American way of drawing: American manuals in the design of the military bases in Spain

Pilar Salazar

As a consequence of the agreements between the American and Spanish governments signed in September 1953, military bases were built in Spanish territory. The project required an extension of more than seven thousand hectares and a budget of three hundred eighty million dollars. It created more work positions for the Spaniards and the Americans than the construction of the Panamá Channel.[1] They developed air and naval bases, pipelines, radar stations in the mountains, underground fuel warehouses, places of refuge, and housing, all following a rigorous construction program with demanding deadlines, carried out under strict conditions. The main work was completed, mainly by the biggest Spanish construction companies, in just over five years. That was a launch pad for their subsequent internationalization.

One of the key elements for the observance of all the conditions imposed by the Americans was the previous work of planning and design that the architects and engineers did for the AESB (Architects and Engineers for the Spanish Bases). Most of the work was done by subcontracting civil Spanish companies, as it had been agreed with the Spanish government. The AESB finished the main works in 1957.[2] In forty-two months

of work, they produced more than 10,000 pages of plans and drawings. These plans of large dimensions were kept hanging on strips of wood, with an index containing the location and content of each plan. The AESB employed around 150 Americans and 580 Spaniards.[3] Interestingly, the total cost of the work carried out by the AESB (a little over $16 million) was considerably less than the estimated cost of $21 million.[4]

1. MANUALS AND REGULATIONS

In the summary presented by the AESB at the end of 1956, we can find a list of the sources used as references for the design of the Spanish installations. This enumeration takes up ten pages, showing the huge number of documents handled in this project. One of the first works of the ASB was to generate - from all the different sources - the specifications that were going to be applied in the Spanish bases. The 300 resulting specifications were divided into two groups: technical and material, covering from more general topics (e.g., the design of the hospitals) to other more specific ones (e.g., the sand proportions used in the concrete). The specifications were based on the documents from all the different entities involved in the works. They were reviewed, adapted, completed, and divided into eight groups, according to where they came from and their field of application.

The first group includes the federal standards and specifications, which were the highest reference in the construction field in the USA. Following them, we find the standards and specifications of the Navy Bureau of Yards and Docks, the entity in charge of the construction of the bases. They include indications, circular letters, design sketches, and, most importantly, the manual about each of the topics.

The third section includes the Navy specifications for some of the installations that were not determined in the last two groups. In addition, some military departments created regulations for their own buildings, such as hospitals, air control buildings, or radio stations. The fifth section includes the data about the air installations, indicated by the American Air Force. In the sixth section, we find the Spanish and American technical codes.

The seventh source was the technical associations and those formed by the manufacturers, with their own standards on materials, shapes, sizes, indications about how to use them, external conditions needed, maximum load, etc. Finally, they indicated a long list of entities with a stake in some of the works, including, the Spanish National Railway Company, the Foreign Trade Department, and the American Hospital Public Service, among others. All of these regulations were followed in all the works in Spain.

Among all the documents from these sources, the most important architectural documents were the manuals issued by the Bureau of Yards and Docks. In the 1940s, the Bureau had published a collection of manuals which specified everything necessary for the design and construction of the military installations; the collection was updated in the 1960s. It comprised ten basic manuals about architecture, structural engineering, electrical engineering, mechanic engineering, civil engineering, drawings and specifications, soil mechanic and basements, fire protection, Arctic engineering, and economic data for military constructions, followed by eighteen other more specific manuals, such as those addressing the construction of military housing, hospitals, harbors, or the media.

In this paper, we examine the technical publications (TP) of the NavDocks used as references and the Manual of Design (MD) of the Bureau of Yards and Docks, and analyze the two manuals with the greatest impact on the architectural field.

Manual of the Bureau of Yards and Docks

The Bureau of Yards and Docks published a specific manual about the administrative and technical work of the department. It was created to assist all of the agents involved, in order to reduce effort and increase efficiency.

Among the different tasks of the Bureau, the design of military installations was the essential one, developed by the design office. We can find a description of the work of this office in the third chapter: "the preparation of designs, plans and specifications for all public works and public utilities of the Navy, whether prepared by the Bureau, by field offices or by outside architects and engineers."[5] They were in charge of ensuring the usefulness and the correctness of the maps and reports. They worked in tandem with the laboratories - who sent to them the analysis and details of the area - and with the construction department. They decided which works were requested to external companies, took part in the choice of location for the bases, and established which tests were necessary and which standards to follow.

The construction department was in charge of following all the works done by the Bureau from the beginning to the end. They had to guarantee that the money budgeted for the projects was used to carry them out. They collected data from the area and sent it to the design office, with which they were in close contact to solve any modifications.[6]

Throughout the manual, we can find specifications of the work of both departments. The fourteenth chapter discusses the making of the drawings. This chapter was published as a single book to be distributed easily: "This pamphlet should be consulted frequently and carefully in order that the drawings, surveys, and other technical records of this Bureau may possess the required uniformity."[7] Most of the indications were designed to save money and effort: to obtain the maximum efficiency at the minimum price. This goal is visible in the instructions for drawing, the standardization of the elements, and the instructions regarding the pictures:

A drawing is a means of conveying information to others; and it, as well as reproductions thereof, must be clear and legible beyond question. The information placed there on must not only be correct, but it must be so arranged and referenced that the drawing can be easily and correctly interpreted.[8]

With this idea in the background, they specify each of the small details that could be under question in the drawing of the plans, such the thickness of the lines, the spaces between drawings on the same sheet of paper, the standard size of the sheets (officially 29 x 35 inches), the scale of each element, the symbology for each material, the type of paper and all other drawing tools, how to number the pages, where to locate the signature of the responsible agents, the references to the as-built reviews, or the needed authorization for the publication of the plans. They anticipate against any kind of caprice, from the shading of the lines to the ornamentation of the lettering.[9] Nothing is left to chance; every question is answered in the manual.

One of the last chapters is about photography, explaining the four different reasons for taking photographs: establishing constant progress on the works, demonstrating the state of one tool, capturing publishable views, or maintaining a visual memory of events that could be of historical interest in the future. With all of this in mind, they specify how to take pictures for each one of the aims: the proper angles, the amount of light needed, or the number of pictures to take.

Design manual: Architecture

The second manual we will analyze is the basic architecture manual published by the Bureau of Yards and Docks. It was the basic guide that any architect or constructor had to know. It was divided into twelve chapters: 1. Basic design considerations; 2. Planning and design; 3. Special design considerations; 4. Basic materials; 5. Construction; 6. Building components; 7. Interior finishes; 8. Design variations for climatic extremes; 9. Prefabrication; 10. Architectural acoustics; 11. Colour treatment; and 12. New materials and systems.[10]

The chapter begins with a discussion of the attributions of the person responsible for the design, revealing a conception of the profession different from that of Spanish architects. The manual discusses the design architect that works on the shape, the distribution and the external aspects of the building, but not on the structural or constructive parts.

Due to the organization of architectural firms in the US, a project was completely defined before giving it to the constructor. It was not the architect who specified the final details, but engineers and technicians working together. Degrees were more generalist than those awarded in Spain, so it was possible for people with different backgrounds to become architects, and for architects to specialize in various areas. In many firms we could find a partnership between an engineer architect and a designer architect, such as Adler and Sullivan, among others.[11]

This manual was focused on the architect's role as designer. The architect had some

elements that he had to combine and organize following a series of indications. They detailed the responsibilities of the designer, from the first phase of collecting and analyzing data on the location, studying urbanism in relation to the area, the location of the buildings to the design of every building and any of the elements. Everything had to be organized following a functional logic, and every single step was described in the manual.

One of the elements which demands our attention because of the clarity of emphasis placed on it is standardization:

Economy (of spaces) may be achieved by standardizing space dimensions and arrangements.

1) A module or modular unit should be established for recurring or duplicated functional elements, such as classrooms and offices.

2) Dimensions of materials, column spaces, windows, etc., should be coordinated to conform with the established module

3) Modules should be utilized as consistently as possible. Small spaces may be adapted within a modular arrangement and an entire building may, in many cases, be planned on a modular basis

4) Simplicity of Layout. The rectangular plan is the most economical. Space planning should provide for a simple plan arrangement free form needless wall breaks and irregular shapes.[12]

Standardization allowed for perfection in the details and for the meticulous study of every possible difficulty in construction. Every process was perfectly planned, because they had been tested before at other bases. This attention to detail was followed from the drawing of the plans to their materialization. We can verify it when we compare the plans for the Spanish bases with the built reality: each element is exactly where it is supposed to be. As later reforms have shown, measuring a distance in the plans corresponds exactly with the measurements in the reality.

We can find this same standardization in the exterior shape of the buildings, which should follow three key indications: being simple, without any useless ornament; taking care in the choice of suitable materials and their convergence; and lastly, taking into account the relationship with the environment.

Among the topics dealt with in the manuals, we can find specifications on the date of expiry assigned to every element. Once the date was out, the elements were replaced, even if they were in good conditions.[13] Constructive and decorative elements, as well as furniture, were covered by this rule. During those years, that caused a black market in Spain for products discarded by the Americans. Every element was standardized and was part of a catalog, so replacement was relatively easy until the 1990s, when the Americans left the bases.

The manual reserves a chapter to address the level of detail to achieve, giving major importance to the search for perfection in details, as critical elements that will indicate the efficiency and appearance of the building. To take care of them, they advise paying attention to simplicity (in the connections, in the shapes and in the repetition of elements), the search for economy of space (searching for efficiency sizes and prefabricated shapes), and modular coordination.[14] It introduces the advantages and disadvantages of the different materials used in construction—timber, steel, iron, concrete, ceramic bricks or aluminum—and indicates the situations in which each material should be used. It also explains the control conditions and the specifications and possibilities of each one.

The chapter related to construction details of each of the structural and installation elements of a building, explains their qualities and possibilities, in order to help the designer to choose and combine the correct ones. These include the exterior walls, the soil, the roof and the thermic isolation, as well as the chimneys, stairs, interior walls, facing walls, windows, doors, bejeweling, and so forth. The chapter illustrates its explanations with drawings that show the advantages and disadvantages of each element. The manual here is almost a catalog in which the architect can choose between different elements, where he is even given the cautions to take into account in the assembly.

Chapters 9 and 11 are of great importance too. Chapter 9 addresses the advantages (quickness, economy, facility of assembly) and disadvantages (small variety of prefabricated materials, lack of flexibility, dependence on transportation, restrictions on the design because of the materials, and the lack of quality in the finishing touches) of prefabrication, and specifies which buildings are candidates to be prefabricated, and with which elements.

In Chapter 11, we can find information about colour, its meanings, and the criteria used for selecting colours in a building. It includes a figure explaining how each colour appears at different hours of the day and with different kinds of light, in order to help the designer choose depending on the function of the building. It explains the different rooms of a building and recommends strategies for combining colour in each element: soil, ceiling, walls, or machines.

2. AMERICAN PLANS VS. SPANISH PLANS

In these two manuals, along with the one we enumerated before, the Bureau wrote a series of specifications adapted to the Spanish workforce, the available materials and machines, and the climatologic, economic and cultural Spanish conditions. It was necessary for architects and engineers from Spain and the USA to work together; the Spanish provided the local knowledge, because they had a good command of the national construction normative and the usual design criteria in each area.[15] One of the Spanish architects who worked in the Projects Department, Luis Vázquez de Castro, declared about the Americans:

They prepared some standards from the Spanish constructive systems in order to homogenize the projects and facilitate the hiring of companies. They made a standard from the Spanish brick and with it, they measured everything: windows, elevations, drip edge flashings, corridors, rooms... That was the translation to Spanish from the American constructive systems.[16]

Knowing about this joint work, we can ask ourselves how much, and in which way, the manuals influenced the drawing styles and architectural design of the Spanish technicians involved.

The plans of the buildings drawn by the Americans drew significant attention because of their high level of definition. As they are abandoned nowadays, we were able to see the plans for the Hospital of the Torrejon Air Base, built in 1956 by the Spanish firm of Botella and Marcide, architects specializing in hospitals. We have search plans designed by the same architects before and after their work with the Americans, and we have compared them, trying to find any possible influence. In this article, we address only the degree of definition of the plans and the way to represent and draw them, not the formal aspects or the interior distribution of the buildings, which were imposed by the different programs.

There is a major difference between the American and the Spanish plans. The American ones integrate different elements: for example, one single sheet may include a representation of a floor, a façade, or a section with numerous constructive details, an index which specifies the materials, and many explicative quotations. The Spanish plans are much simpler, with a unique representation on each sheet.

The plans for the Torrejon Hospital use codes to define every room, every material, and the joinery. The tables specify the room with the code, the kind of room, the height of the ceiling and of the skirting board, and the type and colour of the walls, ceilings, windows and doors. They mark the structural axes with discontinuous lines that end with a circle with a number: alphabetical in the vertical sense and numerical in the horizontal one, the same in every sheet of paper. They draw the graphic scale of every representation, besides the numerical one.

In contrast, in the Spanish plans, we cannot find any of these elements, only the name of every room written in the interior of them. The graphical documentation that was mandatory in Spain to present to the authorities at that time was minimal. That contributed to the fact that the Spanish plans lacked the detail of the American ones.

If we compare the dates of the different plans by the firm Botella and Marcide, we find something interesting. The representation system that they used in the hospital plans designed following the work with Americans (for example, the Residencia Sanitaria La Paz, designed in 1961 by Martín José Marcide

and Aurelio Botella, or the Residencia Sanitaria of Badajoz, designed in 1964 by Aurelio Botella) was quite similar to the one they used before, or the one that was usually used in Spain. Botella and Marcide did not implement any of the innovations they found in the American plans. Their plans for the Spanish buildings were much more artistic and less complex. They drew the American plans in the compulsory way, but, apparently, they did not acquire or assimilate the American drawing styles.[17]

Despite this, we can state, because of the declarations of other architects that the joint work with the Americans was not in vain. At the same time, the huge differences in the conditions between the two countries (in addition of the client that they had for this work: the American Army), contributed to the fact that the Spanish architects could not see the American requirements as something applicable, even if they considered them as desirable. It was impossible to achieve the level of definition that was required in the States on the salary of a Spanish architect, and the organization and collaboration between professional groups was completely different in Spain.

The AESB was satisfied with the work of the Spanish architects: "They are efficient workers. They achieve the high standard in the engineering works and they pay attention to details in their drawings. Once they understand the design problems, they can do the work with minimal supervision."[18] Some of the Spanish architects worked under AESB supervision in their offices, with a direct contract, but most of them were subcontracted to develop plans for some buildings. The first ones worked in close contact with the American architects. Some of the plans were first drawn in the AESB, who then asked an external company to develop them. All of the firms were required to follow the American methods, and they received the necessary training to do so. That increased the final cost of the projects. Jaime Ferrater, one of the architects who worked for the Americans, declared:

Initially, the subcontractors, not used to the American way of drawing, dedicated nearly 600 hours to prepare one plan; currently, the Production Department of the AESB produced them in about 150 hours, including the last lines. To my understanding, we are costing money to the AESB.[19]

This opinion was shared by the Americans, who sometimes complained about the effort required to teach their methods to the Spaniards. The draftsmen had the same problem. At the beginning, trying to make the plans exactly as they were asked to do so, they created works of art with an excellent level of detail and precision, but that took them more than double the allotted time. The final cost of the works requested of the Spaniards was much higher than the ones that the Americans prepared, even if the salary of the Americans was much higher.[20]

In the minutes of the Critical Session of Architecture organized concerning this topic, we read that the Spanish architects appreciated the lessons of the work with the Americans: the joint work of architects and engineers, the ideal of a project in which the installations are included in the design, the sincerity of the American projects "understanding this as the fact that every element and every detail is studied and defined,"[21] the normalization and organization that gives clarity and homogenization to the representation, the strict control of hours dedicated to every drawing and finally, the economic and time benefits that would be obtained if the Spanish firms adapted the American way to work. They claimed that they would like to have the same salaries as the Americans in order to achieve all these conditions.

We can sum up all we have said here with a comment made by Fernando Moreno Barberá:

"These works that a group of architects have carried out with the Americans are like a spiritual retreat; we leave with peace of mind, of knowing that we would be able to work in this serious way in the case it was possible to do so, or if someone asked us to work that way."[22]

1. B. Stapleton, "What are we doing in Spain?" Engineering New-Record 15 (May 1953): 86

2. "From Here and There in Spain," Civil Engineering Corps Bulletin 7, No. 11 (July 1957): 16

3. Capt. C. Bertelsen, "Addres. Madrid 2 Feb 1957" USNSM, RG 5, Series I, Spain, p.5

4. A.E.S.B., Record Report Military facilities in Spain, Bureau of Yards and Docks, Vol. II (Madrid: 1956): B6.

5. Bureau of Yards and Docks, Manual, 1944, Washington, p.3.14.

6. Ibid., p.3.15

7. Bureau of Yards and Docks, Requirements of the BuDocks in the preparation of drawings, suveys and other technical records, Washington D.C. (1939): 14.0.

8. Ibid., p.14-2.

9. Ibid, p.2-24.

10. Bureau of Yards and Docks, Design manual: Architecture (Washington, D.C.: U.S. Government Printing Office, 1962): 1.IX–XI

11. J.E. Burchard, "Constitución de una arquitectura," Atlántico 9 (Madrid: Casa Americana, 1958): 56.

12. Bureau of Yards and Docks, Design manual: Architecture (Washington, D.C.: U.S. Government Printing Office, 1962): 1–2–5.

13. The Architectural Manual of the Bureau of Yards and Docks published by the US Navy (1962: 1.1.1), specifies the expiration date of any construction. Every space had a lifetime, so maintenance after this period was not economic and they demolished or substituted them. They did a bigger inversion in the buildings with a longer lifetime. The spaces could be permanent, almost permanent, 15 years of lifetime, 5 years or temporary.

14. Ibid., 1-2-7.

15. A.E.S.B., Record Report..., C-146

16. Luis Vázquez de Castro, interview by Luis Bilbao Larrondo, 2013.

17. At that time, Spain did not have a normative that homogenized the representative criteria. In 1974, the NTE (Technological Norms for the Edification) were approved. They advised about how to represent the elements, but were not mandatory.

18. Com. C. J. Kurzam, "Report of temporary additional duty military construction program in Spain 19 May 1954–12 Jun 1954", USNSM, RG 5, Series I, Spain.

19. "La organización de las oficinas de arquitectura en Norteamérica," Revista Nacional de Arquitectura 167 (1955): 42

20. "Works of art", The Wall Street Journal, Feb 21, 1955 "Turning the designs into detailed blueprints has posed another problem, however, according to yet another American on the job "Look at this blueprint drawn by one of our Spanish draftsman –it is work of art", he says. "It is completely done in ink, all the notations are perfectly made using a lettering guide; the detailing work is so exact it looks like engraving" Sounds good? Well, it is, except that these finely drawn blueprints take the Spanish employees so long to create that their services are costing as much as the imported American draftsmen who work beside them at salaries twice as high."

21. "La organización de las oficinas...", p.39

22. Idem, p.39

Military bases
manuals
plans
USA