

Urban Development Problems of the Ports of Rotterdam and Amsterdam

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Article abstract

Au cours des siècles, Amsterdam et Rotterdam ont modifié leur site et leur situation en récupérant, pour l'accroissement urbain, des terres submergées, et en creusant fleuves et canaux afin de rivaliser avec les ports que l'Europe Occidentale possède sur la mer du Nord. A cause de certaines différences de situation et de fonction, de l'évolution historique de ces deux villes, de plans présents et passés et de destructions causées par la deuxième guerre mondiale, ces ports ont recours à des méthodes bien différentes afin de résoudre les problèmes que présente l'accroissement rapide de leur population métropolitaine.

Ces problèmes que connaissent toutes les grandes villes modernes s'amplifient lorsqu'il s'agit d'un des endroits les plus peuplés du monde, car manquer de les résoudre entraînerait pour Amsterdam et Rotterdam l'incapacité de continuer à fonctionner comme des régions urbaines normales.

Ces problèmes sont le manque d'espace pour le port, et le manque de facilités industrielles et commerciales ; la nécessité de fournir des moyens de transport efficaces, des logements adéquats et des terrains de récréation pour la population croissante ; la nécessité de veiller à la circulation de plus en plus dense.

En 1962, Rotterdam devint le plus grand port du monde. Mais, bien que possédant un tonnage total inférieur, Amsterdam projette d'augmenter cette capacité de recevoir des cargaisons, ce qui lui permettrait d'offrir des chiffres comparables à ceux que possède aujourd'hui Rotterdam. Les deux villes attirent de nombreuses industries dans cette rapide industrialisation de la Hollande.

Amsterdam cherche à conserver le charme et l'ambiance de la vieille ville et à construire du nouveau en banlieue. Rotterdam, plutôt que de recréer le port, a voulu transformer complètement le coeur de la ville. Ces deux villes offrent un exemple

d'espace vital limité. Aussi doivent-elles envisager l'utilisation de chaque pouce de terrain afin d'en assurer l'emploi rationnel.

Les solutions offertes par les Hollandais pourraient fournir certaines réponses aux problèmes croissants que posent les régions urbaines.

URBAN DEVELOPMENT PROBLEMS OF THE PORTS OF ROTTERDAM AND AMSTERDAM

by

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For over six hundred years, the Dutch ports of Rotterdam and Amsterdam have modified their original site and situation by reclaiming land for urban growth, deepening their waterways, and digging new channels and canals to the open sea in order to compete with the North Sea ports of Europe. Table 1 shows the commanding position of Rotterdam as well as the rapid growth rate of Amsterdam since the Second World War.

Due to differences in location and function, historical evolution, past and present planning laws, and the effects of the Second World War, Amsterdam and Rotterdam are using different methods to solve the problems brought forth by the rapid post-war growth of their metropolitan

Table 1 (1) *Seaborne Goods Traffic in some West European Ports*

(In millions of tons [1000 kg])

	1938	1959	1960	1964
Rotterdam	42	70.7	83.4	113.6
Antwerpen	24	35.2	37	53.3
Hamburg	26	29.1	30.8	35.4
Bremen	9	14.1	15.1	15.8
Emden	8	7.1	10.3	no figure
Amsterdam	6	9.9	10.8	14.7
Ghent	3	2.8	2.7	no figure

areas. These problems, common to all modern cities, become magnified in one of the most densely populated areas in the world where the failure to solve them would certainly result in the inability of Rotterdam and Amsterdam to continue to function as normal urban areas. They include : the lack of land for port, industrial, and commercial facilities ; the need to provide efficient public transportation, adequate housing accommodation and recreational land for their growing populations ; and increasingly severe traffic congestion.

This paper will briefly touch upon the history of these ports and their place in the Dutch and European economy, and compare the unique methods by which Rotterdam and Amsterdam are solving their urban problems.

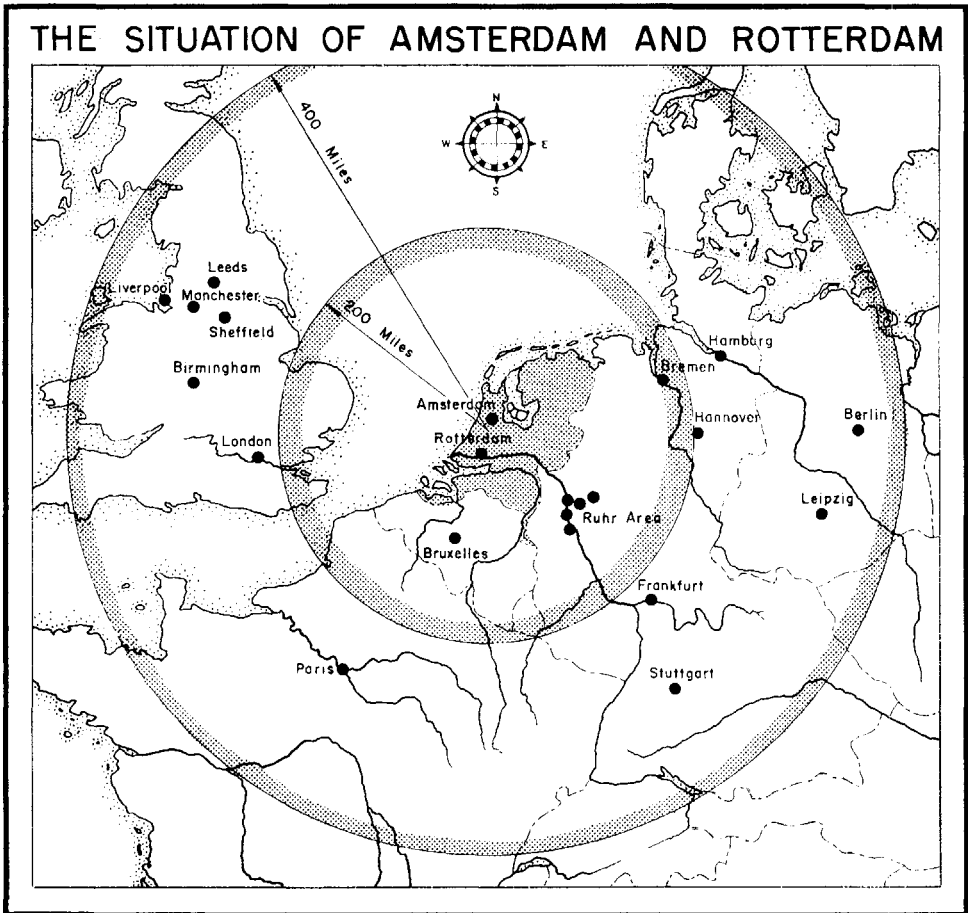
Rotterdam

The history of Rotterdam has been closely connected with its location in the Rhine Delta. A little over one hundred years ago the port had no significance whatsoever from an international point of view. However, within the last century, Rotterdam has climbed rapidly, overtaking London and New York to become the largest port in the world. Recently released figures list the total

goods traffic by sea in 1964 at 113.6 million metric tons for Rotterdam compared to 95.03 million metric tons for New York City in 1963 (2).

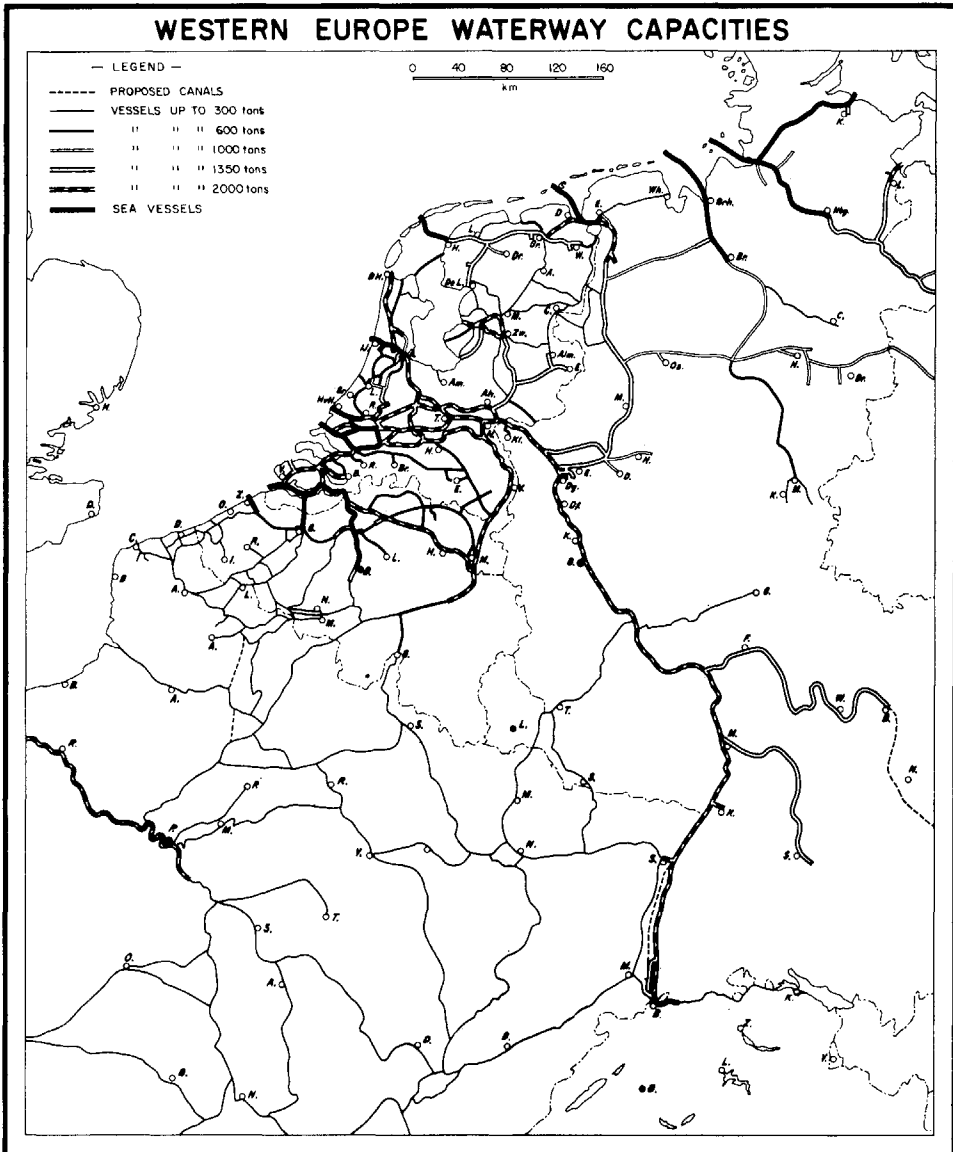
The great fabricating centers of the Ruhr-Westphalian region and the London Basin as well as some of the densest populated areas of the world in Holland and Belgium are found within a 200 mile radius of Rotterdam. A 400-mile radius would include the commercial and industrial concentrations of Frankfurt, Mannheim-Ludwigshafen, Hanover, Paris, Lorraine, Basel, and the English Midlands (Figure 1). The Rhine, with its tributary rivers and connecting canals, joins Rotterdam to a population of about 125,000,000 highly skilled Western Europeans who are contributing to the present economic renaissance of the continent (Figure 2). As this hinterland continues to grow, the port of Rotterdam will reflect the increasing imports and exports of this part of Western Europe as well as the increasing traffic of raw materials and finished products due to the recent industrialization of the Netherlands itself (Figure 3).

Figure 1



The history of Rotterdam may be broadly discussed in three phases. Firstly, its origin in the 14th century as a small fishing village located on a bend of one of the estuary branches of the Rhine. The second phase began in 1872 with the excavation of the channel known as the New Waterway by which Rotterdam was directly connected with the North Sea (Figure 4). The third stage which is still underway, commenced in the early 1950's with the establishment of the European Economic Community and the development of large new

Figure 2



March 1965
Modified after Schaalplas der gehele Aarde, BOS-NIERMEYER 1961, p.75

H.J. Stoffe

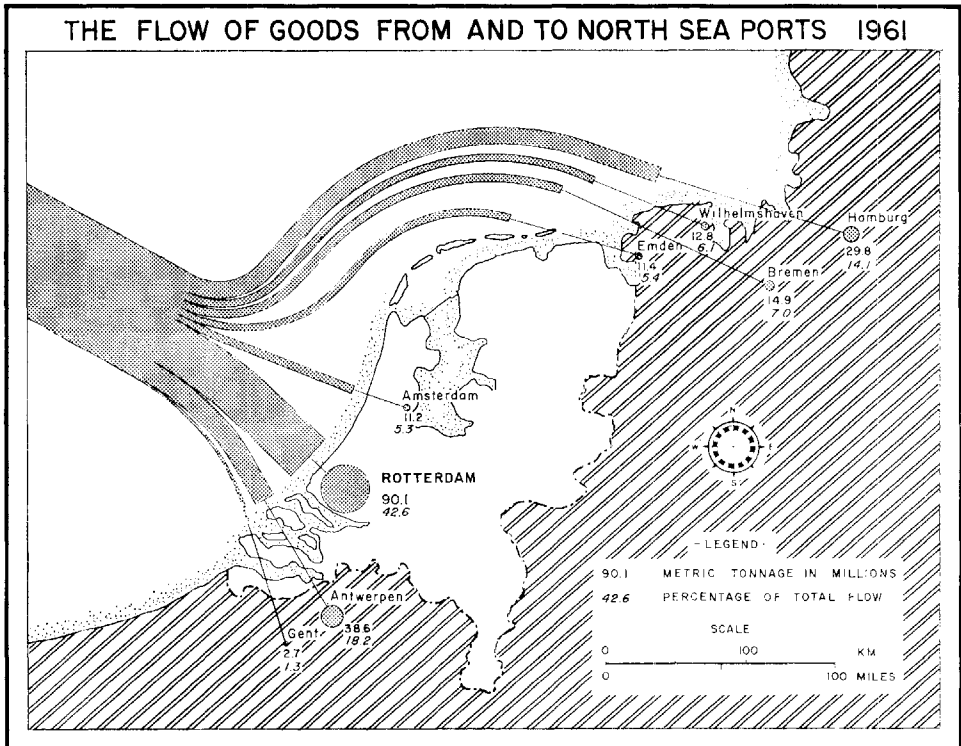
port and industrial facilities at the mouth of the New Waterway, known as Europoort (Figure 4).

The original site of Rotterdam was on the north bank of the New Maas, which is one of the Rhine's distributaries. A study of the map of the delta region, will show the Rhine and its many distributary streams flowing through Belgium and the Netherlands (Figure 5). It will not show the many changes along their beds effected by nature and man in the centuries since the last continental glaciation. These streams, often swollen by flood, meandered aimlessly across the marshy wastes here picking up, there depositing great quantities of sands and gravels laid down by the Riss ice mass. Man's efforts to control these river movements began as he had settled in the region and have continued with increasing skill and ingenuity to the present day.

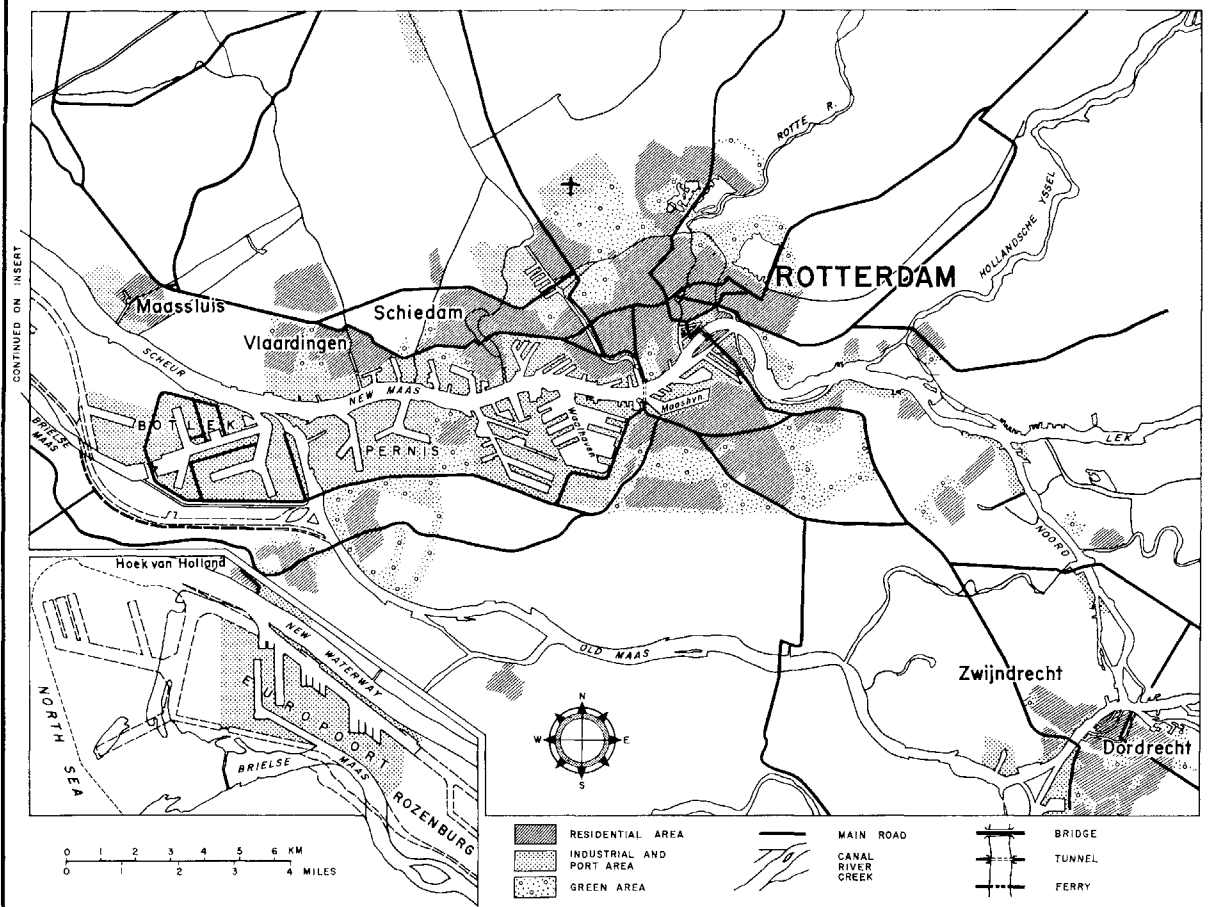
This area originally was a flat, windswept coastal region with little natural defense against the great smashing storms which swept out of the North Sea. The old town of Rotterdam grew up in the 14th century where the south flowing Rotte River emptied into the New Maas (Figure 4). A dam was built across the Rotte (hence the name Rotterdam) to act as a barrier against the sea floods which often accompanied the severe storms, drowning great tracts of low lying land.

Rotterdam suffered greatly from the feudal wars which laid waste to much of this area of the Netherlands during the 15th century. As well, its development

Figure 3



ROTTERDAM AND VICINITY



AUG. 1964

Figure 4

was hampered by the competition of older and more powerful towns, especially Dordrecht which led all Dutch ports in trade until the 17th century. During this period, boats made their way the eighteen miles from the North Sea to Rotterdam by sailing up the inlet known as the Brielsche Maas. But by the middle of the 18th century, sailing vessels had increased in size, and hundreds of years of continuous silting had first formed and then added considerable land surface to the island of Rozenburg in the Brielsche Maas, thus choking the channel (3). This route had to be abandoned and a new route, requiring many days to sail 70 twisting miles eastward through Dordrecht and then westward through the distributaries of the Rhine and out to the open sea was established. A canal was dug through the island of Voorne, south of Rotterdam, in 1829, as an alternative direct route to the North Sea, but the estuary leading to it became silt-laden in about thirty to forty years. And so failure greeted all efforts from 1700 on which had attempted to provide direct access from the North Sea to Rotterdam. However, by the latter half of the 19th century, a new plan was undertaken and with the help of powerful steam-dredges, work was begun on the New Waterway. By 1872, a channel had been completed through the dunes at the Hook of Holland connecting the New Maas River with the North Sea. At last Rotterdam and one of the world's busiest waterways were connected by a lock-free, bridge-free, waterway, since deepened to accommodate the largest vessels afloat.

H.J. Stolle

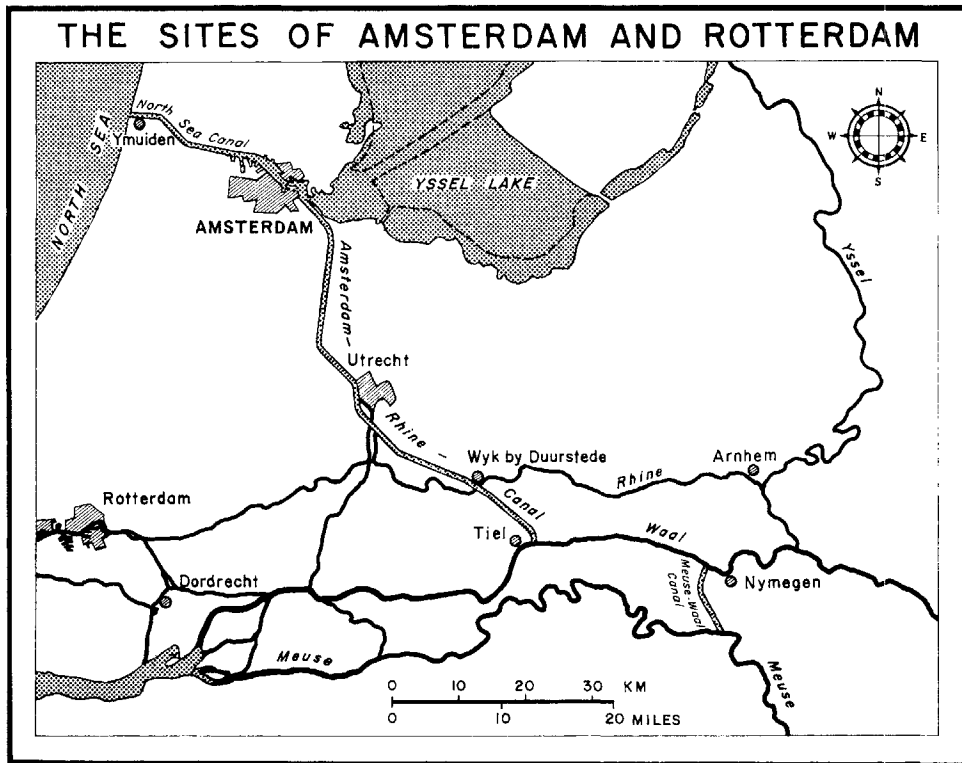
The opening of the New Waterway could not have come at a better time for the full force of the industrial revolution was upon Germany. The Ruhr-Westphalian industrial complex was rapidly expanding and large amounts of Swedish and Norwegian ores were necessary to augment domestic sources. It soon became vital for Germany to import a growing volume of bulk goods such as ores, timber, and grain, much of which was transferred from ocean freighter to river barge at Rotterdam and carried up the Rhine to the Ruhr-Rhenish industrial centers. Table 2 illustrates how Rotterdam's share of Rhine traffic was over 50% in 1961.

The reaction to this steadily growing demand for bulk goods was immediate and the Rotterdam area augmented its port facilities and increased in population to 430,000 by 1900, almost four times the 1830 figure (Table 3). The number of incoming vessels rose sharply from close to 2,000 in 1850 to over 7,000 by 1900 (Table 4).

Table 2 (4) Goods Traffic on the Rhine Across the Netherlands-German Frontier - 1961

Destination	Percent
Rotterdam	53.4
Amsterdam	5.9
Remainder of the Netherlands	17.5
Antwerp	9.7
Remainder of Belgium	8.7
Other	4.8
Total traffic across the frontier	100

Figure 5



Aug. 1964

H.J. Stolle

Starting in 1890, a series of harbours was constructed on the north and south banks of the Maas and development continued down river without interruption until the construction in 1938 of two petroleum harbours at Pernis (Figure 4, Photo 1). In spite of rather difficult times after the first World War and during the depression, Rotterdam had sufficiently recovered traffic so that by 1938 a record total of over 15,000 ocean going vessels entered the port and over 42,000,000 tons of seaborne cargo were handled, a figure not surpassed until 1954 because of the Second World War (Table 4).

Table 3 (5) Population of Rotterdam-Schiedam-Vlaardingen

1830	125,000
1900	430,000
1920	650,000
1930	760,000
1940	825,000
1950	855,000
1960	960,000

Photo 1 An aerial view looking in a northeast direction over the New Maas and the older port facilities of Rotterdam. The Rijnbaven and Maasbaven are visible in the upper right of the photo, the Waalbaven is visible at the center right and the Merwebaven is visible at the center left. The absence of bridges is quite evident. The Willens Bridge is visible at the top of the photo and the ventilation towers from the Maas Tunnel may be seen at the right tip of the large pack. This photo was taken during the early 1950's and post war reconstruction does not stand out.

(Photo K. L. M.)



Table 4 (6) Rotterdam Port Statistics

Year	Number of Incoming Ships	Average Tonnage (net registered tons)	Handling of Mineral Oil (in 1000 tons)	Sea-borne goods traffic (in tons of 1000 kg)
1850	1,940	203		
1900	7,360	811		
1910	9,630	959		
1920	5,990	1,188		
1930	12,350	1,603	1,070	
1938	15,360	1,610	2,920	42,370,990
1946	4,464	—	—	8,097,618
1948	8,502	—	—	15,759,646
1950	12,883	1,505	9,000	29,687,714
1952	15,443	1,646	12,200	39,782,503
1954	18,024	1,822	19,190	48,759,268
1956	21,239	2,038	27,380	72,214,372
1957	22,028	2,044	28,410	74,113,900
1958	21,956	2,207	34,320	73,844,118
1959	23,291	2,142	31,540	70,693,200
1960	24,344	2,388	38,120	83,405,000
1962	25,000+	—	—	96,600,000

A little after 12 o'clock noon on May 14, 1940, German bombers deliberately destroyed the heart of Rotterdam. Nearly 25,000 dwellings, as well as thousands of shops, many churches, the railway stations, hotels, and schools were burned beyond use (Photos 2 and 3). The response to this cowardly, unprovoked attack was immediate and sure. A mere four days later, the City Architect, Dr. W. C. Witteveen, was instructed by the Municipality to prepare a plan for the reconstruction of the city centre and by December 1941, the first official drawing of this plan was completed. The city, meanwhile, carried out an extensive expropriation program, including the ruins and sites of the bombed buildings as well as a large number of undamaged buildings and sites on the fringe of the devastated area. The Municipality thus became the sole proprietor of building sites in the city centre and it also expropriated a large tract of land outside the city for future housing and industrial areas.

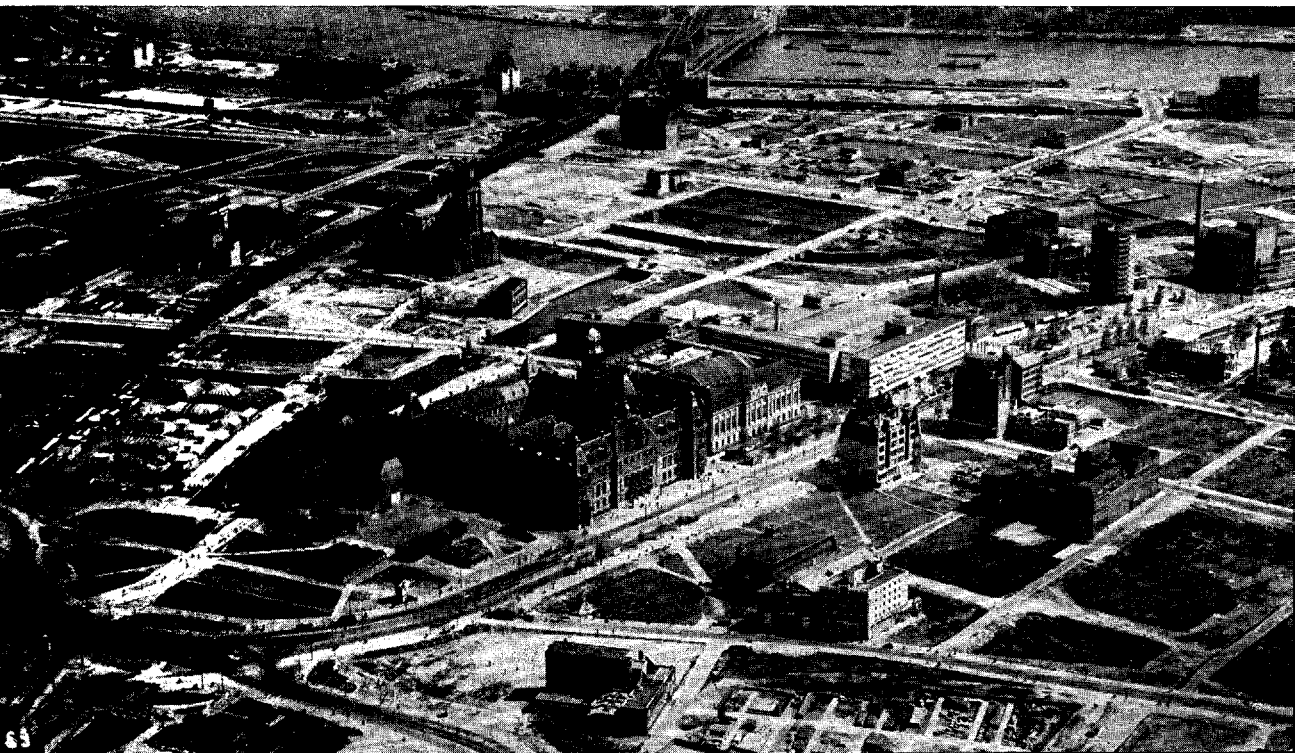
Work was started during the occupation on Dr. Witteveen's plan. Roads and canals were built, bridges constructed, houses and shops completed, and the Maas Tunnel, started before the War, was finished. The Germans put a stop to all rebuilding operations in July 1942 but secret meetings continued to be held by the people of the city concerning reconstruction. Before the Germans left Rotterdam in May 1945 they further destroyed one-third of the wharves at which sea-going vessels berthed and about 40% of the harbour equipment (7).

Restoration of the port had immediate priority after the war and by the end of December 1949, the destroyed docks were rebuilt and modernized and Rotterdam was prepared to service the increasing number of incoming ships. Nevertheless, it was still necessary to prepare the port for future growth. Before the war, the dock facilities were mainly designed to handle bulk cargo and oil



Photos 2 and 3 The Central Business Section of Rotterdam as it looked prior to World War II. The view is towards the southeast. Located on the left side of the Coolingsingel, Rotterdam's main boulevard, is the city hall and the post office. Figure 3 shows the way this area looked after the May bombing. The city hall and post office remain, as well as a scattering of other buildings; however most of the area was completely destroyed.

(Photos K. L. M.)



traffic. Now, these docks were redesigned to handle the various kinds of general cargo and the bulk cargoes such as oil, chemicals, and iron-ore, were to be discharged in new docks built closer to the sea. Here, the larger vessels of the future could be moored and new industries such as refineries, chemical work, and steel plants could process the raw materials.

In 1947 a start was made on such a scheme with the implementation of the Botlek harbour plan which was designed to transform the large tract of polderland lying west of Pernis, into a harbour and industrial area of 3,100 acres (Figure 4). Such firms as Dow Chemical and Esso Nederland soon leased industrial sites and although some scepticism had been expressed at the time as to the success of this venture, the last available space has been leased by the Aluminium Industry of Zürich.

Two years after the completion of the Botlek scheme, a decision was made to further expand the port facilities of Rotterdam. The agrarian island of Rozenburg, which had forced the cutting of the New Waterway, was to be turned into the «Europoort» (Figure 4). When completed, this gateway to the Common Market countries will increase the Rotterdam harbour area by 10,500 acres (8). The economic basis of the new scheme is the increasing tonnage of tankers and bulk carriers (up to 100,000 and perhaps 250,000 tons) and the rising demand for raw materials by the iron, steel, petro-chemical, and oil industries all over Western Europe. Shell, Caltex-Esso, and Gulf Oil are already established and oil now flows by pipeline to the refineries at Botlek and Pernis and by the Rhine pipeline to the Ruhr-Cologne Bay industrial region. The number of vessels using these varied and efficient facilities year by year rose to over 25,000 in 1962 (Table 4). Table 5 points out the increases in seaborne goods traffic in the port of Rotterdam from 1929 to 1962. Especially significant is the dramatic rise of mineral oils from 7% of the total traffic in 1938 to about 55% in 1962 (Table 5).

The banks of the New Waterway between Rotterdam and the sea are being transformed into one of the world's most important industrial and port complexes. The activity of the port can best be observed from the top of the Euromast, an imposing concrete tower, resembling the bridge of a gigantic ship. Row upon row of grass-hopper-like cranes line the quay sides. Wheat is being unloaded from Canada and iron ore from Sweden. Vessels are under construction and freighters are being repaired in enormous dry docks. The *Rotterdam*, flagship of the *Holland America* line, is berthed across from the Euromast while the smaller *Maasdam* has slipped from her pier and is heading for the open sea. Above the myriad of sounds from all the port activity can be heard the steady clang-clang of the ever present dredges maintaining the proper channel depth. Darting everywhere amongst the larger vessels are scores of barges from Germany, France, Belgium, Holland, and Switzerland. The water of the Maas has been whipped up into a confused jumble of waves by the continuous movement of all these vessels. On the western horizon a multitude of oil storage tanks can be made out beneath the smoke and flame pouring forth from the Pernis and Botlek oil refineries. Farther to the west, but obscured by all the smoke lie the newly constructed great docks of Europoort, and the North Sea.

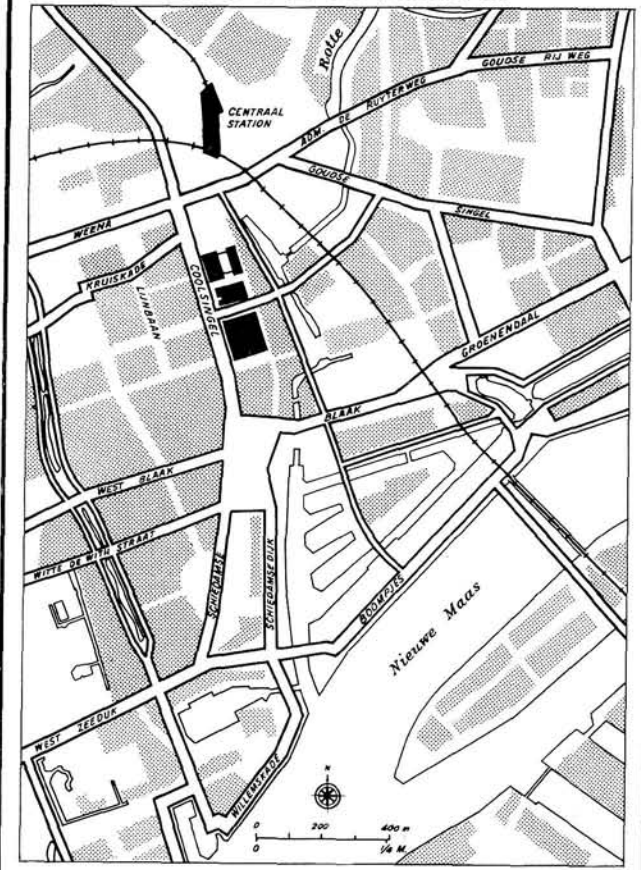
Table 5 (10) Seaborne Goods Traffic in the Port of Rotterdam
(in millions of tons of 1000 kg [excl. bunkering materials].)

	1929	1938	1956	1958	1960	1962
Coal	10.80	11.00	15.97	8.71	5.31	5.9
Ore	10.40	11.05	9.41	8.23	12.69	11.1
Fertilizers	0.39	1.33	1.85	3.09	3.09	3.1
Cereals	3.70	3.88	4.32	5.04	5.48	5.8
Other goods in bulk	2.69	2.27	1.78	1.56	2.33	2.1
<hr/>						
Total Dry Bulk goods	27.98	29.53	33.33	26.63	28.90	28.0
Mineral Oils	1.07	2.92	27.38	34.32	38.12	52.8
General merchandise	7.60	7.80	9.65	11.21	14.33	15.8
<hr/>						
TOTAL	36.65	40.25	70.36	72.16	81.35	96.6

Because of the concentrated port development immediately after the War, the rehabilitation of the central city had to wait for the early fifties. The old «Witteveen Plan,» some of which was finished during the War, was incorporated into a new plan, the so-called «Basic Scheme for the Reconstruction of the City of Rotterdam» drawn up by Mr. Cornelius Van Traa, Director of Town Planning and Reconstruction since 1946. The main purpose of this plan was to make optimum use of the 640 acres in the center city which were burned out by the German bombers. Although many Continental cities had this same opportunity because of the terrible destruction during the later phases of the War, only Rotterdam has succeeded in breaking completely with the past and redeveloping the central core according to a rational and modern plan.

The old heart of Rotterdam has become, even more than it was before the War, the administrative, cultural, and commercial center of the city. Major industries have been excluded from this part of Rotterdam and through traffic re-routed. Only 10,000 flats have been built in the center of the city where nearly 25,000 dwellings were destroyed but new suburban areas and development around the periphery of the city have been undertaken. In planning the new city center, special attention was given to the widening of streets and to the need for parking places, public gardens, and open space. 70% of the total area is devoted to open space compared to 45% in the old city thereby reducing the area available for building sites (10). However, the erection of taller buildings has allowed the total building volume to remain virtually unchanged. The focal point of the central redevelopment is the Lynbaan, a well landscaped shopping center for pedestrians only. Surrounded by large block flats, the Lynbaan is reminiscent of the pulsing piazzas of Italy. Flowers, trees, and sculptures color and soften the angular lines of the shops and sidewalks, and outdoor cafes allow the shopper to eat, drink, and chat away from the noise and fumes of the main streets. Numerous other new buildings have been constructed in and around the city center including the central station, banks, department stores, cinemas, a theatre, churches, hospitals, and the largest wholesale building in

CENTRAL ROTTERDAM



October 1964

Figure 6

H. J. Stolle

Europe (Figure 6, Photo 4). Surrounding the city, a series of gardens and parks form a green belt for leisure and recreational use.

Many problems remain, but they are being tackled with a striking demonstration of civic energy. One of the remaining difficulties is the commuter barrier of the Maas River which almost 300,000 people travel across or under each day. New tunnels and bridges have been planned and are under construction and work began four years ago on a subway system of four miles to relieve surface congestion. More

Photo 4 The central business section of Rotterdam has been totally restored. This view is in a north-westerly direction. The post office and city hall are located at the right center of the photo and the new central station is at the top right. The Coolsiingel has been built up with many new buildings including the Bijenkorf (beehive) department store which is located in back of the large free standing sculpture. The Lynbaan shopping street is partially hidden by the buildings of the Coolsiingel; however the low stores are visible surrounded by high rise block flats.

(Photo K. L. M.)

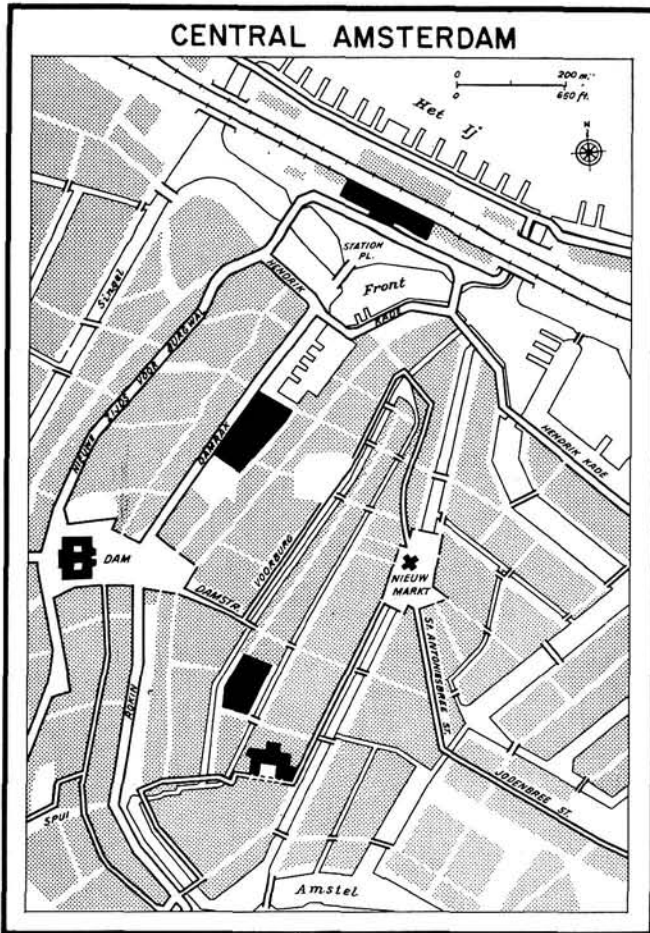




Photos 2 and 3 The Central Business Section of Rotterdam as it looked prior to World War II. The view is towards the southeast. Located on the left side of the Coolingsingel, Rotterdam's main boulevard, is the city hall and the post office. Figure 3 shows the way this area looked after the May bombing. The city hall and post office remain, as well as a scattering of other buildings ; however most of the area was completely destroyed.

(Photos K. L. M.)





October 1964

H.J. Stolle

Figure 8

The early situation of Amsterdam brought the city into contact, by way of the sheltered Zuiderzee and Waddenzee, with the major centers of the Hanseatic League. Beer was imported from Hamburg in 1323 and the demand for ships to transport the brew encouraged locals into trading. Local products such as cloth, fish, and agricultural produce were exchanged for English wool, wine and millstones from the Rhineland, and spices, oil, salt, and wine from or through France and Flanders. By the 15th century the Dutch had become powerful enough to challenge German commercial interests in the Baltic. The space required by these commercial ventures and for the construction of shipyards caused repeated expansions of the town. Because the area

Photo 5 The Central station of Amsterdam seen from the air. In the background is the IJ. The site is approximately where the Amstel flowed into the IJ.

(Photo K. L. M.)



around the city was a water-logged expanse of peat and tidal flats, growth was difficult. The solving of problems such as adequate water supply, sewage disposal, and land reclamation required a cooperative effort because of the cost and difficulty involved. Therefore, the city did not grow continuously but in a series of well-defined and regulated stages beginning in 1382.

Historical events favoured the continued growth of Amsterdam in the late 16th and early 17th centuries. Antwerp fell to the Spanish and the Treaty of Westphalia closed the Scheldt River to navigation. An influx of highly skilled Flemish, Huguenot, and Jewish refugees swelled the population of the city to approximately 105,000 in 1620 (Table 6).

In comparison, Rotterdam was but a small village of 15,000. Commercial contacts developed with the Mediterranean Basin, Africa, the Americas, and the Far East. The East India Company was founded in 1602 and Amsterdam was established as the predominant colonial entrepôt. Its position, protected from the danger of assault from the sea, and capable of defense by flooding in case of landward attack, was secure and civic authorities responded to the opportunities at hand and deliberately planned the territorial expansion of the city in a manner unique in contemporary Europe.

From 1610 on, the city was enlarged by adding canals, roads, living quarters, public and commercial buildings, and dock space. The basic idea of the plan was a semi-circle of concentric canals with the Ij as their base. This plan, which was to result in an eventual four-fold increase in area, gave the central city its present unusual half-moon shape (Figures 7 and 8, Photo 6). By the middle of the 18th Century, population had reached 200,000 (Table 6). It did not grow larger for almost a century because the rise of Great Britain as a powerful maritime nation and the occupation of the Netherlands by Napoleon's armies interrupted the flow of commerce and severed communications with the East Indies. In addition, access to the port was becoming increasingly difficult as ships grew larger and the channels through the Zuiderzee silted up.

In the early 19th Century a solution to both of these problems was attempted. Amsterdam was reestablished as an entrepôt for the East Indian trade and the North Holland canal from the Ij to Den Helder was opened. However, this canal twisted north from Amsterdam and was inadequate to cope with modern shipping. The city found itself in the same position as Rotterdam and like

Table 6 (11) Population of Amsterdam
(excluding suburbs)

1620	105,000
1796	217,000
1829	202,000
1839	211,000
1849	226,000
1859	243,000
1869	265,000
1879	317,000
1889	408,000
1899	511,000
1909	566,000
1920	683,000
1930	757,000
1939	801,000
1950	845,000
1958	872,000
1960	866,000
1963	868,000

Rotterdam, sought a solution to the problem of being cut off from the open sea. Amsterdam's answer was almost the same. A direct route from the city through the dune coast to the North Sea was realized with the opening of the North Sea Canal in 1876 (Figure 7). This canal, unlike the New Waterway, has two sets of locks, one at the mouth near IJmuiden and the other near Amsterdam connecting with the IJssel Lake. The entrance lock has since been enlarged three times and can accommodate the longest vessels in the world and the existing entrance-way to the canal is being rebuilt to suit vessels up to 100,000 tons with a draft of 43 feet.

Although Amsterdam finally had an outlet to the open sea, her communications route to the great rivers which formed the connecting links with the European hinterland remained poor, to the detriment of the economic development of the port. In 1893 the Merwede Canal, giving better access to the Rhine, was opened but it was not until 1952 when the Amsterdam-Rhine Canal was completed that this problem was overcome (Figure 5).

After the opening of the North Sea Canal, a new period of vigorous economic expansion began. Docking and storage facilities were extended to the

Photo 6 Three stages in Amsterdam's development may be seen from this photo. In the upper right corner is the central station. Leading from the station is the main street of Amsterdam, the Damrak. Where the Damrak turns right is the site of the original dam across the Amstel now occupied by a large square known as the Dam. The Concentric Canals built from the early 17th Century stand out as tree bordered waterways. Nineteenth Century housing may be seen to the left of the last canal.

(Photo K. L. M.)





(Photo K. L. M.)

Photo 7 A high density housing development located south of old Amsterdam. The streets converge at Victorieplein. To the right is the Amstel River.

east and west of the city along the Ij (Figure 7). By 1897, the population approached half a million, more than twice the figure for 1849 (Table 6). In order to house the influx of people, new residential areas were built with little regard to the existing pattern of the city. This expansion was not controlled by the authorities and monotonous unplanned quarters appeared which quickly deteriorated into slums. The local authorities tore down many buildings of historical value and filled in a number of canals which were transformed into thoroughfares. Fortunately, the Netherlands Housing Act of 1901 brought a stop to this unplanned development and since 1931 all municipalities in the Netherlands have had to establish a master plan.

Between the two World Wars, Amsterdam was the vanguard of scientific town planning. In the early twenties, two garden cities north of the Ij, Oostzaan and Nieuwendam were built (Figure 7). Between the years 1928 and 1934, a comprehensive plan for the city, designed to cover the physical requirements of housing, work, traffic, and recreation to the year 2000 materialized. Delayed during the War years, the plan is being realized with the construction of further garden cities north and south of the old city including a highly developed complex

of block flats around the artificial lake of Sloterpas (Figure 7, Photo 7). The lake provides excellent recreation facilities such as sailing, swimming, and fishing in the midst of about 125,000 people who will dwell in this area. These new satellite towns are connected to the old central city of Amsterdam by express highways whose center medians are reserved for high speed tram lines joining with the main tram net of the city (Table 7).

At the present the problem of traffic congestion is most severe. Bus, autos, trams, scooters, and bicycles clog the narrow streets of the central city during morning and evening rush hours. The construction of a series of bypass highways, new tunnels under the Ij, and a subway will help to relieve the situation but the problem, will remain acute for some time to come.

The rehabilitation of old Amsterdam is an important part of the master plan. The historical flavour of the 17th century city with its beautiful churches, rich homes, and narrow streets and canals will be preserved when possible and renewed where necessary. Here skyscraper construction will be forbidden, not only for esthetic reasons but also because of the in-

creased traffic and pedestrian congestion which inevitably follows. Instead, new sites for commerce and industry, and space for parklands will be carved out of the 19th century slum district surrounding the central core. The Amsterdam of the future will occupy a far greater area than it did in 1945 despite a relatively slight increase in total population to 950,000 (13).

Amsterdam is continuing to prosper as a result of the interplay of old and new economics forces. The conurbation of the city, stretching for about 25 miles east and west, includes important development areas such as the mouth of the North Sea Canal, with its blast furnaces, steel plants, and other industries, the old-

Table 7 (12) Suburban Areas Built or Under Construction Since World War II — Amsterdam

	Houses or Apartments	Occupants
WEST :		
Slotermeer	10,000	35,000
Guezeveld	4,600	16,500
Slotervaart	5,500	16,750
Osdorp	12,000	41,000
Bos en Lommer	5,000	17,500
Overtoomse Veld	3,140	10,500
Westlandracht	1,600	5,400
EAST :		
Frankendael	1,200	4,200
Amstelstation	500	1,750
Middenmeer	1,200	4,200
Klein Dantzig	300	1,050
Populierenweg	380	1,300
NORTH :		
Tuindorp Oostzaan — west	380	1,400
Tuindorp Oostzaan — east	1,000	3,700
SOUTH :		
Buitenveldert	8,900	30,000
Zuider-Amstelkanaal	900	3,100
Minervaplein e.o.	340	1,200
Rivierenlaan e.o.	340	1,200
	57,280	195,750

er but important Zaan region to the north, and the developing area around Schiphol International Airport, where over 14,000 persons are employed. In the future, the reclaimed land of the IJsselmeer to the east of Amsterdam will become an entirely new hinterland for the city, with sites for new towns and recreational facilities.

The port of Amsterdam has reacted favourably to this increasing activity and has rapidly expanded since the end of the War. In the immediate post-war

Table 8 (16) International Seaborne Goods Traffic

(in 1000 tons)

Year	Sea-going vessels entered	Total
1938	3,464	5,655
1949	3,891	5,025
1950	4,480	5,233
1951	4,354	6,310
1952	4,707	6,187
1953	5,309	6,293
1954	5,515	7,008
1955	6,187	7,760
1956	6,837	9,713
1957	7,118	11,137
1958	7,107	11,304
1959	7,219	9,946
1960	7,530	10,827
1961	7,993	11,246
1962	8,151	12,208
1963	8,540	14,493
1964	—	14,700

years it was necessary to restore the capacity and facilities of the port to the 1938 level and by 1960, the area of harbour basins had been doubled. In the last decade, Amsterdam has developed from a purely national port into an international transit harbour. East-bound traffic increased from 529,000 tons in 1952 to 5,000,000 tons in 1960 (14). The main cause of this rapid increase was the opening of the Amsterdam-Rhine Canal, nevertheless, many of the favourable conditions which apply to the situation of Rotterdam are also applicable to Amsterdam (Figures 1 and 2). Facilities for the storing and handling of bulk goods have been enlarged and modernized and future plans include the development of 6,600 acres of industrial sites. All this activity is reflected

by the record cargo handled in 1964 of 14,700,000 tons (15) (Table 8) (16). While this figure is far short of Rotterdam's total of 96 millions tons, it is a dramatic increase from the 8 million tons recorded in the early 1950's. Future prospects for port growth remain buoyant, for the Dutch planners intend to increase Amsterdam's cargo handling capacity so that it will be comparable to the present-day figures for Rotterdam. The significant factors behind these formidable plans include the hoped-for economic union of Great Britain with the Common Market, the construction of the Channel Tunnel, the vast reserves of natural gas in the north of the country, and the excellent prospects for new finds of gas and oil elsewhere in the Netherlands and the North Sea.

CONCLUSIONS

In comparing the growth of Rotterdam and Amsterdam one clearly sees the manner in which their early sites have been enlarged and their situations altered. Both cities, because of economic necessity and the dynamic nature of their inhabitants, overcame all natural geographic limitations as well as those

problems imposed because of the Second World War. They have reorganized their port facilities and provided space for modern industrial enterprises, taking into consideration the changing trade patterns of mid-century Europe. New residential and business areas have been created, and internal and external transportation methods extended and improved.

The main point which stands out in this paper is the attitude of both cities towards rational planning for their present and future growth. All segments of city life which contribute to the economic, social, and cultural strength of the urban entity are taken into account. This is in sharp contrast to most of the world's great cities, where growth, more often than not, is of a haphazard and speculative nature.

Amsterdam is trying to conserve the charm and form of the old city and build anew in the outskirts. Rotterdam, rather than recreating the past, has completely altered the central core. In both cases, the population of the central city will be reduced and satellite towns surrounding the urban nuclei will take up the growth.

Rotterdam and Amsterdam are examples of cities which have finite spatial limitations. Thus they must literally plan every foot of space in order to insure a rational and efficient use of the land.

The solutions of the Dutch planners may provide some of the answers to the increasingly severe urban problems of Canada.

RÉSUMÉ

Au cours des siècles, Amsterdam et Rotterdam ont modifié leur site et leur situation en récupérant, pour l'accroissement urbain, des terres submergées, et en creusant fleuves et canaux afin de rivaliser avec les ports que l'Europe Occidentale possède sur la mer du Nord. À cause de certaines différences de situation et de fonction, de l'évolution historique de ces deux villes, de plans présents et passés et de destructions causées par la deuxième guerre mondiale, ces ports ont recours à des méthodes bien différentes afin de résoudre les problèmes que présente l'accroissement rapide de leur population métropolitaine.

Ces problèmes que connaissent toutes les grandes villes modernes s'amplifient lorsqu'il s'agit d'un des endroits les plus peuplés du monde, car manquer de les résoudre entraînerait pour Amsterdam et Rotterdam l'incapacité de continuer à fonctionner comme des régions urbaines normales.

Ces problèmes sont le manque d'espace pour le port, et le manque de facilités industrielles et commerciales ; la nécessité de fournir des moyens de transport efficaces, des logements adéquats et des terrains de récréation pour la population croissante ; la nécessité de veiller à la circulation de plus en plus dense.

En 1962, Rotterdam devint le plus grand port du monde. Mais, bien que possédant un tonnage total inférieur, Amsterdam projette d'augmenter cette capacité de recevoir des cargaisons, ce qui lui permettrait d'offrir des chiffres comparables à ceux que possède aujourd'hui Rotterdam. Les deux villes attirent de nombreuses industries dans cette rapide industrialisation de la Hollande.

Amsterdam cherche à conserver le charme et l'ambiance de la vieille ville et à construire du nouveau en banlieue. Rotterdam, plutôt que de recréer le port, a voulu transformer complètement le cœur de la ville. Ces deux villes offrent un exemple

d'espace vital limité. Aussi doivent-elles envisager l'utilisation de chaque pouce de terrain afin d'en assurer l'emploi rationnel.

Les solutions offertes par les Hollandais pourraient fournir certaines réponses aux problèmes croissants que posent les régions urbaines.

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