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Steel architecture available for all. Renzo Zavanella's work between design and production (1946-1958)

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Abstract

Renzo Zavanella stood out in the Italian framework for the research of architectural and construction solutions, which, taking advantage of steel construction, aimed at the mass production of buildings using prefabricated, demountable, reusable elements. Zavanella's efforts to collaborate with the manufacturing sector, which was oriented toward the massive diffusion of steel architecture in the 1950s, are not well known. Through the analysis of key buildings, this study aims to highlight this collaboration. Between 1946 and 1958, there were two phases of the architect's work: the first one concerned the construction of OM temporary exhibition pavilions (1946-1953); the second one, linked to the collaboration with UISAA and CECA, concerned prototypes for the assembly production of buildings. The steel structure service station (1954) represented the first project for the mass production of buildings, but the prototype was not built. The acme of this phase coincided with Expo 1958 when Zavanella developed a steel structure house project for UISAA, involved in the construction of the CECA pavilion. Budget problems forced the reduction of work; Zavanella reviewed the project for the exhibition, but the weakness of the context in which he worked manifested itself again.
The contemporary Italian construction developments confirmed the obstacles that affected Zavanella's work. Mass-produced buildings and the idea of a steel construction available for all remained largely unimplemented.

Keywords: Italian construction history, Steel construction, Exhibition, Industrialization, Mass production building

1. Introduction

In the 1950s, Italian steel construction developments were marked by the effects of the activity of the European Coal and Steel Community (CECA), founded in 1951 to create a common market for coal and steel. Belgium, France, the Federal Republic of Germany, Italy, Luxembourg, and the Netherlands became members. In Italy, in the field of building construction, CECA's work was conducted by the Italian Steel Applications Development Office (UISAA), by the Association of Steel Builders (ACAI), and by the College of Steel Technicians (CTA). Renzo Zavanella (1900-1988), an architect from Mantua interested in the relationship between project and industrial production on the scale of objects and architectural design, participated in these events. The results of the steel construction promotion program in the national context were conditioned by the Italian designers and builders' lack of familiarity with the technique and by the caution of users towards steel architecture. The frequent application of this option was favored in extra-residential fields (i.e., offices, factories), thanks, above all, to large public and private clients, such as Eni, Rai, La Rinascente, and Olivetti [1].

These cases concerned unique buildings, in which the use of the metal components corresponded with a proto-industrialized phase far from the mass production of construction systems and standardized buildings. It was more oriented towards the construction of iconic tall buildings, large roofs and curtain walls. In fact, the Italian experimentation on the steel house, which began in the interwar years – pilot cases were the houses of the 1933 Triennale – struggled to restart after the war. Building industrialization remained a theoretical question with sporadic applications in the debate on construction techniques for reconstruction. The slow post-war conversion of the steel

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industry and the hegemony of masonry and reinforced concrete techniques, supported by public programs, consigned steel construction to the margins of the reconstruction phase and expansion period of the 1950s. There were many reasons for this: the predilection of masonry and reinforced concrete techniques in public programs; the predominant structural research on reinforced concrete by the masters of Italian engineering; the consequent development of investments in the Italian manufacturing sector, as a consequence of the circumstances mentioned above, towards reinforced concrete, with a limited repertoire of wall components and finishings for steel structures buildings; the artisan organization of the manufacturing sector and of the design process that slowed down the industrialization of the building process; the slow diffusion of the prefabrication in the housing field and starting from reinforced concrete systems. Indeed, it was only in the early1960s that the *Prà Italsider* district in Genoa (1960-61) documented the attempt to relaunch experimentation on the steel house for large projects, which nevertheless remained a niche solution on the national scene and was rarely characterized as an option for mass housing [2]. The use of metal components associated with a concrete structure was more frequent, as happened in tall buildings with the spread of the curtain wall, a sign of the slow adaptation of the construction sector to the industrialization of the building site. The work of Renzo Zavanella stood out in this framework for the research of architectural and construction solutions, which, taking advantage of steel construction principles, was aimed at the mass production of buildings using prefabricated, demountable, reusable elements. The most recent studies conducted on Renzo Zavanella, based on readings developed in the 1960s [3], have highlighted the relationship between the architectural design process and the aesthetics of the industrial components in his work [4]. Studies done in the early 2000s in the field of construction history have indicated the designer's contribution to the development of suspended cable roofs in Italy in the 1940s-50s [5]. Zavanella interpreted this type of roof, synthesizing the aesthetic values of the "poetics of the filiform" of a rationalist matrix [6] with the mastery of steel construction.

However, Zavanella's efforts to collaborate between design and manufacturing sectors, oriented at the massive diffusion of steel architecture in the daily life of the Italian 1950s society, are less known. Through the analysis of relevant buildings designed by Zavanella, dating back to the period 1946-58, and of some emerging features of his approach to steel construction, this study aims to highlight this collaboration to enrich the knowledge of the steel construction history in Italy in the second half of the twentieth century.

2. Renzo Zavanella and the Italian steel building construction industry

Renzo Zavanella trained in Milan, where, in the 1930s, he participated in the development of advertising and exhibition architecture. The agreement established with Officine Meccaniche (OM) in 1946 marked a turning point in Zavanella's career and in the events of the Italian steel construction of that moment. After the war, his participation in the *Movimento per gli Studi di Architettura* (MSA) (Architectural Studies Movement) introduced Zavanella to the unification and standardization issues debated in the years of building reconstruction, training him to explore the aesthetics of the *civilization of machines* in domestic and working spaces.

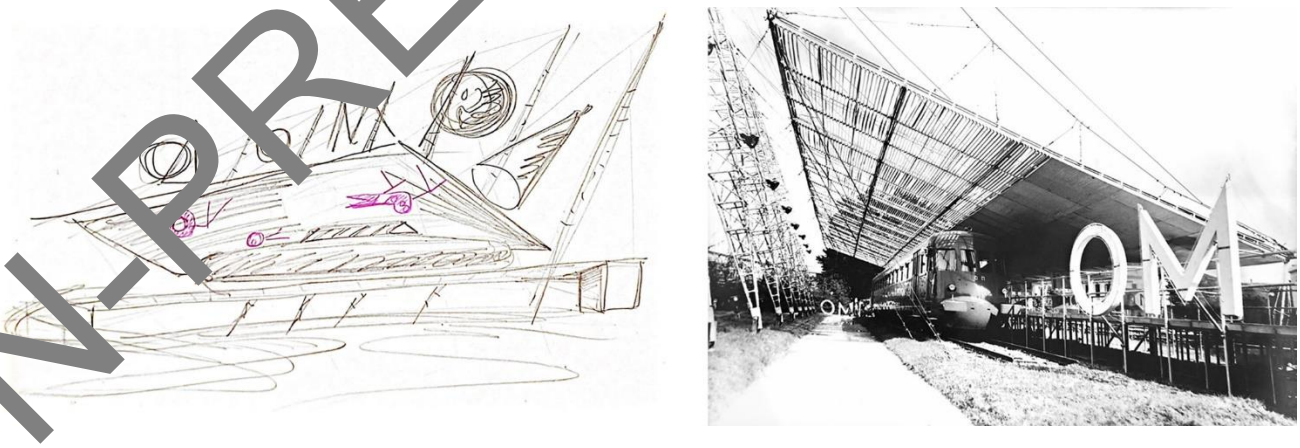

Fig. 1. The OM shelter at the Fiera Campionaria of Milan, 1950. Preliminary sketch and the built stand. Source: Centro Studi e Archivio della Comunicazione, Università degli Studi di Parma, Renzo Zavanella Collection.

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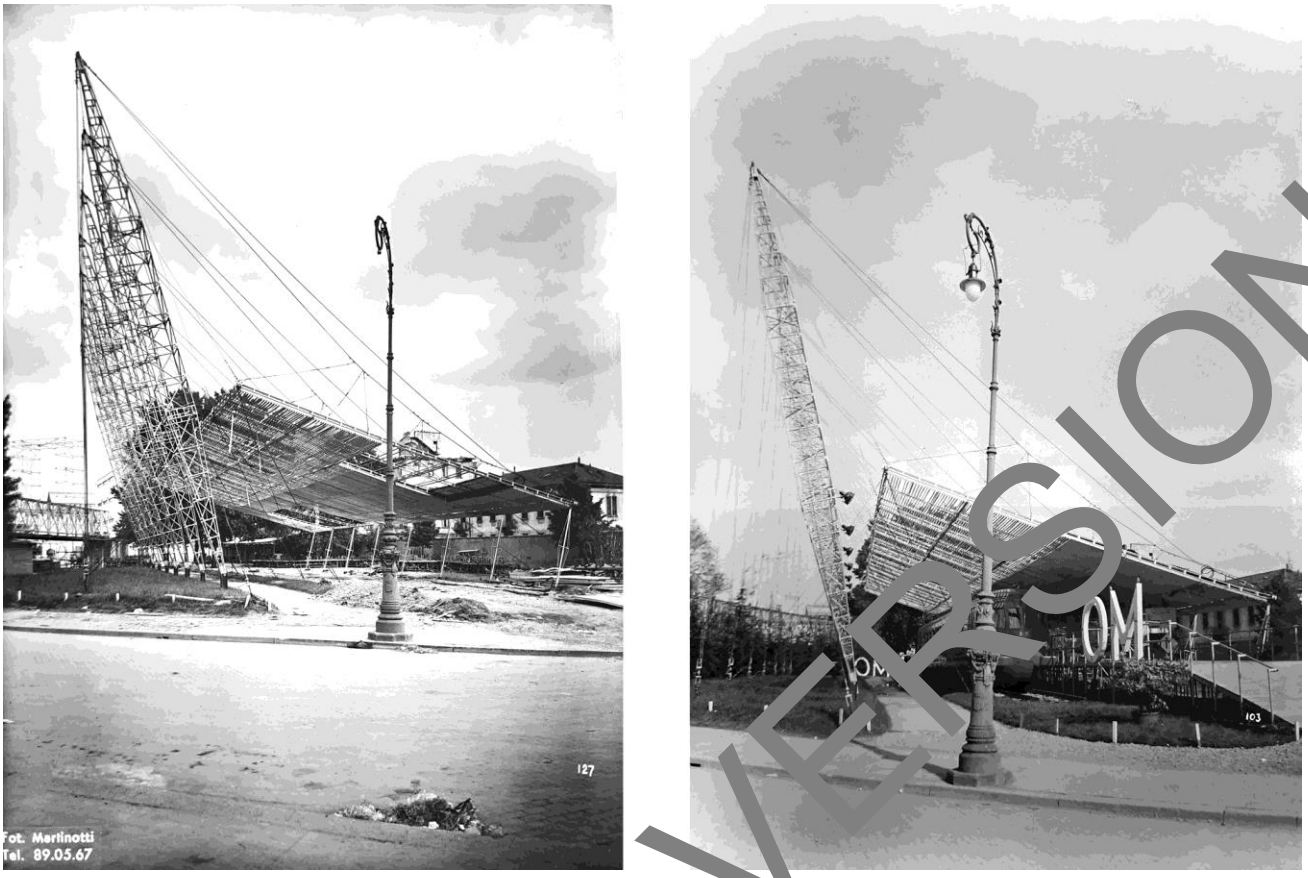

Fig. 2. The OM shelter at the Fiera Campionaria of Milan, 1950: the canopy under construction (left) and the realized building with the suspended cable roof (right). Source: Centro Studi e Archivio della Comunicazione, Università degli Studi di Parma, Renzo Zavanella Collection.

Zavanella's investigation started with the inventive exhibition structures for OM at the Milan Fair (1946-48-50-53) and continued with the Finmeccanica pavilion for the XI Triennale (1954), the project for the Dalmine motorway service station (1954), and then the Steel House for the 1958 Expo in Brussels. The use of steel, the exaltation of static flows, of connections, of the filiform silhouettes of the rods, forged the language of these works, in which Zavanella managed the code of steel construction with enthusiastic optimism as a "direct interpreter and creator of particular living conditions of Man" [7], that is the age of modernity, to which he looked with convinced trust in technology. Therefore, Zavanella aimed to achieve more diffusion of metal construction. However, he urgently needed to overcome the difficulties that inhibited this trend in Italy. Among the problems that affected the Italian context, he identified the still immature relationship between designers and manufacturers in the coordination of resources in the optimization of design and construction processes as one of the weak points of the Italian background. Zavanella's ten-year work with privileged interlocutors such as the UISAA, with companies such as Dalmine and, finally, with the CECA represented an attempt to counter this weakness.

Zavanella's tenacity supported his work as a privileged designer, accredited by clients-promoters of steel architecture, which recognized him as a precious ally for the development of consistent policies on metal construction, as well as a designer skilled in making the technique a spectacular matter. The development trajectory coincided with the series of stands and prototypes he curated for the exhibitions. The analysis of the buildings helps to clarify the experience and to place Zavanella's work in the Italian context of those years, highlighting – according to this study - two phases in the architect's work between 1946 and 1958. The first, linked to the collaboration with OM, concerned the construction of temporary exhibition pavilions and the spectacular use of steel construction. The stands and pavilions were a springboard for Zavanella's research into a broad use of steel, not limited to elite experiences and the iconic construction sites of large clients. The Fiera Campionaria in Milan constituted a decisive testing ground. The resonance of the event put the public in contact with the stands designed by Zavanella and fed public interest in these new architectures. At the same time, the Milanese successes did the groundwork for accrediting Zavanella at organizations such as UISAA and CECA as a skilled metal construction designer and helped him strengthen his relationship with industrial clients. The second phase of Zavanella's work, linked to his collaboration with UISAA and

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CECA and to a mass diffusion of steel construction, concerned the design of prototypes for the assembly production of buildings.

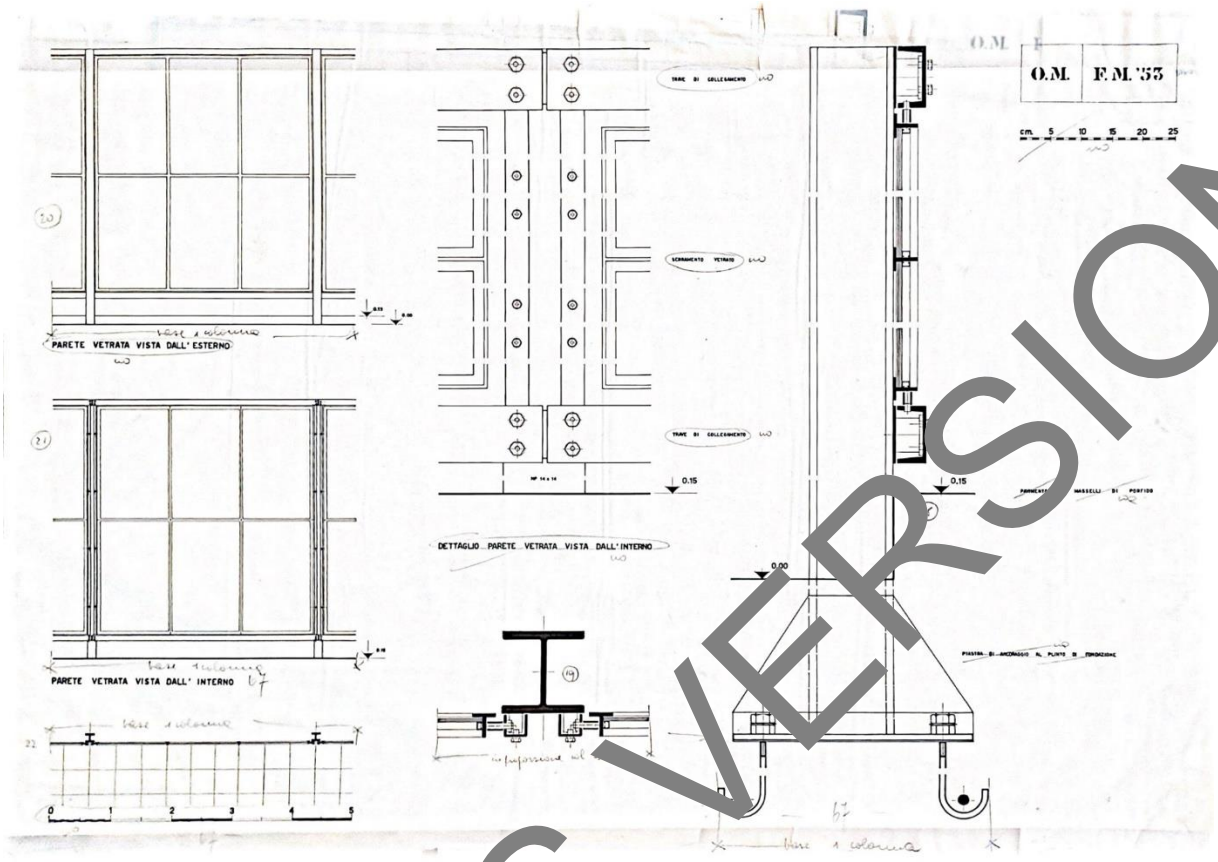

Fig. 3. The OM pavilion at Fiera Campionaria of Milan, 1953: construction details of the facade by Renzo Zavanella, highlighting the connection between the steel pillars and the glass façade. Source: Centro Studi e Archivio della Comunicazione Università degli Studi di Parma, Renzo Zavanella Collection.

The project for the steel structure service station for the X Triennale marked the transition to this new phase of Zavanella's program. It represented, in fact, the first project for the mass production of buildings. For Zavanella, it was a demonstration of the possibility of impacting the construction market with cheap, standardized, demountable solutions. On this occasion, Zavanella exhibited his idea of a building to be mass-produced, then reformulated a few years later at the UISAA and the CECA with the participation of the Steel Community at the Brussels Exhibition of 1958. In the 1954 exhibition, Zavanella was also very attracted to service buildings for transport systems as a field of experimentation for mass production. He considered this type of building "one of the liveliest and most current aspects of the needs of modern man" and positively evaluated the realization of typical elements for motels or service stations. He believed that "typical constructions such as these could be resolved on the level of a highly studied integral prefabrication to be able to be saved after the exhibition and then assembled even at a great distance" [8]. The acme of this second phase coincided with the 1958 Expo in Brussels. Zavanella was a member of the UISAA working group for the design of the CECA pavilion. His goal remained the effective collaboration with a client, promoting the development of an aesthetic of steel in the spaces and objects of daily use. The occasion was a steel structure house project with prefabricated and demountable elements. With this project, he intended to demonstrate how "a steel house can solve the housing problem both functionally and economically given its possibility of being mass-assembly production" [9].

3. The exhibition pavilions: spectacular structures

After WWII, in the Fiera Campionaria of Milan, which reopened with the reconstruction of the fair district, metal construction had prominence, with Gino Covre's large roofs, such as the two exhibition halls for the 1950 edition and the Meccanica Pesante pavilion for the 1951 exhibition (100 m of span). In addition to these examples of large roofs, the fair also stood out for its developments in small temporary constructions, such as the Guest House (1949) and the

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tower built for Fiat 1950, using tubular-section mullions, U-section cross-bands, and lattice elements. Pavilions marked the character of the exhibition, in the construction of which Zavanella's work emerged for the spectacularity of the roofs, as proved by the 1946 OM stand. Two years later, the first case linked to the large metal roofs that marked Zavanella's involvement at the Fiera of Milan advanced. The 1948 OM shelter was one of the first Italian examples of suspended cable roofs, which was resolved with the composition of a large, inclined flat surface (30x5.50 m) and six lattice trees (14.50 m high) with a tubular section to which the cable system was anchored. In 1950, Zavanella presented a variant of the 1948 stand at the Milanese fair: it was the shelter for the exhibition of the OM ALN 990 railcar. It was a pavilion consisting of a 1-metre raised walkway and a 35-metre-long canopy, with a maximum height of 18 m. The structure of the shelter was as essential as it was spectacular. Zavanella studied the shelter in numerous preliminary sketches, considering the incidence of the sun's rays and the geometrical composition given by the combination of the flat surface and the inclined supports (Fig. 1). The result was, as Zavanella wrote, a canopy "entirely hovering in space", suspended from a network of rods anchored to eight spindle-shaped supports, arranged at a distance of 5 m (Fig. 2). In 1953, Zavanella was once again the protagonist of the Milanese fair with a new OM pavilion, 45 m long, 8.40 m wide and 6.50 m high, on which a lattice roof was arranged. The plan of the building was organized on a 125x125 cm grid. The longer side of the module regulated the composition of the front, made up of 125 cm panels, and the arrangement of the pillars, placed at a distance of 3.75 m.

Fig. 4. The OM pavilion of 1953 under construction. Source: Centro Studi e Archivio della Comunicazione, Università degli Studi di Parma, Renzo Zavanella Collection.

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The structure of the building consisted of pillars connected to the crosspieces, arranged 45 cm from the ground and in correspondence with the roof structure. The beams had a section consisting of a C profile (100 mm) and a flat iron, while the roof consisted of trusses (primary and secondary) 10.80 m long and arranged at a span of 1.25 m. The sections of the bars of the trusses consisted of channel section, T-bar, and angle-bar profiles (Fig. 3). The intrados of the roof was clad by wooden matchboarding, while the external cladding was made of corrugated aluminum sheets (Fig. 4). The ceiling of the pavilion consisted of modular panels of steel grids (Keller type), which shaded and diffused the light (Fig. 5).

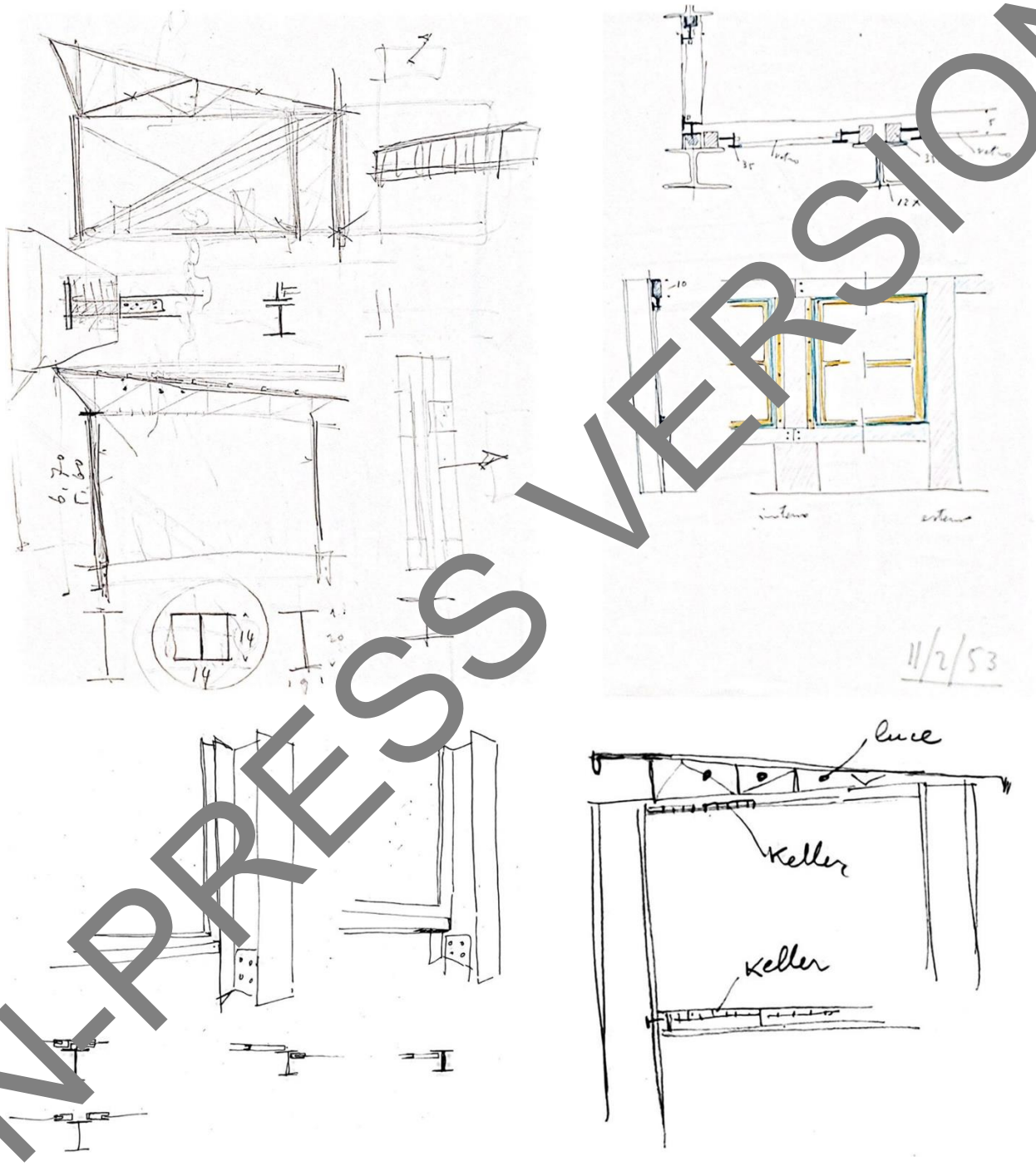

Fig. 5. The OM pavilion in 1953: preliminary sketches by Zavanella concerning the typical pavilion section, the joints between pillars and beams, and pillars and glass façade. Source: Centro Studi e Archivio della Comunicazione, Università degli Studi di Parma, Renzo Zavanella Collection.

In the same decade, Zavanella contributed to the cultural laboratory of the Triennale with research on buildings related to the diffusion of mass motorization in Italy [10]. In 1954 (X edition), he was curator of the *Architetture in*

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Movimento section and designed, with Giulio Minoletti and Mario Tevarotto, the Finmare-Finmeccanica pavilion, created to house an exhibition of drawings, photographs and components of naval buildings and furnishings. The building was part of the exhibition, destined, as Zavanella wrote, to host "those constructions which should be understood as real cinematic architectures" [11]. The pavilion was conceived as a promenade on the water, developed on a walkway that extended from one side of the lake to the other in the Triennale park. In the middle part of the path, the walkway was protected by a flat roof arranged on a series of pillars organized on a modular grid with a square base (2.80x2.80 m). This central part of the path was the actual pavilion made up of demountable steel elements (Fig. 6). The structure consisted of 36 columns, whose base was placed at the bottom of the pond. Their section comprised four angle bars welded together and spaced by metal blocks (Fig. 7). These 36 pillars were connected to each other by beams with a section composed of a U-profile and flat iron. The beams were arranged at the level of the walkway and in correspondence with the roof structure. Purlins were placed on the main steel structure to support the corrugated galvanized steel sheet panels.

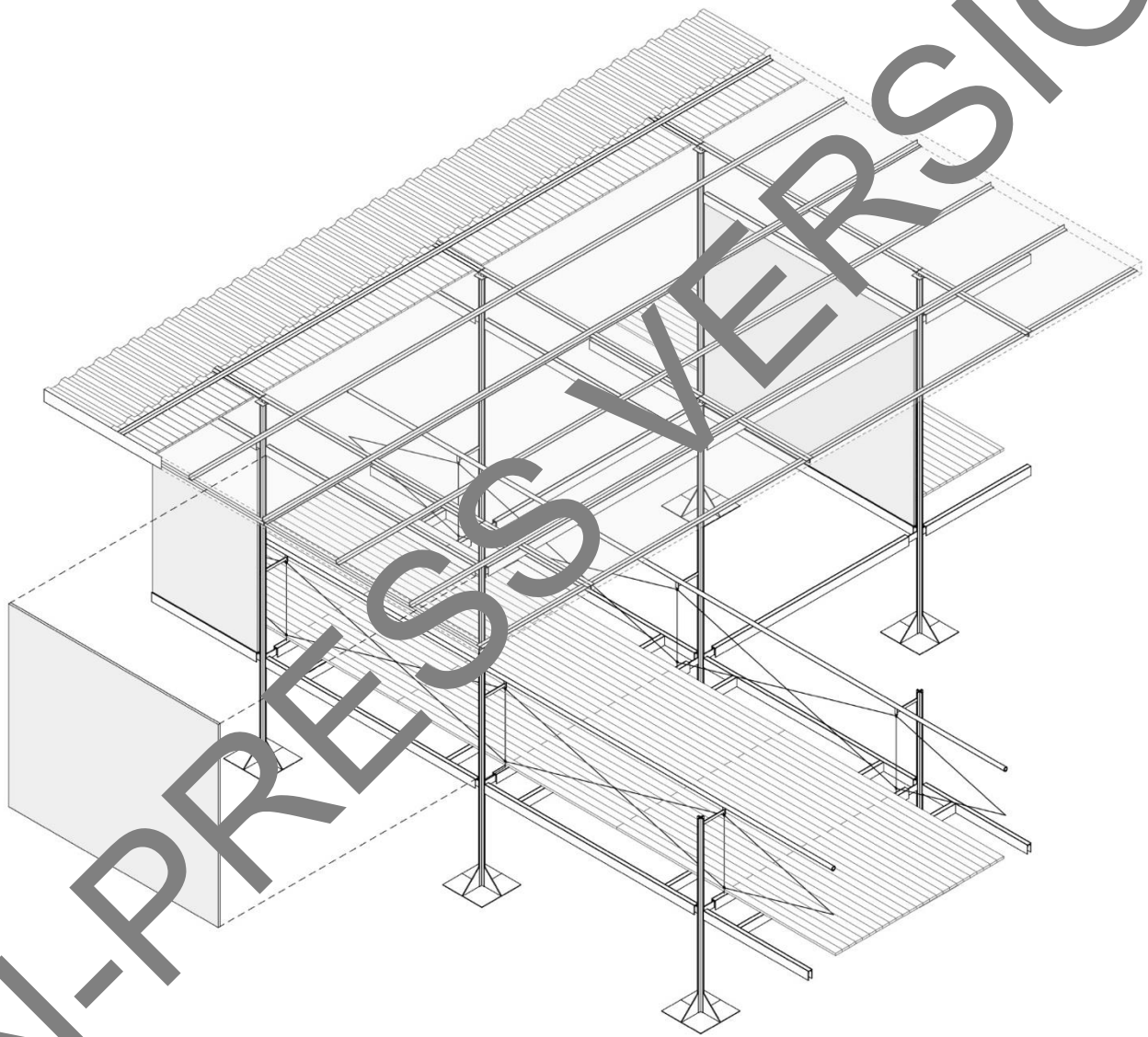

Fig. 6. Scheme of the construction system implemented for the Finmare pavilion at X Triennale of Milan, 1954: steel beams connected pillars under and above bracing panels (also used for exhibitions); lower beams supported the wooden floor of the walkway; purlins (L section) were placed on the steel structure to support the folded roofing sheet panels and the wooden ceiling. Source: image elaborated by the authors, 2024.

4. The Dalmine service station. The first project for mass production

In the 1940s-1950s, the design of service stations was based on metal construction. Consider, for example, the work of Andrea Marchetti, which focused on the use of elements that could be combined in configurations for small, medium and large stations for urban areas, and the series of urban service boxes developed by Agip. Marchetti started with

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typological studies on the new motorway service buildings and used metal construction as an effective option for prefabricated stations. Zavanella participated in this framework, albeit following a different path, taking steel as a material and technique effective to express various modern architectural typologies, including stations. Marchetti and Zavanella shared an interest in canopy design, which was considered a key element of the station's aesthetic and construction system [12]. In Zavanella's project, it became an iconic sign, exploiting the potential of technology to give spectacular features to the architecture of the small object in continuity with the pavilion roofs. Comparing the steel station project with the following service station designed by Zavanella for Motta in the 1960s-1970s, it is noticeable a different aesthetical language of the metal construction, in which he merged the vernacular approach required from Motta with the insertion of industrial components such as HE and IPE profiles, and sandwich panels [13]. The architect evolved his approach from the spectacular dimension of the large canopy to the domestic scale of the Motta restaurant, preserving the key role of the steel components in the representation of modern spaces. Zavanella's work was a particular expression in this field, comparable to the use of steel – even if his realizations were few – with the series of Pavesi and Motta highway bridge-restaurants. Steel service station for 1954 Triennale testified his first contribution to highway architecture.

In December 1953, the first documented contact between Zavanella and the UISAA took place to agree on the institution's participation in the X Triennale of Milan. The architect demanded that the UISAA management create a prototype of a single-family house or a portion of an apartment building with an all-steel structure, finishes and furnishings. The architect also introduced the option of a highway service building, such as a service station or motel.

In a letter dated December 1953, Zavanella specified the objectives of the project, which beyond the typology of the prototype, had to have "a technical, construction and economic form and substance whose features can affect the wider problem of the house steel structure" [14], thus highlighting the issue of the diffusion of steel in the housing sector, going against of the Italian construction mainstream of those years.

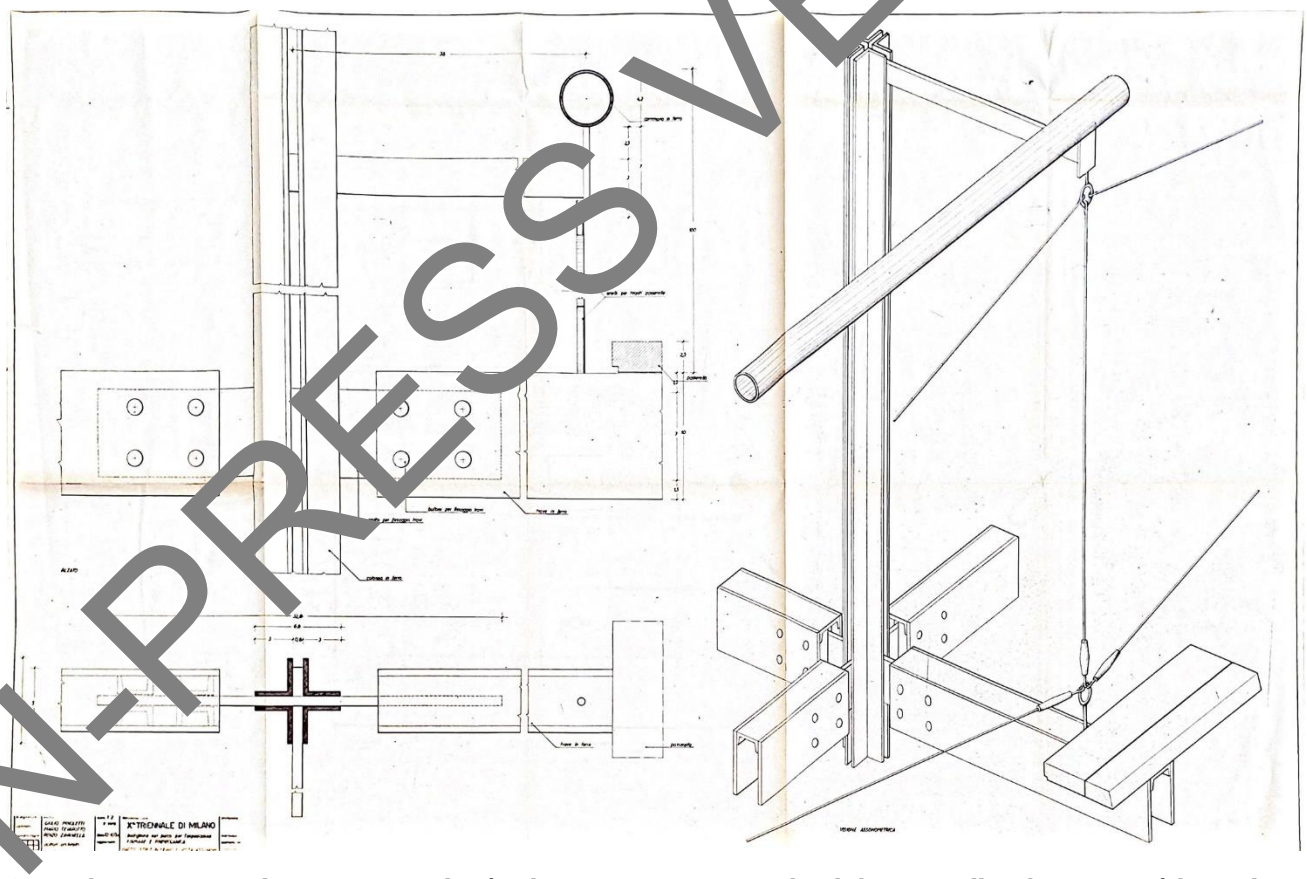

Fig. 7. The Finmare pavilion at X Triennale of Milan, 1954: construction details by Zavanella. The section of the steel columns is noteworthy, made up of four angle bars welded together and spaced by metal blocks. Source: Centro Studi e Archivio della Comunicazione, Università degli Studi di Parma, Renzo Zavanella Collection.

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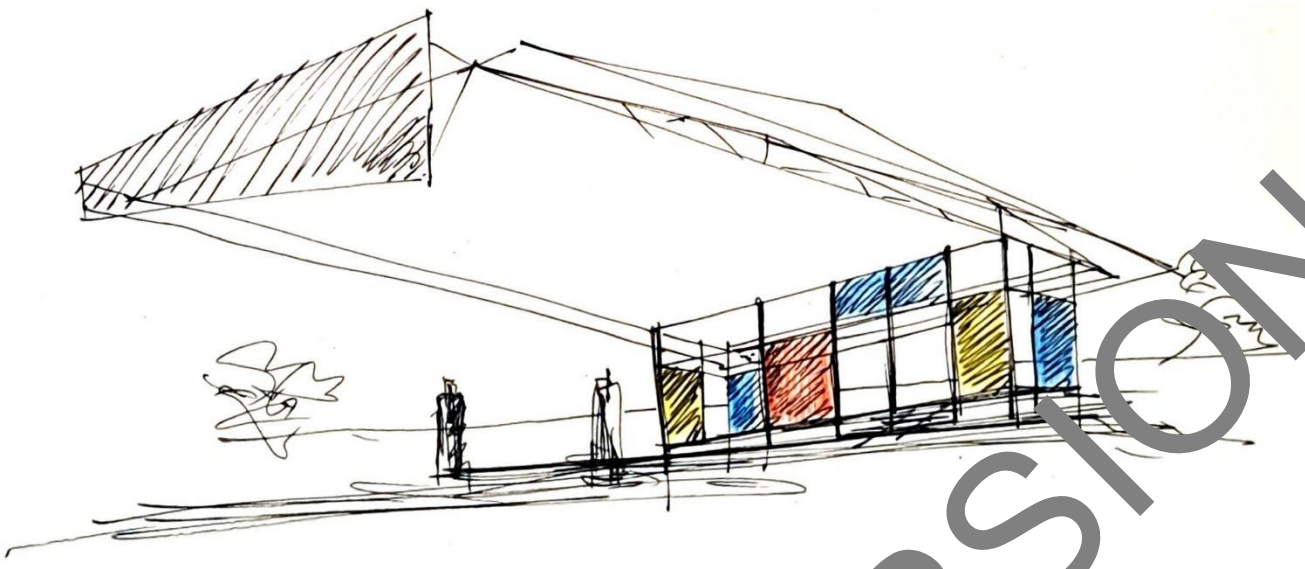

Fig. 8. *Dalmine Station* at X Triennale of Milan, 1954: preliminary sketch by Zavanella. Noteworthy are the great canopy and the use of different colors for the modular panels of the box. Source: Centro Studi e Archivio della Comunicazione, Università degli Studi di Parma, Renzo Zavanella Collection.

Ultimately, Zavanella's project focused on a motorway service station. It included a box (6.50x4.20 m) for assistance and sales services to travelers and a sunshade canopy extending over the service area. The element of great interest in the project was the shelter, 7.90 m long and supported by metal lattice beams arranged on uprights placed on the perimeter of the box (Fig. 8). The cladding of the steel structure was made up of aluminum sheet panels on the extrados and of plastic material panels on the intrados. The structure of the cabin and the shelter were completely prefabricated and could be disassembled. The external walls consisted of components with a metal frame and glazing panels. Some parts of the walls were made up of opaque panels of insulating material with a brightly colored plastic coating. During the winter of 1954, contacts with the UISAA management continued, but the institution could not support the prototype's creation. In the spring of 1954, the *Società Dalmine* took over, giving a favorable opinion on Zavanella's preliminary drawings and developing one by its technical department dating to 6 April 1954. The Dalmine station was based on a 1.125 cm module and a typical plan metric unit of 4.50x2.25 m [15], updated in a second version with a canopy (17.50 m long) [16]. Zavanella wrote to the UISAA manager Eng. Del Grosso informed him in June 1954 that the station would be built by the *Società Dalmine*. After a few days, it was Del Grosso himself who congratulated Dalmine and recommended the involvement in the project of the National Research Council (CNR) that was interested in promoting "productivity in building construction", establishing the presentation of the project as "Dalmine construction on the initiative of UISAA" as a condition of the agreement [17]. At this point, the contacts established by Zavanella between promoters and producers in the steel sector around the project of a steel prototype for the X Triennale seemed to translate into a decisive test for the diffusion of the material and technique in the Italian construction scene. However, the breaking of the context in which Zavanella worked did not take long to manifest itself. In early July, Dalmine wrote to the Mantuan architect to acknowledge that the station project had stopped [18]. So, nothing was done. The Dalmine station project did not reach the X Triennale, and the test of the steel mass diffusion program was postponed.

The steel house for the 1958 Brussels Universal Exhibition. The European context

The opportunity for Zavanella reoccurred a few years later. On 6 December 1955, a meeting of the CECA working group was held in Paris to discuss the institution's participation in the 1958 Brussels Universal Exhibition. It was decided to entrust the development of the various program points to be treated in the sections of the CECA pavilion to the Information Centers of the member countries [19]. Each Information Center (for Italy, the UISAA) was required to indicate an architect expert in the field of exhibitions. Zavanella participated in the first steps of the UISAA work. In a document dated 2 April 1956, the architect summarized his vision of the project, noting that the intent would be to "make known the importance assumed by steel understood not as a means of production, but as a product protagonist of direct and immediate relationship with the life of Man in his most diverse and distant needs, humble or important" [20]. The complex coordination between the various CECA countries determined constant changes to the pavilion's program. In the end, UISAA would be entrusted, among other things, with constructing a pilot single-family steel house designed by Zavanella. The Brussels project was part of the repertoire of prefabricated single-family houses developed

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in Italy starting from the 1933 Triennale and enriched with the prototypes of the 1954 exhibition, including the mountain house by Baldessari and Grisotti, the B24 house by Ravegnani and Vincenti, and the single-family house by Ponti, Rosselli and Fornaroli. In these buildings and other subsequent ones, such as the Minolina series designed by Minoletti for Holiday, all conceived as holiday homes, the metal structure was combined with wall and floor components of various types and, as in the prototype by Ravegnani and Vincenti, it was exhibited as an essential part of the aesthetical system of the house [21]. In Zavanella's prototype, on the other hand, steel was the basic material used for the structure and for the finishing and furnishing elements, an expression of the aesthetical and construction system of the building. We can note that it was the application of a promotion program similar to the campaign on the use of steel developed in the 1930s, which can be summed up in the call launched by *Casabella*, "Built in steel" [22], and that Zava[illegible]lla revised, aiming at the diffusion of a catalogue of small buildings. The house was designed to be [illegible]mble[illegible] disassembled, and reassembled, thanks to the modular nature of the elements, constituting a proving [illegible]example [illegible]f a catalogue house. Furthermore, if in the exhibition pavilions, the disassembly of the construction was [illegible]rdered by [illegible]e planned use of the buildings, in this case, the temporariness and lightness of the construction we[illegible] a new [illegible]d courageously antithetical issue of the domestic space, built on the values of permanence and mass typ[illegible]l of t[illegible]ma[illegible]nry technique, to which the Italian tradition was anchored. Concerning the concept of temporari[illegible]ss related [illegible] demountable buildings, Zavanella pointed out that "the house thus prefabricated does not denounce the weakne[illegible]nd te[illegible]porariness associated with other similar constructions. Even though it is fully advanced in its conc[illegible]n, tast[illegible] materials, and construction systems, it assimilates the tradition of the home understood in its [illegible]ssential and eter[illegible]al values: solid, protective, durable, welcoming, and intimate, small, and yet large, a true sign of peace [illegible]d civilization" [23].

Fig. 9. Steel house at the CECA pavilion, Expo 1958 in Brussels. Preliminary sketches by Renzo Zavanella. Source: Centro Studi e Archivio della Comunicazione, Università degli Studi di Parma, Renzo Zavanella Collection.

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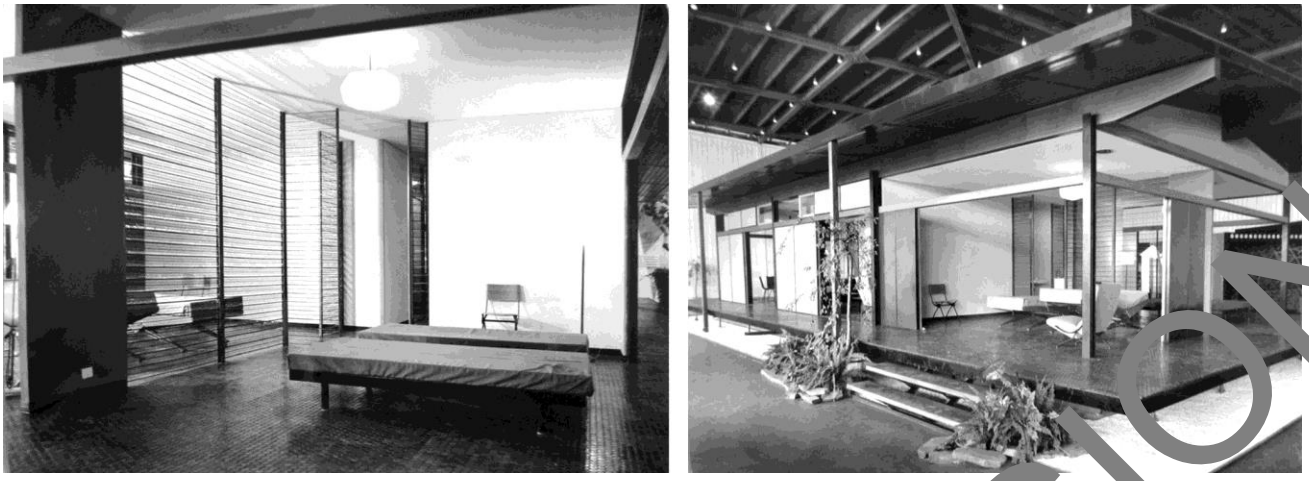

Fig. 10. Steel house at the CECA pavilion, Expo 1958 in Brussels. View of the prototype. Source: Centro Studi e Archivio della Comunicazione, Università degli Studi di Parma, Renzo Zavanella Collection.

The volume of the building is essential and corresponds to the principles of steel construction. Only in the design of the roof did Zavanella renounce the correspondence between the modernity of technique and innovation of architectural language, preferring the profile of the pitched roof to make the prefabricated object more similar to traditional housing models.

In the preliminary project, the structure of the house included uprights with a square, rectangular or T section and connecting beams arranged to support the guides of the external doors and windows and the perimeter walls and, on the fronts of the building, to support the roof structure (Fig. 9). In the built prototype, the structure of the house consisted of 8 pillars set on a reinforced concrete foundation plinth. In contrast, the structure of the floor, confirmed in the built version, was made up of T-section profiles (Fig. 10). The perimeter walls were planned and built of demountable modular elements, made up of panels with external cladding in enameled sheet metal, internal finish in gypsum plaster laid on a "Nervometal" support mesh obtained from cold-rolled steel strips, and interposed thermal insulating layer.

The events related to the assembly of the house document the troubled transition from the design phase to production and the construction site, highlighting the difficulties encountered by Zavanella in coordinating the specific issues of the prototype with the complex bureaucratic machine of the CECA and in transporting the components produced in Italy by Officine Bruno Cavaglieri to Belgium. Budget problems forced a decisive reduction of the work. Zavanella reviewed the project for the exhibition. The entire structure of the house was built, and the living room area was completed, while the other rooms were delimited only by the floors and ceilings. At the end of the exhibition, in the absence of specific drawings, the disassembly of the prototype was difficult, distressing one of the assumptions of Zavanella's program [2].

6. Conclusions

The analysis of Zavanella's work in the two phases – the exhibition pavilions and the projects for mass construction – highlights some predominant and invariant features in the architect's approach.

First, with reference to the use of the technique, we can observe that Zavanella conquered its avant-garde position in steel construction thanks to the research on the adjustability and disassembly of the construction system and to the ambition of the aesthetics of steel that he developed from the 1950s projects to the following realizations of the 1960s, such as the BPM offices and facilities. The 1950s buildings were fundamental in the definition of this path. The bolted unions between beams and pillars and the use of dry-assembled floors (in the OM pavilion of 1953 and the Finmare pavilion) match the issue of the demountable construction system, which he developed beyond the temporary nature of the exhibition buildings. Likewise, the study of the construction details, testified by the preliminary sketches of the nodes of the various structures, is a sign of the control of the technique, which moves towards the definition of an architectural language of steel construction, articulated through the colors used to highlight the static and construction relationships between the elements.

Secondly, as we consider his program for promoting steel as a technique available for all, some remarks can be raised. According to early studies on the Italian architect, he developed his ability to use mass industrial production as

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a "tool of language rather than of functional organization and economic rationality" [25]. However, it is possible to outline a further contribution, suggesting a wider role of the Italian architect in the steel construction background. In the 1940s-1950s, Zavanella's clients were agencies in charge of the industrialization of building production; they were responsible for the diffusion of steel construction in technological, aesthetic, functional and economic terms. Zavanella's collaboration with clients such Dalmine and UISAA is the feature of the architect's work and a substantial sign of his thought that moves behind the evolution of architectural language. The architect aspired to affect the cultural approach to steel architecture, starting from the relationship between production and design. He shared with his clients the aim of introducing the industrial product in a cultural and social background that was still skeptical of the subject, emphasizing typical features of steel construction: functional, economic, and social. His attention to the disassembly and reuse of the parts of the buildings, suggested by economic reasons, is extremely current and underlines his approach to the critical aspects of the technique. In Zavanella's works, disassembly and reuse issues were dictated by construction correctness, using the technique according to its characteristics and with respect to the economy, compatible with the idea of the modern technology available for all. Nevertheless, Zavanella's vision was affected by tools that were still being pioneered. The architect implemented his strategy by starting with his artisan atelier. The companies with which he collaborated to develop his projects to be mass-produced were factories such as Bruno Cavaglieri of Lecco, which worked according to an advanced craftsmanship approach. In this view, Zavanella's work was as part of the prefabrication of small buildings, such as service stations, single-family houses, and exhibition pavilions. These essential functional and construction systems allowed, in the 1950s, designers and manufacturers to experiment with the technique and create prototypes. However, this effort was not matched by commercial diffusion. The trend in contemporary Italian construction developments confirmed the obstacles that affected Zavanella's work. Mass-produced buildings and the idea of a steel construction available for all remained largely unimplemented.

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