Megastructures: a great-size solution for affordable housing. The case study of Rome.

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ABSTRACT

During the 70's and 80's, affordable housing production in Europe faced the huge emergency caused by rising urbanization. In suburban areas of European main cities, megastructures appeared, drawing visible marks in urban fabric. Megastructures were planned to synthesize residential functions and all existing services of traditional city in unique buildings. Nowadays, these buildings are affected by bad physical conditions and they are no longer able to satisfy the needs of the contemporary demand. The proposed paper investigates the genesis of housing megastructures with particular regards to the Italian case and council housing districts realized in Rome within the 1st public plan for council and affordable housing (1964), an original plan for the settlement of 700,000 inhabitants. A focus will be proposed concerning the differences between megastructures and traditional big buildings and the main connections between the spread of great-size buildings and the industrialization and automatization of construction techniques. An insight about possible future regenerations intervention is suggested.

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Megastructures; Council housing; Great-size Intervention; Regeneration; Existing Buildings

Introduction

Large-scale buildings appeared in Europe after the Second World War in the late 1950s as the result of the achievements of affordable housing research developed in the first half of the century. Rationalism deeply focused on minimal surfaces and standards. At the end of the First World War, important researchers began to investigate new solutions to ensure minimum requirements for low-cost housing[1]. The work of Gropius, Le Corbusier and not least Klein was aimed at introducing, in housing design, dimensional solutions that would guarantee the individual and the family satisfaction of the minimum needs and not exclusively the respect of hygiene standards.

The introduction of concepts such as the *existenzminimum* was the driving force for the diffusion of large-size complexes. Given the minimum living space for the satisfaction of human needs, the cell-unit could be repeated on a large scale, in a socialist vision of the world in which all men are equal without taking into account their social class. This approach presented by the rationalist movement allowed the introduction of industrialization in housing construction, according to the logic of the maximum result with the minimum economic effort[2].

In this cultural context, large-scale interventions started spreading. The term "*grand ensemble*" appeared for the first in 1935 in an article by the urbanist Maurice Rotival[3] published in "*L'Architecture d'aujourd'hui*" in which the concept of the *grand ensemble* is proposed to contrast the "*lèpre pavillonaire*" of the suburban traditional sprawl. From its origin, the great dimension approach is conceived as a way to provide respectable shelter to working classes and at the same time to guarantee a well-formed and structured urban development. Particularly interesting on the phenomenon of the French *grands ensembles* are the writings of A. Samonà[4].

A universal definition for "large-scale complex", or better with the French term *grand ensemble*, does not exist. There is not a legal definition and there is not an official category for this sort of urban development. The term does not define a manner of construction but rather a shape or a kind of landscape characterized by towers and lines in suburban areas[5] .

In 1959, the geographer Philippe Pinchemel[6] defined the *grands ensembles* as large-scale constructions with several thousands of apartments inserted in balanced and complete residential complexes. In France in 1959 to define a ZUP[7], the minimum threshold of 500 dwellings was defined. The threshold of 500 dwellings is considered a distinction between a large and a non-large housing settlement.

However, the size of the settlement cannot be the only factor for such a clear distinction between large and non-large housing. Given the ambiguity of the definition, Vieillard-Baron in his text finds five criteria for

204. Baffa Rivolta, Matilde and Augusto Rossari, eds. *Alexander Klein, Lo studio delle piante e la progettazione degli spazi negli alloggi minimi. Scritti e progetti dal 1906 al 1957* (Milano: Gabriele Mazzotta editore, 1975).

205. RenatoDeFusco,*Storiadell'architettura contemporanea* (Napoli: Laterza,1982).

206. MarcelRotival,'LesGrandsEnsembles', *L'Architecture d'aujourd'hui*, no. 6 (1935): 57–72.

207. AlbertoSamonà,*Lanuovadimensione urbana in Francia. I grands ensambles e la modificazione della forma della città* (Padova: Marsilio Editori, 1966);
Alberto Samonà, 'L'esperienza dei *grands ensambles* e il rinnovamento della struttura urbana', *Zodiac*, no. 13 (1964).

208. HervèVieillard-Baron,*Surl'originedes grands ensemble,* in *Le monde des grands ensembles,* edited by Frédéric Dufaux, Annie Fourcaut (Paris: éditions Créaphis, 2004).

209. PhilippePinchemel,RevueLogementn° 115, octobre 1959.

210. Zone à urbaniser en priorité.

defining a *grand ensemble*:

- the sharp break with the nearby urban fabric;
- the shape of constructions (*tours et barres*);
- the size (at least 500 accommodations);
- the method of financing with public partnership;
- the use of repeated construction procedures and the inclusion in the buildings of services and shops.

The definition of megastructures

Bars connected to towers, terraced houses merged into unitary complexes with multi-storey buildings, lines with concave or convex shapes, paths for pedestrian mobility (such as bridges or balconies) hosting residences and services: the occasion of the great size was an incentive for many designers to propose innovative typological solutions. Once the minimal residential cell (typological unit[8]) is defined, innovative solutions come from their varied aggregations.

The concept of housing becomes wider and complex: through impact solutions, architects tried to provide in unitary buildings all the functions to satisfy inhabitant needs. In this way, residential megastructures were born.

In the wake of this international great size fever, which arose in the first half of the '50s with interesting housing solutions especially in France and Great Britain, a series of residential megastructures began to be realized in Europe. During the 1960s with the definition of new settlements in suburban areas of big cities, architects and urban planners proposed interesting and disruptive housing solutions.

Important efforts were produced to design networks linking humans, technology, infrastructures and environment[9]. Several urban layouts appeared based on large-scale design and interactions between functions, structures and infrastructures: for Paris, Yona Friedman's Spatial City (1960) and Paul Maymont's Circular City (1965); for Tokyo, Kenzo Tange's Tokyo Bay project (1960) and Buckminster Fuller's Tetrahedral City (1968); for London, Archigram's Plug-In City (1964)[10].

The designers proved to be sensitive to the theme of the large dimension and proposed megastructures. On the contrary, many designers considered megastructures a complete social failure and started re-proposing in opposition traditional typological solutions, although marked by the great sign.

Within the definition of large dimension settlements, therefore, a first major distinction can be made: (i) large-scale interventions characterized by residential megastructures; (ii) large-scale interventions characterized

211. For typological unit is meant a group of flats (2 or 3 ... 8) and shared spaces (landings and stairs) composing the smallest autonomous unit in which a building can be subdivided (Lorenzo Diana, *Metodo CRI_TRA: un metodo di valutazione comparativa delle criticità e della trasformabilità edilizia del patrimonio residenziale pubblico in Italia* In *L' Analisi Multicriteri tra valutazione e decisione,* edited by Enrico Fattinnanzi and Giulio Mondini (Roma: DEI-Tipografia del Genio Civile, 2015); Enrico Fattinnanzi, 'La valutazione della qualità e dei costi nei progetti residenziali. Il brevetto SISCo', *Valori e valutazioni*, A. 5, no. 7-8 (2011)).

212. Larry Busbea, *Topologies: the Urban Utopia in France, 1960-1970* (Cambridge: MIT Press, 2007).

213. Ariane Lourie Harrison, *Architectural Theories of the Environment: Posthuman Territory* (London: Routledge, 2013).

by traditional types (simple multi-story complexes, towers, terraced houses).

It is difficult to give a univocal definition to the term "megastructure". Definitively univocal, however, is its precursor: Fort Empereur of Le Corbusier **[Fig. 1]**. Present in the Plan of Algiers of 1931, Fort Empereur shows an unlimited length and the clear distinction between the main permanent structure and the single residences, arranged according to the individual needs[11].

214. ReynerBanham,*Megastructure:Urban Futures of the Recent Past* (New York: Harper & Row Publishers, 1976).

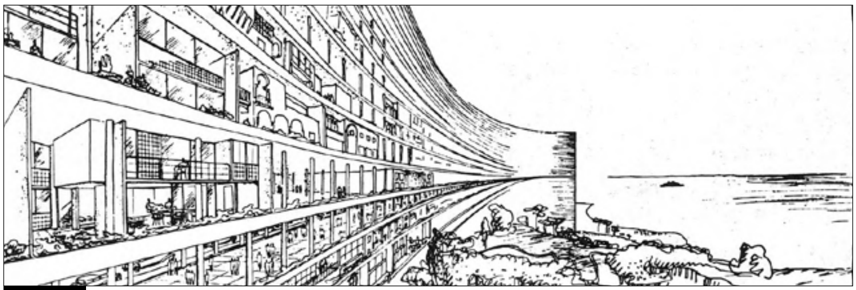


FIG. 1 Fort Empereur (Le Corbusier) present in the plan for Algiers of 1931 [Picture taken from: https://adt1314.wordpress.com/page/16/]

Fumihiko Maki, in Investigations in Collective Form, defined the megastructure as: "... a large frame in which all the functions of a city or part of a city are housed. It has been made possible by present day technology. In a sense, it is a man-made feature of the landscape. It is like the great hill on which Italian towns were built"[12].

In 1968, Ralph Wilcoxon (urban planning librarian at Berkeley's College of Environmental Design) proposed an introduction to his Megastructure Bibliography that defined megastructure:

- "... not only a structure of great size, but ... also a structure which is frequently:
- constructed of modular units;
- capable of great or even "unlimited" extension;
- a structural framework into which smaller structural units (for example, rooms, houses or other small buildings of other sort) can be built - or even "plugged-in" or "clipped-on" - after having been prefabricated elsewhere;
- a structural framework expected to have a useful life much longer than that of the smaller units which it might support"[13].

215. FumihikoMaki,*InvestigationsinCollective Form* (St. Louis: Washington University, School of Architecture, a special publication book 2, 1964).

216. RalphWilcoxen,*Ashortbibliographyon megastructures* (Monticello, Ill.: Council of Planning Librarians, Exchange bibliography 66, 1968).

Among the different types of megastructures, residential megastructures result to be particularly interesting. Given the assumption that in a megastructure more functions are provided within a single complex, it must be underlined that isolating and separating residential megastructures from other kind of megastructures is difficult and fundamentally wrong.

In this way, a residential megastructure is considered: a particular sub-class of megastructures where the residential function is prevalent; a kind of suburban development in antithesis to the traditional sprawl; a housing settlement with a social and popular connotation; a building with a strong functional mix. Several recurring elements distinguish residential megastructures: the multi-functionality; the monumentality of the structural elements; the possibility of successive extensions; the double level of fixed structure on a large scale and minor housing units.

The Great Britain was a country where many residential megastructures were built. However, the trend towards large size, both in Britain and in other European countries, had always influenced the history of social housing. The concept of vast residential block has become almost a symbolic guarantee of the good intention of "giving houses to the people"[14]

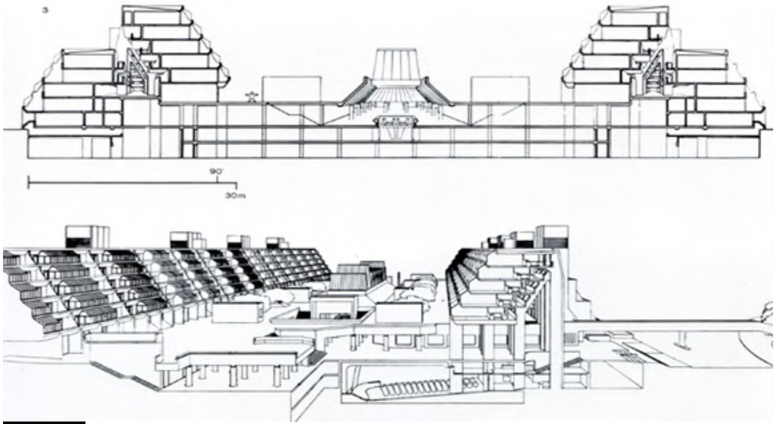


FIG. 2 Brunswick Center in Bloomsbury (London) – section [Picture taken from: https://www.pinterest.ch/pin/697917273479532929/]

Some examples of residential megastructures in England are emblematic.

In 1964, Sir Leslie Martin and Patrick Hodgkinson designed the Brunswick Center in Bloomsbury (London – [Fig. 2]). The Brunswick Center was defined as a megastructure right from the start: perhaps the first example of urban megastructure, a building that is a city instead of to be simply one component of a city[15]. It appears a megastructure even based on a merely visual criterion. It has two back-to-back *terrassenhauser* sections, facing one of the sides of the lot. The A-frames that support them are asymmetric: not only one of the legs of each frame is vertical but also the terraces are arranged asymmetrically. The terraces of the external facades begin and end two floors lower than those of the internal facades. For eight bays of the external east façade the terraces are completely abolished, and the vertical pillars form a gigantic portico through which it is possible to pass from the external public space to the internal space of the Brunswick Square. One of the main coincidences with the megastructure principles is the fact that the existing building is expandable if needed. The tribute to Antonio Sant'Elia [Fig. 3], the foremost ancestor of megastructures, is clear: the *terrassenhauser* sections above the public access spaces inside the A-frame; the twin towers that flank the entrances and stairways; the tapering of the surfaces around these entrances; the horizontal lines fluted in the side walls. Even the tapering of the vertical pillars in the open portico appears unequivocally

217. Banham, *Megastructure.*

218. Renato Crosby, "Brunswick Center, Bloomsbury, London. Criticism by Theo Crosby." *Architectural Review* no. 908, vo. 152(1972): 211-214

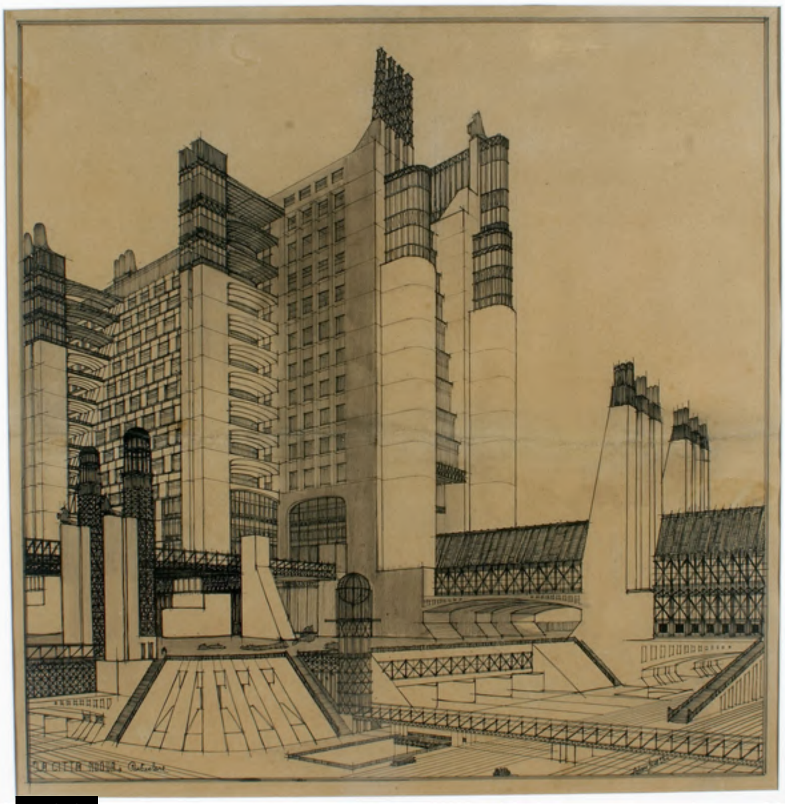


FIG. 3 Antonio Sant'Elia, particular of the series La città Nuova, 1914 [Picture taken from: HYPERLINK "https://it.wikipedia.org/wiki/Antonio_San%27Elia" \l "/media/File:Casa_Sant%27Elia.jpg" https://it.wikipedia.org/wiki/Antonio_San%27Elia#/media/File:Casa_Sant%27Elia.jpg]

futurist[16].

In 1963, Chamberlin Powell and Bon designed the Barbican District in the City of London **[Fig. 4]** including 2,000 apartments and multiple functions. Functionally it looks like a megastructure but the vision is less "megastructural" than the contemporary Park Hill in Sheffield **[Fig. 5]**. In the construction details, Barbican District recalls the romantic classicism of the last Le Corbusier: the concrete is left *brut* giving a general atmosphere of magnificent ruins. The general conception is based on a pair of long slabs raised on *piloties* above the parking spots (like *unité d'habitation* of Le Corbusier). These slabs are disposed along three sides of a square, to evoke memories of classic Georgian London urban planning procedures. For many years it was called "the damn megastructure" because incomplete[17].

FIG. 4 Barbican District in the City of London [Picture taken from: http://www.london-epc.co.uk/wp-content/uploads/2014/11/barbican.jpg]

FIG. 5 Park Hill in Sheffield (Jack Lynn and Ivor Smith) [Picture taken from: https://www.citymetric.com/fabric/massive-cliff-windows-regeneration-sheffield-s-park-hill-estate-3462, Image: Hawkins\Brown]

FIG. 6 A scene from the movie "A clockwork Orange" by Stanley Kubrick set in Thamesmead [Picture taken from: https://umd.studio/journal/thamesmead/]

The Thamesmead neighborhood, in the suburbs of London, was a complete New Town that looked like a single great-size building of several miles. It can be considered as a typical residential megastructure, not even bad at first sight with *terrassenhauser* on water, shops, schools, and a health center all accessible through varied network of pedestrian coverings[18]. When Stanley Kubrick wanted to conjure up an urban dystopia for his film "A Clockwork Orange" **[Fig. 6]**, the concrete tower blocks, artificial lakes and elevated walkways of Thamesmead provided the futuristic backdrop[19].The Alexandra Road complex **[Fig. 7]** in the Borough of Camden in North West London, designed by Neave Brown, tends to use the term "megastructure" in a remarkably narrow and frankly hermetic sense. Paradigm of geometric simplicity among other megastructures: standard *terrasenhausen* section, with inward-facing terraces and railroad-facing shoulders. The 7-storey section is repeated without any variation for the 1,700 meters of the entire block, with the only variation of the slight curvature. The Alexandra Road complex was accused to be "inhumanly boring" as well as the district of Clipstone Street in London (by Mike Gold, Studio Armstrong and McManus), product of the so-called "cold school"[20].

219. Banham, *Megastructure*

220. *Ibid.*

221. *Ibid.*

222. Joanne O'Connor, 'From Kubrick's dystopia to creative hub – London's new town is reborn'.*The Guardian online*. 2017. (Source: https://www.theguardian.com/society/2017/may/13/thamesmead-regeneration-kubrick-dystopia-creative-hub-clockwork-orange).

223. Banham, *Megastructure.*

FIG. 7 Alexandra Road, Camden (North London) [Picture taken from: http://www.panoramio.com/photo/16965970]

FIG. 8 Robin Hood garden (Alison and Peter Smithson) [Picture taken from: http://www.justurbanism.com/tag/london/]

In London, another intervention of a brutal nature that can be considered for the typological mix as a megastructure is the Robin Hood Garden [Fig. 8] by Alison and Peter Smithson.

In the other side of the world, around 1960, the launch of the Metabolic manifesto[21] was an attempt to present megastructures as a Japanese contribution to the modern architecture, marking the independence and maturity of Japanese architecture. The Metabolism tried to fuse the great size dimension approach of megastructures with the continuous transformation of cities as active biological organisms. Urban Metabolic utopias were based on the concept of "city as a process" in opposition to modernist ideas of the "city design"[22]. Kenzo Tange best exhibited the ideals of the Metabolist manifesto in the 1960 Tokyo Bay project. The project is based on the idea that the standard modern city is victim of the sprawl. Tokyo has no more free land to exploit; therefore new building plots must be artificially created on the sea with a process of interlocking loops expanding across the bay. Following the principles of megastructures, fixed monumental structures are the pattern of the intervention while small units, dedicated especially to housing, have a temporary role and can be continuously regenerated. The basic structure has a curved A-section with not aligned units stacked on top of each other [Fig. 8a][23]. Metabolic architectures appear powerful, imposing, brutalist, irregular, bringing out the use of reinforced concrete in a monumental and massive way. The Metabolism, despite its strong iconographic charge, remained more a theoretical and symbolic utopia rather than a practical movement. Only some individual buildings were built all around the Japan. A clear symbol of the Metabolic architecture is the Nakagin Capsule Tower, designed by Kisho Kurokawa in 1970 [Fig. 8b].

For the definition of residential megastructures, as done previously for large-scale settlements, we try to establish a conventional definition.

224. Launchedbyagroupofyoungarchitects including Fumihiko Maki

225. Zhongjie Lin, *Kenzo Tange and the Metabolist Movement: Urban Utopias of Modern Japan* (London; New York: Routledge, 2010).

226. Banham, *Megastructure.*

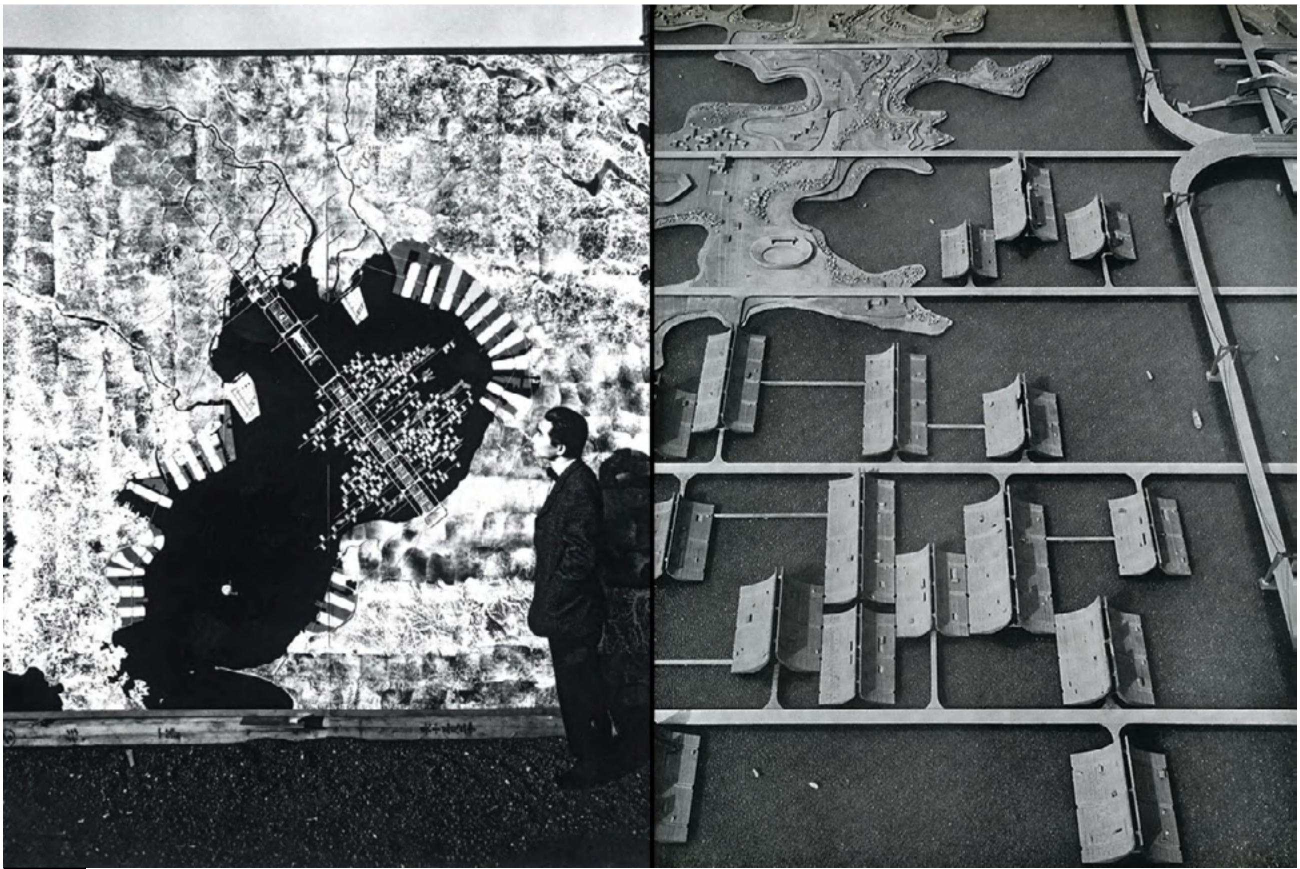


FIG. 8a Kenzo Tange's Tokyo Bay project (1960) [Picture taken from: http://archeyes.com/plan-tokyo-1960-kenzo-tange/]

Large-scale complexes are considered as residential megastructures if, within high-density unitary buildings mainly for residential use, there is:

- a functional mix between spaces for flats, spaces for commercial activities, spaces for services to people and spaces for collective activities;
- a clear separation between the flows linked to vehicular and pedestrian mobility, with intersections between the two (eg the case of bridge buildings);
- an important presence of common spaces, open or closed, with a clear shape identified in the overall organism;
- a modular and repetitive housing system;
- an integration between different typological units;
- a monumental structural framework and a housing system at smaller scale;
- a relationship with the orography of the site in which they are inserted.

Several residential megastructure arose in various European countries. In detail, we will analyse the production of residential megastructures in Italy and more specifically the case of Rome. In Rome during the years ranging from 1960 to the end of the 80s, a massive intervention in terms of council housing was set.

FIG. 8b Nakagin Capsule Tower in Tokyo (Kisho Kurokawa) [Picture taken from: https://en.wikipedia.org/wiki/Nakagin_Capsule_Tower]

A large part of the Italian council housing asset has been built since 1960s, in continuity with the global utopian megastructure fever. In those years, main cities were populated in the suburban areas of great-size structures designed for affordable housing, with the target of hosting all the functions of the whole city in unique buildings.

Several megastructures were built in the suburban area of big cities: Corviale, Laurentino, Vigne Nuove and Pineto in Rome, Rozzol Melara in Trieste **[Fig. 9]**, Monte Amiata in the Galleratese district in Milan **[Fig. 10]**, Le Vele in the Secondigliano area in Naples **[Fig. 11]**, Forte Quezzi in Genova and many others. In these structures, the architectural sign bypasses its traditional dimension to become urban as an artificial element of the landscape. In these settlements, an interesting interaction can be found in the distribution system, in the different functions and in the different mobility systems.

Rome and the 1st P.E.E.P. – description of the asset

The period ranging from 1964, the year of approval of the 1st P.E.E.P.[24] (1st public plan for council and affordable housing) of Rome, to the end of

227. In Italian, P.E.E.P. stands for Piano di Edilizia Economica e Popolare.

FIG. 9 Rozzol Melara (Trieste) [Picture taken from: https://c1.staticflickr.com/3/2811/9004643693_81063ac07e.jpg]

FIG. 10 Gallaratese (Milano) [Picture taken from: http://www.atlantedellarteitaliana.it/immagine/00010/6294OP1593AU10698.jpg]

FIG. 11 Le Vele (Napoli) [Picture taken from: http://www.listonemag.it/wp-content/uploads/2014/06/vele3.jpg]

'80s, year of completion of the last settlements, is the period defined of the "great dimension".

The different districts approved and realized within the P.E.E.P. plan indeed do not share between each other only a specific period of construction. What almost all districts share is the design approach: the districts realized are considered as finite parts, concluded in itself, following the approach of the large dimension, completely antithetical to the traditional compact city.

The main interesting elements regarding the 1st P.E.E.P. are:

- the numerical consistency and localization of the districts that makes Rome a unique case in Europe for the number of council housing units built and for the contribution given to the urban development of today's suburbs;
- the morphology and the density of districts, in sharp contrast to the compact existing city;
- the typology proposed for buildings, a virtuous example in many cases of articulations and experiments, including the experiences of megastructures;
- the construction techniques, with the use in many cases of prefabricated elements or the use of tools aimed at the industrialization of the construction procedures.

The distinctive traits of the 1st PEEP in Rome: the monumental urban architecture

The 1959 was a turning point in Italian architecture. It was in fact the year when Ludovico Quaroni presented for the competition for the CEP district of the Barene of San Giuliano in Mestre his proposal: a group of "circus" of varying sizes, respectively with 370, 270, 170 meters of internal diameter [Fig. 12]. Quaroni's project did not win the competition but, given its strong figurative power, it became a "model" to be copied in infinite variations, prototype of the "designed" architecture, of the gesture, of the architect's self-referential and individual sign.

This project became emblematic for a whole generation of designers to the point of repeating and emulating the model in countless cases. "The excess of figurative charge, of non-requested monumental and symbolic values, of excessively redundant plasticism at the minute scale (monotonous at the urban scale)"[25] of the public housing districts realized in Rome between the second half of the '60s and the end of '80s made these suburbs a "formalistic museum of illustrious language but of dubious civilization"[26].

Most of the neighborhoods planned in Rome within the 1st P.E.E.P. (1964) respond to these logics: self-referencing districts, where designers mainly sought the uniqueness of the architectural gesture that became urban and of great size to obtain a strong recognition and a unique link with the creator. In the constitution of a Roman great-size architectural trend, a key role was also played by the approval of the General Urban Plan (PRG[27] urban project: a project for the development, the reorganization and the relocation of directional structures and infrastructures outside the historical city centre,

228. Francesco Tentori, 'L'architettura urbana in Italia', *Rassegna di architettura e urbanistica*, A XXV, no. 73/74/75 (1991): 89.

229. *Ibid.,* 90.

230. Piano Regolatore Generale.

FIG. 12 Proposal for the CEP district of Barene di San Giuliano in Venezia-Mestre (Ludovico Quaroni) [Picture taken from: http://studioata.com/]

already overloaded of functions and traffic. The S.D.O. urban project was a large-scale intervention for the generation of a structural axis[28] cutting the town in the eastern part from the north to the south. The S.D.O. project was never realized (in 2008 the official abandonment of the project) but for decades was a main research topic[29] . The research about the urban development of the S.D.O. fed designer awareness on the importance of the interaction between infrastructures (urban highways and main roads), directional and residential functions. In the different areas involved, monumental great-size structures were considered as interesting solutions for the interaction between the different functions [Fig. 12a]. The S.D.O. has been the occasion to analyse in detail the link between city and great-size projects, underling the importance of the relationship between formal and technological features of megastructures and urban development. For some designers the general S.D.O. orientation was too unbalanced towards high-ranking directional functions not considering the importance of housing and small-scale functions[30]. Their criticism to the S.D.O. was because it proposed megastructures only in the shape but not in the substance of the functions proposed. On the contrary, Aymonino et al. (1973) proposed an important role to the housing function that was considered as the base of urban development, introduced even on a large-scale.

231. The so called "Asse attrezzato" (equipped axis).

232. Mario Ferrari, *Il progetto urbano in Italia: 1940-1990* (Firenze: Alinea, 2005).

233. Carlo Aymonino, Costantino Dardi and Raffaele Panella, 'Proposta architettonica per Roma-est', *Controspazio*, no. 6 (1973): 45-48.

Formal aspects were not the only reason to push the housing size towards urban scale. Indeed other important reasons are added to this logic.

Above all, we find the need of Public Administration to cope as quickly as possible with the strong demand for housing due to the process of urbanism that had brought to Rome a very large number of inhabitants from the surroundings and living in precarious shelters and slams. The need of a large number of flats in a short period of time led to large size interventions because of the sharp reduction in construction time, optimizing the urbanization networks and the overall costs.

The great size interventions introduced by Quaroni with the Barene di San Giuliano project were in line with the international movements at the time. The French grands ensambles, the English megastructure proposals, the Japanese metabolic projects were in fact some

FIG. 12a S.D.O. project, solution for the test area Prenestino-Casilino. Preliminary study by Bruno Zevi, Mario Fiorentino, Riccardo Morandi, Lucio e Vincenzo Passarelli, Ludovico Quaroni e Vincio Delleani [Aa. Vv. 2006 – picture taken from: http://www.architetti.san.beniculturali.it/architetti-portlet/showImage/fedora?pix=san.dl.SAN: IMG-00006589 /DS_IMAGE_1/2012-05-30T16:00:00.125Z]

very important references that conditioned the international design scene for years.

Quantitative aspects: a plan for 700 thousand inhabitants

Originally the 1st P.E.E.P. of Rome was a plan for 700,000 inhabitants on a surface of 50 km square **[Tab. 2]**. First interventions started at the end of '60s. After some modifications to the original program, the total number of inhabitants settled has been 400,000[31]. With 400,000 inhabitants, the 1st PEEP plan would ideally amount to the 7th place by number of inhabitants among Italian cities, ahead of important capitals of region like Bologna, Florence and Bari **[Tab. 1]**.

234. AnotnioAlbano,*Romailpianoeipiani. Residenza pubblica e integrazione urbana*. (Roma: Gangemi Editore, 2001).

Nowadays the council housing asset of the city of Rome is still particularly large. In 2000, there were 89,096 flats managed by public administrations. Of these accommodations, a portion is directly managed by the municipality of Rome while the largest number (52,592 flats[32]) is owned and managed by the ATER (the Territorial Company for Council Housing). Despite the processes of alienation[33] of the recent years, we cannot underestimate the numeric importance of this data. The council city is not a depleted asset, a closed experience of the past, a dead city. Considering 2.4 inhabitants per accommodation[34] the total number of inhabitants is 213,830, still an impressive figure!

235. Data from the « ATER 2008 Social Report » .

236. Hereconsideredas:aconveyanceof property to another.

237. V.v.Aa,*LaboratorioCittàPubblica.Città pubbliche, linee guida per la riqualificazione urbana* (Milano: Bruno Mondadori Editore, 2009).

Main Italian cities for number of inhabitants Roma2 872 800 inh.Milano1 366 180 inh.Napoli966 144 inh.Torino882 523 inh. Palermo668 405 inh.Genova580 097 inh.1st P.E.E.P. of Rome401 275 inh. Bologna389 261 inh.Firenze380 948 inh.Bari323 370 inh.Catania311 620 inh.Venezia261 321 inh.Verona257 275 inh.Messina234 293 inh. Padova210 440 inh.Trieste204 338 inh.Table 1 – Main Italian cities for number of inhabitants with the total number of inhabitants settled by the 1st P.E.E.P. of Rome

Applying the definition of Vieillard-Baron[35] to the interventions of the 1st PEEP, with the minimum threshold of 1,000 dwellings, to align the definition to that one of Philippe Pinchemel, we immediately find a particularly interesting figure.

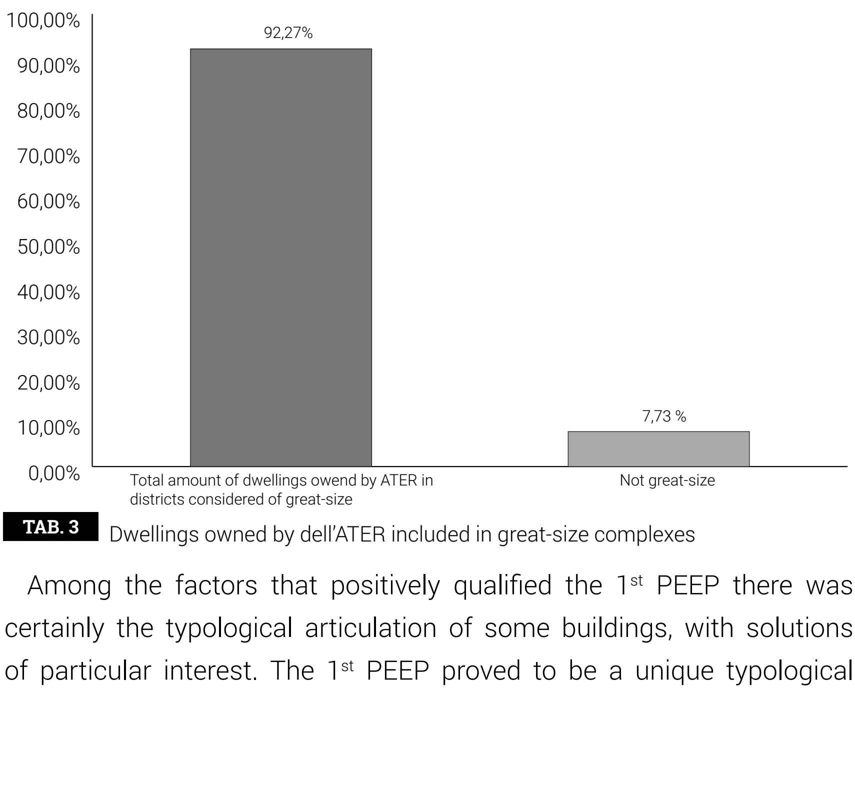
238. Thetermgreat-dimensionsettlement does not define a manner of construction but rather a shape and a kind of landscape characterized by towers and lines in suburban areas.

The dwellings currently owned by ATER that are in buildings identified as large-size complexes are 21,842, equal to 92.27% of the total. The remaining 1,830 equal to 7.73% refer to more minute and discrete interventions **[Tab. 3]**. Therefore, the city planned by the 1st PEEP can be considered as the city of the great dimension, the city where the design gesture goes beyond the architectural scale to become urban.

Main Italian cities for number of inhabitants	
Roma	2 872 800 inh.
Milano	1 366 180 inh.
Napoli	966 144 inh.
Torino	882 523 inh.
Palermo	668 405 inh.
Genova	580 097 inh.
1st P.E.E.P. of Rome	**401 275 inh.**
Bologna	389 261 inh.
Firenze	380 948 inh.
Bari	323 370 inh.
Catania	311 620 inh.
Venezia	261 321 inh.
Verona	257 275 inh.
Messina	234 293 inh.
Padova	210 440 inh.
Trieste	204 338 inh.

TAB. 1 Main Italian cities for number of inhabitants with the total number of inhabitants settled by the 1st P.E.E.P. of Rome

"Great" buildings and megastructures



TAB. 3 Dwellings owned by dell'ATER included in great-size complexes

Among the factors that positively qualified the 1st PEEP there was certainly the typological articulation of some buildings, with solutions of particular interest. The 1st PEEP proved to be a unique typological

N.	Piano di Zona	REALIZZAZIONI			DENSITÀ ABITATIVA	F.A.R.
		stanze (abitanti)	mc totali	superficie totale	ab/ha	SUL/St
1	Castel Giubileo	8.046	724.500	462.000	174	0,52
2	Fidene I	3.445	317.400	246.700	140	0,43
3	Fidene II	1.075	89.010	142.060	76	0,21
4	Serpentara I	8.690	803.300	445.750	195	0,60
5	Serpentara II	10.919	958.518	396.200	276	0,81
6	Valmelaina	15.800	1.308.240	1.214.250	130	0,36
7	Vigne Nuove	8.333	492.730	549.000	152	0,30
9	Prima Porta	4.551	440.000	725.000	63	0,20
10	Casal dei Pazzi	21.143	1.880.555	1.525.400	139	0,41
12	Rebibbia	9.663	864.956	728.600	133	0,40
13	Pietralata	11.380	407.000	850.450	134	0,16
14	Tiburtino Nord	11.048	758.037	1.112.070	99	0,23
15	Tiburtino Sud	37.000	3.309.893	1.875.100	197	0,59
16	La Rustica 1	1.132	104.550	77.800	146	0,45
16a	La Rustica 2	1.548	124.050	127.000	122	0,33
18	Arco di Travertino	2.074	154.386	366.350	57	0,14
19	Tor Sapienza	4.650	446.500	492.780	94	0,30
20	Ponte di Nona	6.651	532.730	666.000	100	0,27
22	Tor Bella Monaca	28.000	2.178.650	1.880.000	149	0,39
23	Casilino	10.903	999.480	403.200	270	0,83
25	Fontana Candida	3.523	324.110	392.000	90	0,28
27	Giardinetti	4.320	297.660	323.000	134	0,31
28	Torre Maura	4.000	367.792	362.000	110	0,34
29	Torre Spaccata Est	4.120	378.927	225.800	182	0,56
30	Torre Spaccata Ovest	2.112	259.000	83.000	254	1,04
31	Osteria del Curato 1	2.070	118.208	192.100	108	0,21
33	Quarto Miglio	1.107	104.038	29.800	371	1,16
34	Cinecittà	1.702	156.638	118.000	144	0,44
35	Cecafumo	930	85.600	20.900	445	1,37
35/a	Roma Vecchia	1.010	92.920	14.500	697	2,14
37	Ferratella	11.019	947.700	536.400	205	0,59
38	Laurentino	30.984	2.722.880	1.645.083	188	0,55
39	Grottaperfetta	28.791	2.630.497	1.315.560	219	0,67
40	Vigna Murata	16.860	1.548.874	842.250	200	0,61
46	Spinaceto	26.612	2.407.500	1.873.250	142	0,43
47	Tor de' Cenci Nord	9.670	875.303	688.400	140	0,42
53	Palocco	1.913	158.544	157.837	121	0,33
55	Ostia Lido Nord	6.987	621.825	644.000	108	0,32
57	Isola Sacra	970	72.824	82.300	118	0,29
59	Colli Portuensi Sud	6.978	567.616	250.000	279	0,76

60	Colli Portuensi Nord	3.392	312.103	339.243	100	0,31
61	Corviale	8.512	760.150	605.300	141	0,42
65	Pineto	4.375	400.000	179.440	244	0,74
67	Acqua Traversa Sud	672	53.760	161.200	42	0,11
68	Primavalle Ovest	8.945	262.799	731.410	122	0,12
70	Cortina d'Ampezzo	545	44.800	152.500	36	0,10
71	S.Maria della Pietà	1.238	102.440	213.500	58	0,16
72	Ottavia Nord	2.137	160.168	204.500	104	0,26
	TOTALE	401.545	33.729.161	26.668.983	151	0,42
		stanze (abitanti)	mc totali	superficie totale	ab/ha	SUL/St
N.	**Piano di Zona**	**REALIZZAZIONI**			**DENSITA' TERRITORIALE**	**FAR**
	VARIANTI SINGOLE					
15bis	Tiburtino III	4.073	376.248	322.200	126	0,39
74	Torrevecchia 1	3.652	320.000	244.624	149	0,44
79	Casette Pater 1	130	11.360	8.153	159	0,46
81	Quarticciolo	718	62.385	57.680	124	0,36
83	La Lucchina	4.541	327.410	440.000	103	0,25
	TOTALE	13.114	1.097.403	1.072.657	122	0,34
	VARIANTI INTEGRATIVE					
1V	Cinquina	2.290	158.865	327.250	70	0,16
2V	San Basilio	2.500	202.000	255.000	98	0,26
3V	Settecamini	1.740	142.400	116.000	150	0,41
4V	Casale Caletto	2.960	243.150	316.000	94	0,26
10V	Acilia 2	8.532	711.380	627.618	136	0,38
11V	Dragoncello	1.900	143.250	271.400	70	0,18
12V	Acqua Acetosa	2.126	160.120	339.000	63	0,16
13V	Quartaccio 1	2.433	199.050	303.460	80	0,22
14V	Portuense	1.900	157.320	322.800	59	0,16
15V	La Pisana	1.770	146.556	177.000	100	0,28
	TOTALE	28.151	2.264.091	3.055.528	92	0,25
		stanze (abitanti)	mc totali	superficie totale	ab/ha	SUL/St
N.	Piano di Zona	REALIZZAZIONI			DENSITA' TERRITORIALE	FAR
TOTALE complessivo		442.810	37.090.655	30.797.168	144	0,40

TAB. 2 All the districts of the 1st PEEP of Rome

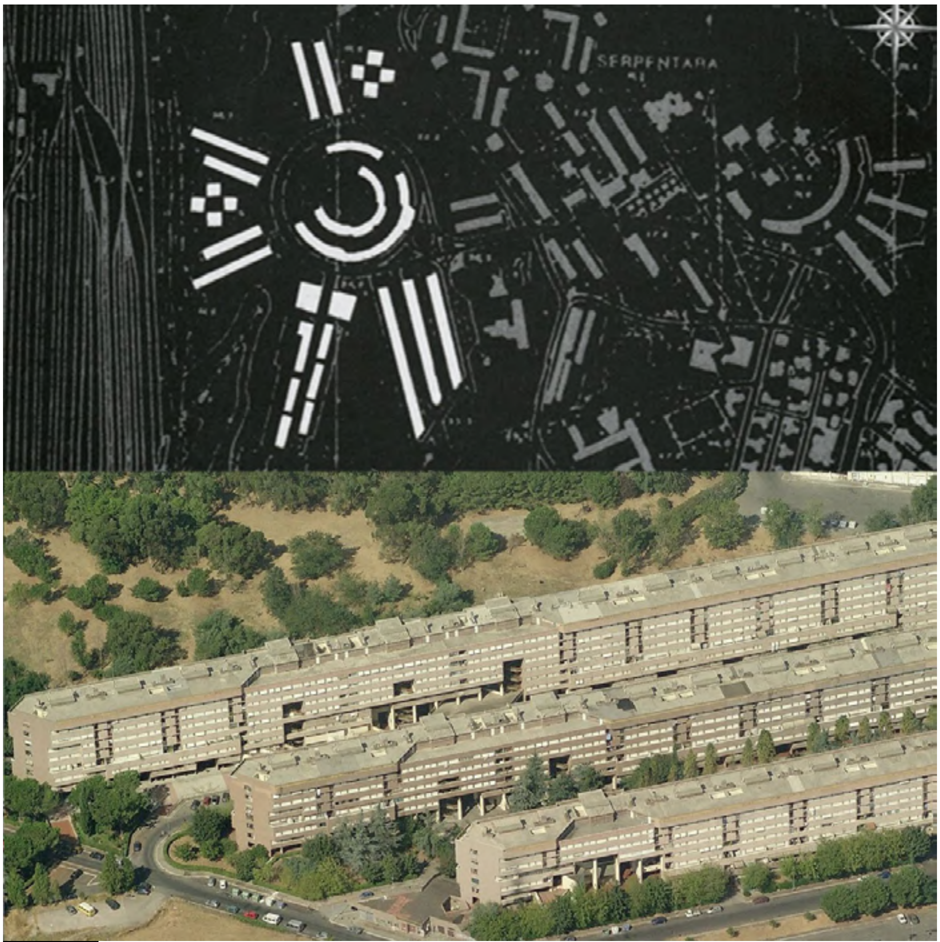


FIG. 13 The Serpentara I district (N 4)

FIG. 14 The Valmelaina district (N 6)

FIG. 15 The Casilino district (N 23)

FIG. 16 The Corviale district (N 61)

laboratory, a harbinger of cutting-edge experimental solutions.

The large size provided designers the chance to undermine the standard conception of housing ensuring the possibility of aggregating, in plan and in elevation, the different units in an alternative way. Large-size housing inspired designers to undermine the concept of standard aggregation of units, based on the repetition of the same model. Often, aggregations in plan and in elevation of dwellings were planned in a completely alternative way if compared to conventional solutions. In the whole building, designers tried to go beyond standard designing approaches based on schematic repetition of standard models. Some interventions in particular tried to propose a varied supply of dwellings, with different shape and size, added up without repetitiveness. In cases with a high articulation, the detection of the different units results particularly complex. The construction elements limiting the freedom of aggregation and articulation of units are: spaces for housing distribution, structural and pipe systems and vertical and horizontal connections.

In addition to particular aggregations in upper floors, another experimental element was the morphological and functional organization of spaces at the ground floors and roofs. These spaces were characterized by the presence of articulated paths and open and closed common areas with a clear shape identified in the overall organism.

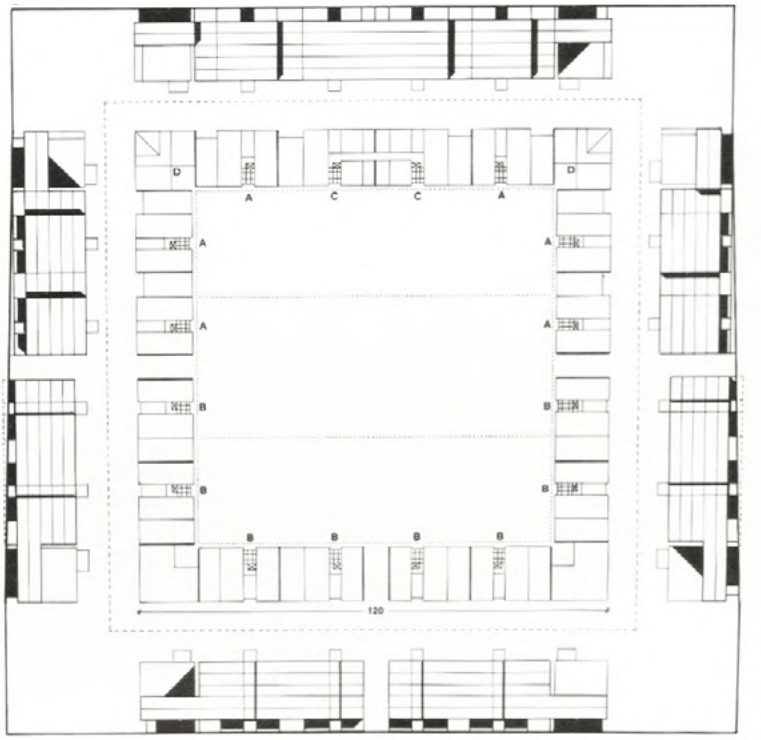


FIG. 17 The district of Valmelaina (N 6), layout of a court, clear repetition on large-scale of standard types [Picture taken from a journal]

Furthermore, the inclusion of services was an important step forward the integration between housing and urban context, trying to relate the private and the public aspects of life. The intent was to create spaces for meeting and participation in community life. The residential service intended to promote self-management and self-organization processes of tenants. If some higher-ranking functions were initially located in separate buildings, in the course of the years services and residences joined unique buildings. The attempt was to bring the house property closer to the equipments, re-proposing the human measure in interventions of monumental measure[36]. The main residential services included in the ground floors and in the roofs were: meeting rooms for assemblies; spaces for cultural, sporting and recreational functions; local service offices; offices for social services; music rooms; deposits; game spaces; theaters; shops. In some cases these spaces are located even in the intermediate levels like in Corviale district (N 61). Here, the commercial and service floor is at the fourth level.

239. M. Costa, 'I servizi residenziali. Punti d'incontro per una vita collettiva', *Edilizia popolare*, no. 123 (1975): 24-54.

FIG. 18 The district of Tor Bella Monaca [Picture taken from: https://www.bing.com/maps/]

The pedestrian paths (galleries, passerellespassarelles, bridges, subways) and the common volumes became iconographic elements characterizing the project to the point of becoming also place names (for example the term "bridges" to characterize the intervention of Laurentino 38 or " the gallery" the fourth floor of Corviale).

Although the articulation of ground floors, as well as of residential floors, proved to be virtuous, not in all the districts architects were able to propose attractive solutions. The occasion of the great dimension did not always translate into articulated solutions and experimentations. On the contrary, the great dimension often became a constraint. The designers who for various reasons did not choose the megastructure solution were forced to propose traditional housing solutions repeated at the great scale [Fig 17].

Thus it is possible to distinguish two different approaches: (i) composite and articulated cases in line with international megastructures; (ii) other cases with the re-propositions of typological standard solutions on a large scale [Fig 18]. The two approaches overlap temporally but especially in the last phase of the 1st PEEP (the '80s), megastructure projects were mostly abandoned. Megastructures indeed after the mid-'70s proved to be already culturally compromised and quickly abandoned. The designers, however, respecting the quantities approved by the 1st PEEP planning, were forced to propose traditional housing solutions on a large scale. The enlargement at the large scale of traditional types caused the construction of buildings repetitive and alienating. Are we sure that traditional but "big" buildings cased less social damages than megastructures?

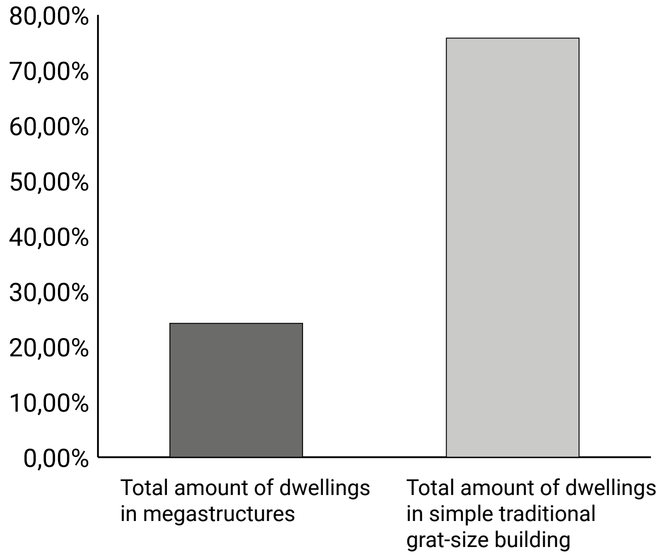
Megastructures and the 1st PEEP

Although within the districts realized during the 1st PEEP of Rome we can identify "only" four main megastructures (Corviale, Vigne

Nuove, Laurentino, Pineto)[37], their incidence in number of dwellings is still relevant. Out of the total dwellings owned by ATER considered as large-scale interventions, those in megastructures [Tab. 4] amount at 5,732 equal to the 24.21% of the total. The remaining dwellings, attributable to traditional typologies, are 17,940 equal to 75.79%.

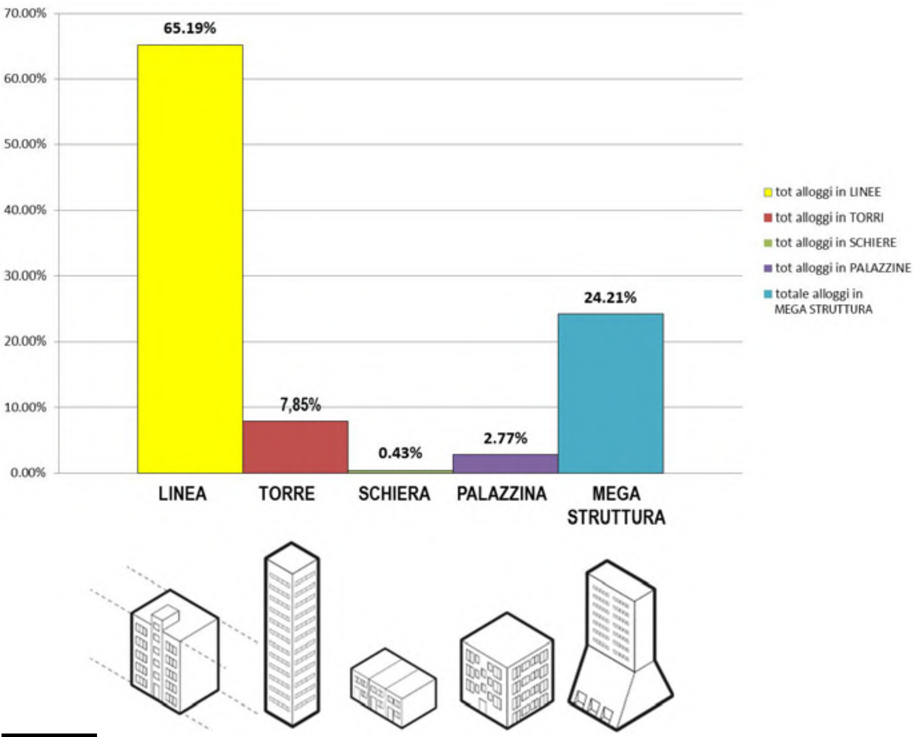
By entering into detail [Tab. 5] concerning the different housing types composing the asset owned by ATER: 15,431 dwellings equal to 65.19% are realized in buildings of "line-type"; 1,859 dwellings equal to 7.85% are located in "tower-type" buildings; only 102 dwellings are located in terraced houses (0.43%); while 656 dwellings, equal to 2.77% are located in "palazzine" (isolated medium-rise buildings). As stated before, the number of dwellings in megastructures is 5,732, equal to 24.21% of the total.

240. LorenzoDiana,Gissara,M.,Currà,E.and Cecere, C, "Tor Bella Monaca e la grande dimensione: scenari di manutenzione e rigenerazione ERP",*Territorio*, no. 78 53-62.



TAB. 4 Dwellings owned by ATER in megastructures and in great-size buildings

Within the districts realized during the 1st PEEP, five cases have been selected and studied in detail [Tab. 6] : two of them considered as megastructures and three considered as traditional great-size buildings. The case study of Prima Porta is shown in figure 19; Vigne Nuove in figure 20; Pineto in figure 21; Torrevecchia in figure 22; Castel Giubileo in figure 23.



TAB. 5 Per cent incidence of the different types of buildings owned by ATER in great-size districts

PDZ	Year of construction	Typology	Structure	Envelope
Prima Porta (N 9)	1972	Standard	r.c. frame	Cavity walls
Vigne Nuove (N 7)	1973	Megastructure	r.c. frame	Light pre – casting
Pineto (N 65)	1979	Megastructure	r.c. walls	Sandwich precast panels
Torrevecchia (N 74)	1982	Standard	r.c. walls	External precast panels
Castel Giubileo (N 1)	1986	Standard	r.c. walls	External precast panels

TAB. 6 The five case studies selected within the districts of the 1st PEEP

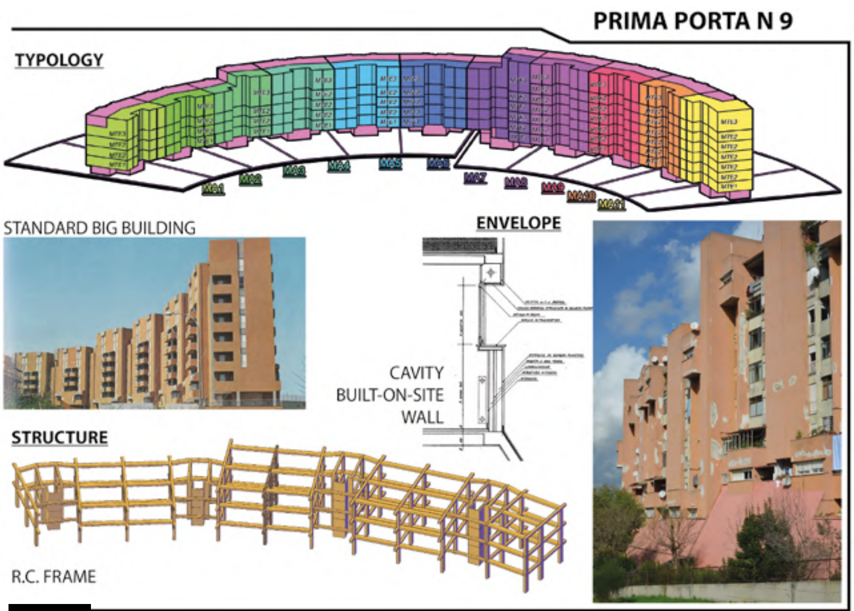


FIG. 19 Prima Porta (N 9) case study [Elaboration of the author]

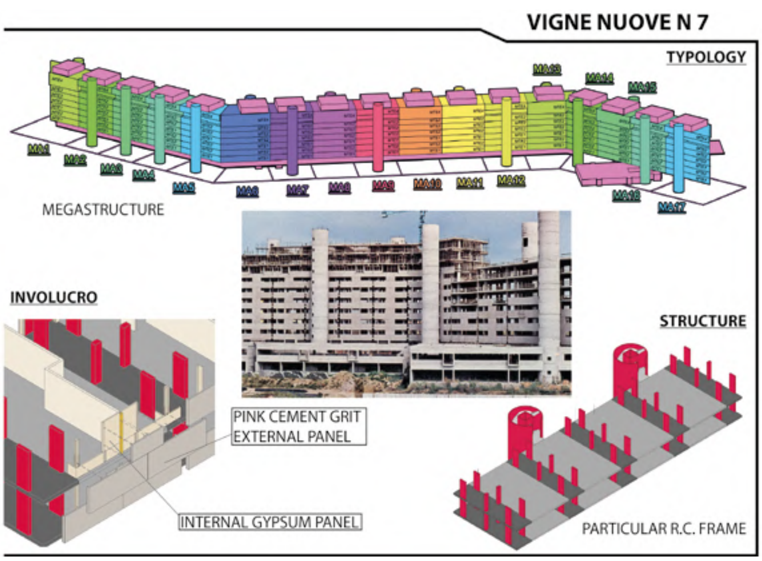


FIG. 20 Vigne Nuove (N 7) case study [Elaboration of the author]

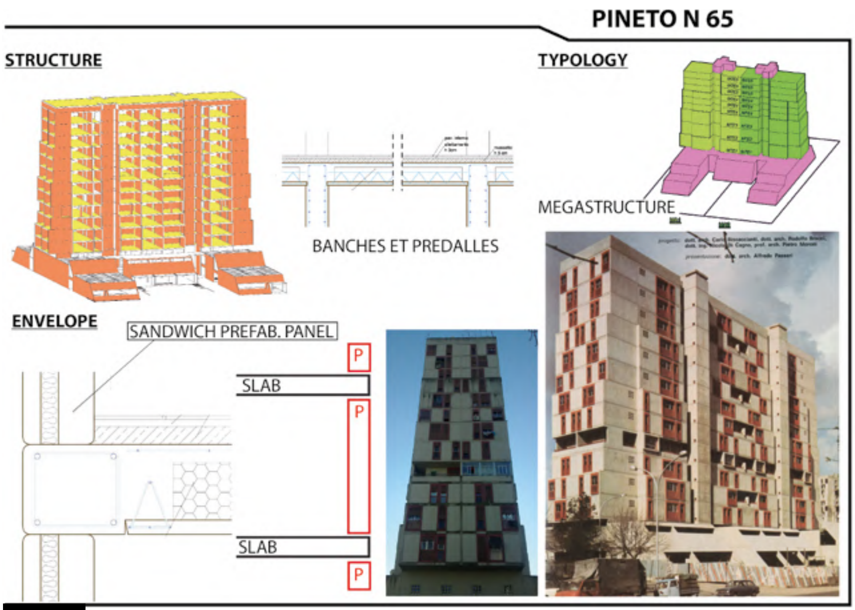


FIG. 21 Pineto (N 65) case study [Elaboration of the author]

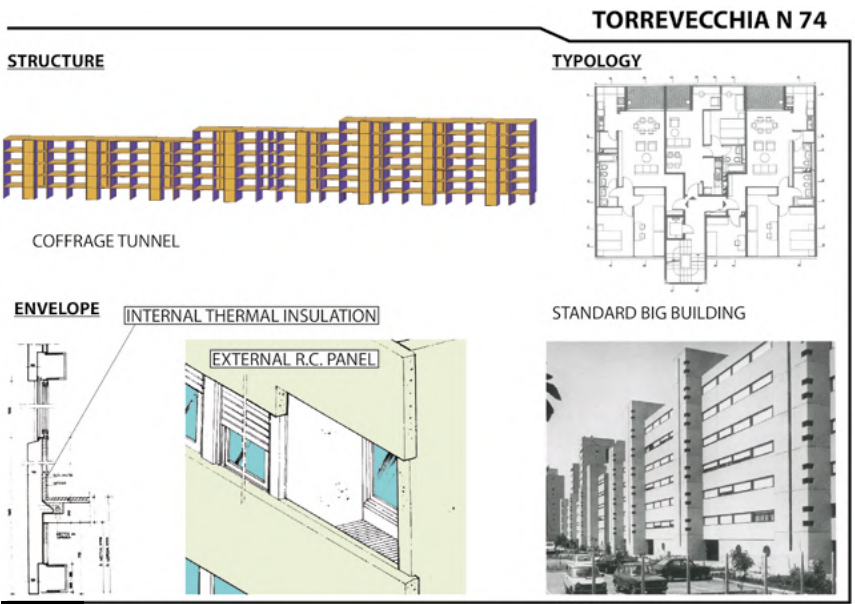


FIG. 22 Torrevecchia (N 74) case study [Elaboration of the author]

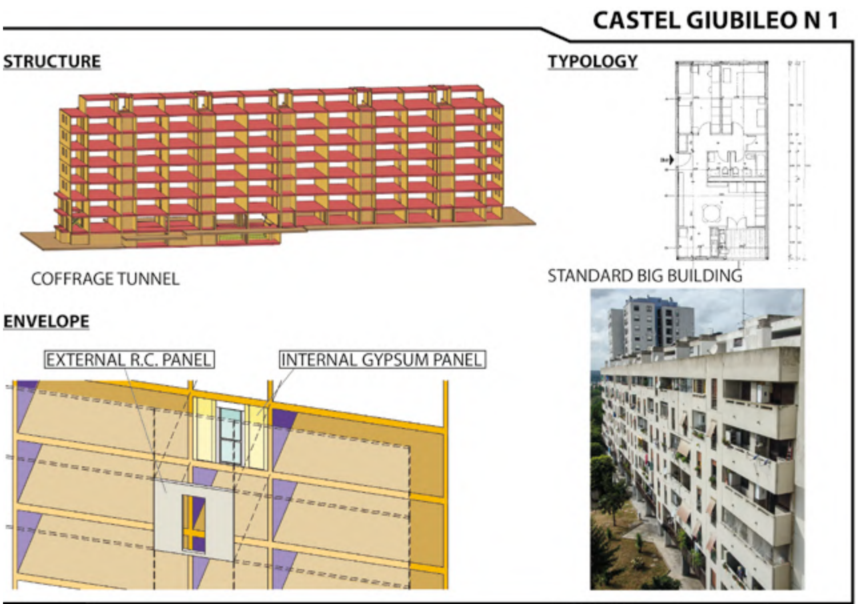


FIG. 23 Castel Giubileo (N 1) case study [Elaboration of the author]

Construction aspects: the beginning of prefabrication

In the historical evolution of the Italian construction industry, the '70s have been characterized by the great trust in prefabricated construction elements. The enlargement of the use of industrialized technologies also to the building sector allowed a sharp acceleration of construction times. In parallel, an automatization of some construction processes (e.g. casting of structural elements, movement of materials etc.) resulted in a reduction of construction costs. The prefabrication of construction components and the automation of some processes were two innovations that were well suited to the open morphology of the great-size interventions of 1st PEEP (… which one has influenced the other? …). The trust in new technologies was such that the majority of council housing interventions were oriented towards this industrialized model. In this way the Italian construction industry tried to fill the gap with other European countries. In fact, already during the second half of the 50s and during the 60s, in Europe, experiments and applications of prefabricated elements to the public residential constructions began.

With the approval of Law 167/1962[38] and the diffusion of megastructures and large-scale interventions, a deep interest arose also in Italy for the prefabrication of construction component and for the automation of the building site.

241. The Law 167/62 was the law that introduced the possibility for Municipalities to recover lands for the purpose of construction of council housing in the suburban areas of city with more than 25 000 inhabitants.

However, the introduction of prefabrication was often not synonymous with optimal results. Not always companies, apart from the cases in which the excellence in the sector intervened, were qualified: lasting and satisfactory results were few. The poor quality in the original productions is perceived in the current degradation of some components.

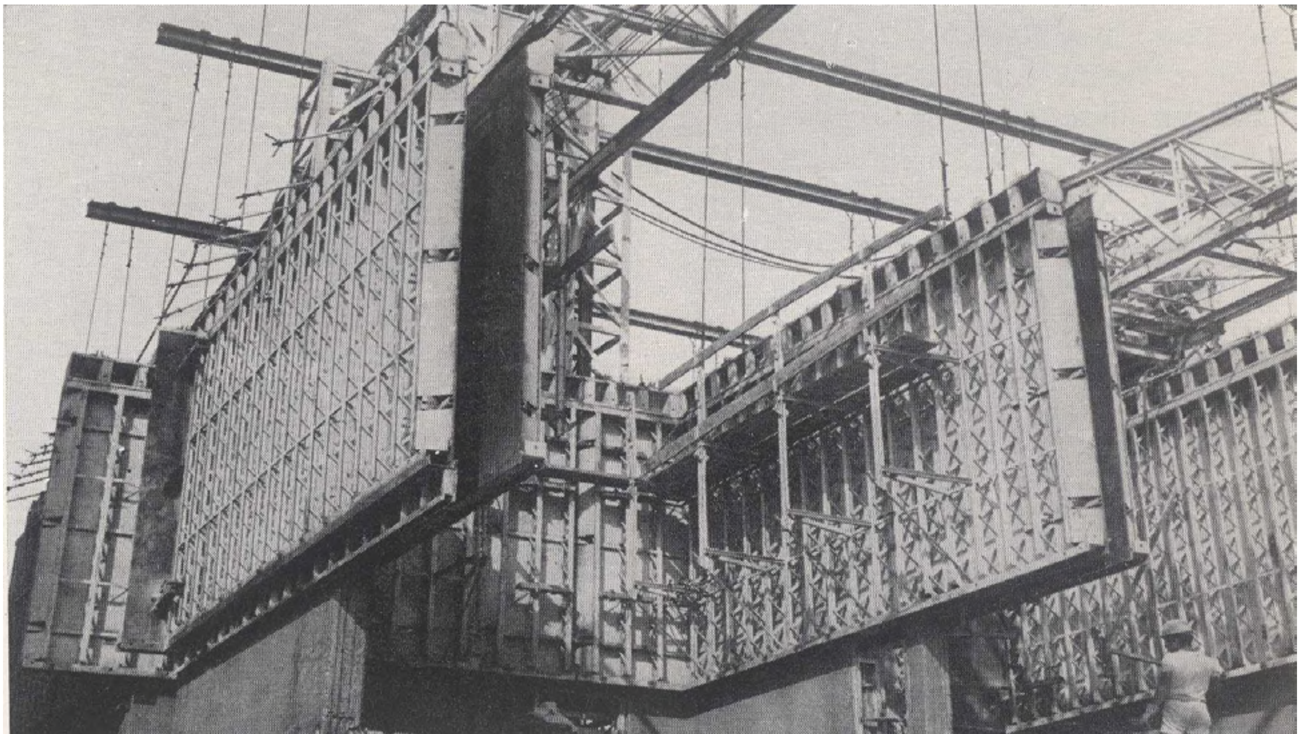


FIG. 24 Prefabricated formwork used for the automatization of the cast phase of the load-bearing structure [Picture taken from a journal]

The work of Imbrighi (1987) resumed and classified the main aspects of the industrialized framework of Italian construction industry. It revealed the main distiction between the system of automatic techniques for the cast in place of load bearing structure and the system of prefabricated techniques for construction elements. The main innovations were applied in the construction of the load bearing structure and in the realization of the envelope elements.

Considering the load bearing structure, a simplification of the worksite operations was carried out, trying to speed up the casting operations by using prefabricated and reusable formworks [Fig. 24]. The use of reusable prefabricated formwork, with the most diversified shapes, allowed the concurrent casting of vertical and horizontal structural elements ensuring a particularly rigid result, with good seismic performance. Over the years, structural elements proved to be durable and reliable.

Concerning envelope elements, pre-assembled components were realized of at the factory and exclusively assembled on site. For the prefabricated elements of the envelope, we cannot speak of a similar success as that of load bearing structure, especially for opaque panels. The prefabricated panels, externally applied, have usually shown problems of resistance to atmospheric agents, especially in the joints with the load bearing structure.

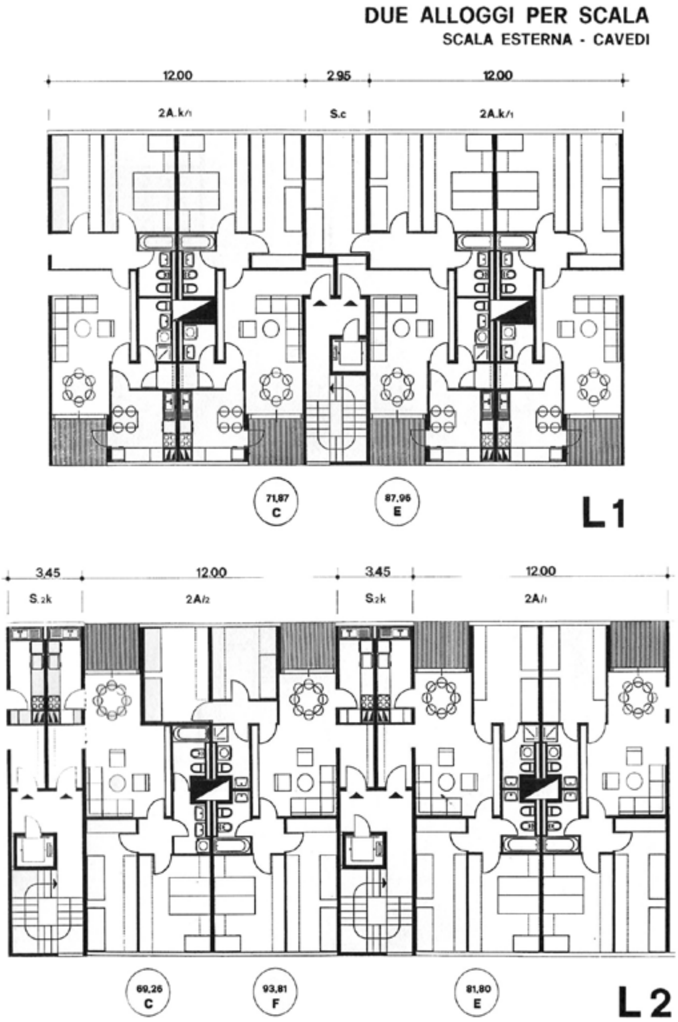


FIG. 25 Standard aggregation of dwellings characterized by parallel r.c. walls: the layout of the dwellings is limited by the presence of transversal structural walls

The introduction of prefabrication in building construction determined a renewal in the approach to housing design, both at the reduced scale of housing units and at the scale of the building and the settlement. The large-scale settlements required, for the reduction of times and for the repeatability of site operations, the introduction of tools that automatized some procedures, with a consequent reduction of costs. The study of Nuti (1984) tries to understand and evaluate the link between the productive factors and the conformation of the housing units. One of the main consequences of the use of prefabricated elements for the casting of the structure was in the layout of dwellings. The shape of dwellings was heavily influenced by the use of transversal cross-sections shear walls, which especially in the standard "big" interventions limited the freedom of internal longitudinal layout [Fig. 25].

The structural system

From a constructive point of view, given the vast time interval of the 1st PEEP (mid-60s / last-80s), we are dealing with different cases. Some settlements were realized prior to the introduction of prefabrication and are therefore strongly linked to traditional technologies. In other settlements, we can see a strong presence of prefabricated components.

Concerning load-bearing structures, therefore, it is possible to find some interventions in reinforced concrete frame completed with composite slabs of reinforced concreate joist and hollow clay blocks up to cases with the use of the *coffrage tunnel* technology.

As mentioned before, one of the main procedure that was automatized at the construction site was the casting of structural elements. In this perspective, among the different construction systems, the most frequent procedures were those characterized by the presence of shear walls cast with prefabricated formworks, according to the technology of *coffrage tunnel* or *banches* et *prédalles*. The main difference between the two systems lies in the presence of fulfilled or lightened slabs.

The *coffrage tunnel*, which greatly speeds up the casting process, presents the contextual casting of vertical and horizontal structural elements thank to reverse U-shaped formworks. Times are reduced but at the expense of flexibility in the spatial layout of dwellings. In fact, the passage of the technical plants must be established at the time of the casting, identifying the location of conduits and cavities. This choice, precisely due to the presence of fulfilled slab, is no longer modifiable in the future unless invasive structural interventions. The same applies to openings inside vertical bearing walls. Openings in walls indeed must be realized with modular formworks inserted inside the main formwork that allow, at the moment of casting, the creation of doors and windows.

Despite well-articulated cases, in most *coffrage tunnel* realizations the repetitive sequence of parallel r.c. walls enhanced the semantic of the *loculus* [Fig. 26]. In great-size interventions, this has contributed to discredit considerably the use of the *coffrage tunnel* technology[39] .

242. P. Marcheggiani, 'La disposizione longitudinale degli elementi di carpenteria "a tunnel", *Edilizia Popolare*, no. 139 (1977).

In conclusion, the technology of the *coffrage tunnel* provides poor performances in terms of flexibility in project layout. The presence of supporting parallel walls limits the flexibility in the organization of dwellings. The internal distribution is hardly constrained by the span between one wall and another and by openings in walls. On the contrary, from a structural point of view, an excellent behavior is detectable. The contextual casting of slabs and vertical elements gives a great rigidity to the structure, ensuring a good behavior in contrasting earthquake actions. The contextual casting guarantees a box-like behavior to the structure with a good general distribution of loads and tensions. Important for the application of the technology of the *coffrage tunnel* was the approval of

FIG. 26 A building of the district of Valmelaina (N 6), the repetitive sequence of parallel r.c. wall enhanced the semantic of loculus,clearly shown here also in the façade envelope cladding panels

Law No. 64/1974 that first introduced some notions on the dynamics of the structures. The *coffrage tunnel* technology, proposing a particularly rigid structure, received the indications of the norm and was often used in seismic areas.

In contrast with the *coffrage tunnel*, in several cases we find the banches et prédalles system: after the casting of the vertical load-bearing structure, a second casting phase generates the horizontal elements. *The prédalles* are prefabricated concrete sheets of 4-6 cm, with steel framework, playing the role of disposable formwork, containing the concrete casting. The slab is lightened by brick or polystyrene elements that considerably reduce the weight of the floor and play a role of acoustic and thermal insulation. The flexibility of intervention on the floor is greater than in the case of fulfilled slab.

Depending on the year of construction, the different settlements present structural systems more or less characterized by the use of industrialized technologies. It is not by chance that, among the first interventions carried out, we find a strong link with the traditional structural systems and few references to prefabrication. For example, in PRIMAPORTA district (N 9, urban planning approval 1965, beginning of construction 1972), we find a traditional concrete frame structure completed with composite slabs of reinforced concreate joist and hollow clay blocks.

In Vigne Nuove district (N 7, approval of the urban planning 1972 and beginning of construction 1973), we are faced with a partial prefabrication of the structural elements. The structure is organized on the base of a 7 meter-span r.c. trestles with 6 pillars supporting a flat plate. The system is completed with a lightened prefabricated slab.

The intervention of Castel Giubileo district (N 1), with an architectural project by Eng. Elio Piroddi is characterized by the use of the technology of the *coffrage tunnel*. The *tunnels* are positioned transversely. The dwellings, with a double opposite view, are free from internal supporting elements with a structural span of 6 m. Constructively analogous to Castel Giubileo, we find the Studio Passarelli intervention in Torrevecchia district (N 74).

In the Pineto district (N 65) in Rome, the supporting structure is realized with the system of *banches and prédalles*.

The vertical envelope

Concerning the supporting structure, the main innovations concerned the automatization of construction procedures, especially for the use of reusable prefabricated formworks. On the contrary, concerning the vertical envelope, constructive elements itself (like infill walls, windows, balconies, etc) were characterized by deep prefabrication.

The year of construction seems to play a decisive role for the choice of the envelope constructive system. In fact, in the temporal interval of the 1st PEEP, it is possible to find buildings that are still particularly linked to traditional standard constructive procedures and others with several prefabricated components. Thus, in some cases the vertical envelope is based on a standard masonry infill with a high manpower needed, while in other cases the worker assumes the simple role of the assembler of façade elements realized of at the factory.

In the case of the Primaporta district (N 9), one of the first realized, we find a conventional vertical envelope system, with infill walls consisting of an external plaster, a row of solid bricks, an air cavity, a row of perforated internal bricks and the interior plaster.

A good level of prefabrication can be found in the intervention of the Vigne Nuove district (N 7), where the external finishing panels in marble/cement granules are prefabricated and attached on a substructure of small concrete pillars cast in place. The envelope panels are completed internally, after an air cavity, by a row of perforated blocks of gypsum.

More recent settlements present a higher level of prefabrication of external panels. The approval of Law No. 373/1976 introduced rules for the reduction of energy consumption of buildings: the envelope components therefore took on a more important role with regard to thermal insulation. Initially absent, layers of thermal insulation began to appear in envelope panel stratigraphy.

Among the different case studies analyzed, the most advanced in terms of prefabrication of the envelope components is the Pineto district (N 65) which presents a single-piece sandwich panel (cement / insulation / cement).

The Castel Giubileo district (N 1) is characterized by a vertical envelope composed of single exterior panels of concrete with a square shape. The panels are provided with a hole to accommodate windows that will be installed on site later. The width of the panels coincides with the span of the underlying structure and they are installed, with the use of cranes, from the outside. Once installed, the panels are completed internally by a row of lightened gypsum blocks. The whole panel does not provide a layer of thermal insulation. This depends on the high level of thermal performance of the external prefabricated panel.

The case of Torrevecchia district (N 74) differs from Castel Giubileo for two main reasons. First, the panels applied externally does not have a square shape such to incorporate the windows. The panels are rectangular elongated shaped leaving a whole free band to be used for ribbon windows. The second difference lies in the stratigraphy of panels. The external prefabricated panel is completed with an internal layer of thermal insulation and a plasterboard panel.

The Regeneration of Megastructures

Nowadays, after about forty years, council housing great-size districts are in dramatic strong isolation conditions. Spaces intended for public gardens and parks are untreated and abandoned. Buildings live situations of material decay and general social issues such as unemployment and precariousness, enhanced by the economic crisis, are widespread.

In this general situation of emergency, megastructures constitute a priority for suburban sustainable regeneration policies. In a context of revitalization of existing public city, looking at megastructures as the target for regeneration interventions results to be the present challenge for cities able to preserve and reuse their existing resources.

As said before, in Rome residential megastructures, although detectable in only 4 cases, amount to 24.21% (equivalent to 5,732 dwellings) of the total number of accommodations in great size buildings. The relevant number of tenants and the consistence of the housing stock would ensure reliable outcomes to regeneration projects.

The necessity of regeneration is supported by the general conformation of public and open spaces of great size districts. Indeed, large empty spaces are available, often exceeding in terms of streets and parking the standard needs of inhabitants. This implies good chances for future transformations, such as little densifications intended for reconnecting with nearby districts, or intervention on the general environmental qualities by actions on gardens and parks.

Also the architectural and constructive conformation of buildings gives the chance for potential transformations, in terms of densification of ground floors and change of use of the roof floors.

As said before, within the complexes of great size of the 1st PEEP, there are two different sets of buildings: the megastructures and the standard big buildings. Especially in megastructures a greater predisposition to transformation is found compared to cases of standard buildings, becoming the preferred target for urban regeneration interventions.

In Pineto (N 65) and Vigne Nuove (N 7), two of the roman megastructures together with Corviale (N 61) and Laurentino (N 38), the incidence of spaces at the ground floors and roofs, originally destined for common functions and today used improperly or abandoned, stand respectively for the 30% and 21% of the whole residential surface. These spaces are ideal for the temporary relocation of tenants during regeneration interventions. It must be stressed that these values are higher in relation to the other standard cases analysed, such as Prima Porta (N 9) and Torrevecchia (N 74), that arrive at 9% and 8%. Two other indexes fundamental for transformation are the possibility of installing solar panels on the roof floors, and the average height of common spaces. Both indexes in megastructures are higher. In Pineto and Vigne Nuove, the index of free space for solar panel at the roof tops is 62% and 46% of the total roof surface. In the conventional cases such as Castel Giubileo, Prima Porta and Torrevecchia this value does not reach 40%. The average height of common spaces, in Pineto and Vigne Nuove is 4.01 m and 2.87 m. The index provides information on the chance of intervening with change of use or technological implementation of the slabs. The non-megastructure buildings do not reach 2.80 m.

This confirms what stated before: the global regeneration of contemporary suburbs should start in megastructures as the ideal place for transformation interventions.

The regeneration of megastructures must ensure a multi-disciplinary approach. Designers have to identify the various qualities concerning architectural, typo-morphological, social, structural and energy aspects of buildings and then they have to operate on the main issues using operative assessment tools[40].

243. Diana, *Metodo*.

To achieve a complete regeneration of housing megastructures, the traditional retrofitting approach based exclusively on physical actions on buildings and open spaces should be replaced with a series of actions that could allow a radical transformation and an operative regeneration of these complexes. To achieve this complex goal, an interaction between material actions of physical intervention on buildings and public spaces and immaterial actions oriented to social aspects with involvement of population should be proposed. The social aspects are neither marginal nor the result of a regeneration project, but they are basic requirements to provide information on the regeneration process itself.

The regeneration of such important social neighbourhoods has to be structured through a combination of immaterial and material actions.

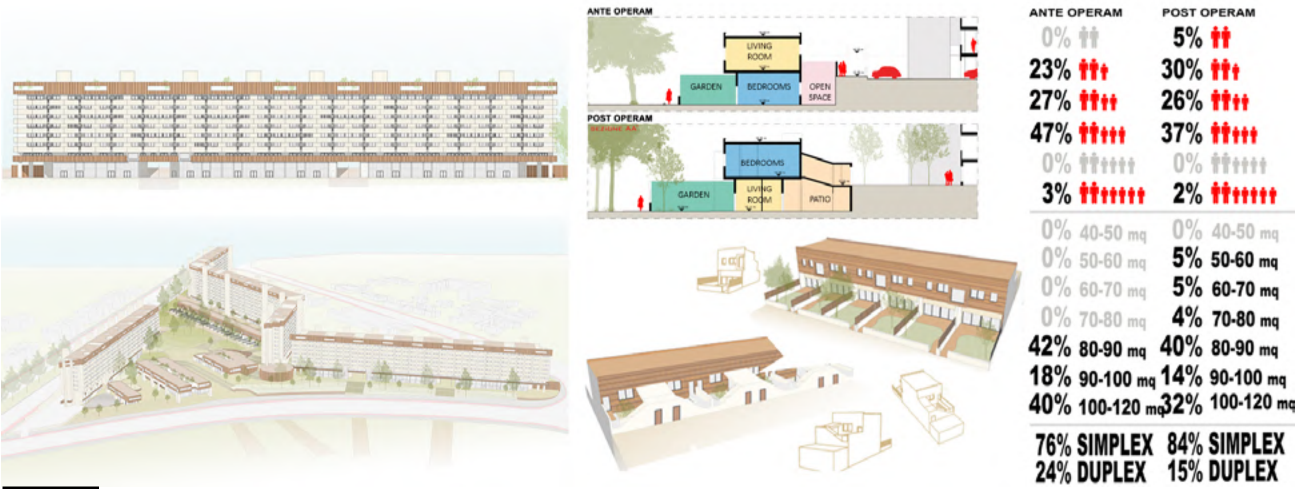


FIG. 27 Proposition for Vigne Nuove regeneration intervention [Elaboration by Simona Vasinton]

Usually, the imposition of retrofitting actions on final users could not automatically guarantee successful and durable results. On the contrary, the core of the regeneration approach is to coordinate the main goals of the project with the involvement of tenants. This objective is achievable through the participation of social disciplines able to develop a new bond between citizens and the transformed building. Moreover, it is fundamental to avoid the risk of repeatability which is common in traditional retrofitting intervention. The target of the regeneration should not be a partial modification but indeed a profound transformation of the existence, its realignment with the current housing demand and the activation of virtuous and sustainable living models.

Regeneration projects should follow four main areas: social actions, actions tending to an architectural-typological reconfiguration, actions that aim to overcome structural issues, energy retrofitting. This methodology aims to guarantee the sustainability and the feasibility of the regeneration process and to ensure an integrated approach needed for an effective collective management by the tenants and for a public control on the final results.

Social measures should aim to reduce the inhabitants' rate of unemployment and to activate participatory planning process. Architectural and typological aspects should aim to detailed planning solutions of building reconfiguration (new accommodations, new functions, new services) and to their fulfilment through a coordinated set of material and immaterial actions. Technical and constructive measures are material actions on the load bearing structure, structural components and envelope elements and have to guarantee the economic and constructive sustainability. In the end, energy retrofitting measures should aim to sustainability in terms of energy, environmental and economic savings. Two proposals for regeneration interventions on Vigne Nuove and Pineto can be seen in figure 27 and 28. **[Figg. 27-28]**

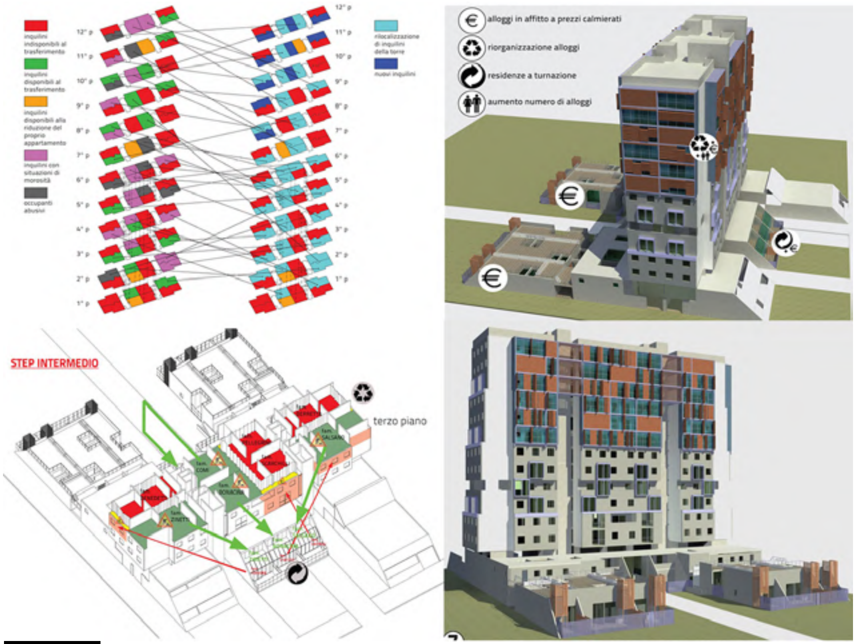


FIG. 28 Proposition for Pineto regeneration intervention [Elaboration by the author]

Conclusion

Megastructures represent an important part of suburban building stock of European cities. During the second half of the 20th Century, great-size buildings arose all over Europe to shelter inhabitants arrived in big towns due to urbanization processes. Within great-size interventions, two sub-sets exist: megastructures and traditional big buildings. Megastructures started to appear in suburban areas of European cities on the wake of architectural international movements such as the French grands ensamble, the English megastructure proposal and the Japanese metabolic projects.

In Italy, from the second half of the 60s' a huge public intervention in housing is detectable. After the approval of the Law 167/62, big Municipalities approved plans for the construction of great-size districts meant for council and affordable housing. The case of Rome is emblematic: the 1st PEEP was a plan for 700,000 (reduced to 400,000) inhabitants. In Rome, megastructures are detectable in only 4 districts but they amount for more than 5 thousands dwellings (around 25% of the dwellings owned by the public agency in great-size districts). Characterized by a particular approach to urban development, meant to summarize in unique buildings all the functions provided by a town, megastructures were elements at urban scale of particular interest from the typological, the structural and the constructive point of view.

In conclusion, several reasons encourage us to look at megastructures as the place for urban regeneration. Some reasons are referred to the category of the "need", those connected to the raised critical issues, and other fall into the category of "possibility", those related to the predisposition of urban fabric and buildings to undergo interventions of regeneration.

The main critical issues stood in the general state of abandon of the buildings and public spaces, characterized by material and performance decay of constructive elements and widespread state of neglect of green public areas and squares. In addition to this, the complex supply of this type of neighbourhoods fails to intercept the instances of the contemporary demand, especially in terms of type, shape and number of dwellings.

From the transformation point of view, the main features are those concerning the shape and nature of the urban fabric and, at a more detailed level, concerning the typological nature of buildings. The concentration in compact and big unique buildings of all the function of the district leaves huge free spaces on which it is possible to intervene through minimum densification and green strategies. These last would aim to enhance the green areas, by the realization of urban parks and the protection of green lawns and gardens, in a global logic of reduction of the heat island phenomenon.

Regarding the typological aspects of buildings, the conformation of megastructures provides good chance for effective regeneration interventions where, in the ground floors and roofs, the presence of extra-residential function spaces ensure possibility of transformation, change of use and densification with minimum land consumption.

As a whole, for its extensiveness and spread, megastructures are the ideal place for sustainable suburban regenerations that could stimulate virtuous processes also for the nearby neighbourhoods.