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The Cement Brick, a Material of the Mexican Revolution. A Study of its Historical Value and its Physical Mechanical Properties

Ir a la versión en español

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ABSTRACT

The aim of this study is to recognize the historical importance of the cement brick that came into use in the domestic architecture of Mexico City in the revolutionary period (1910-1920) and to argue why it fell into disuse in such a pronounced way. An inductive-deductive method was used in four steps. It was argued that, although the use of cement brick in the construction of housing in revolutionary Mexico allowed the transition from a more artisanal process to a more technified one, in the end its significance did not transcend time, forgotten by the advent of reinforced concrete.

KEYWORDS

cement brick, maximum compression strength, artificial materials, Mexican Revolution, domestic architecture, Mexico City

CIRCUMSCRIBING THE PROBLEM: THE APPARENT USE OF BRICK SINCE THE LATE 19TH CENTURY

In Mexico, the architecture of the late 19th and early 20th centuries is synthesized under the appellative *Porfirian architecture*,[1] because it corresponds to the tenure of President Porfirio Diaz (1876-1911), and includes social, economic, and political factors that at the time, so to speak, comprised the spirit of those days and undoubtedly influenced the way of

[1] See Bonet & De la Maza (1980), SEP/INBA (1983), and Piña (1981).

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understanding architecture. If one delves a little deeper into the study of architecture during the Porfiriato period, concepts such as *eclectic architecture* appear,[2] a search that usually ends up in a myriad of stylistic appellatives that do not help to fully understand the panorama, although they encompass a set of related architectures: "it is therefore a matter of degrees of kinship",[3] as Katzman (1973, pp. 114-115) points out.[4]

The problem with conceptualizing an architectural phenomenon in an era pigeonholed by the political regime in power is that it does not characterize each of the different objects of study. For example, the temporality of the Porfirian regime is not enough to encompass the universe of eclectic architecture, which developed vigorously during the years of the Revolution and even during a good part of the 1920s. In the same way, the term *19th century architecture*, instituted by Katzman, is inadequate because, as Francisco de la Maza asserted, "There are long centuries and there are short centuries [...] As a century, the *19th century* was long in France, for example, because it began with the Revolution; it was long in the United States, because it began with its independence. In Mexico, on the other hand, it was short" (De la Maza, 1974, p. 11). Neither does the idea of an architecture of the *belle époque*[5] completely satisfy the periodization, since that stage came to an end with the beginning of World War I. What happens then with the eclectic architecture of the immediately subsequent period? Is it devoid of historical temporality?

But beyond the stylistic discussion about the school to which it belonged, or its incorporation to a precise historical period, in the early 20th century there were significant changes in the way of conceiving architecture that, although not definitive, laid the foundations for a different stage, which would begin in the late 1920s and would become evident from the following decade onwards.

[2] For Francisco de la Maza, the eclectic tendency is confined to a very precise period (1880-1910) and, mainly, to the idea of the Frenchification of architecture (De la Maza, 1974, p. 49).
[3] All quotes are editorial translations from the Spanish versions.
[4] According to Katzman, "the more or less different trends occur in the following quantitative order: Integrated Eclectic, French Eclectic, Semiclassical Eclectic, Very simplified Traditionalist, Neo-Gothic, Metallic Eclectic, Gothic-dominated Eclectic, Neo-Baroque, Utilitarian, Classical-Gothic Hybrid, Romantic Country, Neo-Moorish, Art Nouveau, and Neo-Romanesque"; and he continues: "all 19th architecture is eclectic, even what we call classicist" (Katzman, 1973, pp. 114-115).
[5] "[...] French term used to designate the historical period from 1870 to 1914 characterized by the absence of wars in Europe, by technical and scientific innovations reflected in a frank constant struggle between scientism and idealism, as well as by the economic expansion generated by the triumph of the bourgeoisie, supported by a boundless optimism about the firmness of its positivist ideology" (Aragon, 2011, p. 31).

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This is where the problem under study arises: what happened with the introduction of cement brick in the revolutionary period, with the occurrence of an accumulation of minor technical advances that have not been pertinently studied. Therefore, there is an area of opportunity to discuss the role played by cement brick in the transition from the revolutionary period in Mexico towards 1930, specifically in Mexico City.

Background

Since 1878[6] there was an important resurgence in the use of brick in European architecture (Franklin, 1994, pp. 102-103). In fact, this material was considered a relevant part of the transition towards a new architecture, described as true because it would endorse the technological advances of the Industrial Revolution and would not hide under a cloak of styles inherited from the past that would conceal, as architect Bernardo Calderón asserted, its authentic material and constructive essence:

> Beauty is nothing but the manifestation of truth, and the truth of construction is completely manifested by leaving in sight the material of which it is made. This is how one arrives, by a logical process, to the conviction of discarding the routine and the dreck in our buildings [Calderón, 1923, p. 4].

Purpose

The purpose of this study is to determine the historical importance of cement brick—which has a standard size of 20 x 10 x 6 cm[7] (Figure 1)—within the revolutionary period (1910-1920) and to discuss the information gathered to argue about its implications in the history of housing construction in Mexico City. This study is also intended to evaluate the physical mechanical characteristics of cement brick to have more elements of analysis and, thus, to clarify why it fell into disuse after only 10 years of age.

[6] As Raquel Franklin asserted, the publication of the book *La brique ordinaire au point du vue décorative* generated a fashion in Europe in favor of the use of apparent brick in facades (Franklin, 1994, pp. 102-103). Moreover, at the *Exposition universelle* of the same year (May 1 to November 10, 1878), in Paris, France, equipment for the mechanized elaboration of brick was exhibited. In other words, the revival of the apparent use of brick in Europe was not only a fashion, but a process linked to the industry and economy.

[7] In the 1942 building regulations, "cement brick" was referred to as a *lightweight solid cement brick*, as opposed to the *hollow concrete block* (Suárez, 1942, p. 62). No references to the use of brick were found in the 1921 building regulations (Gómez de la Puente, 1921).

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FIGURE 1. Facade in exposed brick in the house Pomona No. 38, Roma Norte, Mexico City. The use of two types of brick in a polychromatic composition is observed, Huerta brand industrialized red brick (22 x 10 x 6 cm) and cement brick (20 x 10 x 6 cm) smooth with bevel. Work attributed to architect Manuel Cortina García (Photograph: Alejandro Leal & Alberto Muciño, 2020; source: Authors' Collection).

Methodology

An inductive-deductive method was used to achieve the goal of this research and, for the purposes of this paper, it was organized according to the following steps. *1)* Circumscribing the problem. This section contains the motives and the area of interest that give rise to the formulation of the research. *2)* Research network. At this stage, the state of the art was determined and the search was narrowed down with research questions. *3)* Adaptation or conformation of a frame of reference. In this step, the mechanical capacity of the material was discussed and, considering the results of the information collected, a possible answer to the problem at hand was proposed, arguing the use of cement bricks. *4)* Final substantiation. This section provides an answer to the problem posed considering the information obtained. In each step, references on the object of study were searched, and an experimental method for the mechanical characterization of cement brick was applied.

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RESEARCH NETWORK

At the end of the 19th century in Mexico City architecture—primarily in housing—apparent partition walls of brick[8] began to be used more frequently. This eclectic type of architecture used it as a constitutive and ornamental element in walls, although mainly in exterior facades. Its use, starting from complex brickwork that formed geometric and polychromatic patterns (Figure 1), represented a modern form of construction that set apart the conventional use of brick in construction (this consisted mostly of mixed adobe or tepetate walls with brick at corners and framing as reinforcement, often using plastered or veneered finishes). The development of brick architecture, particularly the one that apparently implemented the use of industrialized brick,[9] known at the time as compressed brick (Ladrillera La Huerta, 1923, n. p.), represented both the beginning of a change in the way of building[10] that left behind the idea of the veneered slats, and a technical advance in terms of the characteristics of the bricks used (Figure 2).

As this architectural trend developed, bricks were perfected, going from conventional or common handmade red bricks to industrial bricks, with precise characteristics in terms of their physicomechanical properties.[11] Likewise, the idea of the thick mixed

[8] In Mexico, *tabique* and *ladrillo* are popularly known as brick units with dimensions close to 28 x 14 x 7 cm and 28 x 14 x 2 cm respectively, which have changed over time: one and the other are smaller today compared to those of the viceregal period. We even noticed a significant change in measurements between the twentieth and the twenty-first centuries. For example, in 1904 *El Arte y la Ciencia* magazine specified the following dimensions for one and the other: 27 x 13.5 x 9 cm and 27.5 x 13.5 x 3 cm (Téllez, 1904, pp. 185-187). In all cases, *tabique* is thicker than *ladrillo*, but both share the same dimensions on the other two faces, which are called *soga* (larger dimension) and *tizón* (smaller dimension). However, beyond this precision, in Mexico both terms are used interchangeably. According to Berenice Aguilar Prieto, the term *ladrillo* comes from the Latin *lateris*, which means "piece of baked clay", while *tabique* comes from the Arabic *tasbik*: "[...] which is equivalent to interlace; it is possible that for this reason a wall was called tabique in Spain" (Aguilar, 2012, p. 81). For his part, the engineer Antonio Torres Torija, at the end of the 19th century, did not make this distinction and included *tabique* and *ladrillo* in the category of *bricks*, precisely because they are burned within the family of artificial stones, which also includes adobes, but unlike bricks, the latter are not burned (Torres, 1895, pp. 25-31).

[9] Industrialized brick does not have the same dimensions as the traditional red one (27 x 13.5 x 9 cm); for example, La Huerta brand has 22 x 10 x 6 cm and cement brick, the object of study of this research, has 20 x 10 x 6 cm. In other words, there was a variety of brick sizes depending on the type, location, and manufacturer.

[10] "Our compressed brick provides the architect with artistic and durable results" (Ladrillera La Huerta, 1923, n. p.).

[11] As Francisco Omar Escamilla points out, in the cabinet of construction materials of the then Escuela Nacional de Ingenieros (1882-1929), currently the Facultad de Ingeniería (Faculty of Engineering) of the UNAM, a collection of brick samples was gathered, many of them produced in industrialized fashions. The physical mechanical characteristics of these materials were even published in reports of the materials office of the Secretaría de Obras Públicas (Secretariat of Public Works) (Escamilla, 2013, pp. 387-391).

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FIGURE 2. Two types of cement bricks (20 x 10 x 6 cm). Left, detail of smooth partition wall rigging with bevel; right, detail of grotesque partition wall rigging with bevel (Photographs: Alejandro Leal & Alberto Muciño, 2020; source: Authors' Collection).

wall was abandoned in favor of more slender walls of a single manufacturing (Chanfón, 1998, p. 366).

The use of cement brick in domestic architecture—traditionally seen as a minor genre of that art—became unusually relevant at the end of the 19th century, gradually becoming the protagonist of architectural discussion as well as the recipient of many of the technological advances in construction. That is why this genre is particularly transcendental for a more complete understanding of the history of architecture in Mexico City, since it reveals clues of a change, mainly material, in the way of building architecture. It is in this scenario where the apparent use of brick comes in.

Therefore, it is questioned why cement brick does not appear in the study of the revolutionary architecture (1910-1920) as an important element if it meant a change in the way of building and was the object of study and improvement in its elaboration and use.

As cement brick is an artificial material resulting from a technified production, it is questioned whether it was a material that complied with the mechanical performance required by the current regulations of Mexico City. Therefore, if studies on the mechanical performance of cement partitions used in housing construction in the early 20th century are established, significant information could

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FIGURE 3. Sample of a cement partition wall (20 x 10 x 6 cm) smooth and with bevel, extracted in 2020 from the facade of the house located at Pomona No. 38, col. Roma Norte (Photograph: Alejandro Leal & Alberto Muciño, 2020; source: Authors' Collection).

be obtained that would contribute to the assessment and development of a line of research in technified materials and add information that would place cement partitions walls as a material of importance in Mexico's revolutionary architecture.

ADJUSTMENT OR CONFORMATION OF A FRAMEWORK OF REFERENCE

To learn about the mechanical behavior of cement brick under axial compression, in 2021 a study was carried out on samples at the Laboratorio de Materiales y Sistemas Estructurales (LMSE, Laboratory of Materials and Structural Systems) of the Facultad de Arquitectura (FA, Faculty of Architecture) of the Universidad Nacional Autónoma de México (UNAM, National Autonomous University of Mexico), in which the physical mechanical characteristics were measured (Figure 3). The mechanical analysis of cement bricks not only shed new light on the reasons why it was used so frequently in that period, but also provided elements to explain its permanence over time since today we can still observe it in countless facades in Mexico City's downtown area and in most of urbanizations[12] that were developed at the beginning of the 20th century, in what are now the neighborhoods known as Condesa, Roma Norte, Juárez, San Rafael, Santa María la Ribera, Doctores, San Pedro de los Pinos, Del Carmen Coyoacán, etcetera.[13]

[12] Referred to by Vicente Martín, Agustín Piña and others simply as *the neighborhoods*. See Martín (1977, 1978) and Piña (1981).
[13] The Seminario Tabique de Cemento (*Cement Brick Seminar*) of the Facultad de Arquitectura is coordinated by Dr. Alejandro Leal Menegus and is made up of architecture interns Nelly Alcántara, and Karla Prado, and architect Manuel Miravete. The Seminar is currently working on recording the presence of brick on facades in the neighborhoods of Roma Norte, Roma Sur, San Rafael and Juárez.

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Study of the physical mechanical properties of cement brick

The pieces called *cement brick* are made with mortar, and in order to know their physical mechanical properties today (2023) and, therefore, to observe if mortar strength is preserved based on the current regulations, pieces were extracted from the building located at 38 Pomona Street in the Roma Norte neighborhood, in the Cuauhtémoc district of Mexico City, which had an average size of 6.45 x 10.32 x 15.05 cm.[14] It was decided to extract at least six of them, to test them under simple compression, selecting those with a more uniform geometry. These pieces were prepared for compression testing according to the parameters established by Mexican Standard NMX-C-038-ONNCCE-2013 (Norma Mexicana, 2013), and because of the cubic geometry of the specimen, three measurements of length, width and height were taken for each piece, to average the values obtained (Figure 4).

FIGURE 4. Three images showing the preparation process of the piece, in 2020. To acquire the compressive strength, a load was applied at a constant speed and parallel to the longitudinal direction of the specimen, recording the maximum load at failure (Fult), like what has been done by other researchers (Photographs: Alejandro Leal & Alberto Muciño, 2021; source: Authors' Collection).

As mentioned above, the mechanical tests were carried out at the LMSE. For the compression tests, an Instron® machine, model 400RD, with a capacity of 200 t, was used, which is built with a data acquisition system for obtaining real-time graphs, with a dis-

[14] From the facade restoration works carried out in 2020.

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placement sensitivity of 0.05 mm/s (Figure 5). To calculate maximum compression stress (σult), the expression *σ_ult= F_ult/A* was applied and true stress (σVer) of each test was recorded.

FIGURE 5. Instron® compression testing machine, model 400RD, capacity 200 t (Photograph: Alejandro Leal & Alberto Muciño, 2021; source: Authors' Collection).

After performing mechanical compression tests with the maximum load applied, the relevant equations were carried out to show the maximum stress to strength, obtaining the following results (Figure 6).

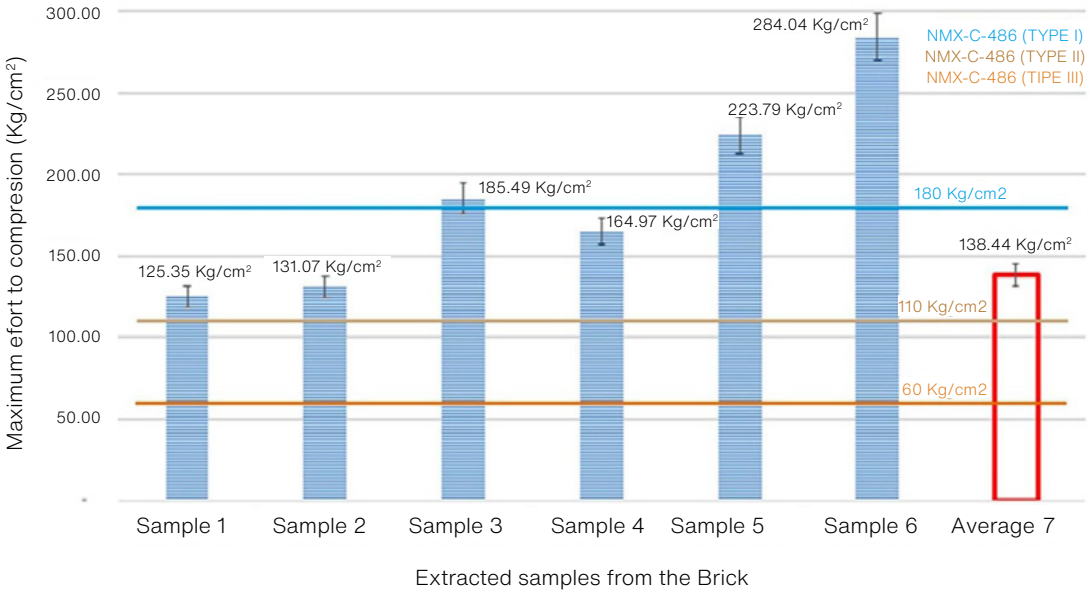

FIGURE 6. Graph of the maximum compressive strength of the samples extracted and prepared according to Mexican Standard NMX-C-038-ONNCCE-2013 (Graph: Alejandro Leal & Alberto Muciño, 2021).

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According to Mexican Standard NMX-C-486-ONNCCE-2014, Mortar for Structural Use (Norma Mexicana, 2014), mortars are classified depending on their strength capacity: Type I, Type II, and Type III. The standard indicates that to implement mortars in non-structural walls (partition walls), Type II and Type III mortar mixes must be designed, while structural walls must have Type I and Type II mortar mixes. Based on the experimentation carried out, it can be observed that, for the most part, the samples of pieces of brick that were extracted exceed, in accordance with current Mexican regulations, Type II and Type III mortar strengths, and are above 110 kg/cm^2 in average strength, which shows that they currently meet the standard, that is, they are in a suitable state of construction.

Hypothesis

Cement brick of the early 20th century has not been sufficiently valued by historiography,[15] despite being a testimony of a transition of ways of building—rather than representing—an achieved style. Nevertheless, with the mechanical tests carried out in this research, it was demonstrated that cement bricks have an axial compression strength that complies with that of structural mortars. Therefore, the following hypothesis is formulated: the architectural current that used cement bricks was overshadowed by the change in tastes brought about by the *belle époque* and the development of reinforced concrete; therefore, the aesthetic factor was more important than structural or economic aspects. In comparison with the temporality of use of cement brick in other European countries, this led to the premature disuse of cement brick as a material and as a construction system.

Argumentation

Although brick is a material that has been present throughout the history of architecture, it gained singular importance in France, Belgium, the Netherlands, Germany, and the United Kingdom in the last quarter of the 19th century, when its industrialized manufacture began. The French influence would be decisive (De la Maza, 1974, p. 49), with the publication of books such as *La brique ordinaire* de Lacroux *(*1878) (Figure 7) and the promotion of new methods and patents of the time at fairs and universal exhibitions.

[15] It should also be noted that during the years of armed conflict in Mexico, there were fewer specialized publications on the production of those years, being a period that would have a significant under-recording of documents.

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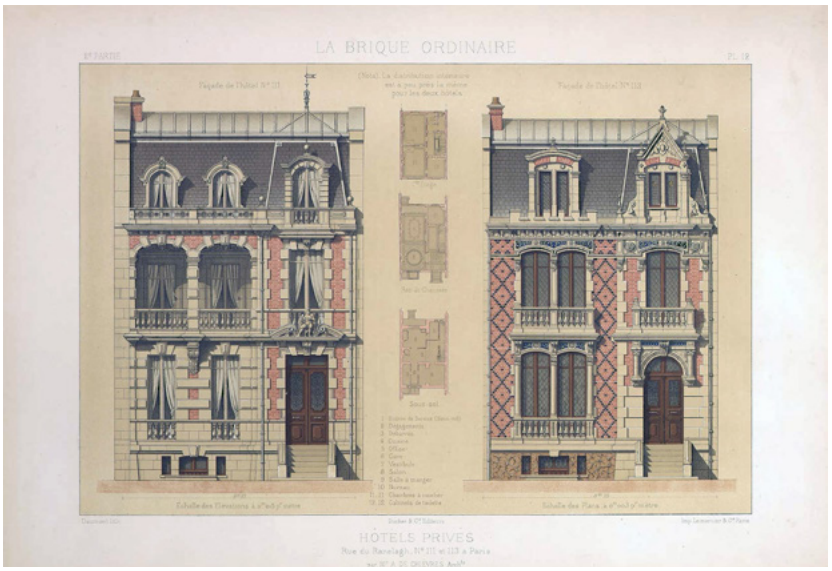

FIGURE 7. Plate 12 from the book *La brique ordinarie* (Source: Jean Lacroux, 1884).

As for the traditional way of building walls in Mexico City, "from the middle of the [19th] century, the construction of brickwork made of reburned brick and blocks of tepetate, a saw-cut natural stone (pumiceous or calcareous tuff), became very popular" (Prado, 1988, p. 309). Although the trend was previous to the European one and does not coincide completely with it—mainly because of the use of mechanized bricks—,[16] it focused on smaller architectures, often of a domestic nature, which set a precedent in the use of traditional brick in an apparent form in such a type of architecture and, surely, it would be behind the reason for its later and comprehensive use in the housing genre, without tepetate but with industrialized bricks.

The above gives an idea that, although it grew, the use of cement brick did not cease to be relatively limited, since in Mexico the use of traditional brick persisted over mechanized brick. In fact, also in use was the so-called *orange* brick, of inferior quality to *colorado* (red) brick, mainly due to a shorter burning time and basically using it as a filling since it was a material completely lacking in characteristics that would allow a structural function (Téllez, 1904, p. 186). In this regard, Katzman pointed out that, although brick was profusely used in viceregal architecture, it is more commonly found as a floor and wall covering and very rarely as a structural component; and he continues: "otherwise it would have been difficult for Engineer Besssosi to affirm, without being criticized, that the building he constructed in 1840 for the Hotel Bella Unión was the first to be made of brick in Mexico" (Katzman, 1973, pp. 247-248).

[16] It would also later be known as *pressed brick*. See Suárez (1942, p. 62).

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FINAL SUBSTANTIATION

The cement brick stage, 1908-1933

Towards the end of the first decade of the 20th century, the use of bricks produced in alternative ways to traditional brick became widespread and, mainly, new materials were incorporated, such as cement. This marked a second moment in the use of apparent brick in Mexico City (Figure 8). It should be noted that at the beginning of the 20th century, the use of reinforced concrete was being developed concurrently in the country, and, like industrialized brick production, it was conceived from experimental practice based on tests outlined by the scientific method. This is the reason why cement brick is a significant material, because it managed to combine the benefits of brick construction with the values attributed to the novel material that entered the scene, called *cement*, witnessing the process of implementing a technological innovation (Arthur, 2009, p. 146)—in this case, Portland cement—in which, prior to the extensive use of reinforced concrete, the new material was used more widely through already known construction methods, as was the case with the erection of masonry brick walls and not through reinforced concrete columns, beams, and slabs.

FIGURE 8. The dates of these two photographs comprise the first and last dates found in the field (in 2021) that verify the use of cement partition walls in Mexico City. Left, authorship signature of architect Auguste Leroy dated 1908; right, authorship plaque of builder Alberto J. Nunes dated 1933 (Photographs: Alejandro Leal & Alberto Muciño, 2021; source: Authors' Collection).

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The change or shift in the use of other materials for facades, such as industrialized brick and especially cement brick, gained importance in housing, but not in other construction genres, which were still considered inadequate for this material. A singular example of the impact of cement brick outside the housing realm was in the hydraulic infrastructure works in Mexico City (1903-1913), particularly in the Casas de Bombas (Euroza, 2021, p.40). However, in general terms, the ideal—concerning the social status and the symbolic value that this material provided to the architecture that was finished in this way—of a mixed construction covered with quarry stone persisted, leaving the resource of integral plastering as the most economical. Therefore, we cannot disregard brick's technical and economic implications in construction or the social and cultural ones.[17]

In this sense, how can we explain such a limited way in which cement brick architecture flourished during a certain period in Mexico City? The answers can vary: from the economic and practical sense of using a standardized material, through the local production of Portland cement, to subjective aspects, such as a taste for new facades, for the publicity around cement and its material qualities; and even a moral sense, by betting on the value of austerity. A preference for building using brick and not ostentatiously using stone, during the revolutionary period and in the years immediately following. In any case, everything points to a change in constructive sensibility and a strategy centered on domestic architecture as well as a particular social sector made up of the *popolo minuto*.

DISCUSSION

The generalized study of revolutionary architecture linked to Porfiriato period disregards the importance of introducing cement brick as a construction resource.[18] This type of brick involved a novel material, such as Portland cement, to produce a mortar mixture.

In the axial compression tests of cement bricks, the main difference in strength was found in that one of the pieces

[17] As Raquel Franklin asserts, a classification of housing is clearly perceived in that period from the constructive perspective of its facades and the social class to which it belongs (1994, pp. 102-103). In this period a preference for quarry stone in facades persisted in the higher social groups; in the lower ones, the preference leaned towards skimming or the brick and tepetate system; and in the case of an intermediate group, the preference was for apparent brick, especially industrialized brick. This reflection contributes to what Vicente Martín Hernández pointed out about the architectural configuration and layout in housing based on social classes (1981, pp. 97-98).

[18] For example, Berenice Aguilar Prieto (2012) does not include cement brick as part of the analysis of the contribution of brick to the 20th century architecture.

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exceeded 180 kg/cm^2, which may reflect that the industrialization of construction in the masonry sector initially sought high strength, without knowing too precisely either the mix design or the science of the materials to reach a certain value.

It is worthwhile noting that mortar strength is given by the cement technology as well as by the fine aggregates (sands) that compose it; nevertheless, after almost a century of permanence, mortars continue conserving suitable strength for buildings, which attests to the quality of the materials used and the correctness of the mixtures.

The field of research is open for future investigations and for studying the aggregates that compose these mortars by means of mineralogical analyses, since probably the interaction of sands with cement modifies the mechanical strength of the mortars, an important characteristic or variable to consider in the duration and permanence of the materials over time.

However, the limited literature on the mechanical properties of cement brick and its constant comparison with traditional brick are possible causes for the dismissal of the former for larger works. It is argued that the cement technology used during the revolutionary era in Mexico was more widely used in bricks and not in columns or beams, and that, although bricks could have adequate mechanical strength, they alone would not solve designs requiring spans, which are often demanded in public works buildings. Despite its outstanding mechanical performance, this pigeonholed cement brick into architectural genres such as housing.

FINAL CONSIDERATIONS

The use of brick at the beginning of the 20th century represented a continuity of the accepted values of the time in favor of hygiene and safety, and the bet on non-combustible materials (stairs, floors and ceilings: the use of the Catalan vault instead of Franciscan ceiling). Hence, brick represents a process in tune with the ideals of the late 19th century and Porfiriato itself. Although the buildings had a mixed construction, they were intended to be provided with the values that cement brick represented, through meticulous plastering that emulated the facades of apparent cement brick (Figure 9). In parallel, in the 1920s, these same ideas, together with the importance of simplifying construction processes, would lead to the widespread use of reinforced concrete as the preferred material in the industry and would represent the end of the apparent brick stage in Mexican architecture.

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FIGURE 9. Flattened facade that looks like cement partition wall, which verifies that, beyond the technical advancement, there was an aesthetic tendency of the apparent partition wall (Photograph: Alejandro Leal & Alberto Muciño, 2021; source: Author's Collection).

This rupture would then come with the widespread development of reinforced concrete as the most popular and economical material. Used in conjunction with the construction procedure of confined masonry, it would eventually become, in construction terms, the predominant system, even up to the present day. In addition to having a technical and economic nature, this preference is also a matter of taste, a circumstance that in part determined the abrupt end of the trend in apparent brick architecture in favor of smooth or textured plastered facades that did not emulate brickwork (a very visible aspect in the *art deco* architecture of the late 1920s). It would also be the reason why historiography has disdained this architecture in apparent brick, on the one hand, by not differentiating it from eclectic architectures built in other ways, and, on the other hand, given the idea that all eclectic architecture is synonymous with Porfiriato and the 19th century; finally, apparent brick architecture was overshadowed by the Revolution that reinforced concrete represented and the triumphant idea of modernity that it embodied.

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REFERENCES

Aguilar, B. (2012). La aportación del ladrillo a la arquitectura del siglo xx. In I. San Martin y M. Cejudo Collera, *Teoría e historia de la arquitectura. Pensar, hacer y conservar la arquitectura* (pp. 81-89). Facultad de Arquitectura-Universidad Nacional Autónoma de México.

Aragón, M. E. (2011). *Casas escasas. El art nouveau en la Ciudad de México*. Instituto Nacional de Antropología e Historia.

Arthur, W. B. (2009). *The Nature of Technology*. Free Press.

Bonet, A., & De la Maza, F. (1980). La arquitectura de la época porfiriana. *Cuadernos de Arquitectura y Conservación del Patrimonio Artístico*, (7).

Calderón, B. (December, 1923). La edificación y los materiales de construcción. *El Arquitecto*, (4).

Chanfón, C. (Chief Coord.). (1998). Historia de la arquitectura y el urbanismo mexicanos, Vol. III, El México independiente. In R. Vargas Salguero (Coord.), *Afirmación del nacionalismo y la modernidad*, tomo II. Universidad Nacional Autónoma de México/Fondo de Cultura Económica.

Cortina, F. (2000). *Manuel Cortina García, un arquitecto de transición* (Bachelor thesis). México: Universidad Iberoamericana.

De la Maza, F. (1974). *Del neoclásico al art nouveau y Primer viaje a Europa*. Secretaría de Educación Pública (Sep-Setentas).

Escamilla, F. (2013). El Primer Laboratorio Mexicano de Ingeniería Civil, hoy Biblioteca Ing. Antonio M. Anza. En F. Escamilla González (Coord.), *200 años del Palacio de Minería: su historia a partir de fuentes documentales* (pp. 364-403). Facultad de Ingeniería-Universidad Nacional Autónoma de México.

Euroza, R. (2021). *El valor patrimonial de las obras de infraestructura hidráulica de la Ciudad de México del periodo 1903-1913: testigos de una modernidad materializada. La Casa de Bombas no. 3, Nativitas* (Master's thesis). Universidad Nacional Autónoma de México.

CONVOCATORIA 2023
CALL FOR PAPERS 2023

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ISSN 2448-5934

ENERO-JUNIO 2023
JANUARY-JUNE 2023

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Franklin, R. (1994). *La casa porfiriana* (Master's thesis). Universidad Nacional Autónoma de México.

Gómez, E. (Ed.). (1921). *Reglamento de construcciones de la Ciudad de México.* Dirección de Obras Públicas-Ayuntamiento Constitucional de México.

Katzman, I. (1973). *Arquitectura del siglo XIX en México*. Universidad Nacional Autónoma de México.

Lacroux, J. (1878). *La brique ordinaire au point de vue décoratif: seconde partie, Applications pratiques: hôtels privés, maisons de campagne, villas, dépendances, etc.* Ducher et Cie.

Ladrillera La Huerta. (June, 1923). *El arquitecto,* (4), n. p.

Martín, V. (September-December, 1977). La vivienda del Porfiriato en algunas colonias de la Ciudad de México, primera parte. *Arquitectura Autogobierno*, (8), 17-23.

Martín, V. (January-June, 1978). La vivienda del Porfiriato en algunas colonias de México, segunda parte. *Arquitectura Autogobierno,* (9), 25-35.

Martín, V. (1981). *Arquitectura doméstica de la ciudad de México 1890-1925*. Universidad Nacional Autónoma de México.

Norma Mexicana. (2013). *Determinación de las dimensiones de ladrillos y bloques para la construcción* (NMX-C-038-ONNCCE-2013).

Norma Mexicana. (2014). *Mortero para uso estructural* (NMX-C-0486-ONNCCE-2013).

Piña, A. (1981). *Siglo XIX: Arquitectura porfirista*. Universidad Nacional Autónoma de México.

Prado, R. (1988). *La arquitectura civil pública en la Ciudad de México y el Palacio Postal. Un ejemplo de ella en el porfirismo* (Doctoral dissertation). Universidad Nacional Autónoma de México.

Secretaría de Educación Pública/Instituto Nacional de Bellas Artes. (1983).

Intervención

ISSN 2448-5934

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Catálogo de la exposición Arquitectura en México: Porfiriato y movimiento moderno. *Cuadernos de Arquitectura y Conservación del Patrimonio Artístico*, núms. (28 & 29).

Suárez, L. R. (Ed.) (1942). *Reglamento de construcciones y de los servicios urbanos en el Distrito Federal*. Dirección de Obras Públicas-Departamento del Distrito Federal.

Téllez, A. (March, 1904). Materiales de construcción: El ladrillo. *Revista El Arte y la Ciencia, 5*(12), 185-187.

Torres, A. (1895). *Introducción al estudio de la construcción práctica*. Oficina Tipográfica de la Secretaría de Fomento.

CONVOCATORIA 2023
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SIDEBAR IMAGE. Eligio Ancona 107 Street, in Santa María la Ribera, Mexico City (Photograph: Alejandro Leal & Alberto Muciño, 2021; source Authors Collection).

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