THE TAMPICO HARBOR WORKS.

MEXICO.

Terminus of the Mexican Central Railway on the Gulf of Mexico.

A MONOGRAPH

BY

ELMER L. CORTHELL, C.E., Dr.Sc.

Chief Engineer of the Works during Construction.

Prepared for the Universal Exposition, St. Louis, Mo., 1904.

ILLUSTRATIONS.

HALF TONES.

PLATES.

APPENDICES.

THE TAMPICO HARBOR WORKS, MEXICO.

A MONOGRAPH

By ELMER L. CORTHELL, C.E., Dr.Sc

Chief Engineer of the Works during Construction.

The purpose of the writer is to furnish to visitors at the Universal Exposition, St. Louis, a résumé of the salient features of these important works, which will explain the interesting exhibits, which it accompanies:

A set of four relief models, which show the changes caused by the works, and an album of fifty-three photographs, which show all phases of the works—plans, methods of construction, physical results, and commercial facilities.

See Appendix I. for a list of these photographs.

General.

Tampico is situated near the mouth of the river Pánuco, about midway between the port of Vera Cruz and the mouth of the Rio Grande, which divides the United States from Mexico. A large part of Mexico is tableland, between 7,000 and 8,000 feet above the level of the sea, the lowlands, or "tierra caliente," along the Gulf of Mexico and along the Pacific being quite narrow. The descent from the tableland to the lowlands is abrupt, and necessitates heavy gradients on the railroads. The main line of the Mexican Central Railway, extending from El Paso to the City of Mexico, bisects this great tableland, its general course running parallel

to the Pacific Coast. In 1883 a branch line to tide-water at Tampico was begun from a point on the main line near Aguas Calientes, a distance of about 400 miles.

Historical.

The commercial history of the mouth of the Panuco River and of the bar lying in front of it in the Gulf of Mexico is a record of continual dangers, losses and disasters. The bar in its natural condition, before the improvement works were built, was variable in position, depth of water and location of the channel, and had sufficient depth only for light draft tugs and lighters, which attempted under great disadvantage and inconvenience to lighter freight and passengers to and from steam and sailing vessels anchored outside in the Gulf. The bar was exposed to the full force of the "northers" sweeping across the Gulf of Mexico from the United States. In the Winter season these northers, of frequent occurrence, often continued without abatement for several days, causing a heavy sea and breakers on the bar, which made lightering, for the time, impossible. The velocity of the wind during these northers is from 40 to 75 miles (64.37 to 120.69 km.) per hour. It was often the case that vessels would lie outside at anchor exposed to the violence of these northers for days and sometimes for weeks and even months, and they were often obliged to weigh anchor and go on to other ports, hoping that the return trip would be less unfavorable to handle their freight and passengers, but were often disappointed.

Formerly Tampico was comparatively much more of a port and a much more important city than it was when the improvement works were undertaken. The building of the Mexican Railway Company from the Port of Vera Cruz to the City of Mexico had drawn most of the commerce to that port, to the detriment of Tampico. The dangerous character of the Tampico bar is attested by the wrecks found in it during the development of the channel and which will be referred to more at length hereafter.

From the time that the Mexican Central Railway Company undertook to build the line to Tampico, referred to above, interest in the improvement of this bar was created and sustained for several years. Various examinations, studies and plans were made by various parties. It was not, however, until after August 30th, 1888 (the date of a concession granted to it by the Mexican Government), that the Railway Company set about the work in earnest. In the Spring of 1889 the writer was engaged by the then President of the Railway Company, the late Mr. Levi C. Wade, to make surveys, plans, estimates and a report upon the subject of improvement. He engaged a competent engineer, Col. A. F. Wrotnowski, to go to Tampico and begin the survey, the writer following him in June. The survey was completed and the plans made

in time to submit them to Mr. Wade, who was then in the City of Mexico, on the 20th of August, 1889. The plans were immediately afterwards submitted to the Government and were approved by Mr. M. Fernandez, Oficial Mayor of the Department of Fomento, September 18th, 1889.

During the Fall and Winter of 1889 the financial and constructive arrangements for building the works were taken under consideration in Boston by the Railway Company. Contractors were invited to make propositions for doing the work. On February 6th, 1890, a contract was entered into with the Louisiana Jetty and Lightering Company of New Orleans, associated with Mr. Jos. H. Hampson, who subsequently, in the Winter of 1890, assumed personally the entire contract, the Louisiana Jetty and Lightering Company retiring.

The works were begun in March, 1890, and inaugurated in April by General Carlos Pacheco, Minister of Fomento.

Descriptive.

The Pánuco River drains a watershed of about 36,400 square miles (94,200 km), the slopes run up to the tablelands, 7,000 feet (2133m) above the sea level and to much higher mountain points. Its tributaries drain widely differing districts; one of them by artificial connection drains the Valley of Mexico. The rainfall occurs mainly in the Summer months; steep slopes make drainage rapid; the volume of discharge in heavy floods is about 190,000 cu. ft. (5380 m^3) per second; the velocity during great floods near the mouth of the river is about 7 ft. (2.13 m) per second; the surface slope is then about 10 in. per mile (254 mm per km), and 7 in. in ordinary floods; the maximum flood discharge may be estimated at about 215,000 cu. ft. (6086 m_3) per second, the area of section at gauging station, about half way between Tampico and the La Barra at the mouth of the River, was 29460 sq. ft. (2710.32 m^2). The average width of the river from Tampico to the mouth is about 1350 ft. (411.45 m) between banks. There are connecting lagoons, and these with the river area form a quite extensive tidal reservoir. The main tidal range is about 15 in. (38 cm), and the tides are diurnal. During floods the river water is quite heavily charged with a fine comminuted sediment, about 18 per cent. of which is silicious matter, the residue clayey. The ratio of sediment to water in maximum floods is about 1 in 400 in bulk, and in ordinary floods 1 in 1300. The bar in front of the mouth of the river in the sea was not a delta bar, the river discharging in a solid stream, not broken up into outlets and passes like the Danube, Mississippi and other rivers. The position of the outer slope of the sea face of the bar had not materially changed during the preceding eight and a half years, covering the time of definite knowledge of conditions, although laterally the crest of the bar had experienced annual changes of importance. The

crest may be assumed, at the time of making the survey in 1889, at about 4400 ft. (1344 m) from the mouth of the river. The slope seaward from this point to the 5 meter curve was quite gradual, but beyond this point a more rapid slope was found; but these conditions changed continually as well as the depth of the bar, the latter varying in the course of six years from a minimum of 5 ft. (1.52 m) to a maximum of 12 ft. (3.66 m). At one time there existed an island above water directly in front of the mouth of the river and it extended entirely across the direct outward channel; around it to the northward there was a circuitous channel.

There were always two opposing forces at work—the fluvial discharge and the sea waves and currents:—when the former predominated it generally formed a channel straight out into the sea; when the latter predominated, which they usually did during the Winter months, it bent the channel southward under the persistent force of currents and waves induced by the "northers." When there is no river current and no winds of force there is a perceptible northerly current—no doubt the Yucatan current (Gulf Stream), but it is not sufficiently strong to resist wind action and it is directly reversed during most of the Winter and Spring months.

See Plate II. showing condition of mouth of river in 1889.

Construction.

The works were built on the following general plans and principles:

1st. Parallel jetties; the north jetty 6500 ft. (1980.80 m) long, and the south jetty 6800 ft. (2070.24 m) long.

2nd. The distance between them is that of those sections of the river where the best channel existed; viz., 1000 ft. (304.80 m) between center lines of the jetties.

3rd. Projection of the jetties straight out into the sea.

4th. Their sea ends rest in about the depth of water required for the channel and present the best situation for the action of the sea currents, moving past the face of the works.

5th. As broad a foundation as practicable, made of brush, and the hearting of the work of the same material, the slopes covered with riprap stone and the top, or crown, down to and below low water, composed of large stone weighing several tons.

6th. Rapid construction to prevent the reformation of the bar in front during the progress of the work.

The Railway Company, to facilitate the work, built a railroad of standard gauge from Tampico to the mouth of the river, over which the stone, brush, and other materials found in the country were transported. The original plan contemplated a light trestle work for handling the mattress work, and light rolling stock, it being the expectation at that

time that the brush and stone would come entirely by barge. The construction of the railroad to the works at La Barra and the change of plan for transporting materials and the discovery of excellent and heavy rock at the El Abra quarry, 78 miles (125.5 km) from the works, changed the entire plan of the trestle work, so as to permit standard gauge locomotives and heavily loaded standard cars to be run over it to the sea end of the jetties. This trestle work was built by an overhanging steam pile driver. The mattresses were built suspended from the trestle over the waves and then dropped into the water and quickly sunken by stone thrown upon them from the cars standing on the tracks overhead.

This method was very satisfactory, for the heavy piles of the trestle work, which was built in bents 15 ft. (4.57 m) apart, held the mattresses that were built around them securely in place so that there was only in rare instances any loss of mattress work by the heavy seas.

The rock was a heavy limestone, weighing nearly as much as granite, 160 to 170 pounds per cu. foot (2562 to 2723 kg per m^3) with a specific gravity of about 2.6. As the trestle work would be needed for possibly three years, the piles supporting the track were creosoted. The mattresses were built of various widths to suit the depths of the water; they were generally of a uniform length of 60 ft. (18.27 m) measured along the jetty, the thickness varied from 7 ft. down to 3 ft. (2.13 m to 0.91 m). Advancing towards the sea, the mattresses were heavily loaded so as not to be disturbed by the waves before other courses could be built on top of them. The north, or exposed jetty, started immediately from the shore into comparatively deep and agitated water; there were no outlying reefs (incipient banks) to protect the work, as is found near the mouths of delta rivers, which build their banks and bars progressively into the sea, as for example at the mouth of the South Pass, of the Mississippi River, where the advance into the Gulf of the bar, reefs and banks, and shore line, was about 110 ft. (33.53 m) per annum, and where these formations on each side greatly protected the works. At Tampico it was a fight with the sea from start to finish. As soon as the mattress work reached the surface of the water the top and slopes were loaded with stone as rapidly as possible.

The cash cost of the construction, including engineering, was about $2,221,000, United States currency.

This does not include buildings, railroad extension from Tampico to La Barra, real estate, wharves, yard tracks, etc., and general expenses and interest.

The entire cost of construction, including the above and all other items, and the cost of the maintenance of the work to December 31st, 1902, has been $3,157,690.40, as it appears in the Report to the Stockholders of the Mexican Central Railway Co., Limited, for the year ending December 31st, 1902.

See Plate I. map of the river and location of the works.

Physical Results of the Work.

Prior to the construction of the works, the fluvial and tidal water discharging at the mouth of the Pánuco River, spread out fan-like over the submerged bar lying in front in the Gulf. The two parallel jetties, extended quickly from the shore out over the bar to deep water, concentrated and directed against this shoal the entire discharge, and from the first moment made their effect felt by deepening the Channel. It is unnecessary to go into the details of this action, but it was always progressive. The only delay in the development of the Channel was caused by an obdurate "inner" bar—really the crest of the old bar—which was composed of cemented material and coral formation, which had been caused by the numerous wrecks which had sunken into the bar during the last 300 years.

This material had to be loosened up by dynamite and by a dredge boat, and the heavier portions of the wrecks had to be lifted and carried ashore. This done, the flood that came soon afterwards, in the Summer of 1893, in less than three weeks enlarged the Channel throughout its entire length, removing in that time about 1,202,000 cubic yards (919,530 m^3) and discharging it beyond the sea ends of the jetties.

The whole amount of material removed by the current from this bar in forming the Channel was about 4,000,000 cubic yards (3,058,000 m^3).

The works have made a channel of great size and excellent navigability and have maintained it.

The bar as it originally existed and the Channel as it now exists are shown on Plates II. and III. These plates give the contours as found under both conditions and they show remarkable and very satisfactory results of the works. The central depths in the Channel from Tampico to the Gulf are shown on Plate I.

The concession from the Mexican Government contemplated a channel through the sea bar, with a central depth of 22 feet (6.7 m) at mean high tide, with the option on the part of the railway company of making it 24 feet (7.3 m).

As is usual on such works the dead angles between the jetties and the shore line became filled out by deposition of sand, carried through the works from the river as sediment or filled in by the waves. These accretions stopped some years ago and the new shore line, thus formed, may be considered practically permanent.

By the action of the waves, the works have become solid; by the action of the sediments, the intersticies of the works have become well filled and they are now less permeable than at the outset. The quarry, from which the rock came during construction is still used for the maintenance of the works. The construction trestle was abandoned some time ago and the piles that supported it cut off at the surface of the crown of the work. The rock is now placed upon it by a derrick boat and the stone is brought on barges for the purpose.

NORTH JETTY FROM THE SEA.

By the action of the waves in heavy storms the rock near the sea ends of the jetties has been disposed over a broad base and the slopes have become stable.

A moderate amount of stone suffices to keep the work up to grade, which is about 5 ft. (1.5 m) above high water near the sea ends and less at the shore line.

The Channel, as shown by a survey made in October and November, 1903, is straight and wide; the least depth between the works is 27.8 ft. (8.47 m); the least width of the 24 ft. (7.32 m) Channel is 580 ft. (176.8 m). (See Plate III.) These dimensions are quite constant; the only tendency to change in recent years is a wearing away of the sea face of the bar, the deep water of the Gulf approaching nearer to the exit from the jetties.

This action, while not unusual in such works, is especially marked at Tampico. It is so important, as bearing upon the permanence of the navigable Channel, that a set of four relief models has been made to show by comparison the changes from time to time on the outer slope of the bar.

These four models are as follows:

The first shows the conditions which existed at the time of the preliminary survey in 1889; a most irregular bar, full of shoals and pockets and without any marked channel anywhere through it. The second is from a survey taken when the channel had been developed to some extent by the works, and this shows a protrusion of the bar into the Gulf. The great amount of material, above stated, thrown out in front of the work, could not be at once disposed of. It required time to remove it to a distance by the currents passing across the sea ends of the jetties. The third model shows plainly the result of this action of the sea currents and the protrusion has disappeared; that was in 1895. Now, in 1903, from the survey above mentioned, a fourth model has been made, which shows the permanence of the satisfactory condition during the previous eight years, and really a still further recession of the bar slope; in fact, the deep water—the 30 ft. contour—is now nearer the shore than when the original survey was made fourteen years before.

These four models are on exhibition at the Exposition. They are side by side and in the order of dates. They are about 6 ft. long and 18 in. wide, with varying shades of blue to show lesser and greater depths.

They, or the photograph of them, show clearly the quite remarkable changes made in this bar by the work, deepening it from 8 ft. (2.44 m) to about 28 ft. (8.53 m) and creating and maintaining a straight Channel of great width from the protected harbor inside to the deep waters of the Gulf of Mexico outside.

PHOTO OF RELIEF MODELS.

Hydraulic engineers, experienced in such works, will appreciate the great success physically of these works, in making and maintaining, without dredging a navigable channel of the above dimensions through a bar of the character described above.

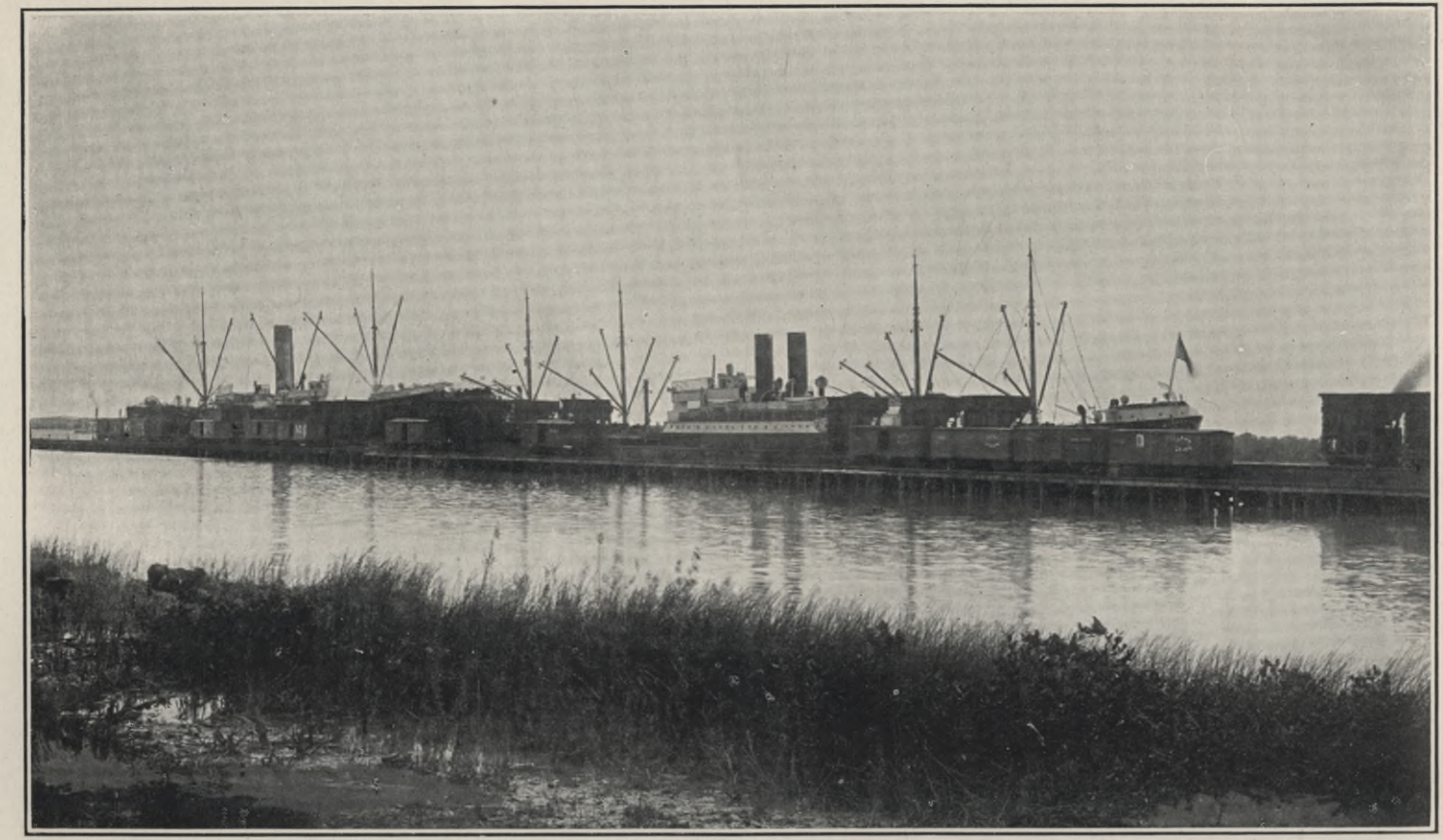
The Commercial Results.

The commercial results have been no less satisfactory.

Tampico, geographically, is well situated for a large commercial business. It is opposite the center of the Republic of Mexico. The two Mexican Central railroad lines radiating from it—one west, and the other northwest —cover the whole of that part of Mexico. The completion of the projected direct line from Tampico to Mexico will give the Port a still greater advantage and place it in a position to control the traffic of a large part of Mexico.

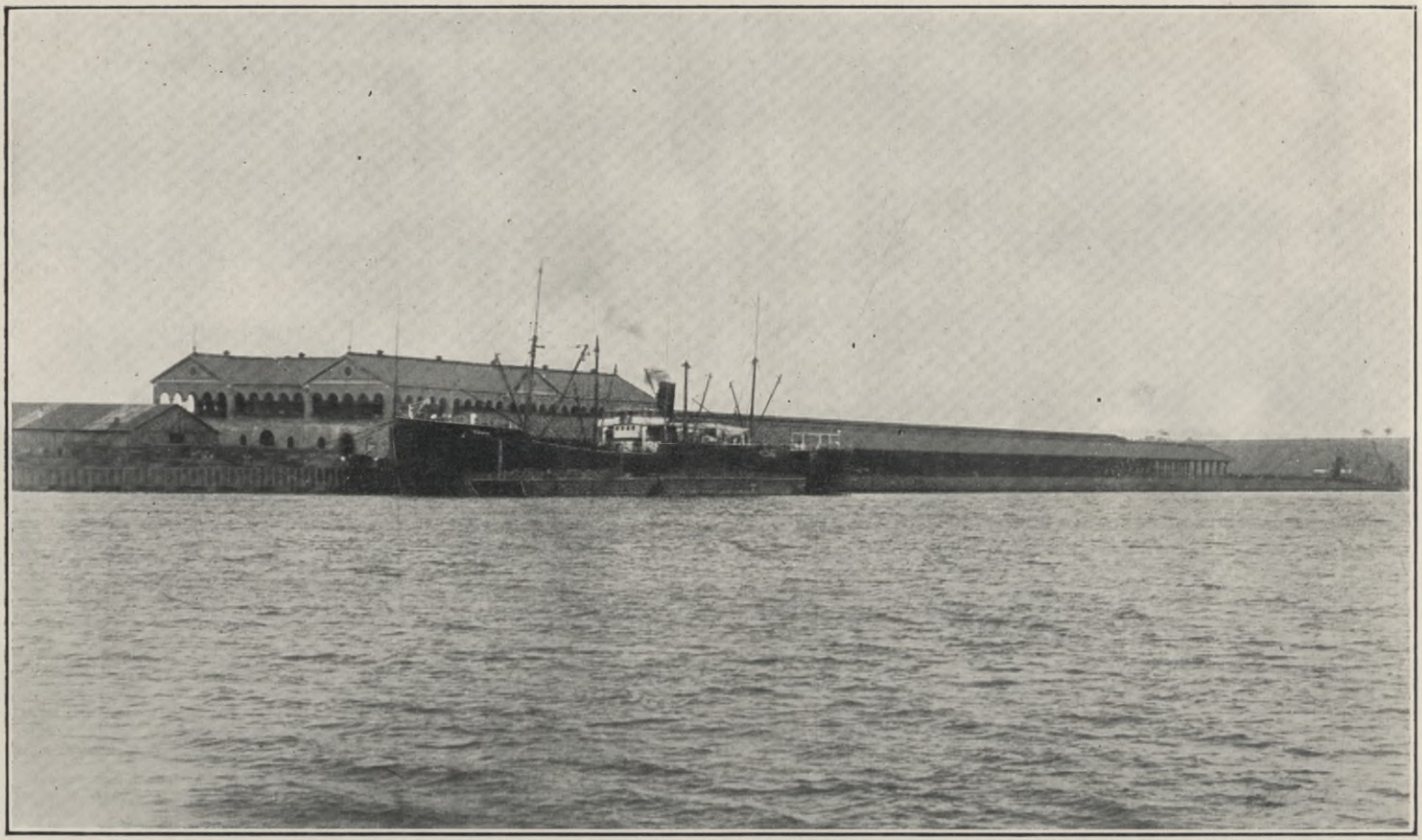
It has taxed the Mexican Central Railway Company to provide the facilities which the steadily growing business of the Port requires, both exports and imports.

In order to show what the facilities at present are, there has been placed on Plate I. the location and length of the various wharves between Tampico and the Gulf. An examination of this plan will show that there are five wharves with a total length of 5720 feet (1743.5 m). There is plenty of water in front of most of them.



WHARF BETWEEN TAMPICO AND LA BARRA.

The longest wharf, nearly half a mile long, at Tampico, was built by the Mexican Government and is a most substantial work, resting on steel cylinders, the original wharf, built on wooden piles having been destroyed by fire as soon as built. The new wharf cost $3,000,000, Mexican currency.



TAMPICO CUSTOM HOUSE AND WHARF.

The Custom House, adjoining and connected with it, is one of the largest and best constructed to be found anywhere. There is another Custom House about half way to the harbor, where the through traffic is handled. Some views of the commercial facilities will show the nature and extent of these works.

The growth of the commerce has been very satisfactory generally, showing a steady progression, when not, general causes have caused it, as at the other ports and entrepots of the Republic.

TAMPICO CUSTOM HOUSE AND WHARF.

The table following (see Appendix II.) gives a complete statement of the exports and imports at various ports and gateways of Mexico. It will be seen that Tampico leads them all in tonnage and value of exports, and leads all, except Vera Cruz, in imports; the latter on account of the greater value of the general merchandise received for Mexico City leading in value of imports, but not in tonnage.

Like all works, which improve transportation conditions and offer additional facilities for the interchange of the world's products, the Tampico Harbor Works have already proven themselves to be beneficent factors in ameliorating the conditions of national and international trade, and their influence has been felt far and wide, not only in Mexico, but in other parts of the world; offering a new entrepôt and reducing the cost of transportation.

ELMER L. CORTHELL,
Civil Engineer.

1 Nassau Street, New York,
March 1, 1904.

APPENDIX I.

TITLES IN ENGLISH AND SPANISH OF PHOTOGRAPHS IN TAMPICO HARBOR WORKS ALBUM.

1. Vista de Nube del Cañon de Tamasopa y del Ferrocarril Central Mexicano.
   Cloud view from Tamasopa Canon and Mexican Central Railroad.
2. Vista desde la Boca del Cañon de Tamasopa.
   View from mouth of Tamasopa Canon.
3. Puente de Dios.
4. Cascades de Tamasopa.
   Cascades, Tamasopa.
5. El Salto del Abra.
   The Falls of el Abra.
6. Sierra del Abra.
7. Cascades del Abra.
   Falls of El Abra.
8. Gruta de Choy, Mirando hacia arriba.
   Choy Cave, looking up.
9. Puente de Choy.
   Choy Bridge.
10. Cantera en el Abra.
    Quarry at El Abra.
11. Campo en la Cantera del Abra.
    El Abra Quarry Camp.
12. Puente del Tamesi.
    Tamesi Bridge.
13. Tampico en dia de Mercado.
    Tampico Market Day.
14. Muelle de Tampico.
    Tampico Wharf.
15. Mercado de Tampico.
    Tampico Market.
16. El Rio desde el Faro.
    River from Light House.
17. Tampico á la Golfo.
    Tampico to the Gulf.
18. Registro de la Marea.
    Tidal Record.
19. Armazon y Muelle.
    Trestle and Jetty.
20. Armazon y Trabajos de Colchon, Muelle del Norte.
    Trestle and Mattress Work, North Jetty.

21. Colchon en Construccion, Trabajadores Manejando la Broza.
Mattress Construction, Laborers Handling Brush.

22. Obras de Colchon, Colchon Suspendido en Construccion.
Mattress Work, Suspended Mattress Under Construction.

23. Fin del Muelle del Norte. Martinete Para Clavar Pilotes y Colchon Suspendido.
End of North Jetty. Pile Driver and Suspended Mattress.

24. Construccion del Colchon, Muelle del Norte, Ingeniero Residente.
Mattress Construction, North Jetty, Resident Engineer.

25. Colchon Flotando.
Mattress Floating.

26. Muelle del Norte.
North Jetty.

27. Vista Distante en Tren, el Muelle del Norte.
North Jetty, Train Distant View.

28. Lineas de Ambos Muelles.
Lines of Both Jetties.

29. El Faro, La Barra.
Light House, La Barra.

30. Los Muelles desde el Faro.
Jetties from Light House.

31. Los Muelles desde el Faro, Mirando al Mar.
Jetties from Light House, Looking out to Sea.

32. El Viejo Pete, El Botero.
Old Pete, the Boatman.

33. Casa del Ingeniero.
Engineer's Quarters.

34. Pendientes Superficiales en la Inundacion de 1893.
Surface Slopes in Flood of 1893.

35. Secciones Comparativas at Traves.
Comparative Cross Sections.

36. Comparativos Perfiles, Curvas de la Marea Baja en la Inundacion de 1893.
Comparative Profiles, Ebb-tide Curves in Flood of 1893.

37. Fotografias de los Modelos.
Photographs of Models.

38. Vista á ojo de Pajaro, los Muelles de Tampico.
Bird's-eye View, Tampico Jetties.

39. Muelle del Norte desde el Mar. 1903.
North Jetty Looking from Sea. 1903.

40. Muelle del Norte. Vista hacia el Mar. 1903.
North Jetty Looking out to Sea. 1903.

41. Muelle para Carbon entre Tampico y los Muelles. 1903.
Coal Wharf between Tampico and Jetties. 1903.

42. Diques aguas abajo del Tampico. 1903.
Docks below Tampico. 1903.

43. Diques y Embarcaciones en Doña Cecilia. 1903.
Docks and Shipping at Doña Cecilia. 1903.

44. Ferro-Carril y Diques en Doña Cecilia. 1903.
Railway and Docks at Do a Cecilia. 1903.

45. Aduana en Construccion y Rio Pánuco. 1901.
Custom House in Construction and Panuco River. 1901.

46. Aduana en Construccion. 1901.
Custom House in Construction. 1901.

47. Vista del Interior del Almacen, Aduana en Construccion, Tampico. 1901.
Interior of Wareroom, Custom House in Construction, Tampico. 1901.

48. Muelle de la Aduana en Construccion, Tampico. 1901.
Custom House Wharf in Construction, Tampico. 1901.

49. Protection de Madera en Construccion, Aduana, Tampico. 1901.
Timber Waling in Construction Custom House, Tampico. 1901.

50. Muelle antes de la Ereccion del Tinglado, Aduana, Tampico 1901.
Wharf Before Erection of Shed, Custom House, Tampico. 1901.

51. Tinglado en Construccion, Aduano, Tampico. 1901.
Erecting Shed, Custom House, Tampico. 1901.

52. Aduana, Muelle y Tinglado Concluido, Tampico. 1902.
Custom House, Wharf and Shed Completed, Tampico. 1902.

53. Aduana y las Operaciones Comerciales, Tampico. 1903.
Custom House and its Commercial Operations, Tampico. 1903.

54. Fotografis de los Modeles de Relieve
Photograph of Rel ef Models.

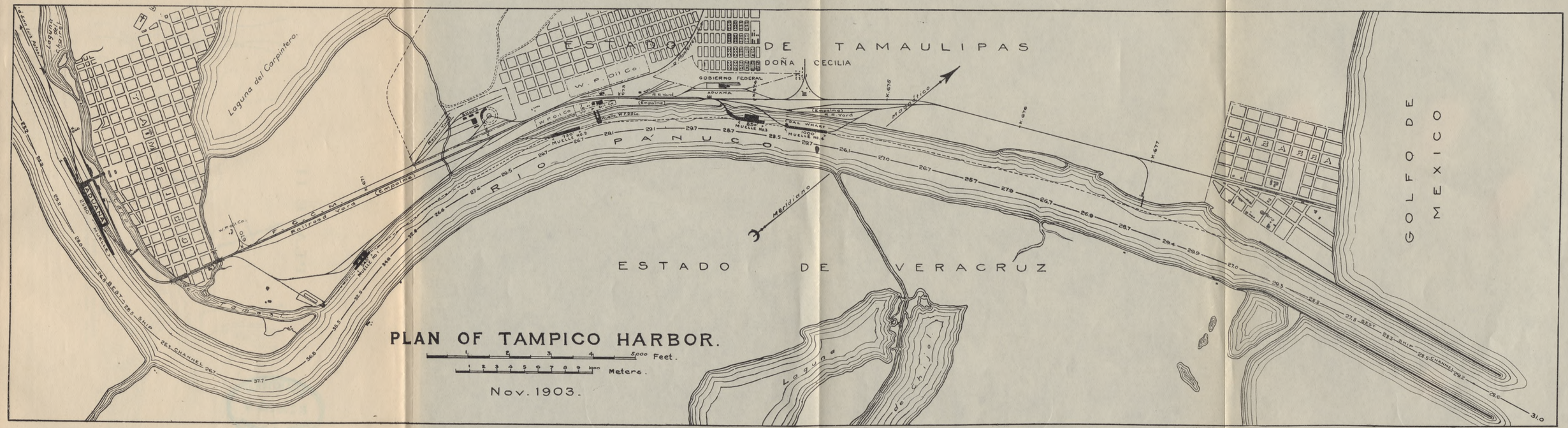
APPENDIX II.

Statement of Tonnage and Values of Exports and Imports via the Various Sea Ports and Gateways of Mexico.

(Values of Exports are in Mexican Silver. Values of Imports are in Gold.)

Fiscal year ending June 30.	TAMPICO.		EL PASO.		EAGLE PASS.	VERA CRUZ.		LAREDO.	OTHER PORTS AND GATEWAYS.	TOTAL VALUE.
	Metric Tons.	Value.	Metric Tons.	Value.	Value.	Metric Tons.	Value.	Value.	Value.	
EXPORTS.										
1885	8,645	$869,480.65	.....	$9,839,057.24	$505,232.93	16,764	$19,651,196.48	$1,440,902.71	$14,364,974.99	$46,670,845.00
1886	8,326	879,895.71	.....	10,577,925.14	788,284.52	17,511	17,425,828.17	1,337,916.24	12,637,867.61	43,647,717.39
1887	12,126	762,896.26	.....	10,641,034.55	507,595.45	17,467	20,168,149.32	1,424,028.91	15,688,225.56	49,191,930.05
1888	8,952	719,789.06	.....	12,022,678.45	874,572.62	19,372	16,067,992.84	1,215,515.04	17,985,360.37	48,885,908.38
1889	7,235	658,022.75	72,866	15,492,955.33	2,195,586.00	21,645	19,532,519.07	2,240,521.52	20,038,818.35	60,158,423.02
1890	7,821	718,125.10	58,013	15,137,724.50	2,521,946.74	28,059	20,115,353.85	3,047,864.71	20,958,373.79	62,499,388.69
1891	7,892	1,075,121.13	85,112	14,301,855.87	2,698,218.71	28,676	20,533,460.73	3,332,243.57	21,335,495.33	63,276,395.34
1892	10,599	3,596,119.71	121,138	16,859,696.03	2,986,294.60	30,194	26,463,287.39	4,847,371.77	20,714,945.45	75,467,714.95
1893	14,150	8,844,537.00	128,682	16,803,659.00	2,375,396.00	31,812	28,073,101.00	6,520,507.00	24,892,021.00	87,509,221.00
1894	49,856	10,967,448.00	107,478	15,701,714.00	2,662,975.00	38,100	22,977,860.00	4,601,913.00	22,431,377.00	79,343,287.00
1895	75,255	15,546,228.00	89,467	14,255,800.00	2,850,062.00	43,425	27,413,009.00	3,016,000.00	27,773,854.00	90,854,953.00
1896	84,213	23,920,464.00	120,184	19,599,797.00	3,065,014.00	35,257	22,354,298.00	3,311,273.00	32,766,056.00	105,016,902.00
1897	101,392	29,952,441.00	122,694	17,929,521.00	2,888,535.00	32,749	22,484,633.00	3,701,086.00	34,390,278.00	111,346,494.00
1898	129,760	36,492,544.00	136,663	19,583,522.00	3,089,394.00	44,692	27,779,298.00	4,158,675.00	37,869,316.00	128,972,749.00
1899	130,898	40,715,602.00	181,036	14,350,931.00	3,047,046.00	69,769	28,344,893.00	6,451,986.00	45,567,668.00	138,478,126.00
1900	142,836	39,989,700.00	124,378	17,234,803.00	2,412,227.00	73,319	25,439,947.00	5,455,611.00	59,524,072.00	150,056,360.00
1901	145,184	43,877,124.00	130,064	21,481,108.00	6,287,077.00	43,961	21,892,184.00	6,948,354.00	48,173,154.00	148,659,001.00
1902	167,337	46,900,359.00	40,276	10,724,500.00	5,677,603.00	51,055	26,497,693.00	6,397,761.00	59,970,229.00	156,168,145.00
IMPORTS.										
1886	10,248	.....	.....	.....	.....	.....	.....	.....	.....	.....
1887	10,278	.....	.....	.....	.....	.....	.....	.....	.....	.....
1888	11,774	.....	.....	.....	.....	.....	.....	.....	.....	.....
1889	12,774	$513,927.15	72,993	$5,793,960.86	$2,732,367.00	.....	$16,445,569.00	$5,728,029.06	$8,811,041.25	$40,024,894.32
1890	16,430	757,029.08	75,288	10,063,672.16	3,394,366.00	.....	19,203,600.00	7,435,727.26	11,164,264.39	52,018,658.89
1891	43,770	.....	47,470	.....	.....	.....	.....	.....	.....	.....
1892	51,626	.....	70,818	.....	.....	.....	.....	.....	.....	.....
1893	98,242	2,649,993.00	84,176	4,494,359.00	4,149,689.00	162,957	14,643,276.00	9,012,965.00	8,462,849.00	43,413,131.00
1894	117,956	2,492,084.00	25,602	2,878,887.00	1,748,426.00	100,202	12,614,905.00	3,990,777.00	6,562,410.00	30,287,489.00
1895	166,853	3,642,007.00	28,430	2,571,977.00	2,386,451.00	169,293	16,123,505.00	3,449,802.00	5,826,698.00	34,000,440.00
1896	188,313	8,685,442.00	35,494	2,677,525.00	4,228,658.00	151,331	15,296,544.00	3,868,956.00	7,496,813.00	42,253,938.00
1897	339,825	8,773,275.00	122,100	2,910,359.00	4,710,415.00	200,530	14,036,136.00	4,693,818.00	7,080,092.00	42,204,095.00
1898	344,282	7,417,665.00	101,881	4,302,119.00	2,271,828.00	268,658	17,653,750.00	4,892,196.00	7,065,934.00	43,603,492.00
1899	382,319	8,223,017.00	108,760	4,321,935.00	3,146,119.00	328,779	21,118,723.00	5,617,929.00	8,441,471.00	50,869,194.00
1900	505,427	10,367,787.00	209,296	5,550,026.00	5,878,416.00	310,567	21,990,838.00	6,733,366.00	10,797,742.00	61,318,175.00
1901	522,774	9,712,956.00	143,096	5,593,597.00	5,694,457.00	355,930	22,328,154.00	8,073,860.00	13,680,428.00	65,083,452.00
1902	541,818	10,279,068.00	123,664	7,554,962.00	4,810,637.00	411,257	20,986,963.00	7,145,171.00	13,871,973.00	64,648,774.00

PLATE I.


ESTADO DE TAMAULIPAS
ESTADO DE VERACRUZ
RIO PANUCO
GOLFO DE MEXICO
Laguna del Carpintero
DOÑA CECILIA
GOBIERNO FEDERAL
ADUANA
W. P. Oil Co.
F. C. N.
Railroad wye (Empalme)
Meridiano
LA BARRA
Laguna de Chijol
PLAN OF TAMPICO HARBOR.
5000 Feet.
1000 Metres.
Nov. 1903.

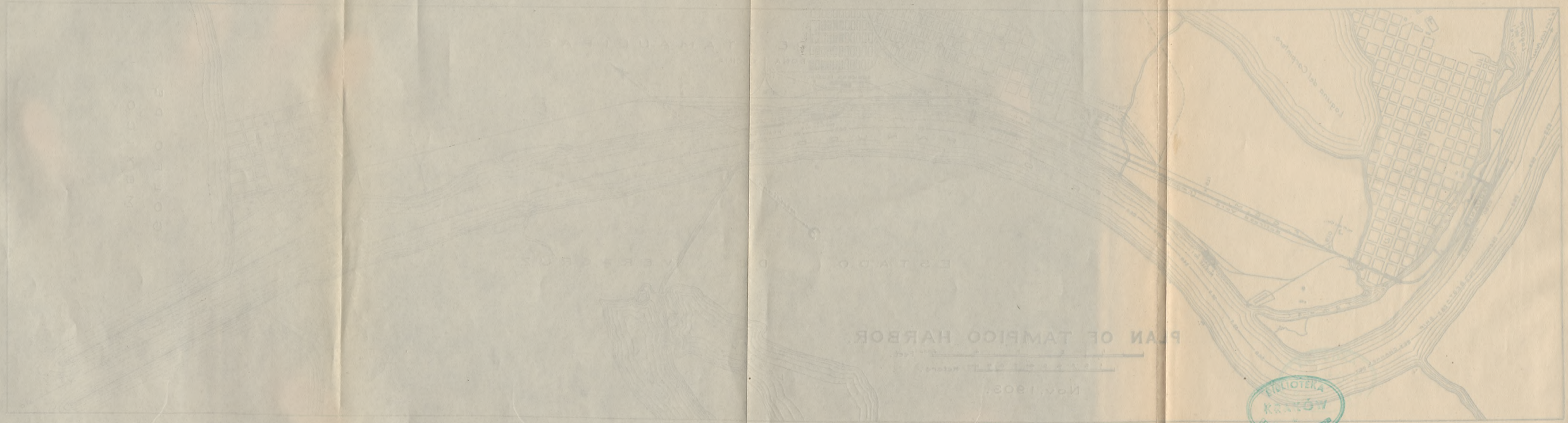
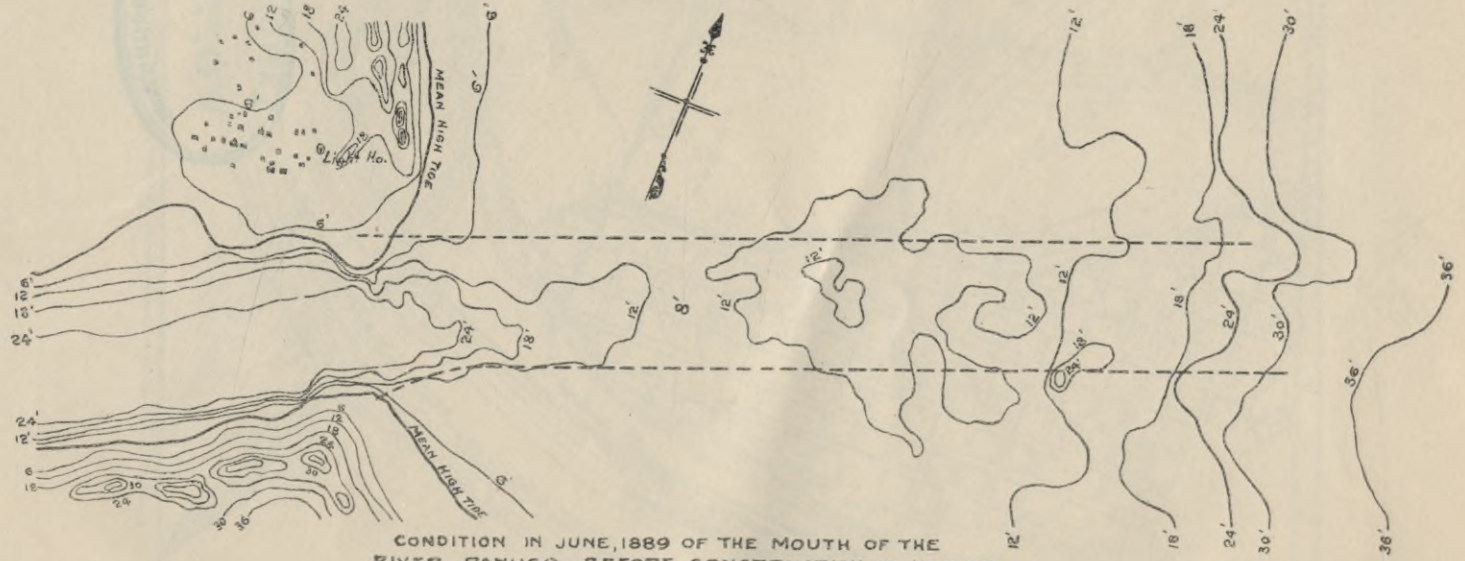


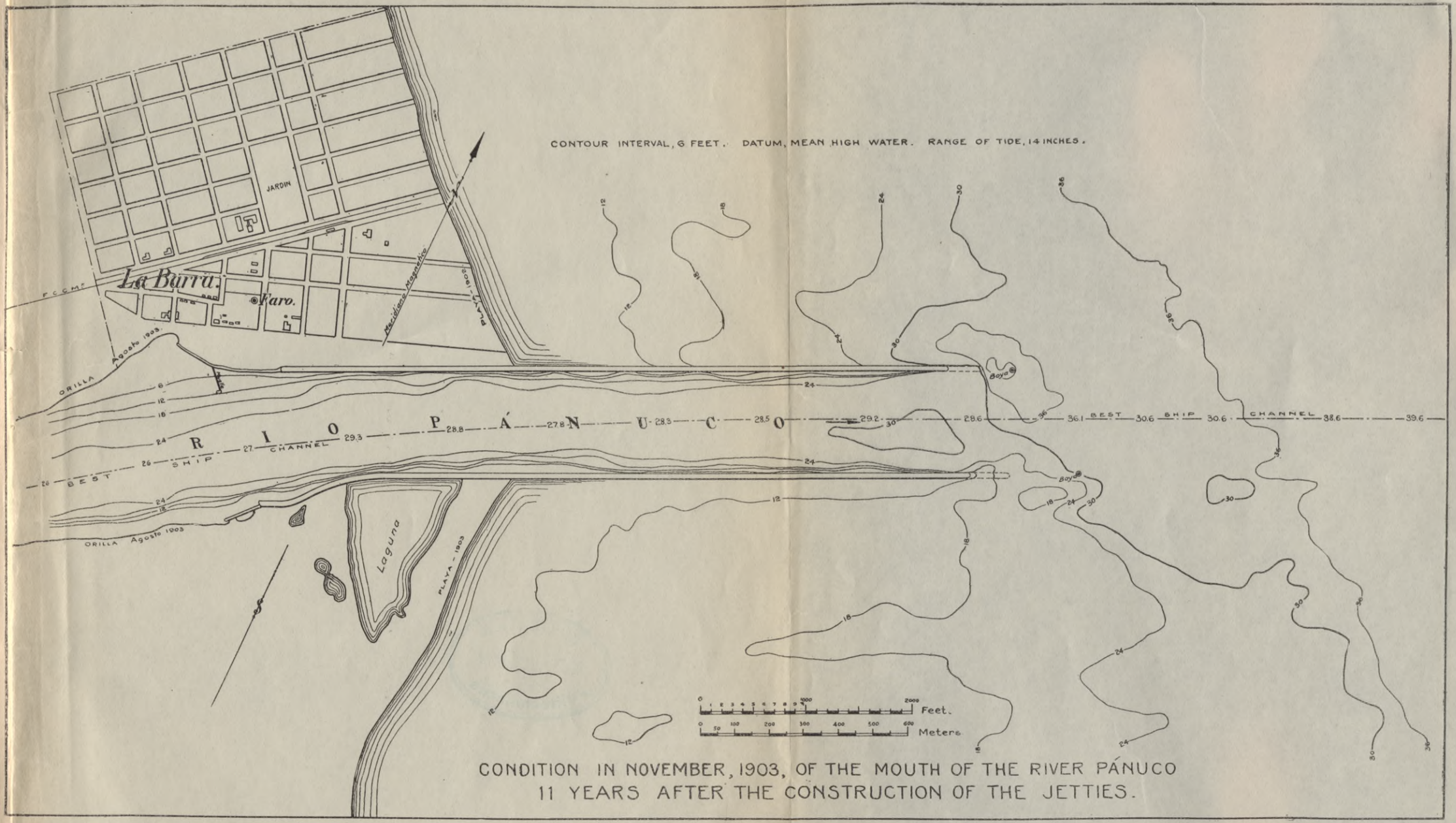
PLATE II.

PLATE II.



CONDITION IN JUNE, 1889 OF THE MOUTH OF THE RIVER PANUCO BEFORE CONSTRUCTION OF JETTIES.

PLATE III.



CONDITION IN NOVEMBER, 1903, OF THE MOUTH OF THE RIVER PÁNUCO
11 YEARS AFTER THE CONSTRUCTION OF THE JETTIES.

Bourne & Co. PRINTERS & STATIONERS. 81 Beaver St.