SOME FACTORS IN THE INDUSTRIAL DEVELOPMENT OF THE PORT OF HOUSTON

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No southern city has displayed a more vigorous growth than Houston, although its development was delayed. Fifty years ago it was the equal of Galveston in population; today it is almost ten times as large. It would be an interesting story indeed to trace the industrial development of Houston from the day the first sawmills were built on the banks of Buffalo Bayou, more than a century ago, to the present-day city, a great agglomeration of industrial establishments. It was in the sawmills and gristmills that the men of the early settlement found employment. From a meager beginning in industry the city with its port accessions has come to be one of the large metropolitan centers of the South with a volume of commerce exceeded only by New York City.

Houston lies inland on the Texas Cretaceous plain a distance of about fifty miles from the Gulf of Mexico. On the plain, cattle, cotton, and rice thrive, and below it in great abundance are oil, gas, sulfur, and salt. Not far to the north are forest resources. Farther inland to the north and northwest are large grain-producing areas. It is the use and movement of these products and their derivatives, in cooperation with other factors or conditions, that have contributed to the rapid rise of a great industrial center and a great ocean port.

Here is an example of a city that dug its way to the sea, for before the opening of the Houston Ship Canal, constructed at a cost of more than $250,000,000, Houston was nothing more than a small town at the back door of Galveston. Man built the harbor and nature furnished the productive hinterland.

A study of the industrial development of Houston is inseparable from a study of the Houston Ship Canal, for the canal has been one of the prime factors in the industrial growth of the city. But Houston is more than a great seaport. It is to some extent a crossroads for many types of transportation. It is an important rail hub with six trunk-lines connecting overland with Canada and Mexico. There is a good highway network radiating from the city, very effectively serving truck traffic. Houston is also well served by airlines, three of which render international service, and miles of buried pipe lines converge on the city.

Inasmuch as the Houston Ship Canal has meant so much to the city, it is first analyzed as a factor in industrial growth. From Bolivar Roads, the outer entrance to Galveston Bay, the Houston Ship Canal extends a distance of approximately 50 miles to the turning basin, which is the head of deepwater navigation and a point only about four miles

from downtown Houston. Following a north-northwestward course across Galveston Bay, the channel enters the mainland 24½ miles from Bolivar Roads. It then follows the course of the San Jacinto River for a distance of 9 miles to the river's junction with Buffalo Bayou. It then extends nearly due west a distance of 16 miles to the turning basin.

From very early days the civic leaders of Houston dreamed of the day when the city would become an inland deep-sea port and their dreams came to full realization in 1915 when regular ocean shipping between the Port of Houston and the Atlantic Coast began. As previously stated, nature offered man considerable encouragement to build a canal, for inland some distance extends Galveston Bay and still further inland the San Jacinto River and Buffalo Bayou. The existence of a waterway from the very beginning of the city's development and the relative ease by which the existing waterway could be improved so as to admit ocean-going vessels were important factors in the undertaking of the construction of a ship canal.

Although there are some defects in Houston's harbor conditions, nevertheless there are many favorable conditions. One of the most favorable conditions so far as industrial development is concerned is the great amount of low shore line of unconsolidated materials. Much of both sides of the channel from Morgan Point to the turning basin is available for the building of wharves or piers and/or the building of industrial establishments. Here we have the example of an attenuated harbor which, of course, has many drawbacks.

There are several streams tributary to the channel now navigable for small craft and shallow-draft vessels. This network of navigable waterways, improvable at a relatively small cost, offers great attractions to industries that are interested in water-borne commerce.

The average rise and fall of the tide on the Houston Ship Channel rarely exceeds 14 inches. The channel is deep enough to accommodate large vessels but not too deep for anchorage, and the bottom is favorable to good anchorage. The harbor is free of ice and relatively free of fog.

Several attempts were made by the people of Houston to have a ship canal constructed to the city. It was not easy to convince people that ships would pass up the port facilities of Galveston in order to reach a port 50 miles inland. The original Houston Ship Canal had a minimum depth of 34 feet, but current authorization calls for a minimum depth of 36 feet throughout the entire course of the channel and at the turning basin. Work toward securing a minimum depth of 36 feet is now underway; however, local interests are requesting Congress for an amended authorization to increase the depth to 40 feet rather than 36 feet along the lower 46 miles of the channel below the Sinclair refinery. A depth of 40 feet would permit the new, deep-draft supertankers to reach the Sinclair refinery.

Houston's harbor on the other hand does possess some defects. Although the harbor is spacious it is

not well arranged, and has the disadvantages of a narrow elongated harbor. The turning basin is only 1100 feet in diameter, adequate for turning the modern tankers and freighters that ply the waterway, but hardly adequate for the large volume of commerce that passes through the port. Furthermore, the channel is somewhat narrow and tortuous in places. It varies in width from 200 feet to 400 feet. The channel cannot be easily negotiated; there is always the danger of bumping into another vessel or a pier.

Although the land is flat and in some places well-drained, there are other places that are low, wet, and poorly drained. There is always the menace of floods due to occasional wind and rain-storms and the region is not free from hurricanes. There is considerable silting in the channel which necessitates costly dredging operations.

Much has been done to negate the unfavorable natural conditions. There has been considerable planning by the Port Commission, shown by the splendid arrangement of the wharves, docks, warehouses, and cargo-handling facilities. There are 79 ships' berths and berthing space for 17 to 25 barges at the port. There is approximately 2,500,000 square feet of transit warehouse space and considerable open space at shipside and in storage yards adjacent to the channel. The generally wide wharf aprons expedite the handling of cargoes. The splendid apron railroad trackage expedites both loading and unloading of cargoes. On the docks one observes the most modern and efficient freight-handling equipment, including locomotive cranes up to 50-ton capacities, a 75-ton stationary crane, magnets and clamshell buckets, lift trucks and pallets, escalators and conveyors, tractors and trailers, and many other mechanical devices for expeditious service.

As a part of the port development, a public grain elevator has been built that has a storage capacity of 3,500,000 bushels of grain. Two ships can be simultaneously loaded at the combined rate of 100,000 bushels per hour. Vessels rarely spend more than 24 hours at the grain berths. Vacuum machines make possible ship-to-car or car-to-ship loading of copra and other bulk materials, and two Link Belt car unloaders can dump seven railroad grain cars per hour. A very valuable addition to the Port's grain-handling facilities is the new gas-fired, direct-heat type grain dryer with a 1500 bushel-per-hour capacity.

The Navigation District maintains a bulk outloading plant designed to handle chemicals, fertilizers, and other similar materials from cars or trucks to ships. Two vegetable oil storage tanks are located near shipside, permitting the handling of oil between ship, tank car, and storage units. At one wharf there are 45,000 cubic feet of refrigerated space.

The Port of Houston is served by six major trunk-line railroads—the Santa Fe, Missouri Pacific, Southern Pacific, Missouri-Kansas-Texas, the Burlington Route, and the Rock Island. In addition there is the public belt railroad on both sides of the canal which connects with the six railroads just mentioned. Known as

the Port Terminal Railroad, it expedites the transfer of cars from one line to another. The efficiency of the Port is determined in a great measure by the prompt handling of cargo to and from the connecting railroads.

To what extent the Intracoastal Canal has contributed to the industrialization of the Port of Houston is a question difficult to answer. Petroleum is the largest item moving over the Texas section of the canal, but this product is more likely to move through the Port and out as crude oil rather than move to the port via the Intracoastal Canal as crude oil for refining in the Houston refineries. Large quantities of salt, sulfur, iron and steel, machinery, sugar, molasses, pipe, shells, and sea food also move over the canal. Some of these either originate in the Houston port area or are destined for the area.

All these items are part and parcel of the industrial facilities of the Port of Houston. Relative to industrial development they are both cause and effect. They are significant elements of the industrial pattern.

A port's efficiency to a great extent is determined by those responsible for its operation. The Harris County Ship Channel Navigation District, created by the State Legislature, is responsible for the development and operation of the Port. It has constituted authority to acquire, construct, maintain, and operate wharves, warehouses, grain elevators, bunkering facilities, belt railroads, and other installations incident or necessary to the operation or development of the port and waterways within the district. The Port Commission or Board has jurisdiction and control over the use of the Houston Ship Canal from its beginning in Galveston Bay to the turning basin at Houston 50 miles inland from the Gulf. It goes without saying that the Board must cooperate with the U. S. Army Corps of Engineers.

Many things other than the physical qualities of the harbor and the port facilities have been of great importance in the localization of industry in the Port of Houston. Since the earliest days of Houston, cotton has been one of the principal factors in the growth and prosperity of the area. The pioneer flatboats which first snaked their way along the tortuous turns of Buffalo Bayou came to the infant village of Houston for the purpose of loading cotton from the river-bottom plantations. As more and more of Houston's productive hinterland was put into cotton production, the importance of the Port of Houston as a cotton market increased. It was in part to handle the increasing traffic resulting from the expansion of cotton production that Buffalo Bayou was widened, straightened, and deepened into the Houston Ship Channel. Among the first shipside terminal facilities installed along its banks were vast warehouses and compresses. The cotton warehouses, high-density compresses, and cotton mills constitute some of the most important elements of the industrial landscape. Houston is today one of the world's largest spot-cotton markets and cotton-shipping ports.

Petroleum refining is another important industrial achievement of

the Port of Houston. Petroleum in enormous quantities not only moves to the port from the region roundabout but also from more distant fields in Texas and Oklahoma. The city has thus become a very important producer of gasoline, fuel oils, kerosene, lubricating oils, butadiene, and other refined products.

Closely allied to the petroleum refining industry is the chemical industry, whose raw materials are in part petroleum. Three very necessary items — acids, hydrocarbons, and fresh water—are abundant: acids in sulfur and salt, hydrocarbons in petroleum and natural gas, and fresh water in the streams and underground reservoirs. From the Tampa, Florida, area, phosphate rock is brought by seagoing barges. Today some of the largest plants along the canal are chemical plants, including fertilizer works. The varied products from these plants include sulphuric acid, anhydrous hydrofluoric acid, anhydrous aluminum, chloride, quicklime, hydrated lime, glycerine, alcohol, methylglycol, chemicals for leather, insecticides, superphosphate, ammonium sulphate, phosphuric acid, triple phosphate, and other agricultural chemicals of one type or another. One of the most noticeable developments of the Houston area has been the shift of the busy petro-chemical industries to this section.

A new plant of the Ethyl Corporation is now under construction on a 400-acre site between the Phillips Terminal and the Shell Oil Company's refinery. The two paramount factors determining the location of the plant are the proximity of the raw materials (or at least some of them) and the local concentration of refining industries. Raw materials required for producing tetraethyl lead, ethyl chloride, sodium, and chlorine are metallic lead, common salt, and petroleum gases. Pig lead will be shipped from smelters in the western states and also from Mexican smelters. Salt brine will be piped from nearby wells, and petroleum hydrocarbons will be purchased from local oil refineries.

The forests of the area early gave rise to sawmilling, some of the early mills having been located along the waterway which later was transformed into the Houston Ship Canal. Many of the plants utilizing products of the forest in one way or another are closely related to the chemical industry. Plants using forestal raw materials turn out pulp, book paper, and hydrogen turpentine. One of the most complete paper mills in the entire South is that of the Champion Paper and Fibre Company, located on the canal and possessing its own wharves. The plant, the largest book-paper mill in the South, utilizes pine pulp, which originally could be used only for the production of kraft papers. Several planing mills draw upon the forests of east Texas for their raw materials. The chemical treatment of wood for ties, piling, and for other uses is a large industry.

The manufacture of cement has also become important in the Houston area. Two large plants manufacture high grade Portland and oil-well cement from oyster shells from Galveston Bay, and clay obtained locally. Barge wharfs are maintained by both plants, and barge

transportation is used in the assembly of the raw materials as well as in the marketing of the finished products. Truck and rail transportation are also used in marketing cement.

In addition to the harbor and port facilities, and to the many and varied raw materials, the area also possesses power resources. Petroleum, although a valuable raw material of industry, also becomes a valuable power resource after refining. The availability of diesel oil or other fuel oil has been a very important factor in industrial development. Many of Houston's industrial plants are using fuel oil. Almost all of the railroads use diesel locomotives.

At this point it might be well to emphasize the bunkering facilities of Houston. Since petroleum is so readily available, either diesel or bunker "C" oil is obtainable from any navigation district dock at the turning basin or from the long reach docks by pipe connection. It is thus possible for ships to bunker while loading or discharging cargoes, thus saving time. In 1949 over 1,200,000 tons of bunker fuel were taken aboard ships. Coal-burning ships would not fare quite so well here.

Another important power resource readily available to the region is natural gas from the several gas fields of Texas and Louisiana. Natural gas is a very important fuel in generating electricity in many of the new industries, particularly the chemical industries. Like petroleum it is also both a power resource and a raw material, and is becoming of increasing importance as a raw material. Natural gas can be made to yield, at a reasonably low cost, certain relatively pure and chemically active hydrocarbon gases which are coming to have an increasing demand as raw materials. In the Houston area these hydrocarbon gases are basic raw materials of chemical industries that make synthetics. Hundreds of compounds are already produced from natural gas and the surface has hardly been scratched.