HISTORIC STRUCTURES REPORT

Part I

6. Historical Data

DRAWBRIDGE AND SALLY PORT
OF EL MORRO CASTLE
SAN JUAN NHS

by:

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United States Department of the Interior
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Contents

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I. Historical Analysis of the Site

A. Geographic location and brief description:

El Morro is the main structural unit of San Juan National Historic Site, which comprises the series of fortresses and bulwarks of the ancient Spanish harbor defenses of the city. The Fort crowns the rocky point which frowns upon the entrance of the harbor, at the west end of San Juan Islet. It consists of five successive masonry tiers of fire, the lowest almost upon the water level, splashed by foam and spray when the seas run high. The other tiers rise to greater command, in amphitheater; each tier self contained and completely separated from the others except for narrow communications cunningly contrived and swept by the fires of the guns. Deep in the massive walls of the tiers, there are bomb-proof casemates with port holes for artillery, storage magazines, secret passages and tunnels, living quarters and subterranean cisterns, all commonly found in an European Sixteenth Century citadel.

The builders of El Morro followed the medieval art that called for vertical defense by seeking the advantage of height. The landward side of the Fort is formed by

two half bastions connected with a curtain. A fixed masonry bridge crosses the dry ditch or moat, from the counterscarp to the threshold of the vaulted passage which gives access to the Fort. This passage or sally port pierces the curtain through its center, as being the part best covered by the flanking fire of the bastions and least exposed to batteries in breach. The outside front is ornamented with a simple neo-classical facade, formed by four Doric Columns, which denote solidity and strength rather than delicate profile and useless ornament. An ample arched vestibule connects with the long vaulted-way that leads to the interior of the Fort.

B. Synopsis of general history of Site:

The general history of El Morro is interwoven with the foundation and growth of the city of San Juan, and the efforts of Spain to establish a point of support or stronghold at the eastern Caribbean. El Morro was the backbone of the defensive system of San Juan, and its significance lies in the imperial function which it performed.

The early history of El Morro is obscure and

confused, but by 1554 there was already a small tower and a bastion at the entrance of the harbor. The single bastion referred to was located in the approximate position of the present lower bastion or battery of the Fort. From 1554 to 1587 very small additions were made to improve this early work. All building activity had been confined to the point of the promontory.

After 1587 the building of fortifications in the Caribbean received a sporadic outbreak of energy, largely due to the maritime struggle between Spain and England. In 1589 the famous Italian military engineer, Juan Bautista Antonelli, designed the still existing hornwork of El Morro at the top of the promontory. The same year, Governor Diego Menéndez de Valdés laid down the foundations of the landward defenses of the Fort, after receiving instructions from Antonelli. In 1591, Captain Pedro de Salazar continued the work of Menéndez de Valdés and by 1594 the builders of El Morro could boast that the Fort was already a citadel.

The building activities of the Fort were paralyzed during the last years of the Century by two powerful

attacks. In 1595 Sir Francis Drake assaulted El Morro from the sea side, but was unsuccessful and had to withdraw. Three years later the Earl of Cumberland took the city of San Juan, after besieging the Fort from the land side. The English remained in the city for about six months, but an epidemic of dysentery forced them out. Cumberland's attack was the product of a well conceived plan to maintain the island of Puerto Rico as a permanent military station in the West Indies. The strategic location of the island loomed as a significant factor, since Spain saw the colony as a vital link in a defensive chain, to be defended at all cost.

After the English evacuated the city, the Spaniards renewed their efforts to strengthen the fortifications. From 1598 to about 1610, the Spanish governors concerted their energies and repaired the great damages caused by the British on the land side of the Fort, and completed, as far as it is known, the design of Antonelli.

The great onslaught of the new Century was a result of the rising Dutch naval power in Europe and the Caribbean. In 1625, a Dutch fleet, led by Bowdoin Hendrick, forced the entrance of the harbor of San Juan and tried

to emulate Cumberland's feat, by taking El Morro from the rear. After a series of bitter and bloody encounters between the Dutch and the Spaniards, in front of the glacis of the Fort and on the western side of the harbor, the former were forced to sail away. In spite of all the destruction and violence, the Spanish defenders had clung to El Morro with stubborness.

As a whole, the Seventeenth Century was a critical period in the history of Spain, and consequently, the story of the fortifications of San Juan is characterized by general decay and abandon. The international chaos that reigned in the Caribbean, motivated by Spain's decline, saw the fortifications in ruins and the garrison destitue and helpless. During the course of the Century, however, some of the Spanish governors, mainly through their own initiative and using the meager economic resources of the island, were able to maintain and repair the walls and ramparts of the city defenses. By 1687, the whole promontory of the Fort was enclosed with walls and temporary structures.

The Eighteenth Century marked the birth of the most productive and flourishing period in the military history

of Puerto Rico. The defensive system of the city, as it exists partially today, was planned and completed through the military reforms of Charles III. The walled city of San Juan became a defense of the first order. During 1731 to 1742, a considerable amount of works had been added to El Morro, but the inside of the Fort was crowded with non-permanent structures which had been built without following a systematic plan. Nothing was done to remedy this until 1765.

From 1765 to 1787, the military engineers O'Daly and Mestre executed the first modern master plan of El Morro which has endured almost entirely to the present day. During the British attack of 1797, a projection of the Napoleonic Wars in Europe, El Morro played a secondary role because the theater of the military operations was on the eastern defenses of San Juan.

During the 1800's the fortifications of the city went through a period of steady refinement, while Spain's American colonies gained independence. Through this Century El Morro remained under the shadow of the great political events of the Island and Europe. The peaceful existence of the city was terminated abruptly in 1898

by the Spanish American War. El Morro suffered the brunt of Admiral Sampson's attack on the city. The occupation of the walled city by the U. S. forces marked the end of Spanish rule, which had begun with the discovery of America.

C. Historical documentation of the drawbridge: 1591-1765

The purpose of this historical report is to find documentary and pictorial or cartographical evidence for the contemplated restoration of the drawbridge and sally port of El Morro. This data will be useful to insure the accurate duplication of the original structures. It also will be helpful for the analysis or interpretation of future on-site physical evidence which might be found during the course of archeological excavations. The following historical summary is intended to be background for the main part of this report(II-A), which covers the story of the drawbridge after the second half of the 18th century.

The purpose of a drawbridge was to establish or interrupt at pleasure the communication between the fixed bridge and the opening of the gate, whether of the main fort itself or of an outwork. Accordingly, the drawbridge

served as a bridge when in an horizontal position, and as a shutter or additional door when it was in a vertical position.

The plan of Captain Pedro de Salazar (1591-1594), is the first and only known cartographical representation of the landward side of El Morro, where the former drawbridge was located. It presents the layout of the Fort as conceived and designed by the military engineer Antonelli in 1587 and 1589, that is, in the form of a hornwork. The plan is nothing else than a general sketch. It does not have signs of a fixed or drawbridge in the moat, but it has a gate or open passage cut in the center of the curtain, which seems to have been defended with a barrier of unknown nature.[1]

As the plan of Antonelli has been lost, it can not be determined if the drawbridge feature was part of his original scheme of the Fort. It is a fact, nevertheless, that there were a moat and a sally port as early as 1594.

It is definitely known that in 1595 and 1598 El Morro had a gate (puerta) entrance.[2] In 1625, during the Dutch attack, the Spanish defenders destroyed the wooden "bridge" of the moat, which rested on three piers of brick and stone,

and a wooden "gate" at the entrance of the Fort.[3]

The first specific fact that a drawbridge was built, is mentioned by governor José de Novoa y Moscoso in 1658. He also refers to the gate in the same general terms as it was stated in 1595, 1598 and 1625.[4]

In 1673 governor Gaspar de Arteaga informed that he had built a drawbridge with "bronze ironworks." The entrance gate, which was arched on the top, was enclosed in a new frame of hewn stone.[5]

In 1689 a new fixed bridge was constructed. It was 34 varas long and 5 in width, made with "beams and thick boards!" The drawbridge was built with "beams, boards and chains to open it up."[6] A year later, the drawbridge needed two "pescantes," probably meaning the side beams of the bridge table.[7]

The engineer Felix Prosperi reported in 1731 that the drawbridge needed two large beams of 14 varas in length, and bronze chains for the lifting mechanism. The gate or door required a threshold of five varas in length.[8]

It is not until the great construction project initiated in 1765, that the drawbridge feature of El Morro comes to light in a more concrete and detailed manner.[9] From the bits

of casual documentary references made about the drawbridge, from 1658 to 1731, we cannot even ascertain the type of bridge constructed. Nevertheless, this scant documentary evidence is very important in the sense that it substantiates the structural continuity of this feature since the middle of the 17th Century. There are very few maps and plans of the 16th and 17th Century connected with the erection or repairs of the Fort. The documents deal with the fortifications in general, and are silent about construction details.

II. Period of 1765 - 1886

A. Drawbridge:

This study has to be concerned primarily with the constructional developments of the drawbridge and sally port as they were built during the second half of the 18th Century. The historical period 1765 - 1785 is taken as a guideline or basis, for two main reasons: (1) availability of historical source material. There is enough evidence to justify the restoration of both structures; (2) the reconstruction work should be in character with this ultimate, most important and major period of construction

in the long history of the Fort.

All construction details, of course, will not be found in the documents and plans of the period, since they cover the entire work or project at a relatively small scale. It was customary for the engineers of San Juan to write quarterly reports explaining the progress of the military works. The reports always covered general constructional features and problems. Usually they were accompanied with maps and plans, especially when a project was finished. The available plans of El Morro and the descriptions of the Spanish military engineers offer general information and certain particular features of the drawbridge, which are excellent and vital sources of information. To supply construction and structural details for which documentary or cartographical evidence is lacking, we must lean on the practice and methods used by the Spanish military engineers.[10]

During the 18th Century, and more especially during the reign of Charles III (1759 - 1778), the Spanish military engineers followed very closely the practice and methods of construction used by the French.[11] The French engineers were so "magnificent in their military buildings",

that their designs and maxims found practical application in the greater number of still existing European and American fortifications.[12]

(1) Date of Construction:

The exact period of construction was 1775 - 1785. The drawbridge and sally port were constructed during the last stage of the building project of El Morro, initiated in 1765 and completed in 1787. Before both structures were constructed, the military engineers rebuilt and strenghtened the whole landward side of the Fort, as it had been planned in 1765. The designers and builders were the engineers Thomas O'Daly and Juan Francisco Mestre.[13]

(2) Type of Bridge:

El Morro had a bridge-bascule type,[14] which was used principally in fortifications defended by dry moats. The bridge and bascule were constructed in one piece so that when the heavy or bascule end (counterweight) descended into a cellar or bascule cage, the outer, lighter and longest portion (table) rose up to block the gateway. The counterbalance of the inner portion greatly facilitated the raising operation. This type of bridge offered

advantages of rapidity of operation, briefer duration of opening and an unlimited vertical clearance.[15] The bascule type was not recommended for water moats, because the cage was very expensive to construct, and in spite of all pains to make it water-tight, moisture would seep in and rot the wooden bascule portion.[16] The governing requirement in all types of bascule, as it is today, was that the counterweight should balance the span in all positions of opening.[17]

From 1785 to 1886 no structural changes were made to the original drawbridge, as far as type of bridge was concerned.[18] There is no documentary information about possible changes and repairs which might have occurred during this long period of time.[19] The bridge can be traced definitely only up to 1886. It cannot be determined by documentary evidence when the drawbridge was removed, but in a series of maps dating from 1886 to 1918, there are signs and traces of it.[20]

(3) General features of a Drawbridge:

The main elements or features of a drawbridge were the table, counterweight, and the lifting mechanism.[21] The military writers of the 18th Century were more or

less in accord concerning specifications for the table, which were applicable for all types of drawbridges.[22]

The table was made of a size to fill the borders or frame of the gate. For the purpose of description, it was divided into five main parts as follows:

The heel or trunnion beam and the head beam were considered the principal parts of the table and were treated as one section. The length of these two pieces was equal to the width of the table. An interior groove two inches deep was made in these pieces to receive the planks of the flooring.

The sleepers or joists, usually 6 to 7 in number, were composed of timbers which united with the head and heel pieces on the level with the groove where the planks of the floor rested. The joists were fastened underneath to the trunnion and head beams with iron plates each about 3 feet long.

The flooring ran across the sleepers at right angles and was made of planks nailed to the joists. As these planks would soon wear out by the frequent passage of heavy gun carriages over the bridge, it was customary to reinforce the floor planks with iron bars about 7 to

8 feet long and 2 1/2 to 3 inches broad. These were fastened by clamps, over each joint and over the middle of each plank of the floor.

The trunnions were about six inches long and three in diameter. They were attached to the trunnion beam with two plates, one above and the other below, and then bolted and riveted together. They could also be let into the upper side of the trunnion beam at 3" from the edge, and "strongly secured by iron hoops and bolts with screws and nuts." The trunnions of the table were thus placed in order that when the table was vertical at the time the draw was open, the center of gravity was outside the axis of the trunnions, and the table had a constant tendency to fall down on its own accord. It was necessary to adhere to this principle for the purpose of securing a rapid and easy lowering of the bridge. The trunnions rested upon sockets fixed in the lateral part of the casing of the drawbridge.[23]

In Exhibit G, Fig. 1, showing a typical table, letter a represents the trunnion beam, and A and C the trunnions. b stands for headpiece which rests on the first pier of the fixed bridge. c represents the sleepers and d the flooring. Notice the position of the iron bars

on the floor planks. The connecting staples or headed bolts at the entrance of the head-piece, were placed only on types of drawbridges having the counterweight separate from the table.

The table, solidly made and furnished with iron hoops and stirrups to ease the tenons of the sleepers, was laid resting on one side upon the first pier of the fixed bridge, and on the other upon the sockets that received the trunnions. To ease these trunnions and the assemblage, a bolster piece was placed under the heel piece, and rested upon "corbels of freestone."[24]

The different measurements of the table are presented in Page 17 for comparative purposes.

Military engineers and writers differed greatly in recommendations pertaining to the mechanism used to give the table mobility. As drawbridges were drawn up and let down by various contrivances, these accounted for the great variety of bridges which developed during the course of the centuries. In other words, what determined the general classification of drawbridges by types, was the system of counterweight and lifting mechanism used.[25]

AUTHOR	Heel or Trunnion-beam	Head-Beam	Sleepers or Joists	Planks of Floor	Length of Trunnions	Size of Table
Taramos	14" broad 12" thick	12" broad 10" thick	6" broad 7" thick	12" broad 2 1/2" thick	6" long 3" diameter	12'x14'
Muller	12" broad 10" thick	10" broad 8" thick	5"x6"	2" thick	6" long 3" diameter	10'x12'
O'Connor	9" broad 9" thick	9" broad 9" thick	6" thick	6 planks	----------	3 meters 58" wide 4 meters long
Belidor	9 3/4" broad 9 3/4" thick	9 3/4" broad 9 3/4" thick	--------	--------	----------	12'x13- 1/3'

Tabulation of measurements for bridge table, according to military authors

The most common way of operating a bascule bridge was by having the counterweight, in the form of a wooden frame, joined to the drawbridge, as in Exhibit G, Fig. 3. It may be observed that the side beams GK and HN, go tapering from the trunnions E, F, towards the ends K, N, in order to make the frame EGHF, nearly of the same weight as the table or bridge proper (EKFN). The entire assembly turns on the trunnions E, F, which rest upon iron plates, and the frame of the bascule GEHF moves in a cellar or bascule cage under the gateway, built for that purpose. To open and close the bridge, two holes were made on the floor of the gateway or vestibule, in order that two long poles could be thrust upon ends G, H, and press them down to raise the table. Likewise, two chains were fixed to these ends, G, H, which passed through the same holes of the floor of the gateway. The chains had a large ring at each end, and when they were pulled, the bascule was drawn up and the drawbridge let down.[26]

(4) Mestre's Reports:

The drawbridge of El Morro was already in operation by July 16, 1785, according to Mestre.[27]

In January 8, 1785, he reported the following: The

fixed bridge, when completed, would be supported with six hewn stone piers, forming five round arches. The sixth pier was "of greater width", because it was where the drawbridge rested. The masonry foundations of the piers were "founded with seven to eight feet in depth". Inside the doorway of the Fort, "an excavation has been made for the operation of the drawbrdige, with depth of four varas, its length of five varas and two feet, and four varas in width".[28]

Six months later he informed that the five round arches of the fixed bridge had bricks as keystones, but their bends had been strengthened with masonry. The footing or foundation of the facade of the Fort, he said, was constructed with hewn stone, "from the foundations of the moat to the axis of the drawbridge". A cage was formed inside the excavation previously done in the doorway, "for the use and operation of the drawbridge". The inside of the cage had a masonry revetment one foot and half thick; the height of the cage was twelve and a half feet. A "hewn stone stairway" was made from the floor of the vestibule "for going down to the cage to open and close the bridge".[29]

It can be observed that in Mestre's reports there are not construction details, and only the following important facts stand out: (1) there was a bascule cage or cellar under the doorway: (2) the cage had access thru a stairway; (3) the bridge was operated from the cage. In other words, he had very little to say about the description or specifications for the table, design of counterweight or bascule, and mechanism to give the table mobility.

(5) El Morro Drawbridge about 1860:

From 1793 to 1860, nothing is known about the drawbridge. A top view of the bridge, of the latter date[30] is the only ground plan available for the table and bascule. Another plan of the same year[31] and one of 1886,[32] show the bridge in a horizontal position as in the plan of 1793.[33]

Since there is no documentary evidence contrary to the fact, we have to assume or take for granted that the design shown in the plan of 1860 is the same or similar to that made by O'Daly and Mestre in 1765 - 1785. If that is the case, they did not follow the typical design,[34] in two respects: counterweight and operating mechanism.

The plan of 1860 presents the table and counterweight constructed in one piece, but forming a continuous causeway or platform which moved or swung upward about a horizontal axis. The counterweight served as floor when the bridge was in a horizontal position, and when it moved into the basucle cage or cellar, a pit or additional obstruction was formed under the gateway.

The stairway mentioned by Mestre in 1785 is shown in Exhibit F, as being located on the first right hand corner of the vestibule. In Exhibit C can be noticed the length of the cage in relation to the thickness of the entrance archway. When in a horizontal position, the counterweight of the bridge protruded only into a very small section of the vestibule floor.

Since the counterweight served as a floor when in a horizontal position, it needed some sort of prop located inside the cage. In Exhibit B, Section A, there is a detail in the background which has the likeness of a prop or support.

No information is available about the type of mechanism used for raising and lowering the bridge.[35]

Future excavations under the gateway of El Morro would

probably throw important light about the following aspects of the bridge: (1) exact location and size of the cage; (2) stairway leading to the cage; (3) axis and trunnions; (4) support of counterweight; (5) operating mechanism; (6) type of wood used (either roble, ceiba, capa prieto or ausubo).[36]

B. Sally Port

(6) Sally Ports in General:

Gates or doors of sally ports were made various ways. Sometimes there was "only an open passage cut in the rampart, shut up by a strong wooden gate, or with a drawbridge, and at others, this passage was arched all over, with a guardhouse within, and a drawbridge, and a gate on the outside."[37]

Gates of large fortresses required moreattention than those of small ones. Sometimes they were secured not only with drawbridges, but with a portcullis, harrow or an organ.

> "A port-culiss, is a wooden gate well covered with iron, with sharp points, drawn up in daytime by pullies, and let down at night. A harrow is a gate made of timber, whose dimensions are commonly 6 by 4 inches, and 6 inches distant from each other, well fastened to three or four cross bars, and secured with iron: And an organ, is a wooden freme, with double bars, through which the timbers slide and fall down".

The portcullis, harrow and organ served all for the same purpose, that is, "to stop the enemy in case he has found means to let down the draw-bridge". Sometimes two of them were used for more security.[38]

In Exhibit G, figure 4, there is the design of a door recommended in military engineering books of the period.[39] The figure represents a gate made under the covered gateway. Each side of the gate turns upon a strong iron pivot, standing on an iron socket, and are fastened above to the wall with hooks and hinges, much in the usual manner of common doors. The outside of the gate is covered with iron bars for about eight feet high, and the "parts between the bars, are drove full of diamond headed nails, to prevent their being cut open". In the lower part of the gate, there is a wicket "In order to pass through, when there is any danger of surprise, and in the morning before the party of men, that is sent out to reconnoitre and see whether the enemy appears, is returned". The upper part of the gate is "left plain, without any iron, because there is no danger of cutting it there".[40]

(7) Sally Port of El Morro:

In connection with the long archway entrance of El

Morro, Mestre made the statement that the vestibule had two doors, "for the greatest safeguard of the Fortess".[41] No documentary details are known about the doors.

Exhibit A, showing El Morro entrance in 1860, is the only view of the sally port which we have been able to obtain. A gate-like structure can be noticed in the background, which looks like a harrow rather than a folding door.

Extant physical evidence, in the form of ausubo (bullet wood) timbers and hinges with screws and nuts, at the entrance of the vestibule, suggests definitely the existence of a two-leaved door. These wood remains and metal hinges are in the process of deterioration. See Photos 2 and 3 for other details.

The two ausubo timbers at the rear of the vestibule, where the second door was located, only have signs of modern hinges. See Photos 4, 5 and 6. The timbers, which seem to be of comparatively recent installation, are in excellent condition of preservation.

NOTES

1. "La planta y modelo como sea fortificado y puesto en defensa la cidadela y puerto de San Juan de Puerto Rico." 1591-1594. Archivo General de Indias, Sevilla, Patronato 176. The first documental reference known about the drawbridge idea or concept, had its origin around 1580-1581, during the governorship of Juan de Cespedes. At this time, no work had been done at the crest of the promontory, but he suggested that a drawbridge should be built to isolate the fortifications of the point. Archivo General de Indias, Santo Domingo, 155-12. Hereafter, all documents and plans of this depository will be cited as AGI, with P for Patronato and SD for Santo Domingo. Patronato and Santo Domingo refer to the general classification of the documents within the Archive. All documents and plans of Spanish archives, used in this report, are found in the Library of San Juan NHP, in the form of prints and microfilms. All other sources consulted are also in the Site Library, unless otherwise stated.

2. AGI-SD, 155-16; Cayetano Coll y Toste, Boletín Histórico de Puerto Rico (San Juan, Puerto Rico, 1914-1927, 14 vols.), V, 50, a collection of documents.

3. Fernando J. Geigel Sabat, Balduino Enrico (Barcelona, 1934), 190, containing documents about the Dutch attack.

4. Coll y Toste, op. cit; III, 280.

5. AGI-SD, 157-29.

6. Ibid; 159-39; 159-40.

7. Ibid; 159-41.

8. Ibid; 2499.

9. Ibid; 2510.

10. The following engineering books have been consulted for practice and methods of constructing drawbridges: John Muller, A System of Mathematicks, Fortification and Artillery (J. Millan, London, 1757, 6 v., Illus.), IV, 191-206. Period 1600-1757; Bernard Forest de Belidor, La

Science des Ingenieurs ... (Didot, Paris, 1813, 1 v., illus.), published for the first time in 1729; John Michael O'Connor, A Treatise on the Science of War and Fortification... (Seymour J., New York, 1817, 2 v., illus.). Period: 1817; N. Macdermott, Military Architecture, Translated from the French of E. Viollet-Le-Duc (James Parker and Co., Oxford and London, 1879, 1v., illus.). Period: 13th to 19th centuries; Miguel Sánchez Taramas, Tratado de Fortificacion (Barcelona, 1769, dedicado al Teniente General Don Juan Martin Zermeño; D. Sebastián Fernández de Medrano, El Architecto Perfecto en el Arte Militar (Brusselas, 1700, 5 v.), ll. The first four authors, Muller, Belidor, O'Connor and Le-Duc, have not been consulted directly, but from extracts in microfilm, facilitated to us by the Castillo de San Marcos NM Library. Hereafter, when these authors are cited, we will be referring to the extracts from this microfilm roll. The two Spanish writers, Sánchez Taramas and Fernández de Medrano, have been cited from typewritten transcriptions (only sections dealing with drawbridges), copied by Captain Juan Manuel Zapatero, of the Servicio Histórico Militar, Madrid. According to Zapatero, the works of these two writers were used as source books by the Spanish military engineers.

11. The reign of Charles III is characterized by the tremendous influence which the French advisers and experts exercised on Spanish colonial reorganization, after 1763. See Arthur S. Aiton, "Spanish Colonial Reorganization under the Family Compact", The Hispanic American Historical Review, XII, No. 3 (1932), 269-280; Lyle Mc Alister, "The Reorganization of the Army of New Spain, 1763-1767", The Hispanic American Historical Review, XXXIII, No. 1 (1953), 1-32. In Spain, Frenchmen not only planned and carried the execution of new fortifications, but reorganized all Spanish arsenals and siege equipment, introduced new methods of the casting of cannon and were responsible, to a great extent, for the rebirth of Spanish naval strength (Aiton, op. cit: 279).

12. Muller, op. cit:;IV, 191.

13. AGI-SD, 2510; 2510-50; 2510Bl. The plan of El Morro,

May 12, 1787, by Mestre, shows the Fort completed as it had been planned in 1765 by Alexander O'Reilly and the Spanish military engineers. Museo Naval, Madrid, Class. k.-b.-8.-23. O'Daly , who was the Chief of the Corps of Engineers, was the designer of the general project of fortifications for San Juan. About 1784, Mestre succeeded him in that capacity.

14. See Exhibit B. This is the first plan of El Morro where the drawbridge is shown. The sources of all the Exhibits are listed as part of the general Bibliography of this Report.

15. Sidney Toy, A History of Fortification, from 3,000 B. C. to A. D. 1700 (The Macmillan Co., New York, 1955), 200. In page 206 there is an excellent illustration of a bascule bridge as it exists in Caernarvon Castle, England. Belidor, op. cit; has also an illustration of a bascule bridge.

16. Muller, op. cit; 198.

17. The Encyclopedia Americana (Americana Corporation, New York-Chicago, 1950, 30v.), IV, 516.

18. See Exhibits B,C,E.

19. In the plan of 1793 (Exhibit B), the bascule cage has peculiar details in the background which can not be identified; both sides of the table appear without railing. In the plans of 1860 (Exhibit C) and 1886 (Exhibit E), the bascule cage does not have any details inside, and both sides of the table have protective railings.

20. These maps will be listed only in the Bibliography of this Report, to avoid the overcrowding of these notes.

21. See Exhibit G. Figure 1 shows table; Figure 2 a counter-weight; Figure 3 a typical table and bascule forming one piece.

22. This can be seen in the illustrations found in Sánchez Taramas, Muller and O'Connor, op. cit. Exhibit G is

reproduced in Muller and Sánchez Taramas, op. cit.

23. Muller, op. cit; 197-198; O'Conner, op. cit; 375-376; Sánchez Taramas, op. cit; Section XV.

24. O'Conner, op. cit; 376.

25. F. Hilton Crowe, Drawbridge Study (St. Augustine, Florida, 1940), loaned by the NPS Region I Office. This excellent study about drawbridges in general, has been of invaluable help in the preparation of this study. Crowe illustrates and describes eight general types of drawbridges.

26. Sánchez Taramas, op. cit; Muller, op. cit; 198.

27. AGI-SD, 2510-51.

28. AGI-SD, 2510-50.

29. AGI-SD, 2510-51. About the length of the cage, Mestre uses a phrase which we have not been able to interpret: "once varas de largo unido".

30. Exhibit F.

31. Exhibit C.

32. Exhibit E.

33. Exhibit B.

34. Exhibit G, Section 3.

35. In México, during the 18th Century, a type of windlass mechanism was very common in drawbridges. See sketch in SJNHS drawbridge file, containing general correspondence about the subject.

36. Roble (oak) and ceiba were the generally recommended types of wood for drawbridges. See Fernández de Medrano, op. cit; 137. Toy, op. cit; 201, states that gates and sally ports were generally made of oak. Ausubo and capá prieto were the most commonly used types of wood

in military works of San Juan.

37. Muller, op. cit; 191.

38. Ibid; 194.

39. Muller and Sánchez Taramas, op. cit.

40. Muller, op. cit; 206.

41. January 29, 1786. AGI-SD, 2510-51.

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I Maps and Plans

1. "La planta y modelo como sea fortificado y puesto en defensa la ciudadela y puerto de San Juan de Puerto Rico." 1591-1594, by Captain Pedro de Salazar. AGI-P, 176.

2. "Plano del Castillo de San Felipe del Morro de la Plaza de San Juan de Puerto Rico, en el estado en que se halla en el año 1742, y el augmento de un camino cubierto y Glazis, que no tiene." No author and identification of archive where original is found. This is the only known plan of El Morro of the first half of the 18th Century.

3. Plano 1 del Castillo del Morro, May 12, 1787, by Juan Francisco Mestre. Museo Naval, Madrid, Class. No. k.-b.-8.-23. It shows the project of El Morro concluded.

4. Plano de la Plaza de San Juan de Puerto Rico, November 17, 1792, by Juan Francisco Mestre. Biblioteca Central Militar, Madrid. Class. k.-b.-3.-47. Drawbridge is marked with an X.

5. Plano y Perfiles del Castillo de San Felipe del Morro, November 16, 1793, by Felipe Ramírez. Servicio Geográfico del Ejército, Madrid. Class. No. LM-8a-a-No. 77. First profile view of drawbridge. See EXHIBIT B.

6. Plano de la Vista y Perfiles del Castillo de San Felipe del Morro, 1860, by Manuel F. Castro. Copy from the National Archives, Record Group No. 77. Front view of entrance to El Morro. See EXHIBITS A and C.

7. Plano de la Planta de las Bovedas del Morro, 1860, by Manuel F. Castro. Copy from the National Archives, Record Group No. 77. Top view of the drawbridge. See EXHIBIT F.

8. Proyecto de recalzo del ángulo norte del Castillo del

Morro, June 10, 1886, by José Laguna. Copy from the National Archives, Record Group No. 77. Excellent profile view of the drawbridge. See EXHIBIT E.

9. Proyecto de Bateria para cinco cañones de .. centimetros en el Castillo del Morro, November 5, 1886, by José González. Copy from the National Archives, Record Group No. 77. Profile view of drawbridge.

10. Proyecto de Baterias en el Castillo del Morro, 1887. Copy from the National Archives, Record Group No. 77. Indication of the drawbridge.

11. Plan showing the north wall from El Morro to San Cristóbal, 1899. Copy from the National Archives, Record Group No. 77. Indication of the drawbridge.

12. Defenses of San Juan: El Morro and Outworks. U. S. Engineers Office, San Juan, Puerto Rico. To accompany armament report dated December 31, 1900. Copy from the National Archives, Record Group No. 77. Indication of the drawbridge.

13. Plano demostrativo de los terrenos Federales, Insulares y de Propiedad Particular en la ciudad de San Juan, Puerto Rico. March 19, 1910. Departamento de lo interior, Division de Terrenos Públicos. Indication of the drawbridge.

14. Military Reservation of San Juan, Puerto Rico. April 3, 1918. Last map that we know, showing indications of the drawbridge.

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16. Report of Governor Suárez Coronel, 1595. AGI-SD, 155-16.

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18. Report of Governor Arteaga, March 10, 1673. AGI-SD, 157-29.

19. Report of Governor Martinez de Andino, March 26, 1689. AGI-SD, 159-39.

20. Report of Governor Arredondo, May 22, 1690. AGI-SD, 159-41.

21. Report of Engineer Félix Prósperi, November 10, 1731. AGI-SD, 2499.

22. Report of Engineer O'Daly, September 25, 1765. AGI-SD, 2510.

23. Report of Engineer Mestre, January 8, 1785. AGI-SD, 2510-50.

24. Report of Mestre, July 16, 1785. AGI-SD, 2510-51.

25. Report of Mestre, January 29, 1786. AGI-SD, 2510-51.

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31. O'Conner, John Michael, A Treatise on the Science of War and Fortification... (Seymour J., New York, 1817, 2 v.,illus., with a volume of plates and maps). The 14 pages extract used as source, covers the gates of fortified towns, their situation, their architecture, and their bridges and profiles. O'Conner was a Captain of Artillery and Late Major and Assistant Adjutant General in the Northern Army (U. S.). His work purports to be a direct translation of Belidor's La Science Des Ingenieurs, but enriched with comments, footnotes and illustrations.

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EXHIBITS OF PLANS

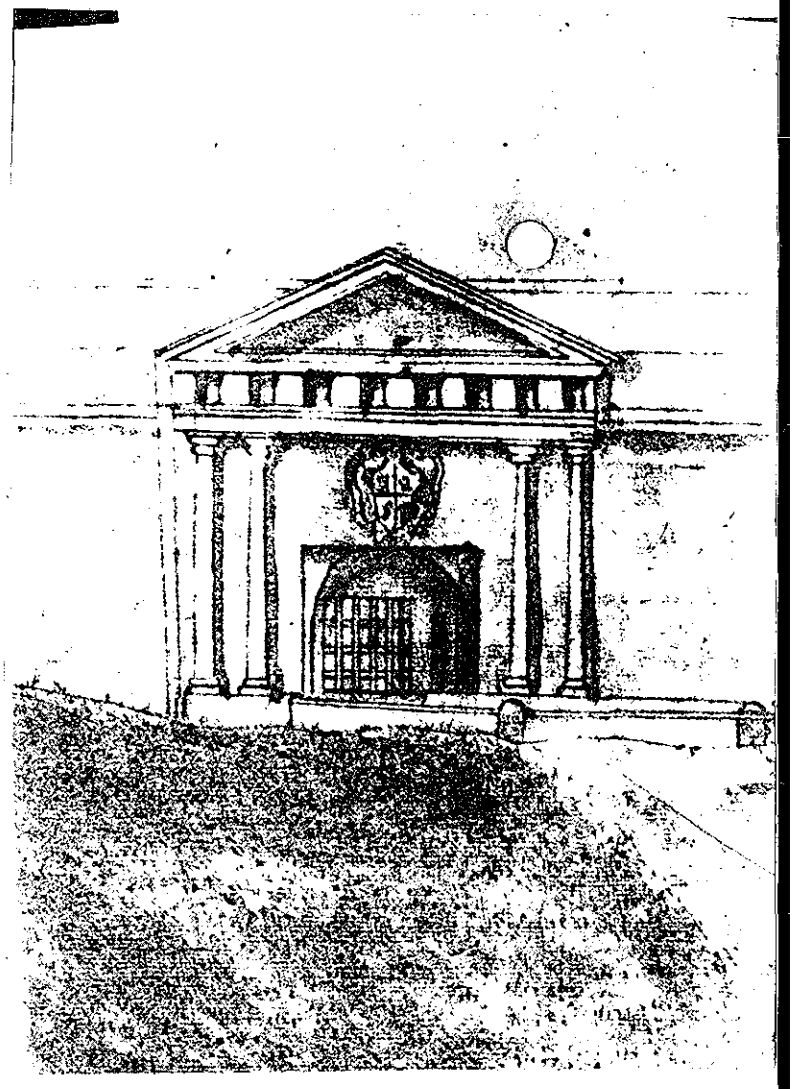

EXHIBIT A: Sally Port of El Morro in 1860. Notice neo-classical facade with Code of Arms on top. A gate or door is in the background.

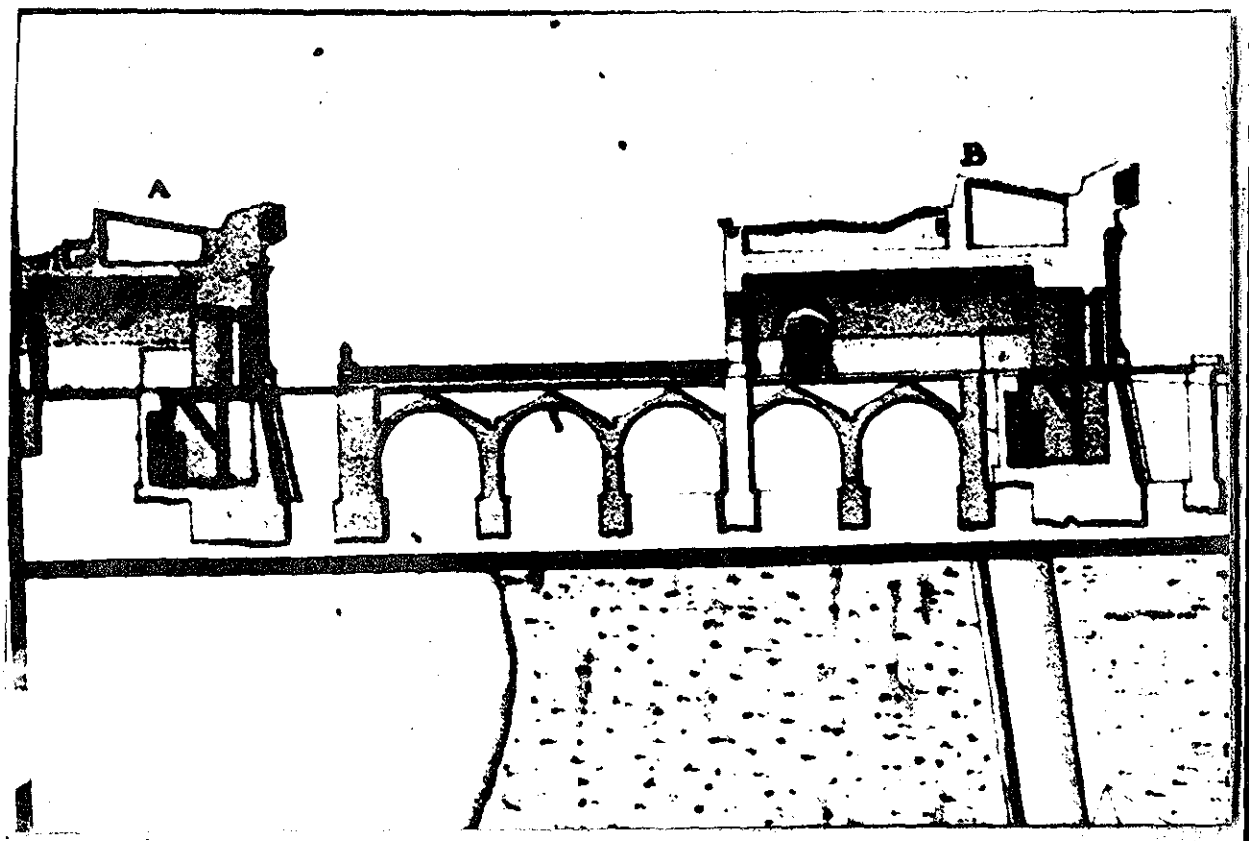

EXHIBIT B: Profile A, at left, shows bascule bridge of El Morro in 1793. Notice bascule cage and the indication in its background of either a prop or lifting mechanism.

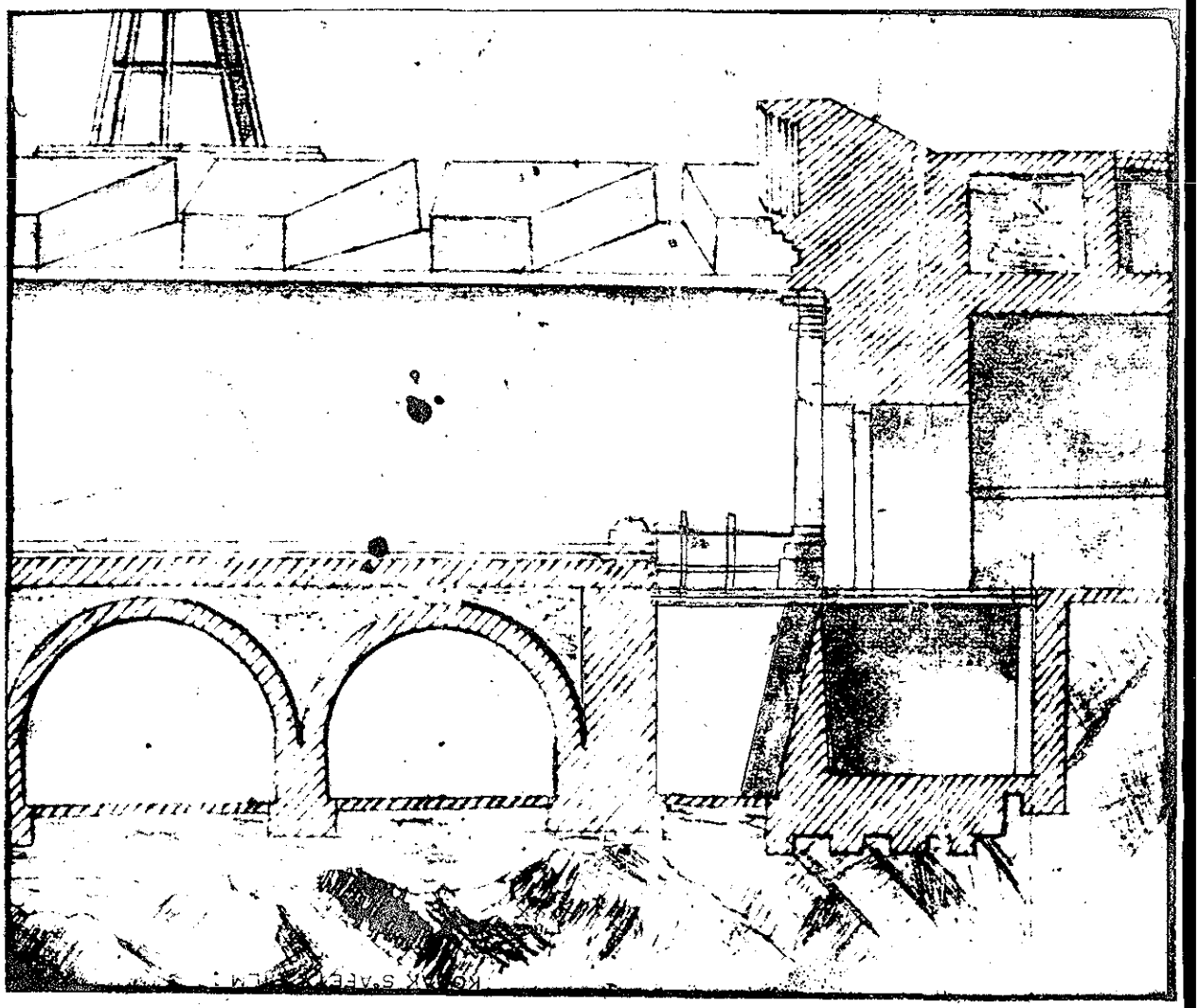

EXHIBIT C: Profile of bascule bridge of El Morro in 1860. Notice wooden rail on flanks of the table.

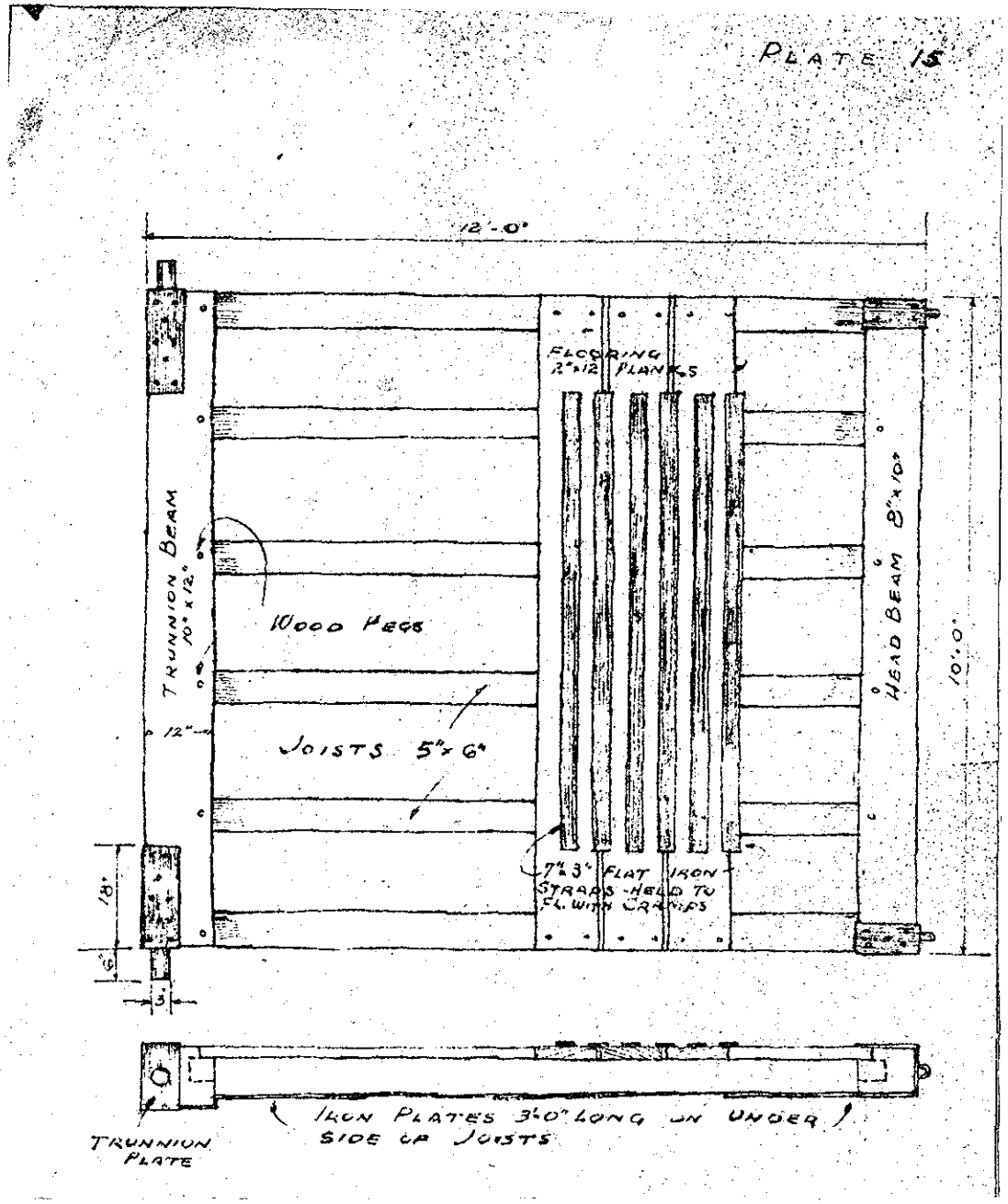

EXHIBIT D: Drawbridge Table based on Muller's description - 1756.
Scale: 1/2" = 1'-0"

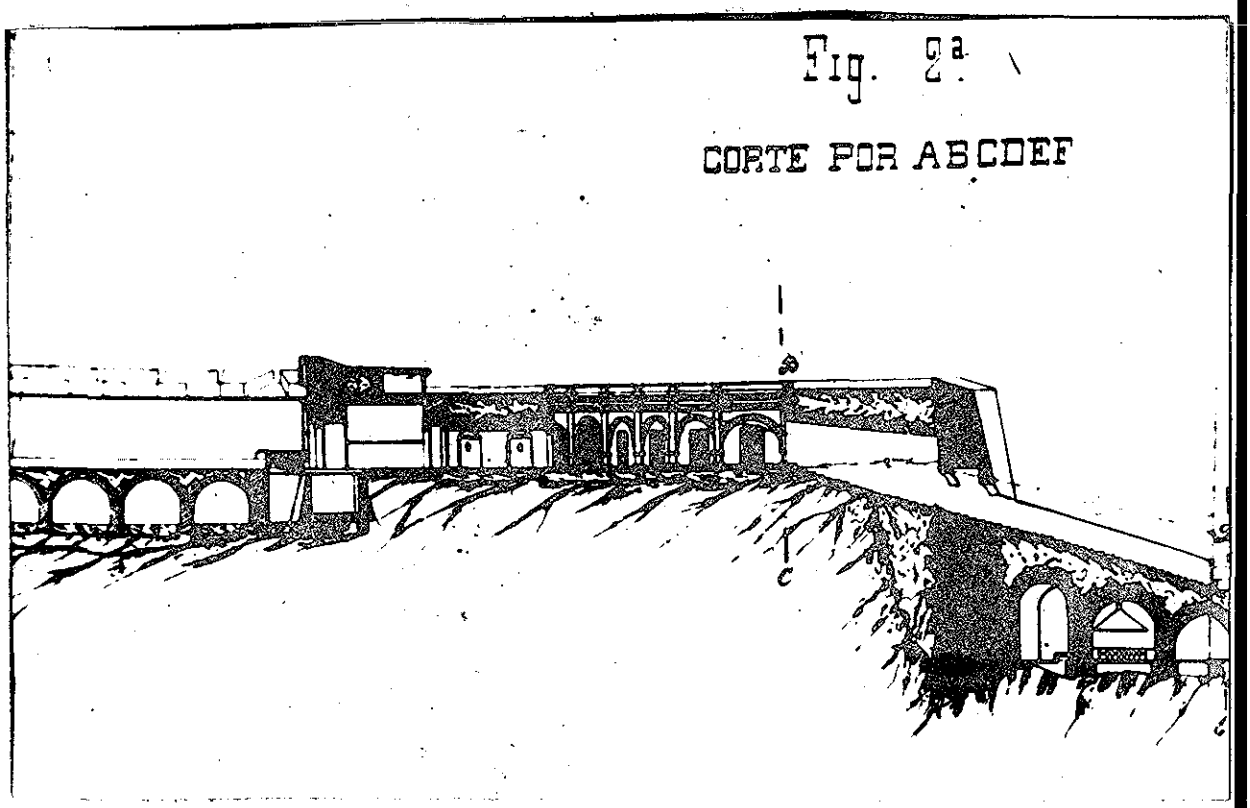

EXHIBIT E: Profile of bascule bridge of El Morro in 1886.

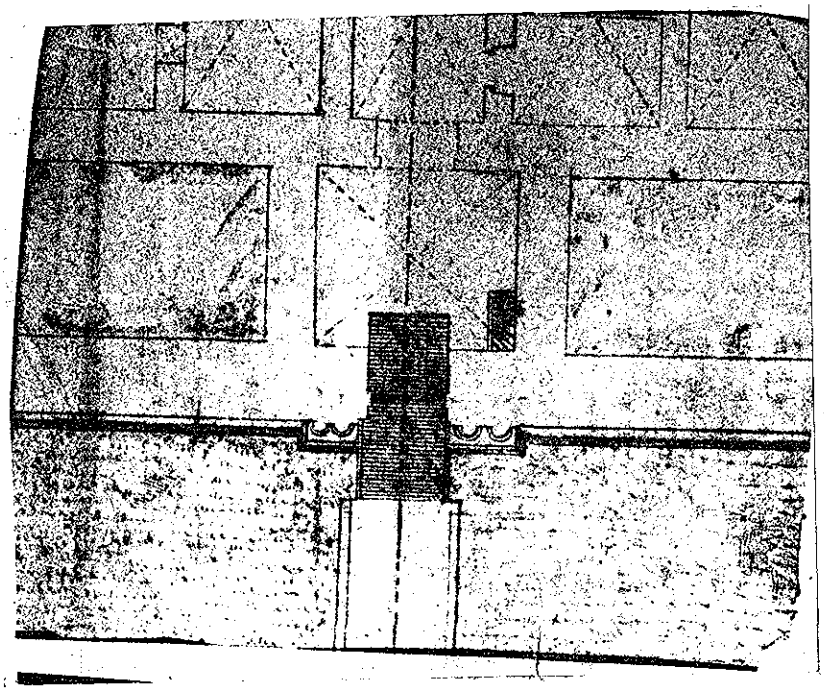

EXHIBIT F: Top view of Drawbridge of El Morro in 1860. Notice position of stairway leading to bascule cage.

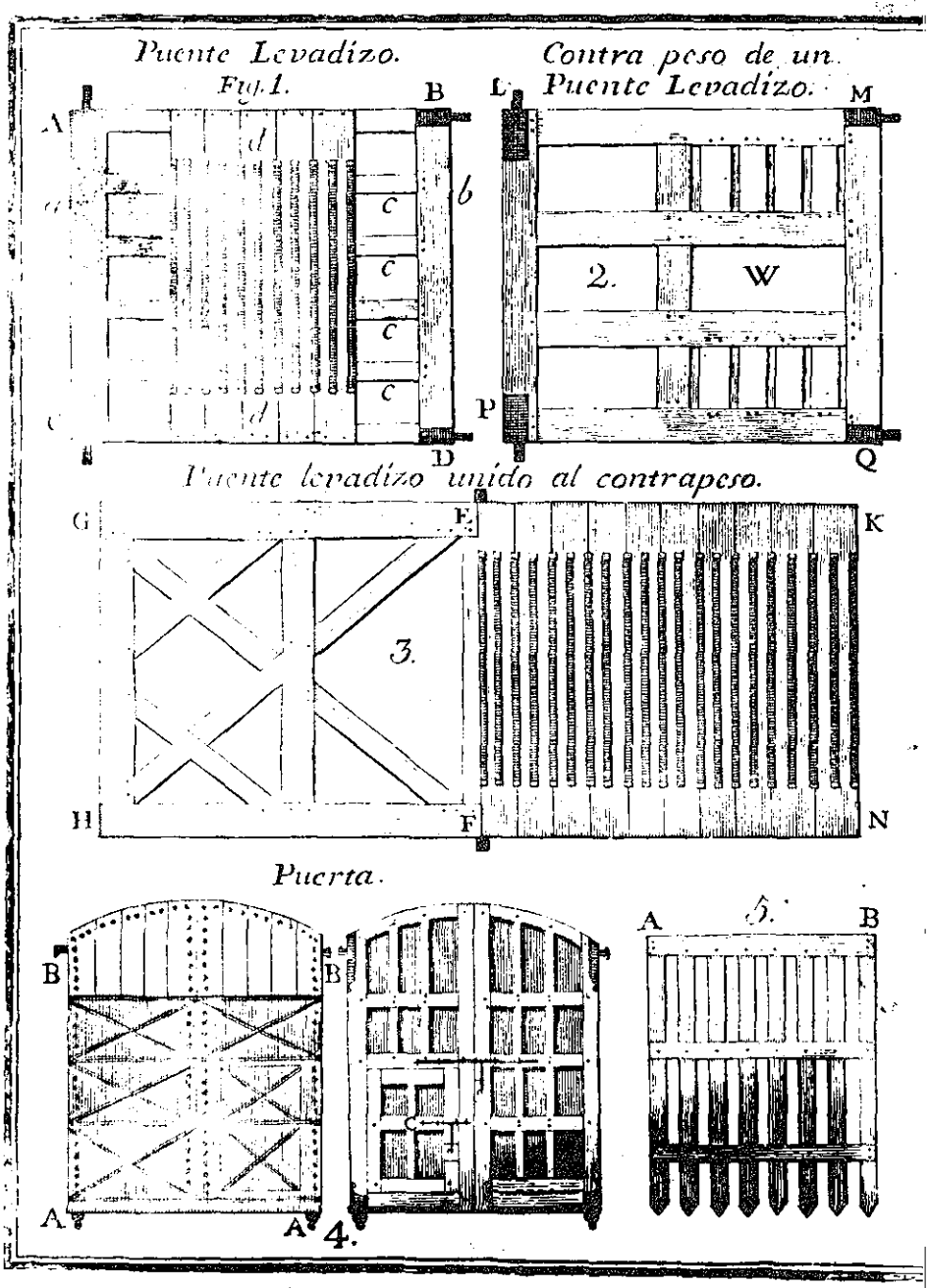

EXHIBIT G: Illustrations taken from Muller and Taramas, showing construction of drawbridge table (Fig. 1), bascule table (Fig. 3), and types of doors or gates (Fig. 4).

EXHIBITS OF PHOTOS

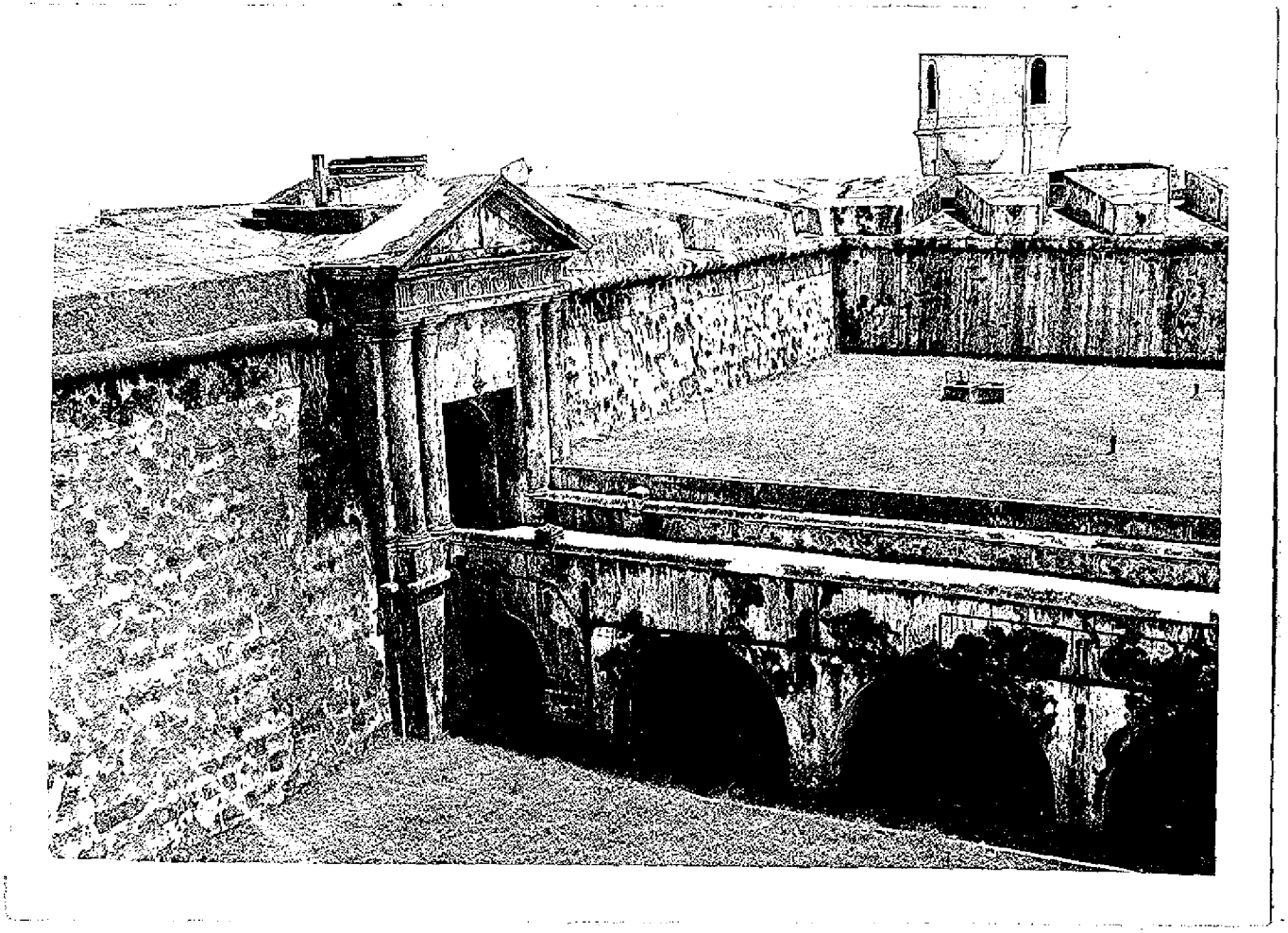

PHOTO 1. Facade and Sally Port entrance of El Morro. Three metal hooks on top of entrance supported the Royal Code of Arms which was hung in 1786 and removed in 1898. Notice the last pier of the fixed bridge where the drawbridge rested.

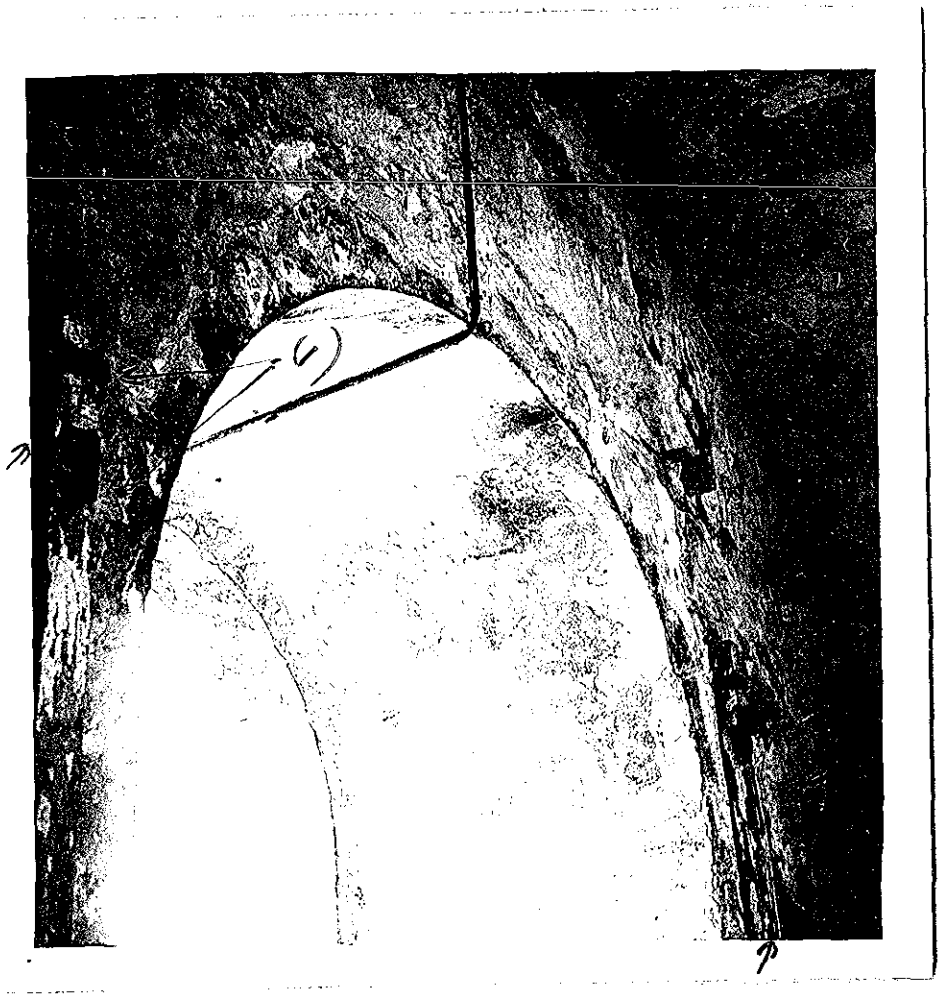

PHOTO 2. Inside of facade looking from vestibule towards fixed bridge. Notice ausubo timbers on both sides of archway. Number (1) in ink shows metal clasps which served as hinges, with screws and nuts on back side of timbers. Each timber has three hinges. The whole thing suggests a folding door.

PHOTO 3. Top part of the right timber (photo 2) with metal clasps. Beam heads (number 1), on both sides of timbers, protrude about 6 inches. Beam and board heads (number 2), above and on both sides of archway, also protrude.

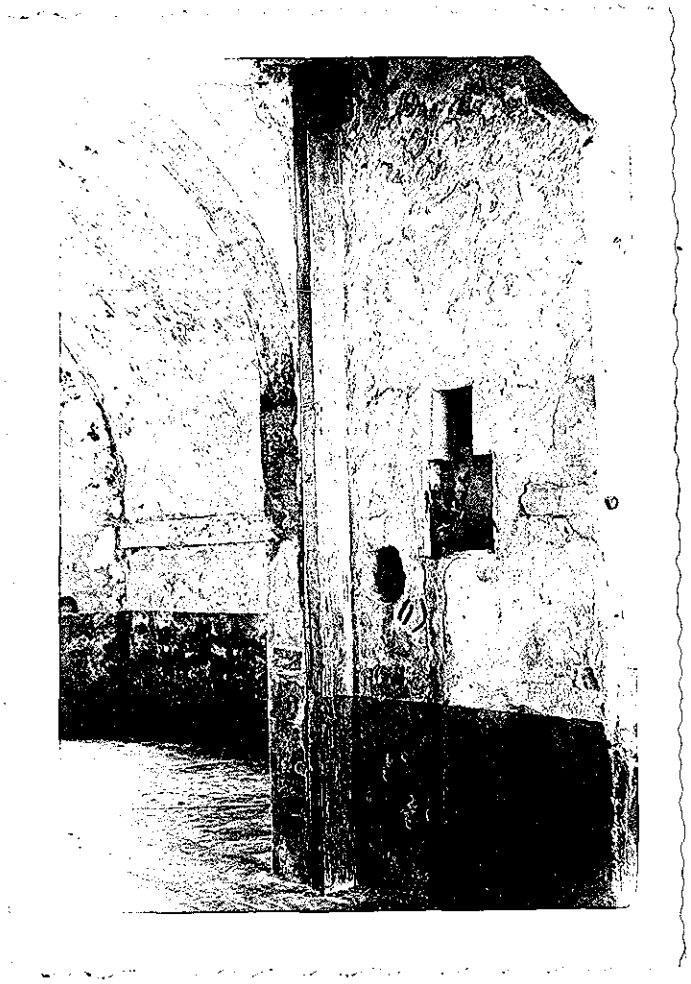

PHOTO 4. Back archway of vestibule where second door was located, taken from main square of Fort. Notice ausubo timber of right side of door. (Opening (1) looks like recess to support a square timber or cross bar). Timber is imbedded in the ceiling and floor of archway.

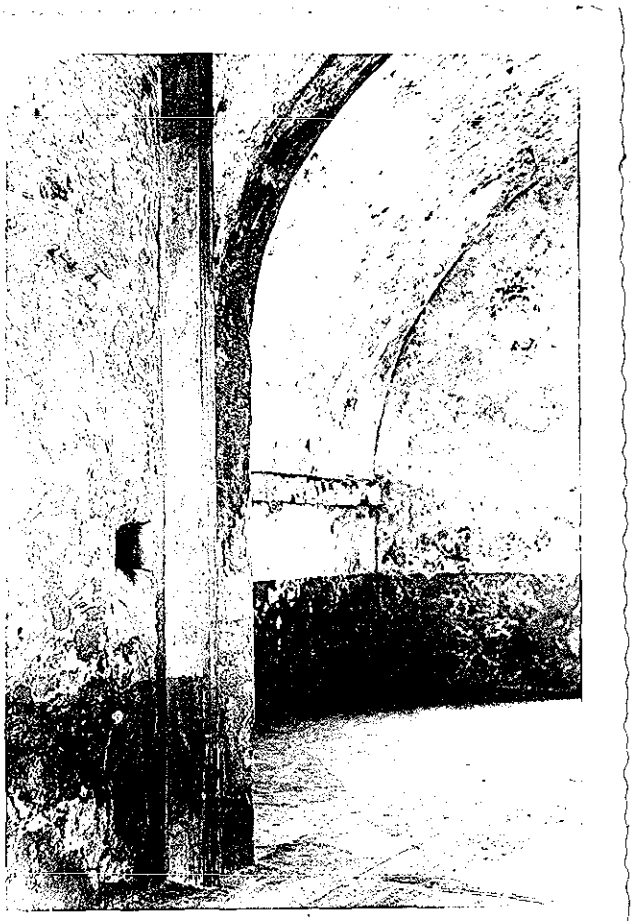

PHOTO 5. Ausubo timber of left side of second door (Photo 4).

PHOTO 6. Archway of Sally Port, seen from main square of Fort. Some of the timbers which supported the doors can be noticed.