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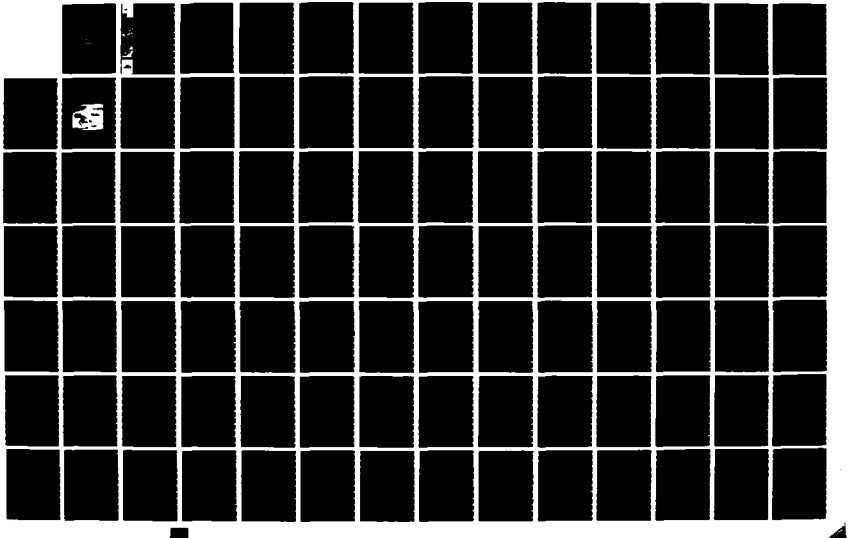

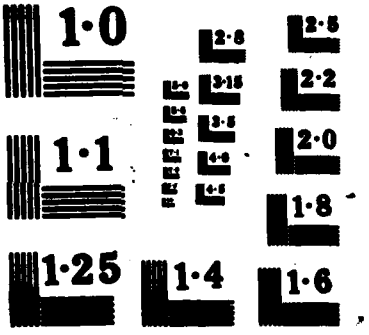
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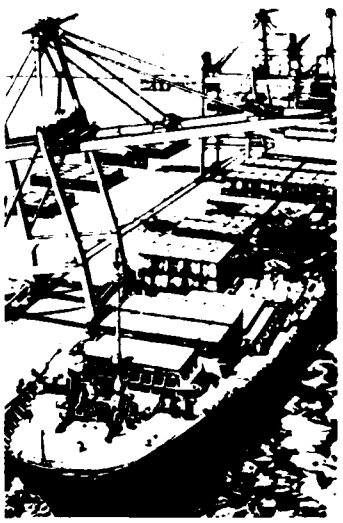

GEOTECHNICAL LABORATORY

TECHNICAL REPORT GL-86-6

12

EVALUATION AND REPAIR OF WAR-DAMAGED PORT FACILITIES

Report 1

PORT CONSTRUCTION HISTORY, INSPECTION TECHNIQUES, AND MAJOR PORT CHARACTERISTICS

by

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The purpose of this study is to provide necessary information that will ensure continuing port operations during emergencies caused by military conflicts.

Port construction, lessons learned, and port damages in previous military conflicts are presented. Technical information on state-of-the-art inspection techniques that may be used to rapidly determine the extent of damage caused to

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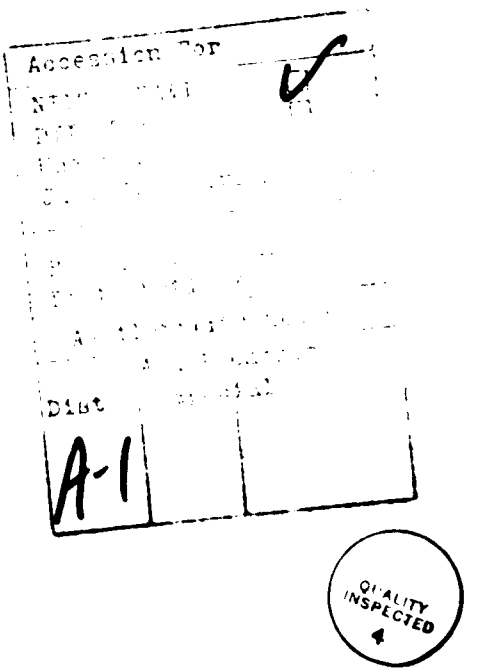
ports during hostile operations is presented and discussed. Major CONUS (Continental United States) and OCONUS (Outside Continental United States) container ports are inventoried and presented in Appendixes B through E. As-constructed facilities of port complexes are identified and data for planners to determine whether to repair the war-damaged port facilities or construct new facilities are provided.

PREFACE

The investigation reported herein is under the sponsorship of the Office, Chief of Engineers (OCE), US Army, and is being conducted under Project AT40, Task CO, Work Unit 009, "Evaluation and Repair of War-Damaged Port Facilities." Dr. Clemens Meyer and Mr. Austin A. Owen were Technical Monitors for OCE.

The study was conducted at the US Army Engineer Waterways Experiment Station (WES) from February 1980 through December 1982 by the Pavement Systems Division (PSD) of the Geotechnical Laboratory (GL). The work was conducted under the general supervision of Dr. W. F. Marcuson III, Chief, GL, and under the direct supervision of Mr. H. H. Ulery, Jr., Chief, PSD, GL. Personnel of the PSD involved in this study were Messrs. H. L. Green, R. H. Grau, and D. M. Ladd. This study was conducted by Mr. C. J. Smith, PSD, who wrote this report. This report was edited by Mr. R. A. Baylot, Jr., Publications and Graphic Arts Division. Mr. D. J. Kirby and Mrs. C. L. McMillin, Technical Information Center, performed a comprehensive literature search for this study.

Director of WES was COL Allen F. Grum, USA. Technical Director was Dr. Robert W. Whalin.



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CONVERSION FACTORS, NON-SI TO SI (METRIC)
UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
acres	4,046.873	square metres
cubic feet	0.02831685	cubic metres
cubic yards	0.7645549	cubic metres
feet	0.3048	metres
gallons (US liquid)	3.785412	cubic decimetres
inches	2.54	centimetres
knots (international)	0.5144444	metres per second
long tons (2,240 pounds)	1,016.05	kilograms
miles (US nautical)	1.852	kilometres
miles (US statute)	1.609347	kilometres
pounds (mass)	0.45359237	kilograms
square feet	0.09290304	square metres
tons (2,000 pounds, mass)	907.1847	kilograms

EVALUATION AND REPAIR OF WAR-DAMAGED PORT FACILITIES

PORT CONSTRUCTION HISTORY, INSPECTION TECHNIQUES, AND MAJOR PORT CHARACTERISTICS

PART I: INTRODUCTION

Purpose and Scope

1. The purpose of this study was to provide general guidance for assessing war damages to port facilities and describing the characteristics of major ports inventoried. This study will enable US Armed Forces and/or indigenous personnel to restore port areas that permit access for the transfer of supplies from support ships to shore facilities and inland. During this study, information was developed to ensure continued port operations during emergencies caused by military confrontations. Specific purposes were to identify port construction methodology and lessons learned in previous military conflicts; to provide information which will permit rapid assessment of war damage using current military/civilian techniques; and to develop data sheets that identify major ports with special characteristics.

2. The scope of this investigation included a review of available publications to identify methods and materials used in previous military conflicts. A comprehensive inventory of CONUS (continental United States) and OCONUS (outside continental United States) ports was compiled and port characteristics identified. The port characteristics identify the as-constructed facilities of port complexes and these data may be used by planners to determine whether to repair the damaged facilities or construct new facilities. Emphasis was made to provide technical information on state-of-the-art inspection techniques that may be used to rapidly determine the extent of damage caused to ports during hostile operations.

3. This is the first of four reports on the subject work unit. Reports 2, 3, and 4 will identify and evaluate expedient repair systems and materials for war-damaged piers/wharves, storage areas, and hardstands. In order to maintain the throughput of supplies various techniques for removal of damaged materials, placement of new materials, etc., will be identified and evaluated and design criteria or procedures for various repair materials and systems

will be developed. This information will also be presented in these three reports.

Historical Background

4. A study was conducted of port construction operations and lessons learned from previous military conflicts. This historical information is summarized in the following paragraphs.

European Theater, World War II

5. Since Cherbourg, France, was the first port to be captured in the Normandy invasion, its prompt rehabilitation was of great strategic importance to US Armed Forces and its Allies (Bowman 1945a). The port was severely damaged by German sabotage before the Germans surrendered. The German destruction was so thorough that three to four times as many days as had been estimated by Army planners were required to get some main port facilities back into service. The Germans not only damaged the port and railway structures by demolitions, but they also mined the harbor and sank ships at strategic locations in the harbor entrances. The Army engineers did not rebuild the dock facilities, but developed the areas which suffered little or no damage by improvising temporary emergency construction. These improvised structures were either constructed over or around the port wreckage. In order to move critical materials and equipment as fast as possible, the engineers decided to develop the beach areas as landing spots for LST's (landing ship, tank) and DUKW's (a 2-1/2-ton,* 6 × 6 amphibian truck) while the more time-consuming and difficult construction jobs in other port areas could get under way. Improvised floating docks consisting of 5- by 5- by 7-ft steel pontoon units were assembled and moved into position by Navy Seabees (Bowman 1945c). The pontoon units were held in position by pile dolphins, which were driven by Army engineers using floating equipment, and the dock was connected to the shore with Bailey bridge spans. A typical installation was 60 ft wide and 1,000 ft long.

6. The tidal changes at LeHavre, France, are of great magnitude; therefore, movement of ships requires wet basins protected by gates and locks (Bowman 1945b). These basins require many bridges to facilitate road and rail

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* A table of factors for converting non-SI units of measurement to SI (metric) units is presented on page 3.

traffic from the docks. Basin facilities were destroyed by Allied bombing and shelling followed by German demolitions which destroyed the locking gates, thus draining the basins at low tide. Where possible, repair of the gates was accomplished to permit the ships to move about through the basins and discharge their cargo; however, the bridges connecting the various basins had to be restored for the cargo to reach land. Bailey bridges and unit construction railroad bridges (UCRB's) were installed to span openings between basins. Damaged gate entrances to basins not vital to the operation of the port were filled with rubble dams. These basins were unused and left filled with water for later repair.

7. The final report of the Chief Engineer, European Theater of Operations (ETO), reviewed the port rehabilitation operations in France (Department of the Army 1945). Preliminary planning began by assuming information such as supplies required to maintain a number of troops, discharge rate over a length of wharf, and assumed destruction from enemy and Allied activity. This information enabled the engineers to develop bills of materials and estimates of labor for a length of wharf reconstruction.

8. The Chief Engineer praised the 2-cu-yd power shovel as the most valuable piece of equipment. The shovels were used for a variety of purposes, including dredging, debris clearance above- and below-water, handling of heavy lifts, and pile driving. The shovels were operated both ashore and afloat. He noted there was a shortage of 60-ton trailers to permit rapid transport of the shovels. The shortage of dump trucks and inadequate size of the trucks presented a problem for debris clearance tasks in port reconstruction. The Chief Engineer noted that dump trucks of considerably greater capacity than the 2-1/2-ton size would be very useful in this type work. Adequate dredging equipment was not available in sufficient quantities. Of the four hopper dredges available, the shallow-draft "Hoffman" proved the most versatile and effective. A dipper or bucket dredge with a capacity of approximately 8 cu yd would have been of great assistance in removing underwater debris alongside the wharfs of a demolished port. Port repair ships were used as floating machine shops. From lessons learned, future repair ships should be heavily loaded with stock of all types to meet the demands for repair of port facilities. Several engineer troop units were used in port construction. These units were properly organized and staffed for the mission, but the units lacked sufficient training in construction to be fully efficient. The

deficiency was corrected as the troops gained experience.

Southwest Pacific, World War II

9. Manila, the principal port of the Philippine Islands, is located in one of the finest natural harbors in the Orient (Gross 1946). The port is located on the eastern shore of Manila Bay and consists of the South and North Harbors and the lower part of the Pasig River, which divides the city and the two harbors. Following Allied bombardments of Manila Harbor, the Japanese dynamited usable piers and wharves, wrecked unloading facilities, and burned storage buildings prior to withdrawing. The harbor was also obstructed by numerous sunken ships at piers and in channels leading to the piers, which is considered a major problem in port rehabilitation. Rehabilitating the port of Manila to be capable of meeting the war shipping requirements required removal of sunken ships which littered the harbor, construction of emergency landings for amphibious craft, pier construction and repair, and removal of material in the harbor by dredging. Piers to be reconstructed were breached in several places across the entire width of the pier and contained several smaller breached sections in the aprons and center portions. Prepared Japanese demolitions destroyed many supporting columns, leaving the trusses hanging from adjoining columns and creating a hazard to future work that would be undertaken. In order to make berths available quickly, the wreckage and debris were cleared from the aprons, and the breaches were spanned with Bailey bridges to allow one-way traffic on the pier. Maximum effort was then concentrated on clearing the center portion. Breaches were repaired by first removing all debris, and divers examined any piles that seemed usable. All loose concrete and reinforcing rods were removed from the usable piles, reinforcing rods were spliced to existing steel, and concrete was poured to bring the piles to grade. If concrete piles were destroyed or damaged beyond repair, four wooden piles were driven at an angle to straddle the destroyed pile and tied as a cluster at the top. After necessary initial repairs were completed on the center portion of a pier, the Bailey bridges spanning the breaches were removed, and more permanent repairs were made to the breaches. The smaller bomb holes were repaired by hanging forms from bents at each side of the breach and pouring concrete in standard flat-slab design.

10. New facilities construction included two 450-ft-long by 44-ft-wide finger-type pile docks built in a period of five weeks. Two Navy floating pontoon cube docks were also constructed. These docks consisted of five

(16-ft by 18-ft) cube barges joined together with standard hinge assemblies. Two double-single, 70-ft-long Bailey bridges were used for approaches to the floating docks. The bridges were anchored at the abutment end and rode free on a greased "slide plate" at the pier end. The first pier was installed in eight days and the second in five days.

South Vietnam

11. Throughout 1965 and 1966, 90 percent of all cargo entered South Vietnam by deep-draft vessels (Dunn 1972, Heiser 1974, and Ploger 1974). Initially, Saigon was the only port with deep-draft berths. With the buildup of United States forces, the cargo tonnage required exceeded the capacity of the port at Saigon. The only solution to the logistics problem was to build more deep-draft ports. Four deep-draft ports located at Da Nang, Qui Nhon, Cam Ranh Bay, and Saigon became the centers of the base development plan.

12. Port development involved more than the construction of additional piers. Barge offloading facilities, ramps for landing craft, and petroleum unloading facilities were all required. To begin the port construction projects, a fleet of dredges including two side-casting, three hopper, and eighteen pipeline cutterhead dredges were assembled to alleviate the dredging problems.

13. In order to expedite the port construction program, finger piers were fabricated by using DeLong barge units. These products of the DeLong Corporation are available in two types. The "A" barge is 80 ft wide by 300 ft long, and the "B" barge is 60 ft wide by 150 ft long. These units are fabricated outside the theater of operations, towed to a site, and quickly emplaced. The barge units are self-elevating on steel caisson legs to form a pier-platform. These barge units made it possible to develop additional deep-draft ports and berths at Qui Nhon, Vung Tau, Cam Ranh Bay, Vung Ro, and Da Nang.

14. The first DeLong pier with all its equipment was towed to Cam Ranh Bay from the east coast of the United States in a trip that took about two months. Personnel of the 497th Port Construction Company, who were to place the pier, were inexperienced in the installation of DeLongs and had to learn from experience on the job. Advice and technical assistance were provided by representatives of the manufacturer. The 80-ft by 300-ft pier required 45 days for assembly by 16 men. Engineers estimated that a timber-pile pier would have required at least six months' work by a platoon of 40 men with

supporting equipment and operators. A 40-ft wide by 800-ft long rock-fill causeway with two 80-ft spans of double-single Bailey bridges was constructed to connect the DeLong pier with the shore. This type construction was used at other port construction sites. Floating piers consisting of 5- by 7- by 7-ft cubes fastened together were also used extensively in South Vietnam.

15. A number of lessons were learned in all areas of US combat support in South Vietnam that can be applied in similar future campaigns. The lessons learned with the greatest bearing on port construction in the theater of operations are presented in Clark et al. (1973), Heiser (1974), and Ploger (1974), and are summarized as follows:

a. The use of DeLong piers in South Vietnam showed that new ports can be created quickly or existing ones expanded in a relatively short time.

b. The utilization of the DeLong pier and the extensive port development program in South Vietnam indicated a shortage of US Army staff officers competent in port construction.

c. The DeLong piers should be retained and exercised by troop units to ensure the capability of Army engineers to install them without contractor assistance.

d. Containerized shipments should be used to a maximum in the early stages of an operation, and especially so in an underdeveloped area.

e. There is a need for container ships to have self-supporting gear for offloading in early combat and at both shallow draft locations and deepwater ports.

f. There is a need to standardize container sizes. The containers should not be so large that port congestion will prevent their use or that they will be incapable of being lifted by heavy-lift helicopters.

g. Personnel who possess specialized skills needed during a contingency operation should be identified (in both the Active and Reserve forces).

h. In order to support forces deployed in an overseas area, an adequate and responsive sealift capable of transporting the bulk of material is essential. The capability of supporting the overseas forces is dependent on a modernized Military Sea Transportation Service (MSTS), now Military Sealift Command (MSC), nucleus fleet backed by access to the resources of the US Merchant Marine.

Areas of Consideration

16. In an all-out conflict, hostile action can be anticipated against targets in the combat zone and communications zone which include the

reinforcement and resupply ports of entry into the theater. Bombings, sabotage, and chemical attack are all possibilities and may be directed at the area immediately behind the combat zone to obstruct the movement of reinforcements through ports and into the theater.

17. Port losses in terms of facilities, equipment, and personnel can be expected in a postattack environment. Hostile action is anticipated to be conducted against the transportation networks (shipping channels, locks and bridges, piers/wharves, materials-handling equipment, storage areas, roadways, railways, etc.), communication networks, military depots, power supplies supporting civilian facilities, and any target where action would degrade the ability of forces to fight effectively. Anticipated port damage due to military action is shown in an artist's concept (Figure 1).

Figure 1. Artist's concept of a war-damaged port

Missions and Responsibilities

18. During the early periods of military conflicts, the repair and restoration of war-damaged port facilities are among the more significant

engineer support missions. The construction effort will require combined efforts of US forces and participation of host nations. Host nations have the responsibilities for providing engineering support within the theater and other support activities as defined in formal agreements between the host nation and the United States.

19. The operation of a port in a theater of operation is a large and vital undertaking, with many divisions of responsibilities between the Navy and the Army. Basic decisions as to the locations of ports, capacity, utilization, wharfage, and storage facilities are made at the theater headquarters and the Theater Army Support Command (TASCOM) headquarters. The general responsibilities of the theater commander, theater Army commander, and TASCOM commander are stated in FM 100-10 (Department of the Army 1976a). The TASCOM Assistant Chief of Staff (AC of S) Movements is responsible for operating ports and furnishing liaison with the Navy, Coast Guard, and other interested military and authorized civilian agencies, both of Allied countries and the United States. Engineer responsibility includes minor salvage operations, such as clearing obstructions and debris from harbor entrances and channel improvement, but does not include large-scale salvaging, which is a Department of the Navy responsibility. The following paragraphs describe the responsibilities of various units for port construction and operation. Detailed missions and responsibilities are listed in TM 5-360 (Department of the Army 1964).

Engineer units

20. Engineer units are responsible for port construction and rehabilitation and for coordinating all work with that of any naval units engaged in harbor clearance and salvage operations or in the neutralization of mines or underwater obstacles in the harbor area.

Transportation units

21. Transportation units perform the mission of operating an overseas port as a facility to provide for the reception, debarkation, embarkation, and transshipment of troops, supplies, and material.

Quartermaster units

22. Quartermaster units have overall responsibility for the operation of petroleum pipeline systems to include off-vessel discharging and loading. They coordinate with naval units, engineer units, and transportation units in determining the location of tanker unloading and vessel refueling facilities.

Specialized Port Construction Capabilities

23. The engineer unit normally responsible for major port construction and rehabilitation is the engineer construction group. The group is organized to include an engineer port construction company or companies, pipeline construction and support companies, engineer construction battalions, dump truck companies, engineer construction support companies, dredge teams, and other units as the mission may require. When several groups are employed together, they are organized as an engineer brigade.

24. The mission of an engineer port construction company as described in TOE 5-129H (Department of the Army 1975b) is to provide specialized engineer support in developing and maintaining port facilities. At the present time, the 497th Engineer Company (Port Construction) located at Fort Eustis, Va., is the only active Army unit in CONUS specializing in port construction and maintenance; two similar Army Reserve units are located in California and Puerto Rico, respectively. The Engineer School, Ft. Belvoir, Va., has indicated that, at the present time, no training or instruction is being taught at the School on port construction.

25. The company capabilities include the construction and maintenance of offshore facilities and waterfront structures, installation and maintenance of POL (petroleum, oils, and lubricants) facilities and anchorages, and provision of limited dredging and removal of underwater obstructions. The company equipment includes crane-shovels with attachments for dredging, excavating, pile driving, and other work; pipeline equipment, hydraulic jacks; air compressors; pumps, tractors; concrete mixers; barge assembly sets; diesel-powered outboard propelling units; bridge erection boats; and landing craft mechanized (LCM). The company is equipped for light repair or salvage operations on ships or other floating plant and has mobile machine shop equipment. The divers are equipped for both deep- and shallow-water operations. Shortcomings in the company consist of a shortage of barge assembly sets, skid-type pile drivers, cranes which are outdated and require continuous maintenance, and critical military occupational specialties. Extensive repairs are required to equipment damaged by saltwater deterioration of steel radiators, wiring, starters, and generators. Personnel need training experience on pile-driving equipment and on erection of DeLong and self-elevating piers.

PART II: DAMAGE ASSESSMENT

26. The movement of supplies is currently anticipated through major and selected secondary ports. These ports include the receiving facilities, connecting transportation networks, civil networks, etc., and are vital to support defense-related activities.

27. Planners can expect ports to be attacked in various ways to render the facilities inoperative or to deny access to the facilities. After an attack, priority should be given to bringing the initial effects of the attack under control. Fires should be extinguished, ships and equipment in danger of damage should be relocated, and wounded personnel should be removed and treated. An initial assessment should be made to determine whether the port can continue the discharge of ships already in the port. If shore cranes are damaged or unavailable, alternate discharge sites or use of ship's equipment should be considered.

28. A detailed assessment of port damage should be made as soon as possible after an attack. The damage estimate should first analyze the crucial areas of a port which could cause operations to completely cease. Crucial areas include access to the port (channel blockage, lock damage, mine blockades, etc.); discharge facilities (container cranes, cargo handling equipment, berth space, etc.); and inland cargo routes (storage, railroads, roadways, etc.). If it is determined that a port cannot be used, then alternate ports and/or discharge methods such as logistics over-the-shore operations (LOTS), beach operations, DeLong pier assembly, etc., should be identified and implemented.

Port Capability

29. A detailed assessment of port damage following an attack should be conducted to determine a port's capability for ship discharge and the effect on three factors which determine port capacity. These factors, as discussed in FM 101-10-1 (Department of the Army 1976c), are the capability of the port to receive ships, discharge cargo, and effect forward cargo movement.

Reception capability

30. Port reception capability is defined as the number of ships that can be moved into a harbor for cargo discharge. This should be based on an

evaluation of the physical facilities of the port and the damage to those facilities. The assessment of the reception capability should include such items as channel depths, obstructions, wharf space, berth anchorage space, weather, and other restrictions to deny ship entrance into a port. The capability of the enemy to continue hostile activity should also be considered.

Discharge capability

31. Port discharge capability is defined as the amount of cargo that can be discharged at the port. This capability should be based on the equipment and personnel available to support operations. An assessment of discharge capability should consider the availability of operational container cranes and other cargo handling equipment, local labor, and floating craft and equipment. Additional factors which should be considered include continuing enemy activity and weather conditions.

Forward movement capability

32. The forward movement capability is defined as the quantity of cargo that can be moved through and out of the port. An assessment of the roads, railroads, storage areas, pipelines, and inland waterways will determine the amount of supplies which can be moved through the port. The availability of trucks and trailers, locomotives and railcars, forklifts, barges, etc., should be considered to determine whether these items are adequate to support forward movement effort. Other factors which should be considered include availability of labor, enemy activity, and weather conditions.

33. A detailed assessment, after it has been completed, may be used as a guide to determine the most restrictive factor which limits the port capacity and to identify those damages which require rapid repair in order to increase the reception, discharge, and forward movement capability. Methods of computing throughput capacity are presented in Chapter 4 of FM 101-10-1 (Department of the Army 1976c).

War-Damaged Port Inspection

34. According to TM 5-360 (Department of the Army 1964), a decision to rehabilitate or abandon war-damaged port facilities should be based on: (a) inspection to determine the extent of damage, (b) the importance of the facility in relation to the overall improvement of the port facility, and (c) limitations on use of the facility after rapid repairs have been made.

Various inspection techniques related to damaged port facilities, such as piers/wharves, storage areas, marshalling yards, hardstands, are discussed in the following paragraphs.

Port Complex Inspection

35. After an enemy attack, a port should be inspected to determine the damage to facilities which would impede the throughput of military supplies to fighting forces. Reconnaissance of the port complex, as discussed in TM 30-246 (Department of the Army 1954); TM 30-245/NAVAIR 10-35-685/AFM 200-50, Vol I (Departments of the Army, Navy, and Air Force 1967); and the following paragraphs, can be documented by aerial photography, aerial observation, or ground observation. Combinations of these documentations will increase the validity of the inspection report.

Aerial photography

36. Aerial photoreconnaissance is a convenient, accurate, and effective means of gathering quick and reliable information. The imagery is a permanent record of the damage and provides the necessary information for the photo interpreter to draw meaningful conclusions from various patterns and tones that are imaged on aerial photographs. The interpretation of imagery is performed by a group of specially trained personnel. The interpreter's job is to identify, collate, evaluate, report, and disseminate their information to appropriate personnel and units. The skill and experience of the interpreter determine the success or failure of the work.

Air observation

37. Low-flying small airplanes and helicopters are used by the aerial observer to record valuable port damage information. The aerial observer has the same view of the damage as the image interpreter at very low altitudes. The image interpreter can see the damage in three dimensions at higher altitudes with the aid of a stereoscope. Aerial observers have only limited time to observe the damage, but image interpreters can study the same area of damage for hours with the aid of magnifiers. For these reasons, aerial observations lack the accuracy and detail of aerial imagery. However, the aerial observer can scan the entire damaged area and can sometimes fill in gaps left by the aerial photo or can determine the most likely areas for spot photo coverage.

Ground observation

38. Ground reconnaissance can be used to document and supplement other methods of damage documentation. The ground observer can travel either by wheeled vehicle or on foot to record pertinent information. Prior to damage inspection by the ground observer, unexploded ordnance must be identified and removal must be accomplished. If ordnance disposal teams are not available or are lacking in quantity to complete the operation in a timely manner, engineer troops can be used. Personnel familiar with engineer explosives can effectively detonate unexploded ordnance under the supervision of knowledgeable personnel. Ground observers can sometimes provide much more detailed information than by aerial imagery for a limited area of damage. The image interpreter can use ground observations to increase his knowledge of the area, thus increasing the effectiveness of his interpretations. Beforehand knowledge concerning a preattacked port is likely to be available in documents, maps, charts, reports, and photographs. These data provide a foundation upon which further data collection can be based.

Pier/Wharf Inspection

39. An assessment of damage to war-damaged port facilities, such as storage areas, marshalling yards, and hardstands, using reconnaissance methods has been discussed in prior paragraphs. Reconnaissance inspection techniques can be used to determine the surface condition of a war-damaged pier/wharf; however, an accurate assessment of the above-water and underwater portion of waterfront facilities should be conducted to determine the structural capacity of the damaged structure. Various inspection techniques related to war-damaged piers/wharves are discussed in the following paragraphs.

Ship discharge facilities

40. Ship discharge facilities are structures that front on or extend into navigable water and are designed for berthing vessels or for other purposes, such as recreation. Berthing, the major function of interest, may be for transfer of cargo or passengers, or for repair, fueling, or providing other services to the vessels. Ship discharge facilities are normally named and designed after the type of vessel that will be using the facility. These facilities include, for example, container, general cargo, landing craft, petroleum, and roll-on/roll-off.

41. A pier or wharf is a term used to describe a discharge facility for unloading and loading the cargo that a vessel transports. A wharf is a facility that usually parallels the shore. The number of linear feet at the face of the wharf is the length of the berthing accommodation. A pier generally is a structure that projects into the water. It usually provides berthing on both sides of the structure and is perpendicular to or at an acute angle to the shore.

Construction types

42. There are two general types of pier and wharf construction: open construction and solid construction. Structures of open construction consist of a pile-supported deck with water below. Structures of solid construction consist of filled caissons or similar cells, or sheet piling walls tied together and backfilled. A combination of solid and open construction may also be used for ship discharge facilities.

Construction materials

43. The majority of waterfront structures to be inspected are constructed of either wood, steel, or concrete. Combinations of these are frequently used; for example, timber or steel piles may support a concrete deck. Other materials such as cast iron and plastic or rubber compounds may be encountered, but not usually as part of the main structural elements.

44. Construction materials discussed in the following paragraph are presented in a report by Brackett et al. (1982). Timber is widely used for the substructure (piles) and superstructure of piers and wharves. Approximately 35 percent of Department of the Navy piers are wood superstructures and piles. Timber piles are often used to support concrete decks. Steel bearing piles, pile caps, and stringers combined with a wood or concrete deck are commonly used but comprise only about 10 percent of underwater pile construction. Steel sheet piling is the most common type of construction material used for bulkheads and also for solid construction of piers and wharves. Concrete is the most common waterfront construction material. More than 40 percent of the Navy piers consist of a concrete deck on concrete piles; many more have a concrete deck on timber or steel piles. Reinforced concrete and prestressed concrete are also used for piles, pile caps, stringers, decks, sheet piling, and other uses.

Structural damage

45. During an aerial bombing attack and/or sabotage, pier/wharf

structural components, such as piling, deck slabs, pile caps, bulkheads, and walls, could be destroyed. The damage zone could extend to surrounding component areas and reduce the load-carrying capability of waterfront structures. Damage to timber piling may consist of broken or split timber, tilted piles, or ruptured connections at the pile head. War damage to concrete piles could result in broken, split, or spalled piling. Steel piles could be bent, dented, tilted, or ruptured. Cratered pier decking; ruptured, split, or spalled pile caps; ruptured bulkheads; fractured, collapsed, or displaced walls; and combinations of damages are possible results of military aggression on waterfront facilities. Combined effects of natural deterioration and war damage will reduce the operational capability of waterfront facilities. Above-water and underwater inspections of piers and wharves should be conducted to assess the structural integrity of deteriorated and/or war-damaged structural components.

46. Natural deterioration (or damage) of waterfront structures constructed of wood, steel, and concrete is caused by exposure to various destructive forces (Brackett et al. 1982 and Departments of the Army, Navy, and Air Force 1978). Natural damage generally falls into one of three principal categories: biological, chemical, or mechanical. Biological attack by marine organisms, fungi, and termites is the major factor in the deterioration of structures constructed of timber. A common damage of concrete structures in or near seawater is cracking and loss of material due to chemical action and corrosion of the reinforcement steel. Corrosion is a primary cause of the deterioration of both steel and reinforced-concrete structures. Mechanical damage can occur with any of the construction materials. The damage is a result of accidental overloads, impact of ships, or abrasive action of sand, ice, and debris, all of which weaken structural elements.

Current Inspection Techniques

47. Waterfront facilities require periodic maintenance and repair to maintain a satisfactory level of operational capability. Inspection of these facilities, specifically piers and wharves, for deterioration and war damage is required to establish a structural assessment and determine the extent of required maintenance and repair. The standard operating procedures (inspection for structural integrity of piers and wharves) for maintenance

of waterfront facilities should apply to facilities damaged during military confrontations. Numerous state-of-the-art inspection techniques have been developed to assess deterioration to waterfront facilities. These techniques are the subject of several reports (Brackett et al. 1982, Brackett 1978, Departments of the Army, Navy, and Air Force 1978, American Association of Port Authorities 1970, and Thornton 1977) and are discussed in the following paragraphs.

Visual inspection

48. Visual examinations may be conducted from the structures, from a boat, or from below the waterline by experienced divers. The most commonly used underwater inspection technique used in the United States, as reported by Brackett (1978), is visual inspection with television and still camera documentation. Visual inspections are conducted to confirm the as-built condition of the structure, to detect severe damage to the structural elements, and to detect surface damage. There are numerous limitations to this type of underwater inspection, including poor visibility, obscured surface defects unless cleaned, strong currents, cold temperatures, and inadequate diver training. It is important to consider the limitations of a visual inspection when determining the condition of a structure based on visual data. This technique can yield quick, valuable information about the condition of a structure; however, the data are only qualitative in nature and do not provide a direct measure of strength.

Soundings

49. Exposed areas and underwater elements of a wood, concrete, or steel structure may be examined by experienced inspectors using a hammer to determine the soundness of structural elements. Soundings are taken by striking the surface, listening to the resultant ring, and determining the soundness of the structural element from the ring's sound. An unmistakable ring from the blow of a hammer on a concrete surface indicates sound material, while a hollow sound indicates loose material. Likewise, soundings with a hammer will detect voids and can be used to estimate the quality of existing timber elements. The resultant soundings below water are reduced by waves, currents, and background noises. This method is economical but not particularly effective because it is only qualitative in nature and relies on the inspector's ability to interpret sounds. Hammer sounding gives a gross indication of internal condition and is successful only in identifying extensive damage.

Underwater nondestructive testing

50. To establish priorities for accomplishing maintenance and repair to Naval shore facilities, inspection of these facilities is required. The Naval Civil Engineering Laboratory, Port Hueneme, Calif., has conducted a study to improve the capabilities of Navy divers to conduct underwater inspection and nondestructive testing (NDT) of waterfront structures. Results of this study are reported by Brackett (1978) and are discussed in the following paragraphs.

51. The state of the art in underwater NDT technology was identified by contacting diving contractors and equipment manufacturers in the United States and the North Sea area of Europe who were involved in underwater inspection. A number of NDT techniques have been developed either in laboratories or factories; however, only five have found application in underwater inspection of waterfront structures constructed of either wood, steel, concrete, or a combination of materials. These methods include ultrasonic testing, magnetic particle inspection, radiography, eddy current testing, and underwater electrical potential. These NDT techniques are briefly discussed in the following paragraphs and are discussed in detail by Brackett (1978).

52. Ultrasonic testing. This technique uses the measurement of the transit time of high-frequency sound waves to detect metal thickness and internal defects. Two measurement methods are commonly used to inspect underwater structural members. The pulse/echo measurement method uses a single transducer to both send and receive signals transmitted into the test material. The transmission measurement method uses separate transducers located on opposite sides of the test structure to send and receive the ultrasonic signal. The pulse/echo system is most commonly employed in the testing of metal structures, while transmission techniques are applied to wood and concrete structures. Ultrasonic testing is best designed for the detection of internal defects and metal thickness.

53. Magnetic particle inspection. Magnetic flux leakage is used in this technique to detect the presence of surface cracks in metallic structures. A phosphorescent ink containing ferrous particles is applied to the surface of a structure in which an electromagnetic field has been induced and inherent surface discontinuities become visible when illuminated with an ultraviolet light. A validity check is required for this technique to assure that the magnetic flux is flowing through the test structure rather than short circuiting through the seawater. The requirement for a validity test is a

major shortcoming of all the underwater NDT techniques used to date.

54. Radiography. The ability of various materials to absorb and scatter radiation is used in this method to produce a photographic image in which the developed film provides an indication of the thickness of the material being inspected. Since the source of radiation and the film must be located on opposite sides of the object to be inspected, this technique is applicable only where both sides of the structure are accessible. Because of the scattering of radiation in water, the maximum size liquid-filled pipe which can be inspected is about 8-9 in. in diameter. This limits the number of waterfront structural members which can be inspected using this technique.

55. Eddy current testing. This method uses information on the electrical conductivity, magnetic permeability, and dielectric properties of metallic materials to detect cracks and measure wall thickness. Some experimental underwater eddy current testing techniques have been demonstrated in the laboratory, but the technique has not been used extensively to test structures in the ocean.

56. Underwater electrical potential. This technique uses the difference in electrical potential between a metallic object and a silver/silver-chloride reference to determine the effectiveness of cathodic protection systems or identify the presence of local galvanic corrosion cells.

57. Comparisons of these five techniques revealed that ultrasonics and radiography can be used to test wood, concrete, or steel structural members, while the other three methods may be used for testing metallic structures only. Radiography and ultrasonics are used to detect internal defects and material thickness. Magnetic particle and eddy current techniques are used to detect surface cracks, and electrical potential measurement is used to determine the effectiveness of cathodic protection systems. An important requirement for successful results from these underwater techniques is that the surface of the test structure be cleaned of marine growth, loose scale, rust, and protective coatings. Without direct contact of the test equipment with the surface to be tested, chances of obtaining valid results are minute. Highly trained personnel are essential in the use of NDT equipment.

Concrete Structure
Testing Above the Waterline

58. Several techniques for underwater testing of concrete structures have been presented in previous paragraphs and are also applicable for

above-water testing. Other NDT methods specifically suited for concrete structural elements above the waterline are dynamic deflection and rebound hammer. These two NDT methods are expedient and can be used in the field.

59. Dynamic deflection. This NDT method, reported in Thornton (1977), applies a sine-wave repetitive force or oscillatory load to a slablike or continuous system, such as floor slabs or pavements, and measures the deflection produced in the system. By evaluation of the deflection measurements, the shape of the deflection basin can be determined. This method is very practical in evaluating highway and airport pavements, as well as other flat slab concrete construction. The dynamic deflection method can be extended for assessing support parameters, joint efficiency, and determining the extent or degree of crack damage.

60. Rebound hammer. This technique, which uses the Schmidt rebound hammer, is useful for testing the surface hardness of concrete structures. The rebound hammer method is the subject of several reports (Brackett et al. 1982, Thornton 1977, US Army Engineer Waterways Experiment Station 1949, and American Society for Testing and Materials 1981). The hammer is operated by pressing a plunger against a smooth surface being tested and releasing a spring-loaded mass which causes an impact of the plunger on the concrete surface. A rebound number is read from a scale on the hammer. These numbers may be compared to other numbers taken from other parts of the surface or may be roughly related to other mechanical or elastic properties of the concrete using a calibration chart. Strength predictions must be based on a specific correlation of strengths versus rebound numbers.

Damage Assessment Using Inspection Data

61. An inspection is a condition survey which identifies the physical condition of an existing structure. The information obtained by an above-water and underwater inspection can be used to make an engineering assessment of the war-damaged waterfront facility and its capacity to carry loads and its capability to be used safely for its intended purpose for a projected period of time. After the findings of the engineering assessment are made available, a decision (to repair and what to repair, to replace and what to replace, etc.) can be made on what action to take concerning the operational use of the damaged structures. Rational engineering decisions can be made on the

feasibility of repairing the existing damaged port structures versus abandonment of the damaged structures and moving to an alternate port or implementing alternate discharge methods.

Current Army Inspection Capabilities

62. Underwater port construction, rehabilitation, war-damage surveys, and recovery are performed by an 11-man diving section with equipment as described in TOE 5-129H (Department of the Army 1975b) and a 9-man diving team with equipment as described in TOE 5-530H6 (Department of the Army 1976b). These two Department of the Army units are trained to conduct diving operations which include planning diving missions; conducting underwater reconnaissance, war-damage surveys, and rehabilitation of existing facilities; performing underwater cutting and welding, demolitions, inspection of existing facilities, and hull inspection and repair; and operating decompression chambers.

63. The diving teams have the task of conducting an underwater reconnaissance to provide information needed for the repair or rehabilitation of war-damaged port facilities. The divers should accurately determine the underwater structural condition of piling or other structural members before undertaking dredging operations near a structure or making repairs to the superstructure. Diving teams are equipped with photographic equipment and tool kits which are used to conduct the underwater surveys by visual inspections and photographic documentation. These teams are not trained or equipped with electronic or other sophisticated equipment to conduct underwater inspection and nondestructive testing of war-damaged waterfront structures.

Port Characteristics

64. Successful military operations will be dependent on ports during a wartime situation. Sealift will be the primary means of any major overseas deployment, reinforcement, and resupply. Estimates have been made that 95 percent of all dry cargo and more than 90 percent of all petroleum will be delivered by sea (US General Accounting Office 1983). Since large quantities of troops and military supplies will be transferred by ships through ports, logistical data are necessary for planners to identify major ports and characteristics of port facilities.

65. The majority (75 to 90 percent) of logistic support in the theater of operations will be containerized (US Army Engineer Waterways Experiment Station 1975 and Department of the Army 1975a). Because the US Army will ship cargo by containers, major CONUS and OCONUS container ports have been identified in the United States, Europe, Mediterranean/European area, and Persian Gulf. These major ports and corresponding port facilities are identified and presented in Appendixes B, C, D, and E, preceded by Appendix A which is a list of abbreviations used in the appendixes. The data presented in these appendixes were extracted from reports by Riethmuller (1981) and Boyes (1981). The appendixes provide compendiums of the more significant port characteristics and the data can be used by military planners to determine whether to repair the damaged port, construct new port facilities, or select an alternate port.

PART III: CONCLUSIONS AND RECOMMENDATIONS

Conclusions

66. Historical information indicates that improvised temporary structures were either constructed over or around war-damaged port wreckage. Beach areas were developed to move critical materials and equipment ashore while time-consuming port reconstruction could be accomplished.

67. The Chief Engineer noted the shortage of port rehabilitation equipment and that troops lacked sufficient training in port construction during World War II.

68. Large quantities--95 percent estimated--of all dry cargo will be delivered by sea and a majority--75 to 90 percent-- of military supplies will be containerized.

69. Port facilities damaged by military conflicts will impede the movement of containerized and other cargo from ship to shore and inland.

70. Shortcomings of specialized port construction and rehabilitation engineer units include the following:

a. No training or instruction is being taught at the US Army Engineer School on port construction.

b. The 497th Engineer Company (Port Construction) has outdated equipment in need of continuous maintenance, and personnel need training in port construction specialties.

71. After an attack and/or sabotage, a detailed assessment of port damage should be completed and the assessment results should be used as a guide to identify the most restrictive areas which require immediate rapid repair to improve movement of cargo.

72. Reconnaissance inspection techniques can be used to determine the surface condition of a war-damaged port complex. Damage assessment can be documented by aerial photography, aerial observation, or ground observation.

73. Current inspection techniques available for assessing structural integrity of war-damaged piers and wharves and other pertinent information are summarized as follows:

a. Visual inspections are commonly conducted to detect surface damage and severe damage to structural elements and to confirm the as-built condition of structures.

b. Hammer soundings give gross indications of internal structural condition and are successful only in identifying extensive damage.

c. The Naval Civil Engineering Laboratory has identified five methods for conducting underwater inspection and NDT of waterfront structures: ultrasonic testing, magnetic particle inspection, radiography, eddy current testing, and electrical potential.

d. Dynamic deflection and rebound hammer are other NDT methods used for conducting above-water inspections on concrete structural elements.

e. Highly trained personnel are essential in the use of NDT equipment.

74. US Army diving teams are trained and equipped only with photographic equipment and tool kits to conduct underwater reconnaissance by visual inspection and photographic documentation.

Recommendations

75. US Army units should maintain sufficient training, and appropriate equipment should be procured and maintained for port construction and rehabilitation.

76. The US Navy has investigated the use of electronic and other sophisticated equipment to conduct underwater inspection, assessment, and nondestructive testing of underwater structures. The Army should consider the use and development of nondestructive testing equipment to conduct above-water and underwater reconnaissance and assessment of war-damaged waterfront facilities.

77. Information presented in this report should be used to update TM 5-360, dated September 1964 (Department of the Army 1964).

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APPENDIX A: ABBREVIATION GUIDE FOR APPENDIXES

1. The following abbreviations not commonly used in WES reports are used in Appendixes B through E.

Terms	Abbreviation
conventional buoy mooring	C.B.M.
deadweight	d.w.
deadweight tonnage	d.w.t.
East	E.
gross registered tonnage	g.r.t.
latitude	Lat.
liquefied natural gas	L.N.G.
liquefied petroleum gas	L.P.G.
longitude	Long.
nearest international airport	N.I.A.
net registered tonnage	n.r.t.
North	N.
roll-on/roll-off	ro/ro
South	S.
single buoy/point mooring	S.B.M./S.P.M.
twenty-foot equivalent unit	TEU
very large crude carrier	V.L.C.C.
West	W.

2. The following is a list of abbreviations not commonly used in WES reports which pertain to tides.

Term	Abbreviation
astronomical	A.
datum	D.
equinoctial	E.
high/higher/highest	H.
Indian	I.
low/lower/lowest	L.
mean	M.
neap	N.

(Continued)

Term (Concluded)	Abbreviation
ordinary	O.
range/rise	R.
spring	S.
tide	T.
water	W.

Examples: H.W. - high water
M.L.W.S.T. - mean low water spring tide

APPENDIX B: CHARACTERISTICS OF CONUS PORTS

1. Leading United States container ports are ranked below according to the throughput of TEU's, followed by compendiums of port characteristics.

Port	Page
New York	B2
Oakland	B3
Seattle	B5
Hampton Roads	B6
Baltimore	B9
Charleston	B12
Houston	B13
New Orleans	B15
Philadelphia	B17
Savannah	B19
Boston	B20
Miami	B21
Portland	B22
San Francisco	B23
Palm Beach	B24
Jacksonville	B25
Wilmington	B26
Galveston	B27
Tacoma	B29

PORT: New York (40°43' N. Lat., 74°00' W. Long.).

APPROACH: A spacious landlocked harbor, entered from the 16-mile-long Ambrose Anchorage Channel (2,000 ft wide and 45 ft deep at M.L.W.), Sandy Hook Channel (2,000 ft wide and 35 ft deep at M.L.W.), and the East River (155 to 1,000 ft wide and 35 ft deep at M.L.W.) from the Long Island Sound. Other channels range in depth from 12 to 40 ft at M.L.W.

FACILITIES:

Wharves - Total harbor frontage along navigable waters, 750 miles. Over 250 deep-draft general cargo vessel berths are available. There are 277 petroleum facilities. Most general cargo piers on Manhattan and Staten Island are owned by the City of New York. Elsewhere, the Port Authority, railroads, industry, and private terminal operators are owners. Deepwater and protected anchorage are available.

Storage - Eighty-five warehouse companies with 16 million sq ft of dry space and 90 million cu ft of cooler space; 386 transit sheds are available.

Cranes - Lifting facilities up to 500 tons, general privately owned, both floating and ashore.

Water - Available.

Tanker terminals - Forty-one oil berths; length 170 to 1,280 ft, draft 20 to 40 ft. Night berthing at all but one berth. Water available at all but seven berths. Bunkers at all but 14 berths.

Bunkers - Bunker "C" and diesel oil are available in abundance.

Container and ro/ro - *There are gantry container cranes at present in* operation at the port as follows: 21 at Elizabeth-Port Authority Marine Terminal; three at Port Newark; two at Weehawken, N.J. (sea-train low-level cranes); five at Howland Hook, Staten Island; three at Global Terminal, Jersey City; and two at Northeast Terminals, Brooklyn.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Thirty-eight marine repair plants; 52 floating dry docks and two graving docks. Lifting capacity of floating dry docks, 300 to 25,000 tons. Graving dock lengths, 573 and 716 ft.

REMARKS: Airports - Four commerical airports operated by the Port Authority--La Guardia and John F. Kennedy International Airport in New York, and Newark International and Teterboro Airports in New Jersey. Most overseas passengers use John F. Kennedy International Airport, about 15 miles from midtown Manhattan in Jamaica, Queens.

PORT: Oakland (37°37' N. Lat., 122°18' W. Long.).

APPROACH: Port is located on the mainland side of San Francisco Bay.

FACILITIES:

Wharves - The port's marine terminal facilities are located in the four areas known as the Outer Harbor, Middle Harbor, Seventh Street, and the Inner Harbor. Twenty-nine large deep-draft vessels can be accommodated at any one time. Channel depth to all facilities is maintained at 35 ft. Depths at individual berths, in most cases, exceed channel depth. The port has over 400 acres of container facilities including 15 full containership berths, 3 combination container/break-bulk berths, 1 container ro/ro berth, 1 full ro/ro berth, 16 container gantry cranes, and 1 mobile crane equipped to handle containers. There are excellent rail, highway, and barge connections to all facilities of the Port.

Storage - Modern steel and concrete transit sheds, wharves, and piers capable of handling all types of ships are available at the port area.

Cranes - Sixteen container gantry cranes and one mobile crane equipped to handle containers are available.

Water - Available.

Tanker terminals -Not reported.

Bunkers - Oil bunkers by barge alongside Port of Oakland facilities.

Container and ro/ro - The Outer Harbor area contains the Oakland Army Base (Military Ocean Terminal Bay Area), Berth 10 complex, Berth 11 and 12 complex, and Berths 5 and 6. The Berth 10 complex is presently used as a combination ro/ro-break-bulk facility, in conjunction with the adjacent Berth 11 and 12 complex, with services of one 227-ton mobile crane. Sea-Land's major facility encompasses 70 acres and includes nearly 2 million sq ft of container storage area, two berths, four container gantry cranes, a container freight station, and a rail/truck terminal. The Public Container Terminal (Berth 6) consists of facilities for one berthing, two cranes, and 11 acres of storage space. Oakland Container Terminal includes two berths served by a 40-ton container gantry crane, over 590,000 sq ft of container storage space, and a total facility area of 32 acres.

The Middle Harbor area includes a 45-acre, 2-berth terminal which includes two container gantry cranes and over 1.7 million sq ft of container storage area. The second major terminal in the Middle Harbor area is a 1-berth, 40-acre facility which includes over 1 million sq ft of container storage space and is served by two container gantry cranes.

The Inner Harbor includes the Grove Street Terminal, Ninth Avenue Terminal, and a private steel and ship breaking terminal.

The Seventh Street Terminal complex consists of almost 148 acres developed for containerized cargo. Two main terminals are served by 6 container gantry cranes and includes over 4.4 million sq ft of container storage area and 6 berths. Within the Seventh Street area are three container freight stations totalling 121,000 sq ft and a 61,400-sq-ft combination container freight station/transit shed.

NEW DEVELOPMENTS: Public Container Terminal Berth 5 under construction. When completed, the entire complex will include more than 49 acres and two berths served by three container cranes.

SHIP REPAIRS: Shipyards are available to handle large-scale construction and repairs.

REMARKS: Airport - Oakland International Airport, owned and operated by the Port of Oakland; 15 minutes from marine terminal facilities.

PORT: Seattle (47°36' N. Lat., 122°20' W. Long.).

APPROACH: A mandatory vessel traffic system has been established by the US Coast Guard. The system comprises two major components--a traffic-separation scheme and vessel-movement reporting system. The traffic-separation scheme comprises a network of one-way traffic lanes, separation zones in between, and precautionary areas. The traffic lanes are each 3,000 ft wide and separated by 1,500-ft-wide separation zones. Each traffic lane has minimum depth of 60 ft (except 40 ft off each end of Partridge Bank).

FACILITIES:

Wharves - Harbor is one of the safest on Pacific Coast, being nearly landlocked. Main saltwater harbor, Elliott Bay; area, 8.3 square miles, shore frontage, 53 miles. Eighty terminal facilities of various types, oil docks, military docks, etc. Eighteen terminals for general commerce with average depth alongside of 35 to 50 ft. Besides Elliott Bay there is a great inland harbor, comprising the freshwater lakes, Lake Washington and Lake Union, connected with Puget Sound by Lake Washington Ship Canal, mean depth, 29 ft. Ships of 761 by 80 ft can enter the locks. The Canal is 8 miles long and has a harbor area of 51 square miles and a shoreline of 139 miles.

Storage - Not reported.

Cranes - See "Container and ro/ro."

Water - Available.

Tanker terminals - Seven berths; lengths from 433 to 650 ft, draft about 35 ft; night berthing possible; water and bunkers available.

Bunkers - Fuel and diesel oil available at installation or by barge.

Container and ro/ro - Terminal 5--three ship berths, four high-speed container cranes; Terminal 18--six ship berths, five high-speed container cranes; Terminal 46--two ship berths, two high-speed container cranes; Terminal 25--two ship berths, two high-speed container cranes.

NEW DEVELOPMENTS: A new container facility at Terminal 37 is under construction; 1,319-ft berthage with two container cranes available; additional 718 ft and two more cranes available.

SHIP REPAIRS: The following facilities are available: 2 docks, each 520 ft long with capacity of 16,000 tons each; 1 dock, 410 ft long and 5,700-ton capacity; 1 dock, 600 ft long with 17,200-long-ton capacity; 1 dock, 540 ft long and 12,000-long-ton capacity; 1 dock, 390 ft long with 3,500-long-ton capacity; 1 dock which is 340 ft long with 3,900-long-ton capacity.

REMARKS: Airport - Sea-Tac International Airport, 15 miles.

PORT: Hampton Roads (36°58' N. Lat., 76°20' W. Long.). Large natural harbor, formed by the confluence of the James, Nansemond, and Elizabeth Rivers. Port is ice-free throughout the year.

APPROACH: Vessels entering from the sea follow a course between the Virginia Capes, across the lower end of Chesapeake Bay via Thimble Shoal Channel into the deep waters of Hampton Roads. Two improved deepwater channels extend through the Roads. One channel, 18 miles long, extends southwards into Norfolk, Portsmouth, and Chesapeake via the Elizabeth River and its southern branch. The second channel, 5 miles long, extends westward to Newport News, and then up the James River to the ports of Hopewell and Richmond. The present project depth from the Virginia Capes to a point just south of the N. & W. Railway Coal piers at Lamberts Point is 45 ft. The channel to Newport News project depth is 45 ft over an 800-ft width. Thimble Shoal Channel is 1,000 ft wide and also 45 ft deep. The width of Norfolk Harbor Channel is 1,500 at its outer end tapering down to 250 to 500 ft at the junction with the Atlantic Intracoastal Waterway route. Four deep-draft anchorages have recently been constructed. Two of the anchorages at Sewells Point have depths of 40 ft and 45 ft. The other two at Newport News have been dredged to 40 ft each.

FACILITIES:

Wharves - Elizabeth River Terminals (Chesapeake) - Two-berth marginal pier, 1,000 ft long, 440 ft of which is used for general cargo, on 35-ft-deep channel. Remainder of pier equipped with bulk-handling equipment, including 40- to 50-ton gantry crane. Adequate warehousing, (105,000 tons) fully conveyorized, and open storage adjacent to the pier, capacity, 105,000 tons. Also a two-berth terminal with 12 ft of water. Two 10,000-ton steam-heated storage tanks, plus bagging equipment capable of bagging 200 tons/hr. Terminal has rail tracks to piers, with connections to all area trunk lines; highway connection to all area highways.

Hidden Storage and Forwarding (Newport News) - 102 warehouses with over 2 million sq ft of storage space, with fumigation equipment of 23,986-cu-ft capacity available for fumigating tobacco.

Lamberts Point (Norfolk) - Lamberts Point Docks Inc. provide berthing space for 17 vessels simultaneously. An adjacent storage space of 1.5 million sq ft is available. This company operates piers P, L, and N at Lamberts Point. Pier L, a covered pier, is 1,200 ft long and 200 ft wide with a depth alongside of 32 ft. Tracks enable enchange of freight direct from car to ship and vice versa. Pier N, a 1,100-ft-long covered pier, is 390 ft wide with 32 ft alongside. It has four sets of tracks, two 15-ton gantry cranes, and covered pier space of 320,000 sq ft. Adjacent to Piers L and N is a 14,479-cu-ft fumigation plant and a yard for 2,100 cars. Pier P is covered and is 400 ft by 1,200 ft with 43-ft aprons, depth alongside, 32 ft, 326,000-sq-ft covered pier space. Two 25-ton gantry cranes are available . The pier also has four sets of tracks, a transit shed, and two supporting land warehouses. The three piers handle varied cargoes and excellent railway and highway connections serve the complex.

Newport News Terminals - Following piers operated by the Peninsula Terminals, Ltd., for the Virginia Port Authority. Pier B is

620 ft long and 543 ft wide overall. This recently built 8-acre facility provides 250,000 sq ft of fireproof covered pier space and specializes in the fast handling of export-import cargo. A 50-ton mobile gantry crane and a 35-ton container carrier handle varied loading/unloading operations. Pier C is 755 ft long and 552 ft wide overall and accommodates two general cargo vessels and one container ship at a time. The pier will provide up to 210,000 sq ft of covered warehouse space, and a 40-ton crane with a 115-ft outreach will handle 20-ft and 40-ft containers as well as general cargo. Other container-handling equipment is available and also large marshalling areas. Pier 2 is 606 ft long and 62 ft wide and is equipped with two 30-ton electric travelling gantry cranes. Two electric car haulers, each capable of pulling eight loaded cars, are available. Magnet and bucket unloading facilities at this pier make it suitable for handling iron ore, bauxite, ore, ballast, sulphur, etc. Pier 8 is 818 ft long and 213 ft wide and is of the transit warehouse type.

Newport News Development - Pier C (north side): a rail-mounted 120-ton gantry crane (multipurpose) with a 112-ft outreach in operation before 1981. Paving approximately 30 acres of backup storage area was completed in 1981.

Norfolk International Terminals - Most kinds of import and export shipments are handled. Two piers for handling bulk and break-bulk cargoes, accommodating up to seven ships at a time. Pier 1 is 320 ft long and 308 ft wide with 30 ft alongside (northside) and 35 ft alongside (southside). Pier 2 is 1,320 ft long and 336 ft wide with 35 ft alongside. Pier and quay space of 900,000 sq ft is available with eight spacious warehouses nearby. Container Berth No. 1 is a 740-ft marginal wharf with 35 ft alongside. Four Paceco cranes. Apron extends 80 ft. Container Berth No. 2 is an 849-ft marginal wharf with 35 ft alongside, eight transtainers. Excellent highway and railway access together with extensive internal rail and road networks. Marshalling area for 6,000 20-ft containers.

Norfolk International Development - Third container berth was extended by 700 ft in 1981.

Norfolk Oil Transit Inc. (Lamberts Point-Norfolk) - Complete oil-handling facilities for bulk liquids. Thirteen 544.3-ton storage tanks with total storage capacity of 2.9 million gal. All tanks provided with heating coils. Sampling, analysis, and blending services available. Pumping capacities up to 400 tons/hr. Water depth, 35 ft.

Portsmouth Marine Terminal - Operated by Portsmouth Terminals Inc. A general cargo and container terminal with 1,730 ft of marginal pier including a ro-ro platform. Container or general cargo vessels handled at either berth. Two 30-ton Paceco portainer cranes and a 110-ton gantry crane travel entire length of pier. Seven Clark Van Carriers to transport containers to storage areas and 40-ton crane also available. Warehouse space of 30,000 sq ft and a 980,000-sq-ft transit shed at pierside and available. Large marshalling areas are included in the complex, which is directly connected by five major railroads.

Portsmouth Marine Development - Marginal container berth has been extended 800 ft.

Sewells Point (Norfolk) - Piers A and B, operated by Lamberts Point Docks, Inc., are each 1,200 ft long and 100 ft wide with 32 ft alongside. Pier A has two gantry cranes. The piers share 230,000 sq ft of covered pier space. Apron tracks and backup tracks expedite cargo movements, and a 160,000-sq-ft warehouse is available for storage. Truck-loading platforms on piers and warehouses. Pier A also has a clamshell bucket facility. Whole area served by five major railroads.

Storage - (See "Wharves.")

Cranes - (See "Wharves."

Water - Available.

Tanker terminals - Fifteen berths; length unlimited; draft from 15 to 38 ft; night berthing possible; water and bunkers available.

Bunkers - Fuel, diesel, and gas oil available.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Newport News Shipbuilding & Drydock Co. has shipyard capable of building or repairing any vessel of any size. Several smaller shipyards specializing in hull, machinery, and electrical repair work are also available.

REMARKS: Airport - Norfolk Regional Airport (approximately 10 to 20 minutes from terminals of Norfolk, Portsmouth, and Chesapeake). Patrick Henry Airport (approximately 10 minutes from Newport News Terminals).

PORT: Baltimore (39°17' N. Lat., 76°35' W. Long.). Located at the Patapsco River about 12 miles north of Chesapeake Bay. The limits of the port include the entire length of the Patapsco and its tributaries, 45 miles of deepwater frontage.

APPROACH: The main ship channel, 20 miles long, has a depth of 41 ft and a width of 787 to 984 ft. It extends from deep water in Chesapeake Bay to Fort McHenry. Several subsidiary channels, from 395 to 591 ft wide and 41 ft deep, serve marine terminals, waterfront industries, etc. Sea routes are via the main ship channel and Chesapeake Bay to the sea, or via the Chesapeake and Delaware ship canal to Delaware Bay and the sea. The C & D canal is a sea-level, toll-free waterway 18 miles long, 443 ft wide, and with a controlling draft of 34 ft.

Anchorages Baltimore offers six general and two specialized anchorages for the convenience of ships calling at the port. Aggregating a total of 1,572 acres, all lie within the confines of the Patapsco River and offer areas of various sizes and depths.

A large general emergency anchorage lies at Sandy Point, 25 miles south of Baltimore in the Chesapeake Bay. This natural deepwater anchorage of unlimited area has depths of 49 ft and more.

FACILITIES:

Wharves - The most important sections of the harbor and tidal estuaries, containing the largest marine terminals, are: Northwest Branch; Middle Branch; Curtis Bay, and lower Patapsco River. Three major US trunk line railroads--the Consolidated Rail Corporation (Conrail), the Chessie System (Chesapeake and Ohio/Baltimore and Ohio), the Western Maryland--and the Canton (local port and switching railroad serving a heavy industrial area) have their ocean terminals directly on the waterfront. Western Maryland Railway and Canton Railroad remain the only railroads operating general cargo facilities. Over 160 licensed interstate motor carriers serve the port. Several nonrailroad companies operate marine facilities.

Baltimore and Ohio R.R. (Chessie System affiliate), at Curtis Bay: one 886-ft-long coal-loading pier; capacities, 4,000 tons/hr (barges only) and 6,000 tons/hr. One open bulk alumina unloading facility and general cargo pier at Hawkins Point; one ore dock with two electrically operated travelling bridge cranes; capacity, 1,800 tons/hr. Rail and truck access. Depths alongside, 34 ft at Curtis Bay.

Canton R.R., at lower Canton: eight general cargo piers with 314,840 sq ft of covered storage, additional dockside warehouses with 871,870 sq ft of space. One bulk facility, an ore pier equipped with three electric travelling bridge cranes, capacity, 3,000 tons/hr. Rail and truck access. Depths alongside, 30 to 41 ft. Supporting yard at Lower Canton has capacity of 1,200 rail cars. Berths: 13.

Clinton Street Marine Terminal Maryland Port Administration (MPA), at Upper Canton: One 2-deck general cargo pier totalling 331,890 sq ft of covered storage, one 13.5-ton and one 16-ton electric gantry crane. Berths: four, capacity for 1,341 rail cars in supporting yards. Over 15 acres of open storage.

Western Maryland Railway, at Port Covington: Four general cargo piers with 581,000 sq ft of covered storage; three of these have marginal berths; three have double deck transit sheds; four have 9-ton electric travelling gantry cranes. Depths alongside, 30 to 40 ft. Supporting yard at Port Covington has capacity of 3,000 rail cars. Berths: 17.

Dundalk Marine Terminal (MPA), at Dundalk: Three 787-ft, seven 590-ft, and two 492-ft marginal berths, serviced by 49-ft-wide aprons, double and triple depressed rail trackage, three 96,870-sq ft and one 48,440-sq ft transit sheds, two 62,970-sq ft and one 60,550-sq-ft container consolidation sheds, two high-speed 44-ton and two 53-ton electric gantry cranes, seven 39-ton bridge container cranes, and one 62-ton mobile crane; ten warehouses totalling 387,500 sq ft and 430 acres of open paved storage. A 120-ft by 71-ft ro/ro platform is located between berths 8 and 9. Two access channels, 6,990 ft long and 35 ft deep, serve the terminal.

Hawkins Point Terminal (MPA): The Hawkins Point Terminal currently provides one bulk/general pier and is operated by the Eastalco Aluminum Co. for the import of alumina. It is equipped with one bulk ore unloader, 105 ft high with a 79-ft outreach, connecting with a conveyor system for direct railcar loading or loading to storage silos. It is used exclusively for the handling of alumina.

North Locust Point Terminal (MPA): Current facilities include seven covered general cargo piers totalling 862,000 sq ft; one 1,180-ft-long multipurpose general cargo pier equipped with two diesel-electric high-speed 66-ton gantry cranes. Depths alongside, 26 to 33 ft. Berths: 17.

South Locust Point Terminal (MPA): A 3-berth, marginal quay terminal with nearly 148 acres of backup land. The facility is designed for both container and break-bulk freight and has two 40-ton container cranes and one whirley crane, in addition to one container consolidation shed with 116,250 sq ft of space. A stiff leg heavy lift derrick with a capacity of 310 tons is located at this facility.

In addition, Rukert Terminals Corporation (six berths, 685,500-sq-ft covered storage, fumigation chamber) and drumming facilities for liquids and Belts Wharf Warehouses Inc. (one berth) and the City of Baltimore (eight piers, 16 berths) operate general cargo terminal facilities; Terminal Corporation operates one berth, 201,500-sq-ft covered and open storage.

At Sparrows Point, the Bethlehem Steel Company operates the largest tidewater ore dock in the world. This dock is 2,165 ft long and has 39 ft alongside and berthing space for three ore carriers up to 72,000 tons. Equipment: four 17/18-ton travelling bridge cranes, capacities each 709 tons/hr, and four travelling straight-line cranes, two with 620 tons/hr capacity and two with 1,063 tons/hr capacity. A second ore dock, 1,004 ft long with 49-ft draft, is in operation; total mooring length, 1171 ft; ore unloading capacity, 5,315 tons/hr.

Storage - See "Wharves."

Cranes - See "Wharves" and "Container and ro/ro."

Water - Available.

Tanker terminals - 17 berths; lengths to 800 ft; drafts from 23 to 41 ft; night berthing possible; water and bunkers available.

Bunkers - All grades of marine bunker fuels and lubricants are available.

Container and ro/ro - Sea-Land Service, Inc. operates a 22-acre terminal for its European, Mediterranean, and Far East container services. The terminal consists of one 790-ft-long marginal wharf with 32 ft-draft, is equipped with one 24-ton gantry-mounted diesel electric container crane, one warehouse, office, consolidation shed with 48,440 sq ft, ground storage for 781 trailers and parking area for over 100 export autos, two rail tracks with 8-car capacity; it is served by the Canton Railroad with connections to the Chessie System, Conrail, and Western Maryland. The Maryland Port Administration provides major container facilities at Dundalk Marine Terminal, with six berths, of a total of 12 at the Terminal, exclusively for container cargo; seven container cranes and a 120-ft ro/ro platform. There are three consolidation sheds totalling 186,480 sq ft. At South Locust Point Marine Terminal, three berths, two container cranes, and one consolidation shed in operation.

NEW DEVELOPMENTS: At Dundalk Marine Terminal, development plans include: one additional container berth with 1,030 ft of wharf length, additional ro/ro platform, two more 40-ton container cranes, one additional container consolidation shed with 135,620 sq ft of space, and 15 acres of heavy-duty paved backup land.

Long-range plans call for the Maryland Port Administration to develop an area of Baltimore Harbor known as Masonville into a multi-berth container facility comprising some 395 acres by 1990.

The Port Administration plans major renovation of its Clinton Street Marine Terminal with the installation of two cranes to add to the existing two on the south side of the pier; the construction of a truck access ramp to the second deck has been completed.

SHIP REPAIRS: Bethlehem Steel Corporation, Shipbuilding Division has two yards: three floating dry docks, 690 ft by 110 ft, lifting capacity, 18,000 tons; 877 by 139 ft, capacity, 44,000 tons; 504 ft by 84 ft, capacity, 7,500 tons. Two graving docks, 591 ft by 78 ft, 460 by 58 ft. Nine outfitting piers; 19 cranes, capacity, 10-50 tons; two mobile derrick barges of 248 and 32 tons capacity; and berthing facilities for 30 vessels. Maryland Shipbuilding and Drydock Company: four floating dry docks, 618 by 95 ft, capacity, 20,680 tons; 187 by 80 ft, capacity, 2,500 tons; 440 by 80 ft, capacity, 7,950 tons; 827 by 150 ft, capacity, 125,000 tons. All drydock tonnages referred to are the displacement tonnages of vessels. Five outfitting piers; two floating cranes; capacity, 35 tons, berthing facilities for 32 vessels.

REMARKS: Airport - Baltimore-Washington International Airport, 10 miles from downtown Baltimore.

PORT: Charleston (32°46' N. Lat., 79°55' W. Long.).

APPROACH: Channel at bar, 35 ft M.L.W., 1,000 ft wide; 600 by 35 ft M.L.W. from inner end of jetties to Town Creek; 500 ft by 35 ft M.L.W. through Town Creek; 600 by 35 ft M.L.W. from Town Creek to Navy Yard; 400 by 35 ft M.L.W. to Goose Creek. Turning Basin, 1,100 ft by 35 ft M.L.W., at North Charleston Terminals. A channel 600 by 35 ft around north and east ends of Drum Island. Channel in Ashley River, 17 ft at M.L.W., 240 ft wide. Tidal range: 5 to 6 ft. Vessels drawing 37 ft have called at Charleston and vessels drawing 36 ft and less can safely enter the harbor.

FACILITIES:

Wharves - The State Ports Authority owns and operates the most modern terminal facilities south of Baltimore, Maryland. Cranes for all break-bulk commodities; heavy lifts up to 400 tons available. There is a break-bulk dock at North Charleston equipped with a 50-ton gantry crane and a 1,500,000-bushel grain elevator with ship-loading facilities. There are 600,000 cu ft of cold storage space. Also a 48,440-sq-ft warehouse and six acres of land at Trident Industrial Park adjacent to North Charleston Terminal. At Union Pier a 125-ton gantry crane has been added, paving of open storage space, and construction of one 106,600-sq-ft and one 96,870-sq-ft warehouse have been completed.

Storage - See "Wharves."

Cranes - See "Wharves" and "Container and ro/ro."

Water - Available.

Tanker terminals - Eight berths; lengths from 60 to 705 ft; draft 30 ft to 35 ft; night berthing possible.

Bunkers - Bunkering is available.

Container and ro/ro - Columbus Street Terminal has a 3,880-ft marginal pier with berthing for break-bulk and container ships; equipped with one 50-ton and one 45-ton container crane, one 75-ton, one 50-ton, and one 30-ton gantry crane, and one 400-ton heavy lift sheer-leg; a second container crane and 12 acres of paved open storage have been added. North Charleston Terminal has a 2,650-ft marginal pier for container and break-bulk ships; equipped with three 45-ton container cranes and a 50-ton gantry crane. An additional 25 acres of paved container storage area has been completed.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Various drydocks and shipyards are available for ship repairs.

REMARKS: Airport - Charleston Municipal Airport, 10 miles.

PORT: Houston (29°45' N. Lat., 95°17' W. Long.). Situated 50 miles from Gulf of Mexico.

APPROACH: From Bolivar Road, Galveston Bay, the Houston Ship Channel extends 51 miles inland to the Houston Turning Basin, head of deepwater navigation. Depth in channel, 36 to 40 ft. Turning Basin is 1,100 ft. There are two tunnel crossings under the ship channel, one at Pasadena and one at Baytown. Channel clearance is limited to 141 ft above M.L.T. due to overhead I 610 bridge, just downstream of Port of Houston wharf 31.

FACILITIES:

Wharves - There are over 100 wharves in the entire port of Houston complex, reaching 25 miles from the Turning Basin to Morgans Point, near Baytown, where the ship channel enters Galveston Bay. Some 60 of these are for public hire and handle general cargo. The remainder are specialized wharves and belong to the complex of refineries, chemical plants, steel mills, and other industries that line the channel.

The Port Authority has 45 of the general cargo wharves. The remaining 15 general cargo wharves for private hire are at the Petty, Manchester, Goodpasture, Adams Terminals, and Equity Docks.

The Port of Houston's general cargo wharves, eight of which are open facilities, range from 253 to 826 ft length and are equipped with open and covered storage sheds, rail spurs, and marginal tracks. There are over 7 million sq ft of wharf space and 4.5 million sq ft of it is covered. Fifteen wharves, open and covered, 600 ft long and 260 ft wide, with three apron tracks each; the five newest open wharves have crossover tracks from the front aprons to the back aprons of the adjacent transit covered wharves. Sheds are 200 ft wide with shipside aprons of 52 ft and both rail and trucking docks on the land side.

One bulk-materials handling dock with an unloading tower moving on tracks nearly the full length of the 650-ft dock so as to serve all hatches of the vessels. Tower boom has a reach of 76 ft; bucket capacity is 13 tons/hr free digging. The travelling loading tower will also move nearly the full length of the dock, boom reaches 61 ft, loading capacity is 1,120 tons per hour. The fully automatic bulk plant is served by belt conveyors at the loading and unloading towers. Conveyors also serve the storage bins and weighing hoppers and the car dump pit. Export shipments can be delivered by rail or truck to the loading pit which moves the commodities by belt to shipside. Bulk plant has barge to ship, or vice versa transfer capabilities.

Private Wharves Oiltanking of Texas Inc. operates a deepwater terminal on the north side of the ship channel 14 miles downstream from the Terminal Basin. Largest vessel, 860 ft overall by 120 ft beam by 40-ft with a draft. The ship basin has an area of 25 acres with berths for three ships; depth alongside, 43 ft. The barge docks are 930 ft in length; depth alongside, 16 ft.

Storage - See "Wharves."

Cranes - Modern heavy-lift equipment in the Port of Houston includes landside heavy-lift cranes of 300 tons and floating barge cranes to 500 tons. Three container cranes with 40-ton capacity.

Water - Available.

Tanker terminals - Private facilities for handling bulk liquid commodities are numerous at various refineries, industries, and manufacturing facilities along the Houston Ship Channel.

Bunkers - Fuel and diesel oil are available at several locations. Bunkering connections at City Dock Nos. 9 to 15 for Bunker C, diesel and heavy fuel oil. Also supplied from barges, by Humble Oil & Refinery Co., Gulf Oil Corporation, and Texaco. Gulf Oil and Texaco have private bunkering docks.

Container and ro/ro - The Port of Houston Authority's Barbours Cut Container Terminal is now complete. This area is in Morgans Point adjacent to the Houston Ship Channel and Barbours Cut Ship Channel. With its modern computer-type facilities at Barbours Cut, the Port of Houston should only be complemented by this development. Facilities include two 1,000-ft container wharves, 7 acres of marshalling area, three LeTourneau container yard cranes, two Paceco container cranes on the pier apron, space for approximately 2,700 TEU's, 72 electrical outlets for refrigerated containers, container freight station with 55,000 sq ft of stuffing and stripping space. Ro-ro facilities are also a major part of this area. Turning basin area employs numerous container cranes with lift capacities of 40 tons. Dozens of acres available for marshalling. Private container terminal operators. Ro/ro facilities available.

NEW DEVELOPMENTS: The Port of Houston Authority has recently acquired additional land adjacent to the I 610 Loop Bridge. Formerly the Dickson Industrial Plant, the Port Houston Industrial Park--East has about 115 acres of mostly unimproved land with some 486,000 sq ft of covered warehouse space. Located on this land are four rail spurs which give easy access to any of the four large warehouses. Each of the four warehouses contains overhead block-and-tackle cranes ranging in capacity from 5 to 20 tons. A new road has been cut along the bottom side of the property, giving easy access to existing Port of Houston Authority property on the west side of the bridge.

SHIP REPAIRS: Several shipyards are available for marine repairs.

REMARKS: Airport - Houston Intercontinental Airport, 30 miles from port, served by major international and domestic carriers.

PORT: New Orleans (29°38' N. Lat., 90°2' W. Long.).

APPROACH: Vessels entering the port from the Gulf of Mexico and bound for berths on the Mississippi River use the 13-mile-long South Pass or the 20-mile-long Southwest Pass; both well marked with navigation aids. Depth in South Pass, 30 ft; in Southwest Pass, 40 ft, but requires annual dredging by the US Army Corps of Engineers to maintain this depth. Vessels bound for berths on the Gulf Seaway use the Mississippi River-Gulf Outlet which is 36 ft deep from the Inner Harbor Navigation Canal to Breton Island, and 38 ft deep from Breton Island to the Gulf of Mexico.

FACILITIES:

Wharves - No piers extend into the stream, but there is an almost continuous line of wharves and steel sheds about 16 miles long, of which 11 miles are owned and operated by the Board of Commissioners. The terminal is served by rail and road connections. Rail and barge lines extend thousands of miles N., E., and W. Fresh water and electrical current for light and power available. Docks and transit sheds equipped with sprinkler system.

Storage - Not reported.

Cranes - See "Container and ro/ro."

Water - Available.

Tanker terminals - 148 oil berths. Length, 490 to 650 ft, unlimited; draft, 29 to 40 ft. Night berthing possible.

Bunkers - Fuel and diesel oil supplied by most major oil companies.

Container and ro/ro - Essentially, all of the 11.25 miles of public general cargo wharves can be used for general cargo/container combination vessels. These wharves are serviced by 24 floating cranes with capacities from 50-600 tons, and 12 shore cranes with capacities from 12 to 320 tons. In addition to these facilities, there are the container terminals of France Road, Berths 1, 4, and 5. These terminals comprise 65 acres, 1,600 ft of full containership wharf, and are serviced by four Paceco container cranes. These container terminals have immediate access to rail and the interstate highway system. There are three ro/ro facilities--at Morrison Yard, at Dwyer Road, and a double facility at Florida Avenue Wharf. All of these facilities are located on the Inner Harbor-Navigation Canal which has direct access to the Gulf of Mexico, a distance of approximately 70 miles. A two-berth ro-ro break-bulk facility available at the turning basin of the Industrial Canal.

NEW DEVELOPMENTS: General cargo/coffee wharf to be converted into an international passenger terminal near the Rivergate. New ship repair wharf planned. An additional container berth planned at France Road Terminal.

As part of the 5-year improvement program, Harmony Street Wharf has been demolished and is being replaced by a wharf 950 ft long and 164 ft wide. Similar work is being carried out at Seventh Street Wharf.

SHIP REPAIRS: Port has eight floating docks, one pontoon, and one marine

railway. Several companies and facilities are available to handle all types of marine repair.

REMARKS: Airport - New Orleans International Airport, Moisant Field, 18 miles from river harbor.

PORT: Philadelphia (39°57' N. Lat., 75°10' W. Long.). Located on the Delaware and Schuylkill Rivers.

APPROACH: In the Schuylkill River the channel is 33 ft deep to Point Breeze, and 26 ft to Gibsons Point. Rise of tide is 5.5 ft. The Chesapeake and Delaware Canal, connecting the Delaware River with Chesapeake Bay, has a depth from 25 to 27 ft and 250 ft bottom width. Vessels up to 25-ft draft are permitted to transit the canal without notification 24 hours a day. Vessels exceeding 275 ft in overall length, however, must first make application for transit. There are also extensive privately owned general and bulk-handling facilities in Philadelphia Central Harbor area.

Delaware River - Channel 40 ft deep to Newbold Island, with tanker terminal facilities and seven refineries.

Largest Vessel: Unlimited draft in Delaware Bay; 40-ft draft in Delaware River.

FACILITIES:

Wharves - Port facilities for marine commerce consist of 52 marine terminal complexes which provide berthing space for 115 modern deep-draft, oceangoing vessels. These marine terminal complexes are directly accessible to rail and motor carriers and many of them are covered or shedded.

Storage - Not reported.

Cranes - Not reported.

Water - Available at many marine terminal complexes.

Tanker terminals - 29 oil berths. Length, 640 to 3,080 ft, draft, 29 to 40 ft. Night berthing possible.

Bunkers - Fuel oil and light diesel fuel from various oil companies.

Container and ro/ro - Packer Avenue Marine Terminal has four single-deck transit sheds 500 by 180 ft; 40-ft apron with two rail tracks. Two cargo warehouses, 500 by 200 ft, and one reefer warehouse, 1.5 million cu ft. Rail and truck platforms serving each building. 104 acres total area. Two 45-ton container cranes each with an outreach of 119 ft; backreach 184 ft; one 75-ton mobile crane. Connection with all railroads and accessible to highway vehicles. Marginal wharf of 3,100 ft with a ro/ro berth of 825 ft. There is a ro/ro transit shed 500 by 180 ft. Packer Avenue Marine Terminal placed an additional container berth in operation in early 1978. A combination container/heavy-lift crane placed in operation at Packer Avenue Marine Terminal in early 1979. Tioga Marine Terminal has one transit shed containing 300,000 sq ft; 100 acres total area. Seven berths with a marginal wharf of 3,170 ft; a slip berth of 725 ft and a ro/ro berth of 610 ft. Two 45-ton container cranes with an outreach of 114 ft and a backreach of 184 ft. Connection with all railroads and accessible to highway vehicles. Two surface tracks on apron and one surface track inshore serve the terminal area. Tioga Marine Terminal has installed a new truck entrance control gate and additional container marshalling area.

NEW DEVELOPMENTS: The C. & D. Canal is being expanded and deepened to

accommodate 98 percent of the ships moving between Ameriport and Baltimore, New York, and Boston. A foreign trade zone is now located in Philadelphia.

SHIP REPAIRS: Major and minor repairs possible at various facilities. The Sun Shipbuilding and Drydock Co. has a two-section drydock to accommodate vessels with widths up to 197 ft and with its 70,000-ton lifting capacity is capable of handling vessels up to 400,000 d.w.t. and is serviced by four 25-ton gantry cranes. Smaller drydocks and several marine railways for harbor craft are also in service. Five Government drydocks up to 1,100 ft long are located at the Navy Yard.

REMARKS: Airport - Philadelphia International Airport, served by international and domestic carriers, 7 miles from center of city.

PORT: Savannah (32°05' N. Lat., 81°06' W. Long.).

APPROACH: Natural landlocked freshwater harbor, 18 miles up river and channel from Atlantic. Channel 38 ft deep M.L.W.; approximately 500 ft wide in port approaches and 400 ft in main port area with turning basins ranging from 900 to 1,000 ft wide at 34 ft depth.

FACILITIES:

Wharves - Ruling depths throughout harbor, 38 ft M.L.W.; on bar at M.L.W., 38 ft; at berths, 26 to 38 ft L.T.; average rise and fall, 7.4 ft; deepest draft for vessels at cargo and tanker berths, 38 ft, at Container Berth, 38 ft M.L.W., at Lash facility, 40 ft. Berthing capacity for 52 vessels. Total lineal frontage is 5 miles. Twenty-one general cargo berths and two tanker berths are available.

Storage - Total warehouse space is over 4 million sq ft. A fumigation plant and a modern cold storage facility are available.

Cranes - Four 35-ton gantry cranes and two mobile 45-ton cranes at Garden City Terminal; two 50-ton cranes at Ocean Terminal.

Water - Available at five berths.

Tanker terminals - Six oil berths. Length, 560 to 675 ft; draft, 25 to 34 ft. Night berthing at all but one berth.

Bunkers - Fuel available from several oil companies.

Container and ro/ro - At the Garden City Terminal of Georgia Ports Authority adjacent to Berth No. 57, there is a 2,400-ft three-berth container facility serviced by four 40-ton container cranes and a 500-ton stern adjustable ramp for ro/ro cargo. There is to be a two-berth facility constructed on Hutchinson Island. There is a Lash facility located at the mouth of the Savannah River.

NEW DEVELOPMENTS: Channel depth will be improved to 40 ft and channel width to 600 ft from the ocean bar to the jetty channel. A project has also commenced to enlarge King's Island Turning Basins to 1,500 by 1,600 ft. Presently being contracted for construction at Ocean Terminal are two 125-ton gantry cranes. The paving of an additional 12 acres of open storage area and the building of two backup storage warehouses will increase storage space by 400,400 sq ft.

SHIP REPAIRS: Savannah Machine & Foundry Company has a graving dock of 540 by 72 ft.

REMARKS: Airport - Savannah Municipal Airport (Travis Field), 8 miles distant.

PORT: Boston (42°22' N. Lat., 71°03' W. Long.).

APPROACH: Port is situated on the western side of Massachusetts Bay, some 58 miles northwest of the tip of Cape Cod. Its outer and inner harbor include all the tidal waters bounded by a line drawn roughly from Point Allerton to Point Shirley, an area of about 46 square miles exclusive of the islands.

FACILITIES:

Wharves - Docks, piers, or wharves available number 158, most located on the main ship channel at East Boston, Charleston, and South Boston. Additional facilities are situated on the Chelsea River, Mystic River, Quincy, North Weymouth, and Braintree. No major facility in the Port of Boston is more than 7 miles from open sea. Vessels can easily move through the harbor area to deepwater berths in less than an hour via clear, wide channels deepened to a general depth of 40 ft. The absence of car float and lighterage movements keeps local traffic at a minimum, and berthing time and total turnabout time are greatly reduced.

Storage - Not reported.

Cranes - Heavy-lift equipment is readily available for the handling of cargo up to 50 tons at any waterfront facility. Arrangements can be made through Massachusetts Port Authority for equipment having greater lift capacity.

Water - Available.

Tanker terminals - 16 berths; length from 575 ft to 1200 ft; draft from 30 ft to 40 ft; night berthing possible.

Bunkers - Facilities for oil bunkering are excellent and vessels may be supplied at the piers from barges in any part of the harbor.

Container and ro/ro - Sea-Land facility consists of a 27.5-ton container gantry crane and 10-acre container berth located at Castle Island Terminal. The Massachusetts Port Authority's Mystic Public Container Terminal (J. F. Moran Docks) has a 70-ton and a 45-ton container crane and an open storage area of 24 acres.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Eight plants operate waterfront facilities in the port for the construction, repair, and conversion of oceangoing vessels, tugs, tow boats, and various types of small craft. Lifting capabilities of floating drydocks range from 2,000 to 18,000 tons; the length of graving docks ranges from 260 to 940 ft.

REMARKS: Airport - Logan International Airport, East Boston, approximately 3 miles.

PORT: Miami (25°46' N. Lat., 80°10' W. Long.).

APPROACH: Entrance to the harbor is through a 36-ft-deep, 500-ft channel known as Government Cut, dredged across the south tip of Miami Beach, then 400 ft wide to a 900-ft approach channel to the New Port of Miami, a 300-acre bulkhead island in protected Biscayne Bay, only minutes from sea lanes and connected to the heart of Miami's business district by vehicular and railway bridge.

FACILITIES:

Wharves - There are 2,000 ft of berthing, dock aprons 69 ft wide, 70,000 sq ft of clear-span transit cargo buildings; cargo shed "G" 161,500 sq ft, 6,000 ft of dockside rails, a mile of train make-up tracks. Large ships can turn at berth site in the 900-ft-wide approach channel or may continue into the turning basin 1,640 by 1,700 ft. Mean low working depth throughout the harbor is 36 ft; 1,000 ft bulkheaded southside.

Storage - See "Wharves."

Cranes - Not reported.

Water - Not reported.

Tanker terminals - Not reported.

Bunkers - Liquid fuels are readily available at shipside.

Container and ro/ro - Available with acres of open storage space. Ten ro/ro berths. Ten trailer ships may load simultaneously at the ro/ro berths. There is lift-on crane service to a capacity of 250 tons.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Several companies are available for marine repair.

REMARKS: Airport - Miami International Airport, 15 minutes by 12-mile expressway.

PORT: Portland, Oregon (45°31' N. Lat., 122°41' W. Long.). This port is situated on the Willamette River, and is 109 miles from the Pacific Ocean.

APPROACH: Entrance to Columbia River (at mouth), 40-ft depth at L.W., and 0.5-mile width for 1.5 miles. Vessels load at wharves on both sides of river.

FACILITIES:

Wharves - Four cargo terminals are available. The total open storage is 7.1 million sq ft and the total closed storage is 1.7 million sq ft. In addition to the dry general cargo terminals addressed above, special facilities--both public and private--are provided for the handling of heavy lifts, bulk grains, bulk liquid cargoes, lumber, coal, ore, cement, and cold storage cargo.

Storage - See "Wharves."

Cranes - There are 10 mobile cranes, one sheerleg (150 tons), four floating cranes (up to 75 tons), two gantry cranes (35 tons), three gantry cranes (65 tons), and one truck crane (175 tons).

Water - Available.

Tanker terminals - 34 berths, operated by Shell Oil Company, Phillips Petroleum Company Docks, Standard Oil Company, Atlantic-Richfield Company Inc., Texaco-Inc., Mobil Oil Company; length, from 400 to 940 ft; draft, 40 ft; night berthing possible.

Bunkers - Oil fuel available from bunker barges or from any of eight oil company docks.

Container and ro/ro - Two-berth container facility in Portland Harbor on the Columbia River. Berths, each 90 ft long, are supported by 40 acres of paved backup area. Terminal includes three straightline 50-ton container cranes and four mobile traveling bridge cranes for yard work.

On the Willamette River, one container berth with one straight line container and general-purpose crane (33 tons); two straddle carriers; and a 600-van storage yard. Two container berths with two straightline cranes (40 and 50 tons), one 36-ton gantry crane and 26 acres of backup storage area for fenced, lighted storage and preparation facilities for dealers. One ro/ro berth (slip), also dock for sideport loading ro-ro vessels. Two-berth steel and utility dock with 26-acre yard.

NEW DEVELOPMENTS: New floating dry dock at Swan Island Ship Repair Yard. This dry dock, the largest of its type on the US west coast, is 900 ft long with 185-ft clearance between wingwalls.

SHIP REPAIRS: Private marine contractors can be notified through Port of Portland. Four dry docks and a barge building facility. Depth over blocks, 32 ft L.W.; can handle vessels up to 800 ft.

REMARKS: Airport - Portland International Airport, about 10 miles from downtown Portland and waterfront; Portland-Troutdale general aviation airport, 15 minutes from downtown and waterfront. Portland-Hillsboro' general aviation airport, 25 minutes from downtown and waterfront.

PORT: San Francisco (37°47' N. Lat., 122°23' W. Long.).

APPROACH: Bay, 65 miles long and 4 to 10 miles wide. Area: 448 square miles; 79 square miles of safe anchorage, 18 to 80 ft in depth, with not less than 34 ft at seawall and from 75 to 164 ft at end of piers. The outlet or entrance is the Golden Gate, 2,000 ft wide. Depth in main ship channel, 55 ft.

FACILITIES:

Wharves - 18 maritime piers, depth alongside averages 38 ft with up to 42 ft at some berths. The 67-mile Belt Railroad connects each of the piers with three transcontinental railroads.

Storage - Transit sheds and refrigerated space available at most piers.

Cranes - Six container cranes including three 30- to 40-ton Paceco cranes and three 30- to 40-ton Star Porters. One 254-ton P & H heavy lift. Floating cranes available on request.

Water - Fresh water available at all piers at a rate of 20 tons/hr.

Tanker terminals - The total terminal area is 25 square miles. The face measures 723 ft. Two berths at M.L.L.W., 40 ft alongside. Special facilities include 22 square miles of open storage for loading and unloading.

Bunkers - Fuel oil, diesel, and light diesel fuels available from several oil companies.

Container and ro/ro - Piers 94 to 96 offer 76 acres and three berths with a quay of 2,454 ft. The water depth measures 38 ft. Special features include: a Lighter Freight Station/Transit Shed with 174,120 sq ft of covered cargo area; 10-acre Lighter Basin for barge storage; two Paceco cranes and two Star Porters.

Pier 92 with one berth; depth, 38 ft; length, 700 ft; for automobiles.

Pier 80 with seven berths; depth, 38 ft; length, 4,090 ft; equipped with one Paceco crane and one Star Porter; has a freight station, repair building, transit sheds, etc.

Pier 70 with two berths; depth, 40 ft; length, 1,440 ft; for automobiles.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Major and minor marine repair facilities are available. Eight dry docks consisting of 6,500- to 65,000-ton capacity have lengths ranging from 450 to 900 ft and widths of 80 to 150 ft. Five graving docks are each 600 ft long, 85 ft wide, and draft of 30 ft.

REMARKS: Airport - San Francisco International, 15 miles.

PORT: Palm Beach (26°46' N. Lat., 80°04' W. Long.). Port of Palm Beach lies on east coast of Florida approximately 70 miles from Miami.

APPROACH: Entrance through a dogleg channel 400 ft wide, narrowing to 300 ft across Lake Worth and leading to turning basin 1,310 by 1,400 ft. Minimum depth in channel and basin, 35 ft M.L.W.

FACILITIES:

Wharves - The Port of Palm Beach has two slips and four marginal wharves containing 25 berths totalling 5,020 ft in length. Eight berths are on the marginal wharves and the remainder are located within the two slips and in the new loading ramp area. The berths in the south slip have a 35-ft depth and the middle marginal berths are 25 ft in depth. Supplementing the berths are 521,300 sq ft of warehouse space. There are 43 acres of open storage space, including 14 acres exclusively devoted to container handling.

Slip No. 1 is 690 ft long and 210 ft wide, with a water depth of 27 ft. Slip No. 2 is 650 ft long and 225 ft wide, with a water depth of 35 ft at M.L.W., available for berthing all types of cargo-carrying vessels. Designation of the piers on N. and S. sides of these two slips are Piers 2, 3, 5, and 6. Marginal wharves running N. and S. located along the west side of the turning basin are designated as Piers 1, 4, and 7.

The Port of Palm Beach operates Slip No. 2 and the Marginal Wharf, affording berthing space for three Liberty-type vessels at one time. Supplementing these berths are 55,200 sq ft of warehouse space at shipside for general cargo and 200,000 sq ft of open storage and delivery area located within 1,200 ft of shipside. Railroad siding extends alongside Slip No. 2 and warehouse joining the spur railroad operated by the Port of Palm Beach, connecting directly with the Florida East Coast Railway main line. Serving the entire port area are 7 miles of track capable of handling 600 railroad cars.

Storage - See "Wharves."

Cranes - One 300-ton single-lift capacity; one 200-ton, two 150-ton, one 125-ton, three 26-ton forklifts; one 23-ton and two 10-ton forklifts.

Water - Available at berths.

Tanker terminals - Not reported.

Bunkers - Bunker oil available; no coal. Water and bunker oil can be supplied in any quantity by pipeline and hose connection.

Container and ro/ro - Six ro/ro ramps, 14-acre container marshalling area.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Not reported.

REMARKS: Airport - W. Palm Beach, 10 miles.

PORT: Jacksonville (30°20' N. Lat., 81°40' W. Long.). On St. John's River, 22 miles from sea.

APPROACH: Depth at entrance, L.W., 42 ft. Depth on bar, 42 ft.

FACILITIES:

Wharves - The harbor extends some 15 miles along the St. John's River, with terminal facilities mainly on north and west banks of river. Two channels within the harbor. Terminal Channel along the west bank, 262 ft wide with a depth of 38 ft and Arlington Cut, with a depth of 38 ft. Channel, 20 miles long, 38 ft deep from Mayport to Talleyrand Docks and Terminals.

Talleyrand Docks and Terminals owned and operated by the Jacksonville Port Authority: 4,300 ft of marginal wharf (1,200 ft occupied by Sea-Land Service). Depth marginal wharves, 34 ft M.L.W. Transit sheds total 632,400 sq ft. Water available. Blount Island Terminal owned and operated by the Jacksonville Port Authority: 3,550 ft marginal wharf. Depth alongside, 38 ft M.L.W. Transit sheds total 360,000 sq ft. One 50-ton and one 100-ton revolving gantry crane. Water available.

Commodore's Point Terminal: three berths with 28 ft and one with 30 ft alongside. Transit sheds of 175,000 sq ft, bulk cement silos, and rail spurs.

All the major oil companies maintain marine terminals for bunkering and handling tankers. Full-rail connection with three main-line systems.

Storage - See "Wharves."

Cranes - See "Wharves" and "Container and ro/ro."

Water - Available.

Tanker terminals - Ten berths; length from 600 ft to no limit; draft from 31 to 51 ft; night berthing possible.

Bunkers - Fuel oil at installation or barge; fuel and diesel oil are available from several oil companies.

Container and ro/ro - Sea-Land Service has a 16-acre container yard with two 27-ton Paceco cranes. TMT Trailerferry has a 41-acre yard and a ro/ro berth and ramp. The public container terminal at Blount Island has two 45-ton container cranes with a 113-ft outreach; 120,000 sq ft of stuffing shed and 124 acres yard and two ro-ro ramps for side port vessels. Ro/ro platform under construction.

NEW DEVELOPMENTS: 1,000-ft marginal wharf under construction by Dunn Terminal Corporation. Offshore Power Systems has floating Nuclear Power Plant factory on Blount Island (easterly half) also under construction.

SHIP REPAIRS: Jacksonville Shipyards Inc. have seven dry docks and 84 acres of yard. Provides hull, machinery, and electronics maintenance and repairs.

REMARKS: Airport - Jacksonville International, 15 miles.

PORT: Wilmington (34°14' N. Lat., 77°57' W. Long.).

APPROACH: Not reported.

FACILITIES:

Wharves - State Port Terminal: 6,040 ft of continuous concrete wharf. Channel project depth, 38 ft M.L.W. Forklifts and accessories, tractors, cargo trailers, stevedore-type pallets available. Piggyback ramp, two-vacuum cyanide and acritet fumigation chambers, phosphine (atmospheric) fumigation of containers, two truck and one railroad scale also available.

Storage - 1.5 million sq ft of covered storage space. Bonded space available by arrangement. 33 acres paved open storage accessible by rail and truck.

Cranes - Two 45-ton, one 115-ton, one 225-ton, one 140-ton mobile and and two 40-ton container cranes.

Water - Available.

Tanker terminals - Ten private oil berths. Length, 510 to 725 ft; draft, 24 to 35 ft. Night berthing at all but one berth; water available at six berths.

Bunkers - Exxon, Gulf Bunker C, and diesel available.

Container and ro/ro - Fully equipped to serve cellular-type container ships and semi-container ships. Two 40-ton full bridge container cranes.

NEW DEVELOPMENTS: 26-acre container yard, 13-acre container and general cargo area, 800 ft additional wharf, and 66 ft ro/ro ramp under construction.

SHIP REPAIRS: Major repairs by the N.C. Shipbuilding & Dry Dock Company Minor repairs by Wilmington Iron Works. There are also three marine railways and a 1,000-ton lift floating dock which are owned by Carolina Marine & Dry Dock.

REMARKS: Airport - New Hanover County Airport, 7 miles.

PORT: Galveston (29°0' N. Lat., 94°45' W. Long.). Eastern end of Galveston Island, 2 miles off the Texas Coast.

APPROACH: The depth of Galveston Channel is 40 ft, and of the slips, 32 to 40 ft. Width at narrowest point, 1,200 ft. Distance from dock (Pier 41) to Gulf of Mexico is 10 miles.

FACILITIES:

Wharves - The jetty system consists of two granite breakwaters about 2 miles apart and paralleling the outer channel. The South Jetty begins at Fort Point on the N.E. tip of the island and is 7 miles long. The North Jetty begins at Bolivar Point and is 5 miles in length. Both jetties extend across the inner and outer bars and out into the Gulf of Mexico to a point where there is 40 ft of water. The wharves are located on the north side of the island. Port facilities owned by the Port of Galveston alone include 312 ft of developed frontage (307 ft of berthing space) and provide dockage space for 32 Liberty-type vessels, 20 of which can be berths at shedded piers and 12 at open berths.

The Port of Galveston, a corporation owned and controlled by the City of Galveston, owns the city frontage along Galveston Channel between Ninth and Forty-first Streets. This property has a channel frontage of about 1 mile and a linear frontage, measured around slips, of about 6 miles.

Other than the property owned by the Port of Galveston, commercially improved waterfront areas are located on the south side of Galveston Channel, including a 500-berth yacht basin. A highway and rail causeway spans the channel connecting Galveston and Pelican Island (near 58th Street). The Port of Galveston owns or has the option on 383 acres of Pelican Island.

Private Wharves: Pelican Island has a total frontage of approximately 16,000 ft, 2,825 ft of which is operated by the Todd Shipyards Corporation, Galveston Division, and 310 ft is used by the US Navy.

Storage - Warehouses are chiefly used for storing cotton, the majority having been constructed for this purpose. Ample rail spurs for handling freight movements and at most warehouses such freight is delivered or received at inside or outside loading platforms or through doorways at car level. In addition to the storage area are its 30 shipside warehouses, aggregating 3.3 million sq ft of floor space, the Port owns seven warehouses comprising 1.2 million sq ft. Open ground space with a combined area of 980,000 sq ft. This space is served by the organization's terminal railway system and is suitable for storage of pipe, rails, lumber, steel, poles, barrelled goods, etc. Nine companies provide a total of approximately 7 million sq ft of space for cotton storage. Four companies operate a total of 111,000 sq ft of dry storage space for general cargo; two companies provide about 34,000 sq ft of cold storage space.

Cranes - Todd Shipyards Corporation, Galveston Division, owns two towed derrick barges, the Pop-Eye and the Sam Houston, each of which can lift up to 75 tons. In addition, all modern equipment such as forklift trucks, tractors, trailers, etc., are available.

All types of mechanical equipment are available at Galveston for

handling ship's cargo, including derrick barges, gantry crane, and electro-magnet crane. The Port's cargo-handling equipment is a container crane at Pier 10 (66 ton). The pier's gantry crane has lifting capacities as follows: 50 tons at 63 ft; 42 tons at 70 ft; 33 tons at 80 ft; 27 tons at 89 ft.

In addition, the Greens Bayou Terminal "Big John" 500-ton capacity barge-mounted crane is available to work at shipside at any pier in Galveston.

Water - Water is available at most of the piers from fire hydrants equipped with special hose and portable meters.

Tanker terminals - Not reported.

Bunkers - Bunkers delivered by oil barges.

Container and ro/ro - Special facilities are available for ro/ro cargos. A 10-acre, hard-topped, open berth with nine shipside rail tracks and use of the travelling 66-ton gantry crane is available. The Port's East End Container Terminal, with a 1,000-ft-long dock has a container crane capable of handling forty 40-ft containers per hour, 20 on, 20 off.

The port terminal complex, at Galveston, handles containerized, unitized, and ro/ro shipments. The terminal, 30 minutes from the open Gulf of Mexico, is located between Piers 12 and 14 on the 40-ft Galveston Ship Channel. The port's own terminal railway is used with extensive shipside marginal tracks, six existing berths, 350,000 sq ft of transit shed space, a 100,000-sq-ft warehouse area behind the waterfront, and up to 2.9 million sq ft of open storage adjacent to the terminal. A container crane, a 40-ton transtainer, and two port packers serve the terminal. A covered barge-loading terminal in the 34-35 slip is available for LASH and SEABEE barges; also a 40-ft draft berth, for these barge's motherships at Pelican Island.

NEW DEVELOPMENTS: A berth 1,000 ft long with a draft of 45 ft is under construction. 96 acres with 2,600 ft in length on the Galveston channel, for a bulk plant operation to serve imported ore and exported coal. Construction of an onshore deep-draft oil terminal to begin soon.

SHIP REPAIRS: Todd Shipyards Corporation (Galveston Division) operates four floating dry docks at its plant on Pelican Island. The dry docks have overall lengths ranging from 240 to 614 ft and lifting capacities ranging from 1,500 tons to 15,000 tons. This shipyard can accommodate up to 20 vessels at one time in its yards. Other ship repairers for major and minor marine work are also available in the area.

REMARKS: Airport - 2 miles.

PORT: Tacoma (47° 15' N. Lat., 122° 30' W. Long.).

APPROACH: Located on Commencement Bay at the southern end of Puget Sound; one of the world's finest natural deep-draft harbors. Commencement Bay is 4.5 miles wide with no obstruction at the entrance, as the average water depth is 150 to 180 ft and completely sheltered.

FACILITIES:

Wharves - Terminal facilities include 12 general cargo and bulk-material handling cranes (capacity up to 60 tons), 30 deep-draft berths, located on three (30- to 49-ft depth) waterways. A 200-ft by 400-ft barge slip with solid ground loading for barges of heavy modules.

Storage - 1.7 million sq ft warehouse storage, 3.5 million gal of bulk liquid storage, 2 million cu ft of cold storage; 225 acres of hard surface backup storage area is also available.

Cranes - See "Wharves" and "Container and ro/ro."

Water - Available.

Tanker terminals - Not reported.

Bunkers - Fuel and diesel oil are available from all major oil companies by barge.

Container and ro/ro - Ultramodern container and general cargo facility at Terminal 4; 1,250-ft concrete pier with two ship berths and 46-ft water depth; dual rail tracks on pier for direct ship-to-rail handling. Two 45-ton high-speed container cranes. 150,000 sq ft clearspan warehouse; 25 acres paved, lighted and fenced space. Adjacent 102,000-sq-ft clearspan container freight station with 6 acres paved, lighted storage area at Terminal 7, along with 42 acres of paved backup storage, and two 44-ton container cranes.

182 electrical freezer container outlets at Terminals 4 and 7, and Pierce County Terminal.

Ro/ro facilities at Pierce County Terminal with 1,400-ft pier. Three 102,000-sq-ft clearspan warehouses and 113-acre storage area. New ro/ro facility opposite Terminal 7 consists of 27 acres of paved trailer storage yard, 1,700-ft pier, and 3 ro/ro ramps.

NEW DEVELOPMENTS: Plans for extension of Pier 4 by 298 ft, paving of 12.5 acres of container storage space, and extension of Pier 7 by 500 ft.

SHIP REPAIRS: Repairs are available from several companies.

REMARKS: Airport - Tacoma Industrial Airport, 12 miles from port; Seattle-Tacoma International Airport, 16 miles from port.

APPENDIX C: CHARACTERISTICS OF OCONUS (EUROPEAN) PORTS

1. The following is a list of leading European container ports ranked according to the throughput of TEU's followed by compendiums of port characteristics.

Port	Page
Rotterdam	C2
Bremen	C4
Bremerhaven	C5
Antwerp	C6
Hamburg	C8
Le Havre	C10
London	C12
Southampton	C13
Gothenburg	C15
Belfast	C16
Felixstowe, Suffolk	C17
Liverpool, Merseyside	C19
Dublin	C21
Zeebrugge	C24
Lisbon	C26
Hull, North Humberside	C27
Bilbao	C28
Vlissingen	C29
Clyde Port, Strathclyde	C31
Manchester	C33
Aarhus, Jutland	C35
Helsinki	C36
Oslo	C37
Leixoes	C39
Helsingborg	C40
Gdynia	C41
Rouen	C42
Amsterdam	C44

NETHERLANDS

PORT: Rotterdam (51°55' N. Lat., 4°30' E. Long.).

APPROACH: The approach channel in the North Sea to the entrance of the New Rotterdam Waterway (the Eurogeul) is 19 miles long, 3,937 ft wide at the bottom, with a depth of 80 ft. The Eurogeul then becomes the Maasgeul with a length of 9 miles, which is 1,310 to 1,970 ft wide at the bottom, allowing ships with a draft of 68 ft to pass.

The New Rotterdam Waterway is 17 miles long and is 74 ft Amsterdam Ordnance Datum (N.A.P.) deep at its entrance at the Hook of Holland.

The depth of the river up to Botlek is 48 ft N.A.P.; up to Waalhaven, 44 ft N.A.P.; towards the Europoort-harbor basins there is a depth of 76 ft.

FACILITIES:

Wharves - There are 37 harbors at Rotterdam Port. The total water area is 3,524 acres; and the depth ranges from 16 to 75 ft N.A.P. The total length of wharves is 24 miles. There are 25 shore-based elevators with operating capacities which range from 15 to 1,200 tons/hr.

Storage - The storage sheds at Rotterdam Port have a total area of more than 10 million sq ft. Silos have a total storage area of 472,000 tons.

Cranes - There are 383 cranes at the different harbors of Rotterdam. Lifting capacities are not given.

Water - Fresh water is available.

Tanker terminals - There are a total of 17 tanker terminals, with a total water area of 3,247 acres. Depths range from 20 to 77 ft N.A.P. Total tank storage is 1.1 million cu ft.

Bunkers - Fuel, diesel, gas, coal, and oil are available in any quantity.

Container and ro/ro - There are 10 harbor facilities to accommodate container and ro/ro operations. The length of quays is approximately 4 miles. There are 19 container cranes with lifting capacities not reported. Ro/ro berthing facilities number 14 at the port.

NEW DEVELOPMENTS: Adaptation of the approach channel and harbor mouth to ships with a draft up to 72 ft is in preparation.

On Maasvlakte new container facilities, a coal terminal, and L.N.G./L.P.G. storage are being contemplated. General cargo handling will benefit from a redevelopment scheme for the prewar port area.

Preparatory studies are carried out in view of the replacement of the shore-based radar chain by a highly sophisticated vessel traffic management system.

SHIP REPAIRS Shipbuilding and marine repairs: nine shipyards, seven patent slipways, and one side slipway with travelling cranes are available. There are 29 floating dry docks with lifting capacities ranging from 350 to 54,000 tons. Eight graving docks are available: one dock with

two berths, each 655 ft long; two docks, each 700 ft long; one dock, 755 ft long; and two docks 900 and 950 ft long (with bearing capacity for tankers of 110,000 d.w.t., and 130,000 d.w.t. maximum); one dock 1,000 ft long with a capacity of up to 160,000 d.w.t.; one dock 1,345 ft long with capacity up to 500,000 d.w.t.

REMARKS: Airport - Zestienhoven, nearby.

W. GERMANY

PORT: Bremen (53°05' N. Lat., 8°47' E. Long.).

APPROACH: Bremen is situated 77 miles from the sea on the river Weser, 39 miles above the port of Bremerhaven. Ships up to 34-ft draft can reach Bremen at M.H.W. in safety. Icebreakers keep the water ice-free during the entire winter up to Bremen.

FACILITIES:

Wharves - Depth at entrance up to 32 ft at M.L.W. Sixteen basins available for seagoing vessels. With the exception of seven basins of the "Industriehafen," all harbors of Bremen are tidal docks. All establishments are adapted to direct transfer from vessels to rail tracks. From three to four lines of tracks run along the piers between vessel and shed and two tracks behind and along the sheds. The total length of wharves is 34,582 ft (6.5 miles). Maximum draft ranges from 21 to 31 ft.

Storage - Storage capacity, 2.5 million sq ft; shed storage, 3.1 million sq ft; cold storage, 48,400 sq ft; grain storage, 340,000 tons.

Cranes - 159 cranes that range in sizes from 2.5 to 55 tons; 8 floating cranes 250 tons each; 3 gantry cranes, 18 to 65 tons; 5 general cargo cranes.

Water - Water is available.

Tanker terminals - Oil berth operated by Mobil Oil; length, 656 ft; draft, 34 ft. Night berthing possible. Water and bunkering available.

Bunkers - All kinds of oil available, transport by barges.

Container and ro/ro - Container and ro/ro facilities at Neustadter Hafen and Europahafen.

NEW DEVELOPMENTS: Neustadter Hafen is being extended to three basins.

SHIP REPAIRS: Floating docks for vessels from 9,000 to 13,550 tons capacity are available for ship repairs. Several small shipyards are available.

REMARKS: Airport - Bremen, nearby.

W. GERMANY

PORT: Bremerhaven (53°33' N. Lat., 8°35' E. Long.).

APPROACH: Bremerhaven is on the right bank of the Weser about 37 miles from the river mouth and includes the former city of Wesermunde, the largest fishing port in Germany.

FACILITIES:

Wharves - Depth at entrance is 39 ft L.W. and maximum draft is 44 ft. Nordhaven is an artificial basin, closed by locks. Lock dimensions are: length, 1,220 ft; width, 148 ft; depth (L.W.), 36 ft. Modern bulk, container, ro/ro, passenger, and general cargo facilities are situated in this basin and at Columbus Quay along the river Weser. Columbus Quay has a length of 3,445 ft and depth of 36 ft. Weserport is an ore transshipment installation with a quay length of 1,083 ft and depth of 48 ft. Kaiserhafen-Verbindungshafen consists of 4 basins with general cargo facilities and a total quay length of 22,970 ft.

Storage - Shed area of 1.1 million sq ft and open storage of 635,000 sq ft are available.

Cranes - Nine cranes of 4 to 8 tons and 39 cranes of 3 to 30 tons are available.

Water - Available.

Tanker terminals - Not reported.

Bunkers - Coal available. All grades of oil available from Esso at Columbus Quay; depth of water, 34 ft below Chart Datum. Delivery 1,150 tons/hr maximum. Fuel and diesel grades available by barge from Mobil Oil.

Container and ro/ro - Facilities located at Nordhafen, Stromkaje, and Columbus Quays. The total storage area is 8.8 million sq ft. Depth of water at the present time is 46 ft, and future development is planned for 56 ft. Container loading bridges number 13 for these facilities with lifting capacities of 40 to 54 tons.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Major ship repairs are available. Dry docks: Kaiserdock I (742 ft long, 85 ft wide, 34 ft deep); Kaiserdock II (1,099 ft long, 115 ft wide, 38 ft deep). Ten floating docks of 150 to 8,000 tons capacity available.

REMARKS: Airport - Bremen, 44 miles.

BELGIUM

PORT: Antwerp (51°13' N. Lat., 4°23' E. Long.).

APPROACH: Antwerp is situated on the right bank of the river Scheldt, 40 miles from the North Sea. Access to the river via the Wielingen Channel, via Scheur Channel, or via the Oostgat Channel. A continual dredging program along the river now gives a permitted draft on inward vessels a maximum of 44 ft. Outward bound vessels are limited to a draft of 38 ft.

FACILITIES:

Wharves - The port consists of two parts; quays along the river-front and a large dock system connected to the river by five locks: Zandvliet Lock, width, 187 ft, length, 1,639 ft, depth on sill, 60 ft at H.W.; Baudouin Lock, width, 147 ft, length, 1,180 ft, depth on sill, 51 ft at H.W.; Van Cauwelaert Lock, width, 115 ft, length, 885 ft, depth on sill, 49 ft at H.W.; Royers Lock, width, 72 ft, length, 590 ft, depth on sill, 36 ft at H.W.; Kattendijk Lock, width, 81 ft, length, 360 ft, depth on sill, 25 ft at H.W.

There are 25 principal docks for seagoing vessels. Lengths of quays consist of 57 miles for seagoing vessels and 5 miles for barge traffic.

Storage - Municipal quay sheds alongside the river and the docks, 7.5 million sq ft. Municipal warehouses: 2.3 million sq ft. Private timber storage sheds: 5.6 million sq ft. Private quay sheds and warehouses: 14.3 million sq ft.

Cranes - 463 2.5- to 100-ton quay cranes; 22 5- to 250-ton floating cranes; 77 5- to 130-ton mobile cranes; 18 15- to 25-ton loading bridges; 18 grain elevators on quay and 9 floating grain elevators.

Water - Fresh water is available.

Tanker terminals - Lengths range from 560 to 3,500 ft, drafts range from 39 to 55 ft; night berthing possible; water, bunkers, and slop tank facilities available.

Bunkers - Fuel, diesel, and gas oil are available from wharves or barges.

Container and ro/ro - There are six ro/ro terminals with 12 berths and six specialized container terminals with 8 gantry cranes (lifting capacity 40 to 53 tons).

Behind these terminals, the Belgian Railway Company has set up a railroad container terminal with three 30-ton container cranes.

NEW DEVELOPMENTS: Expansion of the port on the left bank of the River Scheldt is under way. The site provides 2,286 acres of canal docks and inset docks and almost 9,390 acres of industrial and port sites. Entrance to these facilities is through the Kallo lock. The Baalhoek Canal will handle vessels up to 125,000 d.w.t.

On the right bank, the New Harbor Dock was completed in 1981. It is 7,218 ft long and has 25,262 ft of quays for dry bulk cargo and general cargo. Water depth is 55 ft.

SHIP REPAIRS: Graving dock exclusively used for repairs and surveys. Ten dry docks owned by the city and eight owned privately. Shipbuilding at the Hoboken shipyards and upriver at Temse and Rupelmonde.

REMARKS: Airports - Deurne (Antwerp); N.I.A., Zaventem (Brussels), 25 miles.

W. GERMANY

PORT: Hamburg (53°33' N. Lat., 9°58' E. Long.).

APPROACH: Depth entrance approaches 43 ft H.W. Entering with maximum draft should be arranged with Elbe River and harbor pilots. Depths in port up to 53 ft. The bottom entrance approaches and harbor basins are soft sand and mud--no rocks--so that there is no danger of severe damage to ships. An open tidal port, Hamburg has no locks; ships may approach and leave the port at any time without delay. When leaving, maximum draft cannot exceed 33 ft. For vessels larger than 70,000 g.r.t., 36 ft for normal vessels and 39 ft for container vessels. Tidal fluctuation is 8.5 ft. Deep-draft ships can arrive at high tide and discharge immediately in order to remain afloat at low tide.

FACILITIES:

Wharves - Total area of the port: 24,710 acres; of water surface, 9,340 acres. Ships are handled at quay and dolphin berths. Thirty-eight harbor basins with 22 miles of quay walls and additional dolphin berths can accommodate more than 335 seagoing ships at once. In addition there are 24 basins with 72,890 ft of quay walls and 87,500 ft of dolphin berths for rivercraft. Basins for rivercraft surround those for seagoing ships and are interconnected by small channels. Barges can thus reach all transshipment places without disturbing seagoing traffic. Similarly a dense network of port rail tracks (total length, 404 miles) and roads connects all quay berths and storage plants with the main lines of the German and Central-European traffic system. Two- and three-rail tracks and wide shed platforms with truck approaches alongside sheds facilitate direct loading from wagon or truck into seagoing ships and vice versa. Normal truck traffic is handled on wide roads on the shoreside of sheds.

Storage - Ninety-five quay sheds with 10.2 million sq ft. Five sheds with 614,000 sq ft are temperature-controlled, that is, insulated against cold and equipped with heating plants for the intermediate storage of tropical fruit in winter. Consolidated cargo arriving by rail and road will be offloaded centrally into special distribution shed, "Ubersee-Zentrum," (total area 1.7 million sq ft, of which 1.2 million sq ft are under cover), sorted, and then delivered alongside the loading ships by lighters or by trucks.

Cranes - About 485 quay cranes--mostly modern full-portal with 122 heavy-lift cranes; and more than 1,726 forklift trucks, mobile cranes, electric trucks, and other mechanical gear. There are also transporter bridges with 5 to 10 tons lifting capacity, while three other plants specialize in the discharge and storage of tropical timber.

Water - Available.

Tanker terminals - Water and bunkering at all berths. Storage tanks for all kinds of oil have a capacity of 5 million tons. Three large oil refineries are situated in Hamburg. Twenty-seven berths are available.

Bunkers - Fuel, diesel, and gas oil brought alongside by harbor

craft in any quantity. Bunker coal of any quantity loaded at ship's berth by floating elevators.

Container and ro/ro - There are five container and ro/ro terminals. Total length of berths, 20,203 ft; total number of berths: 28 container, 5 ro/ro. Depth of water, 33 to 48 ft. Total open storage area, 18.3 million sq ft; total shedded area, 2.4 million sq ft. Large quantities of handling equipment with varying lifting capacities are available: 68 cranes, 3 to 50 tons; 7 mobile cranes, 12 to 60 tons; more than 350 forklifts with capacity to 15 tons; other container-handling equipment.

Ore and bulk cargo - There are 11 terminals for ore and bulk cargo with a total quay length of 13,670 ft (2.6 miles) and an average draft of 38 ft. There are five grain-handling facilities; maximum draft, 35 to 43 ft; maximum length, 650 to 900 ft. There are 25 elevators with a total operating capacity of 4,750 tons/hr.

NEW DEVELOPMENTS: Further development of the Port of Hamburg, including industrial facilities, is planned for the Suderelbe area, West of the Kohlbrand, especially at the Altenwerder area, around the Sandauhafen. In 1985 another container terminal is planned to be operational in the Altenwerder area, south of the Hansaport installation.

SHIP REPAIRS: Repairs to seagoing vessels and marine engines are available from several sources.

REMARKS: Airport - Hamburg-Fuhlsbuttel, 7 miles.

FRANCE

PORT: Le Havre (49°29' N. Lat., 0°06' E. Long.).

APPROACH: The northwest channel, or harbor entrance, which is 8 miles long and 98 ft wide, with a depth of at least 51 ft at L.W.O.S.T., gives access to the biggest ships at any time of the tide. It leads through a large outer and a smaller inner harbor into the tidal basins (665 acres) devoted to trans-Atlantic traffic (with oil basins for tankers), and into the inner basins (203 acres), mainly the Bassin de l'Eure and Bassin Bellot. The Canal de Tancarville links the harbor to the Seine upwards of the estuary and is dredged to 30 ft along Bassin Vetillart and Quai du Rhin. At the far end of Theophile Ducrocq Basin is the Francois ler Lock, 1,312 by 220 ft, which can receive fully laden vessels of 250,000 d.w.t.

Beyond the locks is a 128-acre constant level basin (South East Basin), 2,595 ft long and 1,985 ft wide, which constitutes the beginning of the Grand Canal du Havre, running almost parallel to the Tancarville Canal. The South East Basin is linked to the Tancarville Canal by a 4,100-ft by 656-ft canal. To the south of these works is a 1,112-acre storage area.

FACILITIES:

Wharves - There are 203 miles of railway track inside the port area and 73 miles of roads. There are 15 docks with a total of 53 quays. Total quay length is 51,686 ft (9.8 miles). There are quays for petroleum products, bulk liquid (non oil), liquid gas, oil, bulk fertilizer, chemical products, and tanker terminals. The total number of available moorings is 90.

Storage - Available shed storage is 5.3 million sq ft.

Cranes - 142 rail-travelling cranes; six floating cranes (plus one floating elevator); 28 gantry cranes; one diesel crane; eight miscellaneous cranes; four grain elevators; two mobile elevators.

Water - Available.

Tanker terminals - Nine berths operated by the Cie Industrielle Maritime; handles ships up to 280,000 d.w.t. Night berthing not possible for ships over 50,000 n.r.t.; water and bunkers available.

About 12 miles N. of Le Havre's access channel and 2.5 miles S. of the Cap d'Antifer at St. Jouin-Bruneval is the port of Le Havre-Antifer, an oil terminal with two berths for tankers up to 550,000 d.w.t. tons. Access channel 1,804 ft wide; 4,757-ft-diameter turning circle. Port protected to the N. by a breakwater 2.2 miles long. The oil, directly unloaded from tankers into reservoirs, is pumped to Le Havre's installations through a 15.5-mile-long pipeline.

Bunkers - Fuel and diesel oil can be supplied throughout the port by barges.

Container and ro/ro - Container facilities available at three specialized quays. Quai de l'Atlantique: 2,625 ft of quayage with three berths, one of which handles ro/ro traffic. Four 40-ton-capacity

gantry cranes; two 42-ton capacity gantry cranes; two sheds, one 108,000-sq-ft and one 75,400-sq-ft shed for stuffing and stripping containers. Quai de l'Europe: 3,855 ft of quayage with four berths, two of which handle ro/ro traffic. Four 40-ton gantry cranes and two 42-ton gantry cranes; three sheds for stuffing and stripping containers. Quai Bougainville: terminal in a constant level basin; 4,167 ft of quayage; 45 acres of land; four 40-ton-capacity gantry cranes; three sheds. There are also 15 ro/ro berths for ships with maximum lengths ranging from 295 to 1,080 ft.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Several berths for ships up to 90,000 d.w.t. Seven dry docks available from 230 to 1,017 ft in length.

REMARKS: Airport - 4.3 miles from Le Havre; regular services to Gatwick, Nantes, and Lyon.

UNITED KINGDOM

PORT: London (51°30' N. Lat., 0°10' W. Long.). The Port of London comprises the 95 miles of the tidal River Thames, and three enclosed dock systems.

APPROACH: The following channels are under maintenance by the Authority: from London Bridge to Tower Bridge, width, 328 to 377 ft, depth at chart datum 8 ft; from Tower Bridge to Thames Tunnel, 381 to 420 ft and 12 ft; from Thames Tunnel to Greenland Dock, 420 to 450 ft and 12 ft; from Greenland Dock to King George V Dock, 450 to 600 ft at 14 to 17 ft; from King George V Dock to Dageham Pylons, 600 ft and 19 ft; from Dagenham Pylons to Coldharbour Point, 600 ft and 23 ft; from Coldharbour Point to Thames Haven, 1,000 ft and 26 ft; from Thames Haven to No. 1 Sea Reach Buoy, 1,000 ft and 31 ft graded to 35 ft. The main buoyed channels in the outer estuary are the Barrow Deep, the Edinburgh Channels, the Black Deep, and Knock John Channels.

FACILITIES:

Wharves - There is a riverside ro/ro berth at Prufleet Deep Wharf which handles products from Finland and another ro/ro facility at Convoy's Wharf. Victoria Deep Water Terminal at East Greenwich is the only custom-built container berth outside of the Docks and has a ship frontage of 850 ft, and barge frontage of 350 ft.

Samuel Williams Terminal at Dagenham Dock with berthing for 6 vessels has a high capacity for dealing both with bulk cargos and also has ample storage for bulk liquids.

Three enclosed dock systems owned and operated by the Port Authority, providing 22 miles of quayage. Royal Dock lock entrance: 800 ft long, 100 ft wide, and depth of 45 ft. Tilbury Dock lock entrance: 1,000 ft long, 116 ft wide, and depth of 46 ft. India and Millwall Dock lock entrance: 584 ft long, 80 ft wide, and depth of 35 ft.

Storage - Total shed capacity in excess of 97 million sq ft. Total open storage in excess of 1 million sq ft.

Cranes - 200 electric quay cranes; 34 mobile; two 120-ton and one 60-ton floating cranes; eleven 30-ton and five 45-ton container-handling cranes.

Water - Fresh water available.

Tanker terminals - 42 berths; length ranging from 557 to 1,200 ft, draft from 30 to 47 ft; night berthing possible; water, bunkers, and slop tank facilities available.

Bunkers - Available.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Private companies provide extensive dry dock and repair facilities. Length of dry docks, 167 to 752 ft; width, 40 to 126 ft; depth, 10 to 39 ft.

REMARKS: Airport - Southend, 16 miles. London, Heathrow, 20 miles.

PORT: Southampton, Hampshire (50°54' N. Lat., 1°24' W. Long.).

APPROACH: Tides: A stand of slack water at the highest level giving practically three hours of H.W. twice every 24 hours. The young flood "stand" at 6 ft above chart datum is also a major tidal facility for the handling of large ships and lasts with slack water from 1-1/2 to 3-1/2 hours after local L.W. Tides: Spring range, 6 ft; Neap rise, 13 ft. Depth at entrance from W.W. Bramble Buoy to Hook Light Buoys, 40 ft new chart datum, and thence to the docks, 33 ft new chart datum.

FACILITIES::

Wharves - The Southampton Docks comprise three basins and extensive river quays.

Prince Charles Container Port is made up of 6 berths. Total length of the quays, 5,846 ft; nominal dredged depth below chart datum, 30 to 42 ft.

Western Docks is made up of 10 berths. Total length of quays, 8,011 ft; nominal dredged depth below chart datum, 34 to 38 ft.

Ocean Dock has 6 berths with an entrance that is 400 ft wide. Total length of quays, 3,806 ft; depth, 38 ft below chart datum.

Test Quays has 8 berths. Total length of quays, 4,127 ft; depth below chart datum, 14 to 34 ft.

Dock Head is 469 ft in length and 26 ft in depth.

Express Dock has 8 berths with an entrance that is 159 ft wide. Total length of quays, 3,261 ft; depth below chart datum, 23 to 25 ft.

Itchen Quays is made up of 9 berths. Total length, 4,039 ft; depth below chart datum, 7 to 33 ft.

Princess Alexandra Dock has 10 berths with an entrance that is 325 ft wide. Total length, 2,661 ft; depth below chart datum, 16 to 20 ft.

Town Quay has 9 berths. Total length, 2,575 ft; depth, 9 to 22 ft.

There are 3 dry docks with a total length of 2,589 ft.

Storage - Throughout the docks, there are spacious transit sheds. Modern passenger reception halls are provided at each of the liner terminals. A cold store at berth 108 has space for 4,527 tons of refrigerated cargo.

Cranes - Cranes, ranging from 3 to 50 tons capacity, and one floating crane of 150 tons. Privately owned pneumatic grain plant (Solent Mills) handles 236 tons/hr.

Water - Available.

Tanker terminals - Facilities are located at Fawley and Hamble marine terminals.

Bunkers - 24-hour service available.
Container and ro/ro - Common user container quay, 1,883 ft long, with services to North America, Far East, N.W. Europe, North Africa, and Ireland. Two 30-ton, one 40-ton portainer cranes. Link span for ro/ro traffic. Trio Lines, Far Eastern, and SAECES South African container trade dealt with at a 3,051-ft-long quay. Five 35-ton portainer cranes. Seven exclusive container trains each way every weekday to Birmingham, Glasgow (Coatbridge), Leeds, Liverpool, London, and Manchester. Two bonded container depots with covered storage areas for cargo inspection, consolidation, or unloading of unit traffic.

Ro/ro services for passengers, cars, containers, and wheeled freight operates between Southampton, Le Havre, and Cherburg.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Husbands Shipyard at Marchwood; Vosper Ship Repairers, Eastern Docks.

REMARKS: Airport - Eastleight (Southampton), 5 miles from Docks.

SWEDEN

PORT: Gothenburg (57°42' N. Lat., 11°58' E. Long.).

APPROACH: Not reported.

FACILITIES:

Wharves - Anchorage in the river and outside the harbor has good mud bottom. Vessels up to 32 ft can lie alongside general cargo quays which afford excellent facilities for loading and discharging. Navigation open all year round. Free port facilities available.

Largest vessel: 1,079 by 158 ft by 62 ft. There are 31 quays with a total length of 9,646 ft and depths ranging from 13 to 36 ft.

Storage - There are 12 storage sheds, two of which are partially heated, and a storage hall.

Cranes - Nineteen 5-ton cranes; sixteen 16-ton cranes; twelve 5/10-ton cranes; six 6/10-ton cranes; 3 ro/ro ramps.

Water - Available.

Tanker terminals - 25 berths, operated by the Port of Gothenburg Authority, Esso Oil Company, Nynas Oil Company; length from 100 ft to no limit; draft from 17 to 63 ft; night berthing possible at all berths; water and bunkers by barge; slop tank facilities available. The Torshamnen Jetty has a depth of 66 ft and can accommodate carriers up to 225,000 d.w.t.

Bunkers - Fuel, diesel, and gas are available.

Container and ro/ro - Available at the Skandia Harbor. There are 15 quays with a total length of 7,890 ft; depths range from 23 to 39 ft. Four cranes on rails for container with derrick bridles for 20/40-ft containers; two new 25-ton combi cranes and two new 30-ton transtainer cranes.

NEW DEVELOPMENTS: Due W. of the Skandia Harbor, the Alusborg Harbor is under construction and, when completed, will have an area of 6.5 million sq ft and will be connected directly with the Skandia Harbor. Some quays are already in operation though the harbor will not be completed until the early 1980's. In the long run, it is planned to concentrate almost all the port's dry cargo activities in the Alusborg and Skandia harbors. A new container terminal is under construction at the Eriksberg shipyard. It will cover 646,000 sq ft and have a 108,000-sq-ft warehouse and two transverse cranes on pillars.

SHIP REPAIRS: Various types of ship repair, reconstruction, and engine repairs are available at 3 docking facilities, a floating dock, and a graving dock.

REMARKS: Airport - Landvetter, 15 miles from the center of Port.

PORT: Belfast, N. Ireland (54°36' N. Lat., 5°56' W. Long.).

APPROACH: The depth below the harbor datum varies in Victoria Channel between 15 and 30 ft. The depth below harbor datum in Musgrave Channel and Herdman Channel is 21 ft. Note: The intended depths are not always maintained because of silting. Tides: M.H.W. spring tides, 11 ft (above harbor datum); M.H.W. neap tides, 10 ft; M.L.W. spring tides, 1.3 ft; M.L.W. neap tides, 4 ft; highest spring tide on record, 15 ft. Largest vessel: vessels with a maximum draft of 28 ft can enter or leave at any time when M.H.W. is 10 ft or more above harbor datum.

FACILITIES:

Wharves - The area of the docks and basins--including a pontoon of the river space, which is practically a dock--is about 365 acres. Total quayage of the port is 37,650 ft.

Storage - Excellent transit shed accommodation covering 754,000 sq ft.

Cranes - Operated by the Belfast Harbor Commissioners: one 197-ton, three 30-ton, two 25-ton, one 15-ton, one 10-ton, one 7-1/2-ton, thirteen 5-ton, and six 3-ton. Operated by Harland and Wolff Ltd.: two 39-ton, two 16-ton, three 10-ton, and seven 5-ton.

Water - Fresh water available at most berths by hose.

Tanker terminals - Three berths; length from 600 to 1,000 ft; draft about 28 ft; night berthing possible; water, bunkers, and slop tank facilities available by special arrangement.

Bunkers - Fuel, diesel, gas oil from Shell U.K. Oil, and Esso Petroleum Company Ltd.

Container and ro/ro - There are 14 specialized drive-on/drive-off and lift-on/lift-off container berths in full operation. In addition, one heavy-load ro/ro platform for weights up to 590 tons.

Ore and bulk cargo - Unitank Storage Company Ltd. have constructed a bulk liquids terminal on a site on the County Down side of the harbor for the storage of petroleum and chemical products.

NEW DEVELOPMENTS: An area of about 74 acres on the County Down side of the harbor is under reclamation to provide additional berthage. On the County Antrim side, 99 acres are available for development.

SHIP REPAIRS: Repairs are available at several dry docks and shipbuilding docks. Lengths of docks range from 1,100 to 1,800 ft with a width of 300 ft.

REMARKS: Airport - Belfast (Aldergrove), 16 miles.

PORT: Felixstowe, Suffolk (51°57' N. Lat., 1°19' E. Long.).

APPROACH: Entrance to Felixstowe dock basin is 145 ft wide, with a depth of 18 ft L.W.O.S.T. There are no lock gates and vessels may enter or leave basin at any state of tide. Tidal range is 11 ft.

FACILITIES:

Wharves - There are 5 wharves at Felixstowe Port. Transatlantic Container Terminal is 2,040 ft long with the depth of water at 33 ft at L.W.O.S.T. Covered storage is 26,000 sq ft and open storage covers 69 acres. There are 3 gantry cranes with 30 to 40 tons capacities, 11 mobile cranes with capacities up to 27.5 tons. There are 98 fork-lift trucks with capacities up to 25 tons. Dock Basin contains three quays. East Quay is 430 ft long; North Quay is 640 ft long, and South Quay is 610 ft long with water depths of 18 ft. Vessels up to 350 ft in length are accepted. Covered storage is 450,000 sq ft and open storage covers 19 acres. One 32-ton Scotch Derrick crane is available. Northern Development has 1,100 ft of quayage with dual-purpose quays for general cargo and ro/ro berthage and a 450-ft ro/ro berth. Vessels of up to 500 ft are accepted. There are 284,000 sq ft of covered storage and 30 acres of open storage. There is one 30-ton fixed gantry crane and one 35-ton-capacity electric travelling crane available for cargo handling. Ferry Terminal is a 360-ft-long ro/ro berth. The depth of water is 22 ft and vessels of 450 ft in length are accepted. There are 52,000 sq ft of covered storage and 25 acres of open storage. One 32-ton-capacity electic travelling crane is available. There is one Tanker Terminal with a depth of water of 30 ft. Vessels up to 600 ft in length are accepted. There are 138 storage tanks with a total storage capacity of 2.8 million cu ft.

Storage - see "Wharves."

Cranes - see "Wharves."

Water - Available.

Tanker terminals - Oil jetty north of the dock entrance, 1,100 ft long with dolphin head to accommodate tankers of up to 25,000 d.w.t. in 30 ft of water at L.W.O.S.T. Three tank farms for 2.8 million cu ft capacity (138 tanks, some heated) are specifically developed for storage of high and low flashpoint chemical and industrial solvents.

Bunkers - All principal oil companies can supply by road trailer wagons. Gas oil is also available through Conoco Ltd. pipeline at the Oil Jetty. Gas and marine oil are available from self-propelled barge operated by Allantone Supplies Ltd. as distributors for Conoco Ltd. Coal is available on order to ship agents.

NEW DEVELOPMENTS: Private warehouses under development adjacent to the Port; 1.2 million sq ft of warehousing space and 1.2 million cu ft of cold storage space already available, as well as an inland clearance depot for containerized cargo. Six Paceco Transtainer gantry cranes are being installed.

SHIP REPAIRS: Minor hull and engineering repairs, diving services, and underwater repairs are available.

REMARKS: Airport - Ipswich, 12 miles.

PORT: Liverpool, Merseyside (53°24' N. Lat., 3° W. Long.) on the Mersey.

APPROACH: Least depth at entrance, 25 ft below chart datum. Tides: Mean spring range, 28 ft. Mean neap range, 15 ft.

FACILITIES:

Wharves - The area of anchorage for large ships on the Mersey is about 2,000 acres, and for small boats about 495 additional acres. Wharf facilities are located within two main docking areas: Liverpool Docks and Birkenhead Docks. Liverpool consists of 40 docks with total water area of 430 acres and total quayage length of 20 miles. Within Birkenhead Docks are 16 wharf areas with a total water area of 180 acres and total quayage length of 9.4 miles.

Storage - Not reported.

Cranes - Not reported.

Water - Available.

Tanker terminals - Tranmere Tanker Terminals: Tanker discharging terminal for supplying the Shell and Burmah Stanlow refineries through a 24-in. pipeline from the S. stage and through a 40-in. pipeline from the N. stage. Two floating stages, each 367 ft long by 62 ft wide, provide berthage at the S. stage for tankers of up to 95,000 d.w.t. in a depth alongside of 38 ft below chart datum (1975), and at the N. stage there is a depth of 41 ft below chart datum (1975) and tankers up to 275,000 d.w.t. can be accommodated on a reduced draft of up to 49 ft. Rock Ferry Tanker-Cleaning Jetty: Adjacent to the Tranmere terminal is a tanker-cleaning installation operated by Mersey Tanker Services Ltd. Jetty, 1,400 ft long with berth head of 275 ft in present depth of 23 ft below chart datum (1975), capable of handling tankers of up to 100,000 d.w.t. on light draft. On the jetty head is a 3-ton travelling crane with a 100-ft outreach.

Bunkers - Fuel, diesel, and gas oil from Shell U.K. Oil, B. P. Oil, or from Esso Petroleum Ltd. Bunkering is generally by lighters or barges.

Container and ro/ro - The Royal Seaforth Container Terminal has a 3,600-ft quay backed by a marshalling area of 59 acres. Five container cranes are provided and other facilities include two ro/ro ramps and groupage sheds for consolidating break-bulk cargos. A length of quay and approach has been specifically strengthened to cater for extra heavy lifts of up to 1,000 tons. The B & I and Belfast Terminals also include container and ro/ro facilities and there are a number of ro/ro ramps in other parts of the dock system.

Ore and bulk cargo - Heavy lifts are handled by three floating cranes of capacities up to 200 tons. Other cranes are: 180 quay cranes; one 50-ton electic crane; 240 mobile cranes including one at 40 tons, one at 35 tons, one at 30 tons.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Birkenhead Graving Docks: No. 1 East berth has a length of 939 ft; approximate depth of water, 23 ft; coping at gate quoins above

chart datum, 35 ft; width of entrance, 60 ft. No. 3 West berth is 750 ft long; approximate depth of water, 27 ft; coping at gate quoins above chart datum, 35 ft; width of entrance, 85 ft. Liverpool Graving Docks has five berths with a total length of 8,172 ft; coping at hollow quoins above chart datum, 32 to 40 ft; width of entrance, 33 to 94 ft.

REMARKS: Airport - Speke, Liverpool, nearby.

PORT: Dublin (53°21' N. Lat., 6°16' W. Long.) on the River Liffey, 7 miles from the Irish Sea.

APPROACH: Tides, on Dublin Bar, 12 ft M.H.W.S., 11 ft M.H.W.N. Anchorage: Scotch Bay, just beyond Dun Laoghaire, about 7 miles from Dublin Docks. Depth at L.W., 36 to 59 ft. There is a channel across the Bar at M.L.W.S. of 26 ft. Vessels up to 30,000 d.w.t. can, at present, enter the port on various tides and drawing about 34 ft.

Vessels drawing 23 ft and less can enter at any stage of the tide. The Inner Channel of the harbor, formed by the almost straight channel of the River Liffey, from the entrance at Poolbeg Lighthouse to Alexandra Basin, is 705 ft wide for the greater part of its length and is maintained at a depth of 26 ft at L.W. From the Alexandra Basin entrance, the river is quayed for a distance of nearly 2 miles to Butt Bridge in the center of the city.

FACILITIES:

Wharves - North side of the River: Quays available for berthage 7,360 ft; depth at L.W., 16 to 22 ft. Electric cranes, the property of the Board: one of 100 tons, nine of 4 tons, one of 6 tons.

South side of the River: Quays available for berthage, 5,240 ft; depth at L.W., 16 to 22 ft. Electric cranes, the property of the Board: 10 of 4 tons.

South Bank Quay: Serves the Electricity Supply Board's Ringsend Power Station, 700 ft, depth at L.W., 28 ft. Two transporter cranes of 5 tons each for the discharge of coal and pipelines for the discharge of oil. Tanker jetty serving the Electricity Supply Board's Poolbeg Generating Station, depth at L.W., 37 ft.

Alexandra Basin: Has a water area of 47 acres. Quays on the south and west sides, 2,690 ft; depth at L.W., 24 to 26 ft. Electric cranes, the property of the Board: one of 6 tons, six of 4 tons.

Alexandra Quay West: On the north side of Alexandra Basin, 1,180 ft; depth at L.W., 32 ft. Electric cranes, the property of the Board: one of 6 tons, seven of 4 tons.

Dry Bulk Jetty: In Alexandra Basin, with a main section of 750 ft, used for bulk cargos, depth at L.W., 31 ft, with provision for deepening; equipped with pipelines for liquid sulphur, conveyor, and two electric cranes of 10 tons.

Ocean Pier West: At the eastern end of Alexandra Basin, 1,370 ft; depth at L.W., 32 ft. Electric cranes, the property of the Board: one of 10 tons, seven of 4 tons, one of 35 tons for overseas container and unit load traffic.

Ocean Pier South: At the eastern end of Alexandra Basin, entrance, 465 ft; depth at L.W., 32 ft.

Alexandra Basin East: Has a water area of 28 acres, comprises the eastern side of Ocean Pier, Alexandra Quay East, and the Eastern and Western Oil Jetties.

Ocean Pier East: 800 ft; depth at L.W., 32 ft. Electric cranes, the property of the Board: four of 4 tons.

Alexandra Quay East: 1,182 ft; depth at L.W., 32 ft. Electric cranes, the property of the Board: five of 4 tons; one privately owned 30-ton dockside container gantry.

Grand Canal Docks: (Owned by Coras Iompair Eireann) on the south side of the river are used chiefly by small vessels engaged in carrying coals, grain, and sands used in the manufacture of glass. Area, 24 acres, about 600 ft of quayage.

Storage - Transit Sheds: The Port contains a length of about 9,600 ft of transit sheds situated on the quays, covering an area of 626,000 sq ft. About three-quarters of this space is used for overseas trade and the remainder for cross-Channel trade.

Warehousing: A four-story warehouse, Stack "D," situated at Alexandra Quay provides almost 6 acres of warehousing space close to deepwater berthage, and Stack "I," situated in the Custom House Docks premises, provides 3 acres of storage. Extensive warehouses covering 7 acres with forklift truck and pallet handling, racking, etc., are operated by Merchant's Warehousing Company Ltd., convenient to both deepwater and cross-Channel berths.

Cranes - see "Wharves."

Water - Available.

Tanker terminals - Western Oil Jetty: West side, 741 ft; depth at at L.W., 35 ft. East side, 771 ft; depth at L.W., 35 ft.

Eastern Oil Jetty: West side, 680 ft; depth at L.W., 34 ft. East side, 680 ft; depth at L.W., 21 ft. Night berthing possible. Water, bunkering, and slop tank facilities by special arrangement.

Common User Pipeline System: Provides 21 pipelines to Eastern Oil Jetty and 15 pipelines to the Western Oil Jetty.

Bunkers - Fuel and diesel medium grades available at Alexandra Basin East (depth, 34 ft L.W.); delivery at up to 150 tons/hr; also by oil company road tankers, in any part of the port.

Container and ro/ro - Four container terminals are operated on an exclusive use basis by shipping companies.

The B. & I. Terminal has a 750-ft-long quay, depth at M.L.W.S., 20 ft, an area of 27 acres, and is served by a 30-ton transporter crane and two 28-ton derrick cranes. The terminal contains a groupage shed of 64,580 sq ft and has a special rail siding for container trains.

The British Rail Terminal has a 475-ft-long quay, depth at M.L.W.S., 20 ft, an area of 8 acres, and is served by two 30-ton transporter cranes and two 30-ton Goliath cranes.

The Bristol Seaway Terminal has a 550-ft-long berth, depth at M.L.W.S., 25 ft (which forms part of the longer quay), and is served by a 30-ton transporter crane. The secondary handling of containers is carried out by a 30-ton gantry crane. The total storage area is 7 acres (presently being extended), and the terminal contains a 32,290-sq-ft groupage shed.

The Irish Sea Ferries Terminal has a 367-ft-long berth, depth at M.L.W.S., 32 ft (which forms part of a longer quay), and is served by a 30-ton long-span transporter crane. The total area of the terminal is 5.6 acres.

The Southside Common User Container Terminal has a 800-ft-long quay with 25 ft depth at M.L.W.S.; it is equipped with a 30-ton transporter crane, and a 32-ton derrick crane, and has 9.6 acres of surfaced backup area, 32,290-sq-ft groupage shed, and 12 reefer points.

Containers are also handled at a number of general cargo berths which are served by jib derrick cranes and transporter cranes.

Special unit loads and containers are also handled by a 100-ton fixed crane.

A ro/ro car/freight ferry terminal is used by the Dublin/Liverpool passenger service and by the Dublin/Fleetwood freight service. The 459-ft-long berth has a depth of water of 20 ft at L.W.S.T., and vessels of up to 79 ft beam can be accommodated. The 115-ft-long shore ramp can take vehicles of up to 140 tons. The terminal buildings and other facilities have been specially designed to enable a 1-hour turnaround of the passenger ferry vessels to be achieved and there is also ample space for freight. Provision has been made for a second ramp.

A multipurpose ro/ro facility is in operation at the South Quays. The 105-ft-long shore ramp is 36 ft wide at the seaward end. It takes vehicles of up to 140 tons and is so designed that it can accept a wide variety of vessels up to 85 ft beam (maximum width of ship's door, 23 ft). Ample storage is available in close proximity to the berth which has a depth of water 25 ft at L.W.S.T.

Ore and bulk cargo - A 1,171-ft-long deepwater quay with 37 ft of water at M.L.W.S. is in operation for coal and other bulk materials. An area of 10.5 acres has been surfaced at the back of the quay. Two 10-ton and two 4-ton grab cranes, conveyors, and other mechanical handling equipment available.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Ship repair and graving docks with crane equipment are available.

REMARKS: Airport - Dublin Airport, 5.5 miles.

BELGIUM

PORT: Zeebrugge (51°20' N. Lat., 3°12' E. Long.).

APPROACH: Port is formed by a gigantic semicircular breakwater 8,160 ft long covering the roadstead and entrance to Bruges ship canal against all winds for S.W. to N.

Pas-vanhet Zand and Swinging Basin dredged to 34 ft.

Tides: Mean range, 12 ft. Spring range, 14 ft.

Largest vessel: V.L.C.C. maximum length, 1,150 ft.

FACILITIES:

Wharves - This breakwater offers 5,150 ft of quayage fronting the roadstead, depths of 26 ft, 29 ft, and 34 ft. Ample shed and railway accommodations are provided on this mole. The quays are equipped with six electric travelling cranes of 8 tons, adjustable jibs 80 ft long, two electric cranes to lift 8 tons, adjustable jibs 105 ft long, or 16 tons with adjustable jibs 52 ft, and two electric cranes to lift 3 tons, adjustable jibs 65 ft long. A fully equipped bunkering station with three berths is installed at the seaward end of the breakwater. Safe anchorage for shipping is available in the roadstead; the entrance channel from the roadstead to the lock and the ship canal is 350 ft wide, with a depth of 24 ft at low tide. The lock is 518 ft long and 65 ft wide at the entrance and has a depth of 17 ft on the sill at L.W.O.S.T. The inner harbor of Zeebrugge comprises one basin and two docks provided with wooden wharves.

Storage - There is a Molasses Storage Installation with a capacity of 30,000 tons; a deep-freeze storage installation with a capacity of 212,000 cu ft.

Cranes - See "Wharves."

Water - Fresh water available.

Tanker terminals - Length of quay: 1,950 ft with a depth of 43 ft at L.L.W.S. Discharging facilities for Texaco; night berthing possible; water, stores, and bunkers available.

Bunkers - Depot for oil bunkering, with pipelines, operated by Societe Belge de Soutage. Three bunker berths alongside mole.

Container and ro/ro - There are two container terminals at Zeebrugge outer port: the ocean container terminal (OCT) and the shortsea container terminal (SCT).

The OCT is equipped with three 45-ton gantry cranes providing 2,297 ft of quay. This quay is also adapted for oceangoing ro/ro vessels. The SCT is equipped with two 30-ton gantry cranes providing 886 ft of quay. Both terminals are linked to road and rail.

The outer port provides a ro/ro terminal with services to various ports of the world.

NEW DEVELOPMENTS: A sea lock, accessible for vessels of 150,000 d.w.t., as well as additional docks, is under construction eastward of Zeebrugge

and will provide access to a new industrial area.

SHIP REPAIRS: Facilities for minor ship repairs.

REMARKS: Airport - Ostend, 16 miles; Brussels national airport, 81 miles.

PORTUGAL

PORT: Lisbon (38°43' N. Lat., 9°11' W. Long.).

APPROACH: The Port of Lisbon is situated on the Tagus estuary, which is 15 miles long and between 1.2 and 8.7 miles wide with a highest tidal rise of 14 ft. At the bar which gives access to the port is a channel with a depth of 49 ft (59 ft at high tide), but this will probably be deepened to allow passage of vessels of the largest tonnage.

FACILITIES:

Wharves - The port wharves have an overall length of 39,370 ft (7.5 miles) on the North Bank with water depths varying between 13 and 33 ft. On the South Bank the wharves have a total length of 8,300 ft with depths from 10 to 36 ft.

Storage - About 2.5 million sq ft of total covered warehouse area is is available.

Cranes - 88 cranes from 1.5 to 12 tons capacity; six mobile cranes from 1.5 to 30 tons capacity; three container cranes of 30 to 33 tons capacity.

Water - Fresh water available by barge in moderate quantities.

Tanker terminals - Nine berths available with lengths from 79 ft; draft from 21 to 36 ft. Night berthing and water at all berths; bunkers available subject to tidal restrictions at some berths; slop tank facilities available.

Bunkers - Fuel, diesel, and gas oil from Shell Portuguesa by barge and at two berths at Banatica. Fuel, diesel, and gas oil also available from Mobile Oil Portuguesa by barge and at one berth at Sonap Terminal. All grades are available from Esso Standard Portugal Inc. by barge and at berth.

Container and ro/ro - Container Terminal at Santa Apolonia. Length of wharf, 2,760 ft; depth, 39 ft; 860,000 sq ft of storage. Three gantry cranes, five transtainers, five side-loaders, and nine front-loader stackers.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Shipyards and dry docks are available for extensive ship repairs.

REMARKS: Airport - Lisbon Airport about 6.5 miles from city.

PORT: Hull, North Humberside (53°44' N. Lat., 0°22' W. Long.) on the North Bank of the Humber, about 23 miles inland.

APPROACH: Not reported.

FACILITIES:

Wharves - There are five docks with a total water area of 190 acres; river frontage over 36,000 ft (6.8 miles); dock quayage over 55,000 ft (10.6 miles). There are 131 cranes and 29 sheds and warehouses. There are also three river quays and jetties with a total length of over 1,700 ft. There are also five graving docks with a total length of 2,600 ft.

Storage - Sheds and warehouses are available.

Cranes - King George Dock: one floating crane (60 tons capacity), one floating derrick (150 ton), and quay cranes up to 10 tons capacity. Queen Elizabeth Dock: eight 6-ton, four 7.5-ton, and two 10-ton-capacity cranes, and two container cranes (35 and 40 tons). Alexandra Dock: a 100-ton crane for heavy lifts.

Water - Available.

Tanker terminals - Two berths; length, 670 ft; draft, 30 ft; night berthing possible; water and bunkers available.

Bunkers - Fuel, diesel, and gas oil are available.

Container and ro/ro - Available at the King George, the Queen Elizabeth, and the Alexandra Docks.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Graving docks are available.

REMARKS: None.

SPAIN

PORT: Bilbao (43°20' N. Lat., 3°01' W. Long.).

APPROACH: Port extends 13 miles up river Nervion from the Super Puerto Breakwater; length, 8,038 ft; depth, 98 ft, which extends from Punta Lucero approx. in an E.N.E. direction and can accommodate super tankers on its inner side. Depth of approach to breakwater, 115 ft L.W.O.S.T. The bay formed between this breakwater and the old Santurce Breakwater used for anchorage of vessels awaiting entry; depths, 66 to 82 ft. Depth of approach to Santurce Breakwater entrance, 46 ft.

FACILITIES:

Wharves - Twelve quays are available for ship accommodation with a total length of more than 29,000 ft (5.5 miles) of quayage and drafts ranging from 13 to 46 ft.

Storage - Total shed space for above quays is 603,000 sq ft.

Cranes - One 400-ton floating crane, and smaller mobile cranes (100 tons at 10-ft radius) available. More than 145 cranes of various capacities (3 to 40 tons) are available.

Water - Available.

Tanker terminals - A 500,000 d.w.t. Petronor berth is available; a 150,000 d.w.t. Petronor berth for discharging crude oil and loading refined products and a 40,000 d.w.t. berth for loading refined products are also available.

Bunkers - Bunkers are only supplied by Campsa. At the outer port of Santurce there are also bunkering facilities; one small tanker for fuel oil and another for gas oil are used for vessels at anchor.

Container and ro/ro - One berth at Santurce used for ferry service to Southampton and Bordeaux. One ferry berth upriver at La Helguera Quay. Container terminal operating at Espigon No. 2 N. Mole. Container equipment includes four 40-ton gantry cranes; six 12-ton portal cranes; four 30-ton van-carriers, and two 35-ton transtainers available; seven 25-ton forklift trucks.

NEW DEVELOPMENTS: A new 10,827-ft-long breakwater to be built from Punta Galea in a W. direction; work will start from the sea side, 1,640 ft off the new Petronor breakwater.

SHIP REPAIRS: Ample facilities for all types of repairs, including five dry docks with lengths of 328 to 545 ft, beams of 46 to 72 ft, drafts of 6 to 9 ft, and capacities of 7,000 to 17,000 tons d.w.t. are available.

REMARKS: Airport - Sondica Airport, 6 miles from port.

NETHERLANDS

PORT: Vlissingen (51°27' N. Lat., 3°34' E. Long.).

APPROACH: Flushing Roads offers a safe and spacious anchorage with a sandy bottom. Vessels should anchor south of Koopmanshaven no less than 3/4 mile from the northern coast. Depths vary from 32 to 85 ft. Tides: heights above L.L.W.S.; M.H.W.S., 15 ft; M.L.W.S., 0.75 ft; M.H.W.N., 13 ft; M.L.W.N., 3 ft.

FACILITIES:

Wharves - Flushing consists of two separate but connected harbors. Outer Harbor: The outer harbor is tidal; has a length of 4,300 ft and a width of 900 ft. The west side quay is 1,150 ft long and can accommodate vessels up to 33-ft draft. This quay also has a rail connection. The landing stage at the northern part of the outer harbor can accommodate coasters and lighters on both sides. Depth at low tide, 20 ft; depth at high tide, 29 ft.

Inner Docks: These are connected to the outer harbor by a double lock and sluice. The largest lock has a length of 455 ft, a width of 72 ft, and a depth on sill of 18 ft at L.L.W.S. The other lock has a length of 213 ft, a width of 26 ft, and a depth on sill of 10 ft at L.L.W.S. The sluice has a width of 113 ft and a depth on sill of 28 ft. It is only operated on request, but any vessel may pass through it at slack tide. Depth in the inner harbor ranges from 21 to 24 ft. Both docks are surrounded by quays and have a depth of 24 ft, a length of 1,300 ft, and a width of 330 ft. Only quays of the first inner dock are connected with main railway system.

Flushing East: The port and industrial area covers 3,000 acres and is situated a few miles east of Flushing. Width at entrance, 1,150 ft. Depth at center of the entrance, 34 ft. Quay length, 1,740 ft. Draft alongside, 38 ft. There are two special berths which have a maximum draft of 41 ft for discharging bulk carriers, tankers, and dangerous cargos situated at the entrance of the basin.

Storage - Outer harbor has 90,400 sq ft of shed space. Inner harbor has 20,100 sq ft of shed space. Ample open space available for storage.

Cranes - One 8-ton, two 10-ton, three 12-ton, and two 25-ton. Also floating cranes are available with capacities of 225, 75, 40, and 8 tons.

Water - Available.

Tanker terminals - Jetty in River Schelde will accommodate tankers up to 100,000 d.w.t.; maximum length, 920 ft; maximum draft, 49 ft. Three jetties for inland barges and coasters in the van Cittershaven: two have maximum draft 20 ft; the other has a maximum draft of 30 ft.

Bunkers - Available ex-barge in the Vlissingen or Everingen Roads.

Container and ro/ro - Container terminal at Flushing East has a quay length of 1,740 ft. There are two cranes suitable for 20-ft, 30-ft, and 40-ft containers and also a ro/ro ramp. The stacking area

is 2.7 million sq ft. There are 129,000 sq ft of sheds for stripping and stuffing containers.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Docking facilities for vessels up to 45,000 d.w.t. Repair facilities for vessels up to about 250,000 d.w.t.; such that ships can enter the harbor when in ballast, depending upon draft. The highly up-to-date equipment installed ensures that all hull, deck, engine, and boiler repairs can be carried out quickly. The yard occupies 280 acres and has repair quays with a total length of 2,300 ft--with cranes up to 40 tons lifting capacity. Draft alongside, 30 ft at low tide.

REMARKS: Airport - Mideen Zeeland, 3 miles.

PORT: Clyde Port, Strathclyde (Comprises the port facilities of Glasgow on the Clyde River and Greenock on the Firth of Clyde; 55°51' N. Lat., 4°16' W. Long.).

APPROACH: Glasgow Harbor extends from about 0.5 miles below to 4 miles below Glasgow Bridge. O.S. rise 12, ft; O.N. rise, 9 ft; extreme R. of T., 15 ft; duration of flood tide O.S.T., 6 hr 10 min; duration of ebb tide O.S.T., 6 hr 10 min; at Erskine 9 miles from Glasgow Bridge O.S.T., velocity of flood tide, 1.6 knots, 1/4-tide; velocity of ebb tide, O.S.T., 1.5 knots, 1/4-tide. Depth in the river channel varies from about 26 ft at west end of Glasgow Harbor to 27 ft at Greenock L.W.O.S.T. Largest vessel entering the Clyde, 32-ft draft; leaving port, 32-ft draft. The harbor below Glasgow Bridge has a depth of 28 to 38 ft at H.W.O.S.T.

FACILITIES:

Wharves - Facilities at Glasgow consist of General Terminus Quay, Prince's Dock, Graving Docks, Meadowside Quay, Merklands Quay, Shieldhall Riverside Quay, King George V Dock, Renfrew Harbor, and Rothesay Dock. These facilities are briefly described:

General Terminus Quay: about 3/4 mile below Glasgow Bridge, is 1,150 ft long and 36 ft deep at H.W.O.S.T. The quay is used for iron ore imports and has three unloaders.

Prince's Dock: about 1.5 miles below Glasgow Bridge, a tidal basin, entering from south side of lower harbor. Entrance, 156 ft wide; water area, 21 acres; quay frontage, 1,800 ft. The dock comprises a canting basin 1,150 ft long and from 505 to 675 ft wide; also a south basin, 800 ft long by 200 ft wide; depth of canting basin, 32 to 39 ft, and south basin, 36 ft at H.W.O.S.T. West and south quays open. The west quay is equipped with two 5-ton electric cranes, and the south quay has one 40-ton and two 5-ton electric travelling cranes.

Graving Docks: Available in six locations with a total quayage length of 3,880 ft and widths ranging from 62 to 95 ft. Two 25-ton travelling cranes service the graving docks at Govan.

Meadowside Quay: 2.5 miles below Glasgow Bridge, 2,280 ft long with goods shed 100 ft wide, covering 5 acres; seven 6-ton travelling cranes on quays; gantry behind goods shed to hold 176,000 tons of grain; facilities for discharging bulk proteins. Railway connection. Depth in front of quay, 40 ft H.W.O.S.T.

Merklands Quay: about 3 miles below Glasgow Bridge, 1,440 ft in length. The eastern portion, 500 ft in length, with buildings covering 6 acres, is reserved for the cattle trade; the remainder of the quay, with 4 acres of ground, and goods shed 663 ft long by 217 ft wide, is used for fruit and general traffic and has two 3-ton travelling cranes. Depth in front of quay, 37 ft H.W.O.S.T.

Shieldhall Riverside Quay: 3.75 miles below Glasgow Bridge, 1,734 ft in length, equipped with one 30-ton, one 25-ton, two 10-ton, one 6-ton, and two 5-ton travelling electric cranes. Adjoining timber

AD-A170 416 EVALUATION AND REPAIR OF WAR-DAMAGED PORT FACILITIES 2/2
REPORT 1 PORT CONSTR..(U) ARMY ENGINEER WATERWAYS
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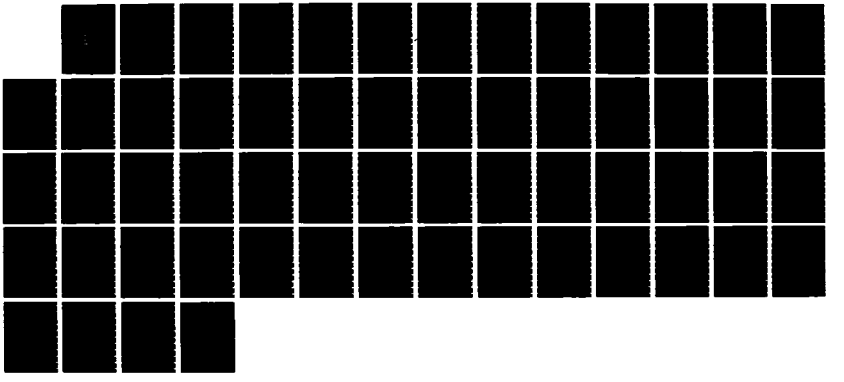

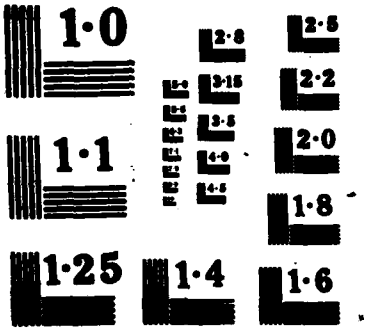
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storage depot extends to 8 acres. Depth in front of quay, 40 ft H.W.O.S.T.

King George V Dock: a tidal basin entering from the south side of the river, 4 miles below Glasgow Bridge. Length, 2,483 ft; width 350 ft; quay frontage, 5,200 ft. Water area, 20 acres; quay space, 50 acres; depth at H.W.O.S.T., 44 ft. Goods shed on east quay, 2,000 ft long by 100 ft wide; on west quay, 2,160 ft long by 110 ft wide; also 387 ft long by 150 ft wide with paved area behind to receive containers, timber, minerals, and general cargo. West quay equipped with fourteen 5-ton and east quay with one 35-ton, two 6-ton, four 5-ton, and one 3-ton travelling electric cranes. Two transit depots at Deanside and Braehead, near King George V Dock, six sheds, each 500 by 100 ft.

Renfrew Harbor: at the mouth of the Pudzeoch Burn, 5.4 miles below Glasgow Bridge. Harbor 660 ft long by 100 ft wide. Length of wharf, 480 ft. Depth in front, 25 ft H.W.O.S.T.

Rothesay Dock: Tidal basin on north side of the River Clyde, 6.5 miles below Glasgow Bridge. Entrance, 200 ft wide. Water area, 20 acres, and quay frontage, 4,330 ft. Comprises an outer basin 600 by 600 to 680 ft; an inner basin 1,735 ft long, 300 to 230 ft wide, and a riverside quay 350 ft long. Depth basins, 36 ft H.W.O.S.T. West Quay of the outer basin has two 8-ton travelling electric cranes. South Quay has six 8-ton and three 10-ton electric cranes.

Facilities at Greenock consist of 6 quayage areas with a total length of 10,500 ft. Transit sheds, general sheds, and warehouses are located on most of the quays.

Storage - See "Wharves."

Cranes - See "Wharves."

Water - Available.

Tanker terminals - Three oil berths. Length, 560 ft; draft, 30 to 32 ft. Night berthing possible. Water and bunkers available. Slop tank facilities at one berth.

Bunkers - Fuel, diesel, and gas oil by special barges, or road tankers at any part of the harbor.

Container and ro/ro - The Clydeport Container Terminal is located at Greenock. Length, 1,200 ft, with depth alongside of 42 ft L.W.O.S.T. One 40-ton and two 35-ton quayside transporter cranes with outreach of 105 ft beyond cope line are each capable of lifting fully loaded 40-ft containers. Paved area of 40 acres provided for handling containers in transit and customs shed is available.

NEW DEVELOPMENTS: Container facilities are being expanded. New equipment including straddle carriers, forklifts, mobile cranes, and bag elevators are being procured.

SHIP REPAIRS: Five dry docks are available at Greenock with a total length of 2,740-ft quayage.

REMARKS: Airport located at Glasgow, nearby.

PORT: Manchester (53°29' N. Lat., 2°14' W. Long.).

APPROACH: The Customs Port of Manchester begins at the eastern termination of the Port of Liverpool at an imaginary straight line across the River Mersey from Dungeon Point in Lancashire to the site of the old Ince Ferry (now demolished) in Cheshire, and includes the Mersey above this line and the River Irwell, so far as navigable, the River Weaver to Frodsham Bridge, and also the Manchester Ship Canal from the entrance at Eastham (where it touches the Port of Liverpool) to Hunt's Bank in Manchester. The Canal is about 36 miles in length, and the terminal docks are at Manchester.

The Ship Canal has 30 ft of water from Eastham to Ince Oil Berth (5+ miles) and 28 ft of water from Ince to Manchester Docks.

FACILITIES:

Wharves - Queen Elizabeth II Oil Dock - This dock, especially designed for the handling of bulk petroleum (classes A, B, and C) and liquid chemicals (including those flashing below 23 C), is adjacent to the locks at Eastham and is approached from the Mersey through its own entrance lock, 807 ft long by 100 ft wide. The dock has four berths, each capable of accommodating a large tanker, and is directly connected to oil installations by pipelines. The dock has a depth of 40 ft of water. The dock has a water area of 19 acres in the form of a square. Berth No. 1, 800 ft; Berth No .2, 690 ft; Berth No. 3, 900 ft; and Berth No. 4, 730 ft.

Eastham Locks - The main entrance to the Canal. There are two locks, one 600 by 80 ft and the other 350 by 50 ft.

Other locks at the port include Latchford, Irlam, Barton, and Mode Wheel. There are two locks at each location with dimensions as follows: large locks, 600 by 65 ft; small locks, 350 by 45 ft.

Total length of quays is 28,900 ft (5.5 miles).

Storage - Available, but areas were not reported.

Cranes - Available, but quantities and sizes not reported.

Water - Available.

Tanker terminals - 22 berths; length from 255 to 685 ft; draft from 8 to 36 ft; night berthing possible; water and bunkers available.

Bunkers - All grades of fuel are available by barge and road delivery.

Container and ro/ro - At the Westerly end of No. 9 Dock is a container terminal equipped with two transporter cranes of 25 and 35 tons capacity and a 9.9-acre marshalling yard served by 12 container straddle carriers capable of stacking three high. At the rear of the berth (Vere Street area), two single-floor warehouses have been modified for use as container consolidation and deconsolidation depots, served by a front-end loader capable of handling 35-ton containers and a fleet of trailers. Ro/ro facilities available for serving specially designed ships for the transport of heavy loads of up to 300 tons per unit at Heavy Lift Berth. Containers are also handled by Cawoods Marine

Terminals Ltd. at Ellesmere Port, where there is one 25-ton and one 35-ton gantry crane backed by two rear transtainer cranes of 30-ton capacity; there is also a ramp facility for loading/discharging road vehicles. Containers are also handled at the DuPont Wharf, Acton Grange, where a 30-ton container gantry crane is available.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Three dry docks are available with lengths ranging from 450 to 535 ft and width of 65 ft.

REMARKS: Airport - Manchester (Ringway) Airport, approximately 8 miles.

DENMARK

PORT: Aarhus, Jutland (56°09' N. Lat., 10°13' E. Long.).

APPROACH: Not reported.

FACILITIES:

Wharves - The harbor has a water area of 205 acres, a land area of 302 acres, and other 6-1/2 miles of quays. Depths: Basins 1 and 2, 25 ft; 3 and 4, 33 ft; 5, 30 ft; 6, 7, and 8, 36 ft; 9 and 10, 39 ft.

Storage - Not reported.

Cranes - Two 32/40-ton container cranes, one 40-ton Belotti container crane, one 50-ton heavy-duty crane, one 20-ton floating crane, nineteen 2.5/5-ton luffing jib cranes, three 1-1/4-ton mobile cranes, and nine privately owned cranes.

Water - Available.

Tanker terminals - Six berths; length, no limit; draft, 36 ft; night berthing possible; water, bunkers, and slop tank facilities available.

Bunkers - Coal available. Fuel oil, marine diesel, and medium diesel are also available.

Container and ro/ro - Container terminal at Basin 7 has one combined heavy-duty and container crane of 50 tons, two container cranes of 32 and 40 tons, and container fork trucks up to 40 tons. The terminal covers 30 acres and has 2,820 ft of quays. There are two warehouses each of 54,000 sq ft. The terminal has two ro/ro berths with fixed ramps and one with a movable ramp.

NEW DEVELOPMENTS: An additional basin is being built to the East of the port, with 39 ft depth, and a quay length of approximately 6,600 ft.

SHIP REPAIRS: Two floating dry docks, lifting up to 8,500 tons and 4,000 tons are available.

REMARKS: None.

FINLAND

PORT: Helsinki (Helsingfors) (60°10' N. Lat., 24°57' E. Long.).

APPROACH: The waterway leading from the sea via Helsinki Lighthouse, situated in the Gulf of Finland off the islets and shoals south of the Port of Helsinki at a distance of about 12 miles, may be considered the main approach to Helsinki. The channel is navigable by vessels with a draft up to 31 ft. Pilots are obtained from the pilot station at Harmaja.

The fairway by Porkkala Lighthouse runs along the Eastern coast of the Porkkala peninsula. It is navigable by vessels with a maximum draft of 29 ft. Pilots can be obtained from Porkkala-Ronnskar. The pilotage distance from Porkkala Lighthouse to Helsinki is 30 nautical miles.

FACILITIES:

Wharves - The West Harbor consists of 23 quays with a total length of 11,500 ft and depths alongside the quays ranging from 11 to 33 ft.

South Harbor has a total of 17 quays with total quayage of 6,700 ft and depths alongside ranging from 8 to 30 ft.

Sornainen Harbor consists of 11 quays with total quayage of 6,700 ft and depths alongside the quays range from 18 to 32 ft.

Storage - 725,000 sq ft of warehouse floor area at the West Harbor; 433,000 sq ft at the South Harbor; and 849,000 sq ft at Sornainen Harbor.

Cranes - 40 to 50 small cranes with lifting capacities ranging from 1.5 to 6 tons; one 40-ton container crane; two 25-ton stationary cranes; one 50-ton and one 150-ton stationary cranes.

Water - Available.

Tanker terminals - Herttoniemi and Laajasalo form together the oil harbor of Helsinki, where the leading oil companies have oil tanks and their own piers. Herttoniemi Harbor consists of three oil piers with a total length of 1,100 ft. Laajasalo Oil Harbor has three oil piers totalling 395 ft.

Bunkers - Oil and coal are available in unlimited quantities. All leading international oil bunkering firms represented.

Container and ro/ro - Container crane for 20- to 40-ft containers at Saukko (Uttern) quay. Handling capacity: 30 to 40 containers/hr; maximum lift, 40 tons. Ro/ro facilities at South Harbor, Sompasaari, and West Harbor comprise 15 ferry berths.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: All types of repairs are undertaken. Two dry docks available; floating dock lifting capacity, 12,000 tons; two 150-ton quayside cranes; and one 50-ton floating crane.

REMARKS: Airport - Helsinki-Vantaa, 12 miles north.

NORWAY

PORT: Oslo (59°55' N. Lat., 10°45' E. Long.).

APPROACH: Situated at the head of the 60-mile-long, easily navigable Oslofjord. Well sheltered with depth alongside up to 40 ft for vessels float. Excellent anchorages all over the harbor at depths from 59 to 148 ft. Tides negligible and vessels can enter or leave by day or night without difficulty. Average level at neap tides at quay is 1 ft. Ice-free.

FACILITIES:

Wharves - Total length of 28 quays - 38,680 ft (7.3 miles); depth alongside ranges from 7 to 49 ft.

Storage - Warehouses and sheds total 3.3 million sq ft of floor space. In region of Bekkelaget quay, two five-story car houses and one shed with floor space totalling 4.8 million sq ft.

Cranes - 38 electrical portal cranes (4 to 12 tons); four mobile cranes up to 7 tons; one floating crane of 100 tons; one stationary 200-ton derrick crane; one container crane for 20-, 30-, and 40-ft containers up to 30 tons net.

Water - Available.

Tanker terminals - Eight berths available with night berthing possible at all berths; bunkers and slop tank facilities are also available. Berth lengths are about 600 ft long with drafts up to 40 ft.

Bunkers - All the major oil companies have installations in the Oslofjord, 7 to 13 miles S. of the city, which can be called at en route without deviation. Draft alongside installations approximately 40 ft. Supplies are also arranged by lighterage in the port.

Container and ro/ro - At Kneppeskjaer Pier, Soreng Pier, Brandskjaer Pier, Pier No. II, Sjursoy Quay, and Fillpstad Quay containers are handled increasingly. There is one container crane at Sjursoy Quay capable of handling 20-, 30-, and 40-ft containers up to 30 tons net. Ro/ro facilities at Hjortnes Quay, Brandskjaer Pier, Pier No. II, Pale Quay, Gronli Quay, Sjursoy N., Kneppseskjaer Pier, and N. and S. Bekkelags Quay.

NEW DEVELOPMENTS: Revierhavna: New port area under construction. Total terminal area when completed, 732,000 sq ft. Quay length, 575 ft with ro/ro facilities and lift-on/lift-off container crane.

Kongshavn: Area reclaimed so far, 969,000 sq ft. Further reclamation (through filling into the sea) postponed. New ro/ro terminal planned located north of N. Kongshavnkai.

Kneppeskjaerutstikkeren: Total area filled in, 646,000 sq ft. New shed, 38,000 sq ft, planned constructed here. Complete ro/ro arrangement with 495-ft quay (north) and ro/ro arrangement with 130 ft (south).

Sondre Bekkelagskai: Quay of 1,035 ft length with ro/ro arrangement in both ends of quay (north and south). New shed No. 92,

area, 27,000 sq ft. Total open area, 388,000 sq ft.

Ormsundkaia: Planned ro/ro terminal with quay length of 920 ft. Future land area planned, approximately 430,000 sq ft.

SHIP REPAIRS:: One shipbuilding yard with three floating docks from 345- to 650-ft length, 24- to 26-ft depths on keel blocks, and lifting capacities up to 19,000 tons. One gracing dock 565 ft long, with 23-ft depth. All kinds of hull and machinery repairs are carried out.

REMARKS: Airport - Fornebu, about 20 minutes from city Air Terminal; Gardemoen airport, about one hour from Terminal.

PORTUGAL

PORT: Leixoes (41°09' N. Lat., 8°41' W. Long.).

APPROACH: Vessels drawing up to 30 ft can usually enter at any time. Depth at entrance, approximately 35 ft.

FACILITIES:

Wharves - This harbor is a complement to Port of Oporto, 3 miles north of the mouth of the Douro River, and in direct communication by tramcar, road, and rail with Oporto. Harbor is protected by a breakwater about one-half mile long. Loading and discharging can be done along 656 ft of the South Mole where vessels berth at low tide drawing up to 20 ft. Dock No. 1: entrance, 26 ft; inside, 30 ft L.W.; width, 574 ft; length, 1,640 ft; W. of E., 164 ft. Total water area, including Dock No. 1, 3,000 sq ft. Dock No. 2 opens off Dock No. 1. Harbor and dock railways, connected with national railway system.

Storage - Not reported.

Cranes - One 94-ton, one 15-ton, twenty-six 5-ton, and eight 3-ton electric cranes.

Water - Available.

Tanker terminals - Three berths available: lengths range from 395 to 1,600 ft; drafts range from 20 to 54 ft.

Bunkers - Bunker coal and fuel oil can be supplied alongside the quay or by lighters.

Container and ro/ro - One gantry crane with lifting capacity of 31 tons, one side loader for handling containers.

NEW DEVELOPMENTS: Dock No. 4, for bulk carrier vessels, and a terminal for containers with two gantry cranes are under construction.

SHIP REPAIRS: Repairs may be carried out on vessels afloat. Slipway 80 ft long, for vessels up to 300 tons.

REMARKS: Airport - Pedras Rubras, 3 miles, with daily air service to Lisbon.

SWEDEN

PORT: Helsingborg (56°03' N. Lat., 12°42' E. Long.).

APPROACH: Strong current outside harbors; difficult to enter port in N.W. gale.

FACILITIES:

Wharves - North Harbor: N. entrance is 262 ft wide and 33 ft deep; S. entrance is 295 ft wide and 33 ft deep. Outer basin (Ocean Harbor) is about 30 ft deep; Central basin (Ferry Harbor) is 23 ft deep; N. basin is 2,130 ft long and 20 ft deep; S. basin is 1,215 ft long and 23 ft deep. Two dry docks are available. South Harbor: This harbor actually consists of three harbors--the tanker terminal (described below); bulk and general cargo terminal; and the container terminal (described below).

Storage - Ample covered and open storage are available.

Cranes - Cranes from 3 to 10 tons capacity available for bulk and general cargo; one 45-ton-capacity crane. Cranes are available at container terminal.

Water - Fresh water available.

Tanker terminals - Three berths for vessels up to 65,000 d.w.t.; length of 722 ft; draft of 34 ft at two berths and 26 ft at one berth; night berthing at all berths; water and bunker facilities available at two berths.

Bunkers - Coal is available. Fuel oil, gas oil, diesel, and medium diesel are available from installations at entrance to South Harbor. Berths: 1,000 ft with 36 ft alongside.

Container and ro/ro - The container terminal is 1.6 million sq ft in size and is fully equipped for container handling. Depth of water, 30 ft; length of quays, 1,890 ft; one 35-ton container crane and two 30-ton cranes used for containers and break-bulk cargo are available. Two ro/ro berths and an additional eight ro/ro berths are available in the North Harbor.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Two dry docks are available to repair vessels of up to 5,550 d.w.t.

REMARKS: Airport - Sturup, 44 miles; Helsingborg/Angelholm, 19 miles; Kastrup, 37 miles.

POLAND

PORT: Gdynia (54°32' N. Lat., 18°34' E. Long.).

APPROACH: Depth at entrance is 46 ft. Maximum draft of vessels, up to 37 ft.

FACILITIES:

Wharves - Artificial port protected by concrete breakwaters totalling 1.6 miles. Total quayage is over 6 miles.

Storage - Over 3.2 million sq ft of storage space is available.

Cranes - Port is equipped with twenty-six 100-ton floating cranes.

Water - Water supplied from hydrants on quays.

Tanker terminals - Available.

Bunkers - All grades of oil, lubricants, and gas are available.

Container and ro/ro - Container terminal of 245,000 sq ft equipped with a multipurpose 40-ton crane, a mobile crane, two sideloaders, tractors, and bogies. Terminal is being enlarged with the development of 301,000-sq-ft area which will be equipped with a 40-ton crane, three sideloaders, and ancillary equipment.

NEW DEVELOPMENTS: Further extension of handling-storage container terminal on Polish Quay. Modernization of Wenda Pier will provide handling of large cargo. Construction of a new container terminal on Helskie Quay is in progress, with container park and reception area. On Indian Quay, a terminal is to be built for handling grain and feedstuffs. Further equipping of the quays with modern cranes and short-range transport units.

SHIP REPAIRS: Shipbuilding and repair yard handle all types of deck and engine repairs. Three floating docks of 1,200 tons, 3,500 tons, and 4,500 tons lifting capacity; one slipway of 150 tons lifting capacity. One 8,000-ton floating dock planned.

REMARKS: Airport - Gdansk, 12 miles (Gdansk-Rebiechowo); 186 miles from Warsaw.

FRANCE

PORT: Rouen (49°26' N. Lat., 1°15' E. Long.) on the Seine River, 75 miles from Paris.

APPROACH: Rouen is accessible to any ship up to 30,000 tons fully loaded. Suspension bridge over Seine at Tancarville has clearance over water under main span of 197 ft. The Seine can be navigated by vessels of 27- to 34-ft draft upriver depending on tides; that is, 27 ft during 95 percent, 31 ft during 50 percent, and 34 ft during 5 percent of the tides. Draft is limited to 30 ft for speedy ships downriver, although a special technique allows them to proceed downriver with 30- to 32-ft draft. It is now possible for vessels to go downriver on two tides, anchoring en route, and after a few hours to resume their journey. This technique is possible for ships equipped with radar, usable on the river and whose speed is over 12 knots. Ships' length limited to 785 ft. Ships take 6 hours to move up the channel from the sea to Rouen.

FACILITIES:

Wharves - About 18 quays, ranging in length from 330 to 8,600 ft, are available for cargo handling. Total quays length is approximately 8 miles.

Storage - Shed capacity is about 1.8 million sq ft.

Cranes - Forty 6-ton, forty-two 8-ton, five 25-ton, two 35-ton.

Water - Available.

Tanker terminals - There is one petroleum basin at Petit-Couronne with accommodation for two tankers of the T-2 class simultaneously and for inland craft. At Port Jerome, berths are provided in the river for petroelum products for seagoing ships and inland crafts.

Bunkers - Fuel, diesel, and gas oil are available by barge.

Container and ro/ro - Two forklift trucks are available for the manipulation of heavy packages and for containerized traffic. Assistance rendered by the "Turney" floating cranes, capacity 30 tons, speed 10 mph (two engines), and very easily maneuverable. The "Turney" is capable of carrying 10 TEU containers at the same time. Containers then unloaded either on to quay or side loader and thence to the railway. There are four berths for ro/ro traffic, including one at Petit-Couronne, for stern or side loaders; one on the left bank, at Moulineaux, for cars and trucks with loaded trailers, rolling on or out through the forepeak of ferry boats; and on the right-hand side at St. Gervais Docks, for citrus fruits from Morocco, general cargo from Senegal, and timber packages from Scandinavia. Rouen-Quevilly container berth is equipped with two 25-ton special container cranes and two 35-ton portal cranes; handling capacity, 50,000 TEU's per year.

NEW DEVELOPMENTS: Container terminal at Rouen-Quevilly Basin; two berths, each 656 ft long; four 0.375-ton linkable cranes, two 25-ton cranes, and two 35-ton gantry cranes.

SHIP REPAIRS: Two floating docks of 14,000 and 8,000 tons. Thirteen repair posts.

REMARKS: Airport - N.I.A.: Orly (Paris), 81 miles. Rouen Airport for traffic to Gatwick.

NETHERLANDS

PORT: Amsterdam (52°22' N. Lat., 4°53' E. Long.) at conjunction of North Sea Canal and Amsterdam-Rhine Canal.

APPROACH: Entrance to North Sea Canal at Ymuiden by one of the three locks (largest: 1,312 ft long, 164 ft wide, and 49 ft deep on sill). The North Sea Canal is 1,312 ft wide and 49 ft deep. The distance from the locks to the West harbor is 9 miles; to the Eastern harbor section, 14 miles. The canal is lighted at night and navigable in all circumstances. No tides or currents in canal or docks. At present fully loaded ships of about 85,000 d.w.t. can reach the port. Amsterdam is accessible for fully loaded vessels with 43-ft draft under all conditions and about 45 ft at high water at Ymuiden.

From Amsterdam to the River Rhine runs the Amsterdam-Rhine Canal, which is 45 miles long, 246 ft wide at water level, and 14 ft deep; lighted at night. There are three big locks of which one is almost always open. Work is in progress to make the canal 328 ft wide at bottom and 18 to 20 ft deep. Maximum draft of vessels admitted to the canal is 10 ft with a breadth of 43 ft.

FACILITIES:

Wharves - Total quayage in the port area for inland craft, 19,650 ft; and in town about 16,400 ft. All quays are provided with railway connections. There are 35 buoys for seagoing vessels, offering berths for 24 vessels. Depths alongside quays range from 21 to 49 ft.

Storage - Total space for general cargo, 3.9 million sq ft. Sheds for bulk cargo, 279,000 sq ft. Sheds for timber storage, 2 million sq ft; and a timber warehouse of 161,000 sq ft. Warehouses for general cargo in the port district, 1.5 million sq ft.

Cranes - All quays equipped with cranes; 111 for handling general cargo; 10 for bulk goods; 8 table cranes and 7 bridge-transporters; 8 floating cranes; and 3 container cranes. Lifting capacity varies from 1 to 50 tons; bridge-transporters from 7 to 50 tons and container cranes 50 tons each. Also 12 floating sheerlegs with lifting capacity varying from 10 to 300 tons. One mobile container crane of 36 tons, two container railway cranes of 35 tons, and four overhead travelling cranes.

Water - Water is available from barges.

Tanker terminals - Eleven docks are available. Docks can accommodate tankers from 300 to 980 ft long.

Bunkers - Fuel, diesel, and gas oil at wharf or by barge is available.

Container and ro/ro - Container Terminal Amsterdam consists of a fenced-in area of 3.2 million sq ft for container marshalling yard and traffic purposes. Present quayage extends 3,570 ft with a depth of 34 ft and 41 ft alongside. A groupage shed of 32,300 sq ft has 46 doors, so that a great number of containers can be handled simultaneously. Also, two multipurpose sheds of 86,100 sq ft each; three 50-ton gantry container cranes for loading and discharging container and unit load vessels. One multipurpose crane of 30 tons lifting capacity. Two 30-ton general cargo cranes and seven 5-ton cranes

available. Two 35-ton rail-mounted transtainers with 92-ft span. A fleet of trucks and semi-trailers available for transport of containers and other heavy units on terminal site. Rail connections. The Coen Terminal (ro/ro operations) located in Coenhaven is equipped with ramp 84 ft wide and has two more berths for ro/ro vessels. Depth, 33 ft. A mobile container crane (35 tons capacity), side loaders (20 tons), tug masters, slave trailers, flats, containers, and forklift trucks available. The Skandia terminal is located in Suezhaven and equipped with a ramp 85 ft wide; quay length, 1,310 ft; shed space, 24,700 sq ft; with a passenger hall and marshalling area of 301,000 sq ft.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Four graving docks are available to accommodate vessels with a capacity ranging from 10,000 to 72,000 d.w.t. There are electric cranes up to 50 tons along the docks and floating cranes of up to 150 tons. The yard is equipped for hull and engine repairs of all kinds. The North Yard consists of four floating dry docks. The docks can accommodate vessels ranging from 28,000 to 40,000 d.w.t. Electric cranes (75 tons) and floating cranes (75 tons) are available. Other facilities are available for various ship repairs.

REMARKS: Airport - Schiphol, approximately 8 miles from center of Amsterdam.

APPENDIX D: CHARACTERISTICS OF OCONUS MEDITERRANEAN/EUROPEAN PORTS

1. The following is a list of leading Mediterranean/European container ports ranked according to the throughput of TEU's followed by compendiums of port characteristics.

Port	Page
Leghorn	D2
Genoa	D4
Algeciras	D6
Marseilles	D7
Barcelona	D9
Piraeus	D10
La Spezia	D11
Naples	D12
Valencia	D14
Trieste	D15
Venice	D16
Palermo	D18
Palma De Mallorca	D19
Koper	D20
Limassol	D21
Sete	D22
Cadiz	D23
Rijeka	D25

ITALY

PORT: Leghorn (Livorno) (43°33' N. Lat., 10°18' E. Long.).

APPROACH: North entrance for small craft only. South entrance, first part between the southern extremity of the Diga Curvilinea and the western extremity of the Diga della Vegliaia, depth, 33 ft; second part between extremity of the Diga Curvilinea and the lighthouse rock, depth, from 33 to 33.5 ft. Entrance of the Porto Mediceo, depth not uniform. Dredging to 30 ft in progress. Depth of the outer harbor from 19 to 33 ft.

FACILITIES:

Wharves - Total length of quays for loading and unloading in the Proto Mediceo, Cappellini Basin, and Firenze Basin, 9,396 ft, length of railway lines, 5,889 ft. In the inner port the quays have a total length of 5,364 ft; equipped with railway lines. Depth alongside quays, from 23 to 30 ft normally, but dredging in progress. Porto Mediceo: Postal steamers and regular lines for loading and unloading general merchandise and passenger steamers; warships, ships being fitted out; yachts, trawlers, sailing vessels, and tugs. Cappellini Basin: Steamers with cargos of cereals, coal, and phosphates; general merchandise. Firenze Basin: Steamers which load marble, general cargo, and goods in bulk. Darsena Petroli: tankers. Alto Fondale Quay is situated in the S. part of Bacino S. Stefano and is approximately 1,968 ft long and fitted with eight cranes with lifting capacity of 3 tons each. Two rail lines in this quay, depth, 31 ft. New Port: tankers and ships with cargos for the industrial concerns. Elevators, two 6-ton and four 5-ton. Pneumatic grain silo, 180 tons/hr. Dry Dock: length of sill, 461 ft; length to sea, 505 ft; depth at entrance, 19 ft; width of sill, 50 ft; width at sea, 72 ft. Grain wharves: Stabilimento dei Silos for discharging, warehousing, and eventual treatment of cereals, seeds, vegetables, and affinities. Capacity, 12,000 tons; 546,000 cu ft. Grain silo. Ample cold storage facilities at Industrial Dock.

Storage - Not reported.

Cranes - One 30-ton, five 12-ton, nine 9-ton, seven 6-ton.

Water - Available.

Tanker terminals - Three oil berths operated by Gulf Italiana and Esso Italiana. Lengths: 590 and 788 ft; drafts, 30 and 37 ft.

Bunkers - Coal at Cappellini Basin. Bunker fuel oil available.

Container and ro/ro - A container terminal of 1.2 million sq ft available. Two Paceco gantry cranes available.

NEW DEVELOPMENTS: The Darsena Toscana is now underway: 9,842 ft of new berths are planned in areas already connected by rail and road. The industrial port area still has 222 acres for development, which is in the planning stage. 984 ft of new quayage is now operative.

SHIP REPAIRS: Two dry docks available; length 1,148 ft; width, 184 ft (to be equipped with two cranes of 20 and 75 tons; and length, 450 ft; width, 57 ft.

REMARKS: Airport - San Giusto Airport, distance, 11 miles.

ITALY

PORT: Genoa (44°24' N. Lat., 8°54' E. Long.).

APPROACH: Not reported.

FACILITIES:

Wharves - Depths: outer port from 53 to 66 ft; Porto Vecchio, 26 ft; Maritime station (passenger terminal), Ponte Andrea Doria, 36 ft; Ponte dei Mille, 29 ft; Sampiedarena New Docks, 36 ft; Italsider berth, 42 ft.

Breakwater: Defense breakwaters, 32,746 ft long; Undersurge jetties, 4,810 ft long; Molo Cagni, 2,047 ft long.

Docking facilities: Within the port area there are 21 piers, separated by docks, covering a perimeter of 87,177 ft and an area of 6 acres. Up to 200 ships can be berthed, of which about 100 can simultaneously carry out unloading and loading operations. Passenger vessels are moored at the Ponte dei Mille, which has four berths, all equipped with modern passenger facilities.

Storage - Open yard spaces total 3.5 million sq ft; warehouses of 4.1 million sq ft. The Port Authority owns 29 warehouses with a total floor area of 1.6 million sq ft; the others belong to private concerns. Other facilities include a cotton warehouse, a cold storage warehouse, etc. Two grain silos with capacities of 65,000 and 45,000 tons, each with an intake of 500 to 550 tons/hr.

Cranes - 752 cranes, self-moving and forklift trucks from 1 to 45 tons capacity. There are 38 floating cranes up to 200 tons capacity.

Water - Available.

Tanker terminals - The Multedo Terminal has four piers and eight berths with depths up to 46 ft. Depth at entrance channel, 49 ft. Pipelines for crude oil to inland refineries. Shore tanks receive ballast from tankers up to 15,000 tons. One mile south of Multedo Port entrance is the Single Point Mooring, a platform connected with shore installations by a 3,999-ft sea line, capacity, 424,000 to 495,000 cu ft/hr. Depth sufficient for tankers up to 500,000 d.w.t.

Bunkers - Fuel oil, diesel, lubricants, and fuel oil, all grades, are available from various companies.

Container and ro/ro - Ponte Libia container terminal has a quay of 1,099 ft, with a depth of 34 ft; two 40-ton bridge cranes and six 30-ton straddle carriers; 503,000-sq-ft open yards. Ponte Ronco terminal has a quay of 1,161 ft, with a depth of 39 ft; two 40-ton bridge cranes and three straddle carriers. A third container terminal is under construction at Calata Bettolo. Berth, 1,640 ft in length, equipped with three cranes for 20-ft and 40-ft containers; 1.4-million-sq-ft area for handling and stockpiling of containers. Rail connections. Ro/ro facilities have been made available at Ponte Colombo and at Ponte A. Doria, connecting Genoa with Sardinia, Sicily, Spain, and North African ports.

NEW DEVELOPMENTS: New port at Voltri, 5 miles west of Genoa harbor, under construction. A large pier is being built which will take general

cargo as well as containers and ro/ro ships. A breakwater will protect the complex. At present some of the reclaimed land is being used for the storage of empty containers. The 300,000-ton dry dock is completed and is operational.

SHIP REPAIRS: Eighty workshops and six dry docks available for ship repair and many companies are in the area for major ship repair.

REMARKS: Airport - The Cristoforno Colombo International Airport, built on an artificially created peninsula, 6 miles from the center of town, has an area of 321 acres.

SPAIN

PORT: Algeciras (36°07' N. Lat., 5°26' W. Long.).

APPROACH: Not reported.

FACILITIES:

Wharves - Depth of water at sea entrance at extreme end of quay, 35 ft; on sides North and South, 32 ft. Depth on bar, from 33 to 82 ft. Anchorage in 30 to 90 ft, sheltered by breakwater 4,219 ft in length. Railway quay, 951 ft long. Muelle Galera, maximum draft, 26 ft. Dique Norte, maximum draft, 30 ft.

Storage - Not reported.

Cranes - Three 6-ton and two 25-ton cranes available. No floating crane. Vessels can use own winches.

Water - Can be supplied in bay or alongside.

Tanker terminals - Two berths of 377 ft, one of 984 ft, one of 1,247 ft, and one of 2,297 ft. Maximum draft 66 ft.

Bunkers - Fuel oil station of bunkering; maximum depth, 31 ft; gas-oil station for fishing vessels. No coal bunkers.

Container and ro/ro - Four berths for ro/ro services. Container facilities available.

Ore and bulk cargo - Berth available for vessels up to 31-ft draft, discharging bulk grain, cement, etc.; maximum draft, 66 ft.

NEW DEVELOPMENTS: One 30-ton crane planned. Buoy for vessels up to 500,000 d.w.t. discharging crude oil. New wharves and extensions to existing wharves planned.

Container terminal with 1,634 ft of berths, for services to the Americas and the Mediterranean.

SHIP REPAIRS: Available. Underwater hull cleaning available.

REMARKS: Airport - Malaga, 68 miles.

FRANCE

PORT: Marseilles (43°19' N. Lat., 5°22' E. Long.).

APPROACH: Size of the largest ships able to enter the harbor areas of the Marseilles Port Authority and the private tanker ports: range of ship length, 560 to 900 ft; range of draft, 20 to 60 ft.

FACILITIES:

Wharves - Deep natural entrance; nontidal. The extensive harbor is divided into basins for commercial traffic: Bassin de la Grande Joliette, Bassin d'Arenc, Bassin National, Bassin de la Pinede, Bassin du President Wilson, Bassin Leon Gourret, Bassin Mirabeau. The approximate depth of water is 66 ft at the North pass and 36 ft at the South pass. Berths: 93 general cargo berths, including 29 for ro/ro vessels, and 13 specialized wharves (bulk cargos), 29 for ship repairs, and 20 secondary berths for ships waiting to load/discharge; total length of berths, 57,660 ft; depths range from 20 to 49 ft.

Storage - Covered storage, 4.4 million sq ft; open storage, 5.8 million sq ft; refrigerated storage, 671,000 cu ft.

Cranes - Quayside cranes: 42 from 3 to 6 tons capacity, 84 from 6 to 12 tons capacity, of which 7 are mobile; there are also 12 cranes from 12 to 15 tons capacity, of which 6 are mobile; 5 cranes over 15-ton capacity, of which 2 are mobile; largest which is mobile can lift 35 tons. Dry dock cranes: 15, the largest with a lifting capacity of 148 tons. Floating cranes: three owned by the Authority of 89, 148, and 590 tons capacity; three privately owned, the largest having 69 tons capacity. Also owned by the Authority: 22 forklift trucks; 6 motorized ramps and conveyors; 16,000 pallets. Other privately owned equipment: 19 heavy and light trucks and tractors; 96 mobile cranes; 482 forklift trucks; 47 quay tractors; 182 towed trailers and trolleys. Quayside equipment: 122 motorized ramps and conveyors; 49,500 pallets for use with forklift trucks; 4,000 tarpaulins.

Water - Fresh water available by four motor barges.

Tanker terminals - Available at: Saumaty Dock, with two berths; lengths, 164 ft and 262 ft; depth, 16 ft; suitable for barges; pipelines to Mourepiane Oil Depot. North Fore Port with one berth, depth, 34 ft; degassing station and for treatment of water contaminated by oil; able to accept tankers up to 200,000 d.w.t. and L.N.G. carriers.

Bunkers - Fuel, diesel, and gas oil by barge, and from Shell Francaise, at two berths on Mole G. All grades from Esso Standard S.A. Francaise by barges. Fuel, diesel, and gas oil from Mobil Oil Francaise.

Container and ro/ro - 23 ro/ro berths and three floating pontoons for use at berths not specifically designed for ro/ro traffic. Drafts, from 22 to 39 ft. Container storage of 431,000 sq ft.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Ten dry docks available (including one for ships of 800,000 tons and one for ships of 200,000 tons), 29 berths, one large dry floating dock of 11,000 tons lifting capacity, and 14,380 ft of wet

repair berths. These docks and a deballasting station are owned by the Port Authority. There are three private ship repairing firms capable of handling all types of hull and machinery repairs. Salvage tugs, diving boats, and floating shears and cranes available.

REMARKS: Airport - Marignane, 20 minutes by road.

SPAIN

PORT: Barcelona (41°20' N. Lat., 2°10' E. Long.).

APPROACH: The harbor is formed by breakwaters, and is safe in all weather, accommodating all but the largest vessels. A breakwater on the east side of the port affords very good shelter from S.E. gales. Pilotage is obligatory for entering and leaving the harbor. Depth at entrance, 53 ft; at quays, 26 to 46 ft. There is no tide, but water level up to 2 ft according to set of currents. Most of the quays have railway lines.

FACILITIES:

Wharves - Not reported.

Storage - See "Container and ro/ro."

Cranes - 123 electric cranes, one 15-ton and two 80-ton floating cranes; forklifts, mobile cranes, and trucks.

Water - Available.

Tanker terminals - Seven berths; lengths, from 426 to 751 ft; draft, from 26 to 44 ft; night berthing; water and bunkers at all berths.

Bunkers - Ships requiring fuel oil are supplied by fueling tender.

Container and ro/ro - Container terminal equipped with two 50-ton container cranes, six straddle carriers, and six forklifts. 40,000-sq-ft warehouse; 727,000-sq-ft marshalling area. Two quays: 791 ft long, draft, 46 ft; and 427 ft long, draft, 26 to 46 ft. One ro/ro berth used by the Canguto ferry service, to Genoa, and several ro/ro berths for passenger and cargo services to the Balearic Islands.

Ore and bulk cargo - There are storage tanks for bulk liquids and chemical products (capacity, 1.5 million cu ft), edible oils (capacity, 0.7 million cu ft), and asphalt and bitumen products (capacity, 0.3 million cu ft). There is also a natural gas cracking plant (capacity, 7.1 million cu ft). Refrigeration store of 15,000 tons capacity. Grain silo of 65,000 tons capacity. Facilities for handling potash in bulk. Cement silo of 8,800 tons capacity. Terminal for the handling of bulk sulphuric acid.

NEW DEVELOPMENTS: An additional 646,000 sq ft planned for container marshalling area, plus a 108,000-sq-ft shed for cargo storage. A further 269,000-sq-ft area planned for ro/ro traffic. Dry dock under construction for vessels up to 50,000 d.w.t.

SHIP REPAIRS: There is one floating dock of 6,000 tons lifting capacity belonging to the port authority. Workshops for light repairs are available.

REMARKS: Airport - Aeropuerto del Prat (Muntadas), 9 miles S.

GREECE

PORT: Piraeus (37°57' N. Lat., 23°36' E. Long.), the port of Athens.

APPROACH: Central Port protected by two breakwaters at entrance; orientation from N.E. to S.W.; total water surface of about 11.8 million sq ft. Depths of water vary from 20 to 41 ft alongside the quays and up to 89 ft deep in the middle of the port.

FACILITIES:

Wharves - The Port of Piraeus with its annexes comprises quays of about 60,000 ft in length, of which 30,000 ft are commercial quays, 10,300 ft passenger quays, 13,500 ft for ship repair work, and the rest auxiliary quays.

Storage - There are warehouses and harbor sheds of 2.3 million sq ft total area. Nearby there is privately owned refrigerated storage.

Cranes - One electric bridge crane, 10 tons capacity with an hourly output of 100 to 160 tons for discharging coal and ores (Hercules Port); two for raw materials (Foron Bay) with an hourly output of 80 tons. Four diesel electric floating cranes of over 15 tons capacity; two of which have a capacity of 100 tons; 130 electrical diesel mobile cranes, lifting capacity 2 to 40 tons each. Large number of forklift trucks, trailers, tractors, weighbridges, lighters, tugboats, etc.

Water - Water can be supplied to ships at any hour of the day or night, either by pumping from water barges or by piping from hydrants.

Tanker terminals - Seven oil berths operated by Elbyn Company Ltd., Fina, Mobil Oil, Petroless, Shell, and Texaco. Lengths: 500 ft to no limit; drafts, 25 to 31 ft. Night berthing at all berths. Water and bunkering at some berths.

Bunkers - All kinds of oil bunkers available; also coal.

Container and ro/ro - Nine straddle carriers and a 41-ton-capacity gantry crane at Container Terminal.

NEW DEVELOPMENTS: Construction of Pier 1 of Hercules Port and the petroleum products pier; erection of sheds, warehouses, etc.; installation of second gantry crane, 100 stacking vehicles, nine tugboats, etc.; two more floating docks planned.

SHIP REPAIRS: Major ship repair facilities are available; these include graving docks, floating docks, and equipment available for ships up to 75,000 to 200,000 d.w.t. can be repaired.

REMARKS: Airport - At Hellinikon, 7 miles.

ITALY

PORT: La Spezia (44°04' N. Lat., 9°51' E. Long.), Naval Station.

APPROACH: Not reported.

FACILITIES:

Wharves - Total length of nine berths, 4,400 ft, with lengths ranging from 260 to 680 ft. Average draft is 28 ft with a range of 18 to 33 ft.

Storage - Not reported.

Cranes - Total electric cranes available: two 2-ton; two 4-ton; thirteen 6-ton; two 12-ton; and one 30-ton.

Water - Available.

Tanker terminals - Shell Jetty; a dolphin jetty where two supertankers of 39-ft maximum draft can moor alongside. A second berth available for smaller tankers which moor stern onto quay. Fresh water available ex-quays. Buoy Field where tankers with a maximum draft of 40 ft can moor and discharge ex-sea line; fresh water available ex-sea line. Enel Berth, 820 ft long, where both coal vessels and tankers can moor alongside with a maximum draft of 34 ft on La Spezia side and 39 ft on the Lerieri side. Coal discharged at an average rate of 7,000 tons in 18 hours; fuel oil discharged at an average rate of 1,000 tons/hr.

Bunkers - Oil bunkers from Shell refinery by pipeline; small quantities by barge. Coal bunkers also available.

Container and ro/ro - In the east side of the port (from the Rafratory Verzocchi area), there is a 328-ft berth where three vessels with maximum drafts of 25 ft can be accommodated. A bridge crane is available with a maximum capacity of 25 tons for moving 20-ft containers. An open storage area of 409,000 sq ft is available, of which 86,000 sq ft is covered. This area and the terminal are directly connected with the main railways and highways to Brennero.

NEW DEVELOPMENTS: 1,181-ft-long quay, with a 1,673-ft-long pier, has been built; depth, 34 to 40 ft.

SHIP REPAIRS: Six dry docks, 341 to 656 ft long; one floating dock, lifting capacity 40,000 tons, for vessels up to 807 ft long, 128 ft wide, with up to 100,000 d.w.t.

REMARKS: Airports - Malpensa (Milan), 250 miles; Ciampino (Rome), 250 miles; Pisa, 60 miles; Genoa, 60 miles.

ITALY

PORT: Naples (40°50' N. Lat., 14°16' E. Long.).

APPROACH: Perfect shelter afforded by St. Vincent pier on the west and the two breakwaters, Duca degli Abruzzi and Foranea. These breakwaters afford two entrances, E. and W., the latter the most commonly used. St. Vincent pier (length, 4,839 ft), fitted with lighthouse visible for 20 miles. All sea entrances and pier heads indicated by fixed lights.

FACILITIES:

Wharves - The port is divided into three zones, the first for passenger traffic, the second for cargo and passengers, and the third, on the extreme easterly end, is the container and oil section.

Berths: There are about 7 miles of piers and 80 mooring berths, of which about 70 percent are suitable for use by large vessels. Berths of any length and width; drafts range from 24 to 34 ft. Quay of liners at the Molo Angioino, 32 ft alongside and 226 ft width. 129,000 sq ft total surface area with six anchorage berths for high tonnage ships alongside both its piers and four berths for medium tonnage ships sternwise at its seaward head. Equipped with vast passenger facilities. Between station building and ships by main gangways at quay level are 12 mobile electrically operated foot bridges mounted above and over the cantilever canopies. Twelve passenger and freight lifting units installed. Linked with port network by six tracks running along quays. A heliport lies on Angioino Apron. Bonded dock at Flavio Gioia landing stage with a surface area of 269,000 sq ft with five anchorage berths for ships of medium tonnage. Its East dock is 814 ft in length. West dock is 814 ft and the head dock is 335 ft long.

Oil port: at the Pontile Vigliena in the industrial area. four large tankers can be berthed at the same time. Depths alongside, from 36 to approximately 40 ft. Two berths at Calata Pollena and at Pontile Bausan. The Vigliena installation can discharge a tanker of 25,000 tons in less than 30 hours. No. 3 Berth is at Progresso Wharf. Available for vessels carrying chemical products and L.P.G. at No. 1 Berth, Pier Progresso is in operation for tankers up to 50,000 gross tons; depth, over 40 ft. Extensive oil pipeline system connecting with refinery plants outside port area.

Storage - Three warehouses with total holding capacity of 883,000 cu ft, one silo of 42,000 tons.

Cranes - Four 6-ton coal elevators (400 tons/hr), electric cranes, twenty-eight 3-ton, two 4.5-ton, six 5-ton, thirteen 6-ton, one 7.5-ton, five 10-ton, one 13.5-ton, one 25-ton, and one 40-ton crane. Two 6-ton and two 4.5-ton cranes operate with grab. Self-propelled cranes, two 5-ton, two 8-ton, two 10-ton, and one 18-ton. One 100-ton and one 60-ton floating cranes.

Water - Available.

Tanker terminals - Available. See "Wharves."

Bunkers - All grades obtainable from Shell Italiana at Molo Vigliena, and from Esso Standard Italiana at Pontile Vigliena. Berths: 660 ft

with 30 ft alongside. Delivery: up to 450 tons/hr. Fuel, diesel, and gas oil available at various terminals or by barge.

Container and ro/ro - 40-ton crane for containers available at Pier No. 46. Piers 51/52 equipped with two 40-ton portal cranes, and can accommodate container vessels up to 12,000 g.r.t. Piers 54/55 will soon be able to accommodate container vessels up to 49-ft draft. There are 635,000 sq ft of space for stripping, stuffing, and handling containers. Piers 5, 12, and 18 can handle ro/ro vessels.

NEW DEVELOPMENTS: A development plan now in progress prepared by Port of Naples Authority and Maritime Works Civic Board. This includes a modernization and enlargement of quays, basins, and wharves, the prolongation of dikes and deepening. A new ship station to be built. Enlargement of port facilities planned. The purchase of 30 new cranes from 1.5 to 3.0 to a floating crane of 200 tons, and new goods elevators and conveyor belts are planned. Also a large workshop planned for maintenance of mechanical equipment.

An isle for anchorage of high tonnage tankers to be installed. The Port Authority plans to purchase approximately 25 acres next to the port area to be reserved for traffic of goods, especially containers. Purchase by Port Authority of a further 618 acres area connected with main roads and railways is designed for stores, depots, and equipment for container handling.

SHIP REPAIRS: There are three dry docks, a floating dock for vessels up to 65,000 d.w.t., 8 pontoons (capacity up to 150 tons), and 7 pontoons belonging to Navy available for commercial operations.

REMARKS: Airport - Capodichino Airport, 5 miles from center of Naples.

SPAIN

PORT: Valencia (39°27' N. Lat., 0°19' W. Long.).

APPROACH: Depth at entrance, 49 ft.

FACILITIES:

Wharves - Depth at quays, 23 to 46 ft. Length of quays: Inner Basin, 5,647 ft; Outer Basin, 3,127 ft; Levante Quay, 1,161 ft; Outer Tranversal Quays, 1,137ft. Pontiente Quay: Turia Pier, 2,682 ft; Turia Quay, 876 ft; Fishing Quay, 1,121 ft; South Quay, 1,969 ft. Main line railway connections. Good and ample yacht anchorage at buoys in Yacht Club water.

Storage - Open sheds, 290,000 sq ft. Closed sheds, 267,000 sq ft. Refrigerated storage space available.

Cranes - 30 electric cranes of 3 tons, 17 of 6 tons, 8 of 12 tons, 1 mobile crane of 7 tons, 6 mobile cranes of 6 to 9 tons, and 1 floating crane of 80 tons. A number of forklift trucks available on a hire basis from private firms and port works authority.

Water - Available.

Tanker terminals - Three berths, length, from 546 to 1,318 ft; depth, from 30 to 36 ft; night berthing is possible; water and bunkers available.

Bunkers - Fuel and gas oil by pipeline and trucks are available.

Container and ro/ro - Container terminal is available at the port.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Companies and equipment are available.

REMARKS: Airport - N.I.A., about 9 miles from Port.

ITALY

PORT: Trieste (45°39' N. Lat., 13°48' E. Long.).

APPROACH: Not reported.

FACILITIES:

Wharves - The harbor is divided into three large areas: the Commercial Port, the Industrial Port, and the Oil Harbor. Total surface of the Commercial Port is 15.3 million sq ft. There are 8 miles of berthing space. There are several facilities at the Industrial Port which are equipped for loading and unloading of industrial products.

Storage - There are transit sheds and warehouses with a total surface area of 5.9 million sq ft, a 30,000-ton-capacity grain silo, two cold storage sheds with a capacity of 13,700 tons.

Cranes - Two floating cranes of 25 and 150 tons; 131 dockside cranes of from 1.5 to 6 tons.

Water - Available.

Tanker terminals - An oil harbor at the terminal of the Trieste-Austria-Germany oil pipeline, which has annual capacity of 50 million tons. Oil Harbor capable of accommodating tankers up to 160,000 tons. Four oil berths available. Lengths, 495 to 925 ft; drafts, 38 to 52 ft. Night berthing possible.

Bunkers - Available.

Container and ro/ro - Container facilities are concentrated on Wharf VII, at the Punto Franco Nuovo. The wharf has a total of 59 acres, of which about 30 acres are used for container handling. The area is served by overhead roads connected to the principal regional highways. Rail connections are provided. The wharf has eight berths, each 656 ft long. The South Pier has four berths and the North Pier has three berths, the eighth berth being situated at the head of the basin between the two piers.

Seventeen van carriers. Three container gantry cranes, 162,000-sq-ft shedded area for stuffing/unstuffing.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Four dry docks are available; lengths range from 380 to 900 ft; widths range from 50 to 90 ft; depths from 17 to 27 ft. All types of engine repairs also possible.

REMARKS: Airport - Ronchi Dei Legionari, 24 miles.

PORT: Venice (45°26' N. Lat., 12°20' E. Long.).

APPROACH: The port of Venice, which includes also Porto Marghera, is situated in the lagoon area between Lido Port entrance and the port entrance of Malamocco and embraces all the canals leading from the entrances to the dry docks, Venice Marittima Commercial Docks, Porto Marghera, and San Leonardo Terminal. Tide range varies from 3 to 5 ft. Marine currents of variable intensity can reach a speed of 3 knots at Malamocco. The ship canal from Lido to the Porto Marghera is 12 miles long; depth of water, 31 ft. The Malamocco Marghera Canal already serving San Leonardo Terminal with a draft of 45 ft has been dredged from San Leonardo to Port Marghera to a draft of 30 ft.

FACILITIES:

Wharves - There are 70,000 ft of operating berths connected by 127 miles of rail tracks and 44 miles of roads.

Storage - 2 million sq ft of warehouse space, 1.2 million cu ft of cold storage space, 15.4 million cu ft of grain silos, oil tanks to hold 150,000 tons of oil, and 4.7 million sq ft of open storage space.

Cranes - 154 shore cranes, two Paceco portainers of 50 tons capacity each, assorted port operating machinery.

Water - Available.

Tanker terminals - 35 oil berths. Length, 2,545 ft; draft, 31 ft. San Leonardo Terminal on the new Malamocco Canal has a finger jetty for up to 45-ft draft.

Bunkers - All specifications of bunkers are available ex-lighter. 48 hours' notice during normal weekdays is necessary to obtain lighters.

Container and ro/ro - Marghera - Container Terminal at the Emilia Quay: two berths (along 1,312-ft quayside), one ro/ro berth, two portainer cranes of 50 tons capacity, two straddle carriers of 40 tons capacity, three rubber-tired gantry cranes of 40 tons capacity, seven other various handling means of about 35 tons capacity, 1.9-million-sq-ft stacking area, 113,000-sq-ft stuffing shed planned.

Ro/ro Terminal at the Friuli and Cadore Quays: two berths, 215,000-sq-ft marshalling area, 77,500-sq-ft stuffing sheds.

Ro/Ro Terminal at the Aosta Quay: Four berths, 431,000-sq-ft marshalling area, 129,000-sq-ft stuffing sheds, one passenger terminal.

NEW DEVELOPMENTS: Marittima-Isonzo Quay (ro/ro terminal under construction), two berths, 753,000-sq-ft marshalling area, one bridge-crane of 30 tons capacity, two rail-mounted gantry cranes of 30 tons capacity, 70,000-sq-ft stuffing shed.

S. Marta Quay (ro/ro terminal being planned), two berths, 538,000-sq-ft marshalling area, one passenger terminal, 34,000-sq-ft cold storage (under construction).

S. Basilio Quay (ro/ro terminal), two berths, one passenger

terminal, 323,000-sq-ft marshalling area (under planning).

SHIP REPAIRS: Dry docks of 20,000 to 175,000 d.w.t. capacity available for repairs. One building dock of 200,000 d.w.t. capacity.

REMARKS: Airport - Venice Airport "Marco Polo"; Treviso Airport, 20 miles.

ITALY

PORT: Palermo (38°08' N. Lat., 13°22' E. Long.).

APPROACH: 50- to 60-ft depth at entrance. Well sheltered from all winds.

FACILITIES:

Wharves - Loading and discharging directly to or from the quays, average depth alongside, 28 ft. Depth at grain quay, 32 ft.

Storage - Not reported.

Cranes - One of 40 tons, four of 20 tons, two of 13 tons, two of 10 tons, and two of 8 tons.

Water - Good water direct from quays.

Tanker terminals - Not reported.

Bunkers - Shell Italiana, Esso Standard, and AGIP can arrange supplies of fuel oil and thin fuel oil. Bunker coal stocks maintained. Temporary mooring operated by R.E.S. (Raffineria Esportazione Siciliana) for loading bunker barges only; R.E.S. has a 2,150 d.w.t. tanker and can supply fuel oil as well as gas oil and arrange for delivery on board.

Container and ro/ro - Containers handled at Puntone Pier 1,329 ft long; six terminals for ro/ro ships. One 35-ton-capacity portainer crane, one 40-ton straddle self-moving crane, four electric cranes, six fork-lift trucks.

NEW DEVELOPMENTS: One graving dock under construction for vessels up to 450,000 d.w.t. to be operated by Bacino di Palermo.

SHIP REPAIRS: All types possible. One graving dock operated by Cantieri Navali Riuniti, 563 by 104 by 27 ft; two floating docks operated by Bacini Siciliani (lifting capacity, 54,000 and 19,000 tons).

REMARKS: Airport - Punta Raisa, 31 miles.

SPAIN

PORT: Palma De Mallorca, Balearics (39°34' N. Lat., 2°38' E. Long.).

APPROACH: Not reported.

FACILITIES:

Wharves - Total length of commercial quays, 13,172 ft with drafts up to 39 ft. Largest vessel: Queen Elizabeth II, 965 ft long, 30-ft draft.

Storage - Not reported.

Cranes - One 80-ton floating crane, ten 6-ton and six 3-ton electric cranes, four 10-ton and two 8-ton mobile cranes, four 12-ton cranes, electric trucks, tractors, and forklifts available.

Water - Not reported.

Tanker terminals - Not reported.

Bunkers - Fuel oil, gas oil, and gasoline are available from several sources.

Container and ro/ro - Two 12-ton electric cranes, one 20-ton container carrier, and one 15-ton mobile crane for containers.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Repairs undertaken by Astilleros de Mallona S.A. for vessels up to a maximum of 2,000 g.r.t.

REMARKS: Airport - Son San Juan, 7.5 miles.

YUGOSLAVIA

PORT: Koper (45°33' N. Lat., 13°44' E. Long.).

APPROACH: Not reported.

FACILITIES:

Wharves - Safe and large anchorage. The harbor is situated in a well protected area which ensures safe berthing accommodation for six ocean-going vessels. Maximum draft, 30 ft. Berth for tankers up to 53-ft depth. A second berth, 445 ft long; 33-ft draft. Normal railroad connection.

Storage - Warehouse, 1.7 million sq ft; refrigerated storage space, 137,000 cu ft; conditioned storage space; open ground for timber, 1.6 million sq ft; eight vegetable oil tanks of total capacity 926,000 cu ft. Two tanks for sulphuric acid with a total capacity of 77,700 cu ft; nine tanks for crude oil with a capacity of 1.9 million cu ft; eight tanks for grain, capacity, 3,200 tons; four gas chambers of 21,200-cu-ft capacity for disinfection and ripening of goods. Four ripening chambers, 70,904 cu ft, for ripening goods or conditioned storage space.

Cranes - One 25-ton and two 20-ton shore cranes.

Water - Available.

Tanker terminals - See "Wharves."

Bunkers - Available by lighter from Rijeka or Trieste.

Container and ro/ro - Container terminal with ro/ro berths.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Floating dock lifting up to 8,000 tons.

REMARKS: Airport - Ljubljana, 86 miles; Trieste (Italy), 37 miles.

CYPRUS

PORT: Limassol (34°40' N. Lat., 33°02' E. Long.).

APPROACH: Breakwater sheltered port. Approach channel dredged to 39 ft with maximum width at entrance of 590 ft.

FACILITIES:

Wharves - Vessels with a maximum draft of 34 ft may berth alongside the two quay walls, which are each 1,312 ft long. The harbor basin has been dredged to 36 ft. Turning basin, 1,805 ft. The Lighter Basin is still in use. Two quays, totalling 984 ft in length; depth of water varies from 8 to 16 ft. Alongside the 545-ft-long south quay, there is a depth of 16 ft where small vessels not exceeding 263 ft in length and 15-ft draft can berth and discharge direct onto quay.

Storage - Three warehouses available at 259,000 sq ft; plus 183,000 sq ft of additional close storage space.

Cranes - Fifteen mobile cranes from 2 to 16 tons capacity.

Water - Fresh water available.

Tanker terminals - Akrotiri Oil Berth (within Sovereign Bases); tankers and other vessels have to clear at Limassol and take on pilot for berthing; advance notice of arrival necessary.

There are two oil berths at Moni, 7 miles eastward of Limassol; tankers moored to buoys.

Bunkers - Oil bunkers supplied by tanker trucks from Larnaca.

Container and ro/ro - Containers handled by floating crane, luffing crane on rails, straddle and van carriers, and auxiliary equipment. There is a 463,000-sq-ft container paved yard. Ro/ro vessels can discharge on the quays.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Dry dock, 294 ft long; major engine repair facilities available.

REMARKS: Airport - Larnaca, 52 miles.

PORT: Sete (43°24' N. Lat., 3°42' E. Long.).

APPROACH: See "Wharves."

FACILITIES:

Wharves - Depth at entrance (Mole Masselin), 30 ft in the outer port, at Bassin Aux Petroles and the new east basin, 39 ft. Maximum draft is 36 ft. The harbor is protected by the Maritime Canal and vessels drawing 23 ft come alongside the quays. There is a grain silo of 10,000 tons capacity, and a phosphate silo of 22,000 tons capacity. A new basin in the east of the harbor is now in operation. There are three berths 650 ft long and 39 ft deep; two berths 623 ft long and 39 ft deep; and a ro/ro berth, 328 ft long.

Storage - Not reported.

Cranes - Eighteen cranes available on the waterfront; four of 6 tons, eight of 7.5 tons, two of 8 tons, two of 12 tons, and two of 16 tons. Four truck cranes and a floating crane of 135 tons. On the newly opened West Quay, there are two 9-ton cranes.

Water - Not reported.

Tanker terminals - Offshore berth for crude oil, at the sea-line terminal, about 43 miles from the shore. Can accommodate tankers up to 270,000 d.w.t. Depth, 69 ft. At Bassin Aux Petroles there are two berths for refined products tankers up to 490 ft with a draft of 30 ft. A third berth available for tankers up to 30,000 d.w.t. and with a draft of 39 ft.

Bunkers - Fuel, diesel, and gas oil from Mobil-Oil Francaise by barge.

Container and ro/ro - Containers can be handled either by truck crane or forklift trucks; one berth for ro/ro ships of 23-ft draft and three berths for ro/ro ships of 29-ft draft. (One of them at passenger terminal.) A further two ro/ro berths are now in operation.

Ore and bulk cargo - Available for bulk carriers of 35,000 d.w.t. with maximum draft of 39 ft. Plenty of storage space available.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Small repairs can be accommodated.

REMARKS: Airport - Frejorgues (Montpellier), 17 miles.

CYPRUS

PORT: Limassol (34°40' N. Lat., 33°02' E. Long.).

APPROACH: Breakwater sheltered port. Approach channel dredged to 39 ft with maximum width at entrance of 590 ft.

FACILITIES:

Wharves - Vessels with a maximum draft of 34 ft may berth alongside the two quay walls, which are each 1,312 ft long. The harbor basin has been dredged to 36 ft. Turning basin, 1,805 ft. The Lighter Basin is still in use. Two quays, totalling 984 ft in length; depth of water varies from 8 to 16 ft. Alongside the 545-ft-long south quay, there is a depth of 16 ft where small vessels not exceeding 263 ft in length and 15-ft draft can berth and discharge direct onto quay.

Storage - Three warehouses available at 259,000 sq ft; plus 183,000 sq ft of additional close storage space.

Cranes - Fifteen mobile cranes from 2 to 16 tons capacity.

Water - Fresh water available.

Tanker terminals - Akrotiri Oil Berth (within Sovereign Bases); tankers and other vessels have to clear at Limassol and take on pilot for berthing; advance notice of arrival necessary.

There are two oil berths at Moni, 7 miles eastward of Limassol; tankers moored to buoys.

Bunkers - Oil bunkers supplied by tanker trucks from Larnaca.

Container and ro/ro - Containers handled by floating crane, luffing crane on rails, straddle and van carriers, and auxiliary equipment. There is a 463,000-sq-ft container paved yard. Ro/ro vessels can discharge on the quays.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Dry dock, 294 ft long; major engine repair facilities available.

REMARKS: Airport - Larnaca, 52 miles.

PORT: Sete (43°24' N. Lat., 3°42' E. Long.).

APPROACH: See "Wharves."

FACILITIES:

Wharves - Depth at entrance (Mole Masselin), 30 ft in the outer port, at Bassin Aux Petroles and the new east basin, 39 ft. Maximum draft is 36 ft. The harbor is protected by the Maritime Canal and vessels drawing 23 ft come alongside the quays. There is a grain silo of 10,000 tons capacity, and a phosphate silo of 22,000 tons capacity. A new basin in the east of the harbor is now in operation. There are three berths 650 ft long and 39 ft deep; two berths 623 ft long and 39 ft deep; and a ro/ro berth, 328 ft long.

Storage - Not reported.

Cranes - Eighteen cranes available on the waterfront; four of 6 tons, eight of 7.5 tons, two of 8 tons, two of 12 tons, and two of 16 tons. Four truck cranes and a floating crane of 135 tons. On the newly opened West Quay, there are two 9-ton cranes.

Water - Not reported.

Tanker terminals - Offshore berth for crude oil, at the sea-line terminal, about 43 miles from the shore. Can accommodate tankers up to 270,000 d.w.t. Depth, 69 ft. At Bassin Aux Petroles there are two berths for refined products tankers up to 490 ft with a draft of 30 ft. A third berth available for tankers up to 30,000 d.w.t. and with a draft of 39 ft.

Bunkers - Fuel, diesel, and gas oil from Mobil-Oil Francaise by barge.

Container and ro/ro - Containers can be handled either by truck crane or forklift trucks; one berth for ro/ro ships of 23-ft draft and three berths for ro/ro ships of 29-ft draft. (One of them at passenger terminal.) A further two ro/ro berths are now in operation.

Ore and bulk cargo - Available for bulk carriers of 35,000 d.w.t. with maximum draft of 39 ft. Plenty of storage space available.

NEW DEVELOPMENTS: Not reported.

SHIP REPAIRS: Small repairs can be accommodated.

REMARKS: Airport - Frejorgues (Montpellier), 17 miles.

SPAIN

PORT: Cadiz (36°32' N. Lat., 6°17' W. Long.).

APPROACH: The port is on the most southerly part of the Iberian Peninsula. The Cadiz coast extends for 159 miles. Maximum controlling depth at entrance channel, 29 ft at L.L.W. Vessels over 550 ft long are anchored N. of Diamante Buoy, where there are no draft restrictions. Vessels can enter at any time of day or night.

FACILITIES:

Wharves - The Commercial Harbor: Pier No. 1 (Reina Victoria), 722 ft long; Pier No. 2 (Marques de Comillas), 1,510 ft long; Pier No. 3 (Alfonso XIII), 1,444 ft long with a 820-ft extension; Pier No. 4 (Generalisimo Franco), 1,132 ft long. Controlling draft, 30 ft.

Commercial Docks Nos. 1 and 2 have 86,000-sq-ft and 75,000-sq-ft open storage space plus 11,000-sq-ft and 97,000-sq-ft covered storage space, respectively. Railway connections. Commercial Dock No. 3 has 75,000-sq-ft open storage and 61,000 sq ft of shed storage. Commercial Dock No. 4 has 151,000-sq-ft open storage and 39,000 sq ft of covered storage.

International Free Zone (Zona Franca): Commercial Quay is 985 ft long and Ribera Quay is 525 ft long. Controlling draft, 27 ft. The majority of the port's container traffic is handled in this area.

Private facilities consist of one van carrier and one side loader. Storage space: covered, 215,000 sq ft; open, 646,000 sq ft. Entry permitted day and night, during slack water.

The Fishing Harbor: Pier Fernandez Ladreda is 1,608 ft long and Pier Levante 1,820 ft long.

Warehouse capacity: Fernandez, 189,000 sq ft; Levante, 46,000 sq ft plus two private refrigerated warehouses of 650 and 1,200 tons capacity.

Storage - Total open storage, 1 million sq ft; total covered storage, 658,000 sq ft.

Cranes - Five mobile cranes with capacity from 60 to 130 tons, two mobile cranes lifting 30 and 60 tons, fifteen electric 6-ton cranes.

Water - Available at all quays.

Tanker terminals - Available.

Bunkers - Gas oil and fuel oil can be supplied to vessels; also by barge at Commercial Quays or at anchor in bay.

Container and ro/ro - Six mobile cranes for containers available, from 60 and 150 tons capacity; one container crane, capacity 40 tons at 112 ft; two 30-ton capacity forklifts available.

NEW DEVELOPMENTS: One electric 30-ton crane and six electric 6-ton cranes ordered.

SHIP REPAIRS: Two companies have shipyards in port. Five dry docks and three slipways operated between them. Also, two building berths, one float-

ing crane of 60 tons capacity, which is available for hire and a large number of shore cranes. Also, two floating docks of 4,100 tons and 39,000 tons lifting capacity.

REMARKS: Airport - Seville, 99 miles.

YUGOSLAVIA

PORT: Rijeka (45°19' N. Lat., 14°27' E. Long.).

APPROACH: Well sheltered harbor; anchorage outside good and safe. Breakwaters, 5,755 ft and 1,378 ft. Width of entrance, 886 ft; width of entrance of Susak Basin, 164 ft. Depth at entrance, 130 ft; in midharbor, 66 to 92 ft; at quays, 20 to 33 ft.

FACILITIES:

Wharves - Accommodation for 29 oceangoing vessels and a number of smaller coasters. Harbor comprises six basins (including Susak), four of which are for loading and discharging general cargo including containers and timber, ore, etc., one for passengers, and one exclusively for tankers, protected by a headwater 794 ft long; entrance, 197 ft wide and 39 ft in depth, decreasing to 20 to 25 ft.

Length of rail track, 12 miles. Electric lights for night work. Rail connections with Central Europe, Italy, and the Balkan Peninsula.

Storage - Covered surface for cool storage, 3.2 million sq ft; cool tanks for discharge of vegetable oil, 1.3 million cu ft. Open storage space for ores and minerals, 670,000 sq ft. About 1.3 million sq ft of open storage space for timber, and 680,000 sq ft for covered storage space. Grain elevator with capacity of 32,000 tons; daily capacity, 5,000 tons (draft, 34 ft).

Cranes - Floating cranes for heavy lifts up to 120 tons; 12 mobile cranes lifting up to 30 tons; 130 forklifts lifting up to 12 tons; and 64 electric cranes lifting up to 5 tons.

Water - Available.

Tanker terminals - Quay, 787 ft long with 50-ft draft for supertankers, near refinery at Urinj.

Bunkers - Available, any kind of fuels and lubricants.

Container and ro/ro - Container terminal with few ro/ro berths.

Ore and bulk cargo - Bulk cargo terminal in Bakar Basin; one berth for vessels up to 150,000 d.w.t., unloading iron ore, coke, and coal; rate, 15,000 tons/day.

NEW DEVELOPMENTS: New Container Terminal, phase I: one berth and two gantry cranes. 194,000 sq ft of covered storage area; a refrigerated storehouse. Extension of bulk cargo terminal to accommodate ships up to 150,000 d.w.t.

SHIP REPAIRS: All kinds of repairs; floating docks for vessels up to 100,000 d.w.t. Three floating docks of 5,500, 24,000, and 12,000 tons lifting capacity are available.

REMARKS: Airport - Zagreb, 93 miles. Ljubljana, 93 miles. Rijeka Airport, near Omisalj, on the Island of Krk, 28 miles from Rijeka.

APPENDIX E: CHARACTERISTICS OF OCONUS PERSIAN GULF PORTS

1. The following is a list of leading Persian Gulf container ports ranked according to the throughput of TEU's followed by compendiums of port characteristics.

Port	Page
Dammam	E2
Port Rashid, Dubai	E3
Shuwaikh	E4
Port Khalid, Sharjah	E6
Mina Sulman	E7
Jebel Ali, Dubai	E8
Abu Dhabi	E9
Port Qaboos	E11
Bandar Khomeini	E12
Jubail	E13
Khor Fakkan, Sharjah	E14
Basrah	E15

SAUDI ARABIA

PORT: Dammam (26°30'N. Lat., 50°12' E. Long.).

APPROACH: Detailed information not reported, but the deepwater departure channel at Ras Tanura has a depth of 69 ft at S.L.W.

FACILITIES:

Wharves - There are 22 berths at the port, five berths 787 ft long, one berth 705 ft long, 13 berths 590 ft long, and three that are 492 ft in length. The depth alongside ranges from 30 to 46 ft.

Storage - Main pier, three warehouses of 60,000 sq ft each and four of 52,000 sq ft each. East pier, two warehouses of 60,000 sq ft each and five others under construction. Old Customs Area, 14 storage sheds of 237,000-sq-ft total area; 10.4 million sq ft of open storage space available in the port. Cargo can also be discharged at anchorage over the side into barges for unloading at the small craft pier, which has a draft of 12 ft, is equipped with two transit sheds, and is situated on the east side of the causeway about 5 miles from the shoreline. A 6-mile-long rock causeway carrying road and rail joins the main pier to the shore.

Cranes - Twelve 3-ton electric portal cranes and three of 6 tons capacity, 18 steel lighters of 150 to 350 tons capacity; various forklift trucks, tractors, and trailers. Heavy lift rail cranes of 80 and 150 tons capacity available.

Water - Not available.

Tanker terminals - Not available.

Bunkers - Not available.

NEW DEVELOPMENTS: Port expansion program consists of providing a ro/ro berth, a grain silo, flour mill, and additional 25 berths. Small craft pier is being expanded to accommodate 19 barges to operate at one time. Container berths and gantry cranes for handling also planned. Forty-eight electric cranes of 6 to 15 tons capacity are being installed.

SHIP REPAIRS: None reported.

REMARKS: Dhahram Airport is 15 miles from the port.

UNITED ARAB EMIRATES

PORT: Port Rashid, Dubai (25°16' N. Lat., 55°16' E. Long.).

APPROACH: Anchorage, 2 miles from entrance. Holding ground generally poor. There are no hazards. Minimum depth in channel, 43 ft. Occasional storms from northwest. Maximum tide rise and fall, 7 ft. Maximum draft, 38 ft. No restriction for beam and length.

FACILITIES:

Wharves - Thirty-five deepwater berths and four berths restricted to vessels with less than 20-ft draft. Berth 1, 33 ft; 2, 32 ft; 3-16 (except 10) 31 ft; 17-32, 38 ft; 33-35, 43 ft.

Storage - Twenty-two storage sheds 400 by 200 ft adjacent to berths. Extensive hard surface storage areas.

Cranes - Mobile cranes of 5 to 40 tons. Two container cranes of 35 tons at Berth 10. Karrilift, Karricon, and associated container handling equipment. Forklift trucks and trailers at each berth.

Water - Available at all berths.

Tanker terminals - Berth capable of taking vessels up to 853 ft long; maximum draft, 37 ft; vessels of 37-ft but not over 38-ft draft may be berthed subject to weather conditions.

Bunkers - Shell bunker fuels are available at Berths 1 to 4, 6 to 9, and 17 to 37, in addition to tanker berth and include fuel oil, thin fuel oils, diesel and gas oil. Marine lubricants and chemicals are available for delivery to the ship.

Container and ro/ro - Containers discharged direct to transport by ship's gear, or by container crane on Berth 10, or Berths 33-35 off-loaded by shore cranes if necessary. Ample storage area. Ro/ro with a maximum rise and fall of tide of 7 ft. No difficulty experienced. M.L.W.S.T. height to quay edge, 12 ft. Six storage sheds available.

NEW DEVELOPMENTS: Additional ship repair yard is under construction.

SHIP REPAIRS: Round-the-clock service, which ranges from major boiler repairs to repair of main diesel engines and auxiliaries, underwater welding, shot blasting, hull cleaning, and diving services. One slipway can accommodate vessels up to 100 tons. They are also able to handle all kinds of engine and hull repairs.

REMARKS: International Airport is 2 miles.

KUWAIT

PORT: Shuwaikh (29°21' N. Lat., 47°56' E. Long.).

APPROACH: Approach to harbor is through a 4.5-mile-long, 500-ft-wide channel marked by buoys and dolphins and dredged to 28 ft below chart datum. Maximum height of H.W. above chart datum (A.C.D.) is 13 ft.

FACILITIES:

Wharves - There are eight deepwater wharves each 600 ft long dredged to 33 ft below chart datum, able to take ships with up to 31-ft draft. Two extra berths west of deepwater wharves for medium and small vessels, 1,300 ft long, dredged to 33 ft below chart datum, with a 112-ft width. Three passenger-handling terminals dredged to 33 ft below chart datum. Two dolphin berths capable of handling vessels with up to 27-ft draft; three dolphin berths dredged to 28 ft below chart datum; maximum length of vessel, 600 ft. There are three basins for small craft known as the "Small Craft Harbor," 1,416 ft long by 300 ft wide; "Yacht Basin," 553 ft long by 250 ft wide; width of entrance to both basins, 215 ft; and the "Maintenance Basin," 390 ft by 272 ft, entrance, 136 ft. All three basins have a depth of 11 ft and are used by barges, tugs, launches, trawlers, etc.

Storage - 462,000-sq-ft covered storage for general cargo; 880,000-sq-ft shed space, of which 34,000 sq ft is reserved for hazardous cargo; also 2.3 million sq ft of open storage.

Cranes - There are 32 electric cranes, 24 with a capacity of 3 tons and 8 with a capacity of 6 tons. Several mobile cranes with lifting capacity of 25 tons and one with capacity of 90 tons (jib length, 65 ft). There is also a floating crane with 100 tons capacity at 34 ft.

Water - Available to ships alongside all berths.

Tanker terminals - Not reported.

Bunkers - No coal bunkers. In addition to the full facilities afforded at Mena-Al-Ahmadi, light bunker fuel oil (300 tons/hr) and marine diesel oil (200 tons/hr) only can be supplied alongside the deepwater Berths 1 to 7. Gas oil at 25 tons/hr available at Berths 6 and 7. Small quantities of gas oil supplied to the berths by tanker truck. Lubrication oils available.

Container and ro/ro - Port equipped with two 30-ton container cranes and a 100-ton floating crane.

Ore and bulk cargo - There is a grain elevator at No. 2 berth capable of discharging at a rate of 150 tons/hr.

NEW DEVELOPMENTS: Considerable reclamation work has been taking place to the north of the port, which is in the last stages of development. Six deepwater berths (Nos. 9-14, each 600 ft long and 33 ft deep, under construction) will be equipped with three 3-ton and one 6-ton electrical cranes at each berth. An additional 30-ton crane is to be erected between Berths 12 and 13. Fishing harbor to accommodate 70 trawlers and four motherships will be available. Farther east there will be four berths for handling livestock, perishable goods, and

refrigerated cargo, Nos. 15-18, each 600 ft long with 28 ft depth. Cold storage of 10,000 tons capacity and covered and open storage will be provided. Ten 3-ton-capacity electrical cranes are to be installed at these berths. Bunkering facilities will be available. A further extension to the east for a shipbuilding and ship repair yard under construction and soon to be completed with syncrolift of 3,150 maximum lifting capacity, a transfer system for 16 vessels, and a slip for building berths. Inner basin is to be dredged to 33 ft below A.C.D.

SHIP REPAIRS: Minor repairs for all types of vessels by local companies, arranged through vessel's agents. Slipway facility capacity, up to 1,000 tons, used mainly for port craft.

REMARKS: Kuwait International Airport is 11 miles distant.

UNITED ARAB EMIRATES

PORT: Port Khalid, Sharjah (25°22' N. Lat., 55°22' E. Long.).

APPROACH: In January, February, and March winds range up to 25 knots. Tidal variation, 4 to 5 ft. Maximum draft, 29 ft. Channel to Berths 5, 6, and 7, maximum draft, 33 ft.

FACILITIES:

Wharves - Berths 1 and 2, deepwater container terminal. Berths 3-6, 2,360 ft long. Berths 8-12 have a total length of 5,446 ft.

Storage - 4,500 tons of reefer storage at Berth 8. Ten storage warehouses 200 by 100 ft.

Cranes - Cranes up to 200 tons available.

Water - Available.

Tanker terminals - None reported.

Bunkers - One tanker terminal or from shore trucks.

Container and ro/ro - Container terminal at Berths 1 and 2. The terminal has 1,191 ft of quay frontage, two 35-ft "Tango" container cranes, 20- and 40-ton forklift trucks, terminal tractors, and container slave trailers. There is a 1.1-million-sq-ft container park and two 592,000-sq-ft transit sheds for less-than-container load (LCL) operations. Berth 7 has a ro/ro ramp and has a length of 771 ft.

NEW DEVELOPMENTS: None reported.

SHIP REPAIRS: Available at Emirates Marine Services.

REMARKS: Dubai and Sharjah Airports, 15-20 minutes drive.

BAHRAIN

PORT: Mina Sulman (26°12' N. Lat., 50°37' E. Long.).

APPROACH: Approach to Mina Sulman is through a channel at Sitra. Maximum draft in the channel is 27 ft.

FACILITIES:

Wharves - The port has a finger pier, 2,625 ft long, with berths for 10 oceangoing vessels on both sides of the pier; the draft limitation alongside these berths is 30 ft at L.W.

Storage - None.

Cranes - Mobile cranes only; there are no container cranes.

Water - Available.

Tanker terminals - None.

Bunkers - All types available alongside oil jetty at Sitra.

NEW DEVELOPMENTS: Another six berths, 656 ft each, including a container berth and a ro/ro berth, plus a small craft harbor, under construction; maximum draft, 36 ft; two 46-ton gantry cranes to be installed.

SHIP REPAIRS: ASRY (Arab Shipbuilding & Repair Yard Company) Hull and Engine, Dry dock; 1,230 ft by 246 ft up to 500,000 d.w.t., Bahrain Slipway Company, Ltd., The Bahrain Ship Repairing and Engineering Company.

REMARKS: Bahrain International Airport is 6 miles from the port.

UNITED ARAB EMIRATES

PORT: Jebel Ali, Dubai (25°06' N. Lat., 55°02' E. Long.).

APPROACH: Channel entrance is in position 25°03' N. Lat., 54°59.9' E. Long. Width, 410 ft; depth, 33 ft. Dredging in progress. Prevailing winds, north-northwest; there are some storms in winter. Tidal range, 6 ft.

FACILITIES:

Wharves - Berths 18, 19, 62, and 66, depth, 38 ft; 16 and 17, depth, 46 ft, now open.

Storage - None reported.

Cranes - Two container cranes.

Water - Not reported.

Tanker terminals - None reported.

Bunkers - None reported.

NEW DEVELOPMENTS: The new harbor will provide berths for 74 ships of various types. It is to be adjacent to an area in which heavy industries are already being developed, and 15 berths in the harbor will provide water deep enough for large bulk carriers.

SHIP REPAIRS: Not reported.

REMARKS: A new international airport complex is to be constructed within 3 miles of Jebel Ali Harbor.

UNITED ARAB EMIRATES

PORT: Abu Dhabi (24°33' N. Lat., 54°20' E. Long.).

APPROACH: Minimum draft in the approach channel is 32 ft and the width of the fairway channel is 500 ft.

FACILITIES:

Wharves - Presently the port consists of six liner berths, drafts, one of 34 ft and five of 32 ft; and six direct delivery berths, drafts all 38 ft; three lighterage berths, drafts vary from 10 to 19 ft. Berths are 600 ft long each with bollards at 57-ft intervals. As all liner berths are in a straight line and five of the direct delivery berths, this permits berthing of larger vessels, subject to lengths of those already alongside.

Storage - The five storage sheds at the liner berths have a capacity of some 286,000 cu ft and there are additionally five open sheds with a capacity of some 88,000 cu ft. Further five sheds and four open sheds have recently been completed on the six new deepwater (direct delivery) berths, with a total capacity of 353,000 cu ft.

Cranes - Vessels are required to provide their own cargo gear. On the wharf, forklift trucks and trailers are in use to expedite movement of cargo to storage areas. Mobile cranes up to 80 d.w.t. capacity are available in the port area. Three berths are equipped with electric tower cranes, five with 5 tons capacity and one with 10 tons capacity.

Water - Fresh water available.

Tanker terminals - None reported.

Bunkers - Fuel oil and diesel oil bunkers are available for vessels working alongside and subject to suitable weather conditions.

Container and ro/ro - Presently Berth 9 with an open yard of 492 by 164 ft, which is well paved and well lit, is used by vessels discharging containers. Stacking of full containers is done by port mobile crane. Unstacking and sorting of empty containers is done by an 8-ton forklift. Work is progressing well on the strengthening and realignment of Berths 1 to 3 where the new ro/ro and container berths will be sited. There will be two modern container cranes, which will each incorporate booms of 128 ft outward reach from the seaward rail. These will enable discharge of containers not only to shore but also onto feeder vessels alongside the container vessels, and the container cranes will be equipped with swivelling lifting gear to enable quick discharge of all containers.

Ore and bulk cargo - At Berth 6W gas oil and jet fuel are discharged and pumped to the existing lines of Abu Dhabi National Oil Company. Bitumen is discharged and pumped at this berth by the Bitumen Company. Heavy black oil is loaded from barges by the Abu Dhabi National Oil Co. onto the ocean vessels at Berth 9. Berth 19 is allocated as wheat berth, where wheat in bulk is discharged by suction hoses.

NEW DEVELOPMENTS: In addition to the container and ro/ro berths being built

and referred to above, two further deepwater berths (Berths 20 and 21) are under construction.

SHIP REPAIRS: Not reported.

REMARKS: There is an International Airport approximately 5 miles from the Abu Dhabi seaport with worldwide connections.

OMAN

PORT: Port Qaboos (Muttrah) (23°38' N. Lat., 58°35' E. Long.).

APPROACH: Not reported.

FACILITIES:

Wharves - Within the protected harbor are 12 berths: eight berths for ships up to 30-ft draft and four for shallow-draft ships up to 12 ft. Berths 1 and 2 combined can accommodate ships up to 1,200 ft. Berths 1, 2, 4, 5, 7, and 8 can accommodate ships up to 550 ft. Berth 3, up to 500 ft. Berth 6, up to 600 ft. An underground conveyor belt at Berth 3 is for bulk cement and grain silos.

Storage - Berths served by nine modern transit buildings.

Cranes - Heavy-lift facilities available.

Water - Not reported.

Tanker terminals - Not reported.

Bunkers - Gail oil available at some berths. Diesel oil available at Berths 6 to 11.

Container and ro/ro - Trailers and tractors are available for discharge of ro/ro and container ships.

Ore and bulk cargo - A bulk cement silo station, capacity, 6,000 tons, supplied by underground pipelines from quayside. Grain silos, capacity, 30,000 tons, served by a quayside underground conveyor. Cold storage warehouse nearing completion. Construction of a warehouse complex planned. Additional modern cargo handling equipment to be bought.

NEW DEVELOPMENTS: Re-equipment with latest machinery for handling ro/ro and containerized ships. Transshipment for all Gulf and nearby ports.

SHIP REPAIRS: Not reported.

REMARKS: Seeb International Airport, 22 miles.

IRAN

PORT: Bandar Khomeini, formerly Bandar Shahpour (30°26' N. Lat., 49°05' E. Long.).

APPROACH: 24-hour daily entrance to harbor is available; no harbor depth is reported.

FACILITIES:

Wharves - Port is a landlocked stream in which work can be carried on in all seasons. Two jetties, 1,476 ft and 1,772 ft. Each jetty has three berths: at Berths 1, 2, and 3, maximum draft is 28 to 30 ft, and at Berths 4, 5, and 6, maximum draft is 35 ft, but this should always be verified. There is a railroad line to Ahwaz.

Storage - Covered storage available: 94,000 tons capacity; asphalted open yard, approximately 15,000 tons capacity. Open storage: limited and congested.

Cranes - Ships discharge with their own gear. Eight cranes on shore used for loading rail wagons, etc. Two container cranes.

Water - Not available.

Tanker terminals - None reported.

Bunkers - Not available.

NEW DEVELOPMENTS: There are now a further 28 berths under construction in three separate phases.

SHIP REPAIRS: Not available.

REMARKS: None.

SAUDI ARABIA

PORT: Jubail (27°02' N. Lat., 49°41' E. Long.).

APPROACH: The approach channel to the berths lies in an east/west direction; depth, 30 ft. It is in the process of being dredged to a depth of 46 ft. Tidal range is 6.5 ft.

FACILITIES:

Wharves - Sixteen berths are of lengths between 656 to 984 ft and depth between 39 and 46 ft. Berths 15 and 16 form the container terminal. Behind these berths, there are 1.9 million sq ft of container storage.

Storage - At present two sheds open at Berths 1 and 2 (394 by 197 ft). Eventually all berths will have sheds.

Cranes - All cranes are mobile. There are six of 20 tons, four of 50 tons, and two of 100 tons. In addition, there are ten forklifts of 5 tons, ten forklifts of 3 tons, two forklifts of 20 tons, and one forklift of 35 tons.

Water - Not available.

Tanker terminals - Not available (see "NEW DEVELOPMENTS").

Bunkers - Not available.

NEW DEVELOPMENTS: An industrial port is under construction; when complete, it will have 14 berths at 17,388 ft of quays with depths up to 98 ft. A tanker terminal will be able to accommodate vessels up to 300,000 d.w.t.

SHIP REPAIRS: None available.

REMARKS: None.

UNITED ARAB EMIRATES

PORT: Khor Fakkan, Sharjah (25°21' N. Lat., 56°22' E. Long.).

APPROACH: Safe approach, no sandbanks. Minimum depth at M.L.W.S., 39 ft. Most of year winds never exceed force 3. Occasional force of 8 squalls. Maximum tide rise and fall, 8 ft. Maximum vessel draft, 38 ft.

FACILITIES:

Wharves - 1,411 ft of quay dredged to 39 ft. Cement jetty, 246 ft long; maximum draft, 17 ft.

Storage - 108,000 sq ft of open storage space. 86 reefer points on terminal. No sheds.

Cranes - Two 40-ton Mitsubishi portainers and four Mitsubishi yard cranes.

Water - Available.

Tanker terminals - None reported.

Bunkers - Brought by barge from Sharjah.

Container and ro/ro - 1,411-ft container quay with two berths; equipped with two 40-ton container cranes, four 40-ton yard cranes, and six van carriers.

NEW DEVELOPMENTS: Bunker tanks planned for future.

SHIP REPAIRS: Sharjah Ship Repairs and Engineering Works.

REMARKS: Sharjah International Airport, 71 miles; Dubai International Airport, 87 miles.

IRAQ

PORT: Basrah (30°31' N. Lat., 47°51' E. Long.).

APPROACH: The port of Basrah extends from the Outer Bar to 17 miles above the town of Basrah. The Shatt-al-Arab is a wide, deep fairway. The dredge channel admits vessels drawing up to 35 ft at H.H.W. At Fao (15 miles), Abadam (42 miles), Khorramshahr (53 miles), and Basrah (71 miles), vessels up to 561 ft long can lie with safety in the stream or alongside the Maqal Wharves. Vessels proceeding to and from Basrah are limited by the draft of the Karun Bar (between Khorramshahr and Abadan) which normally only allows vessels drawing about 29 ft to cross.

FACILITIES:

Wharves - Maqal Wharves have a continuous frontage of 6,562 ft, depth of 30 ft alongside, and are served by railway lines. They accommodate 12 vessels simultaneously. Another vessel can be accommodated at Ashar Pier (used by fishing vessels only), and there are also lighter berths about 1,640 ft long and 853 ft wide. Thirteen mooring buoys are available, including seven at Ashar. Concrete wharves, used as fertilizer wharves, are situated at the banks of Shatt Al-Arab River in Abu Flus town. Total length, 328 ft; width, 33 ft; for vessels up to 597 ft long, draft, 29 ft. Three steel jetties north of the Fertilizer Wharf, for vessels up to 561 ft long and 29-ft draft; equipped with six 5-ton electric shore cranes.

Storage - There are 38 large transit sheds and warehouses (1 million sq ft) providing covered accommodation for about 120,000 to 160,000 tons of cargo. Bonded storage facilities, as well as 1,800 tons of cold storage. Also an open area capable of providing storage for 60,000 tons.

Cranes - The wharves are served by 60 electric gantry shore cranes from 1.5 to 15 tons capacity and one electric shore crane of 60 tons capacity. In addition, two self-propelled floating cranes, one of which is 100 tons capacity, capable of lifting direct from ship to railway truck on the wharf, and the other of 20 tons capacity at 98 ft. There are also over 200 pieces of various handling equipment.

Water - Available.

Tanker terminals - Muftiya Jetties: One wooden jetty owned by the Authority; crude and refined oil for local consumption handled, also export oil products. There is also a concrete jetty available for berthing vessels of 574 ft.

Bunkers - Jetties can be supplied with fuel gas and diesel oil fuel.

NEW DEVELOPMENTS: Construction of new industrial port at Khor Al Zubair underway. There will be five berths each 820 ft long; storage buildings for the storage of phosphate and urea; capacity, 370,000 tons; and mechanical handling, conveying, and shiploading equipment.

SHIP REPAIRS: Floating dock available to a total weight of 4,000 tons. Also a slipway taking ships up to 700 tons.

REMARKS: None.

END

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