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OTHER MODERNISMS IN EUROPEAN HOUSING IN REINFORCED CONCRETE (1920-1940)

BY

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Abstract. New technologies brought by industrial development were a central part of the global movement which was Modernism. One of the nuclei of the movement was built by the housing programme, particularly suitable to foster innovation. While in more industrialized countries ways to solve social problems were sought for, in some European countries the new possibilities were seen as an opportunity to give a more prosperous image to cities, by raising density with blocks of flats for the middle class. These blocks of flats were built with a reinforced concrete structure, which allowed for flexibility in the distribution of spaces inside the flat. In this paper the context given by the CIAM to the development of such blocks of flats, a new living form in the Modernism is first explained. The paper moves forward with the analysis of division into zone schemes and with the description on the use of reinforced concrete. More case studies are considered: Greece, where the CIAM was proclaimed, Romania, where a Master Plan in the spirit of the CIAM was made first, Portugal and Italy, where another Modernism was represented by the Novecento movement. The study is useful in order to model interwar multifamily housing buildings, for restoration studies.

Key words: reinforced concrete, Romania, Greece, Portugal, Italy, housing.

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1. Introduction

Modernism was a global movement in architecture, music, arts, physics, philosophy, economic and social theory and industrialization in the first half of the 20th century. One of the nuclei of the ideology of this movement was the housing programme. This is a conservatory programme, however, the new technologies brought by industrial development, including that of reinforced concrete, were employed for fostering innovation. While in the more industrialized European states the Avant-garde went into the direction of assuming the heavy load of solving the problems of social housing, in some others the new possibilities were seen as an opportunity to give a new image to capital cities, allowing for reorganization of the urban tissue, with more dense housing for the middle class in preferential areas. After the Charter of Athens (1933) the function becomes a decisive component in the process of creation. Functional requirements start at social ones up to technology. While relating to French models, a particular condition of the location, namely its seismicity, was neglected. Since then, capital cities where Modernism was to the largest amount represented by housing, were struck by earthquakes, which revealed the vulnerability of these buildings.

Zaharide (1992) sees two parallel movements within the Modern Movement:

1. The (Western) avant-garde, focused on the social load of the housing problem and the urban development control through architecture. The housing design was scientific-rational, using new technologies of industrial production and their expressive values, but also new spatiality and plastics (Raumplan, free plan, in the many “-ism”s *i.e.* co-existing styles). It was developed from the interior (room, apartment) through successive integration levels till urban control. Due to ideology, many projects have demonstrative character.

2. The evolutive tendency, an organic evolution, traditional forms gradually simplified to those of the Avant-garde. The local character is maintained. This is where the case studies are chosen from, never displaying the complete flexibility of Western architecture, just a formal adjustment to new aesthetic canons: use of vertical and horizontal geometry, mostly right angle.

Although the IVth CIAM Congress proclaimed 1933 the seminal Charter in the Greek capital, the Athens Charter was never able to find a home in Athens. Unlike Bucharest, where following the 1933 CIAM a Master Plan was designed following its principles and successfully implemented, Martin Wagner was invited to speak on the Athens Plan in 1935 but with no practical results. The housing needs requested something else. The Greek interwar architecture lacked any references to political connotations or social issues (Giacumacatos, 1999), it was only centred on the characteristics of the dwelling. Giacomacatos (1999) classifies the apartment blocks to constitute, “the public urban face of Greek cities, given the lack of formal or monumental housing”, or of any social architecture.

Boștenaru-Dan (2005) analysed the effects of division into zones. In that paper, the roles of sub-area wide or typological divisions of the town were investigated with the methodology of regression, regarding their contribution to urban earthquake risk management. All timely constituted planning types, recovery, preparedness, mitigation and resilience, are refund today as layers, as the division into zones results are used by differently backgrounded actors: local authorities, civil protection, urban planners, civil engineers. In resilience planning, the urban system is complexly theoretized, then entirely approached. The steady restructuring process of the urban organism is evident in a dynamic analysis. Although materially expressed, the 'urban-frame' is realized spiritually, space adaptation being also social. A retrospective investigation of the role of resilient individual buildings within the urban system of Bucharest, Romania, was undertaken, in order to learn systemic lessons considering the street an educational environment. (In)formation in the study and decision making process stay in a reciprocal relationship, both being obliged in the (in)formation of the public opinion. For a complete view on resilience, both division into zones types, seismic and urbanistic, must be considered and through their superposition new sub-area wide divisions of the town appear, making recommendations according to the vulnerability of the building type.

In Greece, just like in Romania, a nostalgia for the Modernism of the inter-war period was noticed by Constantopoulos (1999), expressed in recent research projects, publications and doctorates towards the record and preservation of the architectural heritage of this time. For this paper a collection of papers in a volume edited by C o n d a r a t o s and W a n g (Biris, 1999; Constantopoulos, 1999; Giacumacatos, 1999; Kalogeras, 1999; Philippides, 1999; Tzirtzilakis, 1999; Zivas, 1999), and several volumes on Romanian architecture were consulted, as well as a volume on Portugal, edited by T o s t ã e s and W a n g (Henriques da Silva, 1997; Souza, 1997; Machedon, 1999). The 1930s have been a turning point in the history of housing. It was the point when the so-called "apartmentalization of Greece" (Constantopoulos, 1999) begun, which means that the form of the apartment in a block has come to be the model for housing in general. To study housing in Greece in the 20th century means to Constantopoulos (*op. cit.*) to study the phenomenon of the urban apartment block. He notes that even new words for the 2-, 3- and 4-roomed apartments, as well as for those set back from the street were found.

In Romania, the first modern house was published in 1927 by Marcel Janco, but overseen till the ARO building by Horia C r e a n g ă was raised in 1929, after which Modernism won general acceptance. Architecture journalism in Romania rejected the local imitation of modernism, opting to solve problems in the country in the spirit of modernism instead, so Machedon and Scoffham (1999). A contradiction between traditionalism and modernism continued to exist and was reflected in controversial discussions. The turn-of-century architecture maintained continuity through adding art deco elements to free volumetric compositions. Also, the career of Romanian architects touched more

styles, from neo-Romanian to neo-classicism, art deco to Modernism. The discussion did not stop at aesthetic and functional thinking, but approached the social impact as well. According to Machedon and Scoffham (*op. cit.*) “they often demonstrated that modern architecture was to be viewed as a total art form that co-ordinated many disciplines”. Journalism about the new architecture appeared also in cultural and literary journals or in scientific ones, like Buletinul AGIR, or even in the publicity magazine of the Romanian Assurance Society (ARO), to which Horia Creangă designed the headquarters. So the ideas on modernism in architecture were not restricted to architectural and artistic circles.

In the earthquakes affecting successively Bucharest in 1940 and 1977, two interwar Modern buildings with cinemas at ground floor collapsed. An exception was the ARO building, the cinema of which had been recently restored after a fire (Prager, 1979). The Ambassador and ARO buildings form an impressive complex maintained after the earthquakes. Machedon and Scoffham (*op. cit.*) say that the ARO building occupied a prominent position in the city. The authors would call it a strategic one. This position was decisive in influencing the architects who built later on the landmarks of modernism along the boulevard. The authors would call that innovation spread until it became a better routine. The collapse of some other buildings on the boulevard in these earthquakes destroyed the unity of the facades of the main N-S boulevard, striking through newness and modernity “on the eve of the second world war” (Machedon & Scoffham, *op. cit.*). The buildings that have replaced the collapsed ones do not match the quality in detail and response to the urban context those replaced (Machedon & Scoffham, *op. cit.*):

a) the Carlton building (1930-32, arch. G.M. Cantacuzino), collapsed 1940, originally balanced the ARO building;

b) the Scala building (ca. 1936, arch. Emil Nădejde), collapsed 1977, was a carved volume compatible with the rounded cinema vis-à-vis, mirrored by another, also by Frankel;

c) the Casata building (ca. 1936, arch. Jean Văleanu), collapsed 1977, was a high vertical accent interrupting the horizontals of the boulevard on a specific setting.

Other buildings were damaged in the earthquakes, so the one called later on Turișt (Fig. 3 a), earlier Palladio apartment building (1936, arch. Marcel Locrar). It had two long facades to the streets and a short one to the Romană square, rebuilt after the 1977 earthquake. Also from the apartment buildings situated elsewhere than the N-S boulevard some were affected by the earthquakes. The Tabacovici apartment building (1934-35, arch. Duiliu Marcu) on Dionisie Lupu street was destroyed in the 1977 earthquake. The text should be as short and concise as possible, excluding anything, which is not directly relevant to the subject matter but including any associated safety, environmental or ethical issues. The text should be readily understood by practicing engineers. All statements and references should be correct and

accurate. Speculative material must be clearly identified as such. The text should be in the third person and should avoid colloquialisms – texts originally prepared for oral presentation therefore will usually need to be rewritten. The text should not refer to the names of individuals, organizations, products or services unless it is essential to understanding and then only appear once. Text must be neither gratuitously complimentary nor in any way derogatory about any person or organization. Principal participants in a project should be listed separately from the text in an Acknowledgement. Scientific and technical English manuals might be very useful for inexperienced authors.

2. Modelling of Interwar Housing Buildings

A model, M , of a system, S , is understood as a system, which, from some points of view, is equivalent to S , but which can be investigated easier than S . The modelling process supposed a cybernetic approach of first analysis (decomposition) and then synthesis (abstract composition of the system M). A system is understood as an organized agglomeration of component parts and/or interests.

2.1. The IVth CIAM in 1933 in Athens and Architectural Characteristics of Historic RC Housing Buildings in Earthquake Prone Parts of Europe

“Growth of the urban population and the related need to build more housing always creates unprecedented opportunities for house building” (Machedon and Scoffham, *op. cit.*).

Housing was a major contributor to interwar architecture because

a) Housing was built to considerable extent and diversity (Zahariade, 1992), having pioneering role compared to other programs in Romania. In Greece pioneering role was played by both housing and school buildings. Within this diversity there are characteristic features that demonstrate the principles of the Modern Movement.

b) Housing plays an important role in careers of architects. In the Modern Movement housing played a role in the formal and functional transformation of architecture internationally.

c) The housing programme has socially impact, here on the emancipation of society.

d) Housing, being at the interference architecture–urbanism, influences the remodelling the fabric and character of the city.

a) Greece

After the fire from 1917, new master plans for Thessaloniki and Athens (1919) were elaborated. Athens begun to receive currents of European Modernism after 1922. These modern influences reached Thessaloniki later on,

in form of the Thessaloniki Art Nouveau (Biris, 1999). While in Thessaloniki a new urban centre was planned by Ernest Hébrard (1918-21), deliberations on re-organizing the morphology of Athens 1919-24 had no decisive effect and Athens excels since through the absence of town planning applications, up to a “concrete monstrosity” (Philippides, 1999). In practice, the Athenian city plan was made in extensions “section by section” (Philippides, *op. cit.*) on rudimentary street layouts. Nothing of the Haussmannian re-organization seen in Bucharest and Lisbon can be found here. The blocks are “as small as possible, not to harm the interests of land owners” (Philippides, *op. cit.*) and still, the parcels foreseen for an apartment block are larger than in Bucharest. Given that the apartment blocks of the 30s were constructed in these extensions of the street grid of the city, the parcels are also regularly with orthogonal contour, thus reducing the irregularity of the structures built on them. Before the Second World War, Athens used to be an attractive and quiet city marked by a uniform Neo-classical character, interrupted here and there by important buildings of the 30s. Tzirtzilakis (1999) quotes Frampton, in the Preface to the Greek edition of *Modern Architecture*: “[Athens] there is perhaps no other capital in the world where one can find such broad acceptance modern architecture both as functional programme and as morphological language”. The Modernism builds here the essence of the city: the neo-classical has been gradually replaced and extended by a typology which is still being produced today in almost the same patterns as in the 1930s (Tzirtzilakis, *op. cit.*). Fred Forbat noticed at the IVth CIAM in Athens 1933 that in Greece no morphological contradiction between tradition and the modern architecture of European rationalism occurred, since the building tradition of the islands is highly cubist and works with bare, ornamentless structures (Giacumacatos, 1999).

The Congrès Internationaux d'Architecture Moderne (CIAM) started 1928, and the IVth Congress was held 1933 in Athens. Among the scopes of the CIAM was advancing the spirit of modern architecture in technical, economic and social circles. The 1933 Congress has a special importance, because of the proclamation of the Athens Charter. This 95 point programme was later documented in 1943 by Le Corbusier (1971) it focused on the issue of urban function zones: creation of independent zones for four ‘functions’: living/housing, working, recreation and circulation. Therefore it was mainly applied in Post-War times, for rebuilding of cities, in mass, and getting thus to be subject of critique for lack of flexibility and inhumane results.

There were the architects of the generation of the 1930s who deliberately adopted the contribution to society that the new architecture could make.

After 1929, when legislation was introduced regulating the architectural characteristics and ownership systems for multi-storey buildings in urban centres, the apartment block type begun to extensively develop in Greece, enjoying, according to Giacumacatos (1999), an unprecedented development to

the present day. First apartment blocks appeared in the 20th century, but were built in masse in the 1930s as “polykatoikia” (multi-residence). The design proposals elaborated by Greek architects were towards “the Europeanization of the Athenian built environment and fostered the corresponding social recognition of the owners of the properties” (Giacumacatos, *op. cit.*). With their investments in the new multi-storey housing building sector they commissioned designs from prominent architects (Fig. 1). Constantopoulos (1999) sees the case of Greece to be unique in Europe of the period, as almost all the most interesting housing architecture projects in the 1930s, blocks of flats for mainly middle-class inhabitants of Athens, “who identified new architecture with the demand for social modernization” (Giacumacatos, *op. cit.*), were in the hands of the private sector. This situation is, however, little different of that in Romania and Portugal, where similar typologies emerged. The typology of the apartment block developed quickly. Hardly can a better layout be conceived, respecting the modern typology, than the Greek block of flats serving as example for the functional model in this paper (Fig. 2), on Zaimi and Stournari streets in Athens (1933-34, arch. V a l e n t i s and M i c h a i l i d i s), which “resemble many of the projects of the Italian Rationalists, in applying the constructional rationale of Le Corbusier, and indeed enhance the Corbusian syntax” (Constantopoulos, *op. cit.*).



Fig. 1 – Typical buildings in Greece: *a* – apartment block at Zaimi and Stournari Sts., architects T. V a l e n t i s and P. M i c h a i l i d i s, 1933 - 1934; *b* – apartment block at Patission-Metsovou Street, arch. Nikolaos N i k o l a i d i s; *c* – apartment block P. Ioakeim – Irodotou Sts., arch. Prokipis V a s i l e i a d i s, 1937.
Photos M. B o ș t e n a r u, 2005.

Many Greek architects were trained in Germany, and also the training provided at the NTUA was organized in a manner corresponding to German

models, but there has been also some French influence (Giacumacatos, 1999). The vast majority of Modern Greek architecture came under the influence of Le Corbusier, from whom literature contributions were available in Romania also. The emerging typology of the Greek apartment in the 30s features the following common characteristics (Constantopoulos, *op. cit.*):

a) the balcony (up to 1.40 m) is an outdoor living space for approx. half the year;

b) the existing urban fabric is retained apartment blocks being constructed on plots formerly occupied by single family houses;

c) the urban zoning does not reflect in the function of the apartment blocks with mixed use (commercial at the ground floor);

d) their height is 5...6 storeys. The permitted height increased 1919...22 with the elevator. Typical width and pattern are more like the specifications for the industrial city of Tony Garnier than others, through the repetition of indifferent buildings, which is found (Tzirtzilakis, *op. cit.*) to have no parallel in any part of the world.

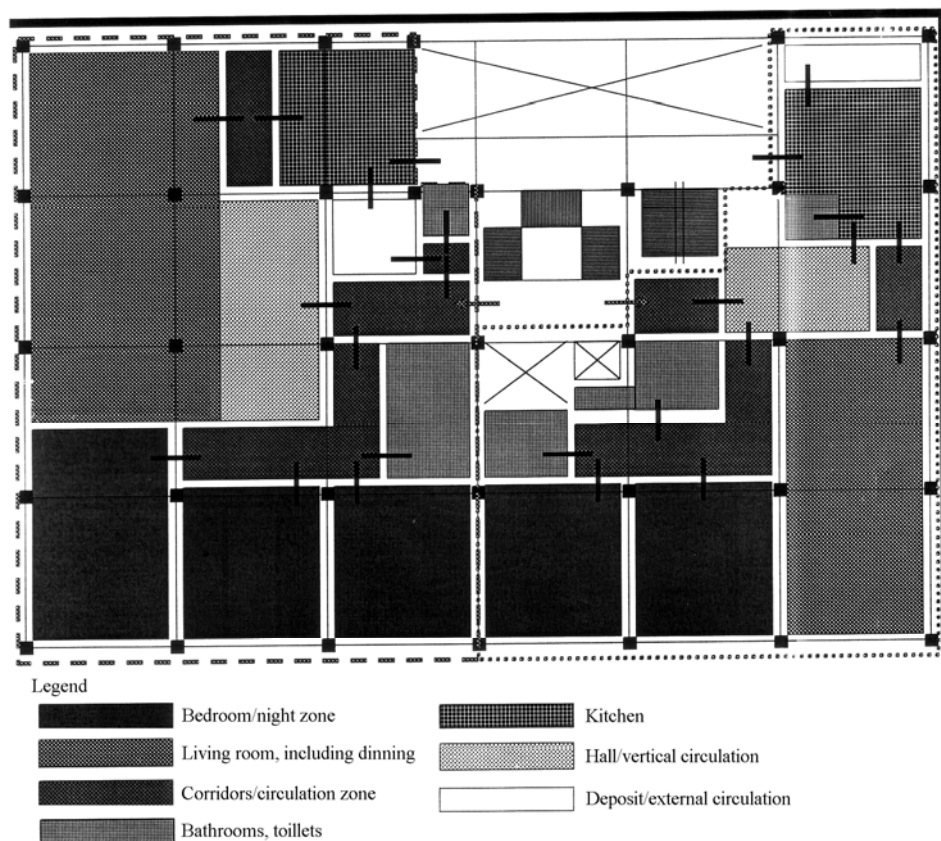


Fig. 2 – Model of the functional scheme in a Greek apartment building.

We would add the presence of the main and service staircase respectively. They are “expressions of culture, rather than work of a single architect” (Tzirtzilakis, *op. cit.*). Actually we find a close approach in Lisbon, with the easy to copy buildings designed by Cassiano B r a n c o. Bucharest had a different approach, since the buildings of the Modernism display a high variety in shapes and height, depending on owner and parcel. But in all cases it is about the face of the city, about transition from the architectural object to the city, highlighting that the programme of the dwelling stays between architecture and urbanism.

b) *Romania*

In Romania, master and development plans were compulsory for urban and touristic centres since 1929 (Machedon & Scoffham, *op. cit.*). Corresponding regulations were compulsory for village planning and design. The Charter of Athens defined the principle of zoning and town planning according to it after the Second World War, but in Bucharest it found application with the Master Plan one year after its proclamation. One reason might have been that there was a generation of interwar architects with a strong interest in urbanism, Machedon and Scoffham (*op. cit.*) mentioning Marcel Janco, Octav Doicescu and Horia Creangă. The Bucharest 1934 Master Plan reinforced the capital's radial concentric shape through zoning: central, residential, industrial, traffic routes, and recreation along the lakes of the Colentina river in the North of the city. Zones with various degrees of functional mix were determined. The main traffic routes were reinforced by the street facade, raising the classification and subsequently the cornice line (24 m on the N-S thoroughfare, which meant about eight floors, and above at corners, marking intersections), so the master plan contributed to the unity of the boulevard, rather than in planimetry, which, for example, in the N-S boulevard “varied 30...50 m through a sophisticated and planned variation of facades. The authors of the master plan included in it concepts of style”, write Machedon and Scoffham (*op. cit.*). To its base stood an “analysis of physical setting, distribution and categories of industry and volume of trade, traffic circulation, geology and topography, green belt, use of subdivisions, areas to be appropriated” (Machedon & Scoffham, *op. cit.*). “The city's master plan provided the template for modelling the built fabric of Bucharest” (Machedon & Scoffham, *op. cit.*). In the zones determined in the plan, the use of structures, their character and size were established. So the height varied from 12 floors in the centre to 4...5 or even 2...3 depending on residential zone they densified. Apartment buildings were a new form of living, which spread through the city. As seen for the case of Greece, also in Romania

the architecture of apartment buildings “had a greater impact on the urban environment than any other housing in Bucharest after the First World War” (Machedon & Scoffham, *op. cit.*) (Fig. 3).

*a**b**c**d*

Fig. 3 – Typical blocks of flats in Romania: *a* – turist, with the changes after the 1977 earthquake, arch. Marcel L o c a r, 1936; *b* – Elena O t t u l e s c u building, arch. Horia C r e a n g ă, 1934-35; *c* – building (Pherekide) on the N-S boulevard with unfolding of facades; *d* – mid-rise building elsewhere: Poldi Chapier building on Onciu Street, arch. Marcel J a n c o, 1935. Photos M. B o ş t e n a r u, 2002.

In Bucharest a unique interplay between the new architecture and the urban setting was achieved as a consequence of the availability of land which permitted major urban interventions, defining till today the features of the city (Machedon & Scoffham, *op. cit.*). The most significant one, the N-S thoroughfare, was traced at the end of the XIXth century after the model of Haussmann's interventions in Paris, 1853...69. Later on, it was completed with modernist facades. This urban architecture section of modernist buildings, has no equal in other European capital cities, so Machedon and Scoffham (*op. cit.*), and the authors have found no contradicting information in literature. Reason for this is that the other historic centres have been completed long before. While in some other European new axes cities were achieved through brutal demolition, in Bucharest they were drawn on relatively sparsely build vacant land, with rural character, changed through the intervention. The N-S boulevard, Machedon and Scoffham (*op. cit.*) say, "was intentionally built to cross a relatively unbuilt area at the rear of buildings lining Calea Victoriei, the oldest main artery. [...]. Analysed individually, the various buildings differed in character and represented individual architects' ideas and personalities. But taken as a whole, they presented an essentially modernist form of urban completeness". Irregular parcels resulted. The parcel is used rationally and gives a functional and formal determination. The intervention in Bucharest features a new way of contextual integration, introducing new spatial landmarks. Another characteristic feature of adaptation of the intervention to the site are set-backs. The master plan guidelines stipulated for central zones a large occupancy of up to 70%, even 100% if 30% of the volume was located at ground floor level. Such occupations were achieved in multifunctional buildings with housing, cinemas, offices and shops. The buildings of the N-S main boulevard were, with the exception of two hotels, all residential and office buildings, with commercial functions and cinemas, at the ground floor level. As the scale of the intervention grew, buildings in close proximity faced plots with sunlight shadows. So recesses at upper floors were developed as neighbourhood regulation. M a c h e d o n and M a c h e d o n (1994) classifies the built volume depending on location as follows:

- a) building inserted in an already existing linear front;
- b) buildings at a crossing of two or more arterial roads;
- c) buildings placed in important squares;
- d) buildings on isolated locations;
- e) lower-rise buildings that can be independently placed in an extended front, coupled or determined by neighbours with blind walls or corner buildings.

Romanian buildings were raised in the interwar time not only in the city centre, where they are, however, most numerous, and give the urban face of the then new boulevards (Fig. 3 c). Similarly to Lisbon they were raised in the extension quarters to the North, the villa quarters for the higher income population – an extension continuing today. Machedon and Scoffham (*op. cit.*) note their varying architectural quality, a unifying term being that "all were

conceived in response to modernism, to the physical and economic requirements of clients with progressive ideas, and to the conditions imposed by a particular location". The latter was defined in the city's master plan. The Ottulescu building (1934...35, architect H. Creangă) builds a notable highlight: "the most modern and interesting approach in the whole Romanian interwar architecture" (Zahariade, 1992) (Fig. 3 b). It is an example of a free plan in a collective apartment block, not in the sense of the flexibility of spaces, but in the disposition of the apartments across the floors. The structural grid is not completely regulated and neutral, as one would expect for a perfect "free plan" example (see the Le Savoye villa by Le Corbusier), but, even if simple and clear, dictated by the spatial order of the 1st and 2nd floor. A two story duplex on ground floor and mezzanine, recessed from the street, takes advantage of the RC structure. Fig. 4 gives a functional scheme of it. One apartment each floor represents generality for a particular category of dwellings with not more than two floors, property of one family or related families (Machedon & Scoffham, *op. cit.*). They are subordinated to regulations similar to those of one family dwellings, being situated in such zones, but display nevertheless two staircases.

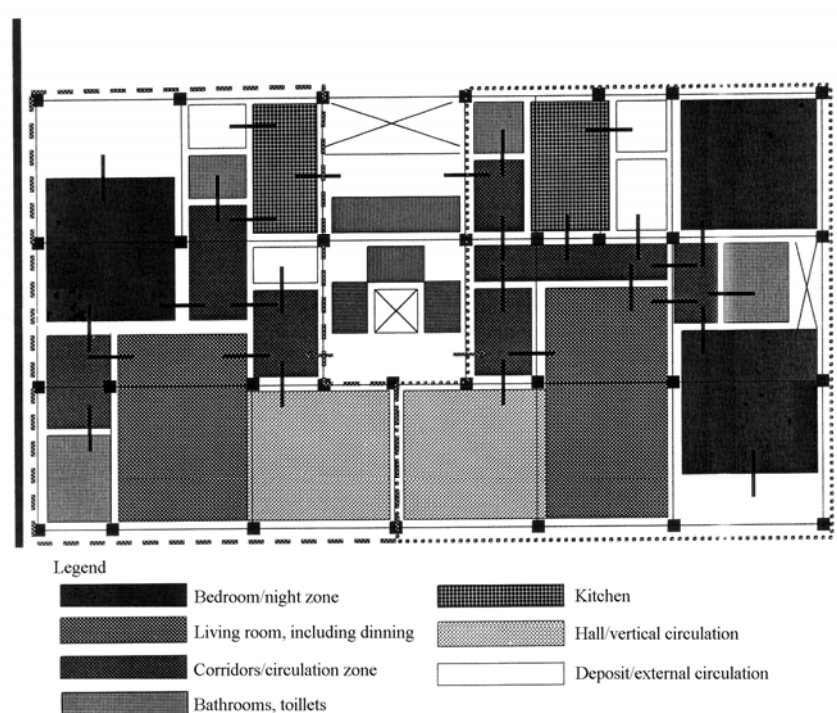


Fig. 4 – Model of the functional scheme in a Romanian apartment building.

Some of the buildings have one apartment on a floor, except on the top, which was given to design studios, duplexes. Marcel Janco built a couple of the typical 3...4 story housing (Fig. 3 d). Some combinations of elements proved

more easy to copy, so a round corner volume articulating two facades of a building of Marcel Locar on Calderon street, which was then built across Bucharest in the vernacular architecture of the period (Machedon & Scoffham, *op. cit.*). Architecture on squares was aimed to give identity to their surroundings, like the one which will build the model in this paper.

Reasons for the development of the apartment building were the increased need for dwellings and the urban planning prescription which permits for higher buildings in the city centre. Also the urbanistic requirement for continuous facades had consequence for their planimetry. The contextualist approach adopted in Romania wasn't characteristic for the Modern Movement ideology, but Lisbon and Athens adopted their own contextualism, conditioned on the different tradition of the Mediterranean, the square simple blocks, as well. The growth needed for housing architecture occurred because of unified Romania after 1918. Machedon and Scoffham (*op. cit.*) estimate the number of new buildings, in their majority housing, from one family houses to apartments, constructed 1920...34 to 29,000. Resistance to innovation was relatively low in Bucharest, due to little established tradition, so experiments in town planning and architecture took place. Romanian architects were too little influenced by the socialist ideology. Thus a collective tendency for collective dwellings with elegant, generous apartments, for renting for higher income population (today condominium) exists. "The objective of improving conditions for living was clear in almost all building programs. [...] Functional needs are complex; they begin with immediate social needs, progress to those associated with psychology and technology, and finally focus on levels of comfort" (Machedon & Scoffham, *op. cit.*). There is, till today, a discussion in Romanian architecture on the relationship between the formal and the functional, and this dialogue found expression in the volumetry of modernist architecture. "The expanding market for comfortable dwellings, villas or apartment buildings, with ample space, reflected Romania's strong economy during this period. Low-cost housing of minimal size, which elsewhere in Europe was the focus of considerable research and development, was fairly uncommon" (Machedon & Scoffham, *op. cit.*), as it was also in Greece. In Romania, the spread of modernism was achieved not by public programs, but mainly by private enterprise and speculation (Machedon & Scoffham, *op. cit.*). Deviations from the mainstream European Modernism were thus dictated by the market. Since the housing programme was implemented through private initiative, speculative development was possible. But, in the same time, clients collaborated with young architects who adhered to the Modern Movement. Speculators required use of the volumetric capacity of the parcels and architects did so, while respecting the master plan.

As an effect of the strong French influence in Romania, the institutionalized haussmanian structure of the dwelling, the apartment block (*immeuble de rapport*) was adopted. This is modernized as regards the layout in plan and section, the equipment, facade and construction technique. Romanian

housing displays some innovations towards the haussmannian typology, according to which the boulevards were cut. Characteristics of Romanian interwar apartment buildings are (completed after (Machedon & Scoffham, *op. cit.*)):

a) Independence of the building plan from the parcel form and geometrization of both building form and service court form (the latter transformed into a backyard, with principal rooms opening to it), reflected in the free articulation of volumes. Such backyards were never implemented in Greece, though prescribed.

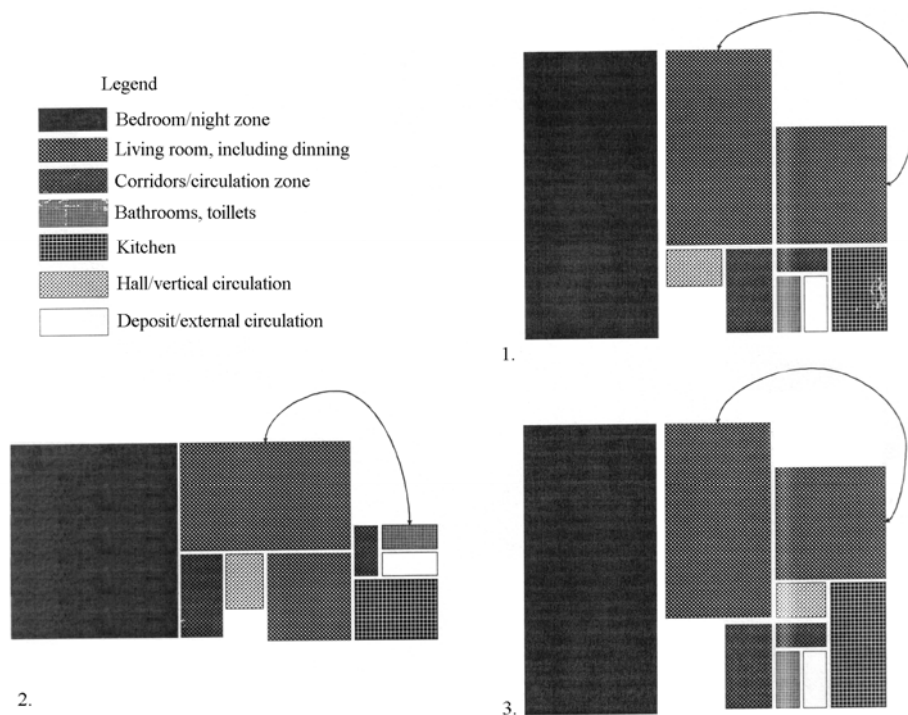


Fig. 5 – Architectural typology, after sketches in architectural teaching for architecture students at “Ion Mincu” Architecture Institute, 1993.

b) The plans focused on a central nucleus of the large living room. Despite the innovation, it is common with the traditional plan that each room has a specific function, what limits the flexibility. Flexible is the reception zone, which cumulates the functions of hall and eating place and can be extended through gliding/glazed doors, communicating visually and functionally with the office space. This latter unit, close to the entrance, has direct access and was necessary for the type of work the owners of such buildings were doing. This scheme is valid till today, as shown in Fig. 5. Functional and spatial-volumetric relationships characterize an architectural programme. A residential unit functionally displays a “day-zone”, and a “night-zone”. A day-zone

encompasses the living and dining rooms, the terrace(s), the kitchen, dependencies and circulation places. Instead of central distribution hall in apartments, in organisation forms applicable even as a classical today, two bedrooms have indirect access over the living room. The night space was separated and used to consist out of compartmented spaces. Functional requirements regarding the vicinity of spaces can largely be met in well designed residential projects. Orientation of the main rooms towards the appropriate cardinal points is a sub-feature of zoning in an apartment (Boștenaru, 2006).

c) 2...3 apartments of 1...5 rooms were grouped at a vertical circulation node. The apartments are small, one to four rooms for small families with 1...2 children (two bedrooms). Usually there are two apartments at a staircase and except small apartments each apartment has two entrances: principal and service, to the respective circulation nodes.

d) The interior spatiality has a geometric and clear composition, exploring the expressive valences of modern technology, not only the equipment. There were three vertical registries:

- 1° the ground floor, usually occupied with public functions and glazed;
- 2° the current floor(s);
- 3° the set-backs.

Many times between the first and the second registry a mezzanine was introduced.

e) An important role for the volumetry played the set-backs, replacing the mansard. Balconies, loggias, recesses built a gradual interior–exterior communication mean.

f) The facade composition emphasized the horizontal. Window areas were grouped as continuous bands. Vertical elements played a role not only for the composition of the architecture object, but also in emphasizing important points of the urban space of the street (for instance at corners, squares). Other features providing compositional and aesthetic identity to Romanian interwar architecture are right angle intersections, combination of strict rectangularity with curved surfaces. Design details often demonstrated an art deco influence.

In most of the cases the Romanian apartment blocks exploited the corner setting of their parcel by special corner solutions. Corners were even created by not building from one limit of the parcel to another, which is the case also in the model in this paper. An exception is the Malaxa-Burileanu building (1935...37, arch. H. Creangă), situated at an intersection, but without adopting a special corner solution.

g) The reinforced concrete structural frame permitted flexibility in both the organisation of the apartment itself and between floors. The apartments vary in size and number within a building and are distributed independently in successive floors.

The formal simplicity of the modern architecture was associated, in Romania as well, with the precision and pure volumes of the vernacular

architecture. Horia Creangă found that the traditional Romanian house in the region around Oltenia, the “cula”, displays the same features.

c) Portugal

Apart of Romania, where the Athens Charter found a home fastly, the apartment block typology developed in Athens and Bucharest can be also found



a



b



c

Fig. 6 – Typical buildings in Portugal: *a* – Avenida de Alvares Cabral, arch. Cassiano Branco, 1935; *b* – Rua Nova de Sao Mamede, arch. Cassiano Branco, 1935; *c* – Hotel Victoria on one of the Avenidas Novas (Avenida da Liberdade), arch. Cassiano Branco, 1934...36. Photos M. Boştenaru, 2005.

in Lisbon, and, more importantly, in the same material, reinforced concrete. The master plan of Lisbon was drawn in 1948, but from 1935 Étienne de G r ö e r was in charge of the extension of Lisbon along Tejo (Souza Lôbo, 1997). Since 1934 master plans for agglomerations over 2,500 inhabitants were compulsory. Also in Portugal boulevards of haussmannian type have been built at the begin of the 20th century: the so-called Avenidas Novas, as city extension to the North. Opposite to Paris, where they were a reform of the existing city, these boulevards built a continuation of the illuminist pombaline city. The area was parcelled pragmatically, in elementary geometry, as blocks, residential areas for the not very numerous higher bourgeoisie. The same parcellation has been used in Porto, but not with the same clarity (Henriques da Silva, 1997), as it was employed in the city centre, where Barry Parker superposed a new structure over the existing network, with focal points, strategic positions. Two dwelling typologies are developed (Henriques da Silva, 1997):

a) With 3 upper floors and up to 8 residential units, many times with just one unit/floor, for upper class tenants. These dwellings had a functional quality which came very close to the one made possible by the concrete method of construction of the Modernism.

b) With 5 or more upper floors, more residential units/floor.

In the 20s, before the Athens Charter, the architecture generation of the Modernism developed. It wasn't an organised movement but the expression of a generation, an experimental phase. The new IST campus became a cristallisation point and precursor of Modernism, including the apartment blocks by Cassiano Branco (Fig. 6). The Portuguese Modernism developed on the basis of the International Movement, promoted from Beaux Arts side, and of the Casa Portuguesa (Vieira Caldas, 1997). The multiple family house, integrated in building groups, was the exemplary solution for central zones. The interior spaces of Cassiano Branco were traditional. The facades, in a style easy to copy by engineers and workers, were repeated across Lisbon. This was reached through constructive simplicity and glossy surfaces.

d) *Italy*

The Italian Modernism before World War I was marked by Arte Nuova (Italian Art Nouveau) and Futurism, the latter being best known through the work of the Comasco architect Antonio S a n t' E l i a, who, however, was later won to the movement due to the success of his drawings. "At the same time that Arte Nuova and Futurism were offering a radical change in contemporary architecture, impetus for reform came from two other domains. One was what the French called "l'urbanisme", the English "town planning", and the Italians "edilizia cittadina". This was the legacy of the nineteenth-century reasoned picturesque as applied to the new interest in the design of garden cities, garden villages, and garden suburbs; in the preservation of old historic urban centres undergoing modernization as advocated by Camillo S i t t e and his followers;

and in the design of new urban neighbourhoods to extend the old city according to Sittesque principles. The other was the enthusiasm for vernacular building, which was seen as the way to renew architecture for the modern age while



Fig. 7 – Garbatella, Rome. Arch.: Innocenzo Sabbatini (1920-1922). Photo M. Boştenaru, 2006.

retaining national identity”. (Etlin, 1991, p. 100) Urban planning was adopted by the architects as priority area, not only as “alternative to architecture but as way to a new architecture” (Etlin, *op. cit.*, p. 101) before World War I after the disappointment in looking for a new modern style. The so-called Contextualism was a movement in urban planning promoted by the Roman Associazione Artistica fra I Cultori di Architettura. In 1921 it found its begin in the creation of two garden suburbs near Rome, Garbatella (Fig. 7) and Aniene. Subsequently the Roman Associazione Artistica defined the contextual design in architecture, the so-called “l’ambientismo” (Etlin, *op. cit.*, p. 102) which was to be very important for the 1920-1940 modern movements in Italy, both the Milanese Novecento and the Italian Rationalism. “L’ambientismo was, as G i o v a n n o n i explained, ‘the correlation between a work and its surroundings; the artistic harmony between individual works and the whole’. The general idea was adapted from the Sittesque movement on urban design” (Etlin, *op. cit.*, p. 116). The reasoned picturesque, a union between reason and poetry, was a creation of V i o l l e t - l e - D u c (Etlin, *op. cit.*, pp. 102-107). Italian streetscapes and the relationship between the Italian cottages to their natural landscape were displaying poetic character – “reasoned construction and planning with aesthetic effect” (Etlin, *op. cit.*, p. 104). Late 1927 and early 1928 a related approach became known through the work of the Società degli Amici e Cultori d’Arte of Como, including initiatives of the later best known 1920-1940 architect of Italy, the young Giuseppe T e r r a g n i, “Terragni’s participation in the Sittesque movement of contextual design at a moment when he was also assisting the birth of Italian Rationalism” (Etlin, *op. cit.*, p. 121). Camillo Sitte has promoted an urban analysis in which the monuments appear on the background of common buildings. New constructions must not look old, but remain new, since the new material reinforced concrete asks for new rules, and harmonize themselves with the old, particularly in what concerns the proportions. This was a rarity in avant-garde aesthetic: abstract geometric forms but contextual urban planning approach. However, since in Greece, Romania and Portugal it was mainly built in the city centres, the architecture there had its own contextualism. Etlin (*op. cit.*, p. 255) sees the architecture of Le Corbusier also as being contextual.

So the urban planning approach in Italian architecture began before World War I and was thus at a certain distance of the CIAM, although at the CIAM 1933 in Athens, Como, Genova, Verona and Roma were Italian contributions of analysis.

Between the wars two parallel movements characterised the modern Italian architecture: the so-called “Novecento Milanese” and the Italian Rationalism, the latter better known throughout European Histories of Architecture. The Milanese Novecento can be seen as ‘another modernism’; however, in terms of functional shape of the houses, it was more progressive than the Rationalism. The Rationalism innovated mostly the volumetry of the buildings and the facades, buildings plans remained conventional (Germer,

1991). The Novecento architects studied new function bound typologies, especially a radical innovation in housing. Within the Novecento the building shape was studied to optimize the typology of the plans in order to get them scope related, in consent with the modern life way and the technological means. The main influence in the innovation in building plans was that of Giuseppe de Finetti and Gio Ponti, as well as of the journal *Domus* (Burg, 1992, p. 7). De Finetti studied at Adolf Loos in Vienna, and this might be the origin of his interest for typology (Burg, *op. cit.*, p. 88). First typological investigations were done in the work on artists' ateliers (Burg, *op. cit.*, p. 42). Then, the manifesto of the Milanese Novecento, the *Ca'Brutta* by Giovanni Muzio (Fig. 8 *a*) was an example of use of most modern construction materials and methods, technical

*a**b**c**d*

Fig. 8 – Buildings of the Milanese Novecento: *a* – *Ca' Brutta*, arch. Giovanni Muzio (1922), Via Turati and Via Moscova; *b* – housing building in Via Domenichino, arch. Lancia and Ponti; *c* – housing complex on Via Longhi: three Novecento buildings; *d* – Casa Bonaiti, arch. Giovanni Muzio (1936), Piazza della Repubblica. Photos: M. Boştenaru, 2007.

equipment and the start of the typological development in housing. The type for the “condominium” was introduced in Milano with this building, a type found then in all Novecento housing buildings, and widely spread today.

The plans were divided into clear function groups (representative living spaces, bedrooms, secondary spaces, service areas), and advantageous conditions for light and air were created (Burg, *op. cit.*, p. 50). However, as significant as the innovation in the spatial order of the housing building was, it was less spontaneous than that in facade conformation (Burg, *op. cit.*, p. 70). Also in the buildings of the Novecento Milanese we found the double entrance, main and service, with access for automobiles. The kitchen and the service rooms had a separate entrance. The first building of Lancia and Ponti in which all criteria for the innovation in housing planning were met: intensive use of the ground, economic efficiency, construction, equipment and plan optimisation, was the one on Via Domenichino (Fig. 8 *b* and 9). A characteristic point in the development of the Italian dwelling was the vertical stappeling of “villas”, encouraged by the presence of the lift.

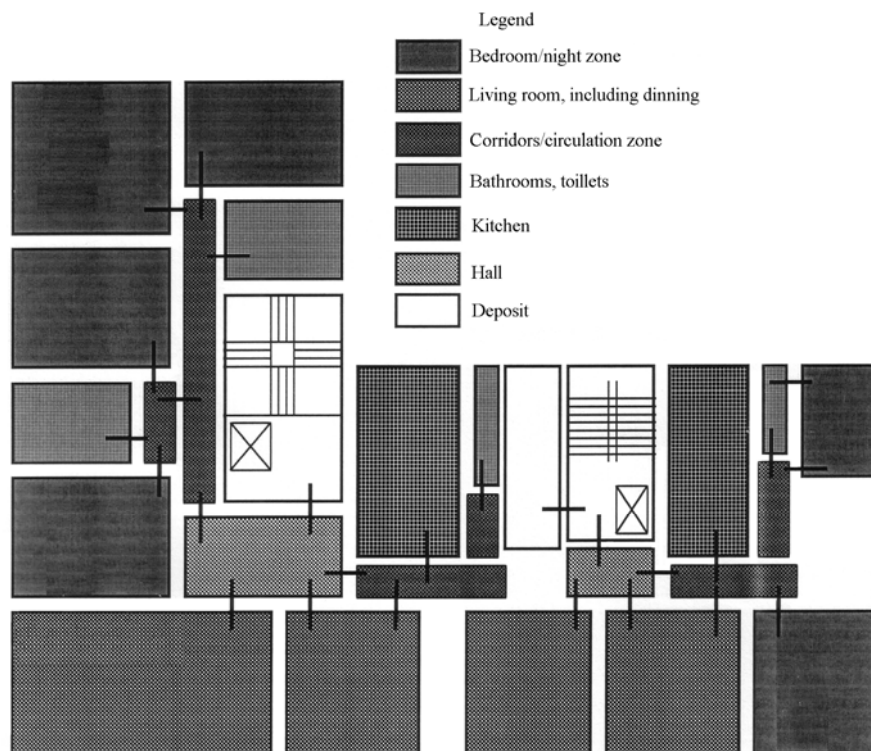


Fig. 9 – Model of the functional scheme in an Italian apartment building.

The latter allowed not only height raise but also a typological evolution (Burg, *op. cit.*, p. 86). Instead of the traditional Marmora staircase the lift started

to be used, just like in Romania. In a housing building (Casa della Meridiana) in Via Calimero (1929...30) de Finetti combines the stapped villa with the serial building plan. It reminds the Ottulescu building by Horia Creangă. It also anticipates the development of the Milanese Novecento in the field of dense, but comfortable urban housing (Burg, *op. cit.*, p. 90). These will be further developed in the 30s. As regards the serial plan, a plan is repeated in one and the same building additively: newly developed dwelling types or space types were employed like normed, but changeable modules. Different from the International Style the individuality of the architecture and of the single dwelling were constant and important aspects of the Novecento (Burg, *op. cit.*, p. 95). The plans were as far variable as to assure unicity of each dwelling. The reinforced concrete skeleton gave liberty in the division of the plans and in the conformation of the volumes. There was a division between the living and eating room in order to avoid the luxury tax for rooms over 25 m² (Burg, *op. cit.*, p. 120). The “Siedlungen” of the Western European so-called “Neues Bauen” were never achieved. Also in street parts like Via Longhi (Fig. 8 c) each house remains individual.

The Milanese Novecento displayed two movements: the Decorative Novecento and the Geometric Novecento, the signal for the latter being given again by Giovanni Muzio with the House Bonaiti (1935...1936) (Fig. 8 d).

In December 1926 seven young Milanese architects (Gruppo 7) introduced in Italy the International Style under the name of “razionalismo” through a manifesto in *Rassegna Italiana* (Etlin, *op. cit.*, p. 225) and formed a movement, the *Movimento Italiano per l'Architettura Razionale*. “Italian Rationalists were intent upon creating a contemporary architecture particularly attentive to functional requirements and constructed with modern materials made into forms that evoked the spirit of a machine civilization. As in many other countries, these architects also attempted to imbue this international avant-garde with a national identity grounded in tradition” (Etlin, *op. cit.*, p. 226). In the first phase the functional solution for the housing issues of an ordinary person stayed in foreground, although these aspects is not so widely known (Etlin, *op. cit.*, pp. 226-229). Rationalists architects participated at the IVth *Congrès Internationaux d'Architecture Moderne* in Athens in 1933 and in the subsequent competition for the 1934 regional plan for Como (Etlin, *op. cit.*, p. 228). This date is of particular importance since in 1934 also the Master Plan of Bucharest, the capital of Romania, was drawn and it generated sequence of modern building on the main boulevard without equal in Europe. In Como, the modern buildings of Terragni are dispersed through the city. A second level of Rationalist activity is seen by Etlin (*op. cit.*, pp. 233-234) in monumental buildings. In this part of activity it reacts to a parallel movement in Milano, the Novecento, lead by Giovanni Muzio and which featured two phases: the Decorative Novecento and the Geometric Novecento. The Geometric Novecento, which followed the Decorative Novecento, was a reaction to Italian Rationalism (Etlin, *op. cit.*). It promoted another type of housing, where

romantic spiritual needs like “casa mia” (my house) (Etlin, *op. cit.*, p. 327) played a very important role. 1931 Rationalism attempted to be made official state architecture, that is, of the Fascist state of the time (Etlin, *op. cit.*, p. 234). Giuseppe Terragni, like the other new rationalist architects, had the feeling of living in a privileged time, “making possible the creation of a new artistic style” (Etlin, *op. cit.*, p. 234). The new time was European. It featured a convergence of the arts, literature, science and architecture on multiple levels.

Reinforced concrete enjoyed the liking of the Italian rationalist architects also before Gruppo 7: “On the eve of World War I, with Sant’Elia in Milan, Giuseppe Lavini in Turin, and Marcello Piacentini in Rome, each of the major urban centers had its spokesman for a rational architecture” (Etlin, *op. cit.*, p. 240). The employment of reinforced concrete was first demonstrated by a cinema in Rome by Piacentini, a far relative of the Hungarian Pre-World War I architecture which Piacentini admired (Piacentini, 1921), more precisely of István Medgyaszay’s theatre in Veszprém. Etlin quotes another comparison, to the Théâtre des Champs-Élysées of the pioneer of reinforced concrete, Auguste Perret, in Paris. The Gruppo 7 also reviewed the current state of modern tendencies throughout the Europe of their time (Etlin, *op. cit.*, p. 147-248), putting a special accent on Germany. Instead of national nuances, they pleaded for local nuances: individual traits. Instead of the vernacular they see the eminent Italian design in form of the urban palazzo. The presence of the individual and national can be linked to the contextualist trait in the Italian rationalism.

Rationalist Architecture was called by Etlin “a contextual Avantgarde” and the whole chapter 8 was dedicated to this issue: “contextual buildings in the multiple meanings of the word: Italian in character, specific to their city, appropriate to the cultural history of their building type, and responsive to particular site conditions” (Etlin, *op. cit.*, p. 255).

As the column and the arch built the vocabulary of the last centuries, the Gruppo 7 looked for the vocabulary of rationalist architecture and found (Etlin, *op. cit.*, p. 250)

1. the lack of decoration;
2. the proportion and abstract rhythms;
3. the expression of the structural skeleton (“la construction apparente”);
4. the cantilevered balcony;
5. the corner window;

which were different of those five enounced by Le Corbusier for modern architecture (Boștenaru, 2004).

Representatives of Italian rationalism were (Etlin, *op. cit.*): Giuseppe Pagano, Gino Levi-Montalcini, Giuseppe Terragni, in Rome Innocenzo Sabbatini, Giuseppe Apponi, Pietro Schieri and Mario Ridolfi, Adalberto Libera, Giovanni Michelucci,

Angiolo M a z z o n i. Roman rationalism promoted in this city of baroque round forms.

The Novocomum in Como (1928...29) by Giuseppe Terragni is the first modern housing building constructed in Italy. It uses a nautical imagery (was called “oceanliner”) which reminds the imagery of the Arkadenbazar by József V á g o in Hungary (Boştenaru, 2004), strengthening again the links between the development of Italian early XXth century architecture and the Hungarian one. The five residential buildings in Milan designed together with Pietro L i n g e r i further applied the functional criteria, with rooms possible to merge by opening of sliding doors, and prismatic geometry seen at Novocomum. The reinforced concrete skeleton builds an integral part of the concept and in case of Casa Rustici the boxlike aspect creates the mentioned parallel to the Italian palazzo (Etlin, *op. cit.*, p. 271).

Rationalism and Novecentism were closer one to the other as the polemic would let to think (Burg, *op. cit.*, p. 114).

2.2. Structural Characteristics

K a l o g e r a s (1999) affirms that, “the general management network often determines whether or not a particular mode of building is implemented, and by extension, helps in the establishment of an architectural style. [...] On the other hand, when a technology of any kind, and more specifically a building technology, is first applied, it sets off a chain of action and reaction on the purely socio-economic level: new social conditions are created, new markets emerge and new values are established. These, in turn, create more new technologies, and so the cycle begins from the beginning again”.

a) Greece

The load-bearing structure of the apartment blocks in the 1930s in Greece was built exclusively in RC. Their morphologic and plastical characteristics were built on examples, taken from journals, from France and Germany. The situation was that described by Kalogeras (*op. cit.*) in Athens in the 1920s, and the movement from Neo-Classicism to Modernism is closely related to the first building projects in which RC was employed. The introduction of RC caused both technical and aesthetic changes. In Greece, unlike in the country of Bauhaus, iron used to be an imported material. So RC might have been an economically efficient solution in Greece, and so used when adequate as technological solution, what did not happen for example at the Einstein tower in Potsdam. Kalogeras (*op. cit.*) affirms that at the beginning of the 20th century there was a wide knowledge of structural techniques in Greece, this exteriorizing in the improvement in exploitation of local materials and in the successful assimilation of new materials and techniques. The so-called

“constructional context” or “environment” had the necessary flexibility and adaptability to innovation (Kalogeras, *op. cit.*). Constantopoulos (1999) sees that in the Greece of the 1930s the country was being built up, the ground was largely unbroken, and easier for fertile experimentation to penetrate, and to be accepted once it had been tried out. Greek engineers and engineering firms played an important role in a rapid dissemination at wide scale of the new structural technique. RC begun to formulate a morphological alphabet on its own in engineering projects (Kalogeras, *op. cit.*), while elevation, faced with other materials, closely associated with historical orders, and modes of ornamentation resisted the impact of RC technology, used to construct all structural elements in the meantime. RC displayed a new constructional potential and, even if not used to its full, morphological liberty, both leading, according to Kalogeras (*op. cit.*), to the rapid spread of this new method of constructing buildings, adopted by civil engineers and architects. These factors lead to achieve the above mentioned effect of structural innovation on an architectural style and the related urban phenomena. The cities begun to change to the form of today.

Structural techniques developed paralelly to new legislation. 1929 matters of ownership for adjacent building with more than three storeys begun to be regulated through the new statutory framework for construction: the General Building Regulations constantly updated till today, including seismic rules. The ideas of the CIAM held in 1933, regarding new aesthetics and new structural techniques for such buildings, were disseminated in the inter-war time. These two changes coincide with the establishing, after 1925, of RC as the basic material for constructing the bearing structures of buildings. The increased density in urban areas almost became synonym to the concept of condominium. The General Building Regulation also built the legal frame for condominium, resulting “in a fundamental morphological shift from the classic base/wall/entablature system of composition, which enshrined the concept of a single residence, to contemporary stratification into identical standard floors”. B o ș t e n a r u (2005) analysed this matter. Historical styles had completely different attitudes towards architectural sincerity, elements being what they seem to. The paper explored the sincerity in the Modern Avantgarde architecture to which sincerity for the expressions of the function, materials and technology applied, in the exterior expression of spatial structures. Buildings of the European Avantgarde were investigated from the point of view of the architecture theory. It resulted that buildings dedicated to ‘serial mono-functionality’, such as multifunctional spectacle or exhibition buildings, display sincerity in exterior expression. Different for so-called ‘polyfunctional’ buildings, with simultaneous various functions on superposed floors. The

analysis for the reasoning behind this started at Semper's base/wall/entablature theory, but the most interesting fund was the superposition of sincere storeys from all points of view in the Dutch pavilion at the EXPO 2000 Hannover. Constantopoulos (*op. cit.*) sees the load-bearing RC-skeleton as the Greek version of the domino, in other words the morphological statement of the pure and plain geometrical prism.

b) *Romania*

The economic development facilitated the introduction of new technologies. "During the 1930s Romanian building enterprises were fully able to employ the new technologies, especially those associated with the wide spread of reinforced concrete" (Machedon & Scoffham, *op. cit.*). This has been documented in detail by P r a g e r (1979) and has been summarised in Boştenaru (2004, 2005). RC had a role in meeting the new expectations of comfort through structures which permitted the flexibility of the interior space. Reception to the new ideas was mainly to new aesthetic principles and less to restructuring of the traditional apartment house. They evolved with changes in science and particularly technology. Machedon and Scoffham (*op. cit.*) quote theoreticians talking about new materials and methods of construction: Florea S t â n c u l e s c u sees turning of material to advantage and Horia Creangă even is sure that "technological advances eliminate the former effects of weather on construction". Functional plans were relatively similar but experiments were done in architectural expression. Design was done from inside to outside, from the patterns of urban living to the response to the urban space (Machedon & Scoffham, *op. cit.*).

In the earthquake prone city of Bucharest, situated on river banks, high underground water and groundy soil called for special foundation solutions. The architectural solution adopted for the site rendered the interwar buildings vulnerable. The load bearing structure of these mid to high-rise constructions is RC skeleton, designed for gravity loads only (German provisions). Inadequate reinforcement, reduced sections and function dictated layout of RC members are reasons why moment resisting frames can be hardly identified. Side wall frames are solid clay brick masonry infilled, providing some resistance to lateral loads. In case of street facades, the masonry on consoles is worsening the seismic behaviour. The higher commercial ground floor, with sparse masonry infill, forms a soft storey. The mezzanine is often of lower height than the upper floors. Sometimes, at this level storey-high beams were constructed, to direct the loads from the upper to the ground floor. For a more detailed description, see Boştenaru (2005).

In Romania, characteristics of RC to interwar time were

a) 70...150 daN/cm² (based on tests at 7 buildings from 1935...1940, including hotels, department stores and office buildings as well), average 120...130 daN/cm² (Bălan *et al.*, 1982).

b) Reinforcement with round smooth steel (Bălan *et al.*, *op. cit.*). The distribution of re-bars in the column section was governed by geometrical principles rather than by structural ones (more bars on the long side). The reinforcement degree has been often under 0.5%: 100...120 kg steel/m³ concrete (Prager, 1979). There weren't enough stirrups at columns and the ones provided were simple, connecting only the corner rebars, not all of them (Bălan *et al.*, *op. cit.*). The reinforcement has had insufficient lap splicing. Preferred diameters at stirrups was of 6...8 mm, maximum distance between longitudinal bars 25...30 cm, medium distance between stirrups 25...35 cm (Bălan *et al.*, *op. cit.*).

c) Portugal

The challenges of the engineering construction and construction materials went over the adaptation to the pragmatical requirements. This is a difference to what Z a h a r i a d e (*op. cit.*) calls M. Avantgarde. In the 20s, within the same decade, a transformation occurred in Portugal. RC, which was first usual for special buildings, was extended for common residential buildings. From special buildings formal conclusions could be drawn. So, a new language developed following new constructive possibilities, which otherwise wouldn't have been possible given the lack of journals. These new structural designs include new concepts of the construction's structure and parts of a structure and the spatial conformation. RC was often used in mixed construction. At IST engineers who tried out the new materials were educated.

d) Italy

Not only the Italian Rationalism, but also the Milanese Novecento continued principles of the Futurism as regards the use of modern construction materials and methods. Futurism pleaded for the use of new materials, not only reinforced concrete, iron and glass, but also light materials like paper, textile fibre and other replacement materials for wood, natural stone and brick (Burg, *op. cit.*, p. 16). Decoration should be abandoned for letting new materials be expressed. Ca'Brutta, the manifesto of Novecento architecture, displayed a complete skeleton construction out of reinforced concrete (Burg, *op. cit.*, p. 50). Almost all housing buildings of the Rationalism and Novecentism were executed with RC skeleton. For the interior light materials were used, while the facades were covered with klinker or natural stone or with simple plastering. They were characterized by perfect quality of the execution, so they don't need any maintenance work today (Burg, *op. cit.*, p. 118).

"Reason 'leads the artist to develop his aesthetic from the system of construction selected according to available materials and resources, as well as conditions and needs that he must satisfy' [...] This dual imperative of satisfying programmatic needs and deriving architectural form in response to

the constructive system furnished the basis for the Gruppo 7's adoption of the word 'rationalism'" (Etlin, *op. cit.*, p. 236). This constructive system used to be reinforced concrete. Etlin (*op. cit.*, p. 238) speaks also of the correspondence between this term and the German 'Sachlichkeit' even if Rationalism was an imperfect translation. It is however interesting to see how more recent publication on the German Avantgarde use the translation of the Italian term in their labels: Weisse Vernunft (White Rationale) is the name of a multimedia CD ROM publication on the architecture in the 20es starring the Siedlung by G r o p i u s in Karlsruhe, Germany. "In selecting rationalism as their credo, the Gruppo 7 focused on what was commonly recognized as the defining feature of a new Western architecture" (Etlin, *op. cit.*, p. 238).

"One of the dealerships of Hennebique trademark in Italy, the most representative and important, was the company G.A. Porcheddu, operating in Italy from 1894 to 1933. [...] The company was the protagonist of great and significant projects in Italy. The most renowned is certainly the Bridge Risorgimento on the Tevere River in Rome. It spanned with a single a bay a distance of one hundred meters and held the primacy of the longest RC bridge for many years.

Mostly present in Piemonte and Northern Italy, some projects were carried out in the rest of the country, too" (Mezzina & Uva, 2006).

An archive on the works of the Porcheddu society can be found at the Turin Polytechnic, "including 385 dossiers containing the documents related to 2600 in ferroconcrete works carried out according to the patent "Hennebique system" from 1895 to 1933". [<http://www.biblio.polito.it/en/biblioteche/edi.html>]. A more recent work on early reinforced concrete in Italy was written by M e z z i n a *et al.* (2009).

4. Conclusions

After a comprehensive typological study, models of typical housing buildings in Athens, where the charter of the 4th CIAM was proclaimed, and respectively Bucharest, where the Charter was applied in the shortest time, were made. Both Greek and Romanian apartment buildings feature mixed use, with commercial functions at ground floor and residential above.

For Greek buildings 5...6 storeys are typical, like in the utopia of Toni G a r n i e r, while the height range has a much larger span in Bucharest, depending on the zone, foreseen in the Master Plan, which leans towards the Charter of Athens (2...12 floors). Common to them is that they feature generous spaces, for social middle class, in condominium property form, served by main and service staircases. This development was not only the consequence of the proclamation, respectively adoption of the Athens Charter, but of its interpretation in frame of the growth induced by economic development, framework also given in Portugal and Italy, and which went hand-in-hand with the possibility to employ new technologies, namely that of RC. Boştenaru

(2001) has shown that in a systemic approach, a construction work with its inhabitants builds a system. Each new intervention, a project, needs significantly longer time than use, in order to be accepted. The levels of acceptance of a change in the environment can be summarized as: idea, then project, then building, then image. The so-called 'image' characterizes the level of the routine. This 'image' builds the starting point of the CA'REDIVIVUS project, leading to the need in retrofitting both urban areas and infrastructure as well as single building, being strategic, of historic importance, or only seen as meeting good pre-requisites for exercising a pilot project, which will spread as a better routine, on them.

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REFERENCES

- Bălan Șt., Cristescu V., Cornea I. (Eds.), *Cutremurul de Pământ din România de la 4 Martie 1977*. Edit. Acad., București, 1982.
- Biris M., *From Late Neo-Classicism to the Emergence of Modernism (1900-1930)*. In *20th Century Architecture – Greece*, S. C o n d a r a t o s, W. W a n g (Eds.), Prestel: Munich, 1999, 15-25.
- Boștenaru Dan, M., *(Un)Sincerity in the Exterior Expression: Spatial Structures in the Avantgarde Architecture*. Proc. of the Internat. Symp. on Shell a. Spatial Struct. "Theory, Technique, Valuation, Maintenance", September 6-10, 2005, Bucharest, Romania, M. M i h ă i l e s c u a. C. M i r c e a (Eds.), Edit. Mediamira, Cluj-Napoca, II, 2005, 753-760.
- Boștenaru Dan, M., *Collaborative Issues in Retrofitting Historical RC Buildings*. Report to IABSE Symp. "Responding to Tomorrow's Challenges in Structural Engineering", Budapest, Paper 0154, 2006.
- Boștenaru-Dan M., *Early Reinforced Concrete Frame Condominium Building with Masonry Infill Walls Designed for Gravity Loads Only*. In *World Housing Encyclopedia – Summary Publication 2004*, S. B r z e v a. M. G r e e n e (Eds.), EERI, Oakland, CA, Report ID 96, 2004.
- Boștenaru-Dan M., *Typological Analysis of Early Reinforced Concrete Housing Buildings in Romania*. Proc. of the 4th Europ. Workshop on Seismic Behav. of Irregular a. Complex Struct., August 26-27, 2005, Thessaloniki, Greece, A. K a p p o s (Ed.), Paper No. 16.
- Boștenaru-Dan M., *Wirtschaftlichkeit und Umsetzbarkeit von Gebäudeverstärkungsmaßnahmen zur Erdbebenertüchtigung*. Proc. of the 2. Forum Katastrophenvorsorge, September 24-26, Leipzig, Germany, 2001, 128-135.

- Boştenaru-Dan, M., *Multi-Criteria decision Model for Retrofitting Existing Buildings*. Natural Hazards a. Earth Syst. Sci., **4**, 4, 485 – 499 (2004).
- Boştenaru-Dan, M., *Multidisciplinary Co-Operation in Building Design According to Urbanistic Zonification and Seismic Microzonation*. Natural Hazards a. Earth Syst. Sci., **5**, 3, special issue “Multidisciplinary approaches in natural hazard and risk assessment”, Guest Editor: Thomas Glade, 397-411 (2005).
- Burg A., *Stadtarchitektur Mailand 1920 - 1940 : die Bewegung des Novecento Milanese um Giovanni Muzio und Giuseppe de Finetti*. Birkhäuser Verlag Basel/Berlin/Boston, 1992.
- Constantopoulos E., *From City-Dwelling to Multi-Dwelling*. In *20th Century Architecture – Greece*, S. C o n d a r a t o s a. W. W a n g (Eds.), Prestel, Munich, 1999, 79-88.
- Etlin R., *Modernism in Italian Architecture, 1890-1940*. MIT Press, Cambridge, MA, USA, 1991.
- Germer S. (Ed.), *Giuseppe Terragni: 1904 - 43; Moderne und Faschismus in Italien*. Klinkhardt u. Biermann Verlag München, 1991.
- Giacumacatos A., *From Conservatism to Populism, Pausing at Modernism (The Architecture of the Inter-War Period)*. In *20th Century Architecture – Greece*, S. C o n d a r a t o s a. W. W a n g (Eds.), Prestel, Munich, 1999, 26-39.
- Henriques da Silva R., *Die ‘Casa Portuguesa’ und die neuen Programme 1900-1920*. In *Architektur im 20. Jahrhundert – Portugal*, A. B e c k e r, A. T o s t õ e s a. W. Wang, Prestel, München, 1997, 15-22.
- Kalogeras N., *The Constructional Environment in Greece over the Last 100 Years*. In *20th Century Architecture – Greece*, S. C o n d a r a t o s a. W. W a n g (Eds.), Prestel, Munich, 1999, 75-78.
- Le Corbusier, *La Charte d'Athènes*. Seuil, Paris, 1971.
- Machedon L., Machedon F., *Modern Architecture in Romania in the 1920s-1940s. Bucharest in the 1920s-1940s between Avant-Garde and Modernism*. Ed. Union of Romanian Architects, Simetria, Bucharest, 1994, 69-90.
- Machedon M., Scoffham E., *Romanian Modernism: The Architecture of Bucharest 1920-1940*. MIT Press, Cambridge MA, USA, 1999.
- Mezzina M., Palmisano F., Uva G., *Reinforced Concrete Constructions at the Beginning of the 20th Century: Historical Review and Structural Assessment*. In *Materials, Technologies and Practice in Historic Heritage Structures*, M. B o ş t e n a r u - D a n, R. P ř i k r y l a. Á. T ö r ö k (Eds.), Springer, Dordrecht, Netherlands, 2009, 293-323.
- Mezzina M., Uva G., *R.C. Technology in Italy at the Beginning of the 20th Century: a Historical Journey through the Work of Porcheddu Society*. Proc. of the 2nd fib Congress, June 5-8, 2006, Naples, Italy, paper ID 20-8, 2006.
- Philippides D., *Town Planning in Greece*. In *20th Century Architecture – Greece*, S. C o n d a r a t o s a. W. W a n g (Eds.), Prestel, Munich, 1999, 65-73.
- Piacentini M., *Il momento architettonico all'estero*. Architetura e Arti Decorative, **1**, May-June, 32-76 (1921).
- Prager E., *Betonul armat în România*. Edit. Tehnică, Bucureşti, 1979.
- Souza Lôbo M., *Stadtkultur und Landschaft*. In *Architektur im 20. Jahrhundert – Portugal*, A. B e c k e r, A. T o s t õ e s a. W. W a n g (Eds.), Prestel, München, 1997, 111-116.

- Tzirtzilakis Y., *Belated Neighbour or Familiar Stranger? Positioning the Models for the Reception of Greek Architecture*. In *20th Century Architecture – Greece*, S. C o n d a r a t o s a. W. W a n g (Eds.), Prestel, Munich, 1999, 100-107.
- Vieira Caldas J., *Fünf Intervalle über die Zweideutigkeit der Moderne*. In *Architektur im 20. Jahrhundert – Portugal*, A. B e c k e r, A. T o s t ã e s a. W. W a n g (Eds.), Prestel, München, 1997, 23-33.
- Zahariade A.M., *Locuința în creația lui Horia Creangă*. Horia Creangă, Catalogul expoziției organizate la împlinirea a 100 de ani de la naștere, Edit. Uniunea Arhitecților din România (UAR), București, 1992, 45-122.
- Zivas D.A., *Conservation and Re-Use: The Case of Greece*. In *20th Century Architecture – Greece*, S. C o n d a r a t o s a. W. W a n g (Eds.), Prestel, Munich, 1999, 95-99.

ALTE MODERNITĂȚI ÎN PROGRAMUL DE LOCUIRE EUROPEANĂ ÎN CONSTRUCȚII DIN BETON ARMAT (1920-1940)

(Rezumat)

Noile tehnologii aduse de dezvoltarea industrială au constituit o parte centrală a mișcării globale care a fost Modernismul. Unul din nucleele mișcării a fost programul de locuire, adecvat cu precădere pentru investigarea inovării. În vreme ce în țări mai industrializate se căutau căi de rezolvare a problemelor sociale, în unele țări europene noile posibilități au fost văzute ca o oportunitate pentru a da o imagine mai prosperă orașelor, mărin d densitatea cu blocuri de apartamente pentru clasa de mijloc. Aceste blocuri de locuințe au fost construite cu o structură din beton armat, care a permis flexibilitate în distribuția spațiilor în interiorul apartamentului. În acest articol contextul dat de CIAM pentru dezvoltarea a astfel de blocuri, o nouă formă de locuire a Modernismului este întâi explicată. Articolul continuă cu analiza schemelor de zonificare și cu descrierea utilizării betonului armat. Sunt considerate mai multe studii de caz: Grecia, unde a fost proclamată CIAM, România, unde un Plan Urbanistic în spiritul CIAM a fost elaborat pentru întâia oară, Portugalia și în final Italia, unde un alt Modernism a fost reprezentat de mișcarea Novecento. Studiul este util pentru a modela locuințe interbelice multifamiliale, pentru studii de restaurare.