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THE PORT OF HAVRE

BY

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THE PORT OF HAVRE.

GEOGRAPHICAL AND HYDROGRAPHICAL INFORMATION.

Havre is situated on the northern bank of the mouth of the Seine. The city occupies the western extremity of a plain, slightly elevated above the level of high tide. Within a few years it has extended to Ingouville Heights, which limit the valley of the Seine.

Very favorably situated for commerce, Havre is the nearest seaport to Paris, its distance being only 228 kilometres by rail. It communicates with this city and with the network of navigable waterways of France by the Seine and the Tancarville Canal.

Havre is the first large port which incoming ocean steamers make. Nearer to the north and the east of France and Switzerland and a part of Southern Germany than Hamburg and Bremen are, it has especially to fear the competition of Antwerp and Dunkirk.

In coming from the west, after passing the Cape of Barfleur, the first land seen contains the mouth of the Seine. Toward the left the chalk cliffs of Caux extend indefinitely, assuming a dazzling whiteness when lighted by the rays of the sun. On the right are seen the hills bordering on the left bank of the Seine from Honfleur to Dives. Their rounded contours, and especially their sombre tints, suffice to distinguish them from those on the north bank of the river.

The Cape de Hève forms the south-west point of the cliffs of Caux. It is distinguishable at night by an elec-

tric flashing light, emitting flashes of white light every five seconds, preceded and followed by total eclipses. Accompanying this light is a fixed light of the fifth order on a neighboring tower.

The great roadstead is an anchorage at sea, exposed to the violence of winds and waves from the north north-east to the south-west, passing by the west. The small roadstead is in the space enclosed between the banks called the Roadstead Heights and the coast of Havre to the Cape de Hève. The land shelters it perfectly against the winds from the north north-east to the east south-east, passing by the east; but it is open to all the other winds.

At different times the propriety of establishing a longitudinal dyke has been discussed, but it has not been undertaken on account of the silting up of the roadstead. The shoals which are between the great and little roadsteads are indicated by nine buoys, two of which are illuminated. A tenth buoy, with a flashing light, indicates the depth of 0.40 metre, the eastern limit of the port channel. Beyond, an automatic whistling buoy (Courtenay System), anchored in November, 1877, indicates the entrance to Havre in case of fog.

The large ships double the heights and enter the port at the south-west. The draught of the ships entering Havre is limited by the depth of water at high tide on the shoals at the entrance of the port, extending seaward for about a mile. The bottom of the pass is not absolutely fixed: it is subject to more or less variation. From one survey to another, the depth of each point changes from 0.50 to 0.80. On this shoal there are points often marked 2 metres below the zero of the chart. We cannot, then, reckon at high tide on a greater depth than 2 metres above the zero of the charts.

The entrance to the port is marked by beacons established on each of the piers, and by a range light placed on the grand quay, as well as by a fog-horn which sounds during a fog.

CURRENTS AND TIDES.

The flood-tide begins to be noticeable at the meridian of Hève and Trouville about four hours and a half before the hour of high tide at Havre. It preserves its velocity so that the water continues its movement toward the east.

But, on account of the convergence of all the currents toward the bay, the Seine is filled before the hour of high tide. A part of this water then fills the Seine dykes, while the rest flows toward the north and the north-west by crossing the bay.

The water which flows to the north of the mouth of the Seine takes an inverse movement to that which it had formerly. The reverse current has received the name of *Verhaule*: it begins below. The *Verhaule* gains quite suddenly a great velocity, which it maintains for a long time. At the extremity of the piers of Havre its intensity is greatest about twenty minutes before the hour of high tide, and it continues twenty minutes after. This current is the last act of the flood-tide: it is this which fills the port. But, by its perpendicular direction at the piers and the coincidence of its maximum intensity with the moment of high tide, it renders the entry of the port difficult, particularly when the winds shift from the south-east to the south-west by the south. After high tide the current diminishes little by little, and it has almost entirely ceased when the ebb-tide begins. The entering ships are then subjected to the action of a normal current at the piers, which forces them to make the port by the south-west; but, when they are once in the channel and partly screened by the south *jetée*, the current then only acts abaft, while the bow is acted upon by the reflected current from the southern *jetée*.

The ships are then subjected to a rotating couple, which turns them and throws them upon the works. The captains and pilots must take account of these circumstances to steer properly in the channel between the *jetées*.

The levels of the tides with reference to the zero of the charts are as follows:—

	Metres.
Low tide at equinoctial spring-tide,	0.30
Low tide at ordinary spring-tide,	0.65
Low tide at ordinary neap-tide,	2.65
Mean level of the sea,	4.50
High tide at ordinary neap-tide,	6.15
High tide at ordinary spring-tide,	7.85

HIGH TIDE AT EQUINOCTIAL SPRING-TIDE.

The tidal curve is not symmetric. The ascending branch is shorter than the descending, and the difference increases as the height of the tide. The space of time during which the height of the tide is maintained constant is about eleven minutes; but, admitting a variation in level of 0.30 metre, the duration amounts to an hour. This peculiarity of the tidal curve is very advantageous for navigation: it allows the docks and basins to remain open about three hours.

Within a few years, important modifications have taken place in the *régime* of the currents and tides. The *Ver-haule* begins from twenty to thirty minutes earlier than formerly, and its maximum velocity is considerably augmented; that is, from 1.8 metres to 2.5 metres for tides having the coefficient of 100.

These perturbations are due to the artificial dykes of the Lower Seine, which have modified the form and the relief of the estuary. They are of such a nature as to make the entry into the port of Havre a source of considerable danger. Consequently, the plan of making a new entrance in a portion more sheltered from siltings has been for some time under discussion.

DESCRIPTION OF THE PORT.

The port of Havre is composed of a channel enclosed between two *jetées*, an outer harbor of nine docks, eleven

navigable locks, and six graving-docks. Three sluices, or locks, connect certain basins.

CHANNEL, OUTER HARBOR.—The channel is directed south-west, toward the mouth of the Orne. Its length is 452 metres, and its minimum width 100 metres. The Calvados side is 18 miles away. Two breakwaters are situated behind the northern *jetée* and a third is beyond the southern *jetée*.

The outer harbor has an area of 21.85 hectares, and comprises the Florida annex. Its width varies from 186 to 290 metres. The distance from the southern pierhead to the lower end of the outer harbor is 760 metres. The quay walls of the outer harbor are 1,985 metres long. The available area is 4 hectares.

DOCKS.—The total area of the nine docks is 74.18 hectares; and their total length 12,265 metres, of which 11,420 is available. The storage area, deduction being made for street service and tracks, is 43.49 hectares.

The arrangement of the different basins is as follows:

BASINS.	AREA OF THE WATER SURFACE.	LENGTH OF QUAYS.		STORAGE AREA ON THE QUAYS.
		TOTAL.	AVAILABLE.	
Royal,	1 h. 20 a.	410 m.	400 m.	0 h. 39 a.
Barre,	5 h. 10 a.	1,180 m.	1,100 m.	3 h. 00 a.
Citadel,	6 h. 00 a.	1,320 m.	1,165 m.	4 h. 10 a.
Eure,	21 h. 30 a.	2,050 m.	1,940 m.	7 h. 33 a.
Commerce,	5 h. 40 a.	1,260 m.	1,235 m.	2 h. 70 a.
Vauban,	7 h. 77 a.	1,940 m.	1,830 m.	5 h. 13 a.
Dock,	4 h. 40 a.	1,240 m.	1,180 m.	2 h. 40 a.
Bellot,	21 h. 21 a.	2,655 m.	2,380 m.	17 h. 96 a.
Florida,	1 h. 80 a.	210 m.	190 m.	0 h. 48 a.
Totals,	74 h. 18 a.	12,265 m.	11,420 m.	43 h. 49 a.

The Royal, the Barre, and the Eure basins communicate directly with the outer harbor. The Citadel basin communicates with it by means of a lock or half-tide basin. The five other basins—namely, the Commercial, the Vauban, the Dock, the Bellot, and the Florida—discharge into the first by means of locks, or intermediate sluices.

The following table shows the lengths of the locks and sluices, as well as the level of the mitre-sills:—

LOCK OR SLUICE.	CONNECTING THE	WIDTH AT THE COPING.	FLOOR LEVEL WITH RESPECT TO DATUM.
Notre Dame, . .	Outer harbor and the Royal basin,	16.00 m.	1.15 m.
De la Barre, . .	Outer harbor and the Barre basin,	13.64 m.	1.15 m.
Aval du Sas, . .	Outer harbor and the Lock basin,	16.16 m.	—1.65 m.
Amont du Sas, .	Lock and the Citadel basin,	16.00 m.	0.65 m.
Transatlantiques,	Outer harbor and the Eure basin,	30.50 m.	—2.85 m.
Lamblardie, . .	Royal Basin and the Commerce basin, . .	13.64 m.	1.55 m.
Angoulême, . .	Commerce and Barre basins,	13.64 m.	1.35 m.
Vauban,	Barre and Vauban basins,	12.00 m.	1.60 m.
L'Eure,	Vauban and Eure basins,	16.00 m.	0.00 m.
Dock,	Eure and Dock basins,	16.00 m.	—0.65 m.
Citadelle, . . .	Citadel and Eure basins,	16.00 m.	0.65 m.
Bellot,	Eure and Bellot basins,	30.00 m.	—2.65 m.
Chevalier, . . .	The two darses in the Bellot basin, . . .	30.00 m.	—2.20 m.
St. Jean,	Eure and Florida basins,	21.00 m.	0.15 m.

The object of the lock, or half-tide basin, of the Citadel is to prolong the tide, which is limited in the other locks to about three hours: it locks the ships which wish to enter or go out at other times than that of high tide. The locks are provided with only one pair of ebb-gates, with the exception of the Transatlantic locks, which have two. The Vauban lock is the only one which has both ebb and flood gates. The gates of the Eure and Dock locks were removed when their floorings were lowered, and they have never been replaced.

All these gates have two equal leaves, except those of the Notre Dame lock: they are all of wood except the gates of the Transatlantic, and Bellot locks, which are of iron. The passage over the locks and sluiceways is effected by bridges. Two-tracked, single-spanned swing bridges have generally been substituted for the old and complicated ones. These are economically constructed and easily manœuvred. The Transatlantic, Florida, Saint John, and Dock bridges are double-spanned. The Saint John and Florida bridges are the only ones which have only a driveway.

The width of the quays is from 20 to 25 metres around the old basins; it is from 50 to 60 metres for those more recently constructed, and is 70 and 115 metres at the Bellot basin. These dimensions comprise a driveway of 8 to 11 metres in width. Three lumber wharves are situated at the Barre, Vauban, and the Eure basins: they are respectively 70 metres, 100 metres, and 45 metres long. The bridges, gates, and sluices of the locks debouching into the outer harbor and the Bellot lock, as well as the bridge of the sluice uniting the two divisions of the Bellot basin, are manœuvred by hydraulic power. The hydraulic capstans serve equally for hauling ships crossing these different locks and sluices.

Since June 1, 1881, the channel, the outer port, as well as the locks uniting the Royal, the Barre, the Citadel, and the Eure basins, have been lighted by electricity for night tides. The service works very regularly, to the great benefit of navigation; and this lighting was extended to the Bellot lock in 1891.

GRAVING-DOCKS.—Six graving-docks have been constructed by the government for the inspection and repair of ships, which are operated by contract; also a gridiron, a floating dock, and three pontoons. The graving-docks are situated in the Citadel basin: the three others lead to the Eure basin. All these ways are closed by means of floating ship-gates.

The principal dimensions of these works are given in the following table:—

DESIGNATION.	CITADEL GRAVING-DOCKS.			EURE GRAVING-DOCKS.		
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
Length on keel blocks, . .	45.00 m.	61.50 m.	76.00 m.	130.00 m.	150.00 m.	115.00 m.
Maximum length of ships admitted,	48.50 m.	68.00 m.	83.00 m.	155.00 m.	171.00 m.	130.00 m.
LOCK.						
Width of coping,	11.00 m.	13.00 m.	16.00 m.	30.12 m.	20.00 m.	16.00 m.
Width at the springing line of the flooring,	9.25 m.	11.12 m.	14.00 m.	28.12 m.	17.96 m.	14.18 m.
Level of the flooring, . .	2.15 m.	1.65 m.	1.15 m.	-0.85 m.	-0.85 m.	0.00 m.
Height of water upon the flooring at high tide of ordinary neap-tide,	4.00 m.	4.50 m.	5.00 m.	7.00 m.	7.00 m.	6.15 m.
Height of water upon the flooring at high tide of ordinary spring-tide,	5.70 m.	6.20 m.	6.70 m.	8.70 m.	8.70 m.	7.85 m.
GRAVING-DOCK.						
Width of coping,	15.00 m.	17.00 m.	20.00 m.	34.52 m.	27.44 m.	23.44 m.
Width at the springing of the lock walls,	9.25 m.	11.15 m.	14.12 m.	28.12 m.	18.00 m.	14.18 m.

At the graving-docks Nos. 4 and 5 a second hollow quoin for the floating gate has been placed 14.30 metres beyond the first. The Transatlantic steamers are placed in graving-dock No. 4, with the floating gate in its usual position. The graving-docks of the Citadel, at high tide, debouch at low tide, the water running into the outer harbor. At dead low water, there remains to be pumped out a depth of water varying in height with the level of the low tide. The graving-docks of the Eure basin can be emptied only by means of pumps. This is done in less than three hours.

The floating-dock placed in the Barre basin in 1884 is a great rectangular wooden structure, 65 metres long, 19.50 metres wide, and 7.40 metres high, closed at one end by a gate turning round a horizontal axle. It can raise a ship of 800 tons in four hours.

The gridiron is 47.60 metres long and 11 metres wide. The tops of the keel blocks are at the reference (3.65 metres); that is, 1 metre above the level of the lowest neap-tides. It is therefore covered at high tide with 4.20 metres of water and 2.50 metres water at neap-tide. The pontoons accommodate vessels of 1,200 tons: they serve also for repairing old wooden ships.

THE REMOVAL OF THE SILT FROM THE PORT.—Scouring was for a long time employed to keep the channel clear; but it had to be abandoned, as it was found inefficient.

The maintenance of the depths in the outer harbor is accomplished by dredging. Silting does not take place regularly. In fine and calm weather it is slight, while it is considerable during tempests, and particularly when violent winds occur during a freshet of the Seine.

Beyond the northern pier, the siltings are almost nothing. In the portion included between the extremities of the two piers they produce an annual deposit of 20,000 cubic metres, and form two points, starting from the south *poulier*, and tend to close the channel.

In the outer harbor, the deposits are divided unequally, — almost none at the foot of the quay walls, founded at a high level, and in front of which a sloping berme is made; they attain up to 1.20 metres per year in the deeper portions (we may estimate it on an average at 0.35 per square metre, counting the whole surface of the outer harbor).

The height of these annual deposits exceeds 0.04 metres in the basins communicating directly with the outer harbor. It is about 0.03 for the others, and amounts to 0.17 in the lock chambers. These deposits appear to have notably increased within a few years.

EQUIPMENT.—Railroads in direct communication with the western system are laid down around the basins of the Citadel, Eure, Dock, Vauban, and Bellot, upon the south-east and north-east quays of the Barre basin, and on the east quay of the outer harbor.

These roads connect with the warehouses and large stores. A maritime station is situated at the east of the Bellot basin, and side tracks are laid between the Barre and Citadel basins.

The Chamber of Commerce has built sheds around the basins of the Eure and the Citadel and the dock west of the Bellot basin. These constructions, nineteen in number, have a total length of 2,137 metres and a surface of 63,215 square metres: their length varies from 15 to 55 metres. Several of these sheds are let by the year to navigation companies, the others being at the disposal of the public.

The Chamber of Commerce has, besides, a complete outfit for the handling of merchandise; namely, thirty-four hydraulic cranes of from 400 to 1,250 kilogrammes, and twelve steam-cranes of from 1,000 to 1,500 kilogrammes.

The Dock Warehouse Company has the monopoly of the warehouses: it controls the Dock basin and the South Vauban quay for a length of 460 metres. The quays north and south of the Dock basin, being each 555 metres in length, and the South Vauban quay, 460 metres, are provided with sheds. The Warehouse dock has a total area of 183,500 metres. It includes 37,300 metres of sheds, 37,400 metres of covered way, 39 storehouses, having an area of 59,300 metres and a capacity of 150,000 tons of merchandise, and six cellars for wines and spirits,—a total area of 8,300 metres, or 8,000 tons' capacity.

Five other storehouses, not being on the edge of the quays, are at the disposal of the public. They are called the general and public warehouses, the Pont-Rouge docks, the Paris, the Briquet, and the public and commercial warehouses. Three masting-sheers and five fixed cranes are for public use. The masting-sheers are erected on the banks of the Commerce, Vauban, and Eure basins, and raise respectively 50, 30, and 100 tons. The power of the cranes varies from 6,000 to 14,000 kilogrammes.

Besides this apparatus, which may be used by the public and which has been the object of judicial concession, there have been erected on the quays, by prefectorial decree, a large number of sheds, tents, and cranes for the use of navigation companies or private individuals who have built them. The most important of these constructions are the following:—

Those of the General Transatlantic Company, covering an area of 4,170 metres.

Those of the Hamburg-American Company, covering an area of 945 metres.

Those of the Southampton Boats, covering an area of 340 metres.

The General Transatlantic Company has a floating sheers capable of raising 30 tons. Seven weighing platforms have been erected by the city of Havre for the weighing of merchandise at different parts of the harbor: their use is gratuitous.

WORKS IN PROGRESS OF EXECUTION OR PROJECTED.

The interior of the port of Havre now is in a satisfactory condition. It is being further improved by the construction of a tenth dock for the use of the petroleum trade.

This dock is near completion. It has an area of 1.50 hectares and a perimeter of 575 metres. It is situated at the east of the Bellot basin, with which it communicates by a sluice 17 metres wide, of which the flooring is at the reference (−2 metres). The depth of water in this basin is 8.15 metres at high neap-tide. Provisions are made to allow the rapid carrying away of petroleum brought by sea or for its warehousing close to the basin.

But the entrance of the harbor is not quite satisfactory.

It lacks in depth. Moreover, it is in danger of silting, and large ships can enter the basins only during three hours of each flood-tide. In order to remedy this diffi-

culty and to prolong the Seine dykes, works demanded for the benefit of the port of Rouen, it is indispensable to make a new entrance to Havre.

A project for this is under consideration, and will soon be submitted to Parliament. It consists of:—

1. The construction in front of the entrance of the present harbor of a new outer harbor, accessible by two exterior entrances, one directed toward the west and the other toward the south-west, where the depths necessary for navigation will be realized and sustained by means of dredging.

2. The removal of the northern and southern *jetées* and a part of the Florida bridges, to allow an easy and direct access to the present outer harbor, or tidal port, notably increased, and the construction of a quay in this new part of the port, with foundations laid at great depth, where the incoming ships may float at all times without having to enter the docks.

3. The construction of a lock practicable for the large ships during at least half of the tide, and giving access to the basins from the outer harbor.

The new outer harbor is included between two converging dykes, directed seaward: the north dyke, 550 metres long, starts from the spurs; while the southern dyke, 625 metres long, is joined by a temporary coffer-dam and by the new tidal quay with the Saint John dyke, on a level with the Florida bridges on the central basin.

The outer harbor is excavated to a depth of 4.50 below the datum plane. The entrance pass, through the actual shoals from 2.20 to 2.50, is to be dredged to the same depth. It will be 200 metres wide between the pierheads.

The principal, or western, pass will be dredged to the reference (-4.50), without this dredging necessitating a deepening of more than 0.50 metre to 1.50 metres, except at the immediate approaches of the port. This pass, as well as the outer harbor, will have a depth of at least 9 metres during six hours of each tide, which will allow

ships drawing 8 metres to enter the port for the same interval of time. A draught of 7 metres sufficient for ships of 6 metres draught will be assured during slack water.

The lock facing the entrance to the new outer harbor takes the place of the Florida dock, and connects the outer harbor with the Eure basin. The chamber is 225 metres long and 30 metres broad. An intermediate gate divides it into two chambers, 120 and 75 metres long respectively.

The reference of the upper flooring of the outer lock is (-4 metres), which suffices for the lockage of all ships which have gone over the pass. The reference of the upper flooring of the inner lock is (-3 metres), thus assuming a minimum draught of 8.50 metres, corresponding to the lowest level maintained in the basins during slack water.

COMMERCIAL AND STATISTICAL INFORMATION.

The following statement shows the increase for the last twenty-three years, in number and tonnage of the vessels entering the port of Havre:—

1870.	Number foreign and colonial vessels,	2,849.	Tonnage, 1,206,292
1870.	Number coasting vessels,	2,890.	Tonnage, 226,358
	Total,	<u>5,739.</u>	<u>1,432,650</u>
1892.	Number foreign and colonial vessels,	2,374.	Tonnage, 2,122,487
1892.	Number coasting vessels,	3,638.	Tonnage, 489,345
	Total,	<u>6,012.</u>	<u>2,611,832</u>

These figures do not include the daily passenger boats between Havre, Honfleur, and Trouville, having a tonnage of from 143 to 189.

EXPORTS AND IMPORTS.—The following statement shows the increase in the total weight in tons of the imports and exports during an interval of twenty-two years:—

1870. Foreign and colonial imports,	972,954.	Exports, 335,025
1870. Coasting trade,	112,379.	Exports, 300,201
Total exports and imports,		1,720,559
1891. Foreign and colonial imports,	2,137,749.	Exports, 621,561
1891. Coasting trade,	231,592.	Exports, 392,157
Total exports and imports,		3,383,059

The principal articles of importation are cotton, wool, coffee, woods, tobacco, skins, oil, iron, grains, etc. The exports consist especially of valuable merchandise of comparatively slight bulk, such as tissues, trimmings, ribbons, silks, sugar, wines, pottery, glass, etc.

PASSENGERS.—The regular lines of ships carry passengers. The steamers plying between Honfleur, Trouville, Caen, Southampton, New York, and the Antilles are arranged to accommodate travellers. The steamers of the General Transatlantic and the American-Hamburg Companies take a great number of emigrants.

In 1891 there were thus transported from Havre:—

1st PASSENGERS.		
	Departures.	Arrivals.
Transatlantic lines,	9,341	21,876
English-French lines,	8,073	7,704
Coastwise, Continental lines,	1,813	1,896
Honfleur, Trouville, and Caen lines,	164,462	162,263
Total,	183,689	193,739

2d EMIGRANTS.	
North America (United States and Canada),	32,932
Central America (Columbia, Antilles),	120
South America,	1,878
Total,	34,930

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Embarcadere de la Seine

MAP OF PORT OF HAVRE.

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