or functional reasons. Some were rebuilt with additional structural elements, and others were clad with other materials to make them

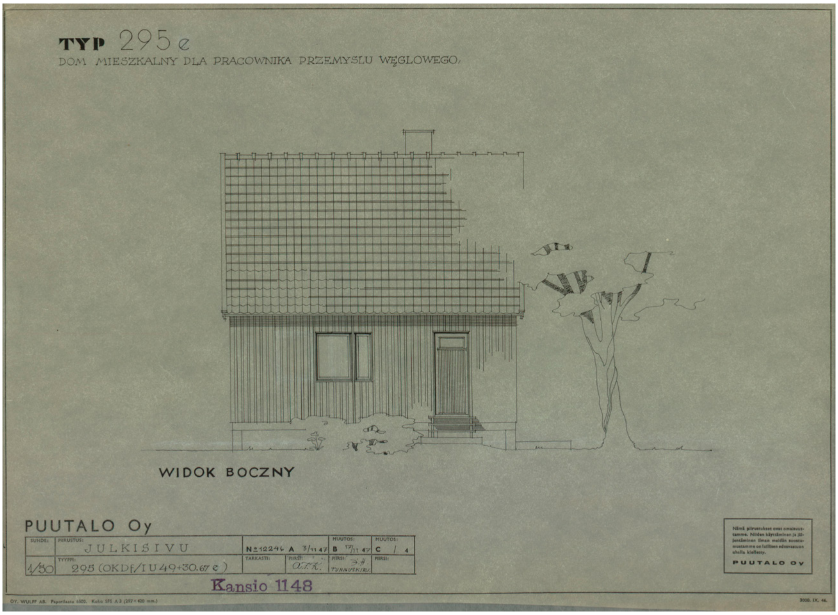


**Fig. 2.3.** Drawing for the Puutalo type 295e, which was sent in large quantities to the Silesia region in southern Poland. Puutalo Oy archives, ELKA.

look more like stone buildings or just more modern. During a visit to the residential areas in Silesia by members of the HoPE-research team in 2023, one inhabitant noted that while the houses nowadays were thought to require a lot of care and maintenance, the wooden structure was still seen as a positive feature.

The Finnish houses that were sent to Poland in the 1940s and 1950s seemed to wind up in selected communities, whether they arrived in Warsaw or in the mining areas. Coal was one of Poland's most important exports at the time, so taking care of the miners became an imperative, as they were considered a source of national pride and a major economic base.[25] The idea of creating communities with the new imported houses seemed to be an important factor in the way the Finnish house settlements were positioned in their various locations. The houses were not scattered around the cities but were placed together in certain areas. These settlements, whether within or outside the cities, were referred to in Polish as *Kolonie* (colony) type areas. The neighborhoods within the colonies were sometimes planned in accord with linear principles, but in the case of Jazdów in Warsaw were arranged in so-called nests, where the houses were grouped to create small communities.[26] In the design of Jazdów, the wish to create a community was evident in the positioning of the

**Fig. 2.4.** Jazdów neighborhood nowadays: the community garden. Photo: Anna Wilczyńska, 2021.

houses around gardens. Here, the nests were divided by small streets and in the early years; there were no fences between the gardens, which contributed to the feeling of unity. From publications that focused on the memories of inhabitants and the social aspects of living in Jazdów, it is possible to conclude that the inhabitants found the community quite idyllic.[27] For those who had experienced the trauma of war, one can think of the area as providing the possibility of settling and organizing a new life.

The *Fińskie domki*, as they are still known, were a privileged form of housing for people who were involved in the national effort to reconstruct the Polish nation. The houses were of high quality and offered a good housing solution; further, although they were meant to be temporary, many survived for a long time. In Jazdów, for instance, many of the original inhabitants moved out in the decades following the construction when it became possible to get apartments in concrete blockhouses, as those were considered easier to care for. But the people who stayed gradually began to build a strong sense of community. As the planned demolition was repeatedly postponed, the structures were gradually expanded and adapted to individual tastes, and the inhabitants began planting trees in their gardens, clearly a sign of their intention to stay (fig. 2.4). The threat of demolition has come and gone over the years. After a long period of citizen activism, the Jazdów area was listed as part of the monument registry and became a paradigm of an alternative social, ecological, and economic model for a city, promoting the dissemination of information about the houses and developing websites and guidelines for the area.[28]

*Fińskie Domki* represent a change in the role of imported prefabricated temporary housing in that they evolved into long-term settled communities. Imported through politics and trade during a time of crisis, they survived and created local identities. In the Polish case, the houses that were assembled as a quick remedy at a time of dire need became homes to people who cherished their sturdy characters and the quality of life they provided. The story of the houses in Poland was very different from that of those sent to Israel, where they arrived during the same years but to completely different circumstances, creating an even more complex heritage and history.

## Israel—A Shelter from the Storm or Foundations of a Home?

Over a decade from 1949 on, Puutalo Oy and other such firms as Puurakenne Oy and Enso-Gutzeit sent thousands of Finnish prefabricated units to Israel to house its rapidly growing population. The State of Israel was founded in 1948, and with its founding the new country in a war-stricken land found itself with a serious housing crisis. Owing to the mass immigration of Jewish refugees from 1947 to 1951, Israel's population more than doubled as it welcomed approximately 686,000 Jewish immigrants from seventy different countries.[29] The need to house those refugees—Holocaust survivors from Europe and North African Jews who fled their homes in the Middle East—became an important part in the forming of the Jewish national home ideologically as well as physically. As described by Allweil, it was a "State-Citizen contract that included a 'housing regime' aimed at transforming immigrants into proper citizens."[30]

The pressing need for housing forced the Israeli government to find immediate temporary solutions. Practical suggestions and offers based on a wide range of different materials came from many countries.[31] Finland became a leading supplier of prefabricated houses, and the two countries had an amicable relationship, which was strengthened by Finnish non-Jewish organizations such as Karmel, founded in 1949, and the Suomi-Israel Friendship Association, founded in 1954.[32] As early as in 1949, Israel signed trade agreements with Finland for exports from Finnish firms, and there was even a secret agreement that gave the Finns priority when it came to prefabricated homes.[33]

In the following years, Israel imported thousands of prefabricated houses and several wooden prefabricated hospitals.[34] The Israeli imports were part of the larger economic relations with the Finnish government, and the houses were paid for with citrus fruits and other commodities. Owing to financial difficulties, the Israeli authorities tended to try to reduce the cost of specific housing types. For instance, the Finnish producers were asked not to include

**Fig. 2.5.** Two men are unpacking building materials in the Ma'abara Tel Yeruham, ca. 1951–1954. Picture: Photograph Collection, The National Library of Israel, The Pritzker Family National Photography Collection, The National Library of Israel, CC BY 4.0 license.

some of the original features, such as floors and roofs, in order to reduce costs.[35] The units were sent to many locations and were distributed by different organizations, such as the Jewish National Fund and as the construction company Solel Boneh (fig. 2.5).[36]

The prefabs were to serve as temporary housing and were not even referred to as *baitim*, the Hebrew term for both houses and homes, but as *zrifim*, wooden shacks or cabins. In reference to their origins, they were called *Zrifim Finnim* (Finnish Cabins). Some of the houses, for example, Puutalo Oy's type 840, which came in several different versions, were specifically developed for the Israeli market and appeared to be based on Israeli drawings.[37] This type was sent to different sites, and the Israeli authorities turned hundreds over to Solel Boneh.[38] The 840 models had simple features; each house was divided into two one-room family apartments, each with a small kitchen and a shower and toilet. When constructed with all its parts, the model offered better accommodations, though very cramped ones.

Many of the houses were sent to the *ma'abara* (*ma'abarot* in plural) transient camps that were scattered all around the country in the effort to find dwellings for the newcomers and, at the same time, to create new outposts in the country and new settlements. The inhabitants of the *ma'abarot* were not voluntary participants in their resettlement and the ongoing trauma caused by the stay in these camps, which had little infrastructure or opportunities for employment, turned the *ma'abarot* and the *zrifim* into symbols of the government's wrongdoing in Israeli popular culture. One example is the movie *Salah Shabti*, where a family of immigrants is settled unwillingly in a *zrif* while trying to get its own apartment in a concrete public housing neighborhood. The *ma'abara* became a trauma for many who passed through, and it was marked by Allweil as a "Violation of the State-Citizen contract."[39]

Nevertheless, despite all the problems, the Finnish houses were an improvement in the accommodations in the *ma'abarot*, which previously had been limited mainly to tents and hastily assembled shacks. However, as they were considered temporary, the wooden houses were built modestly with few details.[40] One example of a *ma'abara* where the Finnish houses replaced tents was Amishav in Petah Tikva, which was built in the early 1950s as a row of tents. These tents were replaced by wooden or metal houses in 1952, an event that was celebrated in a contemporary newsreel.[41] Some of the houses in the film are the Puutalo 840s model, whereas others seemed to be more makeshift with no proper infrastructure, only concrete floors and roofs made of asbestos or metal. The houses were also overcrowded, and in 1963 it was written about Amishav that "many live in the *Finnish Zrifim* Housing Estate with dilapidated wooden houses, horribly overcrowded with a population of ten to fourteen people in one cabin."[42] The Finnish wooden houses that were so appealing in Poland became dangerous dwellings in Israel. As the houses were built without proper safety measures for heating and cooking, there were several fires in Amishav.[43] In time, most of the Finnish houses in Amishav and in other *ma'abarot* were replaced by permanent housing estates. A neighborhood named Hadar-Ganim was built on the original Amishav site, and while there are still a few Finnish houses left, they are threatened by the encroachment of new buildings and are mostly in a very poor state (fig. 2.6).

The authorities in Israel used the *zrifim* to experiment with different kinds of settlements and areas, such as the Amidar Shacks neighborhood in Ramla, which consisted of two-family *zrifim*, built with wood from Finland, with a small plot of land for subsistence farming.[44] In the *ma'abarot* of Tel Yeruham in the desert, the houses were supposed to offer better accommodation for the immigrants who were sent to the harsh area. From the period photos, Puutalo Oy type 840s (fig. 2.5) were used to provide the dwellings. But as noted by Katz, they were poorly executed and sometimes lacked proper flooring, since they were considered temporary dwellings.[45] In the case of Tel Yeruham, the houses were referred to in Israeli scholarship as "Swedish Huts."[46] Although houses were also imported from Sweden, Finland had a priority in exporting

**Fig. 2.6.** *Zrif* in the former Ma'abara Amishav, Petah Tikva, Israel. Photo: Tzafrir Fainholtz, 2022.

prefabs to Israel, and it seems that many of the so-called Swedish Huts were actually from Finland, as in the case of Tel Yeruham.[47]

Not all of the Finnish houses were built in *ma'abarot*, as some were sent to the new agricultural settlements known as kibbutzim and moshavim. In those days, a kibbutz was a socialist agricultural settlement, a commune in the spirit of the Zionist Labor Party, which was leading the Israeli government at the time. Kibbutz members were seen as ideologically motivated pioneers and were recruited to fulfill the Israeli ideology of dispersing the population out of the cities and into the countryside. Some of the Finnish houses, which the Jewish Agency turned over to the Ministry of Construction and Housing, were used to build these new settlements as part of the "From City to Village" project.[48] Kibbutz settlements in the 1940s and 1950s usually had communal dining rooms, toilets, and showers, as well as a children's house, where all the kibbutz children lived together. Those arrangements meant that adults only needed housing for sleeping and resting. The prefabs that were sent to the kibbutzim were usually detached houses that featured a row of rooms, each room able to accommodate up to three of the kibbutz comrades (*haver* in Hebrew) without kitchens or bathrooms. Givat Oz, which was founded in

1949 by Holocaust survivors from Hungary, was one of the kibbutzim that received the Finnish houses. The prefabs, which were to serve as a temporary solution, were assembled by the recipients.[49] Each house had four rooms that were connected through a veranda covered with a mosquito net for fear of malaria.[50] In 1952 the Finnish houses were incorporated into a meticulous general plan that embraced all aspects of communal life, such as a group dining hall, a children's house, open green areas, and so on. Unlike the cramped *ma'abarot*, the houses in Givat Oz were arranged to allow for privacy between the units.[51] Most of the original houses there were demolished and replaced by more comfortable and more private dwellings. One house that was built for unmarried comrades and given the name "Bachelor's House" was turned into a heritage site, now called the Owls Castle owing to its unique appearance in comparison to the neighboring buildings.[52]

The houses in the *ma'abarot* and the kibbutzim in Israel shared many similarities. In both cases, they were temporary, arriving as simplified stripped-down models of Finnish units, and were used to house newcomers to the country (although this was not always true for the kibbutzim). At the same time, the situations both physically and socially were very different. On the one hand, the houses in the kibbutzim formed part of utopian settlements of relatively small groups of pioneers, mostly young people who were seen as a Zionist emblem of the New Jew—a farmer.[53] On the other hand, the *ma'abarot* dwellers, who were of mixed backgrounds and different ages, had problems finding employment and were not necessarily part of the Zionist ethos. Many projects and scholarships are dedicated to the history of this period, with critiques against the role of the *zrifim* as homes for the displaced newcomers. Poorly built, retaining only some of their original features, cramped, and without adequate sanitation, most of the Finnish houses in both the agricultural settlements and the former *ma'abarot* were demolished in the following decades. Few of those prefabs have survived, and those are scattered in different places in the country. Though some are still inhabited, the Finnish houses in Israel did not become permanent homes.

Yet, the wooden houses are still present in local memories. They became emblematic of the first years of the state, symbols of hardship and resilience. In Givat Oz and in Kibbutz Mashabey Sade, the remaining prefabs were turned into museums showing the life there in their first days.[54] A similar treatment awaits a *zrif*, probably from Sweden, that survived from among the *ma'abarot* in Ganei Tikva and is going to be a local heritage site.

The arrival and disappearance of the Finnish houses in Israel suggests that the prefabricated house was treated as a commodity to be bought as cheaply as possible for temporary use and never became a permanent feature in the national landscape. While thousands of such houses dotted the country, only a few have survived. It can be argued that the houses, a product of a northern country with a different culture and climate, were unsuitable for Israel, but it should be remembered that local social and political issues such as the target population for the houses and governmental decisions also affected their ensuing heritage in a very different way than occurred in Finland or in Poland.

### Conclusions: Assembling a Home

During the decades after World War II, Finnish prefabricated houses served as shelters and homes for thousands of people in a range of circumstances. At the same time, the houses also became a tangible symbol of reconstruction. The rapid pace at which the houses could be erected also contributed to showing a progression, a hope for a better future. In regard to the theory of cultural heritage, these decades became an important part of the narrative of reconstruction of a nation and coping with the aftermath of war in Finland and Poland and a sudden massive immigration in Israel.

It is evident that politics and economics were pivotal in determining the meanings of the houses in both a national and an individual context. In Finland, erecting war-veteran homes became an important ideological task within the national reconstruction after the war. Government on both local and national levels prioritized the type-planned or prefabricated houses in reconstruction for creating new residential areas for the displaced. In the local communities, the houses were designed as permanent homes according to new ideas on homemaking and domesticity, representing a vision of the new, modern Finland while giving the resident families new starts. When the architecture of the mid-twentieth century became of interest within the cultural heritage movement in the 1990s, the building type gained a firm position within the national narrative of reconstruction and belonging and is today seen as a natural part of the Finnish built heritage.

In Poland where the houses arrived as a diplomatic gift or through trade, they transitioned from being a temporary solution to becoming permanent homes for communities with a distinct local identity. This was possible because the units were made of high-quality materials, were suitable for the cold Polish climate, and the floor plans were adapted for an efficient middle-class family home, mimicking dwelling traditions of the population from before the war. In terms of reconstruction after disasters, this approach has been shown to give inhabitants a better perception of the temporary housing options, which contributed to creating new permanent settlements.[55] Here, it is also possible to argue that owing to the similarities in dwelling culture and needs related to the climate, the houses functioned in similar ways in Finland and

Poland. Furthermore, they were seen as homes of privilege, intended for communities that the Polish government considered important. This becomes clear in the way the officials and media discussed the houses in public, branding them as luxury products. Apart from the quality of the houses, the communities themselves were carefully planned and the housing positioned in relation to workplaces and urban centers.

In Israel most of the Finnish houses were received by disenfranchised people in transient camps. Moreover, the structures were of low quality and most of them were barrack-like and not suited to local conditions. These houses were mostly viewed as temporary shelters, which can be seen both in official documents and in the way that the media discussed them. These units were sent to the *ma'abarot* without any thought of creating permanent communities, and most of them were later demolished. Despite being of little architectural value, they still were highly symbolic as tokens of the international support for the new State of Israel—a visual reflection of how other nations came together to help the Israeli people. For the inhabitants, however, they were mainly a traumatic dwelling from which they, as in *Salah Shabati*, needed to do all they could to escape. This correlates as well with the previous research on temporary housing in reconstruction areas, where low-quality temporary housing unsuited to the local culture was refused by the communities.[56] In the kibbutzim the situation was different, as the members were seen as pioneers and as important individuals in the Zionist narrative. This made it imperative to create a community through planning, so the Finnish houses were a stage in building a more permanent home. The arrival and disappearance of the Finnish houses in Israel suggests that the prefabricated house was treated as a commodity to be bought as cheaply as possible for temporary use and never to become a permanent feature on the national landscape. While thousands of houses like these dotted the country, just a few have survived. It can be argued that the houses, a product of a northern country of different culture and climate were unsuited for the country, but it should be remembered that local social and political issues such as the target population for the houses and governmental decisions also affected their ensuing heritage in a very different way than they were perceived in Finland or accepted in Poland.

The temporary nature attributed to prefabricated houses used in times of crisis raises important questions about the sustainability of this architecture in different contexts and countries. Returning to Vale, if we look at the mechanisms of meaning in the prefabricated architecture in the case countries, both the national and individual level contribute to a broader understanding of the exported architecture in the aftermath of crisis. The three countries discussed here share both similarities and differences regarding the part that these buildings played in the context of nation-building. What they all have in common is that the industry and governmental decisions in connection with the construction, export, and import of the houses were giving communities a meaningful point from which they were able to assemble homes. Visually, the houses were not originally at all part of the traditional national architecture. The Finnish interpretation of wooden detached modernist homes was initially alien and not necessarily associated with positive values by the users. Instead, officials had to stress that the buildings were a sign of progress and even a luxury to convince the population. In Poland, the Finnish houses gave Polish families the possibility of creating a new and modern life. In Israel they created difficulties, mainly for the inhabitants of the *ma'abarot*, in the context of a camp-style life with crammed accommodations and a minimum of commodities. Still, the Finnish shacks were a house of one's own.

When examining the exported architecture within the framework of cultural heritage, it becomes clear that the same mechanisms that were designed to integrate the prefabricated houses into the national narrative during reconstruction later also made them part of the cultural heritage. In Poland, where the houses were preserved, they became a hub for citizen activism as in Jazdów. In Israel, where the houses were demolished, they became a part of the lore about the hardship during the early years of immigration to the country, a starting point from which things got better. The focus on reconstruction has become an important category for evaluating the houses within the cultural heritage context. Despite being foreign structures, they became an integral part of the stories of survival and overcoming hardship. Here, the question is not about products of well-known architects, the old age of the structures, or their artistic or aesthetic value. The core in the understanding of the Finnish houses as a part of the national architecture is rather connected to the everyday lives of people reconstructing their nations. This argues for the benefits of expanding the discussion on built cultural heritage to include structures that previously would not have been interesting because they were not classified as "architecture." What we have learned from these cases so far is that the quality of the structures played a significant role in their preservation. However, the communities and their opinions on the housing also played a significant role in the preservation and sustainable use of these buildings. When it was possible to reconceptualize the shelters into permanent homes, the communities in these cases showed that imported structures, if well planned and of high quality, can become permanent homes even beyond periods of reconstruction. Moreover, if examined from additional perspectives rather than just the practical or the architectural, one can see that prefabricated housing can be an important provider of information on national narratives and ways of coping with crises and help understand how an imported structure can become a home.

## Notes

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CHAPTER 3

# Prefabricating a Nation

## The Neighborhood of Ramat HaNasi in Bat Yam, Israel, by Architect Yitzhaq Perlstein

*Daphna Levine and Liat Savin Ben Shoshan*

This chapter deals with a prefabrication method imported from France in the 1960s that was used in the construction of public housing in Israel. In the first decade of nationhood, public housing had a part in forming the typical Israeli neighborhood of the new Zionist State. The neighborhoods and the housing units then helped to turn a multiethnic immigrant society into a more homogeneous one that accorded with the values of Zionism.[1] Foreign technology, in this case a French one, had a role shaping local and national identity. The French mass-housing project, a large-scale endeavor that included a massive utilization of prefabrication techniques and elements, was much greater in scope and size than the Israeli one. The French housing projects built in postwar France beginning in the 1950s—known as the *grands ensembles*—were part of a significant transformation in French society and culture.[2] The physical aspects of this transformation included the large-scale state-led construction of mass-housing neighborhoods in the outskirts of French cities and the massive consumption (and production) of modern appliances, cars, and other items for domestic use.[3] Postwar housing in France was shaped by both the centralized state and the dynamics of liberal capitalism.[4] In Israel, most of the urgently needed housing required for the hundreds of thousands of new immigrants who arrived in its first decades had to be built by the state, which had to rely on modern architecture and technology. Modern prefabricated neighborhoods played a major role in the shaping of a new national identity. The neighborhood of Ramat HaNasi in the city of Bat Yam, which is a small city south of Tel Aviv, is such a place, an exemplar of industrialization from the most basic elements of construction to the general urban scheme.

### Introduction

The Ramat HaNasi neighborhood in Bat Yam was built in the late 1960s using a construction method that was innovative for its time: the manufacture of precast elements in a field factory located on site. In the first two decades since statehood, precast construction in Israel was of low quality. In the late 1960s, however, emphasis was placed on industrialization on construction sites, which involved using standard casts and the integration of precast elements. These were produced in factories near the building sites, which reduced the finishing work required on site to a minimum. In building Ramat HaNasi, architect Yitzhaq Perlstein collaborated with French engineer J. Bory and used his construction method; the elements were designed in France and manufactured at the construction site by the Israeli company Ashtrom.

In those years, government contracts with big construction companies in Israel were primarily concerned with the design and erection of large-scale structures. Construction undertaken by the Ministry of Housing—which served to promote nation-building through the creation of homes and neighborhoods—utilized foreign rather than local knowledge, whether it be in planning, execution, or occupation. Furthermore, innovations in construction reflected political and economic contingencies. After 1967, Israel opened up to Palestinian labor, and as this labor was cheap and available, there was little incentive for developing precast construction technologies.[5] By the late 1970s, the development of precast construction decreased still further, and dramatically so, with the shift to a capitalist housing market and the growing involvement of private firms in residential building.[6]

The Ministry of Construction and Housing planned Ramat HaNasi in accord with a neighborhood-community urban concept known as the "neighborhood unit"—small-to-medium-sized autonomous urban neighborhoods with parks, inner pathways, schools, and a commercial center, surrounded by a circular road separating it from the rest of the city.[7] It was envisioned as a semi-autonomous residential area that would evolve into a community. The parks and green areas between the buildings were to serve as local meeting places, where people (many of them recent immigrants from various countries) would get to know one another and consolidate into a community.[8]

The original 1958 plan for Ramat HaNasi covered some thirty-two acres. It was based on a scheme of several elliptical units encircling a green avenue and public buildings.[9] However, ultimately, it was not built according to the original plans, but rather based on plans drawn from 1967 onward. This delay was one of the reasons that it was constructed using prefabrication technologies, which Perlstein imported in the early 1960s (fig. 3.1).

According to the new plan implemented after 1967, the round outline of the inner quarters was replaced with a square one and the winding pathways by an orthogonal network. The buildings were arranged in clusters according to size, from large to small, a solution that afforded greater efficiency in construction, parking, and the flow of traffic. In a view from above, the structure of the courtyards appeared so rigid and orderly that it seemed like the

**Fig. 3.1.** Ramat HaNasi, view from above. Photographer: Roi Boshi.

embodiment of utopian urban planning and social engineering. The modernist conception of the neighborhood unit as a closed system was adapted to the requirements of industrialized construction and to the growing use of private vehicles—roads that were widened to transport construction elements became the access roads to the neighborhood.

Perlstein acquired his expertise in developing and improving public housing units through extensive research of the living space, from the apartment and its place in the building all the way to the building's positioning in an urban space and the regulation of community life on a neighborhood scale. The Ramat HaNasi plan featured a range of housing types, which did not affect the efficiency of planning and construction. Prefabricated modular parts were used from rooms and housing units to entire buildings, and the neighborhood was assembled from combinations of the different elements.

However, the changes in the plan did not make the neighborhood more citified. As with other neighborhoods designed in Israel in the 1960s and 1970s, it did not have an urban feel. In part, it retained the village-like nature that characterized earlier public housing neighborhoods—buildings far apart from one another, surrounded by greenery, with no mixed use, so that the streets were virtually empty throughout the day. Despite the range of building typologies, it conveyed a sense of homogeneity and was separate and distant from the city center.

We deal here with the historical architectural phenomenon of prefabricated construction in Perlstein's mass-housing projects by focusing on the top-down planning of an entire neighborhood in 1960s Israel, its ideology, and how technology enabled the architecture that served it. Through the study of Ramat HaNasi, we explore the utilization of foreign technology in the construction of dwellings that were at the same time universal and industrialized. They also served the Zionist ideology of the melting pot, that is, bringing Jewish immigrants from very different origins to live side by side in identical apartment buildings, which would facilitate the creation of a unified Israeli identity. We discuss the industrialization of housing as a development that reduced the reliance on Palestinian construction workers—dovetailing with pre-state Zionist attempts to separate the Jewish from the Palestinian labor market[10]—and as designed to engineer a newer version of the Zionist subject through an efficient, convenient, and industrialized living environment. We begin with background on the national housing project and follow this discussion with a review of Perlstein and his mass-housing construction. Finally, we focus on the Ramat HaNasi neighborhood and the innovative prefabrication method used in its construction against the background of historical and political circumstances.

## The National Housing Project

Established in 1948, the State of Israel saw rapid development in the 1950s–1970s. Zionism was a nation-building project widely considered as colonial, or more precisely settler-colonial.[11] The arid land in the midst of an Arab world was seen by both the Jewish settlers and by officials of the British Mandate, which had governed the land prior to statehood, as underdeveloped and "primitive." It had to be developed quickly and thoroughly, including the building of modern housing, in order to settle hundreds of thousands of Jewish immigrants.[12]

The new state launched a series of development projects, including towns and settlements, mostly rural or semi-urban, of small and medium size, as well as transportation systems and pipelines. In accord with the Zionist slogan, the Ministry of Housing aspired to "make the desert bloom."[13] It worked toward two intertwined goals: to disperse the new immigrants throughout the country in order to develop the land and to prevent congestion in existing cities and, at the same time, occupy territories from which hundreds of thousands of Palestinians had fled during the 1948 war so as to prevent their return.

Public housing slabs and new settlements covered the entire country with concrete. All projects were designed to ensure sovereignty over the territory through the establishment of Jewish settlements and to construct the physical landscape.[14] The huge number of housing units that had to be supplied quickly dictated frugality: the apartments were small and the buildings simple and low cost. The uniformity of the housing also embodied the Zionist nation-building ideology, which aspired to evolve a modern Israeli citizen, free of the religious and social traditions of the past, socialist instead of bourgeois, and Westernized rather than Oriental or Arab.[15]

The principles of modernist architecture came from Europe by way of Jewish architects, some of whom had studied at the Bauhaus School and others, like Perlstein himself, in British institutions. A primary principle was the *Existenzminimum*: providing every human being with minimal conditions, that is, light and air, living space, and washing and cooking facilities.[16] Another was the concept of serial housing, by which apartments were built in a structure that could be duplicated at low cost. Finally, the new urban planning followed the modernist principle of functional zoning or the spatial separation of urban areas according to function: housing, traffic, work, and entertainment.[17]

## Perlstein and Mass Housing

The vast architectural heritage of Yitzhaq Perlstein (1914–1981) spans more than four decades of participation in the development of public housing in Israel. Despite being relatively little known, he was one of the first and most significant planners of housing in the new state, with some thirty thousand units to his credit by the mid-1960s. In time, he would be known as the architect who built the largest number of housing units in the country.[18]

Perlstein was born in Tel Aviv to Pesia and Ya'acov Perlstein, among the founders of Ahuzat Bayit, the first neighborhood in Tel Aviv. As his father was a landowner and a businessman, he was raised in accord with bourgeois values of private property and land development. He grew up in Tel Aviv, which was gradually filled with modernist buildings, particularly during the wave of immigration from Germany in the 1930s, which was also bourgeois in nature. However, Perlstein was increasingly influenced by socialist ideas, among them equality in housing supply and state investment in and development of urban housing, values that he absorbed from Zionist ideology during his apprenticeship and work with Patrick Abercrombie, and later, in the early 1950s, through his involvement in the Planners Department headed by Arieh Sharon.[19]

In 1933, Perlstein traveled to London to study architecture and town planning at University College (UCL).[20] He studied under the supervision of the well-known town planner Patrick Abercrombie and worked in his office for several years, focusing on a plan for Dublin.[21] These were also years in which Abercrombie developed urban planning methodologies that would become widespread in the postwar era in the planning of London and the British New Towns. These methodologies were based on the division of the city into subsections called neighborhoods or social units, an essentially utopian, socialist, and modernist idea.[22] In terms of construction technology, in those years precast techniques were massively employed in the Soviet Union.[23] Abercrombie, among other Western planners, was in contact with Soviet professionals and even borrowed directly from Soviet methods of industrialized housing via visits to the Soviet Union as early as the 1930s.[24]

Perlstein completed his studies in 1939 and returned to Palestine before the start of World War II and went to work for the British Mandatory Planning Section planning police stations. With the establishment of the State of Israel in 1948, he was included in the Planners Department created by Prime Minister David Ben-Gurion and headed by architect Arieh Sharon.[25] Right after the Planners Department was dissolved in 1951, Perlstein opened his own office. He created a new master plan for the city of Haifa (1952–1954), and then began receiving commissions from the Ministry of Housing. In 1956, he contracted for three major works: the urban outline plan of Ashdod, the neighborhood of Ramat Aviv in north Tel Aviv, and new neighborhoods in the towns of Bat Yam and Holon, south of Tel Aviv. The new projects were planned as neighborhood units and as potential communal spaces where the new Jewish Israeli citizen would evolve.[26]

## Ramat HaNasi, Bat Yam

Bat Yam is a coastal town south of Tel Aviv, established by Jewish settlers in 1926. At that time, an ancient camel route still crossed that stretch of land along the coast from Jabaliya in the south of Jaffa, and a single British police station towered over it from the top of a cliff. In 1921, the House and Garden Society (House and Garden was also the original name of Bat Yam) purchased land in Jabaliya. Buying land was quite common in the years following World War I, owing both to Zionist ideology and the urgent need for housing. As so much of the acquired acreage was dune land, which was lower in cost than agricultural land, it was affordable. However, since it was further south and separated from Tel Aviv by Jaffa, this particular choice had an additional benefit—it spoke to an individualist and pioneering spirit on the part of the settlers, who cut themselves off from the sprawl of Jewish neighborhoods expanding around Tel Aviv.[27]

Upon purchasing the land, the House and Garden Society contacted Berlin-based Jewish architect Alexander Baerwald to prepare an urban construction plan for a city that would present an alternative to both Arab Jaffa


**Fig. 3.2.** Ramat Yosef, 1959, neighborhood plan by Yitzhaq Perlstein.

and secular Tel Aviv.[28] Baerwald designed a network of streets that followed the land's natural topography, from the dunes to the coast, in line with the finest of Garden City models. When an access road to the British police station was paved and the neighborhood was connected to the electric grid and the water system, the first settlers began building homes on lots bought by the society.[29] In 1948, the destruction and depopulation of Jaffa—the nearest urban center—changed the course of Bat Yam's development. The sand dunes east of the town, nationalized after the Palestinians fled the area, were allocated for housing for new immigrants (fig. 3.2). The town was transformed by the construction of social housing projects and new neighborhoods such as Ramat Yosef and Ramat HaNasi, planned and built by Perlstein for the Ministry of Housing on the newly designated "state lands."

The planning of Ramat HaNasi was first conceived in 1958, in a plan that included Ramat Yosef; the latter was built from 1958 to 1962 (fig. 3.3). Originally called "The Big Project" (*HaShikun HaGadol*), the neighborhood was a source of pride for both the Municipality and the Housing Department. Initially, it was designed to include twenty-two hundred residential units, but during the planning process, the buildings increased in height and the number of units grew by one thousand. The plan was for the neighborhood to be an alternative to what was perceived as an alienating and overcrowded urbanism of previously constructed housing projects for immigrants in Bat Yam. The units were separated from each other by green spaces, and main roads went only around them, keeping traffic away from the heart of the neighborhood.[30] Although Ramat Yosef never had small, tile-roofed houses in the middle of an endless green field, the rural image was clearly cast into the neighborhood's design. If it did not actually look like one, it was meant to feel like a small village, a cohesive community unit (figs. 3.4–3.6).

Like Ramat Yosef, Ramat HaNasi was intended to be a semiautonomous residential area, which would be part of the city while also functioning independently with its own public institutions; it was also to have green spaces between the buildings. In the beginning, the overall design concept was a series of oval roads, each with a central pedestrian avenue where public buildings would be located. However, unlike Ramat Yosef, the planning of Ramat HaNasi changed to become more rigid, articulating a powerful drive for exemplary order and efficiency.

The internal design of the apartments in Ramat HaNasi reflected the growing interest in quality of life—a new concept for citizens of the young state that emerged victorious and economically prosperous following the 1967 War. The concept of "home" expanded during those years beyond the purely functional. Ramat HaNasi offered housing of a higher standard that could also be valuable as a financial investment, with luxuries such as elevators, electric

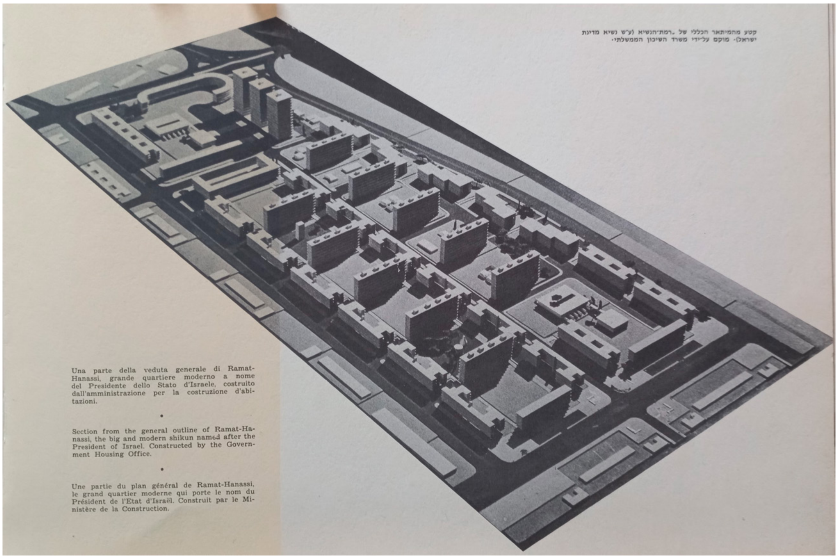


**Fig. 3.3.** A model of Ramat Hanasi, 1962. Municipality of Bat Yam Collection.

**Fig. 3.4.** Ramat Yosef, 2018. Photographer: Roi Boshi.

**Fig. 3.5.** Ramat Yosef, 2018. Photographer: Roi Boshi.

**Fig. 3.6.** Ramat HaNasi, 2018. Photographer: Roi Boshi.

heating, two bathrooms, an American kitchen, a telephone in each apartment, and parking space in most buildings. The neighborhood was marketed to middle-class families as a green complex combining homes, commerce, and leisure: "Here, the children have their own space, the mother feels the home is her castle, and the husband, upon returning from work, finds a warm (or in the summer, a cool) place waiting for him."[31]

Ramat HaNasi was not built according to the original plan but rather in accordance with a different one, first drafted in 1967. The construction was not carried out from start to finish but was broken up into stages in a long process that stretched over several decades. Entire sections of the blueprint were redesigned over that period of time, with revisions reflecting technological developments and the changing perception of what an Israeli environment should look like.

The neighborhood was divided into three quarters, C, D, and E, each with its own detailed plan. Each quarter was divided into subsections where houses formed a boundary around a public area, which was either built up or kept open. A lot of thought went into how the different quarters would connect to each other to ensure that the neighborhood would function as a cohesive unit. The curved lines of the original plan were straightened, and the winding footpaths were phased out in favor of a road hierarchy and a network of perpendicular streets. The construction areas were reduced in size, which improved work efficiency. Despite these external changes, the utopian concept of neighborhood units as autonomous, anti-urban, introverted units, providing residents with everything they needed for daily life was retained.

The plan for Quarter C was drawn in 1967. It is based on typical architectural schemes: six large communal yards were built in the middle of the quarter, one after the other along a straight line from north to south. Parking bays and residential buildings surround the yards. The same pattern recurs on the western side of the quarter, but this time as three subsections, each with a cul-de-sac that includes a parking bay, a green area, and residential buildings, some tall and some shorter row houses. From a bird's-eye view, the layout of the yards is so clear, rigid, and orderly that it seems to be the embodiment of utopian urban planning.

Plan B/106 for Quarter E to the south, from that same year, presented a slightly different variation. Although this quarter is similarly subdivided by roads that lead to cul-de-sacs with parking bays, the layout of the green space is different. Replacing the communal yards are wide, linear gardens that belt around the quarter, while an additional pedestrian avenue crosses it through the middle. Public buildings were erected along the network of green arteries and large spaces were allocated for additional public facilities such as schools, a synagogue, and a commercial center in the neighborhood's center.

In 1971, a plan was approved for Quarter D in the center of Ramat HaNasi. It included a small commercial center and an open public area that surrounded the entire quarter and widened at the highest point into a large public park surrounded by public buildings, mainly schools. In 1974, a plan for a civic and commercial center on Yoseftal Street, in the north of the neighborhood, was added, laying the foundation for the Bat Yam Shopping Mall and the adjacent public library. Specific plans for the neighborhood from the mid-1970s on proposed changes that would undo the original design. These included adding parking spaces between buildings wherever there was shortage; converting open public areas into built spaces; building high-rises in several locations; and increasing the depth and height of residential buildings, especially near what would later become the Tel Aviv metropolitan area's main traffic artery, the Ayalon Highway. In the 1990s, a plan to enlarge the apartments to 110 $m^2$ was approved in many of the buildings as part of a national neighborhood rehabilitation program. Although the plan was approved, it lacked economic incentives that could enable its realization.

Ramat HaNasi and other similar neighborhoods planned by the Ministry of Housing elsewhere in the country in the 1970s were highly dense and seemed utterly urban. But living in them was different. There was no shared urban experience; rather, there was a strongly felt undercurrent of ruralness of the kind that had characterized earlier social housing projects. The neighborhood unit concept—influenced mainly by the Garden City movement and postwar British planners, and also featured in the regional Sharon Plan—was meant to enable social interactions while walking to playgrounds, schools, or other institutions. In Ramat HaNasi, although the low-density construction of the Sharon Plan was replaced with multistory buildings and some of the green spaces gave way to wide roads and driveways, the essence of the socio-spatial idea of the neighborhood did not change. There was also no significant difference in the way the buildings were arranged and the central outdoor space was left as in the earlier plan. Although that space was originally intended as a public meeting place, it remained a vacant area that was neither urban nor devoted to parks or gardens.

Ramat HaNasi was considered one of Bat Yam's high-income neighborhoods, having managed to attract a relatively affluent immigrant population. Although, like other neighborhoods in the city, it suffered from a high rate of resident turnover, owing in part to inadequate maintenance of the neighborhood's infrastructure, it is still considered a high-quality neighborhood. However, this does little to reduce the pressure to roll out extensive raze-and-rebuild plans today.

## An Innovative Prefabricated Living Environment

From the 1950s until the late 1970s, the prevalent conception of institutional construction in planning and execution by the Ministry of Housing was called "direct construction." The concept was of the neighborhood as a stand-alone structural unit. It was aligned with the Ministry of Housing's strong relationships with the major construction companies, such as Ashtrom, as captured in the motto "One construction company for one neighborhood."[32]

The housing blocks in Ramat HaNasi were constructed in the late 1960s using a new construction method based on the production of precast elements in a field factory located on the construction site.[33]Along with other architects at the time, Perlstein tried to shorten the time needed for construction by shifting to industrialized building. As noted by Asher Allweil, in the first decades of statehood, precast construction in Israel was of low quality.[34] However, in the 1960s, industrialization processes in construction accelerated until the major recession of 1966–1967. During that recession, fifteen thousand construction workers lost their jobs, and the precast construction factories suffered from a shortage of work. Indeed, no such factories were established after that, except for the ones that were already under construction.[35] When the pace of construction increased after 1969, the construction companies were faced with a shortage of workers, as, with the postwar prosperity, those who had been laid off during the recession had found easier or better paying jobs. A partial solution lay in the employment of Arab workers from the Occupied Territories.

Development in construction methodologies at the time emphasized attempts to lower investment costs for equipment below what was required for closed precast construction. This was achieved through greater industrialization of processes at the building sites by the use of prefabricated standard casts and the integration of even more precast elements. Produced in factories on or near the sites, these prefabricated components minimized the finishing work on site.[36]

During this time, Perlstein initiated collaboration with the French engineer J. Bory and brought his building methods to Israel. The elements were designed in Paris, modified to accord with local conditions, and then manufactured by Ashtrom on site. Thus, Ramat HaNasi was *preplanned* according Bory's system. The technique was called Cebus, and it "provided flexible methods of analysis and design applied separately to each specific project in accordance with architectural concepts and production techniques."[37] Precasting was considered a "closed method" as it was inclusive and total.[38] The precast elements included sanitary units, single walls, square windows, and hexagonal claddings. The modular planning expanded so that an entire neighborhood was assembled from repetitive precast elements.

The field factory was located near the building site. The repetitive construction elements were produced near the building site in frames that ensured precision. They were stored in special devices until they were transported to the site using five freight cars with a capacity of twelve to twenty tons each. The walls were transported standing up, and the beams and stairs in horizontal positions. On every building site, two teams worked together, each with an eighty-five-ton crane, which lifted the elements from the freight cars and put them in place. First, the beams were set in place, with temporary connectors. Next, the walls and floors were arranged. Finally, all the elements were assembled. In one day's work, the two teams working together were able to complete three housing units.[39] Using the precast construction method in the field factory for all building types allowed for matching the elements to the size of the room, and the design of the connectors ensured complete impermeability. It also enabled different uses in the same frame, as it met an identical high standard and saved time and cost, as well as improving the construction overall and facilitating the rapid and efficient building of multiple homogeneous apartments.[40]

As noted, the implementation of this innovation was affected by economic and political circumstances—the influx of Palestinian laborers after 1967 and the recessions of 1965–1967 and 1972–1973. When labor was cheap and available, there was less need to develop precast construction technologies.[41] By the late 1970s, there was less creativity in construction in the public housing sector owing to the rise of capitalism and the related growing involvement of private construction companies in housing.[42]

## Discussion and Conclusion: Industrial Housing and Homemaking

Despite his great contribution to planning and building mass housing in the country, Yitzhaq Perlstein remains on the backstage of the history of Israeli architecture. Among his many accomplishments, instead of unique planning for each individual site, he created a catalog of apartment schemes like those of other mass-produced products on the market; designed many building details; and imported innovative construction methods. Owing to criticism of life in some of these mass-produced neighborhoods and their deterioration over the years his work is not sufficiently celebrated or fully respected. He was at the forefront of modernist thinking: an integration of architecture with constructive and technological knowledge, efficiency, and creativity. However, as with precast architecture around the world, it has not been given its merited recognition by architecture historians but rather has been criticized as creating homogeneity, a lack of identity, and lack of a sense of belonging among dwellers.

The history of precast architecture, which has yet to be fully explored, contributes to the understanding of the proliferation of modernist ideas in mass housing. Western professional knowledge was brought to Israel and served the nation-building effort. The case of Ramat HaNasi, in particular, offers a glimpse of modernist operations, as it shows how neighborhoods have been built following the same concepts and methods in Israel and worldwide. Mass industrialization of building parts has allowed for duplicating housing units. In an orchestrated performance, walls and floors have been lifted up in the air and efficiently arranged into buildings for the universal human being, without recourse to local knowledge and with little or no relation to the specific location.

In the Israeli context, political processes from the 1950s to the 1970s, such as the nationalization of Palestinian lands, immigrant waves, the pre-1967 recession, and the subsequent influx of Palestinian laborers from the Occupied Territories demonstrate how modernist ideas and technologies are expressive of the history and politics of the local territory. The modernist nation-building ethos was perfectly captured in prefabrication, enabling the building of entire neighborhoods in a fully industrialized environment by big companies for the citizens of a socialist country.

In the construction of the Ramat HaNasi neighborhood, the technological innovation and the importing of knowledge went hand in hand with a change in the labor supply, the consequence of political upheavals and technological development. As Susan Reid notes, machine production—embraced by modernists as a source of rational beauty and perfection and as a means to democratize consumption and improve mass living standards—is also associated with the totalizing and potentially oppressive tendencies of anonymity, standardization, and alienation.[43] Thus modern housing has been widely criticized as a regulating and homogenizing force antithetical to individuality and privacy (in the sense of particularity) and as "one of the most invasive agents of hegemony."[44]

For geographer Timothy Oakes, modernity is characterized by "crisis-prone interactions between space, human agency, and abstract historical processes" and the "tense relationship between place-based subjectivity and placeless objectification."[45] In Ramat HaNasi, residents live among repetitive and homogeneous built settings. While the neighborhood is currently undergoing massive rebuilding processes, and as newly planned buildings replace the old ones, it is yet to be seen whether privatized construction will lead to a stronger sense of subjectivity and belonging, or rather to a similar sense of anonymity and alienation.

In future years, the question of the conservation of these neighborhoods will attract growing interest and raise technological and ethical questions. The technological questions relate to the quality of construction and the ability to conserve and utilize the buildings for the next generation. The ethical questions we should ask relate to the local and international history in which they were created and developed: Whether—and, if so, how—precast buildings influence the creation of communities? What politics are reflected in precast construction? Does the free flow of low-paid Palestinian laborers in the field of construction imply colonizer-colonized relations? We may also ask how precast construction would influence the contemporary real estate market crisis, with spiraling prices and a severe shortage of affordable quality housing? Answers to these questions could shed light on the understanding of mass housing and prefabrication.

## Notes

1. Rachel Kallus and Hubert Law Yone, "National Home/Personal Home: Public Housing and the Shaping of National Space in Israel," *European Planning Studies* 10, no. 6 (2002): 765–79.
2. Kenny Cupers, *The Social Project: Housing Postwar France* (Minneapolis: University of Minnesota Press, 2014), introduction.
3. Kristin Ross, *Fast Cars, Clean Bodies: Decolonization and the Reordering of French Culture* (Cambridge: MIT Press, 1996).
4. Cupers, *Social Project*.
5. The opening of the Israeli market to Palestinian labor from the territories occupied in 1967 dramatically affected employment patterns in the Gaza Strip and in the West Bank, not least in the construction industry. The number of workers from Gaza employed in Israel rose from about 2800 to 13,800 from 1970 to 1975. See Rami AbdulHadi, *Construction and Housing in the West Bank and Gaza Strip*, United Nations Commission on Trade and Development Study (1994), cited in Fatina Abreek-Zubiedat and Tom Avermaete, "Concrete Conflicts: The Vicissitudes of an Ordinary Material in Modernizing Gaza City," *Journal of Urban History* (2020), https://doi.org/10.1177/0096144220983037. "and as this labor was…": Najwa Makhoul, "Changes in the Employment Structure of Arabs in Israel," *Journal of Palestine Studies* 11, no. 3 (Spring 1982): 77–102, 78.
6. Hadas Shadar, *The Building Blocks of Public Housing: Six Decades of Urban Building on Public Initiative in Israel* (Tel Aviv: Ministry of Construction and Housing, 2014). (Hebrew)
7. Perlstein inherited the neighborhood unit concept from Arieh Sharon and was also influenced in that regard by British planners in the pre- and postwar eras, particularly Patrick Abercrombie and Arthur Ling in their Greater London Scheme of 1943. See Peter Collison, "Town Planning and the Neighborhood Unit Concept," *Public Administration* 32, no. 4 (1954): 463–69.
8. Shadar, *Building Blocks of Public Housing*.

9. Ramat HaNasi was divided into three quarters, with a detailed plan prepared for each. The plans adhered to the principles of the neighborhood unit and the green walkways, which enclosed the public buildings in the center. Each quarter comprised fixed subareas that included several buildings that defined the public area, open or built. Furthermore, consideration was given to the interconnection of the quarters, in order to ensure that the neighborhood functioned as an integrated structure (Shmuel Groag and Lilach Harel, "Ramat HaNasi Neighborhood Documentation File," Municipality of Bat Yam, 2016).
10. The concept of "Jewish labor" brought together national and economic goals, an approach that was in force during the first decades of statehood. See Gershon Shafir, *Land, Labor and the Origin of the Israeli–Palestinian Conflict, 1882–1914* (Cambridge: Cambridge University Press, 1989); Michael Shalev, "Jewish Organized Labor and the Palestinians: A Study of State-Society Relations in Israel," in Baruch Kimmerling, ed., *The Israeli State and Society*: *Boundaries and Frontiers* (Albany: SUNY Press, 1989), 93–133; Michael Shalev, *Labor and the Political Economy in Israel* (Oxford: Oxford University Press, 1992).
11. Gershon Shafir, "Settler Citizenship in the Jewish Colonization of Palestine," in Caroline Elkins and Susan Pedersen, eds., *Settler Colonialism in the Twentieth Century* (London: Routledge, 2005), 55–72.
12. Iris Levin, *Migration, Settlement, and the Concepts of House and Home* (New York: Routledge, 2016); André Levy, "Center and Diaspora: Jews in Late-Twentieth Century Morocco," *City & Society* 13, no. 2 (2001): 245–70.
13. Rachel Feldhay Brenner, *Inextricably Bonded: Israeli Arab and Jewish Writers Re-Visioning Culture* (Madison: University of Wisconsin Press, 2004), 143.
14. Kallus and Law Yone, "National Home/Personal Home."
15. Amnon Raz-Krakotzkin, "Exile within the Nation-State," *Theory and Criticism* 4 (1993): 23–55. (Hebrew)
16. The term was coined by Ernst May, and adopted by Walter Gropius, who lectured at CIAM II on "The Sociological Foundations of the Minimum Dwelling," in 1929. See Eric Paul Mumford, *The CIAM Discourse on Urbanism, 1928–1960* (Cambridge: MIT Press, 2002). It was also developed by Karel Teige, who envisioned the minimum dwelling not as a reduced version of a bourgeois apartment or rural cottage, but as an entirely new dwelling type built with the cooperation of architects, sociologists, economists, physicians, etc.
17. Mumford, *CIAM Discourse on Urbanism*.
18. Groag and Harel, "Ramat HaNasi Neighborhood Documentation File."
19. See Perlstein's letter dated January 12, 1939 (The Perlstein Collection, Architecture Heritage Center, Technion, Haifa). The Government Planners Department, established in 1948, was the central body that developed the planning policy of the new state. The department was founded upon the work of professional planners, most of them architects and engineers who studied in

Europe and believed in the humanistic ideology of modern planning, which maintained that "correct" planning can lead to a better world. De facto, this group was the implementer and sometimes the initiator of an aggressive policy of spreading the Jewish population in the country's periphery. That policy was meant to encourage people to settle outside of the dense areas, but, in reality, only new immigrants, who were dependent on the state and the national institutions, could be settled there. See Smadar Sharon, "Planners, the State, and the Shaping of National Space in the 1950s," *Theory and Criticism* 29 (2006): 31–57). (Hebrew)

20. Perlstein describes his choice of school as follows (Hebrew [translation by the authors]): "I am going to University College to study architecture. I do not want to study civil engineering as I had previously thought, since the friends whom I met here say that they fell into a trap, they only study of machines, and very little about buildings. And here, in this school, when I finish, I receive a diploma in architecture as well as a diploma in Town Planning, and I also study measuring and receive a certificate from R.I.B.A, and I get accepted directly to the studies, without exams." Letter from November 24, 1933 (The Perlstein Collection).
21. He was then head of the Department of Town Planning at the UCL. See Michael P. Collins, "The Development of Town Planning Education at University College London, 1914–1969: The Contributions of Professors SD Adshead, LP Abercrombie, and WG Holford," *Planning Perspectives*, 31, no. 2 (2016): 283–98. "focusing on a plan": See in Perlstein's letter dated January 12, 1939 (The Perlstein Collection).
22. The neighborhood units were planned to provide for serenity, greenery, and all necessary services and amenities. They were meant for two thousand to three thousand residents; they were inert, surrounded by a system of roads that connected them to other neighborhoods and to the city center. Inside, there were large green areas and pedestrian walkways, as well as all the required facilities. The neighborhoods were comprised of a series of identical buildings. See Collison, "Town Planning"; John R. Gold, "Towards the Functional City? MARS, CIAM and the London Plans, 1933–42," in Thomas Deckker, ed., *The Modern City Revisited* (London: Routledge, 2000), 81–99.
23. See James Roscoe Wright, "Industrialized Building in the Soviet Union (a Report of the US Delegation to the USSR)," no. 334, US Government Printing Office, 1971; Robert McCutcheon, "The Role of Industrialized Building in Soviet Union Housing Policies," *Habitat International* 13, no. 4 (1989): 43–61. See also Gold, "Towards the Functional City?"
24. Stephen Ward, "Soviet Communism and the British Planning Movement: Rational Learning or Utopian Imagining?" *Planning Perspectives* 27, no. 4 (2012): 1–26. Another important figure in this regard was British architect Arthur Ling, also a former student of Abercrombie at the UCL and one of the men who

implemented Abercrombie's postwar planning. In 1945, Ling became head of the Town Planning Division of the Architect's Department.

25. In that, Perlstein was very much indebted to his association with Abercrombie. Arieh Sharon invited Abercrombie to advise the Planners Team and share his expertise and ideas of planning and social reform. See Rosemary Wakeman, *Practicing Utopia: An Intellectual History of the New Town Movement* (Chicago: University of Chicago Press, 2016), 110–12. He also wrote a report on his visit here: Patrick Abercrombie, "Report on Visit to Israel" (1952), Central Zionist Archives A175/200.
26. Gold, "Towards the Functional City?"; Collison, "Town Planning"; Kallus and Law Yone, "National Home/Personal Home"; Shadar, *Building Blocks of Public Housing*.
27. Ben-Israel, Arnon (Hebrew), "Between Urban Imagination, Memory, and Everyday Life: Bayit Vagan/Bat Yam 1926–1950" (Bat Yam, Center for Mediterranean Urbanism, 2011).
28. Ibid.
29. Daphna Levine, "Sacred Masses: Religious Architecture in Bat Yam," *Massa – Holy* 2 (2018): 38–49.
30. Shadar, *Building Blocks of Public Housing*, 17–18.
31. Nir Cohen, "Territorial Stigma Formation in the Israeli City of Bat Yam, 1950–1983: Planning, People and Practice," *Journal of Historical Geography* 39 (2013): 113–24.
32. Shadar, *Building Blocks of Public Housing*, 140.
33. A brochure produced by the Perlstein office relates to this method as follows: "A practical and economical system was chosen by our office – a system carried out in a field plant adjacent to the building site. This system, developed by engineering consultant J. Bory of Paris, was adapted by us to suit our architectural and local conditions. This prefabrication method is suitable for all types of buildings. To date, over 3,000 apartments of all types and sizes and school buildings have been designed and constructed by our office using this system." Yitzhak Perlstein and Associate Architects and Town Planners, "Planning, Housing and Buildings," *Source* (1966): 73. (Hebrew [translation by the authors])
34. Asher Allweil, "The Research of Building Methodologies in Israel," published by the author, 1983, 2–3.
35. Ibid.
36. Ibid.
37. The system was characterized by "room sized floor panel elements with load-bearing cross walls of precast concrete. Floor slabs span up to 16 m and the exterior wall may be either bearing or non-bearing. It could accommodate a variety of sub-systems, including cast-in electrical conduit, radiant heat tubing,

precast plumbing, venting and waste chute, technical walls or prefabricated plumbing trees. It could be based on on- or off-site casting and storage facilities. An on-site plant and storage facilities of 100 m × 300 m with direct access to the construction area are justified by construction of over 350 units. An estimation of a minimum of 3–5 months was required from contract to production of component parts, and it was applicable to residential structures of from 1 to 28 floors" (ibid.). The principal manager of the system was the Bureau d'Etudes Techniques, headed by J. Bory. The system has produced more than fifteen thousand housing units since 1957 in France, Israel, Italy, and England, in projects varying in size from forty to twelve hundred units. David A. Crane, Edward J. Logue, Keyes, Lethbridge, and Condon (Firm), *Developing New Communities; Application of Technological Innovations* (Washington, DC: US Department of Housing and Urban Development, 1970), 41–44.

38. Allweil, "Research of Building Methodologies."
39. Groag and Harel, "Ramat HaNasi Neighborhood Documentation File."
40. Ibid.
41. As Makhoul notes, only after 1967 were the economic behavioral norms of labor Zionism permanently abandoned and finally subordinated to exclusively capitalist development imperatives, in the context of which a structural demand for indigenous Palestinian labor, as well as for industrial activity, emerged in the Israeli economy. Modern historical records document a constantly available supply of Palestinian labor, resulting from long-lasting policies of land acquisition and use for Jewish settlement, on the one hand, and the "occupation of labor" policy practiced by Jewish leadership under the hegemony of labor Zionism in the pre- and poststatehood eras on the other. Makhoul, "Changes in the Employment Structure of Arabs in Israel," 78.
42. Shadar, *Building Blocks of Public Housing*, 2014.
43. Susan E. Reid, "Makeshift Modernity: DIY, Craft and the Virtuous Homemaker in New Soviet Housing of the 1960s," *International Journal for History, Culture and Modernity* 2, no. 2 (2014): 87–124, 91.
44. Donna Birdwell-Pheasant and Denise Lawrence-Zuniga, "Introduction," in idem, ed., *House Life* (Oxford: Berg, 1999), 28.
45. Timothy Oakes, "Place and the Paradox of Modernity," *Annals of the Association of American Geographers* 87, no. 3 (1997): 510.

CHAPTER 4

# The Reconstruction of Post-Earthquake Skopje

## An International Collection of Prefabricated Houses in the Cold War Era*

*Tamara Bjažić Klarin*

### Introduction

On July 26, 1963, Skopje, the growing industrial capital of the Socialist Republic of Macedonia with 171,000 citizens, was struck by a massive earthquake. More than 75 percent of the city was turned into ruins and 150,000 people became homeless.[1] Nearly all of the public facilities, including schools and hospitals, were either destroyed or seriously damaged. The devastating extent of the damage was due to the age of the buildings, poor construction, and a lack of regulations regarding earthquake-proof construction. The decision-making regarding the rebuilding of the city was swift and effective. The plan was to rebuild the city on its original site in several stages, as there was only limited damage to the public facilities (such as plumbing and sewage). The implementation of the first five-year-long phase of the reconstruction plan called for providing accommodation for 120,000 people.[2] After "performing emergency services, patching up buildings, and getting public services running again," the next step was to develop the basic essentials for the second stage, the reconstruction of the city center, by strengthening the economy (particularly the construction materials industry) and rebuilding the roads.[3] In only a few months, before the winter of 1963, 120,000 people living in tents had to be moved, 50,000 of them to 10,500 flats in repaired buildings and 70,000 to 14,000 mostly lightweight prefabricated housing units in eighteen satellite settlements that were built immediately after the earthquake.[4]

The new settlements included all the infrastructure required for everyday life. The various prefabs were produced in Yugoslavia, imported commercially, or donated from abroad as gifts or humanitarian aid. Thus, Skopje gathered a multitude of contemporary examples of prefabricated single-family houses from the West, the East, and North Africa in the middle of the Cold

War, just one year after the Cuban Missile Crisis. The number and different types of prefabricated buildings turned Skopje into, as Živojin Vekić noted in 1965, a "specific and rare example of mass prefabricated construction."[5]

Gathering all these prefabs from the Eastern and Western blocs was possible owing to Yugoslavia's policy of international collaboration and its membership in the Non-Aligned Movement, which included decolonized countries of Africa and Asia. The day after the earthquake, Yugoslav President Josip Broz Tito appealed for international aid and repeated his appeal at the Eighteenth United Nations' General Assembly in September 1963.[6] The UN undertook to provide Skopje with long-term technical assistance, supported the teams of international experts, and promoted an international competition for rebuilding the city center, the establishment of the Institute of Earthquake Engineering and Seismology in Skopje, and courses for the education of rebar workers.[7]

In this chapter, I deal with a unique international undertaking—the construction of eighteen new settlements—that was overshadowed by the international competition for the city center and the Brutalist buildings constructed there after the earthquake. These new settlements represent a unique international in situ exhibition of lightweight prefabrication on a 1:1 scale that was organized not for exhibition but for disaster relief. I also argue that assembled prefabricated houses in Skopje had a decisive influence on the development of lightweight prefabrication in Yugoslavia and the inclusion of single-family homes in federal housing policy during the mid-1960s.

## Planning the Skopje Periphery

After the earthquake, the well-organized and effective Skopje authorities needed only five days to restore public services. Just ten days later they started the construction of the Đorče Petrov settlement, which was the first out of eighteen permanent prefabricated suburban communities of single-family houses and small apartment buildings.[8] Owing to the earthquake aftershocks, the sheer number of homeless people, the extremely tight deadlines for construction, the extent of the destruction in the city center, and the relatively large production capacity of the domestic lumber industry, the authorities chose to rebuild using a prefabrication building technology. In the long term, Skopje authorities were committed to pursuing large-scale city reconstruction, the creation of a new master plan, and the introduction of the first standards for earthquake-resistant construction, as formulated in the city authorities' and UN recovery plans.[9]

The construction of suburban settlements had a radical impact on the existing urban planning policy. Before World War II, Skopje had two major city areas separated by the River Vardar—the medieval oriental old city and


**Fig. 4.1.** Skopje after the earthquake 1965. Source: "Urbanistički prostorni razvoj," *Arhitektura-urbanizam* 5, no. 28 (1964): 10–11, 11.

the area constructed on the principles of nineteenth-century urban planning. After the war, new housing developments were constructed in the city center in place of "extremely numerous" substandard houses, as the new buildings could benefit from the existing infrastructure. According to Ljube Pota, such an approach proved to be cheaper than constructing new housing on the outskirts of the city.[10] After the earthquake, new suburban settlements led to the decentralization of the city. Now it was divided into the center and a ring of new satellite settlements provided with public services and facilities, and transportation (fig. 4.1). To make use of existing infrastructure and other services during the first period of reconstruction, the new housing was erected between three to ten kilometers from the city center, close to existing settlements or industrial facilities in areas with less seismic activity.[11] Defined as permanent solutions, the settlements were built in accord with Yugoslav urban planning standards, while the buildings, depending on their quality, could be replaced over time with permanent structures.[12]

Carrying out this immense project was enabled by the enactment of a legal and financial framework and the mobilization of the construction industry and a range of experts. Urban planners, civil engineers, and architects from all the

Yugoslav republics came together with foreign specialists in earthquake-resistant construction and prefabrication from the Soviet Union, Great Britain, Japan, and France, who were engaged by the Yugoslav government and the United Nations.[13] To finance the reconstruction, the government established the Fund for the Reconstruction and Development of Skopje, the money from which was designated "particularly for rebuilding and constructing industrial capacities, housing, municipal and communal facilities, workspaces for states bodies, technical support, and teams to clear the ruins as well as preparatory works to rebuild the city and temporary structures to house affected residents."[14]

Each of the Yugoslav republics, except for Montenegro, handled the construction of one or more of the new settlements for around five thousand or ten thousand residents.[15] They provided urban plans, documentation for project implementation, and a selection of prefabricated structures and constructions. Settlements were mostly designed by the republics' and their capital cities' urban planning institutions. The Urban Planning Institute of Croatia was in charge of the settlements of Madžari, Kamenik, and Železara; Belgrade's Institute of Dračevo and Kozle; Ljubljana's Institute of Vlae; and Skopje's Institute of Đorče Petrov I and II, Dexion I and II, and Taftalidže. The Sarajevo-based urban planning and architectural office Dom planned the settlements Butel I and II, while Belgrade-based Design Institute Centroprojekt was in charge of Aerodrom. Montenegro participated in the construction of Lisiče, which was handled by the Yugoslav National Army construction companies. The army cleared the ruins together with military brigades from the Soviet Union, the United States, and the United Kingdom, volunteers from Eastern and Western European countries and Yugoslav youth organizations through federal work actions.[16]

The various institutions involved in the planning invested different degrees of effort in shaping settlements' identities in terms of spatial organization and public spaces. Each settlement was a common residential community (the so-called *mikrorajon*), the basic social and spatial planning unit, with primary schools, kindergartens, healthcare facilities, shops, restaurants, community centers, and playgrounds. The plan was based on the concept of the "open" functional city, meaning detached buildings, good insulation of apartments, and a plenitude of green spaces for rest and leisure. The settlements consisted of larger and smaller neighborhoods with 250 to 300 inhabitants. The plots for single, semidetached, or row family houses were of standard dimensions and provided with plumbing, sewage, and electricity.

The common features of the settlements included the central placement of public facilities, a grouping of larger apartment buildings, and the separation of streets for vehicular traffic and pedestrian pathways. Most of the settlements had a schematic orthogonal network of residential streets (fig. 4.2). In terms of

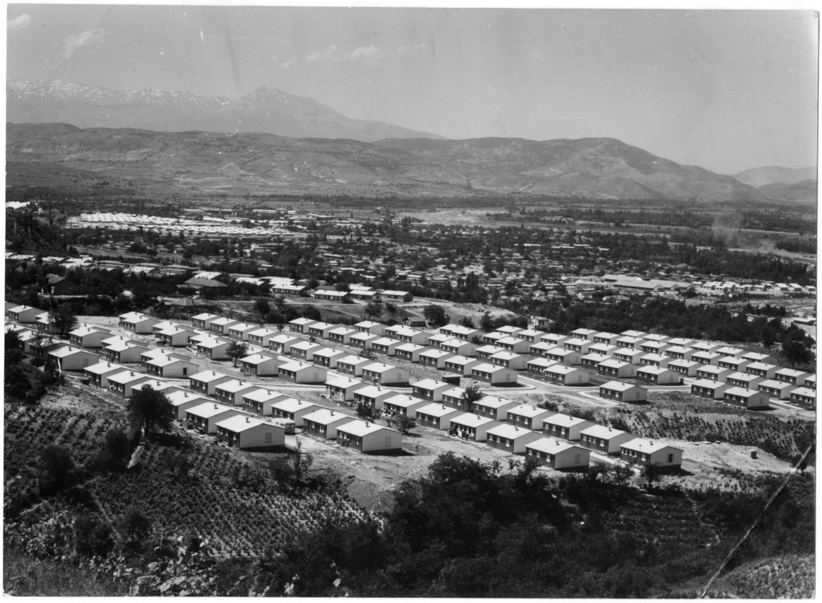

**Fig. 4.2.** Urban Planning Institute of Belgrade, Kozle Settlement, 1963.
Source: HR-HDA-2031 (Hrvatski državni arhiv, Zagreb, Vjesnik).

the quality of planning, settlements Dexion 2, Aerodrom, Madžari, Železara, and Kamenik stood out. The key feature of Dexion 2 was a semicircular main road from which residential cul-de-sacs branch out. The Madžari, Železara, and Kamenik settlements have major ring roads that "grow" out of their centers with public spaces and facilities (fig. 4.3). Aerodrom consisted mainly of small single-story apartment buildings and was also provided with pedestrian shortcuts. Depending on spatial organization and building type, mostly one-story and a smaller number of one- or two-story apartment buildings, the housing density was between 49.5 to 105 residents per hectare.[17]

The post–World War II era witnessed a severe housing crisis owing primarily to wartime destruction and to the demographic changes resulting from rapid industrialization. Settlements of single-family houses with a low population density (80 to 120 inhabitants per hectare) and the high costs involved in developing the required infrastructure such as in Skopje did not fall in line with the government's housing policy.[18] An ordinary residential community was defined as a settlement of between 5,000 and 8,000 residents and an area of between 20 and 36 hectares, resulting in a population density of 350–400 residents per hectare. The high density was achieved by the construction of apartment buildings—slabs and towers with varying numbers of floors to

**Fig. 4.3.** Urban Planning Institute of the Socialist Republic of Croatia, Železara Settlement, 1963. Source: Milica Janković, "Nova prigradska naselja Skoplja," *Arhitektura-urbanizam* 5, no. 28 (1964): 36–41, 38.

preclude uniformity. The type of settlement and housing were discussed and presented in the 1950s through a series of national symposiums and exhibitions organized by the Union of Urban Planners of Yugoslavia, federal and city planning institutes, the Permanent Conference of Cities (Stalna konferencija gradova), and chambers of industry and construction. The first symposium in Rogaška Slatina in 1954 discussed housing and the second in Ljubljana in 1956, accompanied by the exhibition *Housing for Our Conditions* (*Stan za naše prilike*), dealt primarily with housing units and apartment buildings, whereas the exhibition *Family and Household* (*Porodica i domaćinstvo*) at the Zagreb Fair in 1958 was devoted to the residential community as a whole. Apart from housing units and their furnishings, the displays included settlement plans and public facilities. The guidelines for the planning of settlements were further discussed at *The Residential Community as an Urbanist Element in the Planned Development of Cities* *and Populated Areas* symposium in 1958 and finally defined by the *Residential Community as an Element of Spatial Planning* symposium held in 1962.[19]

Despite the post-earthquake guidelines for the planning of settlements in Skopje, it was crucial to rush construction as well as to respond to societal expectations that victims would be provided not only with roofs over their heads but also with an acceptable environment—communities with private homes and gardens. Life in such an environment undoubtedly had a positive impact on traumatized people. From a financial point of view, the advantages of the new Skopje communities compared to the more common slab-and-tower settlements were fewer public green spaces, playgrounds for children, and public parking lots provided and maintained by the municipality. Furthermore, although the Skopje post-earthquake settlements were not favored by urban planners, they provided them with a rare opportunity to construct public facilities and housing at the same time. The construction of planned public facilities and spaces generally lagged behind housing construction by several years, which often led citizens and urban sociologists to criticize both the new settlements and the urban planning.[20]

## The Battle for Prefabricated Construction

The construction of roughly 1 million m$^2$ of city space in Skopje, with 700,000 m$^2$ of residential space and 200,000 m$^2$ for public facilities, required most of the capacity of Yugoslavia's construction firms and producers of construction materials.[21] Increasing production, the lumber industry planned to deliver between 400,000 and 500,000 m$^2$ of prefabricated buildings by the end of 1963. To achieve this, its monthly output had to be quadrupled by "work being carried out in three shifts, including Sundays and holidays, as well as better use of production capacities."[22] The rest was provided by companies engaged in building construction or supplemented by international donations and Yugoslav government emergency imports of prefabricated houses, construction equipment, and materials that were in short supply.[23] There was also a significant shortage of transport facilities and qualified workers. Moreover, prefabricated mass housing was just beginning to be widely adopted.

In 1947, the government set prefabrication as a priority in the first national Five-Year Plan, but the capacity to provide prefabricated mass housing was limited.[24] The first experiments with prefabricated buildings, which began in the immediate postwar period were abandoned in the early 1950s owing to the poor quality of the prefabrication resulting from a lack of technology, knowledge, and experience.[25] As early as in the mid-1950s, Yugoslavia lagged far behind the Western European countries in housing prefabrication.[26] The first

**Fig. 4.4.** Prefabricated single-family houses developed by producer Jelovica in the Vlae settlement, photographer unknown.

big breakthrough was the introduction of the Jugomont system of mid-weight concrete panels produced by a Zagreb-based company—the only Yugoslav prefabricated system certified for construction in earthquake zones in 1963—and the Belgrade IMS skeletal system in 1957.[27]

In the early 1960s, lightweight prefabrication of wooden houses was less developed than the prefabrication of mass-housing systems made of steel and concrete such as Jugomont. The market for wooden houses was limited. The latter served mostly as temporary accommodation for people in need, colonizers, miners, and construction workers, for weekend getaways, and as tourist venues. The result was a small number of producers specializing in this type of construction and minimal investment in research. The Krivaja company in Zavidovići, Bosnia and Herzegovina, planned the first factory production of wooden houses in 1948.[28] In November of that same year, the Federal Ministry of Construction organized a conference in Belgrade that addressed the development of domestic production of wooden houses using factory-produced materials such as wood panels.[29] One outcome of that conference was the introduction of quality prefabricated wooden family homes like the ones produced in Sweden and Finland. According to Mate Baylon, one of Yugoslavia's leading housing experts, such houses, widely accepted in the West, were suitable for those who preferred individual housing rather than multistory apartment

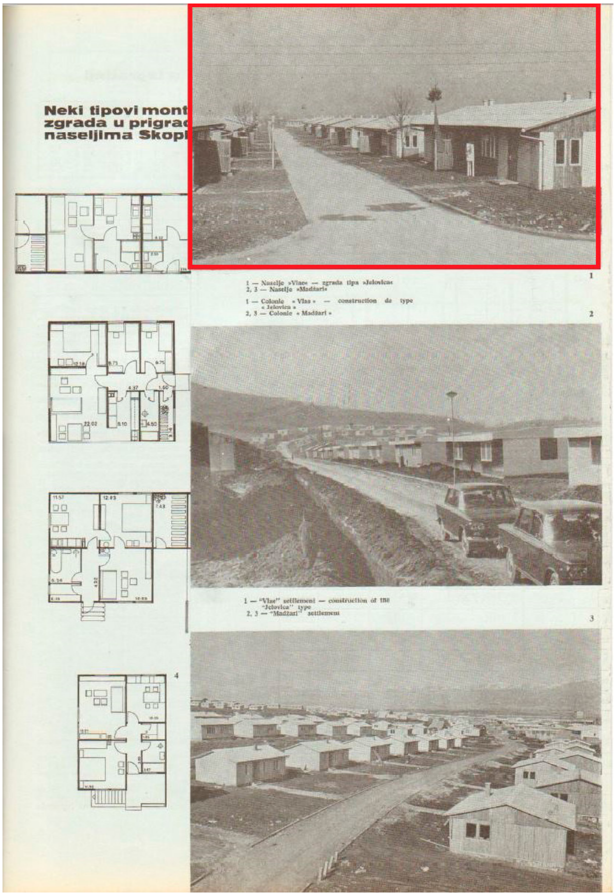

**Fig. 4.5.** Producer Jelovica, house in the Vlae Settlement, floor plan. Source: Milica Janković, "Nova prigradska naselja Skoplja," *Arhitektura-urbanizam* 5, no. 28 (1964), 36–41, page without number.

dwelling.[30] By the mid-1950s, wooden prefabricated weekend houses and bungalows began to make for a larger and larger share of the production of wooden houses. The leading producers, such as Spačva in Vinkovci, Jelovica in Škofja Loka, and Krivaja in Zavidovići, collaborated with architects specializing in the production of wooden prefabricated houses.[31] This resulted in significant improvements in spatial organization, design, construction systems, and production technologies (fig. 4.4, 4.5). The companies often put their houses on display at the Zagreb Fair, and magazine articles popularized prefabricated family homes.[32] Despite all these efforts, the public failed to accept wooden prefabricated family houses as permanent solutions.

At least twenty-three producers of wooden building materials and houses from all the Yugoslav republics took part in the first phase of the Skopje reconstruction. Most of the constructed houses were traditional "barracks" with gabled roofs and wooden or metal frames covered by wooden planks or asbestos-cement plates.[33] The houses were mainly detached and semidetached one-story family homes, with either two larger or four smaller apartments. Krivaja produced detached two-story buildings with four apartments, whereas Soko built two-story detached or row family houses using a metal structure and a modular construction. The square footage and the spatial solutions of all prefab family houses were similar. They followed to a greater or lesser extent established Yugoslav standards for housing defined through the rationalization and standardization of building floor plans. The defining standards were set through a series of architectural competitions held between 1947 and 1952.[34]

The largest number of housing units in Skopje covered between 30 and 70 m$^2$ and had one or two bedrooms, whereas the ones with three bedrooms with surface areas of roughly 80 m$^2$ were rare. The rooms, the kitchen with a dining space, and a bathroom were arranged around a central hall with an entrance to each of them. Thus, all the rooms (sized from 10 to 16 m$^2$) could be used as bedrooms. For more efficiency, the kitchen and bathroom were positioned next to each other so the plumbing installations could be concentrated in one place. Units with larger living rooms with integrated kitchens resembled weekend houses such as the semidetached weekend house designed by Utva. Houses with space for outdoor living, that is, a porch, were designed and assembled by Sport from Belgrade and Pljevlja. The treatment of the walls, floors, and the level of furnishing depended on the producer. Plaster or paint covered the exterior and wallpapers and oil wall paints were common in the interior. Floors were covered with terrazzo, ceramic tiles, or wooden boards. Most of the houses were provided with kitchen sinks and stoves.

Having gathered all the firms involved in the Yugoslav lumber industry, after reconstruction, Skopje gave serious thought to lightweight prefabrication production, its current state of development, and its potential. It was clear that few of the lumber companies had any experience in prefabrication. To bridge the gap, the government of Yugoslavia hired three UN experts in prefabricated housing: Robert Fitzmaurice, E. Whittaker, and C. Douglas. The British had had a lot of experience as prefabrication had been used extensively in its postwar reconstruction, so their mission was to analyze the constructed houses in the thirteen settlements, which had a total of 14,500 domestic units.[35] They were tasked with providing Skopje authorities with guidelines for technological improvements. Their advice also helped to increase the efficiency and reduce the costs of construction. The primary problems were insufficiently developed prefabrication systems, poor quality, and only a minimal degree of finishing of the prefabricated elements in the factory. There was too much "wet work" at sites, which meant that prefabrication did not save a significant amount of time compared to brick-built buildings. Highly treated wooden wall panels coated with final layers on both sides along with built-in doors and windows, which allowed for faster building, such as the houses built by Spačva, were an exception. The highest marks were awarded to a completely new system of slabs made of Siporex (a kind of aerated concrete) used for the construction of the houses in Vlae.

To improve the prefabrication systems, their design, production, and assembly, British experts suggested the construction of a series of prototypes. They also noted the need for the establishment of a management office that would coordinate the transport and delivery, as well as the organization of construction sites and their operation. Overall, their impressions were positive: "this must be considered an incredible undertaking based on all existing standards."[36] The British experts concluded that in this emergency, all the prefab houses provided "the people of Skopje with a relatively cheap, well-equipped, and modern living space."[37] Some residents who moved into these houses experienced decent housing conditions for the first time in their lives, such as the former residents of the Kale city quarter, the old part of Skopje, where most of the dwellings had been substandard.

### Skopje's Post-Earthquake Settlements as an International Collection of Lightweight Prefabrication

Apart from domestically produced prefabs for housing, Skopje's new settlements boast of foreign prefabs donated and imported from nineteen countries on both sides of the Iron Curtain: Austria, Denmark, Finland, France, the United Kingdom, West Germany, Italy, Norway, Sweden, and Switzerland, Bulgaria, Czechoslovakia, East Germany, Poland, and Romania, as well as the United States, Mexico, and Morocco.[38] The prefabs were mostly provided by national governments that were already supporting Yugoslav experts through technical programs, by the Red Cross and other humanitarian or religious organizations, and by private companies.[39] In Skopje, the donated prefabs were located within settlements that were mostly constructed using domestically produced prefabricated housing. The two settlements with prefabs from the United Kingdom and the United States—Dexion I and Dexion II, named after the British producer, and Šuto Orazire—were an exception. In terms of the diversity of the origins of the prefabricated houses, the best example was the settlement Taftalidže, with more than two hundred prefabricated houses from Italy, France, Switzerland, Norway, Czechoslovakia, Poland, and Mexico.


**Fig. 4.6.** Prefabricated houses in Skopje, donated or imported from Czechoslovakia in 1963. Source: HR-HDA-2031 (Hrvatski državni arhiv, Zagreb, Vjesnik).

Donated prefabs showed similar architectural features, such as gabled roofs. But, depending on the donor country, they varied in the quality of construction, material, and the degree of finishing of the prefab elements. The highest-quality prefabs for housing, schools, and healthcare facilities were generally those from Western countries that had long traditions of lightweight prefabrication, such as Finland, Norway, and Sweden, but also Czechoslovakia (fig. 4.6).[40] With their donations, these countries showed a willingness to help, but they also had an economic interest: the donors, governments, and producers were hoping for orders of prefabs from Yugoslav authorities at market rates. The Finnish houses produced by Kotka, Loki, and Puutalo assembled in the Taftalidže, Mađari, Železara, and Kozle settlements attracted the most attention among the domestic experts.[41]

Apart from the quality of materials, details, and furnishings, these houses had a modern spatial organization, which meant larger living rooms with dining areas, working kitchens, and separate sleeping areas. The design of the houses from the United Kingdom and the United States, the most numerous among the donated prefabs, was quite the opposite. The Dexion houses were made of simple perforated steel frames and covered with domestically produced wood, aluminum, or plastic plates.[42] They each had a kitchen, a single room, and a bathroom.

Apart from the dwellings, the American Army and the United Kingdom provided prefabricated multifunctional storage-type buildings exclusively for temporary use (Nissen huts) until more permanent solutions were found. Built in the shape of a hangar with corresponding constructions, they were used for housing, educational and cultural institutions, and some other purposes.

By "collecting" prefabs from West and East as well as the Global South, Skopje provided experts involved in reconstruction with a unique overview of light prefabrication on a 1:1 scale—single and double family houses, small apartment buildings, and public facilities such as the UNICEF Center for the Protection of Mothers with Children and a maternity hospital donated by Czechoslovakia. At that time, the exhibitions of family homes and weekend houses on a 1:1 scale, such as the contemporary *Fertighaus 63* in Hamburg in 1963 and *Casa prefabbricata per vacanze* at the Thirteenth Milan Triennale in 1964, were not common in Yugoslavia.[43] The exhibitions *Housing for Our Conditions* and *Family and Household*, mentioned above, showed several furnished apartments and prefabricated department stores of domestic origin, and the exhibition in the US pavilion at the Zagreb Fair in 1957 showed an American single-family house. One of the first specialized exhibitions of domestic lightweight prefabricated family houses, weekend houses, bungalows, and garages was mounted in the Rijeka city square in 1962, just one year before the Skopje earthquake.[44] Skopje producers, engineers, and architects had a unique opportunity to observe the assembling of prefabs and exchange knowledge with more than one hundred foreign colleagues from almost all the donor countries that were supervising the assembly.

The most valuable donations were not, as one might assume, from the wealthy West but from the socialist countries Bulgaria, Romania, and the Soviet Union. Bulgaria and Romania constructed earthquake-proof buildings for a specialist health clinic, a high school, and three apartment buildings with nine floors, the last in Taftalidže. The Soviet Union donated equipment for the production of prefabricated multistory apartment buildings using a Soviet heavy-weight concrete panel system. The plant in Karpoš that opened in January 1964 was expected to construct twelve hundred apartments a year.[45] The Soviet Union's support for Skopje was part of Khrushchev's politics of peaceful coexistence between the Soviet Union and Yugoslavia, based on the idea of different roads to socialism. As part of his state visit to Yugoslavia in the summer of 1963, Khrushchev visited Skopje accompanied by Tito. Yugoslavia showed its gratitude to fraternal socialist countries by increasing imports "from the East and those countries with which contact had already been established (Finland and others), as well as countries with which Yugoslavia had relations such that payments could be resolved favorably."[46] Ultimately, prefabs were imported from Czechoslovakia, Poland, the United Kingdom, Finland, France, and Morocco, which was the only one among them that was a Non-Aligned Movement (NAM) country. All of those countries except Morocco had been donors. The donations from thirty-seven countries, including many NAM countries, that were not sufficient to construct individual structures, were pooled together to build the prefabricated Universal Hall for public events.

## Toward New Housing Policies

Up to the spring of 1964, a total of 13,674 prefabricated housing units were erected and put to use in Skopje—82 percent were produced by local companies, 11.5 percent through emergency imports, and 6.5 percent were provided through international donations.[47] Owing to the previously mentioned disadvantages, a lack of quality construction materials, quick construction, and bad weather while they were being put up, half of them did not meet building standards, so only 6837 of the units could be used for "longer-term housing."[48] Despite these flaws, the construction of prefabs in Skopje was a great success and an "important lesson […] for our construction industry, our urbanists, and our municipal authorities."[49] Prefabricated structures marked a turning point not only for the lumber industry but also for local and federal housing policy. Owing to the mobilization of all resources and new investments, "significant experiences were gained in the production of prefabricated wooden houses on a larger scale" for the first time.[50] Annual production increased from 115,000 m$^2$ in 1962 to 280,000 m$^2$ in 1964. The new capacities needed new markets both in the country and abroad. Expansion was possible only by increasing the quality of the houses produced and reducing the prices, which implied mass production, prefabrication of more elements, a better quality of materials, more elaborate details, improved spatial organization, and better fittings. As early as in 1964 and 1965, the Yugoslav companies presented several significantly improved new prefabricated structures. Spačva introduced a more flexible construction system based on modular walls and ceiling panels, sanitary blocks, and furnishings. A system designed by the group of Zagreb-based architects called Prefabrikati allowed for a greater variety of floor plans and architectural designs, which included flat roofs, glazed facade panels, and terraces.[51] The Graditelj construction company from Ivanić Grad produced a prefabricated Siporex house with similar design features.[52] However, although the prefabrication of residential buildings was a virtual necessity, architects and engineers interested in the design and development of the systems of prefabrication were still more the exception than the rule.[53]

Slovenian producers went a step further. Using the experience gained in Skopje and supported by the municipal authorities of Ljubljana, the

**Fig. 4.7.** France and Marta Ivanšek, Murgle settlement in Ljubljana, 1965–1988. Source: Ustanova France in Marta Ivanšek, Ljubljana.

companies Edilit, Lesni kombinat, and Jelovica started the construction of a settlement of prefabricated wooden houses called Murgle (M-1) intended for the market (fig. 4.7). Companies saw in Murgle an opportunity for the improvement of serial production and the quality of the house, as well as a reduction in price and better promotion. Their goal was to show potential buyers "their capabilities, both technical and otherwise, as well as the practicality and comfort of prefabricated apartments."[54] The project was a great success. In the period from 1965 until 1982, some 795 prefabricated houses were built in Murgle.[55] The city of Zagreb used the Skopje model for the same purpose and accommodated victims of the flood in 1964 in the newly constructed settlement Retkovec, which was made up of prefabricated homes produced in Croatia, Bosnia and Herzegovina, and Serbia.

Planned settlements of prefabricated family houses gave municipalities a possible solution to the problems involved in the construction of family homes without urban plans and construction permits, which had been an issue since the early 1960s.[56] Furthermore, for the first time since 1945, family homes outnumbered planned mass housing, which was a result of the insufficient number of built apartments, as well as of decentralization of funding for housing. The funds were turned over to the management of the enterprises, which then granted loans to workers for private family homes. As in Western countries, a family house was the ideal housing type in Yugoslavia in terms of both tradition and comfort.[57] The massive use of prefabrication would reduce the price of such housing and significantly speed up construction.

The interests and requirements of citizens, producers, and municipalities, as well as of the representatives of the Permanent Conference of Cities, led to the inclusion of lightweight prefabrication in housing and urban planning at the federal level. As early as 1965, a total of 135,000 apartments were to be built in Yugoslavia, 11,000 of which would be constructed using lightweight prefabrication.[58] Skopje settlements and Murgle became case studies to set standards for such an undertaking. After publishing a series of articles on the first phase of Skopje reconstruction and of Murgle in the journal *Komuna*, the Permanent Conference organized the symposium *One-Story Prefabricated Housing Construction*, which was held in October 1965 in Belgrade.[59] The bases for the discussions among the more than ninety prefabricated system producers, urban planners, members of commercial chambers, and government representatives were the analyses of the costs of the Skopje settlements infrastructure and the quality of their prefabricated houses. Representatives of IMOS, the association for industrial construction, and Jelovica shared the experience they gained during the construction of Murgle. The symposium's conclusion was the realization of a need to come up with technical guidelines for the design and production of prefabricated houses as well as for the use of new materials and systems. Regulations were designed to improve the quality of prefabs and their production in the mutual interest of producers, developers, and potential residents. The issue of low building density was meant to be solved by erecting multistory apartment buildings. Owing to a higher standard of living, private homes became part of a long-term housing policy and urban planning. At the same time, for the residents of Skopje's settlements, the main advantages were the settlements themselves, or rather the infrastructure, as in the long term, these settlements had the potential to "develop into higher standard suburban residential areas" by reducing the number of prefabricated houses and replacing them with those constructed with more durable materials.[60]

## Conclusion

The need for a great number of prefabricated family homes for Skopje after the earthquake in 1963 led to the development of light prefabrication in Yugoslavia. Initially, most of the prefabricated houses produced by local industry were of poor quality and assembly and were not acceptable as long-term housing solutions. The reason for this was that the state housing policies were oriented toward light- and heavy-weight concrete prefabrication systems that were more suitable for constructing apartment buildings, slabs, and towers. The new production capacities provided the basic conditions for further development designed to improve quality. Important knowledge was gained from the foreign experts engaged to identify problems and suggest improvements. Further, local professionals—producers, technologists, and architects—were able to learn in situ about the spatial organization, construction, materials, and assembling of prefabricated houses imported (some as donations) from the more developed European countries with long traditions, such as Finland and Sweden.

At the same time, the settlements of family homes provided an opportunity to consider a more economical way of constructing this type of housing, which, owing to its cost, did not align with the contemporary housing and economic policies, that is, the construction of slabs and towers. The planned prefabricated settlements of private homes was seen as a possible solution to the urgent problem of unplanned construction of houses without building permits by cutting building costs and as an opportunity to offer this type of construction on the open market. At the beginning of the 1960s, there was more individual than collective housing in Yugoslavia. The experience gained through the construction of Murgle in Ljubljana did not seem to have an impact on other projects of a grander scale, mostly because people were suspicious of prefabrication, but also because of its still high costs. What followed in the late 1960s was the integration of individual dwellings within the typologically more diverse housing settlements.

## Notes

* This paper is a result of the research project Models and Practices of Global Cultural Exchange and Non-aligned Movement. Research in the Spatio-Temporal Cultural Dynamics (IPS-2020-01-3992) of the Croatian Science Foundation and the Slovenian Research Agency.

1. The magnitude of the earthquake was 6.25 on the Richter scale. More than one thousand people were killed, and some thirty-five hundred were injured. See UN Development Programme, *Skopje Resurgent: The Story of a United Nations Special Fund Town Planning Project* (New York: UN, 1970).
2. By October the need for accommodation had grown to involve 170,000 people. See John P. Angstadt, “Army Disaster Relief at Skopje,” *Military Engineer* 57, no. 377 (1965): 159.
3. The Government of Yugoslavia, Urban Development Plan for the City of Skopje, Project Proposal, 1963, AJ-130, f. 755, Savezno izvršno veće, Archive of Yugoslavia, Belgrade.

4. This decision was announced on August 1, 1963. See "Milijun m$^2$ montažnih zgrada," *Vjesnik*, August 2, 1963; Doksim Muratovski, "Skopljanci očekuju konačni smještaj," *Vjesnik*, November 26, 1963.
5. Živojin Vekić, "Osvrt na razvoj i dostignuća proizvodnje lakih montažnih objekata u SR BiH," *Arhitektura-urbanizam* 6, no. 35/36 (1965): 30.
6. UN Development Programme, *Skopje Resurgent*, 31.
7. Ernest Weissmann, a Croatian-born architect and assistant director in charge of the UN Housing, Building, and Planning Branch, played a key role in that endeavor. On Weissmann and Skopje, see Ines Tolić, "Ernest Weissmann's 'World City': The Reconstruction of Skopje within the Cold War Context," *Southeastern Europe* 41, no. 2 (2017): 171–99.
8. The first erected settlements were Madžari, Dračevo, Kamenik, Kozle, Butel, Vlae, Lisiče, and Železara: E. Cerjan, "Počela izgradnja novih naselja," *Vjesnik*, August 7, 1963; Ljube Pota, "Koncepcije i izrada urbanističkog plana novog Skoplja, *Komuna* 12, no. 6 (1965): 18–20; "Nova prigradska naselja u Skoplju," in Vladimir Bjelikov et al., eds., *Urbanistička ostvarenja u Jugoslaviji.* 3. kongres—12. savjetovanje, Rijeka, 1965 (Beograd: Urbanistički savez Jugoslavije—Stalna konferencija gradova Jugoslavije, 1965), 18–21.
9. UN Development Programme, *Skopje Resurgent*, 68–70.
10. Ljube Pota, "Skopje: Rekonstrukcija centralnog dijela," *Čovjek i prostor* 5, no. 74 (1958): 3, 8.
11. Fedor Wenzler, "Neće ostati grad – ruševina," *Čovjek i prostor* 10, no. 126 (1963): 1, 6.
12. Donated houses were given free of charge to those who were left without anything (V. Bizjak, "Stanove će raspodjeljivati privredne organizacije," *Vjesnik*, August 27, 1963).
13. An expert commission of leading Serbian, Croatian, and Slovenian experts was involved along with UN experts Maurice Rotival and Aleksandar Nikolaevich Rimsha and the Japanese Government Earthquake Engineering Mission (UN Development Programme, *Skopje Resurgent*, 73–74).
14. The funds were sourced from contributions, investment funds, donations from social and political organizations, reserves from the individual republics, and national and international loans (Predlog Zakona o Fondu za obnovu i izgradnju Skopja, AJ-130, f. 755, Savezno izvršno veće, Archive of Yugoslavia, Belgrade).
15. They were also responsible for reconstruction of damaged houses.
16. The journal *Vaša pomoć Skopju* (*Your Aid to Skopje*) periodically released details of volunteers, experts, and donations.
17. Midhat Aganović et al., eds., *Prizemna montažna stambena izgradnja* (Beograd: Stalna konferencija gradova Jugoslavije, 1965), 52.

18. Single-family house settlements were mostly constructed in smaller towns or on the outskirts of bigger cities. The row family houses were considered as an acceptable option.
19. "Stambena zajednica. Zaključci VII. savjetovanja Saveza urbanista Jugoslavije," *Čovjek i prostor* 5, no. 78 (1958): 1 and 5; Zdenko Kolacio, "Stambena zajednica kao predmet prostornog planiranja," *Čovjek i prostor* 10, no. 119 (1963): 9.
20. Lea Horvat, "Kriza na papiru? O sociološkoj kritici kolektivnog stanovanja u kasnom socijalizmu," *Život umjetnosti* 53, no. 107 (2020): 80–93.
21. Izveštaj o posledicama zemljotresa u Skopju i preuzetim merama za njihovo ublažavanje, August 31, 1963, AJ-526, f. 2, Fond za obnovu i izgradnju Skopja, Archive of Yugoslavia, Belgrade.
22. Soko (Mostar) was the only producer of metal houses: "Milijun m$^2$ montažnih zgrada."
23. Import costs were covered by 25 million dollars obtained through donations from abroad and foreign loans: "Milijun m$^2$ montažnih zgrada"; "Odluka o uvozu građevinskih mašina i montažnih kuća," *Vjesnik*, September 13, 1963.
24. The production of prefabricated wooden houses made of fiber boards was also provided by the plan. See Redakcija, "Graditeljstvo u petogodišnjem planu," *Arhitektura* 1, no. 1/2 (1947): 5.
25. Experiments were carried out with single-family houses and smaller apartment buildings, panel and skeletal construction systems, and different materials: concrete, wood, and metal. See Igor Blumenau, "Opitni objekti Građ. instituta Ministarstva građevina NRS," *Naše građevinarstvo* 3, 8 (1949): 607–13; Ervin Henigsfeld, "Izgradnja prvih opitnih montažnih kuća u Zagrebu," *Naše građevinarstvo* 4, 8 (1950): 396–408.
26. Rajko Rajić, "Građevinska industrija i građevinarstvo pred novim zadacima u stanbenoj izgradnji," *Komuna* 7, no. 1 (1960): 11.
27. Jugomont erected fourteen multistory apartment buildings in Skopje. On mass-housing prefabrication in Yugoslavia, see *Arhitektura-urbanizam* 6, no. 35/36 (1965).
28. The start-up planned in 1948 was delayed to 1950. After the split of Yugoslavia with the Soviet Union, Czechoslovakian experts hired to assemble the factory machines canceled their services. See "Puštena je u pogon tvornica montažnih kuća u Zavidovićima," *Krivaja* 2, no. 20 (1950): 1.
29. I. I., "Konferencija po pitanju montažnih kuća i konstrukcija u Građevinskom institutu Ministarstva građevina FNRJ," *Naše građevinarstvo* 2, no. 12 (1948): 908–909.
30. Mate Baylon, "O izgradnji montažnih zgrada sa konkretnim primjerom jednog finskog načina izgradnje," *Naše građevinarstvo* 2, no. 9 (1948): 555–63.
31. V. Zrnc, "Smještaj turističkih masa," *Čovjek i prostor* 4, no. 64 (1957): 1, 3.
32. Zagreb-based magazine *Globus* published a series of articles in late 1961.

33. The heat insulation was placed between the inner and outer cladding layers.
34. The federal competition was launched in 1947 and Bosnia and Herzegovina, Croatia, Montenegro, and Serbia opened their competitions in 1952. The results of the latter were published in *Arhitektura*: *Pregled osnova stanova za 1948* (Beograd: Ministarstvo građevina FNRJ, 1948).
35. Andreas Vogler, *A House as a Product* (Amsterdam: IOS Press BV, 2015).
36. C. Douglas, E. Whittaker, R. Fitzmaurice, "Izveštaj Misije Ujedinjenih nacija u Skoplju u vezi sa hitnim programom smeštaja stanovništva pre početak jake zime," Novembar 1963, AJ-496, f. 138, Savez inženjera i tehničara Jugoslavije, Archive of Yugoslavia, Belgrade.
37. Milica Janković, "Tipovi montažnih stambenih zgrada u prigradskim naseljima Skoplja," *Komuna* 11, no. 10 (1964): 34.
38. *Your Aid to Skopje* periodically released details of prefabs that were not listed by size, type of construction, or materials.
39. Yugoslavia was provided with technical aid from the United States, the United Kingdom, Italy, and Switzerland since 1952. The United Kingdom and the United States canceled it in 1961 and 1962, respectively. In the late 1950s a fruitful exchange was achieved with Eastern Bloc countries. See "Savezni zavod za međunarodnu tehničku saradnju, Učešće Jugoslavije u međunarodnoj tehničkoj saradnji," January 20, 1968, AJ-130, f. 607, Savezno izvršno veće, Archive of Yugoslavia, Belgrade.
40. "ČSSR šalje 280 kompletno opremljenih montažnih kuća," *Vjesnik*, August 16, 1963.
41. Milica Janković, "Nova prigradska naselja u Skoplju," *Arhitektura-urbanizam* 5, no. 28 (1964): 36–41.
42. Z. Židovec, "Edvard Kardelj u posjetu Skoplju," *Vjesnik*, September 28, 1963.
43. Tredicesima Triennale di Milano – 1964 – Tempo libero, https://archivi.triennale.org/archive/archivi-triennale/13; Rudolf Schilling, "Fertighaus 63," *Schweizerische Bauzeitung* 81, no. 36 (1963): 638–39.
44. "Na Koblerovu trgu otvorena izložba montažnih zgrada," *Novi list*, November 3, 1962.
45. D. Pecovski and G. Angjušev, "Fabrika montažnih stanova u Skopju," *Arhitektura-urbanizam* 6, no. 35/36 (1965): 33–35.
46. The Yugoslav Federal Secretariat for External Trade issued a decree on imports. The procurement plan was made by the Federal Secretariat for Foreign Trade. See Savezno izvršno veće, October 12, 1963, AJ-130, f. 755, Savezno izvršno veće, Archive of Yugoslavia, Belgrade.
47. UN Development Programme, *Skopje Resurgent*, 93.
48. Gradsko sobranje za grad Skopje, Preglog. Program za obnovu i izgradnju Skopja za period 1963–1968, 1964, AJ-526, f. 2, Fond za obnovu i izgradnju Skopja, Archive of Yugoslavia, Belgrade.

49. Edvard Kardelj, “Stvoriti ekonomske uvjete za razvoj suvremenog stambenog građevinarstva,” *Vjesnik*, October 26, 1963.
50. Branislav Stamenković, “Proizvodnja i plasman montažnih drvenih kuća,” *Komuna* 11, no. 12 (1964): 28.
51. Vladimir Robotić, “Montažne stambene zgrade – ‘Spačva,’” *Čovjek i prostor* 12, no. 143 (1965), 7–8.
52. “Montažna izgradnja. “Građevinar” – Ivanić-Grad: montažni objekti od siporeksa,” *Čovjek i prostor* 14, no. 166 (1967): 5–7.
53. The only article on prefabs in the domestic architectural journal was published in a themed edition *Arhitektura-urbanizam* (Architecture-Urbanism) on the occasion of the anniversary of the earthquake in 1964. In the same year Chambers of Commerce of Belgrade and Serbia organized an exhibition on the settlements Kozle and Dračevo in Belgrade, and the Yugoslav Union of Engineers and Technicians organized its congress in Skopje. See M. Janićijević, “Izložba o obnovi i izgradnji Skoplja,” *Komuna* 11, no. 2 (1964): 35; Milan Jančiković, “S velikih gradilišta u Makedoniji,” *Građevinar* 16, no. 12 (1964): 432–436.
54. Miloš Verk, Alenka Bajec, and Marko Deu, “Prvo stambeno naselje montažnih zgrada u Ljubljani,” *Komuna* 12, no. 3 (1965): 30–31.
55. Martina Malešič, “Murgle Settlement,” in Maroje Mrduljaš and Vladimir Kulić, eds., *Unfinished Modernisations: Between Utopia and Pragmatism* (Zagreb: Udruženje hrvatskih arhitekata, 2002), 336–47.
56. This type of construction was already indicated as a problem at the federal gathering of architects in Sarajevo in 1952. See “Zaključci savjetovanja delegata društava arhitekata Jugoslavije održanog dne 6.-8. studenoga u Sarajevu,” *Arhitektura* 6, no. 5 (1952): 51–53.
57. Aganović et al., eds., *Prizemna montažna stambena izgradnja*, 4.
58. Verk et al., “Prvo stambeno naselje,” 31.
59. “Savetovanje o prizemnoj montažnoj izgradnji,” *Komuna* 12, no. 10 (1965): 41.
60. Međunarodni konsultativni odbor za obnovu Skoplja, Nalazi i preporuke, July 18–23, 1964, AJ-526, f. 2, Fond za obnovu i izgradnju Skopja, Archive of Yugoslavia, Belgrade.

PART 2

# Conventional and Experimental in New Neighborhoods

CHAPTER 5

# Another Slab, Sheet, and Brick in the Wall

## The Surge of Prefabrication in Israeli Housing, 1960–1980

*Inbal Ben-Asher Gitler and Yael Allweil*

### Introduction

In 1977, Ram Karmi, chief architect of the Ministry of Housing at a time of profound transformations from a state-sponsored housing program to privatized housing, aired his thoughts on prefabrication in the third volume of *Israel Builds*–the Israeli Ministry of Housing almanac. He lamented industrialization and repetitiveness, which he nonetheless considered indispensable when it comes to housing as a large-scale built environment. Karmi's position on this issue reflects the inherent tension between producing large numbers of technologically progressive welfare-state housing units and affording rich materiality and diversity of form. Karmi perceived the latter as the expression of architectural creativity and as vital for habitability. In fact, this position reflects a vexing question within the ministry and the architectural profession: whether the demands of mass housing, which require industrialization and repetition, constitute architecture at all.

Considering these tensions, in this chapter we discuss prefabrication as Israeli national policy and the associated design approaches and aesthetics of mass housing that evolved during the 1960s and 1970s. Further, we interrogate the links between prefabricated mass housing, nation-building ideologies, and sociopolitical changes and explore the impact of prefabrication on architectural design.

Israeli housing has been researched as a building type both through an architectural and a socioeconomic lens.[1] However, the role of prefabrication in the formation of this building type has remained somewhat on the margins of contemporary scholarly debate, as the present volume demonstrates in regard to numerous other locales. Hence, in the present chapter, we consider the importance of prefabrication for housing and, consequently, for Israeli architecture culture.

To analyze and discuss prefabrication, we first discuss the sociopolitical conditions that brought about the development of a national prefabrication policy. Through a survey of historic documents and publications, we show that between 1960 and 1980, the Ministry of Housing dramatically changed its prefabrication policies to meet the demand for mass housing. These processes are also understood as part of the transition between welfare-state modernism and late capitalist postmodernism. To demonstrate how these developments impacted design, we look at two case studies from the 1960s and 1970s: the Kiron Estate in Kiryat Ono and Ramot Polin in Jerusalem, which reflect two distinct positions regarding the potentialities of prefabrication for engendering high-quality architecture in mass housing. Despite the significance of these two developments to the subject at hand, little research has been conducted on them to date.[2] The present study suggests that the use of prefabrication technologies in their construction and design contributed to the provision of more than basic dwellings. We argue that prefabrication allowed for housing of outstanding quality and experimental design provided to residents from increasingly diverse socioeconomic backgrounds. Concurrently, prefabrication was an attempt to transform dwelling cultures and traditions through novel design ideas. We further demonstrate that prefabrication in Israel in the 1960 and 1970s had a significance beyond efficiency, speed, and economic viability. That significance is related to abstract concepts, such as good design and the essence of modernity and experimentation, but relies on architectural writing during that period.

As this research shows, such values were upheld by diverse communities in Israeli society as well as by the Ministry of Housing. Moreover, prefabrication had a part in assigning real estate value to the rising sector of middle-class urban developments: it reflected construction quality, technological amenities such as heating and air conditioning, the use of new materials such as aluminum, and more. Thus, prefabrication was instrumental in answering and interpreting the residential aspirations and consumption desires of the young, mostly immigrant Israeli society.[3]

## Israeli Architecture Culture and Prefabrication—An Overview

Exploring early housing across Zionist settlements in the 1910s and 1920s, we find quite a puzzling phenomenon of architecture culture: meager, basic, housing, all designed by professional architects with European education and proven expertise in modern design. The archives reveal extensive, long, often heated discussions on design devoted to these basic structures, where, for example, Richard Kauffmann and Leopold Krakauer proposed competing plans for the housing and settlement structure of small communities such as the Beit-Alpha Kibbutz commune.[4] These seemingly meager designs later developed to include more extensive and advanced urban multiresident housing, which became the model for urban and rural settlement icons of the Zionist movement, including Tel Aviv's Hebrew City urbanism and the Kibbutz settlement typology. Such prefabrication techniques as the use of concrete, reinforced concrete, and industrialized brick technologies had been elements in Zionist architecture since the interwar period.[5] Prefabrication was widely used in both urban and rural settlements, indicating an acknowledgment of its advantages not only by policymakers but also by architects and the dwellers themselves.

Israel's postindependence built environment served as a civic vehicle for consolidating the nation-state based on the principles set in the pre-state period. Israeli architects focused chiefly on mass housing and new towns rather than institutional buildings, a situation that created an architecture culture largely premised on housing as a key mechanism for sovereignty and nation building.[6] The pressing sociopolitical needs and economic constraints of mass housing at the pace and scale required by the vast post–World War II Jewish immigration from all over the world led to a national policy of mass housing known as the Sharon Plan.[7] The establishment of Jewish settlements in all areas of the country, which was designed to increase the Jewish presence in unpopulated regions, as well as in places conquered by Israel and towns and villages from which Palestinians were expelled, also demanded mass housing. Prefabrication and building techniques for cheap and rapid construction in the face of a shortage of skilled labor were researched extensively by the Ministry of Housing.[8] Multiple, unprecedented numbers of temporary and permanent housing schemes executed in Israel during this period are discussed in the literature as exemplary cases of welfare-state nation building projects.[9] Moreover, housing architecture during Israel's first three-and-a-half decades was innovative and experimental in character, and as such was widely circulated among the international professional community.[10]

The projects intended for housing new immigrants can be roughly divided into two stages, or "waves." In the first wave, which can generally be dated to Israel's first decade (1948–1958), neighborhoods were designed with a rather uniform planning approach that reflected architectural modernism and the postwar international style, which produced the Israeli iteration of Brutalist mass housing—the Shikun.[11] These buildings and neighborhoods were constructed using efficient and inexpensive building technologies in a very short period of time, with no sensitivity to immigrants' backgrounds or their former habitation values.[12] Uniformity, efficiency, speed, and economic viability characterized the welfare-state's mission to provide housing under the emergency conditions of mass immigration.

The second wave of public mass housing began in the early 1960s and received further impetus following the Israeli annexation of Jerusalem in 1967 and the mass Soviet immigration in 1971–1973.[13] Housing during this period reflected a reassessment of planning approaches as a consequence of the social, structural, and climatic problems that arose with earlier schemes.[14] These later developments can be framed within global criticisms of mass repetitive housing blocks designed for diverse publics and locations, which had been erected in Israel during the emergency conditions of the first wave.[15] An architecture criticized for its disregard of cultural and climatic attributes and the dwellers' cultural and socioeconomic needs, it has been accused of creating alienating built environments serving governments rather than publics, in what Herbert Marcuse has notably defined as "the myth of the benevolent state."[16] Prefabrication served as a major instrument in addressing these criticisms and had a central role in incorporating new ideas in International Modernism, especially New Brutalism.

## The Production of Knowledge and Government Policies Promoting Prefabricated Housing

Historical analyses of Israeli theory and practice reveal that from the 1960s on, prefabrication was assigned an ever more significant role, becoming a key aspect of housing architecture.[17] The Ministry of Housing devised new development policies, circulated knowledge of prefabrication and its advantages, and tested relevant technologies and methods of work. Apart from their importance in providing housing for the masses, prefabrication technologies now went far toward compensating for a shortage of construction workers.[18]

The 1960s and in particular the 1970s saw government policies put in place to encourage prefabrication as a solution to housing demand and workforce deficiencies. These developments were documented and described by Amiram Harlap, who served as a senior architect in the Ministry of Housing Planning and Engineering Division during the 1970s and edited several of the *Israel Builds* almanacs cited above. While originally intended to be published annually, owing to budgetary constraints only five yearbooks were published—in 1959, 1963, 1973, 1977, and 1988—but these nonetheless constituted a clear manifestation of nation-building. They were intended, as Harlap explained, to "introduce to the public, as well as to professionals in the fields of architecture, engineering and construction, the story of the Ministry of Housing's activities […] and present a wide array of subjects […] [including] technological development and industrialization of construction."[19] In general, there was a surge in research and publication on architectural prefabrication throughout this period. Alongside *Israel Builds*, extensive publications on the subject were produced by engineer Asher Allweil, an expert on building technologies, who served in various positions at the Ministry of Housing throughout the state's first four decades and was the ministry's deputy director in the 1960s. Allweil also established the Israeli Building Center, discussed below.[20] The *Israeli Building Center Quarterly* was published from 1970 to 1981, and between 1968 and 1971 the Ministry of Housing commissioned the Technion Building Research Station to certify new products and building technologies. Certifications were documented in thirteen volumes of records, titled "Construction Certification of New Products and Building Technologies in Israel," which evidence new technologies and prefabrication with a significant focus on housing.[21]

The knowledge produced and publicized shaped an image of the Israeli nation-state as progressive, and there were international conferences and cooperation in the field. Within these frameworks, prefabrication processes were photographically documented and events were highlighted in public and professional discourses.[22] For example, in 1967 an Israeli-French symposium on prefabrication was held at the Technion-Israel Institute of Technology, which at the time was Israel's sole venue for academic architects' and engineers' study and accreditation programs.[23] Exhibitions acclaiming prefabrication were also held.[24]

How was prefabrication translated into official policies? This was achieved through several strategies. The Ministry of Housing began to disseminate extensive specifications, regulations, and principles to professionals, in an effort to promote modular construction and standardization. The apex of this process can be identified in 1971–1972 when a law was passed in the Israeli parliament that ensured "modular coordination in construction."[25] The law afforded improved coordination among engineers, designers, architects, and construction workers on site and simplified both planning and on-site construction. Four additional important developments in the 1970s contributed significantly to the utilization of housing prefabrication. First, a governmental unit specializing in prefabrication was established to administer and promote the field, as part of the Planning and Engineering Wing of the Ministry of Housing. Second, two committees on building technology, which included experts from Israel and abroad, were convened. Third, the Israeli Building Center was established to promote the development of new materials and construction technologies and spread knowledge concerning them.[26] Fourth, private construction companies were established, an issue we address in our discussion of prefabrication systems. All of these efforts bore fruit and in the 1973 edition of *Israel Builds*–which was devoted almost entirely to housing—it was estimated that more than a third of Israeli housing construction in which the ministry was involved was prefabricated.[27]

According to Harlap, three general prefabrication approaches or systems were used in Israel:

1. "Closed systems," where a firm produces all the major components for planned buildings itself. The closed systems had their drawbacks, as they required the establishment of large and expensive industrial plants. Moreover, the hermeneutic character of this approach presented architects and engineers with numerous and significant limitations.[28]
2. "Industrial construction," which refers to the preparation of the molds and elements required for on-site casting and its integration with conventional technologies and/or prefabrication. The industrial construction method is, by definition, intended for integration with other building methods, and the differentiation between it and the "open method," detailed below, is rather blurred. However, industrial construction provided a middle ground for producing mass housing on a smaller scale, of some 100–150 units.[29]
3. "Open systems," which integrate the first two construction strategies and make use of additional prefabricated elements, molds, and conventional technologies.[30] The open system was probably the most common, as it allowed for maximum freedom of design while retaining the advantages of prefabrication, modern technologies, and modularity.

The establishment of private construction companies, the number of which had increased significantly by the 1970s, was intended to develop these various production systems more efficiently than the centralizing policy of previous decades.[31] Architect Bitush Komforti provided an extremely instructive account of the relationship between housing architecture in Israel and the new prefabrication firms. At a time when privatization was still largely managed and delegated by the ministry, Komforti explained that the ministry planned residential building types that were modular and could be produced industrially. Thus, private firms that manufacture various prefabricated elements approached the ministry so as to design their products according to its housing requirements. He noted that this relationship was mutual, as the ministry in return attempted insofar as it was possible to incorporate the firms' products.[32]

Consequently, by the end of the 1970s, some twenty building prefabrication firms were operating in Israel,[33] including Ashtrom, M.A.B.A.T, Yuval Gad, Yavne Construction Industries, Module-Beton, Ramet, and Rimon, among others. The companies noted here were considered closed-system firms but, as we shall see, most of them produced elements for open-system integration as well; firms such as Ramet and Yavne Industries also provided the elements for industrial construction. The distribution of prefabrication among private construction companies promoted international technological cooperation to a significant degree. Several firms imported technologies, such as Modul-Beton from Denmark and Coignet or Balency from France.[34] Although industrialized materials prevailed, a company named Comis imported wooden houses from Romania, which continued the "tradition" of importing wooden prefabricated housing, as discussed in the chapter by Mia Åkerfelt, Tzafrir Fainholtz, and Anna Wilczyńska in this volume.[35]

From a socioeconomic perspective, transformations in Israeli society had a major impact on mass housing and in the early 1960s it became geared toward the middle classes, rather than focusing solely on workers and new immigrants. Thus, even more than before, prefabrication acquired such values associated with the welfare state as modernity and quality of life.[36] Thus, prefabrication became not only a practical solution for providing fast and economical housing for the masses but also the means for generating habitation values such as high-quality construction, improved planning processes, and "enhancement of the general character of the neighborhood and its surroundings."[37] From a geographical aspect, prefabrication was favored for building in remote regions or places with complex topographies.[38]

From the late 1970s, economic processes of market privatization also had a dramatic impact on housing prefabrication. The state's provision of public housing declined dramatically, and the government reformed the mortgage market to allow far more private ownership of homes.[39] Ideologically, Israeli architecture culture abruptly turned away from housing as a key typological and ideological premise toward designing urban public spaces and public buildings.[40] These processes occurred more or less simultaneously worldwide and are theorized in contemporary scholarship together with global financialization processes, which since the 1980s, have rearticulated the value of housing from a social to a market product. They also transferred responsibility for the provision of housing from the public to the private sector and the dwellers themselves.[41] Hadas Shadar argues that in Israel, the establishment of the Planning and Engineering Wing at the Ministry of Housing in 1971 was key to developing prefabrication, as it prescribed technological and engineering standards as well as building types to accelerate construction.[42]

However, prefabrication also met with resistance: construction workers often objected to it, claiming that off-site production and speediness of execution deprives them of their income.[43] Concurrently, the quality and economic justification for prefabricated technologies in housing were publicly criticized.[44] Such discussions revealed the role of housing as a designed cultural product and disclosed the negative values associated with or generated by prefabrication. The examples we discuss in the next sections serve as case studies for exploring these issues.

## Advanced Prefabrication for Sophisticated Habitation: the Kiron Estate

The Kiron Estate was designed and built between 1962 and 1965 in the rapidly developing Kiryat Ono, then an Israeli semirural "local council" with detached houses in the vicinity of Tel Aviv (fig. 5.1). The Kiron Estate was designed by architects Yisrael Lotan, Erich Bauman, and Werner Joseph Wittkower, who created 260 dwelling units in seven six-story buildings, each with single-story flats and two-story penthouses.[45] Flats and single-family houses were intended and explicitly marketed for the emerging middle class of white-collar urban workers. Flats ranged from small apartments of 53–70 m$^2$, intended for newlyweds and new immigrants with a modest income, to apartments of 80–120 m$^2$, which were very spacious for their time.[46] The latter were intended for veteran Israelis and new immigrants from North and South America and South Africa, who were often better off financially and for whom designated advertising was produced in English and Spanish.

The buildings of the Kiron Estate were arranged on a grid in a free-form fashion among open green spaces. This arrangement represented a new design concept that sought to create spaces for interactions outdoors and thus enhance social and communal values within the estate. The buildings themselves stood on pilotis and boasted streets-in-the-air; they were constructed with exposed concrete and concrete slabs with bris-soleil shading. Their layout, open outdoor spaces, design, and materials reflected the architects' inspiration from Le Corbusier, Team 10, and New Brutalism.[47] As such, the architecture of the Kiron Estate clearly evidenced the global reexamination of mass-housing architecture.

The Kiron Estate was developed and constructed by a company established specifically for this project, the Central Dan Development Company, Ltd., in partnership with the Ministry of Housing. It established a daughter company, Kiron Investments Ltd., that oversaw the development, marketing, and populating of the estate. This was the first complex in Israel developed by private entrepreneurs.[48] The construction companies were Yuval Gad and Rimon. Both were leading in the industry and were considered closed-system firms, but both provided shell elements, such as prefabricated ceilings and walls, which could be integrated with other elements in open-system construction.[49] Yuval Gad's prefabrication was based on the French Coignet patent. As explained by Ilaria Gianetti, the Coigent technology, patented in 1949, pioneered French prefabrication, focusing on weight-bearing reinforced concrete facade panels, which allowed for multistory buildings.[50] Indeed, the Kiron Estate included one of the first housing high-rises in the country—the twelve-story Havatselet Tower, constructed in 1962–1965, which included the largest apartments in the estate (fig. 5.2). Less information is available

**Fig. 5.1.** Yisrael Lotan, Erich Bauman and Werner Joseph Wittkower, Kiron Estate, Havatselet Tower, Kiryat Ono, 1962–1965. Source: Kiryat Ono Municipal Archive, photo dated 1965. https://www.pikiwiki.org.il/gallery/?s=%D7%A7%D7%99%D7%A8%D7%90%D7%95%D7%9F&method=exact&topic=8&page=2. Accessed 2/4/2023.

regarding Rimon's 1960s technologies, but they were similar to those of Yuval Gad and likewise based on French and German patents.[51]

At Kiron, prefabricated granulite panels constructed the facades and allowed for variation in design: some created oscillating patterns, while others emphasized horizontality. As in French design, there was a correlation between the size of the panels themselves and the size of the rooms.[52] Moreover, the panels—16 cm thick—featured fenestration and ventilation, and contained arteries for electricity, communication, and plumbing. Stairwells, elevator shafts, ceilings, and floors were cast in concrete on site.[53] Additional elements of exposed concrete, also cast on site, gave the estate a unique mass-produced Brutalist appearance, achieved by the shafts, stairwells, and bridges connecting the streets-in-the-air. Concrete balcony awnings and corbels enhanced this appearance. We have not found documentation regarding the choice of exposed concrete and granulite patterns for Kiron, but Israeli architecture culture scholarship provides evidence that industrial bare concrete, in its numerous aesthetic forms, represented values associated with Israeli nation-building. Concrete stood for honesty (also an important value in British New Brutalism),

**Fig. 5.2.** Yisrael Lotan, Erich Bauman and Werner Joseph Wittkower Kiron Estate, Havatselet Tower, Kiryat Ono, 1962-1965. Source: Kiryat Ono Municipal Archive, photo by Komriner, 1965. https://www.pikiwiki.org.il/gallery/?s=%D7%A7%D7%99%D7%A8%D7%90%D7%95%D7%9F&method=exact&topic=8&page=2. Accessed 2/4/2023.

roughness, and climatic adaptation.[54] Granulite was associated with local stone and bare or desert landscapes, hailed as such by several renown architects, including Ram Karmi, Arieh Sharon, and Avraham Yaski.[55] The use of granulite and exposed concrete in Israeli architecture of the early 1960s was a rather novel phenomenon but became more common in civic architecture during the early 1970s.[56] Thus, utilizing them at the Kiron Estate was groundbreaking and represented a search for locality, with prefabrication serving as an important avenue for their design.

The Kiron apartments' spacious design, their architectural details, and their amenities afforded its residents with a high standard of living, which was exceptional in Israel at the time. Kiron Investments equipped the apartments with central gas for hot water and subfloor heating. The kitchen boasted an electric waste grinder and top-drawer sinks and faucets; telephone lines, scarce at the time, were available. Aluminum window casings and glass ventilation shutters were also of a high standard for their time. The floor tiling was a quality terrazzo—prefabricated especially for the estate. Flexibility in the apartments' interior arrangement was provided by mobile partition walls and glass

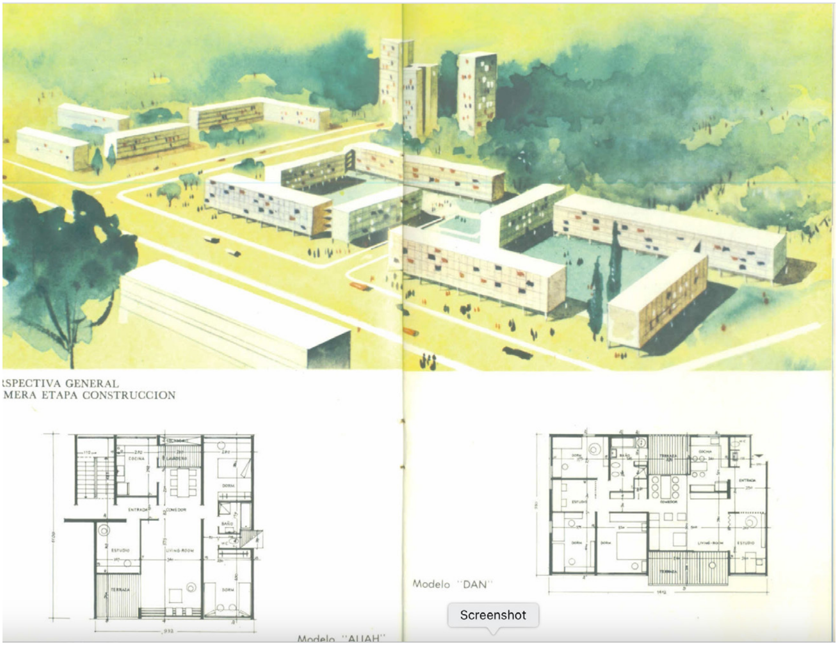


**Fig. 5.3.** Kiron Estate Marketing Brochure. Source: Yisrael Lotan Archive, National Library of Israel.

windows that could be (permanently) moved further out toward the living room balcony.[57]

As noted, the estate catered to middle-class new immigrants from the North and South Americas, and South Africa, among others.[58] To attract those potential residents, the project was marketed abroad in colorful brochures (fig. 5.3).[59] Indeed, immigrants from those continents and countries populated the complex.[60] Thus, in the Kiron Estate, mass production and systemization provided the technological and formal qualities that created modern living for the middle class—far removed from the necessary minimum of earlier immigrant housing in Israel. In designing for the flexible use of space, the architects identified interior modularity as an important modern element as well, which was enabled by prefabrication. It allowed for a new level of freedom for residents in shaping their dwelling according to their changing needs. Huyn-Tae Jung argues that postwar modern "flexible space" was indeed intended for those purposes and geared toward mass housing for the middle class. He identifies the roots of flexible space in the 1940s in United States and demonstrates that it was a crucial consequence of mechanization and systemization, rather than "merely" a result of the search for new architectural forms.[61] In Kiron, an estate also conceived with Northern and Southern American immigrants in mind, it is not unreasonable to assume that an awareness of what was considered modern in America was considered and integrated in the apartments. Thus, prefabrication engendered middle-class values of a modern, technologically advanced quality of life. In the wake of the groundbreaking example of Kiron, implementation of prefabrication using modular concrete components continued to be a central feature of architectural design, including radical experimentation in form and structure, as we show in the next section with the case of Ramot Polin.

## Prefabrication in Experimental Form and Structure: Ramot Polin, Jerusalem

Ramot Polin is a large housing estate consisting of 720 dwelling units in the Ramot area of Jerusalem (figs. 5.4–5.6). Designed by Zvi Hecker, it was part of the Judaization enterprise of Jerusalem post-1967. Intended mostly for Ultra-Orthodox Jews, it is considered an iconic exemplar of prefabricated mass housing, but this estate has not as yet been the subject of much architectural history research.[62]

In its unusual structuring and layout, as well as in its addressing of cultural and religious values, Hecker's design for the estate involved rethinking the spaces and morphology of housing units. From the aspect of prefabrication, this project can be counted among the Israeli Ministry of Housing's attempts to meet the well-known challenges of modernist repetitive apartment blocks by enlisting new technologies to explore new forms for mass housing. At Ramot Polin, Hecker engaged this challenge by employing experimental beehive-like compact space packaging created from factory manufactured prefabricated elements. He proposed an organically inspired structure composed of repetitive modular dodecahedrons (three-dimensional shapes with twelve equal pentagonal faces). These were to be constructed with prefabricated pentagonal concrete slabs, which were to serve as load-bearing walls. Hecker described it as a "system of two interlocked elements: the cube and the pentagonal dodecahedron." He continued to explain that this system "results in a dense space-packing arrangement of cubes inscribed into a loose space-packing formation of dodecahedra."[63]

The innovative morphology, which would stand in contrast to the monotonous apartment blocks surrounding it, as well as the sustainable prefabrication method, convinced the government to approve this seemingly odd proposal. Construction began in 1977. A radical experiment in morphological

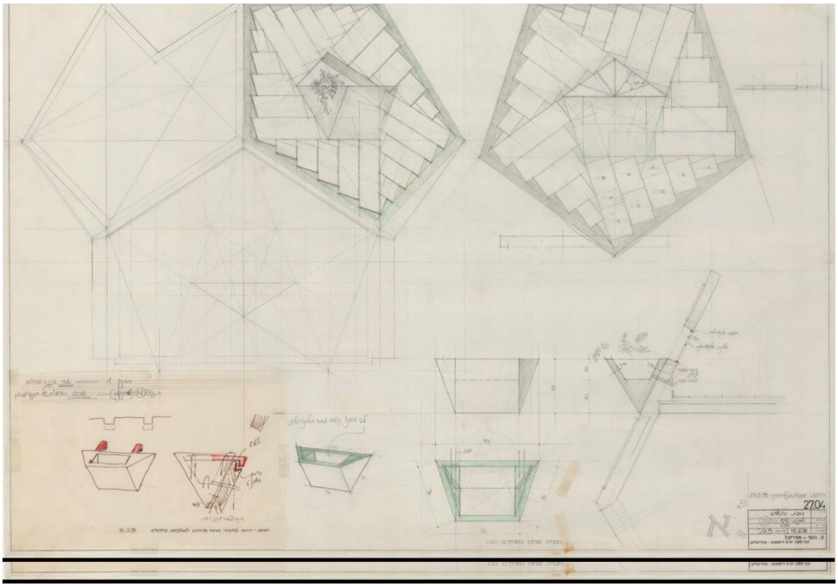

**Fig. 5.4.** Zvi Hecker, Ramot Polin, Jerusalem: Plan of stone arrangement on building slabs, 15/2/1978. Source: Zvi Hecker Archive, National Library of Israel.

architecture, the estate extended Zvi Hecker's vision from single buildings—like the Bat-Yam Municipal Hall and the temporary Achziv Club Med shacks (both designed with Eldar Sharon and Alfred Neumann)—to a large housing estate serving state planning using "pattern thinking in architecture."[64] The estate gained Hecker significant international recognition for its contribution to the international avant-garde and increased recognition of Israel as an important node of architectural creativity. The designs and complete project of Ramot Polin were published in numerous design arenas, including Domus, A+U, Leonardo, Uncube, and the 2008 Venice Biennale Israel.[65] Locally, the project's schemes, models, and drawings were exhibited at the Israel Museum in 1976 and were published extensively in *Israel Builds 1977*.[66]

Ramot Polin was built by the Ashtrom Construction Company, one of the largest in the country with a decade of experience at the time. Contracting Ashtrom for this project had two clear advantages: first, as a closed-system firm, it was able to design, manufacture, and supply the elements composing the pentagonal dodecahedrons, which did not match the standard modules promoted by the ministry in either form or architectural details. Accordingly, the construction system was "developed by Hecker and the Ashtrom Ltd. Engineers."[67] It is described in plans conserved in the Hecker Archive as a "completely prefabricated system of precast concrete elements in which loads

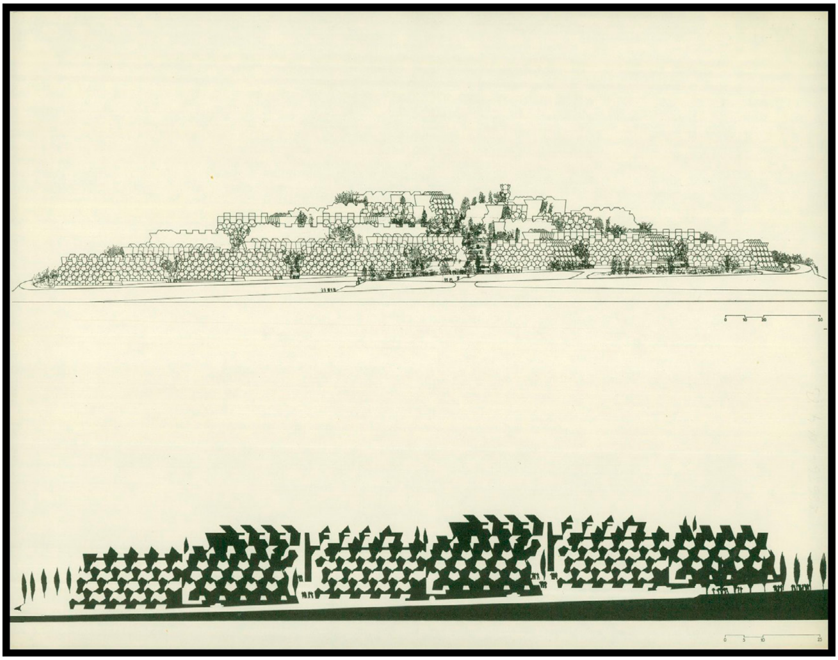

**Fig. 5.5.** Zvi Hecker, Ramot Polin, Jerusalem: General plan, N.D. Source: Zvi Hecker Archive, National Library of Israel.

are carried by load-bearing walls 14 cm thick and spaced 330 m apart."[68] Ashtrom's second advantage was its on-site plant in Jerusalem, where the firm developed the only closed-system prefabricated elements, which included stone facing, in accordance with the municipal building regulation that mandated facing all the buildings in Jerusalem with natural local stone.[69] Figure 5.4 shows the stone arrangement on the modular elements. In this respect, the specification cited above noted that "the pentagonal inclined enclosing panels are cast over a 1-inch layer of Jerusalem stone anchored in place using welding and secondary bolting."[70]

Thus, prefabrication in this project provided the necessary design rigor through close collaboration between the architect and the engineer in a highly experimental project that was unique in its geometric formulations. Ramot Polin is a telling example of avant-garde architecture harnessed by the state for public mass housing. Hecker's "pattern thinking in architecture,"[71] as a feature in modern architecture culture, was implemented by a specialized and elaborate prefabrication system. Its development was made possible by the creativity and high level of expertise of the architect, the engineers, and the contractors. The space-packing rationale of the design prescribed several tiers of

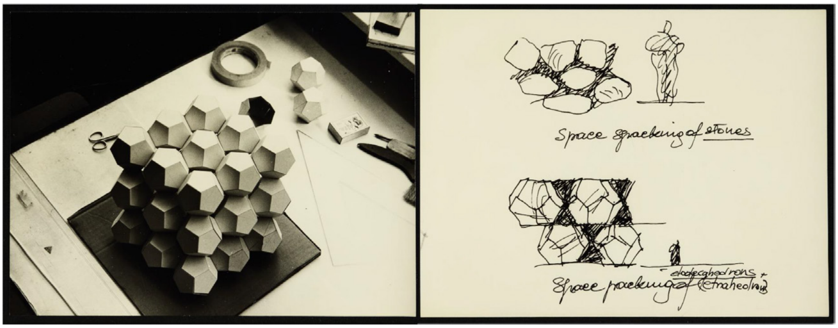


**Fig. 5.6.** Zvi Hecker, Ramot Polin, Jerusalem: Sketch of space packing and photo of dodecahedron model. Source: Zvi Hecker Archive, National Library of Israel.

module replication—starting with the general layout of the neighborhood and continuing to the apartments, the modules creating them, and the slab and sheet components of their construction, which were assembled on site. Thus, prefabrication played an aesthetic role in enabling space-packing and pattern thinking in architecture—Hecker's key design principles.

The serial and modular design of the neighborhood was also significant for Hecker in its relation to the sloping topography of the site. He exploited modularity to "mold" the descending units along the hill (fig. 5.5), thereby substantiating the above-noted claim of 1970s policymakers that prefabrication enables an improved interface with challenging topographies, such as found in Jerusalem. Moreover, locality was expressed by the volumetric and visual association of the dodecahedrons to Jerusalem's stony landscape. A sketch by Hecker shows the comparison he made between "space packing of stones" and "space packing of dodecahedrons," also shown in the model photographed alongside the sketches (fig. 5.6). Hence, Hecker viewed the volumes created from the prefabricated slabs as an interpretation of the local landscape. Prefabrication thus served this project's conceptualization as a modern habitation, while engaging locality in its topography and relationship to local stone through its architecture and by the use of local stone facing.

The fact that prefabrication was an integral part of the planning of the neighborhood from the start was also significant socioeconomically. Economically, owing to the unique polygonal architecture, Ashtrom received a budget 6 percent higher than what was usually allotted for prefabrication firms executing mass-housing projects.[72] This clearly demonstrates that the state was interested in and willing to invest in avant-garde architecture, which ostentatiously signaled progress and modernity as an integral part of its social agenda of housing for the masses.

Prefabrication also enabled several social considerations that sought to acknowledge the residents' religious practices. One telling example is the specific provision for balconies that would provide the spaces for "sukkot," the traditional temporary liturgical huts for observing the Jewish holiday of Sukkot.[73] From a broader social perspective, the replication of the modules represented the ministry's attempt to create an overall egalitarian space to be distributed among two Ultra-Orthodox Jewish communities or sects destined to populate the estate: the Warsaw group and the Polin group. The designations for the Ultra-Orthodox communities (titled in the plans according to the names of the community rabbis), can be seen in Hecker's plans. However, housing the Ultra-Orthodox in the modern prefabricated mass-housing project also implied a welfare allocation of the dwellings according to the size of the families, offering them apartments of three, four, or five rooms. This allocation in effect replaced the distribution of the estate according to sects, hierarchies, or family ties, common in these communities.[74] Thus, prefabrication played a key role in considering religious functions, as with the sukkot, but it also introduced the possibility of significant transformations in spatial practices, dwelling culture, and values.[75] It is significant that eventually the Warsaw group refused to populate the new apartments,[76] indicating this community's resistance to the top-bottom dictation, by both architect and state, of a modular, repetitive, and therefore egalitarian, spatial form.

## Conclusion

The 1977 edition of *Israel Builds* embodied the official summation of three decades of prefabrication, reasserting its use in mass-housing production as an integral part of modern architecture culture—a culture that, beyond technology, produced social values and the expression of locality in architecture. Policymakers hailed prefabrication and deemed it necessary "in order to increase building efficiency, shorten production time, improve the quality and lower cost [of building]."[77] The goals of improving efficiency, ensuring quality, and lowering costs were significant in harnessing prefabrication for the new values of the second wave of mass housing. They were goals that the Ministry of Housing was striving for, as were the diverse Jewish sectors in Israeli society: acclimating immigrants, secular and orthodox communities, and veterans. However, the additional values engendered by prefabrication represented a departure from the state's and the inhabitants' first wave basic emergency needs and earlier nation-building ideals. The 1960s and 1970s saw the replacement of the "necessary minimum" with a "sought after maximum," which included such aspects as variety in the size of dwellings, flexibility in design, spaciousness, climate control, and improved amenities. Moreover, design quality placed significantly more value on the articulation of outdoor spaces, as in the Kiron Estate, as well as on local topography, as in Ramot Polin. Such relationships, as well as materials, also articulated the search for locality. In Kiron, concrete and granulite were used, representing one of the earliest examples of these materials' role in forming Israeli architecture culture; in Ramot Polin, Hecker related architecture to the nature and shape of the local stone and the topography.

Chief architect Karmi's article, cited at the outset of this chapter, summarized these qualities and values of habitats afforded by prefabrication, which articulated the search for architectural innovation and creative expression in the service of producing good habitats in cities and neighborhoods of mass housing.[78] This expression underscores the fact that prefabrication in Israeli housing was conceived as more than the sum of its components and its immediate practical advantages. Finally, the lower cost afforded by prefabrication was important for the state, which continued to oversee planning. Moreover, the prefabrication industry was becoming increasingly significant for privatization of the real estate market. Thus, prefabrication was crucial to processes that transformed housing from a social to a market product, in which framework affordable apartments became a form of investment for the rising Israeli middle class, as reflected in the case of Kiron. In Ramot Polin, prefabrication was an integral aspect of modularity as a means of providing quality housing while attempting to identify and meet the needs of specific communities—in this case, Jerusalem's Ultra-Orthodox Jews.

Finally, the integration of closed and open prefabrication systems developed to manufacture sheets, slabs, and other components for the modular apartment buildings embodied more than efficiency, speed, and economy: it articulated experimentality and innovation in both the industrial process and in design. Moreover, as these projects demonstrate, throughout the 1960s and 1970s leading architects continued to perceive the design of mass housing as central to their engagement in the national homeland enterprise and in exploring novel forms, volumes, and technologies. In the large-scale and ubiquitous enterprise of housing, prefabrication thus emerged as a design concept that enabled outstanding, experimental, and unconventional design. In this respect, Kiron and Ramot Polin were among the last neighborhoods planned by the leading figures of Israeli architecture (including Karmi's brief role as chief architect of the Ministry of Housing). During the 1980s, welfare-state modernism was replaced by late capitalist postmodernism. Housing—prefabricated or other—was no longer central either to the state enterprise or to architectural design. It is noteworthy that both Kiron and Ramot Polin have proved successful over time, which indicates that experimentation and prefabrication, despite the criticism to which they are subject, are valued and have created spaces of habitation esteemed by their residents and communities.

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CHAPTER 6

# Massive Blocks for Soviet Mass Housing

## Standardization and Prefabrication in the Soviet Union

*Angelo Bertolazzi*

### Introduction

The events connected to the Competition for the Palace of the Soviets (1931–1936) as well as the setting up of the Moscow Academy of Architecture (1933) and the Soviet decree of the People's Commissioners concerning "the improvement of housing standards" (1934) have long been regarded as marking a watershed in Soviet architecture. They ushered in a new appraisal of nineteenth-century Russian classicism, revamped by the trends fostered by Socialist Realism, and openly avoided any link with the 1920s avant-garde experiences.[1]

However, the analysis of the evolution of construction techniques and the materials utilized suggests deep ties between the experience gained during the First Five-Year Plan (1927–1932)—notably concerning standardization and industrialization in building—and the later developments in building during the Second (1933–1937) and Third Five-Year Plan (1938–1942) in regard to mass housing. This technological trend was enhanced after World War II when the Soviets attempted to tackle the reconstruction of the country with the Fourth Five-Year Plan (1946–1951). As they belong to the Stalin era, these developments are often ignored by the architectural researchers. The Stalin era was a dramatic and complex period in Russia—always referred to "Totalitarianism"—and it was also interesting and important from the perspective of developing industrialization.

A principal feature of all these various building efforts was the turn to concrete blocks for the construction of multistory houses, which were regarded as the practical means for reaching the number of housing units targeted by the plan in accord with the new 1935–1940 classical trend. In the Soviet Union, the development of such techniques enabled the country to reach the goal of the revolution, that is, to ensure that each family would have a dwelling, in a context in which industrialization in housing was tightly linked to


**Fig. 6.1.** Large block construction: the Elsinovsky's manual (left) and a view of Kvartal no. 21 in construction (right) in Leningrad [Elsinovsky, 1955]. Source: Vladimir Elsinovsky. *Construction of Houses from Large Blocks: Design, Production and Installation* (Строительство домов из крупных блоков. Конструкции, производство и монтаж). Moscow, Leningrad: Gosudarstvennoye izdatel'stvo Literatury, Stroitel'stva i Arkhitektury, 1953, Cover and page 15.

"productivism." This was meant to be the instrument for changing reality toward progress and streamlining that reality into achieving social aims, that is, creating a new world in which all the needs of a man freed by the revolution and master of the means and of the aims of his work might be met. Thus, there was a strict consequential relationship between production and work, in which providing mass housing for workers became part of the productive effort.[2]

The present research was designed to survey the main features of massive-block construction (крупноблочное строительтсво), focusing on the components that made it essential in the later developments in mass housing in the 1960s, which were strictly linked to Khruschev's policies. The evolution of the relevant techniques has been traced back through its main stages and the most meaningful buildings in a more-or-less thirty-year-long development that finally led to a turn to heavy prefabrication (i.e., to large two-dimensional panels). This factor has not been sufficiently considered, even in the face of the ideology that characterized the policies of de-Stalinization of the Soviet Union from 1954 on.[3]

Following an introduction of the context that called for the use of standardized concrete blocks, I discuss the conclusions that were reached by the technically oriented officials in Moscow, Leningrad, and Kiev. It was in those cities that the typological models and the constructive systems that were later adapted to the materials and production features of the various republics in the Soviet Union were first devised. In particular, I focus on how the framework of massive concrete block construction led to the concepts of "productive series" and "standardization," which turned into the staples of mass housing from the late 1950s on.

The manuals and technical and architectural reviews from those times were the primary sources for my survey (fig. 6.1). They not only provided technical information, but their pages also voiced a scathing debate in the context of the very strong links between politics and architecture that even impacted such technical issues as industrialization and prefabrication. At the same time, these sources allowed me to focus on the main features and complexities of the technological framework of Soviet mass housing, which would have been far less in evidence through a survey of archive documents.

## First Steps: Experiences with Large Concrete Blocks and Industrialization

The development and utilization of large standardized concrete blocks is tightly aligned with the Soviet Union's forced industrialization, which got under way during the First Five-Year Plan, as a process that was in accord with the plan's heavy ideological conditioning. The start of the Electrification Plan (Goelro) and the development of heavy industry (i.e., iron, steel, and mechanical enterprises) led to the rapid growth of urban centers (mainly Moscow and Leningrad but even smaller ones, such as Khar'kov, Ivanovo, and Nižnij Novgorod), which entailed a growing demand for new dwellings, owing to the Soviet Union's massive industrial, social, and demographic development during the first three Five-Year Plans. According to the sources, the years between 1928 and 1937 saw iron, steel, and metallurgic production increase by 690 percent and light industry by 390 percent. This resulted in the urban population increasing at an average annual rate of 260 percent between 1927 and 1939, and it reached 518 percent in the late 1930s.[4]

Several research institutes and public-owned partnerships—Standartdom y Standart, Tsentrozhil'soyuz, Standartgorproekt, and Soûzstandartžilstroj—were created within the State Planning Committee to deal with the housing emergency. These units were tasked with studying new housing typologies and introducing new materials and industrialized techniques so as to drastically cut construction times and costs. The "May Brigade" was set up within Standartgorproekt to formulate city plans for Magnitogorsk, Stalinsk, Nišnij-Tagil, and Leninakan and develop industrial solutions similar to the ones used in the Praunheim Siedlung building yard.[5] That firm's "Frankfurt standardized panel" consisted of a concrete, sand, and pumice stone gravel casting, which was poured into horizontal frameworks and pressed and smoothed manually, according to a method devised by May in 1926 and utilized by Frankfurter Hausfabrik.

This method enjoyed great success in Frankfurt as the panels could be assembled rapidly by means of metal brackets, and it paved the way for the first Russian experiments. The panels devised by the May Brigade for the Standartgorproekt company were slightly smaller—250 × 60 × 20 cm—than the German panels, which measured 300 × 110 × 20 cm, because powerful building-yard equipment was rarely available in Russia. Nevertheless, the production techniques were more or less the same, even if the pumice stone in the concrete blend was replaced with blast furnace slag.

This experience paved the way for the ever-more frequent use of both hollow and solid concrete-based elements: in Moscow the first two multistory buildings were raised by engineers G. B. Krasin and E. V. Kostyrko in 1927–1928.[6] In 1931, the Leningrad Soviet held a competition for mass housing built using industrial systems, which led to the first experimental quarter built on Krestovsky Island (1932–1934).[7] In 1929, construction of massive-block housing began in Khar'kov and Kramatorsk in SSR Ukraine, and by 1935 Ukraine topped the list of the Soviet republics with the largest number of massive block houses.[8]

In the early 1930s, concrete-block houses were built roughly either of hollow or thick small-or-medium-sized blocks. The former were utilized either as curtain walls in reinforced concrete framework structures or as wall structures, but the latter required an interior reinforcement framework.[9] The building mixture was made up mainly of concrete with clay and pumice stone or concrete with slag, in order to improve the insulation. In the pumice-stone built case, the block size was 50 ×100 cm and its depth varied between 5 and 25 cm. It had a 1:8 concrete/slag ratio and its resistance to pressure was to 53 kg/cm$^2$, which could be increased to 65 kg/cm$^2$ if sand was added, the ratios being 1 part concrete, 4 parts sand, and 12 parts slag. The weight varied between 900 and 1000 kg/m$^3$. There was some experimentation with 3-ton blocks in the early 1930s, but their use was strictly limited to the availability of suitable cranes.[10]

The first experimental buildings featured so-called black concrete—that is, lacking external finish—abutments that were often later coated in plaster for aesthetic reasons. This solution, however, proved impracticable even during the First Five-Year Plan. The difference in the properties of the wall structure itself and the plaster coating caused the external surfaces to crack and decay rapidly, all the more so with small-sized blocks. As I explain further on, the problem was solved in the mid-1930s by employing larger blocks with a factory surface finish on both sides, which eliminated the need for the plaster coating.

Though large amounts of public money were allocated for mass housing and the restoration of buildings, in 1932 the available dwellings totaled just 25 million square meters as compared to the 62 million planned.[11] The shortfall was due primarily to the productive structure, which—in spite of centralization[12]—was still dependent on the former co-operative structures and state trusts, which favored traditional techniques and materials (bricks, wood, and stone chips). Further, construction systems such as a reinforced concrete framework were proving less efficient in the Russian context. As the quantitative target laid down in the First Five-Year Plan was not reached, there were intensive new efforts toward industrialization in building and a definite turn to concrete blocks, especially owing to the new cultural horizon of the 1930s.

### Between Uniqueness and Standardization: The Moscow Experience

From the late 1920s, Moscow, as the capital of the Soviet Union, served as an experimental construction yard where the new typological solutions connected to setting up a communist society and testing industrialized technological systems could be developed.

In particular, this was significant in determining the success of socialist realism as a response to the formal and lexical disarticulation touted by the futurists and constructivists. In the field of architecture, it led to a return to monumental classicism, which was deemed to be an approach that the masses could comprehend directly. In terms of urban morphology, it resulted in conceiving the structure of the city as a unit and in choosing patterns that harmonized with the historical city. As early as in the 1931 "Report on Rebuilding the Socialist City," drawn up by Lazar M. Kaganovic, showed how Soviet cities, and Moscow in particular, were to be monumental and easily interpreted by the masses, substituting the constructivist principle of buildings being assembled with the unified whole approach.[13] A settlement pattern was formulated within the scope of the new Moscow-devised plan, which was approved in 1935 and was to become the model for all Soviet cities. Reviving nineteenth-century typologies, a monumental road network (*magistraly*) encircled architecturally highly conforming large housing blocks (*kvartaly*), showing classicist stylistic features that had been reinterpreted and given a new impact by socialist realism. The need to produce forms that could be recognized by the masses and at the same time to control the unified vision of the new socialist city as a whole was at the core of the achievement—or rather the novel achievement—of classical features in Soviet architecture from the late 1930s.

In the changed political and cultural context, massive-block mass housing was newly relevant in building development in Moscow and consequently in all of the Soviet republics. The experience within the scope of the First Five-Year Plan had clearly shown that massive blocks had a threefold role (weight-bearing, insulating, and finishing); their weight limit was set at 2.5 tons, in order not to exceed the 3-ton maximum load capacity of the cranes of those times. Utilizing massive blocks even allowed for the possibility of reproducing some classical style elements (ashlar, string course, molding), while cutting the building times and costs that the decoration and finishing plaster works required. In massive-block construction, walls were a building's main architectural and structural elements: "When planning wall composition, it was possible to choose between two options: a more 'tectonic' one, in which the cuts in the blocks revealed their structures and became expressive elements, and a more 'eye-pleasing' one, in which the cuts were hidden inside the blocks."[14]

The Moscow Block Construction Trust (Московский трест блочного строительства) played a central role in developing industrialized massive blocks that were used for most of the buildings erected in the 1930s in accord with the 1935 Moscow Plan (i.e., Bolshaya Polyanka, Kaluzhskaya ulitsa, and Ulitsa Gor'kogo). The trust's first most important contribution was in developing massive-block building for typological housing solutions, with a view toward optimizing the use of materials and making the construction process more efficient. The year 1935 saw the introduction of the M = 50 standard module to determine the length of the walls, the width of the windows and the height of the rooms. The thickness of the external walls (a multiple of the standard module at 50 cm) ensured adequate insulation for the Moscow climate and allowed for the correct calculation of angles. Further, the blocks were designed to afford a minimum resistance of at least 90 kg/cm$^2$.[15] The new module required devising a new 25-cm-thick (i.e., M/2) element for inner walls, since traditionally they were based on the brick's 26-cm-thick module.

The various elements that made up the blocks were chosen so as to yield suitable weight-bearing and thermal insulation properties. The Moscow Trust developed a mixture of Portland concrete, blast furnace slag, and gravel or ground natural stone for the finish, which allowed for different mechanical resistances—ranging from 50 to 70 or 90 kg/cm$^2$—with the same quality of insulation.

From the very beginning—owing to the problems evident in the First Five-Year Plan building yards—the joints between horizontal and vertical blocks were examined carefully: the former was sealed with oakum daubed over with concrete plaster coating and the latter with special light concrete infills. In the same way, detailed enquiries were made as to how to fit and join outer and inner walls, which was achieved by shaping the elements and coating the surfaces to be joined with insulating material, so as to obtain better thermal and acoustic insulation, as well as to make the walls rainwater-tight.

The most innovative outcome of the Moscow Trust's studies was the creation of nomenclature, that is to say an abacus of elements according to which the building could be constructed preserving a sense of specialized, rather than industrial, architectural features. This was achieved by unifying the blocks using a standard module that satisfied the requirements of both the designers and the producers of the blocks. The modularity of the facade was also utilized for the whole structure of the building: generally, each story was made up of several rows or courses, which were to measure exactly 320 cm. The Moscow building yards suggested that the best practice was to employ four courses: one for the windowsills, two for the height of the windows, and one for the lintels, which proved to be the best compromise between the need to reduce the number of elements and at the same time keep them easily movable. The number of the blocks needed to build the front walls could vary considerably—generally between eleven and sixteen, which included the blocks that made up the cornices and copings.[16]

Architectural variety (mainly chromatic) was ensured by the use of a new production cycle for the blocks, developed to replace the wet plaster finish. Cast iron molds were used in the Moscow yards supervised by the Moscow Trust; their bottoms could be removed so as to obtain finished blocks and avoid long and costly adjustments in the yards. The molds were lined with a 2-cm-thick layer of plaster and then the main 45-cm-thick layer of slag-concrete was cast, on top of which were placed a 2-cm-thick mortar slab and finally the 1- or 1.5-cm-thick outer finishing layer. The two layers of plaster were a mixture of concrete mortar and natural stone chips. The block was steam-dried; when hardened, before being set in place, its external surfaces were bush hammered either manually or mechanically; thus, the shade of the mixture caused the block to look like natural stone. The mold could be modified in order to obtain the desired finishing or wall features.[17] Among the most meaningful examples of the use of those techniques, which were enthusiastically hailed in contemporary technical reviews, are the buildings raised in Moscow in the late 1930s by the architects A. Burov and B. Blokhin, supported by the engineers Y. Karmanov and A. Kucherov.[18]

In the first two buildings, erected in Ulitsa Bolshaja Poljanka (1939–1940), the problem posed by the joints was solved by partitioning the standardized 2990 × 810 × 490 mm standardized blocks. In the first building (figs. 6.2, 6.3), characterized by a regular, renaissance-style ashlar, the blocks employed were produced using special cast iron molds. First, a 20- to 30-mm-thick white concrete and ground travertine mortar layer was poured into the mold, followed

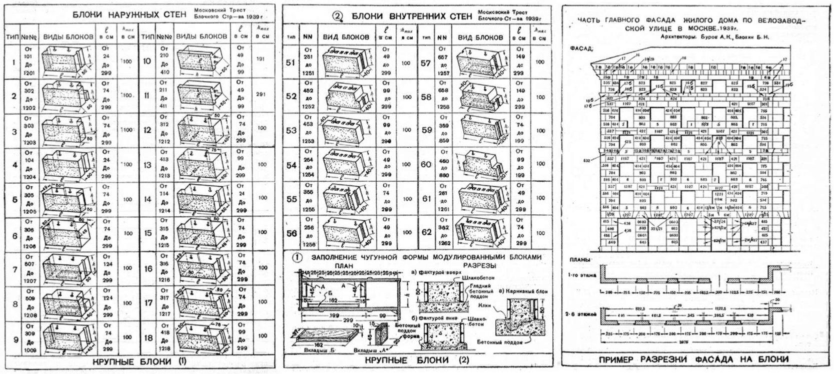


**Fig. 6.2.** Residential building in Ulitsa Bolshaja Poljanka (A. Burov, B. Blokhin, 1939): nomenclature of large blocks and facade abacus [Dyurnbaum, 1946]. Source: Naum Dyurnbaum. *Structures of Civil Buildings (Конструкции гражданских зданий)*. Moscow: Izdatel'stvo Akademii Arkhitektury SSSR, 1946, p. 280, 282.

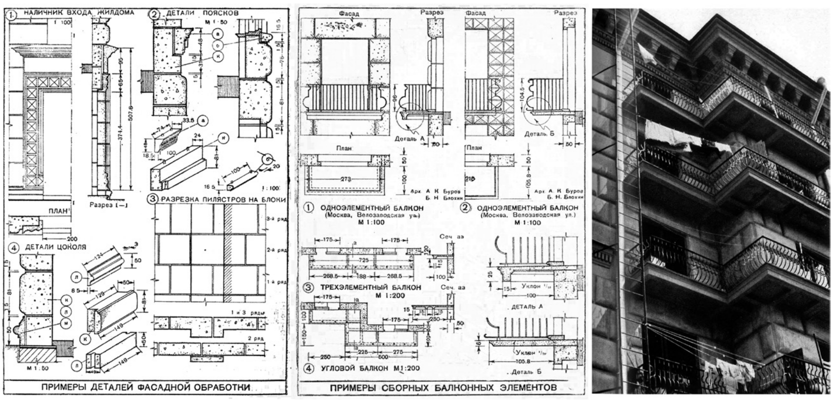


**Fig. 6.3.** Residential building in Ulitsa Bolshaja Poljanka (A. Burov, B. Blokhin, 1939): decorative details, architectural elements and a view of the finished building [Dyurnbaum, 1946]. Source: Naum Dyurnbaum, *Structures of Civil Buildings (Конструкции гражданских зданий)*. Moscow: Izdatel'stvo Akademii Arkhitektury SSSR, 1946, p. 283, 286, 287.

by two layers of slag concrete compacted by vibrators, and finally by a rectified plaster layer. In the second building, the blocks employed were about the same size, but their finishes were different: their surfaces were in fact characterized by thick diamond-shaped bossage that hid the joints. The facade blocks were produced by special metal molds into which a mixture of different kinds of Portland concrete and manganese powder was cast in order to enhance the block's chromatic impact and avoid shrinking while drying.[19] In both cases introducing color and embossing the surfaces caused the two buildings to look different, which obscured the fact that their architectural features were identical and concealed some of the defects in production.

In contrast, the building facing Leningradski Prospekt (1940–1949) is an isolated example in the Moscow of the 1940s. Even though it was made of massive prefabricated blocks, it was built using a new trilithic construction system with horizontal architraves and as-high-as-the-story blocks; the latter's massive size—1260 × 2860 × 600 mm—made them difficult to produce, so the method met with limited success and large-scale production was not feasible. The look of natural stone was achieved by using Portland concrete mixed with variously (white-cream and dark gray) tinted semiliquid mortar.[20]

Though the building was unique (which confirmed the experimental character of the main Moscow building yards), this construction system underscored the trend characterizing the evolution of Soviet prefabricated housing after World War II. Further, by reducing the number of blocks and increasing their size to the extent that they reached the height of the story or measured the width of the room, the Soviets paved the way for the use of huge reinforced concrete slabs in the 1960s.

### Prefabricated "Classicisms": From the Leningrad Building Yards to the Experiences in Kiev

The other hub of massive concrete block mass housing was in Leningrad (now Saint Petersburg). The first experiments in building industrialization in this second largest Soviet city can be traced back to the 1931 Leningrad Soviet competition centered on a residential block that was to be built using prefabricated concrete elements. The competition led to an experimental quarter being built on Krestovsky Island that highlighted massive block housing's increased production efficiency, notwithstanding the fact that the severe Russian climatic conditions took a heavy toll on building-yard work.[21] That toll was the reason for the turn to prefabricated solutions in which most of the production processes (i.e., molding, casting, drying, and finishing) could be carried out in factories, thus limiting building-yard work to assembly with the help of cranes and interior finishing. This allowed production to be assigned to large factories with fixed production lines manned by specialized workers. Moreover, assembly could be handled by just a few skilled workers with access to the needed building-yard equipment.

The importance of efficiency in the production process as a whole (project, production, assembly) came to the fore in the large building yard of the Moscovsky District, along the avenue of the same name, whose masterplan

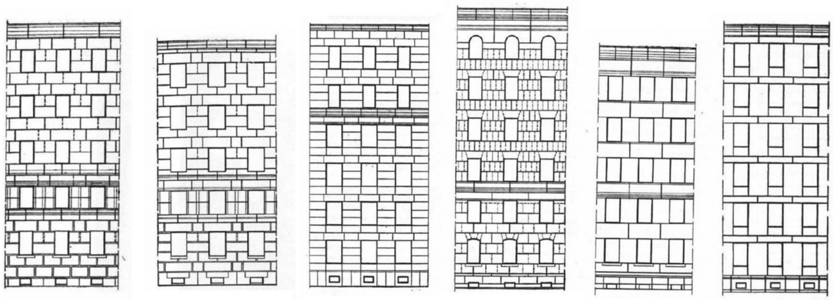

**Fig. 6.4.** Kvartal no. 21 in Leningrad (1936–55): different architectural solution used in large residential buildings [Vasiliev, 1957]. Source: Naum Dyurnbaum, *Structures of Civil Buildings (Конструкции гражданских зданий)*. Moscow: Izdatel'stvo Akademii Arkhitektury SSSR, 1946, p. 293, 294, 296.

went back to 1931, although its construction only engaged the city's assets between 1936 and 1955. In particular, Kvartal no. 21 offered the first chance to look for new solutions that would solve both the technical and architectural issues of massive-block building.[22]

Construction was based on 50-cm-thick slag-concrete blocks, weighing up to 1.5 tons, with outer surfaces that were prefinished with chipped-stone plaster. This choice, conditioned by the capacity of the cranes available in Leningrad, required four or five rows of blocks to build the facade of one story, though at the same time it encouraged the devising of more creative designs as compared with Moscow's, so that there was more variety inside the *kvartal* (fig. 6.4). It was only after the war that the availability of more powerful cranes allowed for reducing number of blocks by increasing their sizes (and weights). From 1950 on, buildings up to six floors high were constructed using single as-high-as-the-windows blocks, so that each story's surface featured three rows. Moreover, in order to allow for a range of architectural solutions, blocks were fashioned in the shape of bow-windows, loggias, and columns; molds were devised that could produce various ashlar patterns. Leningrad, unlike Moscow, avoided complete standardization of the buildings based on a module. The industrialization of the building process and the designing of standard buildings was optimized through the use of more blocks for the inner and outer walls, as the building yards found such blocks easier to produce and handle. The Leningrad experience paved the way for standardized buildings where not only was the constructive system defined but there was some choice in regard to a fair number of the typological and functional features. Owing to Khruschev's new housing policies, this approach met with great success from 1955 on.

The Leningrad massive-block construction experience furthered the 1-415 productive series, which was first developed by Lenproekt in 1955 and utilized in Moskovsky Rayon.[23] It allowed seven five-floor and two seven-floor types of blocks of flats to be built, whose functional and construction-related features were made up entirely of standardized elements. Up to eighty-eight standardized elements were allowed by nomenclature, which were to be employed in at least three different facade solutions. Since only twenty elements were defined as "special" or "allowing limited repetition," the series could be produced more easily than the earlier 1930s and 1940s models. The process of standardization and industrialization of buildings, which involved the adoption of numerous "special" elements with increasing construction times and costs, was not yet complete in the 1920s and 1930s. Moreover, the subsequent technological progress made it possible to reduce the number of "special" elements of the building series and allowed for an increase in production efficiency. The series also provided for buildings with ground floors devoted to services in Kvartal no. 44 (kindergartens, day care centers, and shops).

The series 1-415 Leningrad facade blocks measured 205 × 160 × 50 cm (window blocks), 300 × 142 × 50 cm (windowsill blocks, with a 10-cm-deep recess to house the radiators), and 300 × 53 × 50 cm (architrave blocks). Interior wall blocks measured 275 × 40 cm, their length varying depending on the depth of the building. The 50-cm thickness of the blocks was deemed suitable to ensure adequate thermal insulation and mechanical resistance in buildings as high as five to seven floors (fig. 6.5). The interior-wall blocks were provided with vertical slits to make them lighter and improve acoustic insulation, and special blocks were devised with vertical channels in which all mechanical plants and drainage systems were housed.

The blocks were produced using a concrete and blast-furnace-slag mixture; facade blocks were provided with an outer finish of mixed concrete plaster and stone or brick chips; inner blocks were coated with a damp concrete layer. The use of molds allowed for the production of several kinds of moldings and ornaments that made facades more articulate, even those of balcony components, which were later developed into complete bow-window blocks. Compared with the Moscow productions, rather than a standardization that followed models, the focus was on defining an abacus of finished elements that allowed for the construction of buildings of different heights and layouts in a way that ensured production efficiency and greater architectural variety.

Similar solutions were tested from the late 1940s on by the SSR Ukraine Academy of Architecture and the Kiev Department of Building (Kievproekt). Even in those cases, the research focused on devising a standard building made up of the fewest possible number of blocks but allowed for a range of facades.

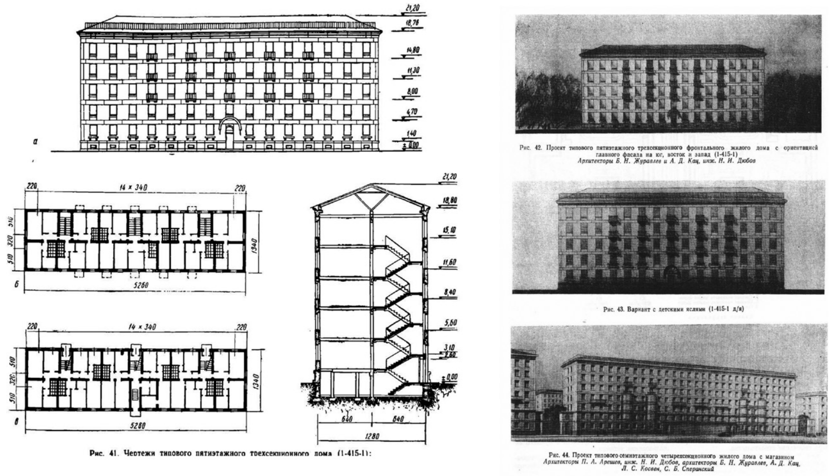


**Fig. 6.5.** Serie 1-415 (*Lenproekt*, 1955): elevation, plans and section of a complete building (left) and three view of different types obtained from 1-415 [Vasiliev, 1957]. Source: *Large-block Construction in Leningrad (Крупноблочное строительство в Ленинграде)*, edited by Boris Vasiliev, Leningrad: Stroyizdat, 1957, p. 14, 15, 16, 17, 19.

The first block of flats built in Zdanov (now Mariupol), which was constructed by the *Giprogad* Khar'kov branch, consisted of four five-story buildings in *Veselaya Ulitza*, two in seven and nine sections and two in three sections. The floorplan called for two sections according to the *Kievproject* no. 3 series, where the buildings were in a row in one and end units in the other. To make the long facades less uniform, the designers used fewer decorated elements, relying instead on the features of the blocks, on the ground floor porches housing shops, and on terraces and balconies.

Outer walls were made up of only three basic elements (window, windowsill, and architrave), which were 45 cm thick with 20-cm-wide vertical slits to reduce their weight to a maximum of 3 tons. The keying-in of the walls was improved by utilizing corner blocks; interior walls were constructed with hollow blocks measuring 270 × 120 × 40 cm and 270 × 100 × 40. Unlike the Moscow and Leningrad buildings, there were no U-shaped blocks to allow access to the various rooms and the choice was made to opt in the nomenclature for architraves to be placed on top of two partition wall panels. The blocks were connected using factory-welded 8-mm-thick iron rebars.[24]

Following this first experience (similar to the *Lenproekt* 1-415 series), *Kievproject* planned a standardized concrete massive-block building. Compared with the Zdanov buildings, nomenclature was standardized to an M = 40-cm module to harmonize with 1-TC 3 series housing patterns, which featured

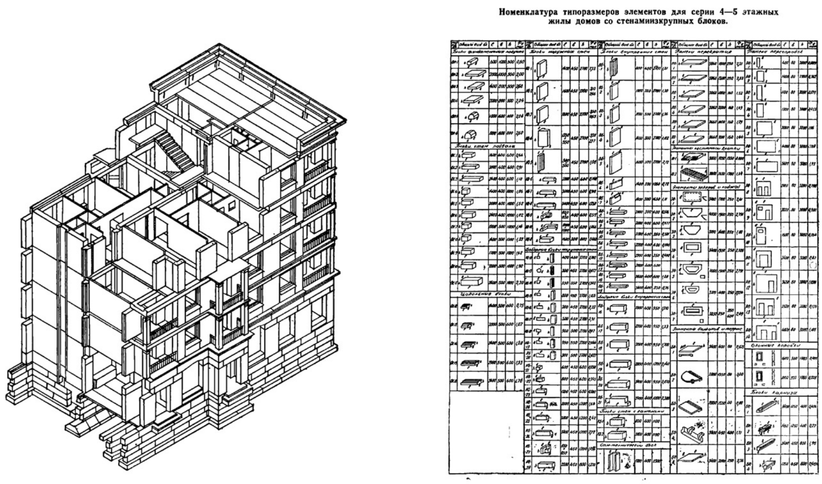


**Fig. 6.6.** Massive concrete blocks building (*Kievproekt*, 1955): constructive view of the standardized 5-storey building (left) and nomenclature of elements [Vasiliev, 1957]. Source: *Large-block Construction in Leningrad (Крупноблочное строительство в Ленинграде)*, edited by Boris Vasiliev, Leningrad: Stroyizdat, 1957, p. 30, 31.

several different layouts, mainly in regard end-unit and corner sections (fig. 6.6). Production viability and the need to reduce nomenclature items led to simplifying housing sections, which were now limited to two (i.e., row and corner buildings). Unlike the Moscow and Leningrad approaches, *Kievproekt* focused on diversifying the volumes of the facades by means of terraces, bow-windows, and balconies, thereby doing away with costly decorative features. In order to increase production efficiency, *Kievproekt* devised eight facade solutions with loggias, bow-windows, balconies, or terraces, making the most of the modularity of the 340-cm-span facades, which allowed for moving outer walls back.

Nomenclature devised one hundred nineteen elements, seventy-seven of which belonged to the structure of the building and forty-two to the finishing and extras: six foundation blocks, eleven basement-wall blocks, eleven outer vertical wall blocks, and another eleven for terraces, bow-windows, and balconies; fifteen blocks were assigned to interior walls, six to ground-floor shops, six to floors, and as many as seventeen to protruding elements. Two elements were used for staircases; three blocks were designed as shafts for piping; fourteen for non-weight-bearing partition panels; two for window boxes; four for cornices; as many as twenty-two special elements for were employed for various internal finishes.[25]

Compared to the same 1-415 series, *Kievproekt* choices led to the standardization and conformity of architectural and structural elements, highlighting the two-span housing sections, even though this would lead to a rather rigid internal layout. From an architectural point of view, choices were made to drop decorative elements and enhance the expressiveness of the materials, the interplay of the unified elements, and the volumetric visual impact of the facades. As far as both construction-related and decorative approaches are concerned, *Kievproekt*'s choices paved the way for the new approaches that were soon to become the characteristic features of Khruschev-era Soviet housing.

The Soviet central authorities decided that the solution to the housing crisis was to increase prefabrication for mass housing: the 1949 Fifth Five-Year Plan (1951–1955) explicitly introduced industrialization as the only practical means for reaching the housing targets: 80 percent of the planned construction was to be new residential homes built using prefabricated elements or other industrialized techniques. This entailed setting up a new sector of national industry devoted to producing prefabricated mass housing, which, indeed, had already been planned for in the Fourth Five-Year Plan (1946–1950). The creation of a veritable "housing industry" came decisively into being in 1951 with the setting up of the Special Office of Architecture and Construction (Специальное архитектурно-строительное бюро—САКАБ). Organized along the lines of aeronautical technical offices, it was made up of various groups of architects and engineers and test laboratories and workshops for the production of prefabricated elements. The goal was in fact to obtain complete control of the production cycle, from the planning of projects (based on the new performance targets) to producing the elements and finally to setting up the assembly yard. The creation of a central office to formulate the projects and the construction systems was the first step toward the centralization that was to be characteristic of Soviet mass housing from the mid-1950s on.

In the wake of the decree "on the rejection of excesses in architectural projects and construction" (1955) and the beginning of de-Stalinization, Nikita Khruschev's new deal set the guidelines for the Soviet mass housing program. The new procedures laid down by the USSR Council of Ministers led to both a theoretical and a practical change. On the one hand, there was a shift from "producing in order to produce" typical of the 1930s to a "scientific production," which was strictly linked to the organization of the plan as far as objects, instruments, and policies were concerned. From a technical-construction point of view, the program's main result was the increased turn to heavy prefabrication, in accordance with a "model-based" approach, chosen as the means of achieving satisfactory results in terms of yields and reduced construction costs. Buildings made up entirely of prefabricated elements accounted for 25 percent of the total in 1950, 70 percent in 1958, and 88 percent in 1965. The 129.8 million square meters built between 1951 and 1955 increased to 592.3 million between 1956 and 1965, which came to 6,052 million apartments built in 1951–1955 and 22,843 million in 1956–1965.

## Conclusions

The appraisal of what was built in the years between the Second and the Fifth Five-Year Plans was tinged—in both the Soviet Union and Western countries—by the political approach to the Stalin era, a lens that tends to highlight the disruptive features, first of all with avant-garde achievements, then with the Khruschev-sponsored 1954 new deal. It has been claimed that standardizing the style based on classicist models impoverished the architectural debate, especially compared with the 1920s. However, the monolithic features of mass housing in Moscow, Leningrad, and other major Russian cities as far away as Magnitogorsk bear evidence of technological research developed in parallel with a new approach to settlement patterns and socialist cities. The paradigms related to classicism, general layout, and architecture were advanced side by side with new construction-related typologies, so as to meet the requirements of the cultural (and political) demands as well as the quantitative targets laid down by the plans.

The major building yards of the 1930s not only fine-tuned concrete massive-block construction but also devised a new way of industrializing the planning and production process. Soviet architects and engineers approached the planning of buildings from a performance-aware point of view, in which industrialized building yards provided the synthesis of the requirements related to distribution, technology, and production. Above all, this led to the concept of productive series, which became the essential technological instrument by which to meet the plans' quantitative targets. Notwithstanding the formal and cultural limitations of Stalinist architecture, there was a fruitful debate that even allowed such limitations to be overcome, proving the intrinsic contradiction between technique and form, well before the decree "Concerning the Elimination of the Excesses in Planning and Building."[26]

## Notes

1. Anatole Kopp, *L'architecture de la période stalinienne* (Grenoble: P.U.G., 1978), 237; Jean-Louis Cohen, "La forme urbaine du 'réalisme socialiste,'" in Jean-Louis Cohen, Marco De Michelis, Manfredo Tafuri, eds., *URSS 1917–1978: La ville, l'architecture*, (Rome: Officina Edizioni, 1979), 141–200; Anna Opočinskaja, "Per una storia dell'Accademia di architettura pansovietica," in Alessandro De Magistris, ed., *U.R.S.S. anni '30-'50. Paesaggi dell'utopia staliniana* (Milan: Edizioni Gabriele Mazzotta, 1997), 63–78.
2. Marcello Petrignani, *Pianificazione ed industrializzazione edilizia nell'URSS* (Salerno: Antonio Salzano Editore, 1978), 12.

3. Natalya Solopova, *La préfabrication en URSS: Concepts techniques et dispositifs architecturaux* (Berlin: DOM, 2020), 68.
4. Nikolay Belcovich and Viktor Schavrin, *Local Economy and Local Budgets of the USSR (*Местное хозяйство и местные бюджеты СССР) (Moscow: Gosplan, 1938), 114.
5. In 1930 Ernst May moved to the Soviet Union, where he contributed to developing industrialized techniques with which he had become familiar in 1925–1930 while he was Stadtbaurat in Frankfurt and in the Römerstadt, Praunheim, Westhausen, and Höhenblick yards. Thomas Flierl, *Standardstädte: Ernst May in der Sowjetunion 1930–1933. Texte und Dokumente* (Berlin: Suhrkamp Verlag, 2012). 159.
6. Ivan Nikolaev, "Construction of the 1st Police House (Постройка 1-го дома милиции)," *Stroitelstvo Moskvy*, no. 1 (January 1929): 6; Oleg Vytke, "The Main Ways of Standard Housing Construction in 1932 (Основные пути стандартного жилстроительства в 1932 году)," *Stroitelstvo Moskvy*, no. 9 (September 1931): 15.
7. Aleksey Chayako and Kazimir Khalturin, "Large-Scale Block Construction in Leningrad (Крупноблочное строительство в Ленинграде)," *Architêktura SSSR*, no. 10 (October 1954): 22; Boris Vasiliev, ed., *Large-Block Construction in Leningrad (*Крупноблочное строительство в Ленинграде) (Leningrad: Stroyizdat, 1957), 5–6.
8. Boris Blokhin, *Architecture of Large-Block Structures* (Архитектура крупноблочных сооружений) (Moscow: Gosudarstvennoye Arkhitekturnoye Izdatel'stvo Akademii Arkhitektury SSSR, 1941), 4.
9. Vladimir Machinsky, *New Building Materials* (Новые строительные материалы), (Moscow: Gosudarstvennoye Izdatel'stvo, 1930),73.
10. Machinsky, *New Building Materials*, 80.
11. To face this housing emergency, the government allocated 39 billion roubles during the First Five-Year Plan, with a 165 percent overall increase in material production. This allowed for 25 million square meters of housing to be built, but that did not fully meet housing requirements. *Jubilee Statistical Yearbook, 1922–1982* (Юбилейный статистический ежегодник 1922–1982) (Moscow: Gosplan), 1982, 426.
12. The Stroikom commission was created within the State Planning Committee or Gosplan (Государственный комитет по планированию – Госплан) set up in 1921 to oversee the development of building industrialization. Igor A. Kazus, *Soviet Architecture in 1920s: Organization and Design* (Советская архитектура 1920-Х годов: Организация проектирования) (Moscow: Progress-Traditsiya, 2009), 80–81.
13. Lazar M. Kaganovič, *L'urbanisme soviétique: La réorganization socialiste de Moscou et des autres villes de l'U.R.S.S.* (Paris: Bureau d'Editions, 1932), 13; Elisabeth Essaïan, *Le prolétariat ne se promène pas nu. Moscou en projets* (Marseille: Éditions Parenthèses, 2021), 126.

14. Boris Blokhin, *Architecture of Large-Block Structures* (Архитектура крупноблочных сооружений) (Moscow: Gosudarstvennoye Arkhitekturnoye Izdatel'stvo Akademii Arkhitektury SSSR, 1941), 151.
15. Blokhin, *Architecture of Large-Block Structures*, 11.
16. However, in the other Soviet Republics there were several variations: for example, in Kramatorsk and Magnitogorsk, the blocks were cut into four identical courses, whereas in Nikopol and Leningrad there were as many as five courses. In contrast there were just two courses in *Dneprostroy* and three in Mariupol.
17. Mishel Crestoe, "Coloured Facades of Residential Buildings" (Цветная отделка фасадов жилых зданий), *Arhitêktura SSSR*, no. 2 (February 1938): 59; Konstantin Sokolov, "Moscow Experience in Designing Large-Block Construction" (Московский опыт проектирования крупноблочного строительства), *Stroitêl'stvo Moskvy*, no. 3/4 (March/April 1939): 18–21.
18. As head architect of the Moscow Trust of Block Construction, Boris Blokhin worked on standardizing concrete elements and producing them in factories. When working together with Andrej Burov, he underscored the need to link design, construction, and production closely rather than making the project plan fit the use of concrete blocks. Blokhin, *Architecture of Large-Block Structures*, 7.
19. Leontiy Ilyin, "Architecture of Large-Block Construction" (Архитектура крупноблочного строительства), *Stroitêl'stvo Moskvy* no. 18 (September 1940): 3; Blokhin, *Architecture of Large-Block Structures*, 7.
20. Georgiy Borisovsky, "The Architecture of New Large-Block Buildings" (Архитектура новых крупноблочных зданий), *Arhitêktura SSSR* no. 10 (May 1940): 12.
21. The competition announced in March 1931 by the local Soviet to solve the scanty supply of bricks awarded three different solutions. The first was the "LDN" system (after engineer V. A. Latynin and N. N. Nosov and architect A. V. Dmitrievsky), which utilized slag and concrete blocks produced in metal molds and reinforced with iron bars. The second was "Takhitekton" (architect I. V. Ryangin, engineer E. V. Perk), which used mobile formworks that industrialized the casting. Finally, the third, devised by engineer D. Kh. Alperovich and architects T. D. Katsenelenbogen and L. P. Petrunkin, employed 5-ton cellular concrete blocks to assemble the building. Boris Vasiliev, ed., *Large-Block Construction in Leningrad* (Крупноблочное строительство в Ленинграде) (Leningrad: Stroyizdat, 1957), 9.
22. The no. 21 quarter (*kvartal*) was planned in 1931; there at first four residential buildings (Nos. 2, 4, 17 and 19) were erected between 1931 and 1934 by assembling concrete blocks with a gantry crane. In 1936, a major factory for the production of blocks was built in the area, which allowed for the construction of several more buildings; by 1939, five buildings (Nos. 12, 13, 14, 15, and 16) were

completed after the 1934 *Lenproekt* standard plan, as well as Nos. 6 and 7 as well. Nos. 1, 21, 22, and 23 were completed after the war (1950–1951) and Nos. 8, 9, and 11 in 1953–1954. Vasilkovsky, "Architecture of Large-Block Structures, 35; Vasiliev, *Large-Block Construction in Leningrad*, 9.

23. The 1-415 standardized series was planned according to *Lenproekt* by architects B. N. Zhuravlev and A. D. Katz together with engineer N. I. Dyubov. The model featured technological, structural, functional, and even architectural choices that had been made with a view to carrying out a completely industrialized and planned production process, in fact anticipating the series introduced in 1957, which was mainly characterized by the employment of reinforced concrete two-dimensional panels. Vasiliev, *Large-Block Construction in Leningrad*, 25.
24. Dmitriy Yablonsky, Vasiliy Lelichenko, and Vladislav Tsvik, "Design of Large-Block Residential Buildings in the Ukrainian SSR" (Проектирование крупноблочных жилых домов в Украинской ССР), in Il'ya Rokhlin, ed., *Design and Construction of Buildings from Large Blocks and Panels* (Проектирование и строительство здании из крупных блоков и панелей) (Kiev: Izdatel'stvo Ukrainskoy Akademii Arkhitektury, 1955), 9.
25. Yablonsky, Lelichenko, and Tsvik, "Design of Large-Block Residential Buildings in the Ukrainian SSR," 10.
26. Decree of the Central Committee of the CPSU and the Council of Ministers of the USSR, "On the Elimination of Excesses in Design and Construction," of 04.11.1955 (Постановление ЦК КПСС и Совета Министров СССР "Об устранении перегибов в проектировании и строительстве").

CHAPTER 7

# Thamesmead

## Prefabrication between Utopia and Dystopia

*Alberto Franchini*

### Introduction

Thamesmead is a new town, built in 1967–1986 by the Greater London Council (GLC) within London's Green Belt. The ensuing discussion discloses how prefabrication had significant consequences for the design choices in the construction of Thamesmead's mass housing. Further, I explore the building techniques and the impact of this town on professionals and laymen. The text is designed to reappraise this project, which is often left out of the general histories of twentieth-century architecture despite its many qualities.[1] The more recent interest in Thamesmead is manifest in some studies concerned with the history of architecture-related fields, such as dwelling design, as evidenced in an article on Thamesmead in the journal *Dash*, and in sociology, in, for example, Valerie G. Wigfall's comprehensive monograph.[2]

The considerations presented here are primarily the results of research based on a survey of architectural periodicals that documented—almost day by day—the progress in the construction of this new town, which was at the time the biggest project in London, hailed as the "Town of the 21st Century."[3] The building of Thamesmead, which was initially envisaged as providing accommodation for sixty thousand inhabitants,[4] is usually seen only in the light of the desperate shortage of housing that London faced in the aftermath of World War II. However, to understand its full historical value, we also have to look through other lenses, such as the history and evolution of prefabrication and the contemporary architectural debate. In doing so, I consider Thamesmead from both the global and local perspectives.

The advantages of prefabrication were obvious even before World War II, but it was only after the war that a huge increase in the need for housing led to its massive adoption. In its first attempt to solve the housing problem, the British Tory government launched the Emergency Factory Made (EFM) program in 1944, which envisioned the production of five hundred thousand prefabricated houses between 1945 and 1947.[5] However, owing to an economic crisis the program was discontinued, and in the end only 156,623 houses were built.[6] According to the British Prefab Museum website, the EFM program produced eleven types of prefabricated single houses, and other designs were imported from the United States and Sweden.[7]

A permanent solution to the housing shortage was finally proposed with the New Towns Act of 1946, which led to the building of eight new towns near London.[8] It was later implemented with the Town Development Act of 1952, which envisioned the expansion of twelve existing towns around London and enabled the London County Council to establish its overspill estates.

## The Long Road on the Way to Implementing the Project

In 1957, the British minister of housing and local government granted the LCC (London County Council, the smaller predecessor of the GLC, which was established in 1965) the right to develop proposals for a major new town for one hundred thousand people. An area was initially chosen near the town of Hook in northeast Hampshire but was abandoned in the early 1960s because it was rejected by the Hampshire County Council.[9] Although the proposal by the LCC never saw the light of day, it was highly influential through the publication of a revised version in 1961.[10] This proposal was prepared by a team of planners, architects, a landscape architect, a civil engineer, a quantity surveyor, and economists who were critical of the earlier New Towns based on the concept of the dispersed of low-density houses. Rather, they favored a compact city surrounded by green areas with proper roads to facilitate the movement of traffic.[11] The most interesting parts of the plan from our point of view are the "platform villages," a hybrid typology of mid-rise dwellings with generous private outdoor spaces crossed by pathways and shops on the lower levels. Although the building system employed has never been studied, one can suggest that, according to the size of the intervention and the limited number of included elements, an industrialized constructive system was envisioned. The main idea seems to have been to achieve a large number of variations with a limited number of elements in order to convey local identification.[12]

The Hook proposal seems to have been the forerunner of two well-known global examples that are similar in terms of the research devoted to achieving a range of variations in a large-scale building, in merging housing with a mix of urban uses through the repetition of a simple module, taking full advantage of prefabrication. One of these models was Habitat'67 by Moshe Safdie, which made use of interlocking prefabricated three-dimensional concrete units that serve as self-supporting structures without additional load-bearing elements.[13] The other is the Metastadt developed by Richard J. Dietrich in 1965, which called for a prefabricated urban building system that uses an orthogonal steel framework with flex-resistant joints.[14] The application of these concepts are recognizable in Hook New Town and also appear, although in a less radical form, in Thamesmead.

A new site for the envisioned new town was found in a marshland area between Woolwich and Erith, south of the River Thames, which ended up being the chosen locale. The LCC produced its first development report in November 1962, which was shortly after this new location was decided upon.[15] The new project, as published in the *Architects' Journal* in December of the same year, was now supposed to accommodate twenty-five thousand people organized in three "village clusters" formed by six or seven village platforms raised from the ground, in accord with the Erith bye-law governing the level of habitable rooms.[16] The LCC report states that the project offered appropriate conditions for the adoption of industrial building methods. Further, it affirmed that these techniques offered two advantages: speed of construction and less need for manpower compared to traditional building methods. A comment published in the *Architects' Journal* notes that the adoption of heavyweight prefabrication would require a considerable capital investment in new factories. What is underscored here is that the possibility of developing a new town of this size would be strongly dependent on industrial development. A large site like this, with its concentrated and steady demand for a limited range of components, might have served as a springboard for the development of an entirely new industrial sector in Britain. But later on, the scheme proved to be impracticable, owing to air pollution above 200 ft (60.96 m). This fact forced the planners to limit the height of the towers to thirteen floors, so the proposal proved to be economically unsustainable. Moreover, a renewed land offer by the Royal Arsenal, incorporating an additional thousand acres, gave the LCC the opportunity for a new proposal.[17]

The recently formed GLC prepared a new master plan in 1965–1966 with an envisioned self-contained community of sixty thousand inhabitants, which was presented to the public in March 1966.[18] Its ambitious goals can be summarized as follows: (1) to provide employment; (2) to develop the riverside and build a central area facing the River Thames as well as to create open spaces; (3) to provide for the separation of vehicular and pedestrian traffic; and (4) to link public transport to the surrounding area.[19] Within this demanding program, architecture played a crucial role with its bold design, unlike, for example, Milton Keynes (1970.[20]

## The Balency and Schuhl System

The initial sketches, which were first presented in the brochure *Woolwich-Erith: A Riverside Project* and then circulated through magazines in Western Europe and the United States,[21] show different building typologies exposing various components that manifest their factory-made appearance.[22] These first renderings let us suppose that the architects were initially looking for prefabrication with very light elements, instead of the heavyweight wall system adopted later. In 1967, a model of a part of the four-floor high linear block, intended to be built in the third of the three initially envisioned erection phases, was displayed. It had a stepped section with reinforced glass fiber units on the front, standardized mechanical stacks and, as we can read in one description, there was some thought given to the use of structural plastics.[23] The GLC had already used reinforced story-high glass fiber panels in the two multistory buildings erected in Walterton Road, Paddington, in 1965.[24]

In any case, in Thamesmead, the design team guided by Sir Hubert Bennet, head of the Department of Architecture and Civic Design, made an important decision.[25] No specific industrialized building system was to be chosen in the very first stage, so as not to impose any restrictions on the design. This decision allowed for the development of a kind of innovative building typology that would otherwise not have been possible, such as the linear block of the first area. The cited journals considered this feature the most appreciated architectural product of this new town, especially in regard to separating pedestrian and vehicular traffic. It also allowed for a high degree of diversification, which would counter the monotony typical of prefabricated council housing.

In the spring of 1966, a cost plan was prepared for the first two stages of Thamesmead, based on traditional construction methods. Then, the National Building Agency made suggestions for combinations of contractors and types of industrialized building systems that promised suitable production and management capacities.[26] Accordingly, three national building firms were invited to submit proposals, and in October 1966 the GLC chose the firm of Holland, Hannen, and Cubitt for the construction of four thousand dwellings over five years.[27] This contractor had been associated since 1964 with the prefabricated system of the French company Balency and Schuhl, which introduced their pioneering patents in France in 1952.[28] Cubitt had gained considerable experience with the Balency system adopted in the Ballymun project in Dublin, and his company was the largest single contractor in Europe at the time.[29] The Balency system was preferred for multistory housing; indeed it was used only for high-rise buildings. The Lowton-Cubitt system was utilized for terrace houses. The two systems were adopted without the same careful attention to the design of the details that we find later in Thamesmead. However, Thamesmead was not the GLC's first attempt to use an industrialized system building; its first use was in the Morris Walk estate in Woolwich (1963) with the Larsen & Nielsen system.[30]

Balency is a concrete building system based on the use of precast wall panels with internal and external elements designed to be load-bearing. Unlike other French systems, for example, Camus and Coignet, concrete floor slabs are cast in situ, making the process more dependent on weather conditions. The height of the panels is set for any contract, but the width can be adjusted as needed. The only standard elements in the system are those made to host the services around which the flats are planned: the "duct units" that carry the vertical main services, rainwater downpipes, and the "functional units" that contain all the ducts, waste stacks, flues, and the ventilation system. These technical blocks are intended to reduce the work on site for the installation of the pipes. In the flat's layout, kitchens, bathrooms, and drying rooms are grouped around a "duct unit." This system offered great economic advantages but at the price of having repeating ground plans on each floor as in the French-built examples, and it left little space for more interesting spatial experimentation or any sort of layout flexibility. The uniformity of the floors is not the only consequence of the adoption of this system. Another fundamental aspect is the requirement that "each building will have a total dead weight sufficient at all times, whether during construction or completed, to resist the lateral wind load forces without inducing undue tension in any of its constituent parts."[31] The structure is indeed a box-type one, based solely on panels without pillars or other structural elements. Other constituents of the system are the partition walls and the external wall panels, the latter having three layers: two outer ones that are load-bearing and a middle one for insulation.

## Avoiding the "House of Cards" Aesthetics

The first contract started in 1967 and envisaged the construction of 1,495 houses, for which there would not have been enough bricklayers in the United Kingdom if only traditional construction methods had been used.[32] For this reason, as well as others, prefabrication seemed to be an obvious choice for Thamesmead.

Construction spread over three areas: south of the Southmere Reservoir, north of Abbey Wood, and north of the first area, extending from Ridgeway to the River Thames. The same urban design principle was adopted for the first two areas (fig. 7.1), whereas the third followed a more organic principle with curved streets and included several traditional brick buildings. Furthermore, from the construction of the second area on, the cost yardstick for local authority housing—adopted in 1969—imposed economies that brought about a drastic simplification in the linear block volumes, which lost all their original qualities in terms of the diversification of the layouts.

**Fig. 7.1.** Thamesmead: Aerial view of estate and the lake, 1971. London Picture Archive, London Metropolitan Archives, LCC Photograph Library.

Thamesmead features three types of dwellings: point blocks, positioned around the reservoirs; linear blocks, placed along the streets and acting as barriers to wind and noise; and low buildings characterized by elevated pedestrian paths. All the residential buildings were erected according to standards suggested by the Parker Morris Committee of 1961, which became mandatory in 1967.[33] The suggestions of the Parker Morris Report were based not on minimum room sizes but on functional requirements and levels of performance, with minimum overall sizes for the dwelling related to the size of the family.[34]

Owing to their weight, the panels used by the Balency system had to be produced in an on-site factory, which was built at the end of 1967. Called the Industrialised Building Factory, it could produce components for 950 dwellings a year. According to the report by Alexander Pike, with fifty steel molds, it was possible to produce approximately seven hundred different castings.[35]

External walls were cast in horizontal molds fitted with hydraulically operated autoclaves to ensure better-quality results (fig. 7.2). To accelerate the panels' initial curing period and obtain an average of two castings a day with one mold, the concrete mix was preheated to about 34°C and the molds to about 45°C before pouring.[36]

**Fig. 7.2.** Thamesmead Factory: Mr. Plummer looking at concrete wall of a house, just coming out steaming hot, 1968. London Picture Archive, London Metropolitan Archives, LCC Photograph Library.

The partition walls were produced in vertical molds with the concrete injected pneumatically from below for greater control over placing, to avoid distortion of the steel and segregation of the mix, and to allow for the natural displacement of air.[37] The internal faces of these molds were made of polished steel to create a smooth panel suitable for the direct in situ application of paint or wallpaper. The same preheating process was adopted and the average per mold, in this case, was three castings a day.

Other special molds were prepared for stairs, balcony fronts, floor slabs (only for low-rise buildings), and pieces for technical installations. After the initial curing period, these were sent to the finishing bay together with the walls to determine whether any minor repairs were necessary. In the external walls, an aggregate of Norwegian granite was exposed by hosing and brushing off the retarder-coated surface. After this process, the elements were lifted by a tower crane and placed in the stockyard before being loaded onto a railway car for delivery to the building site (fig. 7.3).

The panels were prefabricated, but the casting of the floor slabs was done on-site to secure the joints between the elements. In this regard, it is useful to

**Fig. 7.3.** Thamesmead: Harrow Manorway under construction, 1969. London Picture Archive, London Metropolitan Archives, LCC Photograph Library.

remember that in the wake of the Ronan Point disaster, building regulations were altered and all the joints were to be reinforced, which led to delays on site.[38]

On May 16, 1968, at 5:45 a.m., Ivy Hodge, who lived in flat 90 on the eighteenth floor of Ronan Point, lit a match to boil water for a cup of tea, which caused an explosion owing to a gas leak. This occurred only two months after construction, based on the Larsen & Nielsen system (one of the most important load-bearing panel systems up to that time).[39] The explosion caused the corner load-bearing wall to pop out, leading to the gradual collapse of the entire southeast corner of the building and the death of four people. An inquiry was carried out by Queen's Counsel Hugh Griffiths, which had an immediate impact on the relevant legislation.[40] The first of the mandated changes related to a specific clause concerning "Disproportionate Collapse." It required that buildings of more than five stories had to be constructed so that in the event of an accident the building would not collapse to an extent disproportionate to the cause.[41] With that clause, building construction had to take pressures that might be caused by wind, explosions (either internal or external), vehicle incursions, and seismic design into account.[42]

Another, even more important effect was that this tragedy, linked with substantiated problems, caused a great outcry among the British public and undermined the reputation of multistory housing built by the local authorities.[43] Despite this event, the towers at Thamesmead, planned since 1962, continued to play a central role in the project because they gave sufficient financial security to the whole operation and legitimated the initial high cost linked to the adoption of system building. Indeed, the maximum rationalization could only be produced in tower blocks or buildings with few variations. At the end of the sixties, owing to the GLC's Research & Development Department, Britain could produce buildings at a 25 percent lower cost than Continental Europe.[44]

Yet another consequence that followed upon the Ronan Point disaster helps us understand the impact that this tragedy may have had on the design of future housing. After the disaster, which was caused by a weakness in the joints between the slabs and the load-bearing walls, the design of the towers underwent significant aesthetic refinements. In many ways, these modifications seemed to distance their appearance from the typical design of towers that were constructed using concrete load-bearing panel systems. This is just an interpretation, but that fact might have played a role in the considerations of the design team. After the Ronan Point disaster, people were afraid of heavy prefabrication systems, such as Larsen & Nielsen and Balency, which were used extensively in those years, where floor panels just leaned on wall panels.[45] It seems that here the architects worked out a formal solution to conceal the dreaded structural principle that left one feeling that the building was insecure and as weak as a house of cards.

The joints between the panels play a principal role in the definition of the facades and conceal all the floor slabs, so the structural principle that would have been reminiscent of Ronan Point could not be seen. The sameness of the facades is avoided by alternating load-bearing panels with slots in balcony balustrades that double as kitchen ventilators on the other corners of the apartments. It does not seem to be a coincidence that, after the disaster, the gas ventilator became a highly recognizable detail in the building design. In addition, the buildings end at the top with panels protruding from the roof, showing off the panels—the main system building components—with a strong aesthetic statement. Further, the edges present a continuous steel profile, which runs vertically to the top of the building holding the glazed windscreens of the balustrades. This detail and the corner kitchen windows impart a sense of lightness that is generally not seen in buildings constructed using this type of system (fig. 7.4). Again, it seems that all these efforts to dematerialize the corners, the part of the Ronan Point tower affected by the collapse, were intentional and were implemented in response to that event.[46]

**Fig. 7.4.** Thamesmead: Tower blocks completed, 1969. London Picture Archive, London Metropolitan Archives, LCC Photograph Library.

Compared to contemporary housing blocks developed in the same years with a heavy system such as the Balency, which embrace wet joints, Thamesmead reflects a radically different outcome. The lightness obtained owing to careful detailing speaks to the essence of the dry-joint industrialized system, which represents the optimal level of efficiency because all of the components are produced in a factory with the greatest accuracy, independent of weather conditions. This was at the core of the research of Walter Gropius, one of the modernist precursors in the field, which was reflected, for example, in the facades of the experimental prefabricated single-family house designed with Marcel Breuer for the Weissenhofsiedlung in Stuttgart (1926–1927), which was unfortunately demolished.

## Standardization vs. Individualization

In 1969, Thamesmead received the prestigious Sir Patrick Abercrombie Prize from the UIA (Union Internationale des Architects). Politicians and professionals from many countries visited the work in progress at the building site, which was heralded by many planners as "the model for late twentieth-century development."[47]

Reiner Schimkat, the principal designer in charge of a project for the German firm Jourdan, Petermann, and Posenenkse, which won the *Elementa '72* competition, noted that he was influenced by the UK development of Thamesmead and Lillington Street.[48] On the other side of the Atlantic, William K. Woods wrote a diary of his travel in Europe for the *North American Review*, where he saw new developments in the Britain, Sweden, Finland, and France:

> We visited the factory. Inside this cavernous building, men and machines concocted huge concrete wall slabs fitted with window frames, plumbing, electrical conduits and heating mechanisms. What was most amazing to me was the fact that factory-produced parts could be combined to form a final product that stands as an interesting piece of architecture and a pleasant place to live.[49]

From his point of view, among the many merits of this project, it was the overall quality that stood out from among other contemporary projects that also made use of slab construction. For Wood, it was not limited to the form of the buildings but also to the "amount of social and physical planning that these architects incorporated in their blueprints."[50] Some of these assumed qualities were related to the innovative linear building that Woods carefully described and explicitly appreciated.[51]

As we look through other publications, we discover that the most admired housing typology was always the linear block built during the first phase. What is particularly interesting is that it was not built using the Balency system (because the countless variations rendered its use uneconomical); rather, it employed a rationalized-traditional building system with poured-in-place concrete load-bearing structures and prefabricated cladding panels (fig. 7.5). The GLC was aware of and in favor of this decision from the beginning, as it made

**Fig. 7.5.** Thamesmead: Linear blocks completed, 1969. London Picture Archive, London Metropolitan Archives, LCC Photograph Library.

it possible to start work at the construction site before the Industrialised Building Factory was completed.[52]

This specification was often overlooked by authors such as Wood, mainly because although the linear block was made with a-poured-in-place concrete frame, it was covered with a cladding of prefabricated panels poured in simple timber molds in the courtyard of the Balency factory. This treatment of the facades made these blocks apparently identical to the other buildings and resulted in unified images in the first two areas.

Even in one of the Impresa Generale Costruzioni MBM s.p.a. catalogs,[53] the Italian exclusive concessionary of the Balency system, a report on Thamesmead included a photograph of the model showing the foreground of the linear block with its multiple variations, looking "like a giant kind of Lego representing the idea of a kit of parts which can be combined in a variety of ways." It is ironic, as noted by Richard Maccormac, "to discover that it was not carried out in the Balency system."[54] It seems that MBM was intentionally using the appealing image of the linear block of the first phase to demonstrate some qualities of this system even if in reality it was not a Balency project. It is worth remembering that the possibility of achieving personalization through standardization, even though hardly achieved in practice, was, as Gropius wrote in 1927, a constant goal for many modern architects:

> The ultimate objective of this trend will be accomplished only when all the reasonable wishes of the individual for his home can be fulfilled without sacrificing the economic advantages of mass production. The houses and their furnishings will differ in their general appearance to suit the number and kind of their inhabitants. On the other hand, the components from which these buildings will be made will be identical.[55]

If in the 1950s the architects of the LCC were looking at the Unité d'Habitation by Le Corbusier as a model on which to build their council housing as at Roehampton, in the case of Thamesmead, architects such as Giancarlo De Carlo looked at the linear block designed for that town, which he visited in December 1969, on the occasion of a Team 10 meeting.[56] What is clear here is that a design team in the service of the state with its own research and development department was able to create a radical model recognized by an intellectual progressive architect such as De Carlo. For his part, De Carlo took as a starting point the realization of the sophisticated "deck" of the Villaggio Matteotti (1969–1975) made out of a close interplay between built forms and artificial green landscape.[57] He saw the linear block of Thamesmead as a "how to" for building an architecture able to represent the plurality of the lifestyles of its intended inhabitants. He was opposed to the adoption of the heavy panels' system mainly because of the effect on the urban design and the limitations on the internal flexibility of the dwellings, which were for him at the center of his current investigations. The only prefabrication that he considered interesting was the one related to the use of light components, especially metallics. Owing to their cost and the lack of sufficient research at that time in Italy, he decided to work with the concrete poured in place, which was a much cheaper method, more widely in use, and more reliable.[58]

De Carlo's position was an exception in Italy, because prefabrication in various forms had already been embraced by many important architects, especially among those who were closely collaborating with industry or contractors such as Giuseppe Davanzo, Angelo Mangiarotti, Pier Luigi Nervi, Gino Valle, Marco Zanuso, and Vico Magistretti. The latter designed some buildings with the Balency-MBM system, including the one in Gallaratese (1963–1971), but the results were not very different from the average and a far cry from the better results achieved in Thamesmead, which were due to the utilization of system building and rationalized traditional building methods.

## A Controversial History

The success of Thamesmead housing was not solely the result of the refined technical details: it was also due to the care devoted to the treatment of the concrete surfaces made of exposed Norwegian granite aggregate, which gave an enriched material effect. Both concrete and aggregate were white, and their effect, as noted by Richard Maccormac, was "surprisingly humane and pleasant."[59] This was a manual process carried out with a high-pressure hose that seems contrary to Gropius's ideas of efficiency and standardization. On the contrary, this process seemed to add a haptic interaction between man and building that was typical of the Brutalist idea, as posited by Alison and Peter Smithson, who spread it in the United Kingdom.[60]

In the same years that Thamesmead was being built, the Barbican Center designed by Chamberlin, Powell, and Bon was also characterized by a process that revealed the "raw" quality of the concrete, but in a more extreme and tridimensional way owing to the bush-hammering process.[61] This was a manual technique, slower and more expensive than the one adopted at Thamesmead, that involved men holding vibrating hammers whose "end jabs the smooth concrete finish with such a force as to break small pieces of it away to roughen it up," as Roma Agrawal observes.[62]

Although Thamesmead and the Barbican share several features—both are sort of artificial towns based on a structure informed by organization and hierarchy, adopted a similar aesthetic, and pursued the segregation of traffic modes—their reputations are completely different. The former was considered unsuccessful and still has a poor reputation, whereas the latter is a very successful and well-regarded example.[63] The unfortunate development of Thamesmead was not strictly connected to its physical form but to many external factors. Its initial phase was rushed, so the first houses had problems with leaking and condensation.[64] The promised shopping facilities never opened, and "the multi-levelled network of streets and bridges became a confusing, crime-friendly labyrinth."[65] Further, the Jubilee tube connection to central London was never built, "leaving the place cut off, a modernist experiment marooned in the marshes at the end of the earth," as Oliver Wainwright concedes.[66] Moreover, Thamesmead is, as recalled in Christian-Lars Germadnik's thesis, also "very much a victim of a spiral of bad news and bad image, fuelled by the press and also by such influential movies, like *A Clockwork Orange*."[67]

That seems to be true: Stanley Kubrick decided to set some scenes of his famous 1971 movie in Thamesmead not to show the assumed brutality of the concrete itself, as was sometimes claimed.[68] Rather, he exploited the architecture of this new town as the perfect backdrop for his scabrous science-fiction, anti-utopian story. As described by Paolo Mereghetti, the scenario portends the near future as a time dominated by violence and sexual frustration resulting from the disorientation and the impossibility of fulfilling humans' own desires.[69] Kubrick chose the polished prefabricated and futuristic looking Thamesmead for *A Clockwork Orange* as the representation of an efficacious top-down version of a society that allowed little space for any individual freedom of choice.[70]

But Thamesmead can also be seen as a telling example of a certain era—the golden age of the Welfare State—in which towns were planned from scratch by a team of experts in a very short time. This was also considered the golden age of architecture, because in some cases architects were asked to produce not only exceptional projects but also to create new programs.[71] The advent of Margaret Thatcher, elected in 1979, put an end to this glorious time, which had begun to wane several years earlier. In 1985, when four hundred thousand council houses were sold, capital expenditure on public housing was cut by 40 percent and council rents were increased by 150 percent over the level of 1978–1979. The GLC was closed in 1986.[72]

## Conclusion

As we have seen, the choice of prefabrication was based on pragmatic considerations and used cleverly and in a refined fashion.[73] That would not have been possible at that time in England without the global exchanges of engineering and technical knowledge that provided and improved the Balency and Schuhl system, produced in France, a nation that played a pivotal role in the story of architectural prefabrication. In this sense, prefabrication was never a constraining condition on design choices; rather, it guided the aesthetic appearance of the buildings, especially in the first two phases, where, despite the different techniques adopted, the planners decided to make the skin of the buildings uniform with exposed concrete panels. The resulting bold image of modernity aligned with innovative system-building techniques was exploited in promotional material, such as postcards (fig. 7.6) and a short movie aimed at attracting people in need of council houses.[74]

As was shown above, prefabrication in Thamesmead embodied different and contradictory images. In the beginning, it represented the most advanced utopian visions of the architects and urban planners, even before a prefabrication system was chosen. The idea of prefabrication spread, alongside the innovative initial proposals, through the sketches published in the most prestigious professional magazines all over the world. Subsequently, prefabrication became a functional means for implementation of the ideas of the welfare state and, owing to the dedication of Sir Hubert Bennet and his team, a lot of effort

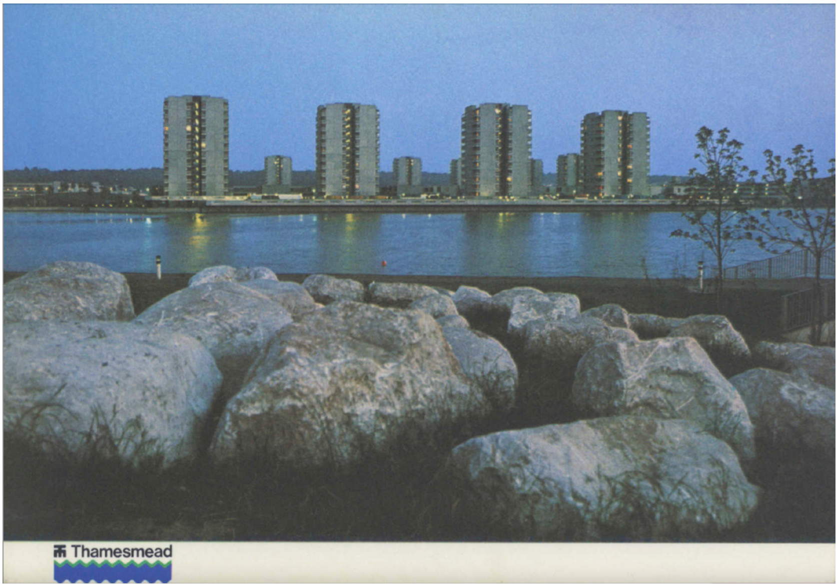


**Fig. 7.6.** Thamesmead: Manorway Gardens, 1982. London Picture Archive, London Metropolitan Archives, LCC Photograph Library.

was devoted to improving the quality of the results, although many things changed after his departure from the GLC.[75] Indeed, although the GLC opted for a conventional "heavy" prefabrication system, mass housing in Thamesmead not only reflected the results of endless repetition following this production method—typical of many mass housing in postwar Europe—but also benefited from the adoption of mixed building techniques.

Nonetheless, construction problems surfaced soon after the first houses were inhabited, and other problems, which were partially fostered by the negative image conveyed by *A Clockwork Orange*, followed as that film changed the image of prefabrication from a positive into a negative and dystopic one.

The housing association known as Peabody, which took over the management of Thamesmead in 2014, started demolition of the area in the name of regeneration.[76] Everything considered, Thamesmead and its constructive technique, with all its limits, has a significant historical value and a conservation project should be introduced to preserve the parts that are still standing.

## Notes

1. Cf. John R. Gold, *The Practice of Modernism: Modern Architects and Urban Transformation, 1954–1972* (London: Routledge, 2007); Barry Bergdoll and Peter Christensen, *Home Delivery: Fabricating the Modern Dwelling*, ed. Ron Broadhurst (New York: The Museum of Modern Art, 2008); Tom Avermaete and Janina Gosseye, *Urban Design in the 20th Century: A History* (Zurich: gta Verlag, 2021).
2. Annenies Kraaij, "Thamesmead: Greater London Council," *Dash* 12/3 (2015): 206–21; Valerie G. Wigfall, *Thamesmead: A Social History* (Stroud: History Press, 2008).
3. My research is based on the analysis of plans, photographs, and texts published in the most renowned architectural periodicals of the time, spanning from 1944 to 1997. Another important source was the website of the Thamesmead Community Archive with its growing collection of some 2,000 items from both official sources and the inhabitants: https://thamesmeadcommunityarchive.org.uk/. Parts of these documents are already published in: Peter Chadwick and Ben Weaver, eds., *The Town of Tomorrow: 50 Years of Thamesmead* (London: Here Press, 2020).
4. The population of Thamesmead, based on the statistics from mid-2018, is 41,121.
5. Martin Pawley, "Ignorance of Broadband Approach Is Reason for Prefabrication Failure," *Architects' Journal* 216, no. 21 (2002): 18.
6. Brenda Vale, *Prefabs*: *A History of the UK Temporary Housing Programme* (London: E&FN SPON, 1995), vii.
7. "History," Prefab Museum, accessed May 29, 2022, https://www.prefabmuseum.uk/content/history/history.
8. Wigfall, *Thamesmead*, 24–25.
9. "NEWS: HOOK NEW TOWN – First Reports of Mark II Town," *Architects' Journal* 133, no. 3433 (1961): 167.
10. London County Council, *The Planning of a New Town. Data and Design Based on a Study for a New Town of 100.000 at Hook, Hampshire* (London: London County Council, 1961).
11. The leaders of this group were Oliver Cox, the architect in charge, and Graeme Shankland, the senior architect planner. Ted Hollamby was the chief architect for the London County Council.
12. "Hook New Town, England," *Canadian Architect* 7, no. 9 (1962): 66–73.
13. Peter Christensen, "Habitat '67. Moshe Safdie," in Bergdoll and Christensen, *Home Delivery*, 124–27.
14. Florian Breiphol, "Metastadt-Bausystem. Richard J. Dietrich," in Bergdoll and Christensen, *Home Delivery*, 136–37.

15. F. G. West was the deputy architect, K. J. Campbell the principal housing architect, J. Whittle the assistant housing architect. Sir Hubert Bennet was the architect to the Council.
16. "Development Study: Housing at Erith," *Architects' Journal* 136, no. 24 (1962): 1337–46.
17. Wigfall, *Thamesmead*, 30–31.
18. "News: WOOLWICH-ERITH – Imagination and Excitement in Large Scale Development," *Architects' Journal* 143, no. 12 (1966): 733–35; George Finch, "News: WOOLWICH-ERITH – Riverside Development Made Clear," *Architects' Journal* 143, no. 17 (1966): 1055.
19. Wigfall, *Thamesmead*, 43.
20. Terence Bendixson, "Criticism: Milton Keynes: The Newest New Town," *Architectural Review* 146, no. 870 (1969): 107.
21. Some of the principal publications are: Joseph Rykwert, "Inghilterra: Un nuovo centro per sessantamila abitanti," *Domus* 442 (1966): 3–10; "GLC: Thamesmead on Show," *Architects' Journal* (London) 145, no. 11 (1967): 658; "Preview '67: Housing: Woolwich-Erith Phase 1, London," *Architectural Review* (London) 141, no. 839 (1967): A20; "3 LONDON," *Architectural Review* (London) 142, no. 849 (1967): 373; "Thamesmead," *Official Architecture and Planning* 30, no. 4 (1967): 555; "Thamesmead," *Werk* (Bern, Switzerland), 54, no. 8 (1967): 511; "Wohnbebauung am Themse-Ufer," *Bauen + Wohnen* (Munich) 21, no. 12 (1967): 473–74; "Woolwich–Erith: Eine neue Stadt im Osten Londons," *Baumeister* (Munich) 64, no. 3 (1968): 269–78; Seton Forbes Cockell,"En voie de réalisation: Une cité riveraine pour 60 000 habitants"; "Thamesmead, nouvelle ville sur la Tamise," *Habitat* (Switzerland) 41, no. 10 (1968): 48–50; John M. Bailey Jr. and Henry Schubart Jr., "Thamesmead, England," *Architectural Forum* (New York) 131, no. 1 (1969): 58–65; Alexander Pike, "Thamesmead Report," *Architectural Design* (UK) 11 (1969): 608; "Thamesmead: Ein Programm steht zur Verwirklichung," *Bauen + Wohnen* (Munich) 24, no. 10 (1970): 357–61; "Thamesmead," *Ekistics* (Athens) 29, no. 171 (1970): 149–52; Paolo Guidicini, "Dall'Inghilterra una città in più: Thamesmead, una città per vivere," *Parametro* 6 (1970): 62–67, 121; William K. Woods, "An Urbanologist's Notebook," *North American Review* (USA) 255, no. 1 (1970): 27–33; "In Inghilterra, tre quartieri residenziali, una scuola," *Domus* 504 (1971): 7–9; N. Bellodi and C. de Angelis. "L'architettura fatta: Verifica a Thamesmead." *Parametro*, no. 10 (1972): 62–67; Richard Maccormac, "Building Illustrated. Thamesmead: Part One," *Architects' Journal* (London), 156, no. 41 (1972): 817–31; Richard Maccormac, "Building Illustrated. Thamesmead: Part Two," *Architects' Journal* (London) 156, no. 42 (1972): 879–96; "English Encampments," *Progressive Architecture* (USA) 7 (1977): 58–63.
22. GLC, *Woolwich–Erith: A Riverside Project* (London, 1966).
23. "3 London," *Architectural Review*, 142, no. 849 (1967): 386.

24. "GLC: Plastic Cladding for Multi-Storey Flats," *Architects' Journal*, 142, no. 21 (1965): 1201–6.
25. Sir Hubert Bennet took over the LCC architect's department in 1956 with a staff of three thousand employees. From 1965 to 1970 he was the head of GLC Department of Architecture and Civic Design. The deputy architect was Jack Whittle. The principal housing architect was Kenneth Campbell. J. G. H. D. Cairns was the architect in charge of Thamesmead.
26. Alexander Pike, "Thamesmead Report," Thamesmead Community Archive, accessed June 1, 2022, https://thamesmeadcommunityarchive.org.uk/explore/thamesmead-report-architectural-journal.
27. Ibid., 12.
28. Ilaria Giannetti, "Reinforced Concrete, Industry and Design: Balency Prefabricated Panels between France and Italy," in J.W.P. Campbell et al., eds., *Iron, Steel and Building. Studies in History of Construction: Proceedings of the Conference of Construction History Society* (Cambridge: Construction History Society, 2020): 627.
29. "Ballymun, Dublin: Industrialised Housing," *Architects' Journal* 144, no. 12 (1966): 730.
30. "LCC housing at Morris Walk, Woolwich," *Official Architecture and Planning* 26, no. 3 (1963): 231.
31. Pike, "Thamesmead Report," 10.
32. Ulrich Knaack, Sharon Chung-Klatte, and Reinhard Hasselbach, *Prefabricated Systems: Principles of Construction* (Basel: Birkhäuser, 2021), 26.
33. Bernard Kilroy, "After Parker Morris," *Architects' Journal* 176, no. 66 (1980): 957–58. "Homes in a Winding Ribbon," *Architects' Journal* 147, no. 22 (1968): 1209.
34. Department of the Environment, *Homes for Today & Tomorrow* (London: HMSO, 1961; The Parker Morris Report).
35. Pike, "Thamesmead Report," 11.
36. GLC, *Thamesmead: The First Areas*, 1976, Thamesmead Community Archive, accessed June 1, 2022, https://thamesmeadcommunityarchive.org.uk/explore/stories/construction-the-making-of-thamesmead.
37. Ibid., 7.
38. Richard Maccormac, "Building Illustrated. Thamesmead: Part Two," *Architects' Journal* 156, no. 42 (1972): 890.
39. Jørgen Burchardt, "Systems for Standardized Precast Concrete Elements: The Case of the Larsen & Nielsen System," in J.W.P. Campbell et al., eds., *Timber and Construction: The Proceedings of the Ninth Conference of the Construction History* (Morrisville: LULU, 2022): 497.
40. "Queen's Counsel": A senior barrister whose skills have been recognized by the Supreme Court and the legal profession after a number of years of work and is given the honorary title of QC; "which had an immediate impact": "Ministry of

Housing and Local Government (MOHLG) Aftermath of Ronan Point," *Architects' Journal* 148, no. 46 (1968): 1111–13.

41. Norbert J. Delatte Jr., *Beyond Failure: Forensic Case Studies for Civil Engineers* (Reston: ASCE Press, 2009), 104.
42. Delatte *Beyond Failure*, 104.
43. Finn Williams, "Designing Upstream: Rebuilding Agency Through New Forms of Public Practice," *Architectural Design* 88, no. 5 (2018): 109.
44. Martin Pawley, "The Rise and Fall of the Public Sector," *Architects' Journal* 184, no. 34 (1986): 24.
45. Matthys Levy and Mario Salvadori, *Why Buildings Fall Down* (New York: W. W. Norton, 1992), 76–83.
46. Further investigations on archival documents are necessary to confirm this interpretation.
47. "Abercrombie Award – Thamesmead Wins," *Architects' Journal* 149, no. 23 (1969): 1488.
48. *Elementa* '72 was a competition launched by the West Germany Ministry of Town Planning and Housing and *Stern* magazine to design a flexible system for public housing; see "Competition: Elementa '72," *Architects' Journal* 155, no. 10 (1972): 493; "Elementa '72," *Architects' Journal* 156, no. 44 (1972): 995.
49. William K. Woods, "An Urbanologist's Notebook," *North American Review*, 255, no. 1 (1970): 30.
50. Ibid.
51. Ibid.
52. John M. Bailey Jr. and Henry Schubart Jr., "Thamesmead, England," *Architectural Forum* 131, no. 1 (1969): 64.
53. "Depliant MBM degli interventi realizzati, s.d.," Archivio Vico Magistretti, accessed May 29, 2022, https://archivio.vicomagistretti.it/magistretti/archive/document/IT-FVM-A001-000228?lang=en.
54. Richard Maccormac, "Building Illustrated. Thamesmead: Part Two," *Architects' Journal* 156, no. 42 (1972): 891.
55. Walter Gropius, "Systematische Vorarbeit für rationellen Wohnungsbau," *Bauhaus*, no. 2 (1927): 1–2, Bauhaus Bookshelf, accessed May 29, 2022, https://www.bauhaus-bookshelf.org/bauhaus_journals_1926_1931-1.html.
56. Nicholas Bullock, *Building the Post-War World: Modern Architecture and Reconstruction in Britain* (London: Routledge, 2002): 281; J. B. Bakema, "London, Dec. '69," 5. BAKEG138, J. B. Bakema Archive, Nieuwe Instituut, Rotterdam.
57. Alberto Franchini, *Il Villaggio Matteotti a Terni: Giancarlo De Carlo e l'abitare collettivo* (Rome: L'Erma di Bretschneider, 2020): 263–64.
58. Ibid., 389–90.
59. Richard Maccormac, "Building Illustrated. Thamesmead: Part Two," *Architects' Journal*, 156, no. 42 (1972): 891.

60. Alexander Clement, *Brutalism: Post-War British Architecture* (Ramsbury: Crowood Press, 2012).
61. The Court of Common Council endorsed the Chamberlin, Powell & Bon plan at the end of 1968.
62. Roma Agrawal, "Concrete," in Nicholas Kenyon, ed., *Building Utopia: The Barbican Centre* (London: Batsford, 2022), 179.
63. Christian-Lars Germadnik, "Two Unequal Sisters – Barbican and South Thamesmead – The Influence of the Built Environment on the Social Milieu" (MSc thesis, University College London, 2005).
64. "Thamesmead: Window and Roof Failures," *Architects' Journal* 154, no. 31 (1971): 234.
65. Oliver Wainwright, "What Happened to the Cockney Riviera? The Botched Regeneration of Brutalist Utopia Thamesmead," *Guardian*, November 30, 2022, accessed May 29, 2022, https://www.theguardian.com/uk-news/2022/nov/30/cockney-riviera-botched-regeneration-brutalist-utopia-thamesmead.
66. Ibid.
67. Germadnik, "Two Unequal Sisters," 30.
68. Stephen Parnell, "The Meanings of Concrete: Introduction," *Journal of Architecture* 20, no. 3 (2015): 372, DOI: 10.1080/13602365.2015.1046218.
69. Paolo Mereghetti, *Il Mereghetti: Dizionario dei Film 2011* (Milan: Dalai editore, 2010), 251.
70. Ibid.
71. Mark Swenarton, Tom Avermaete, and Dirk van den Heuvel, eds., *Architecture and the Welfare State* (London: Routledge, 2015), 14.
72. Martin Pawley, "The Rise and Fall of the Public Sector," *Architects' Journal* 184, no. 34 (1986): 25.
73. The technical details of the first phases can be found in *GLC, Thamesmead: The First Areas* (London: GLC, 1976).
74. https://thamesmeadcommunityarchive.org.uk/. See also: "Thamesmead was intended, among other things, for the resettlement of families from the cleared neighbourhoods. […] This originally low-lying wetland area between the River Thames and the Abbey Wood hills had been deemed unfit for large-scale development for years due to poor soil conditions and the danger of flooding. However, lack of space and a high-pressured housing market changed all that and the location was developed despite the risks." Annenies Kraaij, "Thamesmead: Greater London Council," *Dash* 12/13 (2015): 207.
75. Andrew Saint, "Obituary: Sir Hubert Bennet," *Guardian,* December 23, 2000, accessed May 29, 2022, https://www.theguardian.com/news/2000/dec/23/guardianobituaries.
76. Wainwright, "What Happened to the Cockney Riviera?"

PART 3

# Exhibitions and Prototypes: Architectural Mediation through Prefabrication

CHAPTER 8

# Halls, "Huts," and Houses

## Large Exhibitions, Prefabrication, and Housing

*Regine Hess*

Historically, world's fairs and large national exhibitions displayed a high proportion of prefabricated architecture, either as conventionally or as experimentally designed buildings. The reason lies in the fact that prefabricated architecture could best meet not just the technical but also the representative requirements of large nineteenth-century exhibitions. These took place in the European capitals during the summer months, and the organizers had to deal with the setup and logistics quickly between late autumn and early summer. Thus, the emergence, transformation, and significance of prefabricated architecture can be examined in those venues in a particularly fruitful approach.

The ephemeral buildings were essentially constructed using load-bearing scaffolding with point and strip foundations, light-weight facades, elevated floors, and flat roofs. The construction method was modular-standardized or, in what was methodically even simpler, comprised components and materials produced and assembled on site. Working upward was made possible by domes, barrel vaults, and towers consisting of prefabricated elements. These served as landmarks that allowed the visitors to quickly find their way on the site, were visible from afar, and offered a panorama in which the exhibition merged with city and landscape. Although they are different types of constructions, in what follows, halls and towers are considered the same type in terms of aesthetic and political representation. By this I mean that the monumental halls and towers represented the organizing state power and the institutions of patronage, which marked them with such sovereign signs as flags, coats of arms, and statues of rulers.

Two other types of structures that are important in terms of the general history of prefabricated architecture are model dwellings and "huts." Both housing types were displayed extensively in world's fairs and national industrial and building exhibitions. Their organizers often distinguished between housing in the colonizing countries (in the "metropolis") and the colonized countries (at the "periphery") through calling the first "houses" and the latter "huts." They are both housing types of exhibition architecture, but I understand the pejorative term "hut" together with Itohan Osayimwese as a denial of residential architecture and dwelling culture equal to the colonizers; the matter is questioned here by consistently framing the word hut in quotation marks.[1] These "huts," which were designed mainly by European architects, were inauthentic. In terms of aesthetic and political presentation, they tended to create a derogatory visual image for exhibition visitors and negatively influence their ideas about the lifestyle and the level of "civilization" of indigenous people.

"Huts" in the exhibitions were often accompanied by another building type with an ambivalent architectural history: the barrack, an unsightly service building in which the protagonists of "colonial villages" and "people's shows" had to live temporarily on the exhibition grounds. For example, on the one hand, together with colonial residential and administrative buildings, "hut" and barrack formed the colonial section at the Berliner Gewerbe-Ausstellung (Berlin Trade Exhibition) in 1896. On the other hand, the hall and the model house, that is, the residential building for the population of the "metropolis," formed a pairing from the beginning of the world exhibitions.

At the 1867 Paris World's Fair, so-called villages were added as further exhibition building types, whose individual structures, like the houses, were not always prefabricated but were also brick-built. Finally, there were exhibition pavilions made of dismountable elements of wood or iron covered with plaster, a type that was also invented at the world exhibitions and appear comparatively late in Germany at the trade exhibition mentioned above.

The model houses are of interest for the housing question and for mass-housing construction, as they exemplified a particular technique, aesthetics, materiality, hygiene, and connection to the landscape, as well as ideologies and imageries of social life and gender roles. Prefabricated exhibition buildings are thus considered here as buildings with an expository function and as exhibits that could cover a wide range of social and political representations. This takes account of the fact that large exhibitions and their spaces can be understood as carriers of the meaning of coloniality: at the 1851 Great Exhibition of the Works of Industries of All Nations, the British Empire of the post-Napoleonic age presented itself with all its colonies and protectorates as well as with forty-four "Foreign States." The last were, so to speak, guests of the world power and expressed their manifold relationships with the British Crown through, for example, gifts and works of art as evidence of family relationships. However, a good part of the exhibition was organized, set up, equipped, and supervised by people who were under colonial rule and had to bow to the complex exhibition regime in the "metropolis." Often enough, they themselves were downgraded to exhibits and subjected to questionable exhibition regimes.[2]

Perhaps nothing better illustrates the extent to which European contemporaries were inspired by architectural exhibits from the colonies than the *Hut of the Caribbean* (*Karaibische Hütte*), in which Gottfried Semper reflected the "four elements" of his architectural theory in their purest form.[3] In the catalog of the first World's Fair, it seems to appear as *Indian Hut from Trinidad*.[4]

The method used below to study prefabricated architecture at exhibitions brings together halls and towers, and dwellings and "huts," in order to elucidate the significance of prefabrication in the context of large exhibitions and in terms of representation. Industrialized prefabrication in modernist architecture became more and more necessary in light of the burgeoning populations and their needs for housing, and it demonstrated its capabilities for innovation, expansion, and mobility to millions of visitors. The halls, towers, and model houses were the buildings of tomorrow, whereas the "huts," villages, and pavilions often appeared as images from the past. In the context of world exhibitions, however, the pavilions were also outstanding representations of their peoples in terms of craftsmanship and artistry. They offered modern, ubiquitous constructions in a familiar guise, and, at the same time, the pavilions, their furnished rooms, and exhibits contributed to ideas of national identity.[5]

These mostly hierarchically structured models of time, space, and identity were joined by other patterns of order: the leaps in scale between exhibition palaces and small buildings; the tension between integrating and segregating exhibition space for white and black people; and the coloniality of some of the lifestyles, knowledge systems, and constructions. Thus, exhibitions always had some spaces that were closed to the public. As indicated above, at the *Colonial Exhibition* at the Berlin Trade Exhibition, the closed spaces included one where the exhibited people from Africa and the South Seas had to sleep in a large barrack. Moreover, they were also not allowed to leave the exhibition area unaccompanied, so that the special case of a prefabricated "city" in the city became a racially defined, segregated, and closed space.

## Prefabrication and Representation

Halls, "huts," and houses are thus examined as three modes of representation in the space of large exhibitions.[6] The organizing empire represented itself primarily through the mighty halls. The population was reflected in model houses (first for the working class and later for the middle class) or in magnificent room arrangements (for the bourgeoisie). These, like the halls, were mostly but not consistently prefabricated. The colonies, colonizers, and colonized were "present" through "huts" and residential and administrative buildings. These mobile buildings, which moved back and forth between "metropolis" and "periphery," were usually prefabricated. Thus, from a postcolonial perspective, halls, towers, and model houses represented the "metropolis," whereas colonial buildings and "huts" represented the "periphery."[7] But the "world" exhibition moved the "periphery" into the "metropolis." The famous cartoon by George Cruikshank on the cover of Henry Mayhew's *1851, or The Adventures of Mr. and Mrs. Sandboys and Family, who Came up to London to Enjoy Themselves, and to See the Great Exhibition* gives the impression that the masses set out for London's Crystal Palace to see something new and different. The colonized, however, just like the "metropolis" dwellers, saw some things they already knew, but framed in a new way.[8] The fact that in the center of Cruikshank's globe, caricaturized African people—who are pictured on a comparatively empty piece of earth—seem to be dancing or running up to the Crystal Palace with their arms raised, points once again to the colonial understanding of "world" in world exhibitions.

Halls and towers, on the one hand, and "huts," barracks, and colonial houses, on the other, were respectively the largest and the smallest types of built architecture at large exhibitions. Standardized or individual prefabrication determined their construction, building techniques, and appearance. Metal workshops, joineries, and foundries produced them as individual buildings or ensembles. They demonstrated a mobile, technically, and logistically highly developed construction method that gave the British Empire's hegemonic claim to represent a world power a new, one might say modern, expression.

## State of Research

Thinking of exhibitions, colonialism, and prefabrication together goes back to the research of Itohan Osayimwese, which she expands in *Colonialism and Modern Architecture in Germany*.[9] She argues that the World's Fairs, shaped by colonialism, first brought forth and together "modernism's design language and roster of protagonists."[10] Osayimwese elaborates on how, after the end of the German colonial empire, prefabrication firms invested in the design of houses and furniture by means of collaborations with renowned modernist architects and compensated for the lost branch of colonial construction.[11] She evaluates this process as constituting German Neues Bauen (New Building).

Among the publications on prefabrication in architecture, two new Swiss publications are noteworthy. The first is *System und Serie*, where the authors pose new research questions on prefabricated buildings in Switzerland from the mid-twentieth century on, focusing on their architectural and construction history, their status as an expression of social condition, and their place in preservation theory and practice.[12] Further, they distinguish between "system building" and "building system."[13] In a deliberate extension of the term, the latter also includes communication formats such as company brochures, with which architectural firms and construction companies communicate with clients, residents, and critics. Architectural communication thus also becomes an element of the prefabricated building, an interpretation useful for clarifying questions of representation. For the purposes of this essay it is useful to subsume media of communication in the building system, recognizing that it is precisely through exhibitions that architects act as mediators of their own work and mission.

In the chapter "Erste Hilfe" (First Aid) in his book of the same name, Stanislaus von Moos examines designs by Alvar Aalto, Le Corbusier, Alfred Roth, and Max Bill in the 1940s under conditions of war, reconstruction, and shortage. They were all concerned with barracks and prefabrication as well as with types of prison camps, emergency shelters, and single-family and vacation homes.[14] It becomes clear how architects dealt with these types in their designs and gave them a bourgeois touch through their solutions, which pointed the way to the single-family house and to suburbanization. Moos's attempt to fill the gap in the architectural history of the 1940s in Central Europe also makes it clear that architects hardly ever (wanted to) design whole prefabricated buildings, but rather sought to draft with prefabricated elements. This was also evident at postwar building exhibitions such as the Internationale Bauausstellung 1957 (International Building Exhibition 1957) in West Berlin, where single-family houses made of prefabricated elements can still be found in the Hansa Quarter. Thus, the mobile barrack and workers' housing at large nineteenth-century exhibitions also migrate through the history of large exhibitions in the twentieth century.

## Goals and Questions

My intention in this essay is to compile a selected corpus of prefabricated exhibition architecture and to discuss its various meanings for large exhibitions. I begin with the Great Exhibition of the Works of Industry of All Nations and end with the German Building Exhibition 1900 in Dresden. At the end of the text, I cite exhibitions with prefabricated buildings for the residential sector in the twentieth century. One could argue that only then did the prefabricated house become relevant for mass housing, for example, in single-family house estates and multistory apartment buildings with industrialized constructions. However, this assumption has its price, which is the modern loss of connotations and references of the type from the nineteenth century, that is, segregated space, villages, and historic mock buildings for the representation and self-identification of peoples and nations.

Great Britain was the initial leader in the organization of world exhibitions, whereas Germany became a pioneer in special large arts and crafts and building exhibitions, the first of the latter in 1900. In France, in turn, the type of the "native village" was developed, which also served to represent an empire. That approach arrived in colonial Germany through the Berlin Trade Exhibition in 1896.

I look at six examples of prefabricated and on-site assembled exhibition buildings or ensembles in Great Britain, France, and Germany. They show that the balance between prefabrication and permanent construction slides in one direction: from the prefabricated palace and the masonry pattern house in 1851 to the permanent palace and the prefabricated dwelling in 1900.

The questions are: how were these buildings constructed and mediated and how did they function as expository buildings with a representational mission? Exhibitions are also collections and, especially in the nineteenth century, formed hierarchical orders that reflected the social order in the mirror of material culture. What patterns can we discover here and what part did prefabricated construction play in their establishment? Thus, the following explores constructive, expository, and representative aspects of buildings for large exhibitions that are rendered visible in a summarizing consideration of different types and contexts.

## "Metropolis" and "Periphery": Palaces and "Huts" in Exhibitions

Prefabrication at exhibitions began with the Crystal Palace, which is moreover regarded as the prelude to the history of modern architecture, while other representatives of the type, such as the two Munich exhibition palaces discussed here, have almost been forgotten.[15] The Crystal Palace truly symbolized the "Great Exhibition," as its construction and facade were a combined system, with the exterior and interior merging at its transparent spatial boundary. Its construction in Hyde Park in 1850–1851 was in itself an exhibition: tickets were sold at five shillings to some two hundred visitors to the site each day.[16]

One building type that is on the fringes of architecture history's canon compared to the Crystal Palace includes exhibited colonial buildings and "huts." Although wooden or cast-iron hospitals, lodgings, residential and administrative buildings, warehouses, and churches (which were on display in models or at a 1:1 scale at large exhibitions) have been known since Gilbert Herbert's 1978 *Pioneers of Prefabrication*, they are rarely treated in research. Thus, Herbert's book is still a valid reference. He explained how prefabrication techniques, infrastructure, and logistics of knowledge and materials had facilitated the colonization of the British Empire with simple timber-cut and wooden-framed huts transported overseas from the eighteenth century on.[17] With the first replicable house of the type of the Manning Portable Colonial Cottage for Emigrants, prefabrication became an industry.[18] Apparently, owing to a lack of sources, it cannot be said in general how they looked but

Herbert concluded that they resembled rudimentary English farmhouses.[19] However, some picture sources do exist. Peter Minosh recently published a view of Granville Town, founded in 1787 by the Black Loyalists on a peninsula in the Sierra Leone River.[20] In a 1791 watercolor by John Matthews, about a dozen prefabricated houses can be seen on a fire-cleared site. They are simple single-story dwellings with gable roofs.[21] Here we have an example of the conventional beginnings of a colony at the very start of industrialized prefabrication in the eighteenth century.

Granville Town was forcibly dissolved as early as 1790.[22] Herbert did mention that colony, but only the buildings ordered later by the British Sierra Leone Company in 1792 for Freetown, as the settlement was called then; he does not, however, refer to the settlement of the Black Loyalists.[23] It can be concluded that this perpetuated a narrative according to which Europeans settled Africa with the help of their prefabrication technology, whereas it was not available to Africans or American slaves, meaning they had no part in it.

Sixty years later, however, exhibition hall, "hut," model home, and colonial building were all present in London's Hyde Park, displaying maybe for the first time an in situ image of the empire and the colonies, offering, as Jonathon Shears puts it, "Britain an opportunity to reflect on her position in a global context."[24] Further, exhibition palace and colonial building also went together on the construction level: Herbert argued that in the rationalization of the construction and erection process, the palace resembled prefabricated buildings for the colonial market.[25]

## Examples of Prefabricated Exhibition Buildings as Halls, "Huts," and Houses

### 1. Great Exhibition of the Works of Industry of All Nations, London, 1851

The hall, designed by Joseph Paxton and engineers Charles Fox and John Henderson, was a famously standardized prefabricated structure of cast-iron column and frame construction with inset glass and wood panels that surpassed the size and engineering of railroad stations and greenhouses. At the same time, it was less complex than these. There was no need for facilities for handling passengers or for the hot water tanks for plants from the global South that Paxton had previously constructed. However, in this case, it was important to regulate the circulation of visitors among exhibits and provide a good overview from the galleries.

As just outlined, the glass palaces were to some degree shaped by colonial expansion and the innovations in industrial prefabrication that accompanied

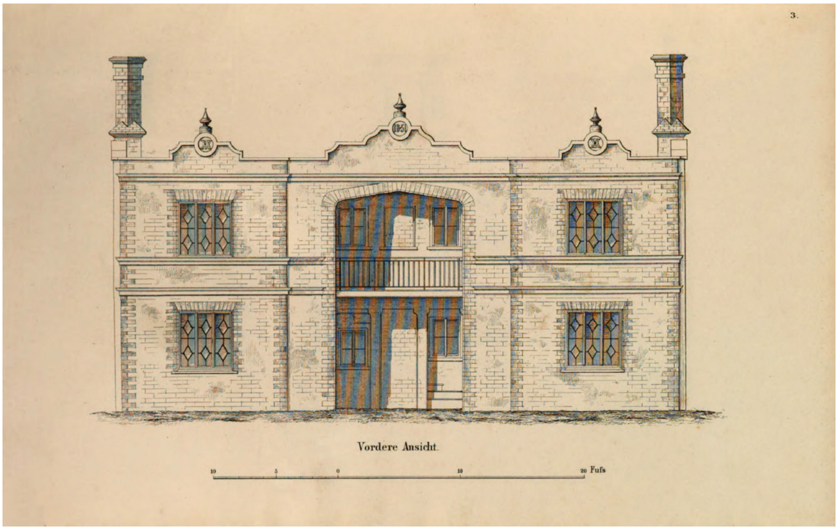


**Fig. 8.1.** Henry Roberts, *Model House for the Class of Manufacturing and Mechanical Operatives*, colored print, 1851. *Das Musterhaus für Arbeiter-Familien*, Potsdam 1852, plate 3.

it. But they also benefited from "colonial botany."[26] Paxton constructed his greenhouses to grow "exotic" plants, which he and his employer, the duke of Devonshire, obtained by sending out "expeditions round the world for new and exotic flora."[27] He built the Great Stove at Chatsworth, which Queen Victoria visited in 1843.[28] In 1849, for the successful cultivation of a large Amazonian water lily called *Victoria Regia*, he constructed a greenhouse with a hot water tank and famously developed the Paxton gutter, which he patented in 1850, setting the stage for the design of the Crystal Palace in the same year.[29] In this way, Paxton, Henderson, and Fox succeeded in gathering the empire's material culture in a single building. The size of the Crystal Palace grew out of the exhibitors' wishes and took the trees that were rooted there into account. It was to be 800,000 ft$^2$ (74,322 m$^2$) and fireproof.

The Great Exhibition model house was in Prince Consort Albert's exhibition section but stood across the street from the Crystal Palace on the site of the Kensington Barracks between flat-roofed military buildings (fig. 8.1). The builder was Henry Roberts, the honorary architect of the Society for Improving the Condition of the Laboring Classes. Construction workers built it of hollow brick "for four families of the class of manufacturing and mechanical operatives."[30] The two-story house, roofed with flat brick arches, was extendable sideways to a row and upward (by reinforcing its load-bearing walls) to three


**Fig. 8.2.** World Exhibition Vienna: *Transportable Iron Dwelling for English Workers. After a Drawing by L. V. Elliot*, 1873, Print. *Leipziger Illustrirte Zeitung*, November 8, 1873, no. 1584, p. 349.

or four stories for twelve families. This exhibit clearly demonstrated the construction and social features of prefabrication: its standardization and expandability and its function in combating housing shortages.[31] Moreover, the role of modern architectural communication also became clear, for Roberts was also a communicator in regard to his house and wrote a handbook about. It was visited by 250,000 people during the Great Exhibition.[32]

Other important factors for architectural communication at the Great Exhibition included the numerous models. The catalog lists "iron model cottages, the model of an emigrant's house, dwellings for the industrious classes, […] for artizans, the model of a house from Nepal, the Model of an Indian House, with native furniture, implements, &c. (articles numbered 1 to 28 inclusive), the Model of a Birch Indian's house and family, a house model from Trinidad [seemingly the mentioned Semper's *Hut of the Caribbean*]", and as illustrative material "views of Burra Burra mine and smelting-house, and of the township."[33]

At the 1873 World's Fair in Vienna, another British model house for working-class families, which resembled the traditional cottage but presented a further development in technology, was on display. Called the Transportable Iron Dwelling for the English Working Class, which was obviously operated as a Tea House (fig. 8.2), it may also have been intended for a warmer climate because of the cross-ventilation in its attic and the fan on the roof.

## 2. General Exhibition of German Industrial and Commercial Products, Munich, 1854

The prefabricated iron and glass exhibition hall as a representation of empire was adopted and further developed. The second British glass palace was built in Dublin in 1852, a third in New York in 1853, and the first one on the Continent followed a year later in Munich. It housed the Allgemeine Ausstellung deutscher Industrie- und Gewerbs-Erzeugnisse (General Exhibition of German Industrial and Commercial Products) by Deutscher Zollverein (German Customs Union) and was modeled on the London Crystal Palace. Munich architect Jakob Kreuter, who had studied Paxton's greenhouses for a conservatory in Munich and introduced his ridge and furrow system there, was responsible for this transfer of knowledge.[34] However, the Glass Palace of Munich was created and erected by architect August von Voit and engineer Ludwig Werder. Its hall was 800 ft long (234 m), 160 ft wide (47 m), and 80 ft high (23.5 m). This made it nearly half as long as the London Crystal Palace and one-third as wide. Built in just eight months, it was visited by nearly two hundred thousand people in the summer of 1854.[35] There were 7,000 exhibitors in 208,000 ft$^2$ of space (the galleries included).[36]

The economic power of the joint trading zone called the German Customs Union, founded in 1834, was the third largest in the world behind that of the British Empire and the United States. Nevertheless, it avoided expansionist representation in the exhibition in Munich and did not display colonial architecture. These were represented only indirectly through their production of raw materials. Nor was housing a theme: we do not know of any corresponding exhibits or even model houses.

Governments of countries that were to be won over to the German Customs Union were invited to participate in the "nonprofit enterprise" and to exhibit the "expression of federal sentiments."[37] The Munich hall was thus a manifestation of a supranational enterprise with a powerful staging of the common economic zone, which was intended to tie in with the representation of empire and to present itself as a "metropolis" even if it was without a "periphery."

After previous industrial exhibitions in Berlin and Vienna, the General Exhibition of German Industrial and Commercial Products was the first large exhibition in the German-speaking world for which a hall of glass and cast-iron assembly construction was built.[38] Subsequently, Berlin and Vienna remained the centers of the German-speaking countries for hosting world and national exhibitions; meanwhile, owing to its Glass Palace, Munich became the venue for famous special exhibitions, especially of arts and crafts.

## 3. German National Arts and Crafts Exhibition, Munich, 1888

In 1888, one year before the Paris World's Fair discussed here, the Bavarian Arts and Crafts Association planned its second German National Arts and Crafts Exhibition, after the first one in 1876. However, the Glass Palace was already occupied by the Munich Artists' Cooperative. Thus, the Arts and Crafts Association planned a temporary development of a site on the Isar River.

The National Arts and Crafts Exhibition developed an important format that was reproduced three times: in 1876 and 1888 in Munich, and in 1906 in Dresden. A year later, members of the Dresden exhibition committee founded the Deutscher Werkbund, which held its first large exhibition in Cologne in 1914. Moreover, as is well known, it also hosted further Werkbund exhibitions in Breslau, Brno, Vienna, and Stuttgart, where model Werkbund housing estates were created. The now world-famous Weißenhof housing estate in 1927 was displayed on the occasion of the Werkbund exhibition *The Apartment*. However, the 1888 Munich exhibition, a distant ancestor of *The Apartment*, featured not model houses but rather elaborately staged and fully furnished rooms for the new consumer class.[39]

The four-hundred-meter-long exhibition building by architect Emanuel von Seidl was planned as a prefabricated, iron-clad structure but was ultimately made of wood and completed within six months.[40] It consisted of a sequence of buildings divided into halls, galleries, restaurants, and gates, which formed a river promenade on the narrow site. Built in the Neo-Rococo style popular in Bavaria at the time, it had the appearance of a pleasure palace. With its simulated stone architecture and its portals with high semicircular arches and figuratively decorated supraports, it resembled the Parisian World's Fair palaces.

The most important exhibits of its thirty exhibition departments were furnished rooms, which, together with the stately style of the palace, characterized a new bourgeois lifestyle. While sumptuous Neo Rococo–style cabinets were on display for the nobility, the bourgeois rooms displayed "old German" Neo-Renaissance style with coffered ceilings, bulky wooden furniture, and heavy carpets.[41] Two exceptions referred to the future, to "Maschinenmöbel" (Machine Furniture) by Richard Riemerschmid and to "Deutsche Werkstätten" (German Workshops) at Hellerau, the first industrialized furniture from the circle of reform architects, exhibited in Dresden 1906. In 1888, these exceptions were a Chinoiserie-style room with "Bamboo-like Furniture," also produced near Dresden, and a plain "Hunting Room" painted in oil colors. They seem to have been early representatives of exotic or folkloric displays, simply constructed with modest ornamentation, anticipating modern design.

The furniture in the hunting room featured plant and animal motifs in strong color contrasts painted on wood. The ornament was no longer applied to the construction, but painted on it (so, as a next step, it could also be removed, as was the case with Riemerschmid's "Machine Furniture"). Its producers (one known as C. Graff) can be counted among members of the early German (before 1900) reform movement, whose center was initially in Munich but then spread to many cities. Dresden, with the founding of the Deutsche Werkstätten, was among them.

Industrial prefabrication in furniture manufacture as well as in architecture, especially industrial architecture, was a prominent theme in the conflict over the position of artists, architects, craftsmen, and producers in the production process. The Werkbund here took a stand for mechanized production together with the so-called process of a "spiritualization of German production,"[42] meaning that creation was guided by the artist or the architect.

However, machine-made furniture and finished (petty bourgeois and working class) homes were products not only of the reform-oriented Dresden workshops, but also—as in Great Britain—of a German prefabricated construction industry that had been growing since the eighteenth century, was active in colonization, and sought its sales at large exhibitions such as in Dresden (see fig. 8.6).[43]

## 4. Exposition universelle, Paris, 1889

At the World's Fair in Paris in 1889, architect Charles Garnier organized the exhibition *L'Habitation humaine* with forty-four "prehistoric" residential buildings on the Quai d'Orsay, with the Eiffel Tower in the background.[44]

This composition of "civilized" and "primitive" societies—in architectural translation, tower and "hut"—was also staged in Dresden in 1900 (see fig. 8.5). It illustrated a binary design of the sites of world exhibitions that was legitimized by racism: the prefabricated, standardized monumental building here and the "stone buildings" of the "developed" peoples made of wood and plaster as well as the "huts" and "tents" of the supposedly prehistoric peoples built of natural materials there. Garnier and his coauthor, art historian Auguste Ammann, justified this bias in their role as mediators in their accompanying book *L'Habitation humaine*:

> While the peoples of the white race, during long centuries, for the progressive development of the all-embracing civilization of mankind, were undergoing hard and continuous labor, and at the same time improving their dwellings, the other races shut themselves up in selfish isolation, and took no part whatever in the great work of universal usefulness.[45]

Among these peoples, Garnier and Ammann assign civilizability to the Chinese, the Japanese, and the inhabitants of Peru, Central America, and Mexico, but not to the Eskimos and the inhabitants of Equatorial Africa and Australia, who "could never get out of barbarism by their own efforts."[46]

There were, moreover, buildings of the "own" French past, namely "Germanic" and "Gallic" wooden buildings. The difference in the "hut" was that, as Garnier and Ammann wrote, the prehistoric period had not yet ended for "peoples outside the general development."[47] This expository order and its "othering" reflected racial thinking in colonialism: a model of progress in which not everyone can participate, as Irene Cheng has pointed out in light of the exhibition.[48]

## 5. German Trade Exhibition and Colonial Exhibition, Berlin, 1896

The German Trade Exhibition in Berlin was also characterized by the binary spatial design consisting of the sections of civilized peoples at the *Hauptausstellung* (*Main Exhibition*) and in *Old Berlin*, underdeveloped peoples at the *Special Exhibition Cairo* and the *Arab City*, and peoples with little capacity for development at the *German Colonial Exhibition*. It had 7.4 million visitors in an area of 1.1 million m$^2$ on the southern bank of the Spree, where Treptow Park had been located since 1882. An east-west axis formed by a lake and the prefabricated main hall by Bruno Schmitz, covered with orientalized and romanesque ornaments, divided the exhibition park. There, the latest machines, materials, weapons, equipment, and building materials were exhibited. According to the exhibition rules the exhibiting companies had to be German, had to run an office in the imperial capital, or had to conduct colonial trade. Several villages were located in the southeastern part. Their models were at the Paris World's Fairs of 1867 and 1889 and at Chicago's World's Columbian Exposition of 1893. The implementation of segregated space at the Colonial Exhibition is an example of the colonization of the "metropolis" as well as the "periphery."

The Colonial Exhibition had a *Scientific Section* devoted to the colonial masters with prefabricated residential and administrative buildings converted for the exhibition, such as the Tropical House of the Christoph & Unmack company (fig. 8.3).[49]

Its *Ethnographic Section* put the inhabitants of the colonies and their artificial "huts" on display. Here, along the exhibition path, villages of various colonized groups were arranged in an elementary style of construction: the *Cameroon Village* and the *Togo Village*, as well as an *Ancestral House* and a *Tree House from Neu-Mecklenburg* (now Latangai Island) and replicas of *House Types from Kaiser-Wilhelmsland* (now Papua New Guinea). The 60,000 ft$^2$ colonial exhibition was

**Fig. 8.3.** Colonial Exhibition, Berlin Trade Exhibition, 1896, *Scientific Department*, Collotype Panel, photographer unknown. Arbeitsausschuss der Deutschen Kolonial-Ausstellung (ed.), *Deutschland und seine Kolonien im Jahre 1896*, Berlin 1897, p. 67.

"inhabited" by 106 colonized women, children, and men from ten societies in Africa and the South Seas recruited and paid for "exhibiting" daily life, customs, costumes, and crafts.[50] A process of self-representation also occurred in the *Cameroon Village*, in which the exhibited people themselves became viewers. The king's son Bismarck Bell (Kwelle Ndume) bought himself an opera glass and used it to look back at the visitors to the exhibition.[51] With the exception of the *Village of Tarawai* from the Bismarck Archipelago,[52] the villages had not been designed or built by the displayed people, but by Rudolf Hellgrewe, a painter of Marchean and colonial African landscapes, and by Fritz Wolff, professor of architecture at the Technische Hochschule zu Berlin in Charlottenburg.

*Old Berlin*, which was one-third the size of the Colonial Exhibition, was a village built in heavyweight construction in the styles of Brick Gothic and German Renaissance. It contained replicas of a Berlin church, demolished city gates, a marketplace, and a suburb of huts.[53] The centerpiece was the old town hall, demolished only in the late 1860s, with an addition of the original medieval courthouse arbor. The architect was Karl Hoffacker, a professor at the Royal School of Art in Berlin, who built the entire village from wood and brick, incorporating spolia of historic houses. He had already participated in the Munich exhibition in 1888. Many merchants, caterers, and employees entertained and served visitors in period costumes in the 120 buildings.[54] Unlike the colonized people, the workers of *Old Berlin* were clearly recognizable as employees because of their costumes, as every visitor was familiar with the contemporary clothing of these, moreover, white people. However, the status of colonized "population" as modern employees was obscured, as it was mandatory that they not wear Western clothing. It is unlikely that the German visitors knew what kind of clothes were worn in the colonies, so this must have given the impression that the colonized people were wearing their everyday clothes and not costumes. It was the members of the Herero people who performed an act of self-assertion and resisted the exhibition regime by wearing their Western clothing and carrying their weapons.[55]

In *Old Berlin*, which represented the city in a historic, nonetheless familiar guise to the Berliners, employed women had a subaltern status. They worked in partly unprotected jobs and, as the Social Democratic newspaper *Vorwärts* wrote, found themselves forced into prostitution.[56] There was also criticism that the proletariat and precarious working conditions remained invisible at the trade exhibition, even though it featured the popular symbol of the proletarian fist and hammer on its poster.[57] The liberal politician Friedrich Naumann complained in his *Exhibition Letters*, "One house is missing from the exhibition, the house of labor."[58] Naumann was one of the founding members of the Werkbund and involved in the Third Arts and Crafts Exhibition in Dresden in 1906. Here, for the first time, a *Workers' House* was on display, solidly constructed by the renown modernist architect Max Taut.[59]

## 6. German Building Exhibition, Dresden, 1900

The first building exhibition of that name took place in 1900 in the permanent exhibition palace with park in the Great Garden, including an *Amusement Park*. As in London and Munich, but now permanent, the hall had been built on royal park land. Temporary structures stood in the exhibition park on the occasion of the Deutsche Bauausstellung (German Building Exhibition): among them a mobile model house for lottery, ready to be taken home by the winners (fig. 8.4). It resembled Christoph & Unmack's homes in its beam construction, vernacular ornamentation in contrasting colors, and cantilevered dwarf roof, which the firm produced until the 1930s.

The *Amusement Park*, with its dominant Reichsbau (Imperial Building) on a central axis flanked by pavilions, was separated from the main exhibition by the Botanical Garden plot, following the binary spatial design of the World's Fairs, and divided into sections designated as "modern" and "Roman-Germanic" (fig. 8.5).

The exhibition train went there through a tunnel and stopped under the terrace of the *Reichsbau*. This prefabricated tower appears to be a frivolous version of Wilhelmine monuments such as the *Kyffhäuser-Denkmal* (Kyffhäuser

**Fig. 8.4.** Theodor Lehnert/Georg Heinsius von Mayenburg, Lottery House, Dresden, 1900, photographer unknown. City Archive Dresden, Hist. Dresd. 1746.

**Fig. 8.5.** F. Drechsler, Amusement Corner, 1900, photographer unknown. City Archive Dresden, Hist. Dresd. 1746.

Monument), which was also designed by Bruno Schmitz. Here the visitors arrived at the *Modern Square* with the pavilions for art, industry, agriculture, shipping, and trade fantastically decorated in Art Deco and Art Nouveau. There was also a colonial building set back from the axis. Imitations of Chinese temples and pagodas, it included a large restaurant run by white employees in corresponding costumes. Entering the entertainment corner not by train but through its main entrance, the *Germanic Gate*, one stood on the *Germanic Campground*, complete with *King's Hall*, *Siegfried's Forge, Hunting's Hut*, and a *Roman Fort*. As at the 1889 World's Fair for the French, the historic "stone buildings" of "developed" peoples made of wood and plaster, together with the prefabricated, monumental building, represented the Germans' proud past and looked toward their future progress.

The German Building Exhibition was the first edition of a type that became so successful in Germany. Although greatly changed in the following decades, later Building Exhibitions are nevertheless comparable. The German Building Exhibition Berlin 1931, and the *Interbau 57* exhibited the hierarchical structure of a central hall and scattered small buildings in a park, national pavilions, villages (then transformed into settlements), a railroad, and even a tower. The tower in Berlin was the *Merobau* 1957 by Günter and Barbara Günschel at *Interbau Industrial Fair*. An especially high church tower in the Tiergarten park can also be thought of as an exhibition tower that was visible from afar.

For the organizers in Dresden, the *Amusement Park* was an ambivalent matter. They confessed, "Nevertheless, we do not want this to be the last and lasting impression that the visitor […] takes away with him." They went on, "Of course [everything] could only be made from substitute materials. We are thus moving here in an illusory world." Yet they judged it to be "modern": "thus one sees here with astonishment what modern architecture is capable of achieving in the field of construction."[60] It was modern because of its technology, but, one concludes, also because of its connection to large exhibitions where there was experimentation with such technologies. The flexible industrialized construction with replaceable facade could divide the World's fairs, as in London, Paris, Vienna, and Chicago, into modern, historic, and colonial connotated spaces. The building exhibition inherited this way of space-making while possessing all the necessary architectural types that were required for it: hall, tower, colonial building, "hut," model dwelling, pavilion, and village (later settlement). Its organizers practiced, as demonstrated for Dresden, "othering" through colonial buildings and white employees in exotic costumes.

## Outlook

Apart from his *Workers' House* from 1906, Taut's work as an exhibition architect includes the towering *Werdandi Hall* at the International Building Exhibition in Leipzig in 1913 in the shape of an upright rectangle. The height of the hall was only topped by the *Monument to the Battle of the Nations* in the background. This ninety-one-meter-high, tower-like building with a huge base, a broad, upwardly tapering shaft, and a large dome was also built by Schmitz. After a construction period that lasted fourteen years, the monument, which was made of concrete, steel, and stone, was inaugurated in 1913 to mark the centenary of the Battle of the Nations against Napoleon. Taut's prefabricated hybrid of hall and tower was erected quickly by Christoph & Unmack using wood, cement, and tar. The client was the *völkisch* Werdandi-Bund, and Annette Menting emphasizes the fact that its members, among whom were Werkbund people, preferred substitute materials and the open display of components on the *Werdandi Hall*.[61] As with Schmitz's buildings, this was apparently still frowned upon in Dresden. The *Werdandi Hall* represents a step on the road to the introduction of prefabricated architecture in Germany. In showing its construction to the outside, it set an example for the

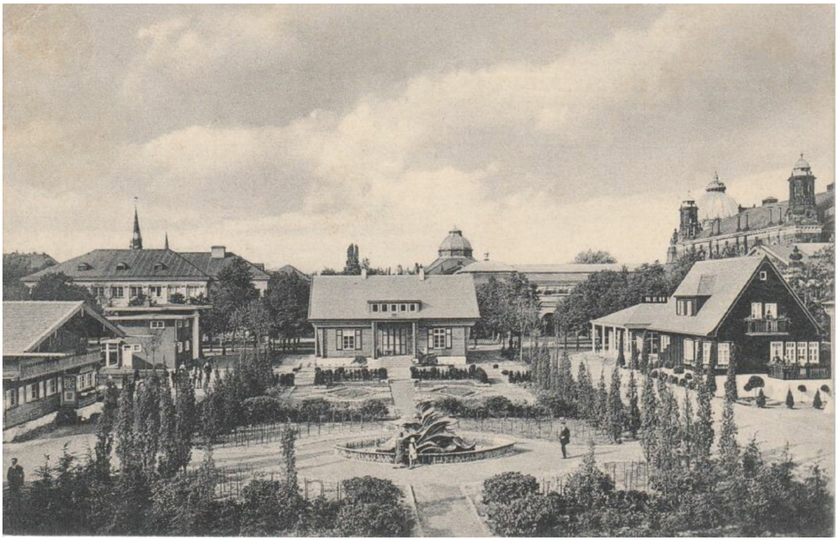

**Fig. 8.6.** Annual Show of German Work, Dresden, 1925, from left to right: Log cabin *Partenkirchen* by Johann Mund, *Slab house 1018* by Bruno Paul, log cabin *Reichenbach* by Albinmüller, weekend house by Paul Wolff, photographer unknown. Postcard, https://sachsen.museum-digital.de/object/28364. Accessed 6/12/2022.

industrialization of modern architecture. The free-standing experimental timber construction still quoted the classic column vocabulary of plinth, shaft, and capital. However, like the early skyscrapers in the United States and in Germany, it transferred it to the monumental dimension.

During the next two decades, Christoph & Unmack, the Deutsche Werkstätten, and the Höntsch company from Dresden cooperated not only with Taut but also with other representatives of modern architecture such as Hans Poelzig, Henry van de Velde, Albinmüller, Bruno Paul, and Konrad Wachsmann. By collaborating with influential architects, the Saxon construction companies were also able to distinguish themselves in the 1920s at large exhibitions such as the Annual Show of German Work in Dresden in 1925 with model apartment buildings. The industrialized timber constructions for mass fabrication were designed in both conventional and experimental ways (fig. 8.6).

Walter Gropius, who developed his own industrialized prefabrication systems with steel frameworks and infill materials developed by the innovative chemical industry, exhibited a residential building made of prefabricated elements at the Weißenhof in 1927. Ernst May, together with Margarete Schütte-Lihotzky, built a deliberately unfinished *Siedlungshaus* in the Frankfurt prefabricated building system made of pumice concrete slabs there.[62] At *Interbau 57*, the single-story flat-roofed atrium houses for middle-class families were prefabricated from concrete slabs by the French company Siporex by architects Arne Jacobsen, Eduard Ludwig, Johannes Krahn, and Gerhard Weber.[63]

## Conclusion

Exhibition palaces were a new type of building based on a novel method of construction. They were derived from large railroad stations and greenhouses. However, with the premiere building known as the Crystal Palace, they immediately acquired their own symbolism by representing the new type of world exhibition. This uniqueness was matched only by the exhibition towers, where the Eiffel Tower achieved the same fame as the London building. They were socially highly significant as representations of imperial world power.

In comparison, the type of prefabricated dwelling made an only modest mark in the world's fairs. Its social significance came from welfare efforts on the part of the exhibition-organizing power: the first model apartment house was assigned to the Prince Albert Exhibition Department (and was solidly walled). The type gained importance only at the special exhibitions, which were developed around 1900. In the ensemble as a historical or contemporary village, the model house acquired social significance for the petty bourgeoisie and the working class. With the village as an imagined "native village" for the colonized subjects in demarcation from whites, the exhibition actively engaged in "othering" and abetted the "construction of ethnicity."

On the question of the significance of prefabricated construction, it can be concluded that it enabled the innovations necessary for holding large-scale exhibitions and, at the same time, made it possible for organizers to work within their time and financial limitations. Furthermore, it "translated" permanent buildings of different periods, regions, functions, construction methods, and even societies into exhibition architectures and staged social stratification and imageries of national identity.

Prefabricated housing architecture accompanied social change in industrial societies, which was demanded and driven by various societal forces. Innovations were thus often encouraged. If this intention to modernize had been lacking, technology alone could not have combated unjust social conditions and would have often stagnated along with them.

## Notes

1. Itohan Osayimwese argued in her speech at the awarding of the Schelling Prize 2020 that "hut" is a pejorative attribution by the colonizers to non-European, non-Western residential architecture, see Itohan Osayimwese, "Herman Frobenius and the History of African Architecture in Translation," filmed September 2021 at Schelling Architecture Foundation 2020 Award Ceremony, Karlsruhe, video, 1:10:04, accessed November 29, 2023, https://www.youtube.com/watch?v=9IqsAjr46GM.
2. Cf. Anne Dreesbach, *Gezähmte Wilde: Die Zurschaustellung "exotischer" Menschen in Deutschland 1870–1940* (Bielefeld: transcript Verlag, 2005).
3. Cf. Gottfried Semper, "Urelemente der Architektur und Polychromie: Ueber architektonische Symbole," in Manfred and Hans Semper, eds., *Gottfried Semper: Gesammelte Schriften*, (Berlin, 1884), vol. 4 of the reprint ed. by Hendrik Karge, *Kleine Schriften* (Hildesheim: Georg Olms Verlag, 2008), 292–303, 294; cf. Harry Mallgrave, *Gottfried Semper: Architect of the Nineteenth Century* (New Haven, CT: Yale University Press, 1996), 197–98.
4. *Official Catalogue of the Great Exhibition of the Works of Industry of All Nations*, by Authority of the Royal Commission, fourth corrected and improved edition (London: Spicer Brothers, 1851), 176, accessed November 29, 2023, https://www.e-rara.ch/zut/doi/10.3931/e-rara-79118.
5. Cf. Bart Pushaw, "'Our Country Has Never Been as Popular as It Is Now!' Finland at the 1900 Exposition Universelle," in David Raizman and Ethan Robey, eds. *Expanding Nationalisms at World's Fairs: Identity, Diversity, and Exchange, 1851–1915* (New York: Routledge, 2018), 130–46.

6. This admittedly reductionist view, which is also due to the short format of the essay, leaves little room for the problems that arise in the process of representation and only opens up a few possibilities for revealing the self-representation of the marginalized, which, moreover, is rarely handed down.
7. In addition to the older terms "motherland" and "colony," historians also use the terms "metropole" and "periphery" or "peripheral" societies. Cf. Jürgen Osterhammel, *Kolonialismus: Geschichte, Formen, Folgen* (Munich: C. H. Beck Verlag, 2001), 19.
8. Henry Mayhew, *1851, or The Adventures of Mr and Mrs Sandboys and Family, Who Came up to London to Enjoy Themselves, and to See the Great Exhibition*, Illustrations by George Cruikshank, London 1851, frontispiece, accessed November 29, 2023, https://www.gutenberg.org/files/65234/65234-h/65234-h.htm#frontis.
9. See Itohan Osayimwese, *Colonialism and Modern Architecture in Germany*, Series Culture, Politics, and the Built Environment (Pittsburgh: University of Pittsburgh Press, 2017), especially the chapters "Expositions in German Colonialism and German Architecture" and "The Colonial Origins of Modernist Prefabrication."
10. Ibid., 21.
11. Ibid., 206–10.
12. ICOMOS Suisse, Arbeitsgruppe System & Serie, ed., *System & Serie: Systembau in der Schweiz – Geschichte und Erhaltung* (Zurich: gta-Verlag, 2022).
13. Ibid., 5.
14. Cf. Stanislaus von Moos, *Erste Hilfe: Architekturdiskurs nach 1940. Eine Spurensuche* (Zurich: gta-Verlag, 2021), 95–185.
15. The literature on the Crystal Palace is almost impossible to survey, but these statements from architectural historiography, e.g., are worth highlighting: "[The Crystal Palace] has far more in common with the architecture of our day than with that of its own." Cited after: Henry-Russell Hitchcock and Philip Johnson, *The International Style* (New York 1932), 2nd rev. ed. (New York: W. W. Norton, 1966), 22; "The Crystal Palace, though ultimately a fragile structure, changed architectural history […]." Cited after: Christian Freigang, *Die Moderne. 1800 bis heute. Baukunst, Technik, Gesellschaft* (Darmstadt: WBG, 2015), 136 (translation by the author).
16. Cf. John McKean, *Crystal Palace: Joseph Paxton and Charles Fox*, Series Lost Masterpieces, introduction by Beth Dunlop and Denis Hector (London: Phaidon, 1994), 25.
17. Gilbert Herbert, *Pioneers of Prefabrication: The British Contribution in the Nineteenth Century* (Baltimore: Johns Hopkins University Press, 1978).
18. Ibid., 9.
19. Ibid., 5.
20. The Black Loyalists were slaves who fought in the Revolutionary Wars on the promise of manumission. They were "repatriated" and founded Granville Town,

see Peter Minosh, "American Architecture in the Black Atlantic: William Thornton's Design for the United States Capitol," in Irene Cheng, Charles L. Davis II, and Mabel O. Wilson, eds., *Race and Modern Architecture: A Critical History form the Enlightenment to the Present* (Pittsburgh, PA: University of Pittsburgh Press, 2020), 43–58, 45 (Matthews's watercolor here as an engraving by William Porter, 46).

21. Ibid., 46.
22. Ibid., 48.
23. Herbert, *Pioneers of Prefabrication*, 6.
24. Jonathon Shears, ed., *The Great Exhibition, 1851: A Source Book* (Manchester: Manchester University Press, 2017), 77.
25. Herbert, *Pioneers of Prefabrication*, 158.
26. Cf. for Germany the brief overview by Lukas Liebich, *Botanik. Universität und Kolonialismus: Das Beispiel Göttingen*, accessed November 29, 2023, https://www.goettingenkolonial.uni-goettingen.de/index.php/disziplinen/botanik.
27. McKean, *Crystal Palace*, 13.
28. Ibid., 14.
29. See *Victoria amazonica*, accessed November 29, 2023, https://en.wikipedia.org/wiki/Victoria_amazonica; "he constructed a greenhouse": McKean, *Crystal Palace*, 15.
30. Ibid., 6.
31. S. Martin Gaskell, *Model Housing: From the Great Exhibition to the Festival of Britain* (London: Mansell, 1986), 19–23.
32. *Das Musterhaus für Arbeiter-Familien: Auf Befehl seiner Hoheit des Prinzen Albert im Jahre 1851 auf der Grossen Ausstellung in London erbaut von Henry Roberts* (Potsdam: Verlag von Ferdinand Riegel, 1852).
33. *Official Catalogue*, 1851, 32, 46, 158, 174, 178, 177.
34. Christoph Hölz, *Der Civil-Ingenieur Franz Jakob Kreuter: Tradition und Moderne 1813–1889*, edited in cooperation with the Förderkreis Roseninsel Starnberger See e.V. (Munich: Deutscher Kunstverlag, 2003), 258–59.
35. *Amtlicher Bericht über die allgemeine Ausstellung deutscher Industrie- und Gewerbs-Erzeugnisse zu München im Jahre 1854*, von der zur Einleitung und Durchführung bestellten Commission veröffentlicht (Munich: Verlag von Georg Franz, 1855), 262–305.
36. Ibid., 45.
37. Ibid., 25. Altogether thirty-two states and cities took part.
38. Cf. Christoph Hölz, "Glaspalast," in Winfried Nerdinger, ed., *Zwischen Glaspalast und Maximilianeum. Architektur in Bayern zur Zeit Maximilians II. 1848–1864*, exhibition catalog (Munich: Architekturmuseum der TU München, 1997), 120–25, 121.

39. I discuss the legacy of Arts and Crafts exhibitions for building exhibitions in my so far unpublished habilitation thesis: "Ephemerpermanent. Eine Architekturgeschichte großer Ausstellungen" (unpublished habilitation manuscript, April 30, 2024), Microsoft Word file.
40. Cf. Joanna Waltraud Kunstmann, *Emanuel von Seidl (1856–1919). Die Villen und Landhäuser* (Munich: Scaneg, 1993); "Die Ausstellungsbauten," in *Chronik der Deutsch-Nationalen Kunstgewerbe-Ausstellung in München 1888*, commissioned by the Directorium and ed. by Paul von Salvisberg, no. 2/3 (Munich: Verlag der Academ. Monatshefte, 1888/1889), 52–54.
41. Cf. Paul Naumann, *Möbel und Zimmer der Deutsch-Nationalen Kunstgewerbe-Ausstellung München 1888* (Dresden: Gilbers'sche Königl. Hof-Verlagsbuchhandlung, 1889).
42. Frederic J. Schwartz, *The Werkbund: Design Theory and Mass Culture before the First World War* (New Haven, CT: Yale University Press, 1996), 107.
43. On the German prefabrication industry, German colonialism, and the furniture industry, see Osayimwese, *Colonialism and Modern Architecture in Germany*, 2017, 206–10.
44. Cf. Beat Wyss, "Anthropologie als Herrschaftswissen," in Beat Wyss, *Bilder von der Globalisierung: Die Weltausstellung von Paris 1889* (Berlin: Insel Verlag, 2010), 138–69.
45. Charles Garnier, A[uguste] Ammann, *L'Habitation Humaine* (Paris: Hachette, 1892), 837 (translation by the author).
46. Ibid., 838 (translation by the author).
47. Ibid., 1.
48. Irene Cheng, "Structural Racism in Modern Architectural Theory," in Cheng, Davis, and Wilson, *Race and Modern Architecture*, 134–52.
49. Cf. Osayimwese, *Colonialism and Modern Architecture in Germany*, 196–228.
50. Biographies of 38 of the 106 exhibition participants were compiled in the exhibition project *zurückgeschaut | looking back – Die Erste Deutsche Kolonialausstellung von 1896 in Berlin-Treptow* in Museum Treptow-Köpenick, https://www.berlin.de/museum-treptow-koepenick/ausstellungen/artikel.649851.php.
51. Ibid.
52. Ibid.
53. Katja Zelljadt, "Presenting and Consuming the Past: Old Berlin at the Industrial Exhibition of 1896," in *Journal of Urban History* 31, no. 3 (2005): 310.
54. Ibid., 310, 325–28.
55. Ibid.
56. "Waitresses in Old Berlin," in *Vorwärts*, no. 3 (June 20, 1896), cited after Zelljadt, "Presenting and Consuming the Past," 322.
57. Zelljadt, "Presenting and Consuming the Past," 324.

58. Friedrich Naumann, “Berliner Gewerbe-Ausstellung 1896,” in Friedrich Naumann, *Ausstellungsbriefe Berlin/Paris/Dresden/Düsseldorf 1896–1906*, Bauwelt Fundamente no. 137 (Basel, Boston, Berlin and Gütersloh and Berlin: Bauverlag, 2007), 16–45, 41 (translation by the author).
59. Cf. Annette Menting, *Max Taut: Das Gesamtwerk* (Munich: Deutsche Verlagsanstalt, 2003), 24–26.
60. Offizieller Katalog der Deutschen Bau-Ausstellung Dresden 1900, July 1900 (Dresden-Blasewitz: Verlag von Alwin Arnold, 1900), 37 (translation by the author).
61. Menting, *Max Taut*, 44.
62. *Offizieller Katalog der Werkbundsiedlung Die Wohnung* (Stuttgart 1927), reprint (Stuttgart: Stuttgarter Gesellschaft für Kunst und Denkmalpflege, 1998), 50, 78.
63. Cf. Gabi Dolff-Bonekämper, *Das Hansaviertel: Internationale Nachkriegsmoderne in Berlin* (Berlin: Verlag Bauwesen, 1999), 126–40.

CHAPTER 9

# The Milan Triennale Exhibitions

## and the Debate on Prefabrication in Postwar Italy

*Ilaria Giannetti and Stefania Mornati*

In the global perspective offered by the present book, the "experimental" conceptualizations, production methods, and prototypes showcased at the Milan Triennale Exhibitions constitute a significant case study for exploring the impact of prefabrication on modernist architectural languages, focusing on the relationship between the technological advances and design processes, at the scale of the single construction system.

In the aftermath of World War II, rebuilding as fast as possible was a priority in most of Europe, and applying the patterns of industrial processes to building appeared to be the best approach in terms of both efficacy and cost. However, owing to frequent clashes between private enterprise and public policy in regard to the societal and economic issues involved in urban planning, building industrialization in Italy was a delayed and less systematic process than elsewhere in Europe. Nevertheless, experimentation and the spread of information about new construction methods played a vital role in architectural culture in Italy. The exhibitions of the Milan Triennale, an institution founded in 1923 by Giovanni Marangoni, were the principal showcases for experiments in Italian postwar prefabrication.

The first Triennale exhibition—the International Exhibition of Decorative Arts—opened in 1923 at Villa Reale in Monza. The event planners' primary goal was to promote links between the new artistic trends and the world of industry. This initiative, at first scheduled every two years, immediately gathered eminent personalities around it. From 1930 on, it has been known as the International Triennial Exhibition of Modern Decorative and Industrial Arts, becoming a triennial event. In 1933, the venue was moved to the Palazzo dell'Arte in Milan, specially built according to a design by Giovanni Muzio. Interrupted by the wartime events in 1940—and with it, the series of competitions, conferences, and collateral events—the Trienniale was resumed in 1947 and, albeit at irregular intervals, continues to this day.

Technological innovation in construction and the relationship between architecture, industry, and urban planning are the themes of the cultural debate that has been fostered by the Triennale since the second half of the 1930s. During the 1940s and the 1950s, the urgency of postwar reconstruction fostered the widening of the architectural section of the exhibition. Within this framework, the Triennale became a showcase for technological experimentation in the construction sector, in line with the intentions of the Milanese construction industry.

In this chapter, we focus on the eighth, tenth, and twelfth editions of the Triennale: the successive exhibitions served to update the state of the art of building prefabrication and industrialization culture in Italy, from the postwar reconstruction to the economic miracle years. The Triennale's historic archive was the key source for our study.

## VIII Triennale: The Mass-Housing Plan

In order to reduce housing costs in the heyday of reconstruction, independent contractors, construction companies, and public bodies and institutions in Italy sought to devise building systems that would be both more efficient and faster. On October 17, 1945, Piero Bottoni, Commissionaire of the Triennale, announced the creation of the *Quatiere dell'Ottava Triennale* (QT8) experimental district within the VIII Triennale exhibition in 1947, which was designed to introduce a suitable state-planned process along the lines of foreign models.[1] The QT8 district featured an area financed by the Ministry of Public Works where fully industrialized construction systems could be tested.

The VIII Triennale bears witness to the vigorous debate on building industrialization to solve the serious postwar housing shortage. The sections on unification, modulation, and industrialization in the Triennale's building exhibition were curated by the architects Paolo Chessa, Ignazio Gardella, Enrico Gentili, Vico Magistretti, and Carlo Rusconi Clerici. As the curators noted, the exhibition, hosted in the Palazzo dell'Arte, highlighted that "house construction has reached the point of inflection between a craft technique and an industrial technique." Furthermore, they elaborated that while the artisan technique "characterized by on-site construction and wet construction… requires long periods to make the house habitable…, the industrial technique allows for the elimination of waste, the reduction of working processes, and high-quality and low-cost products."[2]

The exhibition *Unification, Modulation, and Industrialization* focused on applying an integral industrialization process to housing construction. Although it was based on unification, mass production, and scientific organization, the process was to respect the uniqueness of the architectural work. The curators stressed, "Unification does not mean limiting individual value and freedom but

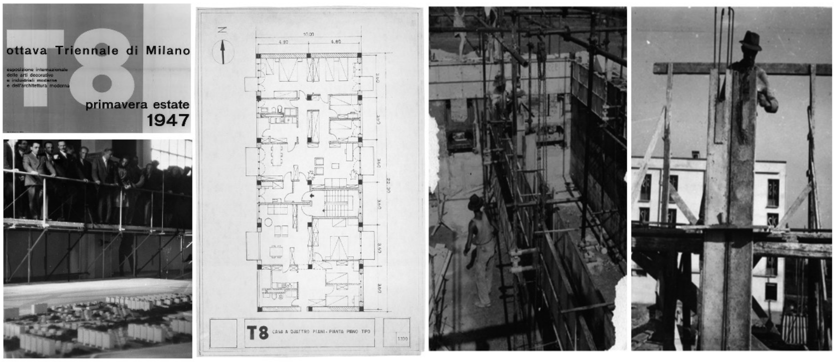


**Fig. 9.1.** Milan Triennale VIII, 1947: Cover of the exhibition catalog, physical model of the QT8 experimental district showed at Palazzo dell'Arte, standard plan of the "prefabricated house," construction site of the Breda-Fiorenzi house and the Gaburri house, 1948. Triennale di Milano-Archivi, Milan.

only coordinating them in the interest of the work of the community."[3] The theoretical approach relied on the exhibition's presentation of a project for a modular wall structure of a housing unit with unified measurements (by architects Carlo Rusconi Clerici, Luigi Frattino, and Luigi Mattioni) together with the 1:1 scale prototype of a prefabricated house by Gabriele Mucci, designed in cooperation with nine other architects, including Ernesto Nathan Rogers, Mario Terzaghi, and Augusto Magnaghi. The purpose of this prototype was to prepare the ground for "the achievement, with modest means, of the best conditions of well-being and civil living," as the architects noted in the catalog of the exhibition (fig. 9.1).[4] From a technological point of view, the prototype demonstrated the application of the PM Bogliardo prefabrication system with double-wall reinforced concrete load-bearing panels and beam elements.[5]

Alongside the Palazzo dell'Arte exhibition, the VIII Triennale inaugurated the construction site of the experimental QT8 district. Only one building type was shown, namely a four-story block consisting of forty-two rooms that had been prefabricated. It was to become the basic framework for the approach—and for comparisons—among different building systems. The funds allocated by the Ministry of Public Works amounted to little over 100 million lire, which allowed for the construction of five buildings.[6] Five systems were chosen for the comparisons. The first was the Breda-Fiorenzi system, which utilized a process of mechanization of concrete casting using metal formworks that could be assembled and lifted by means of Innocenti tube and coupler scaffolding. The second one was the Mariani system, which combined reinforced-concrete hollow elements with post-tensioned cables. This was followed by the Ciarlini system, a hollow cylindrical-pole structure with shelf-shaped elements and prefabricated beams. Then came the Gaburri system, which included a series of three hollow elements—plinths, pillars, and beams—as precast parts with concrete on-site finishing to create a framework structure. The last one was the C.G.T. system, a metal structure devised by architects Aldo Cassinelli, Eugenio Gentili Tedeschi, and Mario Tedeschi, which had not yet been utilized.[7]

The Centro Sperimentale dell'Abitazione (CNR), a research group created at the Milan Polytechnic, was tasked with monitoring the building yard.[8] Owing to inadequate means, only the Breda-Fiorenzi and Gaburri systems were subjected to careful scrutiny: the former afforded the sampling and evaluation of cast-in-place mechanization, and the latter offered the chance to prove it was possible to do without the formworks of the traditional frame system. In contrast, both the Mariani and Ciarlini systems proved to be quite unwieldy, owing to both the choices of the contractors and to some faults in the construction that led to the Mariani building project being aborted.[9]

Construction of the four buildings began in 1947 and ended in 1949. In the same year, the launch of the INA-Casa plan, which linked the construction site to the national blue-collar employment program, cut industrialization out of public housing planning and relegated experimentation to private initiative.[10]

## X Triennale: On Industrial Design

In 1951, the IX Triennale dealt with the subject of prefabrication and industrialization in building. The social benefits of industrialized construction in the context of planning for public housing, proposed at the VIII Triennale, evolved, step by step, into a broader discussion on the collaborative relationship between the world of the arts and industrial production.[11] In 1954, the X Triennale witnessed this shift in the cultural debate on building industrialization. Prefabrication, unification, and industrial design constituted the leitmotif of the event: the lines of research on building technology, in accordance with the industrialization section of the VIII Triennale, were developed, as noted by Ivan Matteo Lombardo, the president of the Triennale, on autonomous authorial and productive initiatives in the context of a "vastly experimental" exhibition of "what has not yet been tested."[12] Within a debate on the role of art in the industrial process, for Lombardo "architecture stands as a moment of perfect correspondence, and almost reversibility, between technique and expression." He went on, noting that "industrial production takes place in the form of industrial 'shape,' as the most appropriate expression … that spontaneously arises in the system, in the utensil, in the mass-produced object when these are consistent with the technique."[13]

In accord with this concept, in addition to the exhibition of construction elements set up in the Palazzo dell'Arte, the most innovative building prototypes were installed in the Parco Sempione. The park was suitably reorganized and arranged by the architect Marcello Grisotti to host the other exhibition sections, including examples of buildings complete with their furnishings, each erected using a different construction system. The focus there was on "the industrialization of the building detail itself and construction in general, with special reference to the single-family home."[14] The construction systems presented—all Italian, except for Richard Buckminster Fuller's Geodesic Dome dwelling—bear witness to the use of experimental construction elements, processes, and traditional systems, enhanced by new production processes and the focus on light prefabrication techniques.

Among the prototypes presented, the engineer Giovanni Varlonga, founder of the FEAL company, presented the so-called *Elemento di casa verticale industrializzata* (Industrialized Vertical House Element): a single-story dwelling—with a floor area of approximately 120 m$^2$ and a floor-to-floor height of 2.90 m—stackable on a steel skeleton. The components of the skeleton were hollow Dalmine steel tubes, I.L.V.A. steel laminates, which were standard products for Italian buildings, combined with atypical construction details (fig. 9.2). The project was drawn up by Varlonga in collaboration with the engineer Fabio Fratti of the FEAL Technical Office and the architect Ippolito Malaguzzi Valeri. The prototype pioneered a unique joint that enabled a mechanical connection between the Dalmine tubes, arranged with spacings of five and two meters, and the horizontal beams of the slabs. The structure was completed by cast-on-site reinforced concrete slabs. The joint could be produced in series as the external diameter of the supporting structure remained constant. The necessary reduction of weight from the upper floors in the multistory version was achieved by reducing the thickness of the lamination. Prefabricated inner walls—of aluminum or wood—were installed after the linoleum floor had been laid. The bathroom-kitchen block was also prefabricated and its windows and sliding doors were made of aluminum. Eraclit panels provided thermal insulation with an air chamber, finished on the outside with light-alloy enameled sheet metal. The main qualities of the system were its economy, its speed of construction owing to the radical reduction of on-site work, its lightness, and the fact that it could make use of components already on the market, for example, the standard components of the steel load-bearing structure. The sample building, considered by the Italian Office of Industrial Patents and Trademarks as one of the most interesting proposals of the exhibition, was the subject of an industrial patent that was filed in 1955.[15]

In a project along the lines of the Varlonga prototype, architects Gio Ponti, Antonio Fornaroli, and Alberto Rosselli proposed a single-family house about

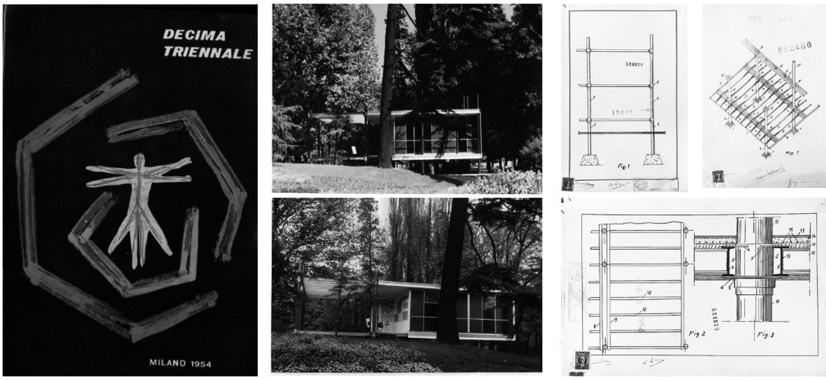


**Fig. 9.2.** Milan Triennale X, 1954: Cover of the exhibition catalog, G. Varlonga. F. Fratti, and I. Malaguzzi Valeri: *Element of the FEAL Vertical Industrialized House* in the Sempione Park, patent of the system. Triennale di Milano-Archivi, Milan.

120 m$^2$ in size. Its metal structure was made of standard steel profiles, exploiting a construction system designed by the engineer Leone Togni.[16] The plan was articulated on staggered floors to underscore the high flexibility of distribution obtained with mass production. The Togni prefabricated block resolved the plant engineering part relating to the bathroom and kitchen.

Architects Lucio Baldassarri and Marcello Grisotti designed several different projects: a prefabricated mountain house, an industrialized country house, and a prefabricated wooden house. They concentrated on innovative construction systems and modifying traditional ones for local or regional solutions in the light of modern technologies. For the prefabricated mountain house model presented at the Triennale, the designers' object was to "technically develop a structure that is as 'universal' as possible."[17] Thus, they employed the thermal-insulating laminated panel by the Salvit company. The use of that panel ensured the join between the two outer asbestos cement layers and the inner asbestos cement-perlite layer. It could be combined with any structural solution to form the envelope for internal partitions and, if supplemented by a cross reinforcement, could also be used for the horizons.

In contrast, for the industrialized country house model, the designers used a load-bearing construction system called ER-Cal, which erected the wall box using a reinforced concrete casting with two Eraclit panels inside to improve the thermal insulation of the walls. The door and window frames were embedded in the casting. A monolithic structure that was erected in a rapid on-site process both served as a load-bearing element and ensured adequate thermal insulation. Baldassarri and Grisotti also exhibited their prefabricated wooden house. The prototype was an example of "integral" prefabrication, using some traditional materials: the wooden truss became the generator module and featured a drawn aluminum carter to provide structural cohesion and protection.

The prototypes discussed here testify more than others to the experimental nature of the X Triennale, which was all about the relationship between the arts and industrial production. This was further emphasized by the experimental character of the Geodesic Dome dwelling by Richard Buckminster Fuller and the Experimental House by architects Mario Ravegnani and Antonello Vincenti in collaboration with the painter Bobi Brunori. The former was made with sheets of waterproofed cardboard; the latter, characterized by a structural module based on an equilateral triangle, featured the assembly of mass-produced elements, demonstrating the possibility of reducing costs while ensuring functional efficiency and aesthetic consistency.

## XII Triennale: The Mass-School Plan

In the 1957 XI Triennale, prefabrication and industrialization in buildings was only a side issue that dealt in a very limited fashion with the developments of the construction sites in QT8. It was not until the XII Triennale in 1960 that industrialization and prefabrication was again a central theme.

In 1958, the Italian government proposed a draft law for a "Ten-Year School Development Plan (1959–1969)." Paragraph 1 of the document was devoted to buildings. In the same year, the Centro Studi della Triennale, together with Ministry of Education technicians, drew up an initial program for the twelfth edition of the Milanese exhibition, which reflected the decision to adopt the thematic exhibition model for the first time.[18] In the framework of the draft of the ten-year plan, the design and construction of school buildings were politically urgent topics.[19]

In September 1960, the public entered the Triennale, greeted in Parco Sempione by the model of a school constructed using a state-of-the-art industrialized process: the full-scale prototype of a primary school, built with the CLASP system, designed by architect Dan Lacey and donated to the City of Milan by the British Ministry of Education. The *School Exhibition* was mounted in the Palazzo dell'Arte: two full-scale models, a "multi-classroom unit" and a "classroom–common-room unit," showcased a novel conception of a school space based on the latest pedagogical concepts (fig. 9.3).[20] At the same time, design competitions for school furniture, industrialized building elements, and pilot primary schools were held to involve architectural research in the design of school buildings. In particular, the Competition for the Study of Industrialized Elements for Elementary School Construction reflected the state of the art of the building industry's production possibilities for the


**Fig. 9.3.** Milan Triennale XII, 1960: Cover of the exhibition catalog, cover of the book *Britain New Schools*, British CLASP school in the Sempione Park, 1960. Triennale di Milano-Archivi, Milan.

construction of industrialized school buildings within a public funding-based program.

The competition call, launched in October 1960, was defined by the Centro Studi in agreement with the ministry and the newly established Italian Prefabrication Association (AIP). The competition involved Italian companies in two distinct areas. The first was called "single elements" and sought innovative solutions for "opaque or transparent external closure elements and simple internal closure elements, with fanlight, door or services," as specified in the competition announcement.[21] The second one, with the theme "combined elements system," required the "project for a single- or multi-classroom school building' as a prototype for fully industrialized construction systems."[22] The competition's organization confirmed its promotional purposes: no building application was planned, but the selected companies were asked to send together with the project and cost estimates a full-scale model of the most significant nodes of the system presented for a final show in Palazzo dell'Arte.[23] The engineer Pier Luigi Nervi, who had recently become very well known in the field of structural prefabrication, chaired the jury that guaranteed the validity of the selected systems.

Among the jury's criteria, one aspect was considered fundamental in evaluating the projects: the capability of producing individual elements combinable in both industrialized construction and, even more so, in traditional construction.[24] Engineer Giuseppe Ciribini suggested one criterion that was far-sighted and particularly suited to a production structure made up of small, highly specialized companies.[25] With this approach, fully industrialized systems could be achieved through temporary production company associations. The actively engaged architects and engineers played a fundamental role in the association of construction firms. They were defining new building systems

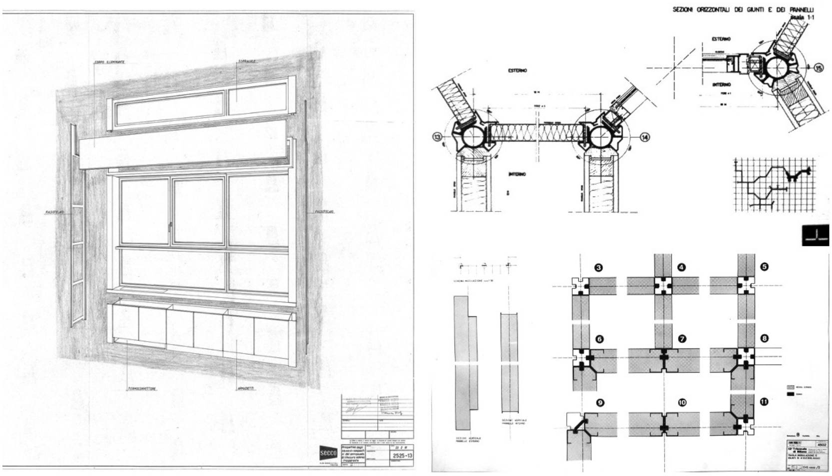


**Fig. 9.4.** Milan Triennale XII, competition: F. Albini and F. Helg, SECCO firm: transparent wall-unit (patented), BBPR Architects, SAIRA-SADI-LuxaFlex: pluridirectional joint for the assembly of prefabricated panels (patented), M. Terzaghi and A. Magnagni: SNAM, joint for the assembly of prefabricated panels. Triennale di Milano-Archivi, Milan.

derived from the assembly of standard elements available on the national building market.

In this sense, the competition featured promising prototypes. As such, we explain them in detail below: (1) the samples of individual elements proposed by the Aldo SECCO company, based on a design by architects Franco Albini and Franca Helg; (2) the grouping of companies SAIRA (*Smalteria Metallurgica Veneta*), SADI, and LUXAFLEX Alluminio, based on a design by the BBPR design studio; and (3) the integrated system, delineated by architects Augusto Magnaghi and Mario Terzaghi for the SNAM Progetti group (fig. 9.4).

### The Prototype by Albini and Helg for SECCO Company

From among the competing building elements, the committee chose the prototype presented by the Aldo SECCO company, a transparent wall package consisting of variously combinable elements. Each element functioned as a single component embedded in a traditional building or as base module of a fully prefabricated construction system. The structure consisted of a series of galvanized steel sheet profiles that framed the components of a wall unit (lockers, opening frames, and fanlight). Between two so-called false-frames, two external C-shaped sheet metal profiles functioned in the same way as joints for the coupling of two modules and as a counterframe for the insertion of the wall unit into the traditional masonry walls. After the competition, the SECCO company filed two new industrial patents to manufacture unique metal window frames called Monobloc, "complete with frame, shutter and relative box, preassembled in a single block."[26] The industrial inventions focused on the two design themes addressed by the Albini-Helg project on which the proposal was based: a prefabricated window unit, embedding the components of the traditional window frame, and its installation in both conventional construction and integral prefabrication systems.

## The BBPR Prototype

Taking part in the same section of the competition, the association of the companies Smalteria Metallurgica Veneta, Officine SAIRA, SADI, and LUXAFLEX Alluminio in connection with the design studio BBPR proposed the project of a "single element." Unlike the projects presented by the other companies in that section focusing on the definition of individual elements, the prototype designed by BBPR featured a joint with which assembly angles between panels could range from 90° to 180°. The connecting element allowed for standard components of panels and window frames within a system with a large degree of freedom of aggregation. As evidence of the various combinatorial possibilities enabled by the connection, the designers offered a series of floor plans showing the arrangement of the perimeter panels and the internal divisions based on five different angles (90°, 120°, 135°, 150°, and 180°). The jury considered the prototype an "element of good design and excellent functional performance," embedding "excellent solution of both the frame and the elements and moldings."[27] The model was also very successful with manufacturers, who realized its potential in the construction market. During the competition, the designers filed an industrial patent for a "joint allowing two or more prefabricated panels to be joined at different angles."[28] The invention involved a joint for connecting panels at different angles, which was similar to the Triennale prototype but also offered some additional features. The system consisted of a hollow tubular mullion that connected elements between the upright and the panels, and a series of "cover strips" that concealed the gaps between the components. The mullion, whose diameter could vary according to the thickness of the panels, was made of steel and flanked by connecting elements composed of extruded aluminum profiles. The latter was the core of the invention. By exploiting the extrusion technique, which allows for very complex shaping, it was possible to configure sections that would enable nine different assembly angles between the panels.

The prototype bore witness to the general interest of the designers of the time in studying the extruded joint within the framework of light prefabrication systems. The production of shaped profiles at relatively low costs enhanced the possibility of using a wide range of standard products, safeguarding the expressive autonomy of the construction detail.

### The Prototype by Magnaghi and Terzaghi for the SNAM Progetti Company

For the "combined elements" section of the competition, the jury highlighted, among other issues, the proposal submitted by SNAM Progetti with the Flli Greppi company and the architects Magnaghi and Terzaghi. The proposal, accompanied by a detailed study of assembly times and operations, relied on a metal framework and lightweight panels system. The project focused on the "industrialization of the individual elements with which to compose the building," instead of defining a "specific solution that would lead to the industrialization of a type of building."[29] Thus, the project represented an "open system" of elements and connections that allowed for different planimetric configurations based on a dimensional module (M = 10 cm) and its multiples (3M, 6M, 12M, 24M, and 30M). SNAM's proposal featured a model of a "general construction cycle," precisely defined in all its phases, and the design of a unique mullion, whose section also allowed for the connection between panels. Like the "single element" designed by BBPR, the Magnaghi-Terzaghi mullion joint was made of extruded sheet metal: two subsequent concepts led to the design of a hollow flower-like mullion, which allowed for an interlocking connection with the panels.

### On the Italian Way: Histories of Successful Building Systems

Among the prototypes presented at different Triennale exhibits, only a few found practical applications in the national building market. The Gaburri system, presented at the VIII Triennale, and the FEAL system, shown at the X Triennale, were the main success stories, and both were widely adopted in Italy and abroad. The Gaburri system supported the integration of prefabricated systems on the traditional Italian building site by decomposing the concrete frame into hollow elements to be completed on site. The FEAL system presented an entirely industrialized system, combining standard products of excellence from the Italian steel industry with the ingenious customized designs of the construction details and assembly processes.

## The Gaburri System

The Gaburri system, implemented at QT8, was the product of three industrial patents filed by construction expert Leon Battista Gaburri between 1941 and 1945. A technical memoir published in the magazine *Cantieri* in 1947 described the original patent as follows:

> The patented CEP system allows for the construction of any type of single- or multistory building, such as minimal, medium-sized, and luxury dwellings, rural constructions, villas, seasonal cottages (also in the high mountains), hotels and industrial buildings, sheds, docks, railway stations, warehouses, canopies, shelters, pylons for power lines and cableways, piles, piers … as well as offering the possibility of quickly restoring collapsed floors of damaged buildings, since the slab can also be used on traditional types of buildings.[30]

On the QT8 construction site, the chronometric test of the Gaburri system verified the inventor's predictions in terms of efficiency for the large-scale construction of residential buildings. As C. Rusconi Clerici noted in a later edition of *Cantieri*, "Considering that each mold produces two castings per day and that each room requires approximately two pillars and two beams, with ten pillar molds, ten beam molds, and two plinth molds, the load-bearing structure required for the assembly of 1000 rooms can be prefabricated in 100 working days."[31]

In 1947, at the same time as it was being exhibited at QT8, the system was used abroad for the first time. Gaburri moved to Argentina, where he was awarded the contract to build housing districts as part of the Plan quinquenal de obra publica (1946–1951). While in Italy, in 1949, the launch of the INA-Casa plan prevented the system from being used in the public housing sector, the Argentina experience was a test case for the large-scale verification of the advantages and limits of the proposed procedure. In 1952, with the second Plan quinquenal de obra publica (1952–1957), the Gaburri system was used in the Barrio 17 Octobre on the outskirts of Buenos Aires, featuring heterogeneous building types from cottages to schools to multistory buildings. After this large-scale application, the system was enhanced by revisions and refinements, as can be seen by patents filed in the 1950s.[32] The system, perfected in use, consisted of internally hollow columns and beams characterized by a rapid and robust connection system with the beams. Its columns and beams, completed by filling and solidifying nodes, formed a frame. Different terminations characterize the pillars: "In practice, each pillar can carry one or more beams and therefore four types of termination have been studied," thus obtaining "a row pillar," "a corner pillar," "three-beam pillars," and "crossing pillars."[33] The terminations also

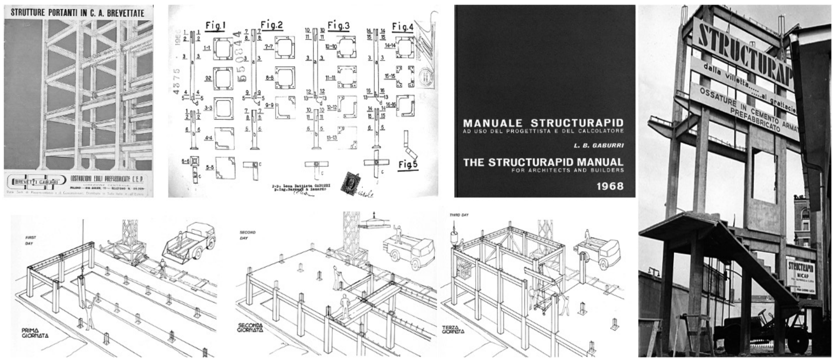


**Fig. 9.5.** The STRUCTURAPID Gaburri system: cover picture of the system patent, 1947, drawing of the system patent, 1956, cover pictures of the handbooks of the Gaburri system, 1968, promotional model of the system and representation of the assembly steps, 1968. Courtesy of Iris Gaburri, Iris Gaburri Private Archive, Alassio.

allow for the connection of beams that "coming out of a pillar should form angles between them of 90° and 180°," guaranteeing better spatial articulation of the structure. To complete the frame, the beam, T-section throughout its extension, had two rectangular-section ends that allow it to be inserted into the column cavity. The variation of the terminations was in contrast to the modularity of the structural solutions: coupled standard components rather than "special pieces" were used to deal with significant structural tasks.[34]

In 1956, the system took on the new trademark STRUCTURAPID (building element materials, precast reinforced concrete load-bearing structures).[35] The patent extended to sixteen countries, including the United States, Indochina, and countries in South America and North Africa.[36] In Italy, eighteen construction companies acquired the STRUCTURAPID patents, providing for the production and marketing of the system throughout the country.[37] In 1963 a large-scale entrepreneurial project coordinated by the Montecatini Edison Industrial Group supported the extensive spread of the system in different building market sectors.[38] In 1968, the publication of the *STRUCTURAPID Manual for the Use of the Designer and the Engineer*, a technical manual for the use of the system in Italian and English, promised economy of time and cost and enhanced the system's commercial success in Italy and abroad (fig. 9.5).[39]

### The FEAL System

The FEAL integral prefabrication system designed in collaboration with the architects F. Fratti and G. Pozzi and engineer C. Castiglioni was named VAR/M3, which combined the initial letters of its inventor, Varlonga, and the number 3, derived from the measure of its dimensional module, which was 300 mm.

The prototype introduced the 300-mm module, which had already been adopted internationally. The structural device, arranged according to regular spans of 5.10, 11.10, and 3.30 m, consisted of simple, unified, and standard elements such as profiles or hollow tubes, completed by pairs of tie rods. Welded steel joints ensured the connection between the components. The floor consisted of a concrete slab, reinforced with an electro-welded net cast in special recoverable steel formworks, which had shaped opposite edges that rested on the lower wing of the beams and did not require temporary supports. Like the prototype exhibited at the X Triennale, this system was also the subject of a patent (no. 582486, 1958) and was included in the FEAL catalog.[40]

Among the lightweight prefabrication proposals presented at the Triennale, FEAL experienced the most significant application in Italy. The system, accompanied by numerous patent applications, was tested in the 1950s for single-story school buildings. In the 1960s it was employed in the construction of multistory schools (there were at least 154 so-called FEAL schools built in Italy between 1960 and 1963) and residential buildings.[41] The system's high level of industrialization, which included maximum standardization of components, accelerated assembly times, and accelerated concrete casting, accounted for its uniqueness on the Italian scene of those years. Characterized by mixed structures of steel and concrete, extruded aluminum completions, and steel plate panels, the FEAL system demonstrated a high degree of flexibility, which meant that it could also accommodate other finishing materials.

In addition to its advanced specialization of individual components, FEAL adopted some very unusual construction-site procedures. The metal frames of the floor slabs were assembled on the ground and stacked one on top of another. Each frame was then raised to the design height, sliding on the load-bearing metal columns that acted as guides. Reinforcement bars were set, and the concrete was cast in recoverable metal formworks; the cast-on-site slabs were later replaced by reinforced concrete prefabricated slabs, called *predalles* (prefabricated reinforced concrete slabs). An example of the versatility of the FEAL system was the residential complex for the company's members in Via Laveno in Milan, designed by architect and designer Marco Zanuso (1916–2001) and built by the Edilvar cooperative between 1961 and 1963. On that occasion, Zanuso actively collaborated with the FEAL company to evaluate the possibility of pursuing more distinctly figurative outcomes through modular systems for different building typologies, exploiting natural materials and dry assembly techniques.

Zanuso designed two identical buildings, articulated on three floors beyond the ground floor, rotated by 90°, and set on a primary geometric grid. The grid guided the alignment of the structure, windows, and internal partition walls. The square staircase block and the lift functioned as a hinge for the living space distribution. An offset of 1.65-m height of the three-level structure contrasted with the modular conception of the plan, generating an irregular and very articulated volumetry of the building.[42] The whole project was based on the adoption of the integral VAR/M3 construction system, which involved extending the industrialized methods to the organization of the working phases and to the casting procedures. The system used HE steel columns with dry-connected main and secondary beams. The internal partitions consisted of 6-cm-thick fitted walls, made of metal, plaster, or wood, which were dry mounted. Of particular interest on the technical-architectural level was the solution adopted for the envelope, which combined technological updating and construction tradition. The wall was made of the FEAL panel, which consisted of a double metal steel plate inside and aluminum outside with an interposed insulating layer of expanded polystyrene. Its total thickness was 6 cm. The panel was connected to a series of secondary aluminum posts anchored to the floors. An 8-cm gap separated the panel from the external finish, which was made with 3-cm-thick slabs of gray Piperino trachyte. The slabs were inserted dry into natural anodized aluminum profiles, which were fixed to the rear structure.

The vertical arrangement of the slabs, the staggered horizontal joints, and the rhythmic scanning of the visible metal profiles contributed to accentuating the upward thrust of the facade, which contrasted with the horizontal lines of the balconies and the crown molding. Furthermore, the technological solution referred back to the curtain wall as a light surface that was independent of the building's primary load-bearing system, which in those years, especially in international models, more than other elements signified the new evolutionary processes in construction. In Zanuso's works, the finishing materials were also standardized; thus, the stone claddings featured a precision cutting treatment that was more akin to industrial processes than craftsmanship in adapting to the minimum tolerances allowed by the steel framework. The residential complex in Via Laveno bears witness to the conception of the traditional middle-class house as an industrialized product, based on the fully integrated approach between industrial research, construction-site evolution, and novel aesthetic values. The industrialization processes—often oriented to provide an adequate response to the need for housing—took on a singular specificity in Via Laveno, offering the technological repertoire to support and enrich the architectural language renewal (fig. 9.6).

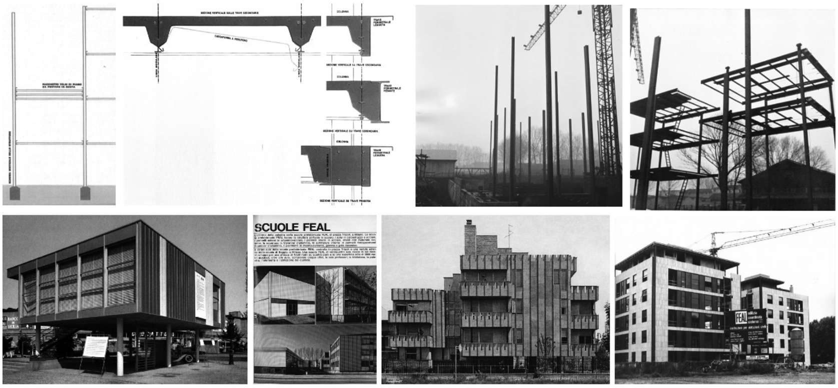


**Fig. 9.6.** The VAR/M3 FEAL system: construction details of the structure, steps of the assembly process, FEAL school prototype, 1958, M. Zanuso: House in Laveno street, Milan 1961–1963 and House in Solaroli Street, Milan, 1970–1971. *FEAL 1960*, Catalog, Milan: Crespi, 1960.

FEAL also exported its construction system: in 1960 foreign orders accounted for approximately 30 percent of its production.[43] The FEAL 1960 information brochure listed the completed constructions from 1955 on, divided into categories: in addition to the Milan and Pomezia plants, the list included thirty-five exhibition buildings (twenty-two of which were abroad), more than a hundred office buildings and industrial complexes, forty residential buildings, nursing homes, cinemas, hotels, barracks, garages, and schools. The catalog of industrialized construction elements was later extended to vertical closures, roofs, false ceilings, internal partitions, and even plant blocks, thus completing the system components.

## Conclusions

Between 1947 and 1960, the Triennale fueled a vigorous architectural debate around industrialization. Its outdoor and indoor exhibitions served as a driving force for the application of exhibited construction systems in actual building practice and for the spread of technical innovations in the sector. Although QT8 did not yield the expected results in terms of the application of industrialization to mass housing, the prototype experimentation had a mobilizing effect on shaping a technical culture around the technological evolution of the building process. In particular, the involvement of the Institute of Architecture of the Milan Polytechnic in monitoring the QT8 construction sites promoted research on construction experimentation and the transfer of industrial methodologies into construction. Giuseppe Ciribini was especially influential in the developments that led to the establishment of the Italian Committee for Building Productivity and the first course in Building Site Organization, under the auspices of the Chair of Building Architecture at the Milan Polytechnic in the 1950s.

Alongside the most compelling experiences of the VIII and X Triennale, significant echoes of the discussion on light prefabrication systems could be found in the "Proposals for Construction" section of the XI Triennale. The exhibition unit curated by Ponti was designed to demonstrate the "relations established by the various industrial productions toward construction architecture," as it reads in the catalog.[44] The "indication of technical coherence resolving itself into stylistic coherence" was the central theme of the exhibition unity.[45] Among the many objects on display was the FEAL industrialized house element, which demonstrated the evolution of the "vertical house."

In addition to the successful Gaburri and FEAL systems, some authorial examples bear witness to the application of the more experimental prototypes presented at the Triennales. These include the Corte di Cadore mountain village, which was commissioned by ENI (Ente Nazionale Idrocarburi) in 1955 and entrusted to architect E. Gellner. The village featured the use of the ER-Cal system, presented at the X Triennale, and based on the use of Salvit panels. The Salvit panel size of 122 cm, adopted as the building module, ensured perfect adherence to the demand for standardization of construction elements envisaged by ENI's top management.[46] Further, the ER-Cal system optimized the thermal state of the walls, which was particularly important for the alpine climate. The village, inaugurated in 1958, represented a model of typological innovation and a clear example of constructive evolution.

The Triennale exhibitions devoted to industrialization between 1947 and 1960 contributed significantly to the architectural culture debate around the evolution of building techniques and the technological upgrade of the building site in Italy. The prototypes presented recount the various paths along which investigation developed in the transition from the urgency of reconstruction to the years of the economic miracle, framed in a delayed and fragmented process compared to such foreign experiences as those of the French and the English. On the one hand, the prototypes demonstrate the design of metal light prefabrication systems via the integration of standard components through the authorial design of the construction details. On the other hand, they document the integration of prefabricated reinforced concrete elements in the cast-on-site-based construction site. Lastly, they document the general similarity between the building industrialization process and the product design approach, and feature the designer's active role in all production phases.

In this sense, the Milan Triennale Exhibitions, framed in the section of this volume devoted to the role of display in the development of prefabrication, were showcases for the specific Italian design approaches in the international discourse on building industrialization.

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CHAPTER 10

# The Living Cell Typology

## Exploring Le Corbusier's Vision through His *Cabanon de vacances*

*Maria Tassopoulou*

### Experimenting on Prototypes

| | |
|---|---|
| *cabanon* (masc.)[1] | |
| (archaic) | hut |
| | prison cell |
| | cell in an insane asylum |
| (Provence dialect) | (holiday) cottage |

Prefabrication emerged as a major focus of housing-related research during the mid-twentieth century and has since continued to attract considerable interest in the realms of architecture and technical studies. The aftermath of World War II, the ensuing housing crises, and rapid urbanization spurred a utopian vision and architectural rationale, which placed the question of dwelling at the forefront of modernist thought. In response to the postwar reconstruction surge, prototypes made of wood and metal were developed to actualize these ideas. This fostered progress in prefabrication methodologies and housing typologies and directed them toward industrialized architecture. Even today, architects, engineers, constructors, and designers continue to experiment with prefabrication processes, in attempts to strike an optimal balance among quality, function, design, economy, and ease of construction. However, the literature on prefabricated iconic cases still lacks comprehensive historical documentation.

This chapter is designed to bridge this gap by focusing on a wooden architectural prototype created by pioneering architect Le Corbusier—his smallest work and personal vacation shelter, an optimal living cell typology called the Cabanon. This case study falls within a broader research framework that deals with the evolution of modern thinking rooted in the concept of mass production. I explore the ways architects responded to new needs and conditions, experimented with new materials and techniques, and endeavored to establish a novel architectural syntax in mass-housing development. I also elaborate on how architects defined the relevant principles of prefabrication and examine the historical impact of this postwar trend.

To address these inquiries, I undertook an in-depth survey of primary sources. A comprehensive review of the Fondation Le Corbusier's archives disclosed 480 documents. They comprise four hundred letters and eighty photographs and postcards, devoted primarily to communication about and construction of the Cabanon and the associated challenges. The limited collection of sketches and designs related to the prototype underscores Le Corbusier's unwavering determination to adhere to the Modulor dimensions—an approach that emphasizes the prefabrication process—rather than solely pursuing an impeccably flawless architectural outcome. Consequently, the Cabanon, a holiday cabin, serves as Le Corbusier's 1:1 scale experiment, delving into the potentials of prefabrication, material quality, and comfort while offering opportunities for replication as an autonomous housing unit.

The postwar era saw the adoption of novel techniques and materials that were developed in the interwar years toward implementing industrial prefabrication. These efforts to create affordable housing resonated strongly in the rapidly evolving "new world," notably in California, which emerged as a hub for factory-based architecture. Renowned architects such as Richard Neutra, Charles and Ray Eames, Eero Saarinen, and John Entenza were at the forefront, experimenting with designs for modern, convenient, and cost-effective postwar homes. These dwellings were envisioned to address the pressing needs for housing while marking a new chapter in architectural innovation. A prime example was the Case Study Houses initiative, which symbolized the concerted push toward standardizing housing concepts and producing large-scale mass housing.[2]

The advent of new technical capabilities and the search for ease of construction gave rise to compact housing patterns, particularly in the form of holiday homes, embodying the most innovative efforts. Architects and designers eagerly embraced this concept, striving to craft modern camping facility variations that aligned with technological advancements while meeting the public's expectations. During the late 1940s, the idea of the "cabin" surged in popularity, coinciding with the rise of the automobile era and the burgeoning interest in tourism, which led to a need for holiday accommodations. Postwar Europe, driven by the allure of leisure, witnessed a flourishing tourism industry intrinsically linked with the experience of rural living and an embrace of nature. The modern urban lifestyle spurred a desire to explore new environments, leading to a demand for affordable vacations; the proliferation of tents, huts, and small houses met this demand, offering basic amenities at reasonable prices while providing close contact with nature. This model, based on the precedents of northern Europe and Great Britain, swiftly spread into Germany and France.

In the initial decades after World War II, architects and engineers diligently pursued the delicate equilibrium between cost and quality while spearheading the utilization of prefabrication techniques. Prefabrication emerged as an optimal solution to the escalating demand for affordable holiday housing, offering a combination of convenience, rapid construction, and comfort. Inspired by scientific advances, technological progress, and lessons from erecting military structures, they conducted experiments that culminated in an idealized representation of machine-based forms that epitomized the efficiencies of the twentieth century in catering to human needs.

The experience with military technology and wartime industrial production further reinforced the belief that, apart from offering shelter, houses should also be easily transportable and constructible in large quantities.[3] Buckminster Fuller's Dymaxion House stands as a prime exemplar of war-influenced architecture, with the goal of amalgamating design, comfort, sanitation, novel materials, and techniques by employing prefabricated units within housing structures.

European-based research on prefabrication, notably in Britain, Scandinavia, Germany, and France, engendered a cadre of experts in the field. Among these luminaries, the French designer Jean Prouvé held a prominent position, collaborating with notable figures such as Robert Mallet-Stevens and Le Corbusier.[4] Prouvé, who trained as a metalworker, began his experiments with prefabricated structures as early as the 1930s and established the Ateliers Jean Prouvé, a construction firm focused primarily on interior equipment and construction details. In the immediate postwar era, his collaboration with the French Ministry of Reconstruction led to a project in Meudon (Hauts-de-Seine).[5] There he showcased his prefabricated building system, which utilized wooden and metal panels atop stone bases designed to level the area's sloping ground and resulted in the construction of fourteen houses.

In his extensive experimental research, Prouvé dealt with both individual and collective housing projects, yielding a spectrum of prototypes including the Demountable House (1944), the Tropical House in Niamey (1949), and a range of prefabricated items of furniture and aluminum shading systems (such as brise-soleil, windows, and aerators). That work enhanced his stature as a foremost inventor of housing typologies and a pioneer in the field of prefabrication. His enduring collaboration and friendship with Le Corbusier exemplify a symbiotic relationship in their work, encapsulating the principles of modern architecture and the notion of housing as a living cell typology.

## The Human Scale

The "machine for living" concept introduced by Le Corbusier deals with anthropometry, particularly concerning the notion of the "cell." The architect's approach centered on the human scale as a pivotal factor in determining the appropriate dimensions for a living space, drawing heavily on the Vitruvian Man and Albrecht Dürer's human proportions.

In the fourth volume of *Le Corbusier's Œuvre complète* (1938–1946), he outlined the "immediate task" of discovering "a common measure" for "building, manufacturing, and prefabricating,"[6] anticipating the seamless movement of products across provinces, countries, and continents. This endeavor led to the creation of the renowned Modulor, his anthropometric scale of proportions. The Modulor scale was designed to determine an ideal ratio derived from the relationship between space and the user. It aligned habitable cell volumes and factory-based architecture, defining the dimensions that would achieve the best balance between quality and economy. Ultimately, dimensional relationships following the Fibonacci sequence were chosen based on the height of a stylized human figure with an extended arm. Le Corbusier's intent was to make it "difficult to do things badly but easy to do them well,"[7] which encapsulated his approach toward prefabrication architecture.

At the core of this scale is the key dimension of 183 cm, which corresponds to the average human height, while 226 cm represents the height of a man with an extended arm, and 113 cm signifies the height of the human navel. Le Corbusier established two interwoven series, a red and a blue one, to create additional proportional resonances and reduce the intervals between consecutive measures.[8] Employed extensively in guiding the design of numerous postwar works, the Modulor scale remains an innovative model for applying standard dimensions in architectural design and as a tool for exploring new typologies.

Throughout the twentieth century, Europe experienced an unidirectional trajectory of urbanization amid constantly shifting political, economic, and social landscapes. In response to these dynamic changes, Le Corbusier was determined to conceptualize and implement the idea of human scale, both in theory and in practice, with a particular focus on the optimal habitable volume. The notion of "cells" remained a consistent theme in his architectural ideology from his early adulthood to his final years.

Le Corbusier's transformative journey to northern Greece in 1907, particularly his encounters with the monasteries of Mount Athos, left an indelible imprint on his architectural philosophy. The monks' cells, minimal spaces designed for living, captivated him. They represented a fusion of the simplicity of a primitive existence and the necessity for shelter with the power of imposing order over nature.[9] The impact of this experience can be seen in his letters to his parents and to Charles L'Eplattenier, where he explicitly articulated, "I would like to live my whole life in what [monks] call a cell. It is the perfect solution for the residence of a working man, a unique typology or even better, an earthly paradise."[10]

Variations of the ultimate living cell typology extend beyond architecture and are rife in the field of engineering. In his seminal work "Towards a New Architecture,"[11] Le Corbusier devoted an entire chapter to the concept of "standard dwellings." He identified the kind of monk's cell found in ships and trains as a bridge between the pinnacular technological machines and economic instruments of that era and fundamental human needs. The notion of "basic," or more accurately, the prevailing concept of "primitive," profoundly impacted modernist architects and remained a consistent theme in Le Corbusier's reflections throughout his career.

Drawing inspiration from Marc-Antoine Laugier's "Primitive Hut" (which embodies the idea of shelter shielding man from nature and offering fundamental architectural principles) and Gottfried Semper's "Caribbean Hut" (with its essential elements of hearth, roof, enclosure, and mound), proponents of modernism reimagined primitiveness within basic typology. This reinterpretation spawned modern huts, manifesting as prefabricated prototypes. The ocean liner, the plane, the car, and the train are designed with an emphasis on economy without compromising human needs, exemplifying the provision of maximum comfort within minimal space. This human-scale model strives to standardize optimal proportions for habitation, meeting the fundamental conditions required for living.

## Grounding on Cap-Martin

Le Corbusier's affinity for the Mediterranean region traces back to the early twentieth century and his formative journey.[12] His profound connection with the French Riviera began in the early 1930s, marked by his visits to the newly erected Villa E1027 in Roquebrune-Cap-Martin, owned by his close friends Jean Badovici and Eileen Gray. This coastal stretch of Cote d'Azur became a regular summer rendezvous for the architect, who often stayed as a guest in the white villa until the early postwar years.

During the summer of 1949, Le Corbusier revisited E1027 accompanied by a group of architects while working on the urban planning of Bogota.[13] This period witnessed the extensive spread of the postwar strategies outlined by CIAM, which prominently featured the concept of mass housing in both vertical and horizontal habitat iterations. Le Corbusier's own architectural endeavors echoed this trend, notably in his engagement with urban planning for small-scale villages set amid mountainous landscapes, such as the Sainte-Baume project in France in 1948.

In the rugged terrain of Roquebrune, accommodating twenty individuals in the picturesque yet challenging landscape of Cap Martin mandated specific housing solutions. As the region recovered from the war's aftermath, Roquebrune exhibited promising growth potential. The postwar surge in holidaymaking positioned the Cote d'Azur at the forefront of development,[14] enticing visitors with its blend of local beauty, serenity, and the allure of an urban escape. Along the steep shores of Cap Martin, makeshift constructions—primarily seaside resorts—dotted the landscape in a haphazard fashion. However, in 1949, Roquebrune-Cap-Martin was still sparsely populated, comprising only a few houses and a makeshift tavern called the Starfish, owned by Thomas Rebutato, a former Italian plumber.[15]

Recognizing the region's potential as a tourist destination, Le Corbusier envisioned a holiday housing development to counter the shambolic planning that threatened the natural charm of the Cote d'Azur. He crafted two studies anchored in the cliffs of the Alpes-Maritimes, focusing on two versions of holiday housing: Roq (derived from Roquebrune) and Rob (named after the tavern's owner, Rebutato). The initial sketches for Roq materialized in September 1949,[16] portraying a typical typology of holiday housing villages that proliferated in tourist destinations during the 1960s. This envisioned development comprised thirty to eighty rooms, varying in size, along with a restaurant and recreational amenities within a semi-hotel structure. The proposed site hung precariously from the rocks, in close proximity to the ancient walls of the Roquebrune village. The study targeted two principals: a private individual, Ms. Delin, the proprietor of the site under consideration, and a public figure—the minister of reconstruction at that time—who was generally receptive toward new projects for the coastal slopes.[17]

Le Corbusier's meticulous analysis of the natural topography in the Cap Martin region fueled his vision for a housing development that would preserve the landscape's beauty. His astute observations highlighted the potential of utilizing the topographical plateaus and variations in density within the landscape to cluster houses on one side while leaving the other side open. The projects fell under the concept of a collective habitat, strategically ascending the steep slope toward the sea. The envisioned mix of horizontal and vertical housing adapted nicely to the steep terrain, forming a striking image of a vertical housing complex when viewed from a distance. In Le Corbusier's accompanying text within *Œuvre complète*, he emphasized, "The steep slope alone offers the solution, and its intersection ensures good views. The forms of the buildings are also tilted for this purpose, especially tall and narrow structures such as that of the Marseille Apartment Building."[18]

In an echo of his earlier architectural concepts, the cell typology resurfaced in a specific pattern, evolving into the scale of an urban model. The "cell structure" housing complex manifested in both the city of Frugès in Pessac and in the Sainte-Baume studies, each tailored to the unique demands of their respective landscapes. Despite Le Corbusier's insistence on the "primary motivation of Mediterranean architecture being incorporated into the special topography of the French Riviera,"[19] his adaptable "living cells" seemingly transcended geographical constraints; they found resonance not only in locations such as Paris in the 1920s and the New Spirit Pavilion but also in Marseille and the Seaside Roquebrune of the 1950s.

The Roq and Rob studies stand as experimental typologies tailored for the Mediterranean landscape, encapsulating the architect's primary urban intentions and architectural principles: air, light, sun, and greenery.[20] The complex was designed in a square layout, divided into eastern and western sections by an existing frontal circulation axis—a staircase thoughtfully integrated into the design. Within this square, three parallel rows gently descend along the slope, with the central row being slightly smaller, thereby forming an open space in the heart of the square. Each row consists of eight to twelve units, on one or two floors, featuring vaulted roofs constructed with concrete and topped with grass. Some variations propose the use of folded aluminum foils.[21]

Le Corbusier's goal was to optimize factors such as insulation, sunlight, and ventilation to ensure optimal indoor comfort while exploring efficient construction methodologies. His pursuit led to the conceptualization of a volume measuring 226 × 226 × 226 cm, referred to as a patent—the "habitable cell volume." This structure, congruent with the human scale, offered both physical and psychological comfort while fostering a profound connection between the occupants and nature.[22]

Despite its ambitious nature, the project encountered funding challenges. However, recognizing the potential for tourist development in the area, tavern owner Thomas Rebutato expressed interest in utilizing his adjacent land. This led Le Corbusier to propose a plan for eighteen rooms, persuading Rebutato to provide the necessary land for constructing a prototype—a model showcasing what was to come. The model was to serve both as an accommodation for the architect during his stay in Cap Martin and as a preview of the future Rob development. It was the summer of 1951.

## Le Cabanon de vacances

> *Primitive man has brought his chariot to a stop, he decides that here shall be his native soil. He chooses a glade, he cuts down the trees which are too close, he levels the earth around; he opens up the road which will carry him to the river or to those of his tribe whom he has just left [...]. The pegs of his tent describe a square, a hexagon or an octagon. The palisade forms a rectangle whose four angles are equal. The door of the enclosure faces exactly the door of the hut. [...]*
> *There is no such thing as primitive man; there are primitive resources. The idea is constant, in full sway from the beginning.*[23]

According to Le Corbusier's own accounts detailed in Modulor 2, the design for the "Petit Cabanon" came to life at the L'Etoile de Mer tavern within a mere "three-quarters of an hour" as a birthday gift for his wife, Yvonne Gallis, on September 30, 1951.[24] Construction of the hut began a year later "on the edge of a rock where the waves hit."[25]

This hut shares architectural principles akin to other cell typologies, reminiscent of those found aboard trains bound for Monte Carlo or ships sailing the Mediterranean. The Petit Cabanon epitomizes maximum physical and mental comfort within the minimum possible dimensions and the lowest possible financial cost.[26] Firmly grounded, it is crowned with a simple roof, covered with aluminum foil. The architectural arrangement delineates three distinct zones that make up the living spaces: a private section encompassing sleeping quarters and a workspace, a semipublic corridor, and an entryway leading to the dining area and communal space situated outside the hut in Rebutato's tavern (see fig. 10.1).

The design of the hut meticulously adheres to the principles outlined in Modulor, maintaining consistency from the exterior structure to the interior furnishings. Specifically, the hut measures 366 cm in length and width, and is precisely twice the height of the Modulor (183 cm). An additional 70 cm is allocated in the floor plan to accommodate the entrance corridor. Rising to a height of 226 cm, the cube aligns precisely with the height of the Modulor with an extended arm. Ventilation is facilitated through two narrow windows strategically positioned opposite each other, complemented by two square windows (70 cm × 70 cm) meticulously crafted by Jean Prouvé and situated at a height of 113 cm. The design is rounded off with an entrance door (fig. 10.1).

In February 1952, André Wogenscky, the head architect at Atelier Le Corbusier, undertook the project codenamed "Case 366 366 Roberto Cap Martin."[27] Initial sketches outlined the design and served as the foundation for the final plans devised by the young architects at Atelier, with Jacques Michel taking the lead in the design.[28] Charles Barberis, a carpenter from Ajaccio,

**Fig. 10.** 1. Cabanon Le Corbusier. Source: Wiki commons.

Corsica, a well-known figure on Sevres Street for his work on the furniture for the Unite d'Habitation in Marseilles, was commissioned to construct the Cabanon, exactly to the dimensions "requested by Le Corbusier."[29]

The hut was constructed entirely in Ajaccio and assembled in Cap Martin, where the final decisions were made with the help of Wogenscky and other studio designers. The interior was crafted using waxed plywood on the walls and chestnut veneer on the furniture.[30] The facades were clad in pine slabs from the tree's outer shell. Rebutato was responsible for overseeing the implementation of the project, serving as a point of contact for all the parties involved, from the craftsmen to Le Corbusier's collaborating architects. As a veteran of construction companies,[31] Rebutato coordinated the construction efforts in conjunction with Barberis and did the plumbing work himself. He managed appointments with technicians and oversaw the installation of the various components, ranging from screws and nails to prefabricated Cabanon equipment, sockets, and the washbasin,[32] and even a prefabricated hut placed a few meters away, referred to as Corbusier's office (Fig. 10.2).

A mere 16 $m^2$ in floor area, the Cabanon is structured in a square layout. Yet, variations between architectural drawings and sketches emerged from various sources, notably in the positioning of the interior door connecting the

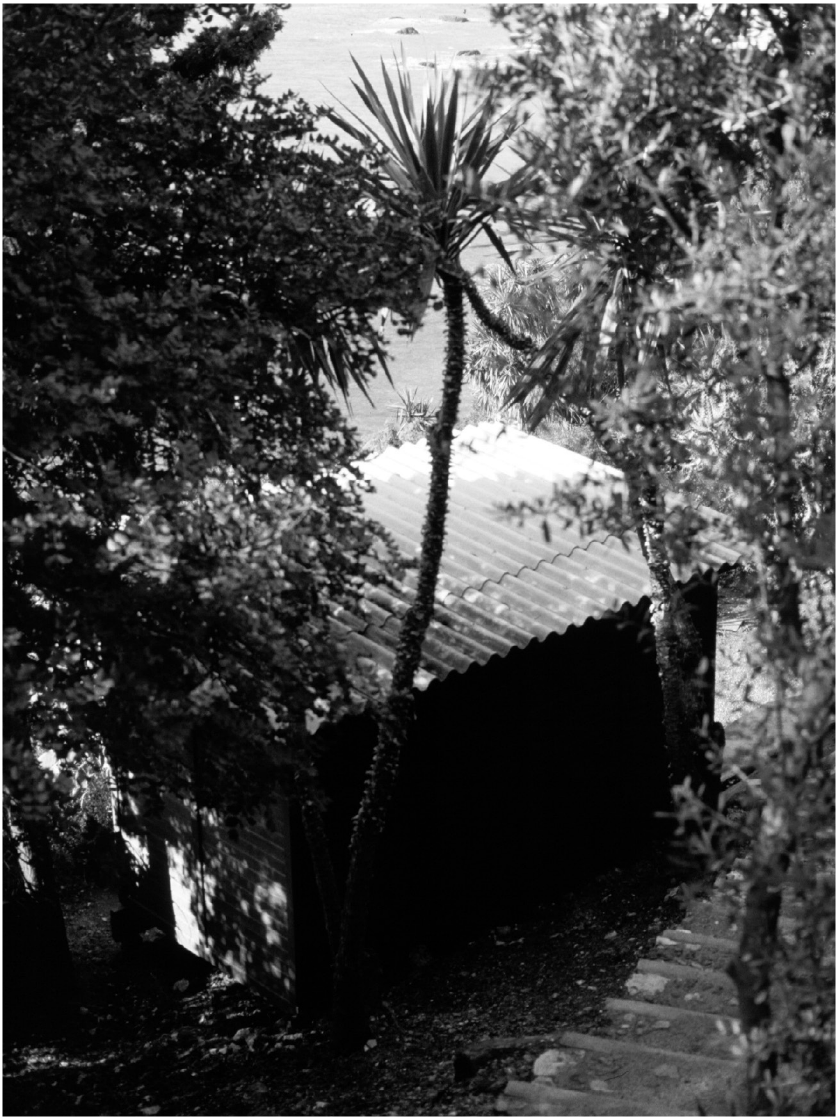

**Fig. 10.2.** Le Corbusier's office. Source: Panayotis Tournikiotis personal archive.

private space to the tavern, window placements, and the furnishings.[33] Aside from floor plans, both official drawings and *Œuvre complète* plans lack detailed dimensions, with the height of the cell (226 cm) being the only dimension referred to, apart from "a decline of an excavation, made to meet the regulations."[34] Height specifications are notably absent except for Prouvé's square windows placed at 113 cm.[35]

The section plan details a storage space in the false ceiling, which is present but in a modified form. However, the internal dimension of 280 cm is not corroborated in Modulor, which raises concerns about its validity. Additionally, the facade plan does not depict the entrance accurately, showing the vertical window starting from floor height when it actually begins at 97 cm. Notably, *Œuvre complète* emphasizes openings and ventilation with distinct "V" markings on the floor plan. The small window near the bed and square windows serve for both ventilation and lighting.

In line with the principles of the free plan, the Cabanon's living space comprises functions arranged within a cube measuring 366 × 366 × 226 cm. However, the proximity of living and wet areas poses functional challenges, as the toilet and headboard are separated only by a curtain.[36] While the spatial arrangement of wet areas seems to have been overlooked architecturally, the official plans suggest an attempt to resolve this technically by linking the hut's facilities to the tavern's plumbing system.

The cell's entrance corridor holds notable significance, as it serves as an elongated threshold between the living and circulation areas, facilitating the transition from the private cell to the communal dining area. This corridor is ornamented with a mural, the study of the Taurus, painted by Le Corbusier himself,[37] as well as a series of paintings displayed along the eastern wall, which are documented in the fifth volume of the *Œuvre complète* (fig. 10.3). Le Corbusier's artistic touch is also apparent in the paintings that adorn the square windows,[38] complemented by adapted mirrors (fig. 10.4). When combined with the dual-folding shutter, these elements create multiple reflections within the limited space of the hut, as evidenced in the famous photographs taken by Lucien Hervé. The floor and ceiling of the Cabanon boast vivid hues, with the floor painted in yellow and the ceiling featuring a combination of white, red, and green. The overall synthesis demonstrates Le Corbusier's utilization of color and painting as integral components of his comprehensive architectural approach.

Although initially intended for Le Corbusier and Yvonne, the limited space of the Cabanon fell short in meeting their practical needs. The available furnishings were sparse, comprising a desk, a wardrobe, and only one bed, contrary to references in the *Œuvre complète* and Bruno Chiambretto's accounts, which mention two beds (fig. 10.5). But photographs from the hut and

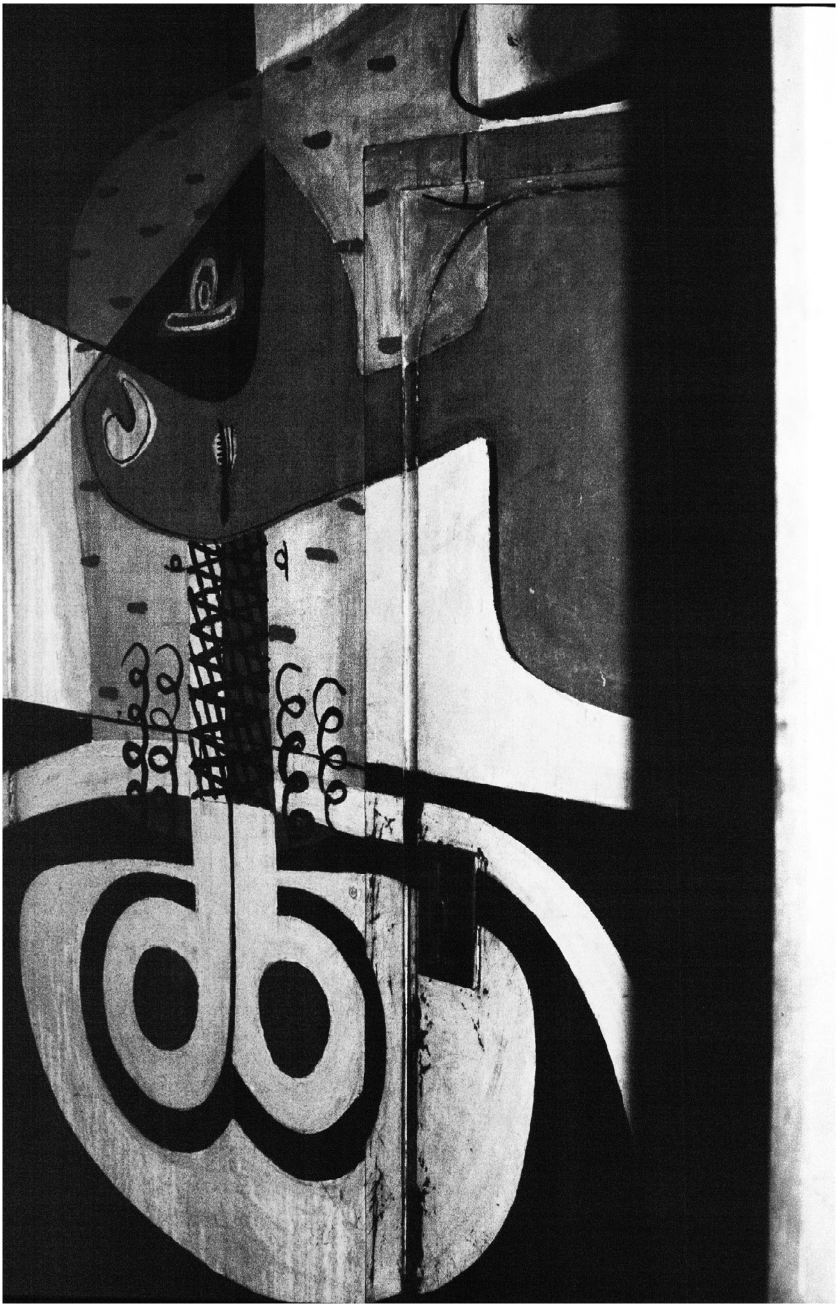

**Fig. 10.3.** Detail of the entrance mural. Source: Panayotis Tournikiotis personal archive.

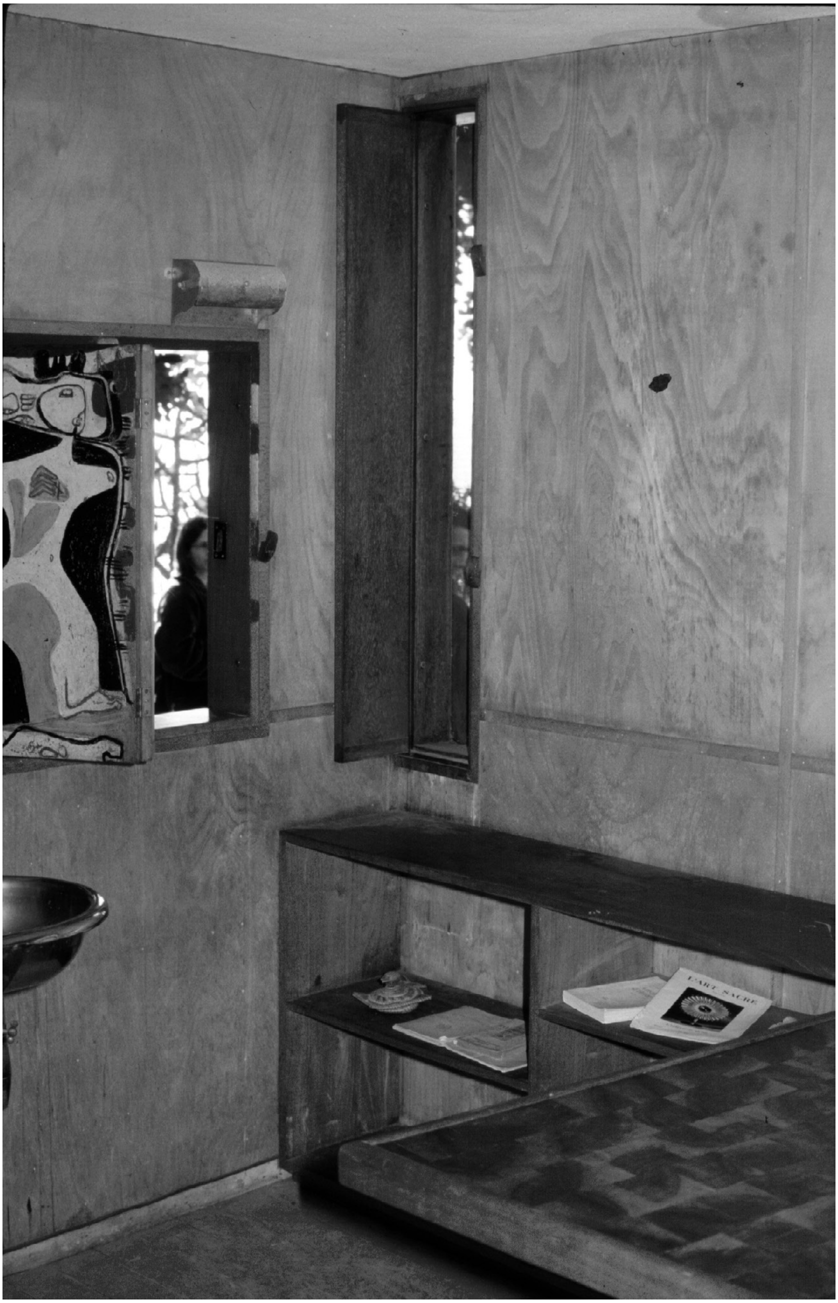

**Fig. 10.4.** Le Corbusier's working corner. Source: Panayotis Tournikiotis personal archive.

**Fig. 10.5.** Cabanon, 1:1 Model. Exhibition *Lucien Hervé | The Summertime of Monsieur Le Corbusier*, Benaki Museum, Athens 2016. Curators: P. Tournikiotis, M. Tassopoulou, M. Bacharidou. Source: Documentation Lab, School of Architecture NTUA.

correspondence do not confirm the presence of the second bed. Hervé's contact prints reveal one bed and a second mattress placed on the floor.[39] It appears that Yvonne's bed was positioned near the WC, while Le Corbusier slept on the floor or vice versa. Yvonne herself voiced dissatisfaction with the living conditions in the hut to Brassai, stating that she was the one who had to sleep on the floor.[40] Following Yvonne's death in 1957, Le Corbusier used the bed.

To address his need for privacy, solitude, and a workspace, Le Corbusier erected an additional small hut a few meters away from the Cabanon (see fig. 10.2). On April 21, 1954, he requested "something like a construction hut" from Wogenscky to be placed adjacent to the Cabanon.[41] The new structure was not designed but shipped in pieces and assembled on site with the help of Rebutato and Fernard Gardien, an architect at Atelier Le Corbusier at the time.[42] The hut's dimensions did not adhere to Modulor or feature any architectural interest; however, it became Le Corbusier's workplace in Cap Martin and the locus that housed his private, strange collection of bones and shells. The hut had two openings, a door and a window, and was equipped with a work desk, full of papers with sketched drawings and texts. A wide stone in front of the door marked the threshold, providing all that was necessary for the working cell of "monk Corbu."[43]

Thus, Cabanon stands as both Le Corbusier's personal retreat and an architectural prototype for potential prefabricated holiday housing. The hut was constructed based on the patent of 266 × 266 × 226 cm, which was designed to standardize fundamental living dimensions in accord with the building materials industry, in order to simplify construction. The careful selection of building materials aligned with basic manufacturing and supply chain standards; for instance, sixteen plywood sheets and simple studs formed the interior walls,[44] while outer lining utilized pine slabs, a common industrial byproduct.

Le Corbusier's meticulous documentation, encompassing correspondence with technicians, material orders, and receipts,[45] highlights his commitment to overseeing the building process and managing expenses. However, many letters indicate that the construction process was not standardized and required on-site supervision, while the actual costs were higher than desired and difficult to manage.[46] At the same time, the humble hut features window openings crafted by Ateliers Prouvé, and such interior furnishings as the chestnut veneer bedside table and an intricately patterned marqueterie table demanded specialized carpentry skills and meticulous craftsmanship.

## Conclusions

Le Corbusier's *Cabanon de vacances* stands as a prototype that exemplifies his explorations on the human scale. At the same time it can be described as an architectural parasite. Nestled within Rebutato's property, it embodies the owner's pursuit of a factory-based architecture rooted in human proportions. At its core lies the essence of interwar and postwar modern architecture—minimal dimensions offering maximal comfort—woven intricately with avant-garde narratives and theoretical investigations into primitive human habitation. Despite its rather postmodern appearance, which might puzzle observers considering its modern origins, the hut was never designed to exist in isolation along the picturesque Côte d'Azure coastline. Instead, it was an integral element of a grander vision for a vernacular habitat, designed to "colonize" the Mediterranean landscape for vacation housing. Three years after the Cabanon was built, Le Corbusier wrote:

> April 7, 55 Cap Martin
> For the past 24 hours I have been curious about an unexpected view of the landscape (the ground) in front of my cabanon. Suddenly, I realize: There is a large surface of bare, clean rock, washed with a wild brush. It's the result of the tidal wave of last February in which I was here.[…] Everything is bare now from the sea to the carob tree. Exactly where the 5 vacation units are planned to be built.[47]

However, despite the initial plans, the Rob study never materialized. Anecdotal evidence suggests that, despite securing funding and Rebutato's agreement, Le Corbusier chose to abandon the project owing to the tranquility he found in Roquebrune. Instead, in 1957, he designed and funded the construction of five small rooms on Rebutato's adjacent property, securing the final ownership of the Cabanon and its surrounding land in exchange.[48] These five "camping units," elevated on metal stilts and constructed from aluminum sheets, echoed the Cabanon's typology. They adhered to basic cell dimensions, flaunted vibrant colors, and featured the Modulor figure on the northwest facade.

The Roq and Rob housing complexes, in essence, represent experiments in a typology that harmonizes with the Mediterranean landscape while embracing core modern urban intentions and architectural standards. These complexes exhibit basic zoning, comprised of two- or three-story units, often interconnected, while some remain separated by open spaces, either for land utilization or to preserve natural landscapes. Despite Le Corbusier's emphasis on "Mediterranean architecture adapting to the unique topography of the French Riviera," these living cells demonstrate spatial flexibility; they range from the 1920s pavilion and the Sainte-Baume project to the multiple units in the Unite d'Habitation, while grounded at the same time at the seaside slopes of Alpes-Maritimes during the 1950s.

Le Corbusier's personal hut, the model of a vacation housing complex—simultaneously primitive and modern in its habitable cell volume—still stands alone as a testament and a challenge to new architectural theories. It embodies the vision and reality of an explosive era that ignited innovative thinking in modern architecture, designed to forge a new construction-based style. In many ways, Le Corbusier's primitive hut guided the avant-garde toward novel housing concepts, revolutionizing habitat environments in both vertical and horizontal urban development typologies.

The Cabanon remains a pivotal example of modern industrialized architecture, leaving an indelible mark on architectural history. It stands as a case study that delicately balances quality, cost, and comfort, offering a lasting legacy on the revolutionary advancements of the postmodern era. It deepens our comprehension of prefabrication's early steps from an architect's perspective, showcasing the ever-evolving nature of modern architecture. From the solitary Cabanon to the multiple mass-housing developments such as the Unite d'Habitation in Marseilles, these living cells of the modern era underscore the significant social parameters in architectural research during a time of crisis. They not only represent a radical experiment but also encapsulate the zeitgeist of the era, which ushered in a new chapter in architectural development.

## Acknowledgments

I am grateful to Prof. Panayotis Tournikiotis for guiding me through the study of Cabanon back in 2016 and for his generous provision of photographs from his personal archive.


## Notes

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3. Carlo Carbone, "The Kit of Parts as Medium and Message for Developing Post-War Dwellings," *Histories of Postwar Architecture* 2, no. 4 (2019): 54–74.
4. Robert Rubin, "Preserving and Presenting Prefab: Jean Prouvé's Tropical House," *Future Anterior: Journal of Historic Preservation, History, Theory, and Criticism* 2, no. 1 (2005): 30–39.
5. Date of construction 1950–1952. See Christian Enjolras, *Jean Prouvé, Les maisons de Meudon, 1949–1999* (Paris: Editions de la Villette, 2003).
6. Le Corbusier et al., *Œuvre complète de 1946–1952* (Zurich: Les Editions d'Architecture, 1953), 170 (translation by the author).
7. Ibid. (translation by the author).
8. Anderson R., "Down to Earth: Martin Heidegger, Le Corbusier, and the Question of Dwelling, Essentially," *Architectural Histories*, 9, no. 1 (2021): 10.
9. "La géométrie est le langage de l'homme," Le Corbusier, *Vers une architecture* (Paris: Éditions Crès, 1923).
10. Letter from Le Corbusier to his parents (September 15, 1907) and to Charles L'Eplattenier (September 19, 1907) (translation by the author). As cited in Charles Jencks, *Le Corbusier and the Continual Revolution in Architecture* (New York: Monacelli Press, 2000), 49.
11. Le Corbusier, *Vers une architecture* (Paris: Éditions Crès, 1923).
12. Le Corbusier, *Journey to the East* (Cambridge, MA: MIT Press, 1987).
13. Le Corbusier would settle in Villa E1027 and J. L. Sert, Paul Lester Wiener, Ritter, and a dozen designers would join him. See Le Corbusier, *Œuvre complète*, 42 and Chiambretto Bruno, *Le Corbusier à Cap-Martin* (Marseilles: Parenthèses, 1987), 11.
14. Le Corbusier is particularly referring in the ever-increasing growth of Cap Martin. See Le Corbusier, *Œuvre complète*, 54

15. Anticipating the development of the area, after retiring from his main occupation, Thomas Rebutato opened a guinguette in coastal Roquebrune in 1948.
16. Le Corbusier designed the project ROQ while sitting at Rebutato's tavern, on September 7, 1949. See Chiambretto, *Le Corbusier à Cap-Martin*, 18.
17. Ibid., 13. The study of LC correspondence also documents a relevant communication on the site and the possible solutions (FLC_M2(9)68).
18. Le Corbusier, *Œuvre complète*, 54 (translation by the author).
19. Chiambretto, *Le Corbusier à Cap-Martin*, 18 (translation by the author).
20. See Le Corbusier, *The Athens Charter* (New York: Grossman, 1973), and Le Corbusier, *When the Cathedrals Were White* (New York: McGraw-Hill, 1964).
21. Chiambretto, *Le Corbusier à Cap-Martin*, 14–15.
22. Le Corbusier, *Œuvre Complète*, 57.
23. Le Corbusier, *Towards a New Architecture*, trans. Etchells Frederick (New York: Dover, 1986), 69–70.
24. Le Corbusier, *Modulor I and II* (2nd ed.) (Cambridge, MA: Harvard University Press, 1980), 239.
25. Ibid. 239. Note that the hut parasitized Rebutato's tavern and is not actually built on a rock hit by the waves, but they do come close.
26. Issues relevant to the cost were often raised during the construction of the Cabanon. Specifically, in a letter to his secretary, Le Corbusier noted, "Si les factures on tête gonflées, c'est que notre part, il y avait eu negligence: on aurait du convenir du prix à l'avance […]. De mon coté, j'avais fourni une conception clere des plans, et le cabanon est une réussite. Du coté argent, c'est un non-sens. […] Le comple sera ventilé, sur l'Atelier et sur l'avenir d'une entreprise de serie qui a techniquement réussi. Et dont le prix du prototype doit être reparti sur la suite des réalisations futures." FLC_M2(9)79-002, letter from Le Corbusier to Jeanne Heilbuth, December, 25, 1952.
27. FLC_M2(9)1. Note for A. Wogenscky, February 8, 1952.
28. FLC_M2(9)112; FLC_24335 – 24344.
29. FLC_M2(9)8. Letter from J. Michel to J. Prouvé, April 23, 1952.
30. FLC_M2(9)9, M2(9)13
31. Thomas Rebutato was himself a plumber.
32. The relevant brochures were found in the Cabanon archives. FLC_M2(9)52-001, -002, -003, FLC_M2(9)56-001, -002
33. "yet, variations": FLC_24334, Official Cabanon plans. Also, Le Corbusier et al., *Œuvre Complète*, 63. "notably in": The most accurate Cabanon plans are depicted in Bruno Ciambretto's study: Ciambretto, *Le Corbusier à Cap-Martin*, 51. A deviation is only observed in the folding mechanism in the southeast window (opening sheets instead of folding ones).

34. "Aside from floor plans": FLC_24334. "with the height": Le Corbusier et al., *Œuvre Complète*, 62. A reference made only in the French and not the English or German accompanying text.
35. FLC_24334.
36. FLC_24335. It is worth mentioning that in the sketches, this bed is rotated by 180°.
37. The Taurus of Cabanon is one of a series of paintings by Le Corbusier that depict and interpret the bull, sometimes as a male symbol, with the horns and phallic symbols dominating and sometimes as a mythological symbol in the form of the minotaur, in a connection with the trends of the artists of his circle, Matisse and Picasso.
38. The paintings depict naked female figures; one of them is influenced by Greek mythology, as referring to Pasiphae, the female figure associated with the bull to give birth to the minotaur.
39. FLC_L4(11)7.
40. Yvonne stated as follows: "He makes me sleep on the floor next to the sink; I wonder how I managed to live 20 years with this fanatic and put up with all his crazy ideas." In Brassai, *The Artists of My Life*, transl. Richard Miller (New York: Viking, 1982).
41. FLC_M2(9)93, note for Wogenscky dictated by Le Corbusier, April 21, 1954 (translation by the author).
42. FLC_M2(9)94, Letter from Wogenscky, July 2, 1954; FLC_M2(9)100, Letter from Le Corbusier secretary to Th. Rebutato, July 5, 1954. FLC_M2(9)101-001 &002, Telegram from Rebutato to Atelier Sevres str; FLC_M2(9)102, Letter from Gardien to Rebutato, July 21, 1954.
43. Letter from Le Corbusier to Auguste Perret, July 1, 1914. Text in French: "Je ne suis pas sectaire. Je songe simplement à un meuble de paysan, à la flèche d'un Sauvage, à une église d'Athos. Là il y avait civilisation," as mentioned in Jean Jenger, *Le Corbusier: Choix de lettres* (Basel: Birkhäuser, 2002), 108 (translation by the author).
44. FLC_M2(9)13.
45. As found in the folder M2(9), at the archives of Fondation Le Corbusier.
46. Indicatively mentioned: FLC_M2(9)26, M2(9)79, M2(9)83, M2(9)107.
47. FLC_M2(9)134. Handwritten note of Le Corbusier, April 7, 1955.
48. Chiambretto, *Le Corbusier*, 77–78.

# Afterword

## How to Build? On the Handling of Existing and Newly Constructed Buildings*

*Silke Langenberg*

The Rasch brothers published two widely acclaimed books, titled *Wie bauen?* (*How to Build?*) toward the end of the 1920s (fig. 11.1a, b).[1] The questions raised at the 2022 annual conference of the Association of Monument Preservation Authorities of Germany titled "Future Perspectives for the Preservation of Monuments" clearly correspond to the core message of these books.[2] As early as in 1999, Uta Hassler addressed the challenges involved in dealing with the building stock of the twentieth century in "Umbau, Sterblichkeit und langfristige Dynamik" ("Reconstruction, Mortality and Long-term Dynamics"). In that essay, which appears in *Umbau: On the Future of the Building Stock* edited together with Niklaus Kohler and Wilfried Wang, she elaborates on the Rasch brothers' observations.[3] She focuses there less on


**Fig. 11.1a, b.** Covers of the publications by Heinz and Bodo Rasch (1927/1928).

questions of monument preservation and the handling of protected "cult objects" and more on the sustainable management of the existing building stock.[4]

In view of climate change, the still enormously high consumption of resources in the construction sector, and a constant housing shortage, it seems appropriate to consider the question "How to build?" once again—this time in the context of preservation. To pose the question is clearly justified in regard to the field of new construction in light of the development of novel digital processes, sustainable building materials, and fabrication methods. However, the *How* part of the question has often been dropped recently and *To Build* has been called into question in the face of the far too frequent—in any case far too ill-considered—replacement of building stocks. Freek Persyn cautiously addressed the question in his inaugural lecture in 2021 at ETH Zurich with the title "Wouldn't It Be Nice If Architects Started Dreaming about Building Less?"[5] The initiative Stop Construction: A Global Moratorium on New Construction, launched in 2022, demands the same in a more radical tone.[6] At the same time, the institutional preservation of historical monuments is currently facing various theoretical and practical challenges, with regard not only to existing buildings but also, in particular, to newly emerging stocks. The future questions and perspectives for historic preservation that arise in this context appear to be urgent.[7]

## Stocks of the Boom Years

The first edition of *Wie bauen?* appeared in 1927 and was directly related to the housing estate of the Werkbund exhibition at the Weissenhof in Stuttgart.[8] The buildings erected there were intended to provide solutions for the dramatic housing shortage in cities that were growing rapidly as a result of industrialization. With their question *How to Build?*, Heinz and Bodo Rasch pointed not only to the new forms of housing and furnishings but also to building processes, including the developing industrial construction methods and new materials and components. Consequently, the subtitle of their second publication is *Materials and Constructions for Industrial Production*.[9] There had been attempts to rationalize the construction process by means of serial prefabrication since the mid-1920s, for example, in Walter Gropius's Dessau-Törten housing estates and in Ernst May's Frankfurt housing projects.[10]

Most of the buildings mentioned above are now protected and are carefully maintained. Nevertheless, they pose problems for the preservation professionals owing to materials, constructions, and prefabricated elements that were barely tested before use.[11] However, considering that the monuments of the Weimar period make up only a fraction of the overall building stock, it

**Fig. 11.2.** Serial prefabrication of building elements in a field factory directly on the construction site of Ruhr University Bochum. Aerial view, status at the end of April 1965, H. Lohoff, Bochum (released by R. P. Münster, no. 0236/65).

seems to be much more important to look at their successors: the extensive building stock of the postwar decades.

Whereas postwar reconstruction of the 1950s employed traditional building techniques,[12] the construction of the buildings of the boom years utilized earlier ideas of serial and industrial building production and, for the first time, with the help of new machines and building techniques, implemented them on a large scale. At the same time, the realization of new urbanistic concepts and architectural planning theories became possible.[13]

The building stock of the postwar decades has been a subject of discussion among scholars of historic preservation for many years.[14] Even if there has been general agreement that no new theory is needed for the evaluation of more recent stocks, it is still necessary to acquire in-depth knowledge of the relevant planning principles and construction processes in order to decide which objects to protect and to appropriately care for those buildings in the future.[15]

Housing construction is the area that accounted for the largest new stock built during the 1960s and 1970s. Another central building task of those decades was university construction—after all, the aim was to avert the German educational catastrophe predicted by the philosopher and theologian Georg Picht in 1964.[16] The first university to be founded after World War II in the still young Federal Republic was the Ruhr University in Bochum, for which construction began in the mid-1960s. Photos from the construction site show various borrowings from earlier innovations (fig. 11.2): the serial prefabrication of the building elements, which resembled the manufacturing process of the hollow blocks in Dessau-Törten, was done in Bochum in a field factory on the construction site. The gantry crane used to move the prefabricated ceiling slabs to their final position was reminiscent of the house-building machine developed by Ernst Neufert and published in his influential early 1940s book, *Bauordnungslehre*.[17]

## Industrial Construction Production

The construction of large buildings in the 1960s and 1970s was often based on specially developed building systems, as serial prefabrication needs only a limited number of standardized elements to be economically feasible. Production in a field factory reduced costs by shortening transport routes but did not pay off because of the initial investment required for setting up the facility.[18] However, as the universities and large hospitals as well as many new housing estates on city outskirts were state construction projects financed with public funds, the additional investments could be justified in part as "promoting the industrialization of the construction sector," regardless of their success or failure.[19]

In Marburg, where one of the first campus extensions was built in the late 1960s, all the parts of the load-bearing structure except for the cores were serially prefabricated in a field factory on site (fig. 11.3). The underlying construction system of the institute buildings is characterized by the combination of separate table units with four slender columns. The addition of further table units is easily possible and was anticipated from the outset. Moreover, the separation of load-bearing elements and finishing is characteristic and reveals essential contemporary planning parameters: these objects are designed for changeability, and their basic principle is "openness."[20] Such anticipation of continued growth was in accord with the spirit of the times, and the planners assumed that things would always go up and forward—until the Club of Rome reminded them of *The Limits of Growth* in 1972.[21]

In the 1960s, large-scale industrial prefabrication and on-site assembly emerged in housing construction as well. The housing estates built during this time by Neue Heimat (New Home), the biggest residential construction

**Fig. 11.3.** Field factory for producing system components on the construction site of the University of Marburg. Hochtief Nachrichten, December 1964.

company in postwar West Germany, illustrate the developments in building technology during Germany's boom years.[22] Neue Heimat used field factories for various large-scale housing projects, for example, at Kiel-Mettenhof. In those cases, manufacturing plants were erected on or close to construction sites to cast large numbers of standardized building *Camus* or the Danish system elements, which were subsequently stored on site for final assembly, eliminated the costs associated with long-distance transport. However, because of the relatively high investment costs, this manufacturing technology hardly ever paid off financially.

The number of prefabrication factories in the Federal Republic of Germany increased significantly during the 1960s—from fourteen in 1961 to five hundred in 1963 alone.[23] During this period, Neue Heimat also significantly increased its share of prefabricated housing units from 11 percent in 1964 to 27.5 percent in 1965 and to 33.8 percent in 1966.[24] For example, panels for the housing estates Fideliopark in Munich-Bogenhausen and Plettstrasse in the new neighborhood Munich-Neuperlach were cast by a company called Hinteregger in its production plant in the nearby municipality of Neufahrn, opened in 1964 and located some 40 km away from the construction site.

Hinteregger had developed an assembly system based on elements with fully installed pipes taken to the construction sites by company-owned trucks for subsequent assembly.[25]

At the beginning of the 1970s, efforts to industrialize residential construction were intensified in order to ease the still unresolved housing shortage and to offset significantly higher wages and construction costs. Neue Heimat participated in the 1972 *Elementa* competition, which was designed to "realize buildings of different shapes and sizes with different functionally adequate floor plans using only a few standardized prefabricated elements."[26] The entry submitted by Neue Heimat's design department under the direction of Paul Seitz received only third prize. Nevertheless, after 1973, its cross-wall construction system with load-bearing transverse walls and a span of 7.20 m was used in-house for projects in Hannover, Oberhausen and Hamburg (Mümmelmannsberg estate).[27] The facade panels and partition walls were not load-bearing, which allowed for the flats to be arranged very flexibly, but for the tenants, this flexibility was often limited to adding an extra wall to create separate bedrooms for the children.[28]

Apart from the prefabrication of standardized elements in factories, various new and improved formwork technologies were further developed and tested on construction sites from the mid-1960s on. Climbing and sliding formwork was increasingly used for installing shafts and stair cores in tall buildings. Formwork carriages or displaceable formwork facilitated cross-wall construction.[29] On the large construction site of the University Hospital of RWTH Aachen University, for example, which was built between 1971 and 1983—also a Neue Heimat project —the sliding formwork method, which had been used in residential construction since 1951, was utilized for the erection of the cores. The columns and slabs were manufactured in a battery formwork on the construction site or in a nearby plant.[30]

As other developers and the federal and state governments involved in the construction of their major education and infrastructure projects, Neue Heimat explicitly promoted the further development of rational production methods. Although they could not achieve significant cost reductions in construction, the new rationalized methods did lead to both time saving and better working conditions.

## Non-Obvious Values

From a preservation perspective, it can be argued that the technical innovations, manufacturing processes, and underlying planning principles are immaterial values of the objects that speak to their protection,[31] even if they are not recognizable after the construction is completed (e.g., sliding frameworks and innovative details). As such, they have both a scientific and, today, an architectural-historical value. At the same time, objects designed to be changeable pose various system-inherent conflicts for the preservation of monuments,[32] as their conversion is usually inevitably accompanied by the loss of original building substance: there may have to be a trade-off between the value of the original basic concept and that of the original material.

Even more difficult than communicating such inherent values, however, seems to be the preservation of large-scale projects that are socially unacceptable because of their scale, design, and choice of materials, as well as their high energy consumption. The aforementioned clinic in Aachen is one of the most prominent examples: on the occasion of the decision for its protection in 2007, under the title "Krankes Haus" (Sick House), the German magazine *Der Spiegel* described the building as a "monstrous energy guzzler" that "is a plague for people" and "protrudes from the landscape like a petroleum refinery."[33] In fact, the clinic in Aachen marks the high point and also the end point of the structural developments of the boom years, even though, owing to its long construction period, it seems committed to the architecture of the high-tech era in purely design terms and shows clear parallels to the Centre Georges-Pompidou in Paris, which opened in 1977. Like the Ruhr University in Bochum, the Aachen Clinic is a project in which progress, technology, and growth are structurally manifested, even if these had long since been replaced by ecological concerns by the time the building was completed. Both buildings are important contemporary examples of historical, urbanistic, and political values of their time, and as such have long been protected. However, as far as their design value is concerned, there is a disproportionately greater need for mediation than with older, smaller, and in many respects more favorable protected objects.[34]

The negative image of many buildings from the 1960s and 1970s also has to do with the fact that they have aged poorly. This is often an outcome of rapid construction but more importantly is due to inadequate maintenance and care. Added to this is the use of materials and constructions with which there was insufficient experience.[35] First and foremost, asbestos, which had been available since the turn of the century, appears prominently on the cover of Heinz and Bodo Rasch's second publication: asbestos fibers are listed after wood, cardboard, and peat, and followed by cork and corrugated iron. In the row below are concrete, glass, iron, plastic, enamel, and aluminum (see fig. 11.1b). The Rasch brothers put a question mark after each of these materials. Whether this was in view of their potential or because the brothers were already aware of the issue whether they were harmless remains open. However, the presence of toxic materials is seldom the sole reason why buildings from the 1960s and 1970s are abandoned and demolished, because the toxicity of asbestos generally has already abated or will abate shortly.[36] Demolitions are more likely to be due, on the one hand, to the poor or outdated condition of the buildings and their services, as well as to problematic building structures and cold bridges, and, on the other hand, to their high energy requirements and the contemporary demand for more comfort. In view of the resources stored in the building, however, retrofitting is far more sensible than replacing the existing structure, and criteria are needed that go beyond classic positions of monument preservation.

## Preservation and Renewal

In recent years, important research projects have helped to slowly change the view of the building stock of the 1960s and 1970s and to increase its acceptance.[37] All too often, however, the argument is based primarily on design. The focus is on eye-catching Brutalist concrete buildings of famous architects, even though these are not representative of the more anonymous masses of serial produced architecture.[38] In reality, only a certain proportion of the objects built in those decades can actually be attributed to Brutalism; nevertheless, for some years now, there has been a struggle for the preservation of these kinds of architectures.[39] Presumably owing to the lack of any exceptional value of the mass-produced objects, the proportionally much larger stock of system buildings is rather neglected and rarely protected.

Since the large building stocks of the boom years were built within a few successive decades, they all have to be renewed or upgraded almost simultaneously.[40] Among the most pressing tasks at present is the adaption of the buildings to contemporary conditions, as well as to current requirements and standards. In this context, system buildings in particular hold great potential, because a considerable part of this stock had been planned for growth, so conversion and further construction were anticipated.[41] The concepts originally oriented toward growth could also prove their worth under the current buzzword “sufficiency.” The focus here is less on the protected objects and more on the large mass of the unspectacular. Most of the buildings of the boom years simply provide affordable housing for a large part of the population, without which cities would no longer function; many of these buildings have already been adapted, altered, upgraded, and refurbished without encountering problems that cannot be solved. This requires not so much institutional preservation of historic buildings but rather responsible architects and builders as well as a society that demands the sustainable use of resources.[42] The demolition moratorium called for by the Bund Deutscher Architektinnen und Architekten (BDA) in 2022 seems to be an important step in this direction. As noted in the document's first sentence, "Instead of demolition and new construction, we stand for preservation, renovation, conversion and further building in the existing stock."[43]

## What Comes Next?

In the meantime, postmodern buildings and high-tech architecture of the late twentieth century are being examined at universities from the point of view of architectural history as well as monument preservation.[44] At the same time, the responsible offices examine the structures with regard to their worthiness of protection and draw up corresponding inventories.[45] In the case of high-tech era, highly engineered buildings, the question arises as to the possibilities of authentic material preservation of industrially prefabricated elements, especially in regard to facades and building services systems (fig. 11.4). In many cases, owing to the fact that the manufacturing companies are no longer in business, repairs are significantly more difficult and documents for many custom-made products are no longer available. The lack of spare parts usually results in the complete replacement of the technical systems, which are rarely designed according to the original plans but are rather technically optimized. In the case of high-tech architecture, it would be against industrial mass-production logic to reproduce spare parts by hand. Here, digital fabrication techniques offer solutions, as they allow for the production of spare parts as individual pieces or in smaller series.[46] Unlike industrial mass-production, large quantities are neither necessary nor feasible for economic production. Although the creation of digital models is costly in the absence of design drawings and 3D data, the possibility of storing data in the long term eliminates the need for stockpiling and enables local on-demand production of spare parts (fig. 11.5).

The digitally designed buildings of the early 1990s were built using contemporary conventional construction methods. Frank Gehry's complex architectural forms, for example, are not necessarily reflected in their construction process.[47] In the case of these young stocks, preservation professionals are primarily faced with the question of selection because what appears exceptional in terms of design at first glance may be comparatively unspectacular when viewed in a larger context. Theoretical discussions about the value of serial products, such as those by Walter Benjamin,[48] can be helpful here.

Unlike buildings designed simply using parametric methods, buildings made by means of digital fabrication processes are often prototypes of new construction methods, manufacturing processes, or material developments. They are also potential candidates for protection—less for design reasons than

**Fig. 11.4.** The filigree high-tech facade of the institute building on Clausiusstrasse “CLA” of ETH Zurich is constructed from special metallic components. Matthias Brenner, ETH Zurich.

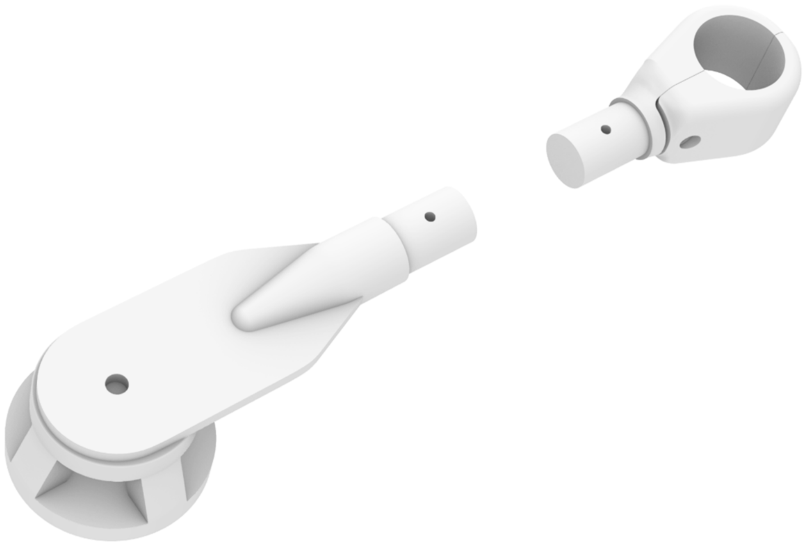

**Fig. 11.5.** The 3D model (for later 3D print) of a construction detail of the facade of the ETH Clausiusstrasse "CLA" institute building is a prototype for a repair process based on digital fabrication. Chair of Construction Heritage and Preservation in collaboration with Digital Building Technologies, ETH Zurich. Clement Estreicher and Matthias Brenner, ETH Zurich.

because of their inherent innovations. Comparative studies are again indispensable here to identify the buildings that actually represent pioneering. More important than the question of selection, however, seems to be the question of long-term conservation possibilities.[49] Highly technical buildings are generally constructed based on specialized knowledge that is only available to a very small group of people. That knowledge is often kept in patent specifications in such a way that the actual production method is difficult or impossible to reconstruct. In the context of monument preservation, it is not only interesting as to what extent the patent mediates as a kind of "actor between technical invention and [actual] building," but also whether it should be taken into account as a scientific value inherent in the structure when weighing whether the building should be protected.[50]

## How to Continue Building?

During the course of the twentieth century, the complexity of construction methods and joining techniques, as well as of the building processes, has increased significantly. Since the beginning of the twenty-first century at the latest, advancing digitization has exacerbated this development. Monument preservation is confronted with further challenges: the issue of long-term conservation and availability of digital planning documents as well as of digital control codes is still unresolved; the need to be able to disassemble digitally fabricated constructions and to maintain them more easily has only recently been considered.[51] Further, there is as yet little experience regarding the fundamental ability of "digital architectures" to age. However, there is great potential in the digital domain around maintenance and servicing.[52]

At present, the latest (digital) developments in building seem to be progressing largely independently and, above all, unobserved by the legal authorities of monument preservation. Unlike building archaeology, which has been critically questioning and adapting its methods for years,[53] there still seems to be potential for development in the field of digitization in monument preservation. The generation familiar with digital processes is still in training. It will be able to provide valuable impetus to the institutions entrusted with the preservation of existing buildings because many of the digital processes, while not yet commonplace, have now become comparatively standard in both planning offices and on construction sites. Building Information Modeling (BIM), for instance, underlies most major construction projects. Prototypes and demonstration projects showing novel digital designs and manufacturing technologies offer the opportunity to observe the aging and repair of experimental building processes, materials, and structures over the long term.[54]

Three-dimensionally printed components and even entire houses can now be found in various countries. In Switzerland, the 29-m-high Tor Alva is currently being built in Mulegns from 143 three-dimensionally printed concrete elements (fig. 11.6).[55] Digital component production from metal is also gaining previously unknown dynamism.[56] In the medium term, digital building processes are likely to not only influence the construction industry but to change it significantly. Various processes developed at an early stage are already marketable products.[57] In turn, patents are behind most of these developments. At the same time, for reasons of sustainability, the use of building materials like concrete and bricks is increasingly being questioned and the construction industry is testing newly developed products. The list of building materials that the Rasch brothers published almost one hundred years ago would now have to be expanded not only to include the mycelium currently being touted as the "building material of the future" but also self-repairing materials.[58]

In the not-so-young twenty-first century, we are still faced with the question *How to build?* The problem of housing construction, which characterized the boom years, remains topical. A lot of building will have to be done in the future, but in a different way than fifty years ago—not only in terms of design but also in terms of construction. If we take the notion of responsible and sustainable use

**Fig. 11.6.** Tor Alva Project in Mulegns, Switzerland. Chair for Digital Building Technologies, ETH Zurich, ©Digital Building Technologies, ETH Zurich.

of resources seriously, we will have to build with lighter, less and more sustainable material in cases of new constructions. In regard to the preservation and continued use of existing stock, another question will be *How to continue building?* It is not the task of historic preservation alone to answer the many pressing questions in building. This is a task incumbent on all architects, engineers, buildings owners, and politicians, as well as on the entire civil society.

## Notes

* This article is based on a keynote lecture given at the Annual Conference of the Association of Monument Preservation Authorities of Germany in 2022. The manuscript in German is published in a slightly shortened form: Silke Langenberg, "Wie bauen? Zum Umgang mit vorhandenen und neu entstehenden Bauten" (in print).

1. Rasch, and Rasch, *Wie bauen*. The publication was originally planned as a series. The first volumes appeared in 1927 and 1928. The third volume was announced in 1928, but did not appear: "*Wie Bauen?* Issue 1929 No. 3 was expected to appear in May 1929." Heinz Rasch and Bodo Rasch, *Wie bauen? Materialien und Konstruktionen für industrielle Produktion* (Stuttgart: Akademischer Verlag Fr. Wedekind, without year [1928]), 286.

2. Vereinigung der Denkmalfachämter in den Ländern, "Zukunftsfragen – Perspektiven für die Denkmalpflege," Jahrestagung der Vereinigung der Landesdenkmalpfleger, Münster, Germany, May 15–18, 2022, accessed March 19, 2024. https://www.vdl-denkmalpflege.de/fileadmin/dateien/Jahrestagung/Einladung_VDL-Jahrestagung-2022.pdf.
3. Uta Hassler, "Umbau, Sterblichkeit und langfristige Dynamik," in Uta Hassler et al., eds., *Umbau: Über die Zukunft des Baubestands* (Tübingen: Wasmuth & Zohlen, 1999), 39–59.
4. Leo Schmidt is the only one to devote his article to the comparatively small stock of protected monuments: Leo Schmidt, "Die Kultobjekte," in Hassler and Kohler, *Umbau*, 190–96.
5. Freek Persyn, "Inaugural Lecture at ETH Zurich," October 20, 2021.
6. Charlotte Maltherre-Barthes and b+, "Stop Construction: A Global Moratorium on New Construction," accessed March 7, 2024, https://stopconstruction.cargo.site/INFO.
7. Vereinigung der Denkmalfachämter in den Ländern, "Zukunftsfragen."
8. Heinz Rasch and Bodo Rasch, *Wie bauen? Bau und Einrichtung der Werkbundsiedlung am Weissenhof in Stuttgart* (Stuttgart: Akademischer Verlag Fr. Wedekind, without year [1927]).
9. Rasch and Rasch, *Wie bauen*, 1928.
10. Andreas Schwarting, *Die Siedlung Dessau-Törten. Rationalität als ästhetisches Programm* (Dresden: Thelem, 2010). See also Hartwig Schmidt et al., "Die Baustelle als Experimentierfeld: Industrieller Wohnungsbau in Berlin 1924–1931," in Uta Hassler and Hartwig Schmidt, eds., *Häuser aus Beton: Vom Stampfbeton zum Grosstafelbau* (Tübingen: Wasmuth, 2004), 60–76.
11. Nationalkomitee der Bundesrepublik Deutschland, ed., *Konservierung der Moderne? Über den Umgang mit den Zeugnissen der Architekturgeschichte des 20. Jahrhunderts. ICOMOS – Hefte des Deutschen Nationalkomitees XXIV* (Munich: Lipp, 1998).
12. Silke Langenberg, "Von konventionell bis rationell: Zur Bautechnik der neuen Heimat," in Hilde Strobl and Andres Lepik, eds., *Die neue Heimat, 1952–1982. Eine sozialdemokratische Utopie und ihre Bauten*, exhibition catalog (Munich: Architekturmuseum der TU München, 2019), 52–61.
13. Silke Langenberg, *Bauten der Boomjahre: Architektonische Konzepte und Planungstheorien der 60er und 70er Jahre*, 2nd ed. (Dortmund: Wulff, 2011). This and the following subsection are based on the manuscript of the publication mentioned. For more references and bibliographical information, see also Silke Langenberg, "Geplante Gestaltung – gebauter Prozess. Architektur der 60er und 70er Jahre," *Wolkenkuckucksheim: Internationale Zeitschrift für Theorie und Wissenschaft der Architektur*, 13, no. 2 (May 2009), https://www.cloud-cuckoo.net/journal1996-2013/inhalt/de/heft/ausgaben/108/Langenberg/langenberg.php.

14. Werner Durth and Niels Gutschow, *Architektur und Städtebau der fünfziger Jahre*, published by the German National Committee for Monument Protection (Bonn: Köllen, 1990); Ralf Lange, *Architektur und Städtebau der sechziger Jahre: Planen und Bauen in der BRD und der DDR von 1960–1975*, published by the German National Committee for Monument Protection (Bonn: Selbstverlag, 2003); Uta Hassler and Catherine Dumont d'Ayot, eds., *Bauten der Boomjahre: Paradoxien der Erhaltung* (Gollion: Infolio, 2009).
15. Christoph Heuter, "Zu nah dran? Bauten der 1960er Jahre als Herausforderung für die Denkmalpflege," in Adrian von Buttlar and Christoph Heuter, eds., *Denkmal!moderne: Architektur der 60er Jahre. Wiederentdeckung einer Epoche* (Berlin: Jovis, 2007), 28–35, 35; Silke Langenberg and Hans-Rudolf Meier, "Herausforderung Systembau: Denkmaltheoretische Fragestellungen," in Arbeitsgruppe System und Serie des ICOMOS Suisse, ed., *System & Serie: Systembau in der Schweiz. Geschichte und Erhaltung* (Zurich: gta-Verlag, 2022), 135.
16. Georg Picht, *Die Deutsche Bildungskatastrophe* (Freiburg: Walter, 1964).
17. Ernst Neufert, *Bauordnungslehre* (Berlin: Volk and Reich Verlag, 1943), 444–72. Hartwig Schmidt has already made the link between the house-building machine of Neufert and the Sommerfeld's *Bauschiff*, cf. Hartwig Schmidt, "Häuser aus Beton. Der Beginn einer neuen Bauweise," in Hassler and Schmidt, *Häuser aus Beton*, 12–23.
18. Langenberg, "Von konventionell bis rationell."
19. German Institute for Economic Development, ed., *Enquete über die Bauwirtschaft*. Commissioned by the Federal Government (Stuttgart: Forum, 1973).
20. Silke Langenberg, ed., *Open as a Matter of Principle: The Marburg Building System* (Sulgen: Niggli, 2013).
21. Donella H. Meadows, Dennis L. Meadows, Jørgen Randers, and William W. Behrens III, *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind* (New York: Universe, 1972).
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23. Walter Meyer-Bohe, *Vorfertigung: Handbuch des Bauens mit Fertigteilen* (Essen: Vulkan, 1964), table 174.
24. *Annual Report NHH*, no. 45 (1965) and *Annual Report NHH*, no. 56 (1966). Here referenced from Peter Kramper, *Neue Heimat: Unternehmenspolitik und*

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25. Silke Langenberg, “Neuperlach bautechnisch: Serielle Fertigung und Montagebau,” in Hild and Müsseler, *Neuperlach*, 388–93.
26. “Precast Construction: Elementa 72,” *Deutsche Bauzeitung*, 110, no. 7 (July 1976): 22.
27. “Die Wohnung passt sich der Familie an,” *NHM* 19, no. 1 (January 1973): 13–22.
28. Peter M. Bode, “Verschiebbare Wände im Schneckenhaus,” *Der Spiegel*, July 14, 1975, 40–44.
29. See Rolf-Dieter Kowalski, *Schaltechnik im Betonbau* (Düsseldorf: Werner, 1977); Oskar M. Schmitt, *Einführung in die Schaltechnik des Betonbaues* (Düsseldorf: Werner, 1981).
30. Langenberg, “Von konventionell bis rationell.”
31. Cf. DFG Priority Program SPP 2255. “Kulturerbe Konstruktion,” acessed March 7, 2024, https://kulturerbe-konstruktion.de/; Hans-Rudolf Meier, “Zur Baugeschichte jüngst vergangener Zukünfte,” in *Wie forschen? Chancen und Grenzen der Bauforschung an Gebäuden nach 1950*, Bericht der Koldewey-Gesellschaft, no. 50 (Stuttgart: Thelem, 2021), 23–33.
32. Silke Langenberg and Hans-Rudolf Meier, “Systemimmanente Konflikte,” in Olaf Gisbertz, Mark Escherich, et al., eds., *Reallabor Nachkriegsmoderne*, DFG-Netzwerk Bauforschung Jüngere Baubestände 1945+ (Berlin: Jovis, 2023), 19–28.
33. Andrea Brandt, “Krankes Haus,” *Der Spiegel* 59, no. 9 (February 24, 2006): 52–53.
34. In 2006, the Aachen hospital’s electricity consumption was 27,000 euros per day. Ibid., 23.
35. Uta Hassler, and Niklaus Kohler, “Einführung,” in Hassler, *Umbau*, 4–7.
36. Gerd Albracht and Oswald A. Schwerdtfeger, eds., *Herausforderung Asbest* (Wiesbaden: Universum, 1991); Wolfgang E. Höper, *Asbest in der Moderne: Industrielle Produktion, Verarbeitung, Verbot, Substitution und Entsorgung* (Münster: Waxmann, 2008).
37. Frank Eckardt, Hans-Rudolf Meier, Ingrid Scheurmann, and Wolfgang Sonne, eds., *Welche Denkmale welcher Moderne? Zum Umgang mit Bauten der 1960er und 70er Jahre* (Berlin: Jovis, 2017).
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39. *SOS Brutalism: A Global Survey*, published by Oliver Elser, Philip Kurz, and Peter Cachola Schmal in cooperation with Deutsches Architekturmuseum DAM and Wüstenrot Foundation, exhibition catalog (Frankfurt am Main: Deutsches Architekturmuseum, 2017).
40. Hassler and Kohler, "Einführung."
41. Silke Langenberg, "Flexibilität, Variabilität, Erweiterbarkeit: Planungsgrundlagen der 1960er und 1970er Jahre," *Archimaera*, 5, no. 4 (December 2011): 103–16.
42. Wilfried Lipp, "Vom modernen zum postmodernen Denkmalkultus? Aspekte zur Reparaturgesellschaft," in Wilfried Lipp and Michael Petzet, eds., *Vom modernen zum postmodernen Denkmalkultus? Denkmalpflege am Ende des 20. Jahrhunderts*, Bayerisches Landesamt für Denkmalpflege, Arbeitsheft 69 (Munich: Lipp, 1994), 6–12; Michael Petzet and Uta Hassler, eds., *Das Denkmal als Altlast? Auf dem Weg in die Reparaturgesellschaft. ICOMOS – Hefte des Deutschen Nationalkomitees XXI*, Nationalkomitee der Bundesrepublik Deutschland (Munich: Lipp, 1998).
43. https://abrissmoratorium.de/.
44. "Denkmal Postmoderne. Erhaltung einer (nicht)abzuschliessenden Epoche," conference March 3–5, 2022 in Weimar, "High-Tech Heritage, (Im)Permanence of Innovation," conference September 14–16, 2023, in Zurich, Chair of Preservation and Building History, Bauhaus University Weimar (Prof. Dr. Hans-Rudolf Meier) and Chair of Construction Heritage and Preservation, ETH Zurich (Prof. Dr. Silke Langenberg).
45. Ira Mazzoni, "Ungeliebt aber prägend," *Süddeutsche Zeitung*, September 5, 2019.
46. Matthias Brenner and Silke Langenberg, "High-Tech Architektur. Herausforderungen und Möglichkeiten der Erhaltung," in Kirsten Angermann et al., eds., *Denkmal Postmoderne: Bestände eine (un)geliebten Epoche* (Basel: Birkhäuser, 2024), 239–45.
47. The fact that buildings have been parametrically designed has little to do with their constructional and structural fabrication was cited as one of the reasons for initiating the international conference series "Fabricate" at the Bartlett School of Architecture London. See Bob Sheil and Ruairi Glynn, eds., *Fabricate: Making Digital Architecture*, London 2011, accessed March 19, 2024, https://www.jstor.org/stable/j.ctt1tp3c6d.
48. Walter Benjamin, "Das Kunstwerk im Zeitalter seiner technischen Reproduzierbarkeit," in Rolf Tiedemann and Hermann Schweppenhäuser, eds., *Walter Benjamin: Gesammelte Schriften*, vol. 1, Abhandlungen, 2nd part (Frankfurt am Main: Suhrkamp Verlag, 1980), 431–69.
49. Silke Langenberg, "Zur Erhaltung des nicht Haltbaren," in Birgit Franz and Gerhard Vinken, eds., *Das Digitale und die Denkmalpflege. Bestandserfassung – Denkmalvermittlung – Datenarchivierung – Rekonstruktion verlorener Objekte*, Veröffentlichungen des Arbeitskreises Theorie und Lehre der Denkmalpflege

e.V., vol. 26 (Heidelberg: Arthistoricum.net, 2017), 48–55, accessed March 7, 2024, https://doi.org/10.11588/arthistoricum.263.348.

50. Robin Rehm and Silke Langenberg, “Das Patent als Akteur technischer Innovationen. Hochschularchitektur der 1960er und 1970er Jahre,” *Kunst + Architektur in der Schweiz* 72, no. 4 (2021): 12–21.
51. The possibility of documenting and exchanging planning and manufacturing data independent of format and version is the topic of several research projects at ETH Zurich, e.g., Block Research Group, Open-Source-Computational Framework COMPAS, https://compas.dev. On aging software, see Parnas, *Software Aging.* “the need to be able”: At ETH, the Chair of Circular Engineering for Architecture (Associate Professor Dr. Catherine De Wolf), established in 2021, is dedicated to the topics of disassembling and re-use in various projects in order to promote possibilities for the further use and reuse of building components, https://cea.ibi.ethz.ch/.
52. Thomas Bock and Thomas Linner, *The Cambridge Handbooks in Construction Robotics: Elementary Technologies and Single-Task Construction Robots* (New York: Cambridge University Press, 2016).
53. Ulrich Weferling et al., eds., *Von Handaufmass bis High Tech I: Messen, modellieren, darstellen* (Darmstadt: Philipp von Zabern, 2003).
54. The DFAB House and the HiLo in Empa’s NEST building (Dübendorf, CH) are such demonstration projects. The construction processes are documented in detail and should provide clues to the future of building and the necessary conservation methods. See Konrad Graser et al., “DFAB House. A Comprehensive Demonstrator of Digital Fabrication in Architecture,” in Jane Burry, Jenny E. Sabin, Bob Sheil, and Marilena Skavara, eds., *Fabricate: Making Resilient Architecture* (London: UCL Press, 2020), 130–39.
55. “Digital Building Technologies”, accessed March 19, 2024, https://dbt.arch.ethz.ch/project/tor-alva/.
56. Mania Aghaei Meibodi et al., “Digital Metal: Additive Manufacturing for Casting Metal Parts in Architecture,” First International Conference on 3D Construction Printing (3DcP), November 25–28, 2018, Melbourne, unpublished manuscript.
57. The nonstandardized masonry facade of the Gantenbein winery (CH), prefabricated with the help of an industrial robot, has been further developed several times since 2006 and used in various projects. The Keller brickyard now offers a ROBmade product line using software solutions from ETH spin-off Rob Technologies: Fassaden by ROBmade. Vom digitalen Entwurf zum Bauteil, accessed March 19, 2024, https://keller-unternehmungen.ch/de-ch/keller-unternehmungen/sortiment/fassaden-robmade.html. For this, see also Gramazio Kohler Research, accessed March 7, 2024, https://gramaziokohler.arch.ethz.ch/web/d/projekte/52.html.

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Alberto Franchini earned a PhD in the History of Architecture and Urban Planning from the IUAV University of Venice in 2019 with a thesis on Giancarlo De Carlo (awarded the L'ERMA-C Prize and published in 2020). He was a Fellow of the Alexander von Humboldt Foundation at the Architecture Museum of TUM from 2021 to 2023, a Postdoctoral Researcher at the Archive of the Modern (USI) from 2019 to 2021, and an Instructor at Milan Polytechnic from 2020 to 2022. He has been a Research Assistant at the Chair of Modern Heritage Conservation at Technical University of Muich (TUM) since February 2024. His interests focus on understanding the role of the user in the design and modification of built heritage.

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Liat Savin Ben Shoshan, BArch, PhD, studied architecture at the Bezalel Academy of Arts and Design and Bar Ilan University. As a Postdoctoral Fellow at the Technion-Israel Institute of Technology, Haifa, she focused on the architect and town planner Yitzhak Perlstein and his cinematic documentation of his works. She writes and lectures on film, culture, and space, and on writing and filming as research methodologies in architectural planning. She has published papers on the window as a cultural and virtual space, the interrelations of urban space, memory, and cinematic space, documentary diary films and the city, and architecture and its reflection in film in the mid-century eras, particularly related to the postwar context and nation-building.

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