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MTMCTEA REPORT SE 90-3d-21

PORTS FOR NATIONAL DEFENSE

An Analysis of Unit Deployments Through US East Coast Ports

JUNE 1992

MILITARY TRAFFIC MANAGEMENT COMMAND
Transportation Engineering Agency
NEWPORT NEWS, VIRGINIA 23606-0276

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AN ANALYSIS OF UNIT DEPLOYMENTS THROUGH US EAST COAST PORTS

June 1992

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Newport News, Virginia 23606-0276

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Statement A per telecon
Army Traffic Management Command/MTTE-SEF
Newport News, VA 23606-0276

NWW 7/9/92

SECTION I
INTRODUCTION

A. BACKGROUND

1. In support of its role as the Department of Defense (DoD) executive agent for surface transportation and common user ocean terminals, Military Traffic Management Command (MTMC) has established the "Highways, Rail, and Ports for National Defense" programs, which identify and monitor the capability of the CONUS infrastructure to support mobilization and deployment.

2. This study, Volume I, of the Ports of National Defense (PND) Program contains revised information for selected east coast ports. It provides a comprehensive description of port facilities and an analysis of ship/berth capability.

B. PURPOSE

To evaluate US east coast commercial port facilities to determine whether they can support a deployment of military units aboard ships.

The study provides:

1. An assessment of the adequacy of commercial port facilities for the deployment of specific types of units.

2. Identification of terminals that are best suited to support deployments and selection of the best berths.

3. A ready-reference digest of the most significant port characteristics. It also describes port support capabilities for terminal operations.

C. CRITERIA

For a port to be considered adequate for the deployment of a military unit, the particular type of unit must be able to clear the port in 5 days. East Coast Army unit movement requirements are detailed in the appendix.

D. ASSUMPTIONS

The following assumptions were made to identify a port's deployment capability:

1. All suitable vessels in the Sealift Readiness Program (SRP), under the Military Sealift Command (MSC) control, and in the Ready Reserve Force (RRF) will be available for DoD use.

2. The rate of unit equipment arrival at a port is not a constraint; that is, equipment will be available for terminal reception.

3. The time allowed for port clearance starts the day after the first increments of the unit arrives in port and stops when all the ships are loaded.

4. Logistical support, such as drivers and mechanics, for deploying units will be provided by the Port Support Activity and/or the deploying unit.

E. METHODOLOGY

1. The number and characteristics of berths necessary to support unit deployments depends on the types of vessels used. Because of the uncertainty as to class or type of vessel that would be used, several ship mixes were selected.

The mixes provide four vessel combinations to be evaluated for each port and deploying unit. Specific vessel designs and some individual ships were selected to add realism to the port scenarios and to preclude any false conclusions on the compatibility between the port facilities and the vessels.

The many possible ship mixes beyond those shown below could provide just as many different loading strategies. But this study presents only a framework for planning and comparison. The characteristics of vessels that are used most frequently in this analysis are contained in MTMCTEA Pamphlet 700-4, Vessel Characteristics Pamphlet for Shiploading, September 1991.

a. Ship mix 1, composed entirely of roll on/roll off (RORO) vessels, is the best suited for moving unit equipment. However, since relatively few RORO ships are in the US-flag fleet, their availability during a contingency may be limited.

b. Ship mix 2 is a combination of vessels representative of those available for deployment. The ships are commercial vessels and RRF and MSC ships. Several ship types are represented.

c. Ship mix 3 consists entirely of breakbulk vessels, many from the RRF. The RRF consists of vessels upgraded, maintained, and positioned to assure availability within 5 to 10 days.

d. Ship mix 4 is composed of MSC's eight FSSs. These ships are large, fast, and self-sustaining.

2. Movement requirements are based on the table of equipment (TOE) authorization for types of units.

3. The facilities and capabilities of each port were determined by literature research, site surveys, and discussions with shipping companies, and military activities.

4. In many ports, RORO-ship ramp incompatibility with various apron heights and tidal changes presents problems. Berthing characteristics, tidal changes, and ship-draft variations frequently make the ramps unusable for part or all of the loading operation.

5. The movement requirements and port capabilities are analyzed for each port in section II of this study. Specific recommendations for each ship mix are made to identify which ports, terminals, and berths are best suited for deployment.

SECTION II

EAST COAST PORTS

PORT OF BALTIMORE (1990)

A. GENERAL

1. Location and Harbor Description (fig II-BAL-1)

The Port of Baltimore is at the head of the Patapsco River. It is about 12 miles northwest of the Chesapeake Bay. From the Atlantic Ocean, two distinct routes provide access to the port. From the south, access to the port is via the Chesapeake Bay between Cape Charles and Cape Henry (Virginia Capes). The Port of Baltimore is 150 miles from the Virginia Capes. The main ship channel in the Chesapeake Bay is 50 feet deep and 1,000 feet wide. The second access route is from the northeast via the Chesapeake and Delaware Canal (C&D Canal). The C&D Canal is 113 miles long with a main ship channel 35 feet deep and 600 feet wide.

Access to the individual terminals of the Port of Baltimore is via the Patapsco River and the Fort McHenry Channel. The Fort McHenry Channel is 50 feet deep and 800 feet wide. At Locust Point (Fort McHenry), the Patapsco River splits, forming the Northwest and Middle Branches. The Northwest Branch has two channels - East and West. The East Channel is 49 feet deep and 600 feet wide, and the West Channel is 40 feet deep and 600 feet wide. Part of the West Channel forms a 1,000- by 1,600-foot turning basin. The Middle Branch has one channel, Ferry Bar Channel. The east section of this channel is 42 feet deep and 600 feet wide. The west section of the channel is 35 feet deep and 400 feet wide.

Seven anchorages are available in the Baltimore Harbor. Two anchorages are for deep-draft vessels, and four anchorages are for shallow-draft vessels. The remaining anchorage is a dead ship anchorage. The US Coast Guard is responsible for the control and administration of all anchorages.

The mean tidal range is 1.1 feet at the Port of Baltimore. However, prolonged winds of constant direction may cause substantial variations in the tide.

Six bridges cross the navigable portions of the Baltimore Harbor. The Francis Scott Key Memorial Bridge is the only bridge crossing the main shipping channel. It has a horizontal clearance of 1,100 feet and a vertical clearance of 185 feet mean high water (MHW). The remaining five bridges are upstream of the terminals. They span the Middle Branch and the Curtis Creek section of the harbor.

Vessels en route to the harbor via the Chesapeake Bay pass beneath the two spans of the William Preston Lane, Jr. Memorial Bridge. The horizontal clearances for these spans range from 1,500 to 1,533 feet, and the vertical clearance is 187 feet MHW. The vertical clearances do not restrict the types of ships that normally call on the port.

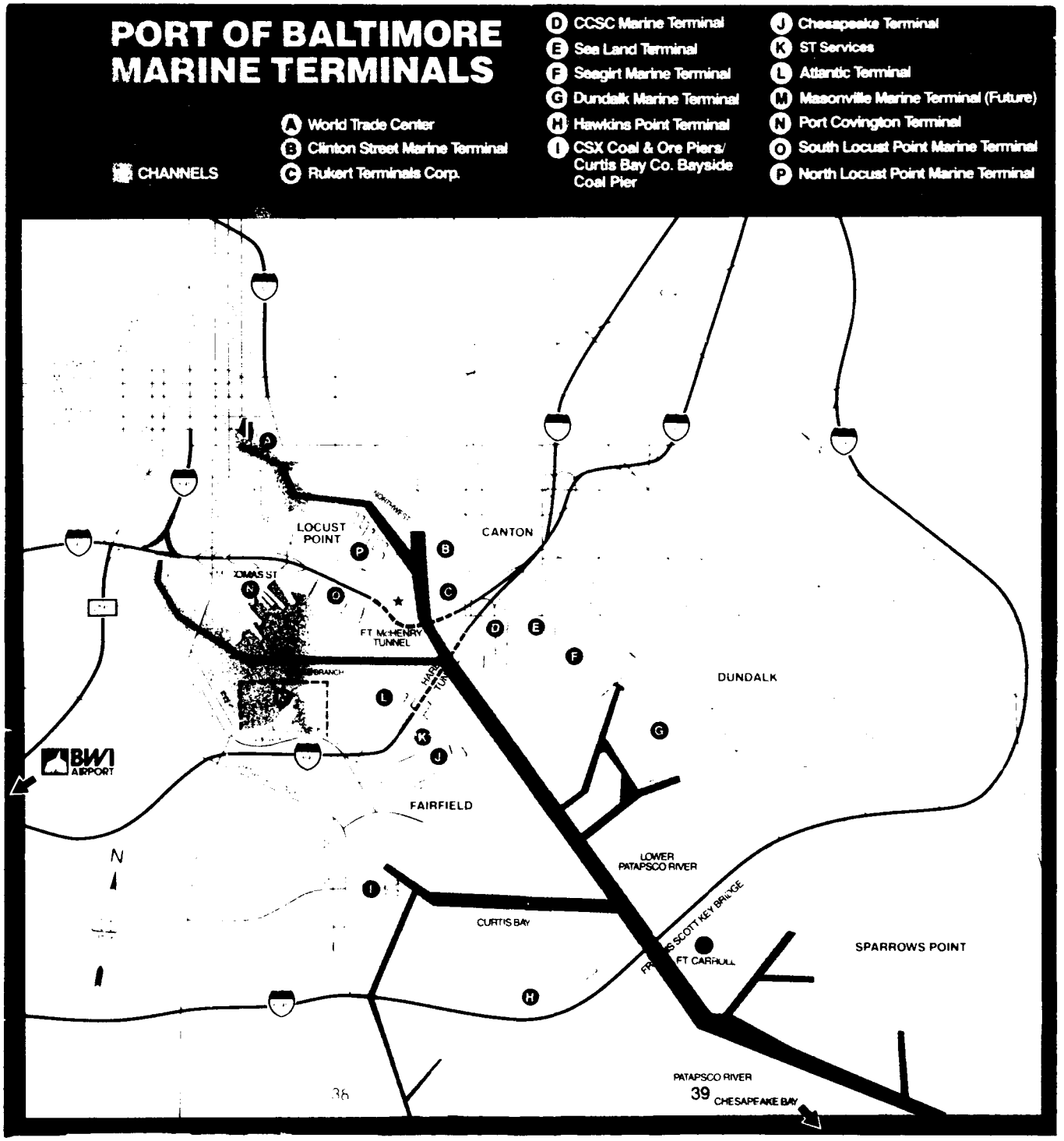


Figure II-BAL-1. Port of Baltimore.

2. Highway Access

Highway access to and from the Port of Baltimore is good. Highways entering Baltimore from the north and south are Interstate Routes 83, 95, 295, and 895 and Ritchie Highway (State Route 2). Highways entering the city from the west and east are Interstate Route 70 and US Route 40. Interstate Route 695 forms a beltway around the city and port areas of Baltimore. This beltway intersects all major highways in the area. I-95 runs parallel to South and North Locust Point Marine Terminals. Access to and from both terminals and I-95 is by way of McComas Street. Dundalk Marine and Seagirt Marine Terminals have access to I-95 and I-895 via Keith Avenue and Broening Highway.

3. Rail Access

An extensive rail network extends throughout the city and port areas of Baltimore. Two railroads, CSX Corporation (CSX) and Consolidated Rail Corporation (Conrail), provide direct rail access to the port of Baltimore.

Dundalk Marine Terminal, the port's largest shipping facility, has a railyard with five main tracks and two support tracks. Seagirt Marine Terminal has an intermodal facility that is discussed in paragraph D. Five regional railyards are within 1 to 4 miles of these terminals. The capacities of these railyards range from 450 to 3,000 railcars each.

4. Airports

The Baltimore/Washington International Airport provides air service to Baltimore. It is 10 miles south of Baltimore and 30 miles north of Washington, DC. Three air cargo buildings, totaling 103,000 square feet, are ready for use by airfreight handlers.

B. PORT FACILITIES

1. North Locust Point Marine Terminal (figs II-BAL-2 and II-BAL-3)

a. Berthing. North Locust Point Marine Terminal is an old facility. It is on the Patapsco River, the south bank of the Northwest Branch. The terminal consists of eight piers. However, only three are active general cargo piers. The active general cargo piers are piers 3 (west side), 4, and 5. Piers 4 and 5 are on the opposite side of one large pier. Piers 6, 8, and 9 are in poor condition. Pier 7 has a grain loading conveyor, and pier 10 has molasses handling equipment. The active general cargo piers are 1,200 feet long, with apron widths from 28 to 65 feet. Apron height averages 9 feet above mean low water (MLW), and the depth alongside the piers is 34 feet MLW. Piers 3W and 5 have transit sheds running their length.

Construction for pier 3W consists of concrete retaining walls with solid fill on timber-relieving platforms supported by timber piles. Construction for piers 4 and 5 consists of steel sheet pile retaining walls with asphalt-surfaced solid fill. Fronting the structure are concrete piles with rubber fenders on the sides and timber fenders at the face.

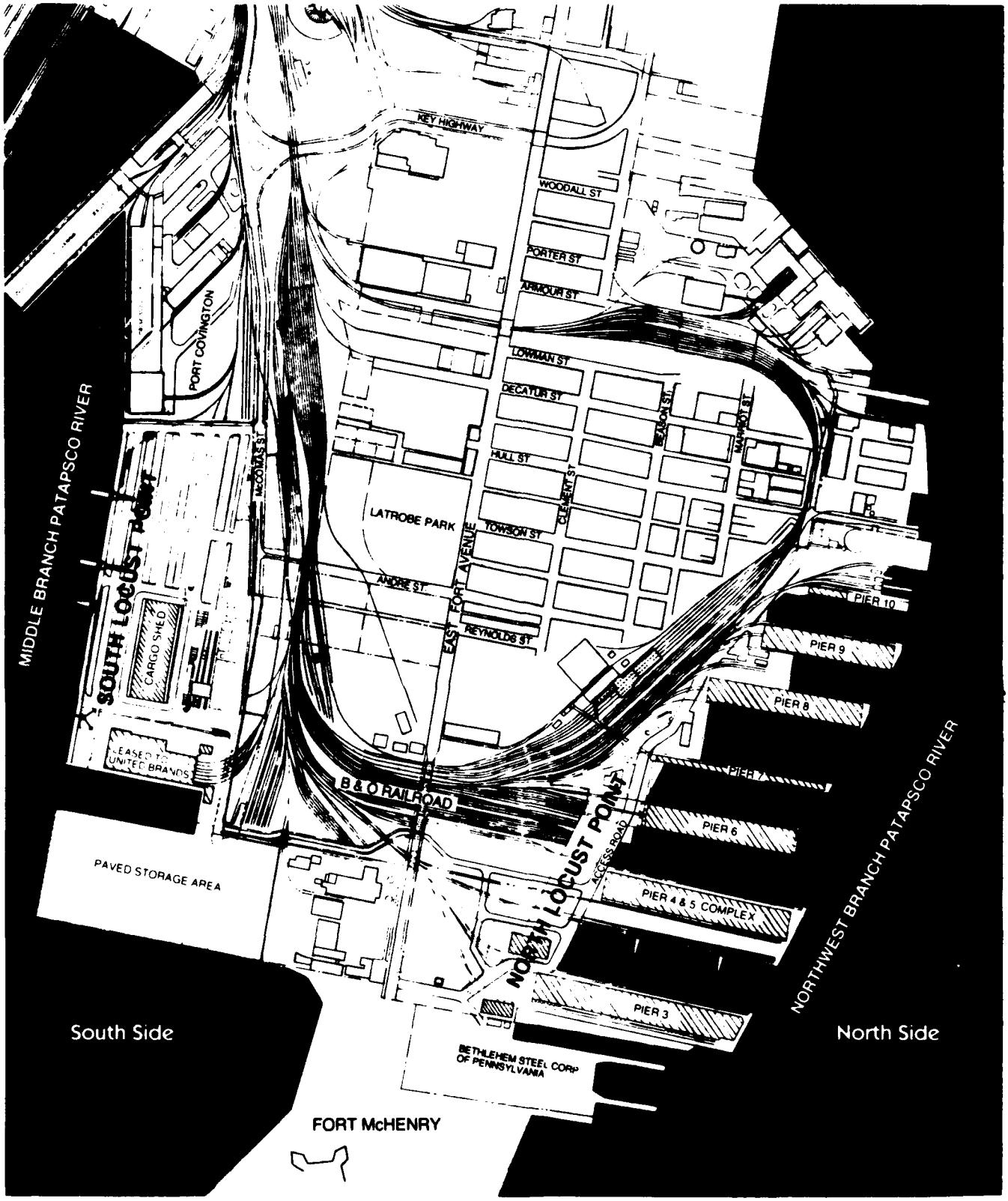


Figure II-BAL-2. North and South Locust Point Terminal.

Figure II-BAL-3. Aerial view of North Locust Point Marine Terminal.

Two 75-ton gantry-mounted whirly cranes serve pier 4. Each pier has adequate lighting for night operations.

Tables II-BAL-1 and II-BAL-2 show the berthing characteristics and capabilities of the terminal. The terminal's ability to support various shipping modes is described below:

(1) Breakbulk Operations. All three general cargo piers are suitable for breakbulk operations. These piers are well supported by transit sheds and rail.

TABLE II-BAL-1
BALTIMORE
BERTH CHARACTERISTICS OF NORTH LOCUST POINT

Characteristics	Berths		
	3W	4	5
Length (ft)	1,200	1,200	1,200
Depth alongside at MLW (ft)	32	32	32
Deck strength (psf)	600	800	800
Apron width (ft)	28	65	37
Apron height above MLW (ft)	9	9	9
Number of container cranes	0	0	0
Number of wharf cranes	0	2	0
Apron lighting	Yes	Yes	Yes
Straight-stern RORO facilities	Yes	Yes	Yes
Apron length served by rail (ft)	1,200	1,200	1,200

Notes:
1. Terminal open storage area is 23 acres

2. Terminal covered storage area is 362825 square feet

TABLE II-BAL-2
BALTIMORE
SUMMARY OF BERTHING CAPABILITIES OF NORTH LOCUST POINT

Vessel	Berths 3W	4	5
Breakbulk			
C3-S-33a	2	2	2
C3-S-37c	2	2	2
C3-S-37d	2	2	2
C3-S-38a	2	2	2
C4-S-1a	2	2	2
C4-S-1qb and 1u	2	2	2
C4-S-58a	2	2	2
C4-S-65a	2	2	2
C4-S-66a	a	a	a
C4-S-69b	1	1	1
Seatrain			
GA and PR-class	2	2	2
Barge			
LASH C8-S-81b	a,f	a,f	a,f
LASH C9-S-81d	a	a	a
LASH lighter	8	8	8
SEABEE C8-S-82a	a	a	a
SEABEE barge	6	6	6
RORO			
Comet	i,j	i,j	i,j
C7-S-95a/Maine-class	a,b	a	a,b
Ponce-class	b,h	b,h	b,h
Great Land-class	b,h	b,h	b,h
Cygnus/Pilot-class	b	1	b
Meteor	i,j	i,j	i,j
AmEagle/Condor	b	i,j	b
MV Ambassador	k,m	k,m	k,m
FSS-class	a,b	a	a,b
Cape D-class	a,b	a	a,b
Cape H-class	a,b	a	a,b
Container			
C6-S-1w	1,e	1,e	1,e
C7-S-68e	1,e	1,e	1,e
C8-S-85c	a,e	a,e	a,e
Combination			
C5-S-78a	a,e	a,e	a,e
C5-S-37e	1,e	1,e	1,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

(2) LASH and SEABEE Operations. Loading LASH lighters and SEABEE barges at the three general cargo piers is possible. The terminal has 24 LASH lighter or 18 SEABEE barge loading positions. Both the LASH and SEABEE mother ships would have to discharge and retrieve their respective lighters at anchor because of their draft limitations.

(3) RORO and FSS Operations. Pier 4 serves as the main RORO loading area for the terminal. At the shore end of the pier is a 12-foot-wide RORO ramp. Apron widths and lack of shore-based ramps restrict any RORO operations at piers 3W and 5. Table II-BAL-2 gives detailed information concerning the types of vessels that can conduct RORO operations at the terminal. It also indicates berthing restrictions that may apply. One FSS vessel could perform restricted parallel ramp RORO operations at pier 4. However, the berth depth and the lack of good staging areas could impede operations.

(4) Container Operations. North Locust Point Marine Terminal has no specialized container handling equipment. However, limited container operations could be conducted at pier 4, using the two 75-ton gantry cranes.

b. Materials Handling Equipment (MHE). Table II-BAL-3 lists the MHE owned and operated by the Port of Baltimore. This equipment is available to all of the port's terminals. Local contractors can supply any additional MHE requirements.

TABLE II-BAL-3
MATERIALS HANDLING EQUIPMENT

Type of Equipment	Capacity (STON)	Quantity
Truck crane	70	1
P&H crane (#6250)	300	2
P&H crane (#9125)	140	6
Trackmobile	6.5	1
Straddle carrier	33.6	6
Floating crane	250	1
Floating crane	150	1
Floating crane	275	1
Top loader (forklift)	50	1
Top loader (forklift)	42.5	7
Top loader (forklift)	40	4
Top loader (forklift)	35	7
Top loader (forklift)	33	2
Top loader (forklift)	32	1
Top loader (forklift)	30	1
Top loader (forklift)	26	1
Top loader (forklift)	25	5
Top loader (forklift)	23	1
Top loader (forklift)	20	2
Yard hustler tractor	45	200
Warehouse forklift	2-15	300
Yard chassis	35	32

c. Staging

(1) Open Storage. Table II-BAL-4 lists the open staging areas within the port of Baltimore. The terminal has about 30 acres of paved, open staging areas. Lumber, steel, heavy machinery, and a limited amount of containers are stored in these areas.

(2) Covered Storage. Table II-BAL-5 lists the covered facilities within the port of Baltimore. Covered storage consists of two transit sheds. Transit shed 3 on pier 3W has 191,792 square feet of storage space. The east side of the shed has a truck- and railcar-level platform. Transit shed 5, which serves piers 4 and 5, has 184,168 square feet of storage space.

d. Security. The Maryland Port Authority police provide 24-hour security patrols and control all gates. Fencing completely encloses the terminal.

TABLE II-BAL-4
OPEN STORAGE

Location	Area (acres)	Surface	Light-ing	Current Use
Dundalk Marine Terminal				
Rear of berth 1	9.2	Paved	Yes	Steel, lumber, containers, autos
Rear of shed 2	7.6	Paved	Yes	Containers, parking
Rear of shed 3	8.7	Paved	Yes	Gen cargo, parking
Rear of shed 4	7.6	Paved	Yes	Containers
Rear of passenger shed	7.5	Paved	Yes	Parking
Rear of shed 6	7.7	Paved	Yes	Containers
Rear of berth 7	4.3	Paved	Yes	Containers, steel
Rear of berth 8	4.1	Paved	Yes	Containers
Rear of berths 9 and 10	7.3	Paved	Yes	Containers
Rear of berth 11	12.8	Paved	Yes	Containers
Rear of berth 12	11.7	Paved	Yes	Containers
Rear of berth 13	14.6	Paved	Yes	Containers
Miscellaneous lots	250.9	Paved	Yes (135.9 acres)	Containers, autos, lumber
South Locust Point Marine Terminal				
Rear of terminal	22.5	Paved	Yes	Containers
Dockside prestaging	6.0	Paved	Yes	Containers
Under construction	20.0	Paved	Yes	Containers
North Locust Point Marine Terminal				
Opposite piers 3 through 5, 8, and 9	23.0	Paved	Yes	Containers, steel, general cargo

TABLE II-BAL-5
COVERED STORAGE

Storage Facility Designation	Floor Area (ft^2)	Number of Unloading Positions (nonconcurrent use) Trucks	Railcars	Current Use
Dundalk Marine Terminal				
Shed 2	100,000	34	7	General cargo
Shed 3A	50,000	18	8	General cargo
Shed 4	100,000	34	14	General cargo
Shed 6	100,000	34	14	General cargo
Shed 8	65,000	26	14	Container stuffing
Shed 11	65,000	26	14	Container stuffing
Shed 12	62,000	23	12	Container stuffing
B-1	15,000	0	0	Lumber
B-5	17,220	0	0	Lumber
B-6	31,000	0	0	Export parking
Terminal warehouse	142,950	51	8	Roll paper, general cargo
South Locust Point Marine Terminal				
South side shed	120,000	25	14	Container stuffing and general cargo
North Locust Point Marine Terminal				
Shed 3	185,225	20	7	General cargo
Shed 5	177,600	83	10	General cargo

e. Rail Operations. CSX provides rail service to the terminals. Pier 3W has two surface tracks on the west apron and a platform-level track on the east apron. Piers 4 and 5 have two surface tracks on the west apron and three surface tracks on the east apron. The platform on the east side of the transit shed serving piers 4 and 5 has two surface-mounted tracks that connect with the 3,000-car Locust Point holding yard. This switching yard is at the rear of the terminal. The terminal has no rail end ramps.

f. Truck Operations. Commercial trucks enter and leave the terminal through the two-lane McComas Street-Extended Gate. Fort Avenue Gate is a two-lane entry and exit gate; however, it is normally secured and not used. The transit shed on pier 3W has 20 truck handling positions, and the transit shed on Piers 4 and 5 has 83 saw-tooth truck loading positions.

g. Helicopter Operations. No designated areas for helicopter operations exist.

h. Marshaling Areas. No marshaling areas exist outside the terminal complex.

2. South Locust Point Marine Terminal (figs II-BAL-2 and II-BAL-4).

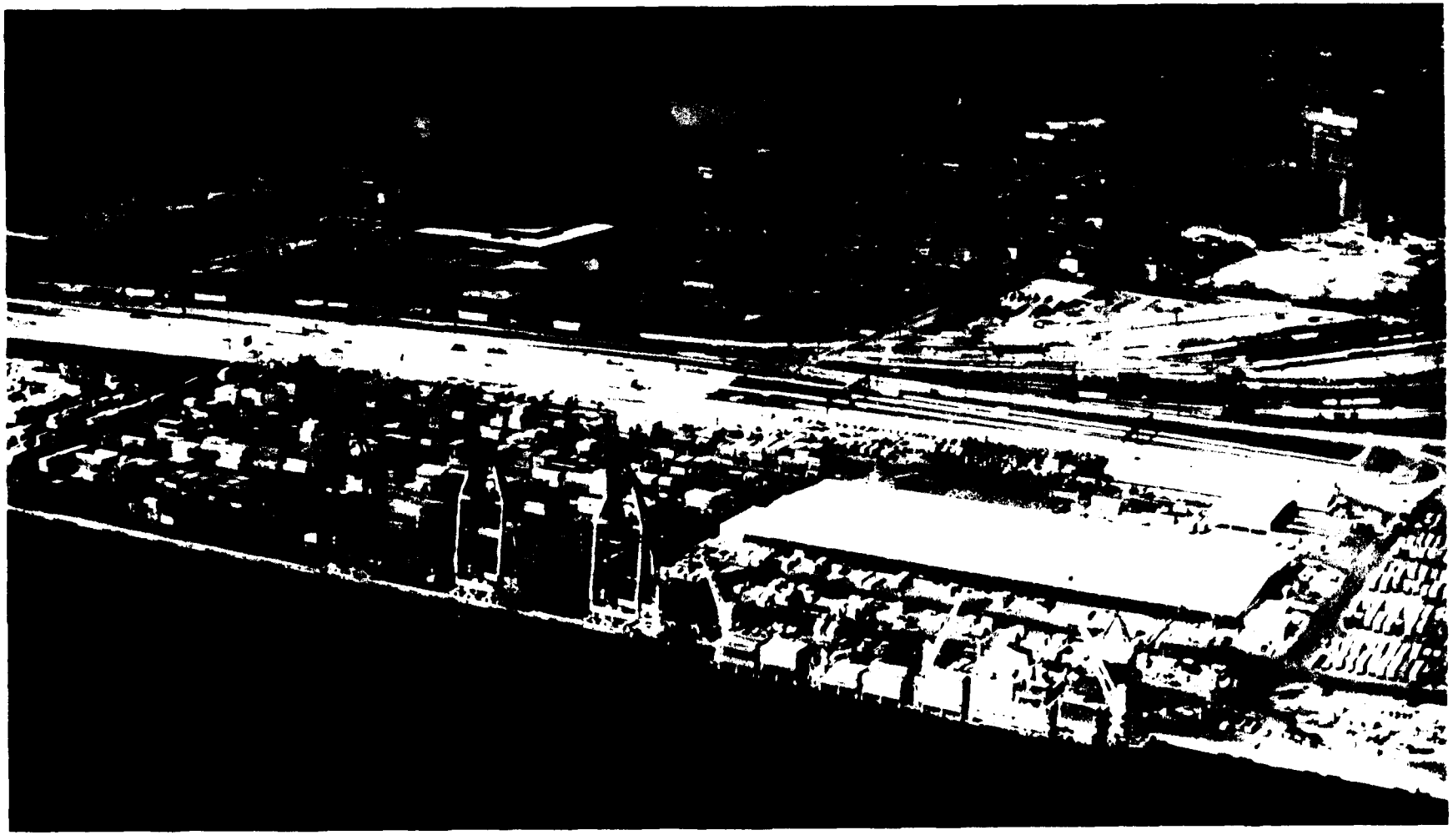


Figure II-BAL-4. Aerial view of South Locust Point Marine Terminal.

a. Berthing. South Locust Point Marine Terminal is on the Patapsco River on the north bank of the Middle Branch. The berthing facilities consist of one 3,195-foot marginal wharf. The open apron has a height of 9 feet above MLW.

Wharf construction consists of prestressed concrete pile and concrete-decked wharf with steel sheet pile bulkhead. The wharf has a timber fendering system.

Three 40-ton electric container cranes and one 100-ton revolving crane serve berths 9 and 10. The wharf and staging areas have adequate lighting for night operations.

Tables II-BAL-6 and II-BAL-7 show the berthing characteristics and capabilities of the terminal. The terminal's ability to support various shipping modes is as follows:

TABLE II-BAL-6
BALTIMORE
BERTH CHARACTERISTICS OF SOUTH LOCUST POINT

	Berths		
Characteristics	9	10	11
Length (ft)	1,139	900	1,156
Depth alongside at MLW (ft)	36	34	30
Deck strength (psf)	750	800	800
Apron width (ft)	Open	Open	Open
Apron height above MLW (ft)	9	9	9
Number of container cranes	0	2	1
Number of wharf cranes	0	1	1
Apron lighting	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No
Apron length served by rail (ft)	1,100	900	1,100

Notes:
1. Terminal open storage area is 43 acres
2. Terminal covered storage area is 120000 square feet

TABLE II-BAL-7
BALTIMORE
SUMMARY OF BERTHING CAPABILITIES OF SOUTH LOCUST POINT

Vessel	Berths 9	10	11
Breakbulk			
C3-S-33a	2	1	a
C3-S-37c	2	1	a
C3-S-37d	2	1	2
C3-S-38a	2	1	2
C4-S-1a	1	1	1
C4-S-1qb and 1u	1	1	a
C4-S-58a	1	1	a
C4-S-65a	1	1	1
C4-S-66a	2	1	a
C4-S-69b	1	1	a
Seatrain			
GA and PR-class	1	1	1
Barge			
LASH C8-S-81b	a,f	a,f	a,f
LASH C9-S-81d	a	a	a
LASH lighter	8	6	8
SEABEE C8-S-82a	a	a	a
SEABEE barge	5	4	5
RORO			
Comet	d,i,j	d,i,j	d,i,j
C7-S-95a/Maine-class	1	1	a
Ponce-class	h	h	h
Great Land-class	h	h	h
Cygnus/Pilot-class	1	1	1
Meteor	d,i,j	d,i,j	d,i,j
AmEagle/Condor	i,j	i,j	i,j
MV Ambassador	d	d	d
FSS-class	1	c	a
Cape D-class	i,j	i,j	a
Cape H-class	1	a	a
Container			
C6-S-1w	1,e	1	1
C7-S-68e	1,e	1	a
C8-S-85c	1,e	1	a
Combination			
C5-S-78a	1,e	1	a
C5-S-37e	1,e	1	1

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

(1) Breakbulk Operations. Unrestricted breakbulk operations can be performed at berths 10 and 11. The only covered storage is one 120,000-square-foot container freight station. Shore-based crane support is adequate if the container cranes are used. All US-flag breakbulk vessels listed in MTMCTEA Pamphlet 700-4 can be fully loaded at these berths. Berth 11, because of its 30-foot depth alongside, hampers some breakbulk vessels, as shown in table II-BAL-6.

(2) LASH and SEABEE Operations. South Locust Point Marine Terminal is capable of loading LASH lighters and SEABEE barges. The terminal has 22 LASH lighter or 14 SEABEE barge loading positions. The draft limitations of mother ships may require an instream discharge and retrieval of the lighters or barges.

(3) RORO and FSS Operations. RORO operations are restricted to side- and slewed-ramp vessel discharge or loading only. This is because of the lack of a straight-stern dock. The C7-S-95a/Maine-class, the Cygnus/Pilot-class, and the Cape H-class RORO vessels can work at South Locust Point Marine Terminal. FSS operations are only possible at berth 9. The other berths are restricted by water depth or berth length.

(4) Container Operations. South Locust Point Marine Terminal operates as a container terminal. The terminal has specialized container cranes, container handling equipment, and paved, open storage to support container operations. Container and combination vessels can operate at berths 10 and 11, but berth 11 has draft restrictions.

b. Materials Handling Equipment (MHE). Table II-BAL-3 lists the MHE owned and operated by the Port of Baltimore. Additional MHE is available from local contractors.

c. Staging

(1) Open Storage. The terminal has 43 acres of paved, lighted and open staging. A 20-acre site behind Port Covington is available for additional container storage.

(2) Covered Storage. Covered storage is provided by a container freight station. This station is next to berth 11 and has an area of 120,000 square feet.

d. Security. A fence completely encloses the terminal. The Maryland Port Authority police control all gates and provide 24-hour security patrols of the terminal.

e. Rail Operations. CSX provides two tracks to the terminal. Two service tracks serve the wharf apron for its entire length. Two surface tracks also serve the loading platform at the rear of the container freight station. The platform has a total of 14 railcar loading positions and one rail end ramp. The end ramp can serve up to six railcars at one time. The terminal has access to the 3,000-car Locust Point Marine Terminal holding yard.

f. Truck Operations. Commercial trucks enter and leave the terminal by way of two-lane McComas Street Gate. A truck weighing station is at the terminal. A second McComas Street Gate

is under construction for access to the terminal through the 20-acre container storage addition. The container freight station has 25 truck loading and handling positions. No truck fixed end ramps are available.

g. Helicopter Operations. No designated area exists for helicopter operations.

h. Marshaling Areas. No designated marshaling areas exist outside the terminal complex.

3. Dundalk Marine Terminal (figs II-BAL-5 and II-BAL-6)

a. Berthing. Dundalk Marine Terminal is the largest marine terminal complex in the Port of Baltimore. It is on the east bank of the Patapsco River. The terminal has 3 marginal wharfs divided into 13 berths. Of these berths, six are breakbulk cargo berths and seven are RORO and container berths. One double-stern RORO ramp is at berths 8 and 9, and a single-stern RORO ramp is at berth 13. The terminal has 9,332 total feet of wharfage and berthing space. Apron widths for berths 2 through 6 are 50 feet wide in front of transit sheds and are open in between. Berths 1 and 7 through 13 have open aprons. Apron height averages 9 feet above MLW. The depth alongside berths 1 through 10 is 34 feet MLW. Berths 11 through 13 have depths of 38 feet MLW. Berths 2 through 6 are next to transit sheds.

Construction for berths 1 through 10 consists of a concrete retaining wall with concrete-surfaced solid fill and a timber-relieving platform supported by timber piles. Piles made of concrete-filled steel pipe support concrete beams under the gantry crane rails. The wharf is fronted by a timber and rubber fendering system. The construction of wharves 11 through 13 is supported by concrete-capped prestressed concrete piling. These wharves have a steel sheet pile bulkhead and solid fill surfaced with asphalt. The wharf is also fronted by a timber fendering system.

Two 60-ton gantry cranes serve berths 2 through 6. Ten 45-ton diesel-electric container cranes serve berths 7 through 13. One 70-ton mobile crane is available at the terminal. The terminal is well lighted for night operations.

Tables II-BAL-8 and II-BAL-9 show the berthing characteristics and capabilities of the terminal. The terminal's ability to support various shipping modes is as follows:

(1) Breakbulk Operations. Breakbulk ships can load at all 13 berths. However, berths 1 through 6 are the recommended areas for breakbulk operations because they have shore-based gantry crane support and/or transit sheds. All US-flag breakbulk vessels listed in MTMCTEA Pamphlet 700-4 can, without restriction, fully load at these berths. As many as six vessels can operate at once.

(2) LASH and SEABEE Operations. LASH lighters and SEABEE barges can load at all berths. The terminal has 64 LASH lighter or 46 SEABEE barge loading positions. Only the LASH C9-S-81d mother ship can berth at Dundalk Marine Terminal. Other LASH and SEABEE mother ships may have to discharge and retrieve their respective lighters instream because of their draft limitations.

Figure II-BAL-5. Aerial view of Dundalk Marine Terminal.

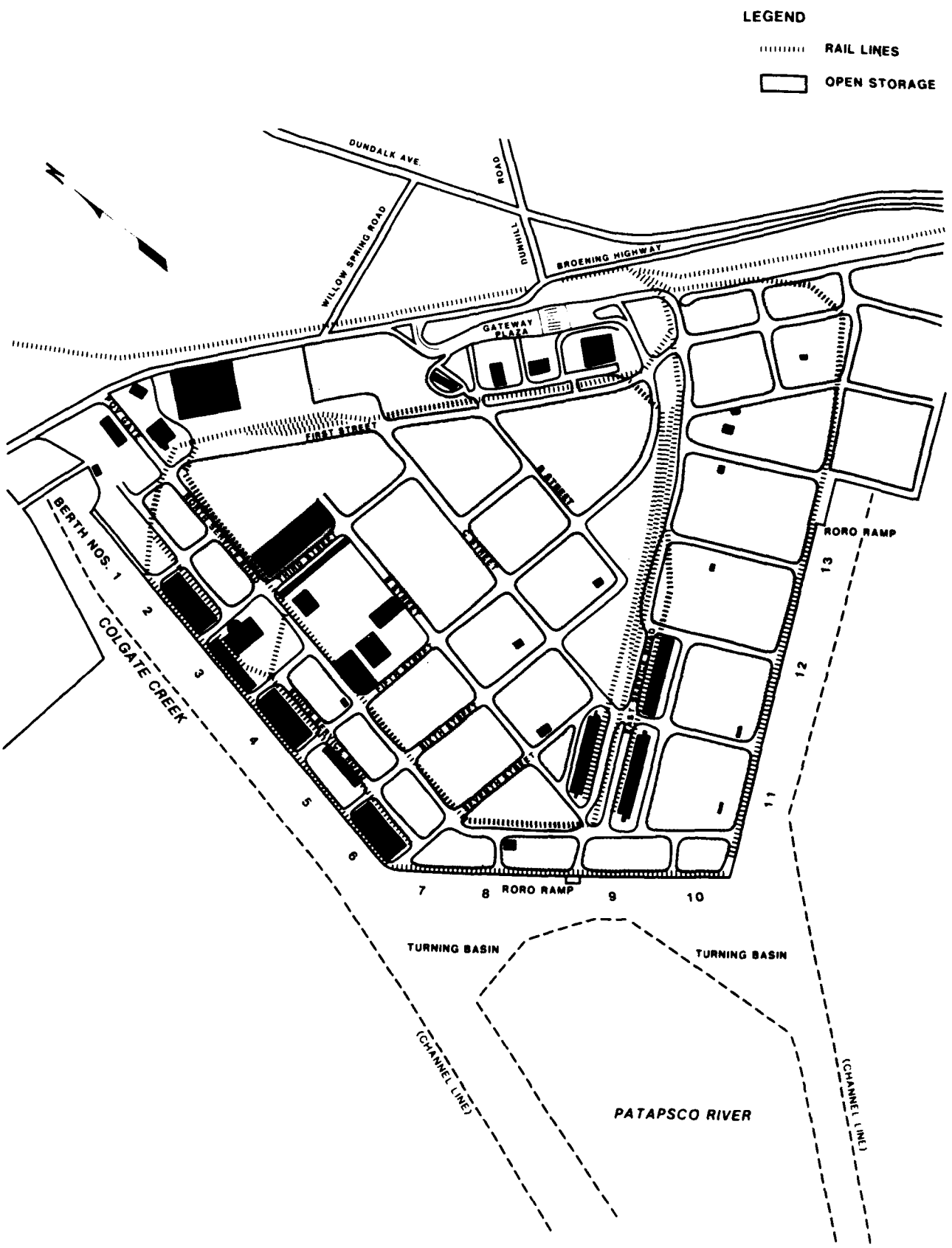


Figure II-BAL-6. Plan of Dundalk Marine Terminal.

TABLE II-BAL-8
BALTIMORE
BERTH CHARACTERISTICS OF DUNDALK MARINE TERMINAL

Characteristics	Berths				
	1	2-6	7-10	11-12	13
Length (ft)	800	3,000	2,658	1,824	1,050
Depth alongside at MLW (ft)	32	32	32	36	36
Deck strength (psf)	600	600	600	1,000	1,000
Apron width (ft)	Open	50	Open	Open	Open
Apron height above MLW (ft)	9	9	9	9	9
Number of container cranes	0	0	4	4	2
Number of wharf cranes	0	2	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	Yes	No	Yes
Apron length served by rail (ft)	800	3,000	2,658	1,824	1,050

Notes:
1. Terminal open storage area is 345 acres
2. Terminal covered storage area is 631450 square feet

TABLE II-BAL-9
BALTIMORE
SUMMARY OF BERTHING CAPABILITIES OF DUNDALK MARINE TERMINAL

Vessel	Berths				
	1	2-6	7-10	11-12	13
Breakbulk					
C3-S-33a	1	5	5	3	2
C3-S-37c	1	5	5	3	2
C3-S-37d	1	5	5	3	2
C3-S-38a	1	5	5	3	2
C4-S-1a	1	5	4	3	1
C4-S-1qb and 1u	1	5	4	3	1
C4-S-58a	1	5	4	3	1
C4-S-65a	1	5	4	3	1
C4-S-66a	a	a	a	3	1
C4-S-69b	1	4	4	3	1
Seatrain					
GA and PR-class	1	5	4	3	1
Barge					
LASH C8-S-81b	a,c,f	a,f	a,f	a,f	a,f
LASH C9-S-81d	a,c	a	a	a	a
LASH lighter	5	21	18	13	7
SEABEE C8-S-82a	a,c	a	a	a	a
SEABEE barge	4	15	13	9	5
RORO					
Comet	d,i,j	d,o	i,j	d,i,j	i,j
C7-S-95a/Maine-class	a	a,b	a	2	1
Ponce-class	h	b,h	h	h	h
Great Land-class	h	b,h	h	h	h
Cygnus/Pilot-class	1	b	4	2	1
Meteor	d,i,j	d,o	i,j	d,i,j	i,j
AmEagle/Condor	i,j	b	i,j	i,j	i,j
MV Ambassador	d	d	k,m	d	k,m
FSS-class	a,c	a,b	a	1	1
Cape D-class	a	a,b	a	i,j	i,j
Cape H-class	a	a,b	a	2	1
Container					
C6-S-1w	1,e	4,e	3	2	1
C7-S-68e	1,e	4,e	3	2	1
C8-S-85c	a,c,e	a,e	a	2	1
Combination					
C5-S-78a	a,e	a,e	a	2	1
C5-S-37e	1,e	4,e	4	2	1

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

(3) RORO and FSS Operations. Berths 8, 9, and 13 serve as the main sites for RORO operations. Berths 8 and 9 have a 122- by 75-foot double-stern concrete RORO ramp. Berth 13 has one 83-foot single-stern concrete RORO ramp. Portable shore- based RORO ramps are also available for use at other berths. Table II-BAL-7 provides information concerning the types of vessels that can conduct RORO operations at the terminal and any restrictions that may apply. This terminal has excellent facilities to support FSS operations. Berths 7 through 13 offer no restrictions to FSS vessels.

(4) Container Operations. Container operations are the primary function of Dundalk Marine Terminal. Berths 7 through 13 are for container operations. These berths have 10 specialized container cranes. Container handling equipment is available in the form of straddle carriers, yard hustlers, and top loaders (table II-BAL-3).

b. Materials Handling Equipment (MHE). Table II-BAL-3 lists the MHE owned and operated by the Port of Baltimore. Additional MHE is available from local contractors.

c. Staging

(1) Open Storage. The terminal has about 354 acres of open, paved storage. The open storage is mainly used for container and RORO storage. All open storage is well lighted for night operations.

(2) Covered Storage. About 750,000 square feet of covered storage is available at the terminal. This covered storage is distributed among 11 transit sheds and warehouses. These facilities store general cargo, lumber, export packing, and roll paper.

d. Security. The terminal, which is well lighted, is completely enclosed with a 7-foot chain link fence. The Maryland Port Authority police control all gates and provide 24-hour security patrols.

e. Rail Operations. Conrail provides one track to Dundalk Marine Terminal. However, an extensive rail system is within the terminal. This rail system includes one surface track running the length of berth 1, two surface tracks running the length of berths 2 through 6 and 11 through 13, and three surface tracks running the length of berths 7 through 10. This trackage joins additional terminal trackage, which includes one 50-car and one 200-car terminal railyard. Transit shed 2 has one platform-level track, and transit sheds 3A, 4, and 6 have two platform-level tracks. Three concrete fixed rail end ramps and one steel, bilevel mobile rail end ramp serve the terminal.

f. Truck Operations. Two gates serve the terminal. Commercial trucks enter and leave through the 10-lane gateway plaza. Automobiles enter and leave through the four-lane gate for privately owned vehicles. The terminal has two truck weighing stations. It also has two fixed and several portable truck end ramps. The transit sheds and warehouses have a total of 246 truck handling positions.

g. Helicopter Operations. The terminal has several suitable locations for helicopter landing and staging areas. The terminal's large, open spaces are an asset for this purpose.

h. Marshaling Areas. No designated marshaling areas exist outside the terminal complex. However, Dundalk Marine Terminal has enough staging area and support systems. No auxiliary marshaling areas should be necessary.

4. Seagirt Marine Terminal (figs II-BAL-7 and II-BAL-8)

a. Berthing. Seagirt Marine Terminal is in the Canton section of Baltimore, along the north shore of the Patapsco River. It is west of Dundalk Marine Terminal and connects to it via an internal highway bridge. This bridge crosses Colgate Creek.

The site was formerly a containment area for disposal of excavated material from the Fort McHenry Tunnel. Starting in May 1983, the site was dewatered. This was accomplished by using a system of drains and a sophisticated wick drain system. To further dewater and consolidate the site, a geotextile fabric covered by 3 feet of sand and rock was laid down. Over this, surcharge was placed. Finally, a special asphalt over the surcharge created the terminal's paving. Seagirt Marine Terminal occupies 135 acres of land. Concrete forms the new terminals 3,827 feet of rubber-fendered marginal wharf. Berthing consists of one Sea-Land berth and three common-user berths. The Sea-Land berth is mainly for barge operations. Berths 1 through 3 are open aproned and have 40 feet of water alongside. Deck strength at berths 1 through 3 is 1,000 pounds per square foot.

Figure II-BAL-7. Seagirt Marine Terminal.

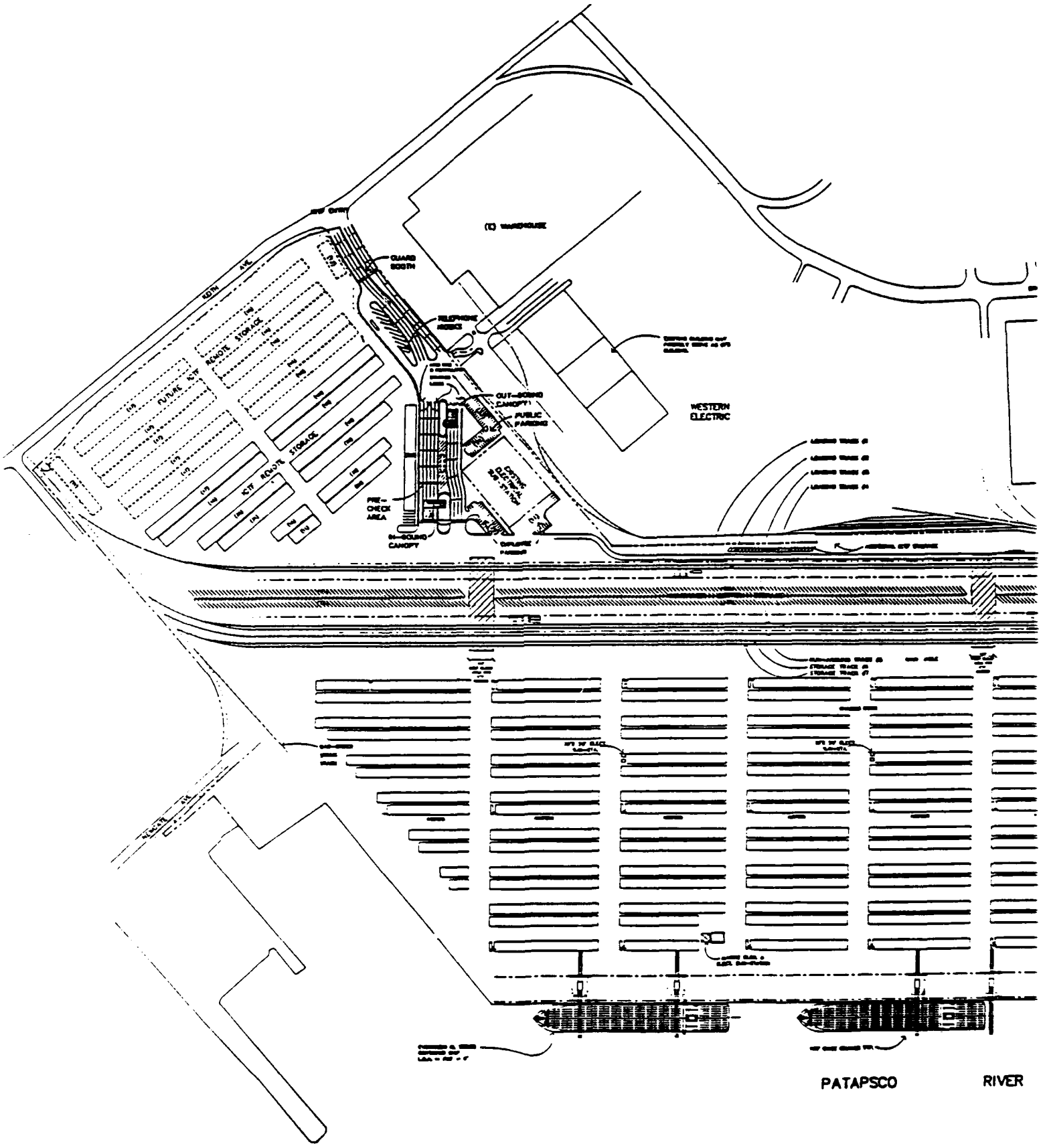
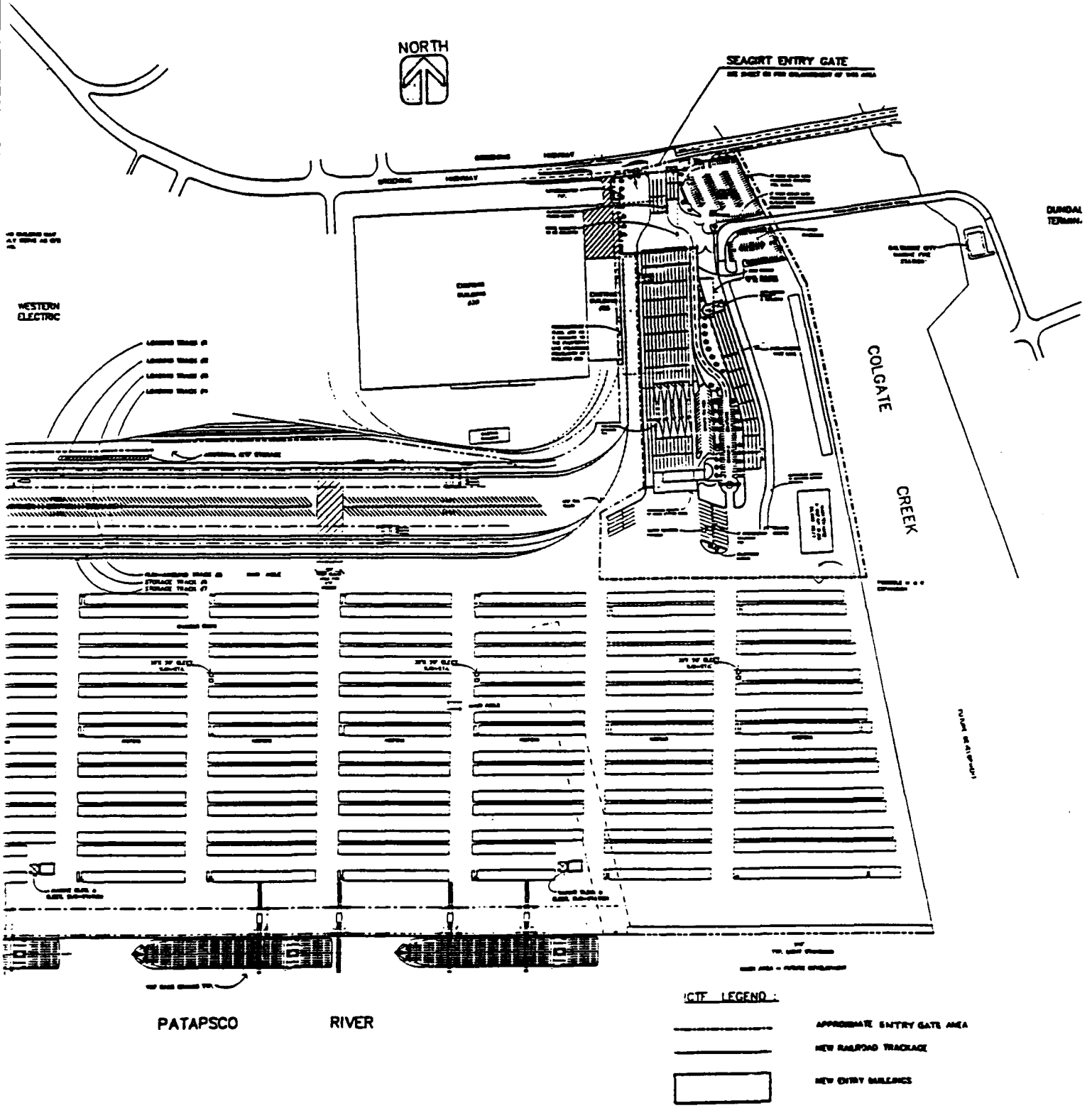


Figure II-BAL-8. Seagirt Marine Terminal site plan.


NORTH
SEAGIRT ENTRY GATE
WESTERN ELECTRIC
COLGATE
CREEK
PATAPSCO
RIVER
CTF LEGEND :
APPROXIMATE ENTRY GATE AREA
NEW RAILROAD TRACKAGE
NEW ENTRY BUILDINGS

plan.

Seagirt Marine Terminal is designed primarily as a container terminal. It has eight container cranes, and emphasis is put on chassis operation. However, the use of transtainers, straddle carriers, and top loaders makes off-chassis stacking possible. Operations at night are possible because of an excellent lighting system.

Tables II-BAL-10 and II-BAL-11 summarize the berthing characteristics and capabilities of the terminal. The terminal's ability to support various shipping modes is as follows:

(1) Breakbulk Operations. Unrestricted breakbulk operations are possible at berths 1 through 3. The terminal's container cranes are adaptable to load breakbulk cargo if necessary.

TABLE II-BAL-10
BALTIMORE
BERTH CHARACTERISTICS OF SEAGIRT MARINE TERMINAL

Characteristics	Berths			
	SL	1	2	3
Length (ft)	700	1,071	1,028	1,028
Depth alongside at MLW (ft)	30	40	40	40
Deck strength (psf)	600	1,000	1,000	1,000
Apron width (ft)	50	Open	Open	Open
Apron height above MLW (ft)	9	9	9	9
Number of container cranes	1	2	3	2
Number of wharf cranes	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	Yes	No	No	No
Apron length served by rail (ft)	0	0	0	0

Notes:
1. Terminal open storage area is 135 acres
2. Terminal covered storage area is 0 square feet

TABLE II-BAL-11
BALTIMORE
SUMMARY OF BERTHING CAPABILITIES OF SEAGIRT MARINE TERMINAL

Vessel	Berths			
	SL	1	2	3
Breakbulk				
C3-S-33a	a	2	2	2
C3-S-37c	a	2	1	1
C3-S-37d	1	2	1	1
C3-S-38a	1	2	1	1
C4-S-1a	1	1	1	1
C4-S-1qb and 1u	a	1	1	1
C4-S-58a	a	1	1	1
C4-S-65a	1	1	1	1
C4-S-66a	a	1	1	1
C4-S-69b	a	1	1	1
Seatrain				
GA and PR-class	1	1	1	1
Barge				
LASH C8-S-81b	a,c,f	a,f	a,f	a,f
LASH C9-S-81d	a,c	1	1	1
LASH lighter	5	7	7	7
SEABEE C8-S-82a	a,c	1	1	1
SEABEE barge	3	5	5	5
RORO				
Comet	i,j	d,i,j	d,i,j	d,i,j
C7-S-95a/Maine-class	a,b,c	1	1	1
Ponce-class	b,h	h	h	h
Great Land-class	b,c,h	h	h	h
Cygnus/Pilot-class	b	1	1	1
Meteor	i,j	d,i,j	d,i,j	d,i,j
AmEagle/Condor	b	i,j	i,j	i,j
MV Ambassador	k,m	d	d	d
FSS-class	a,b,c	1	1	1
Cape D-class	a,b	i,j	i,j	i,j
Cape H-class	a,b,c	1	1	1
Container				
C6-S-1w	1	1	1	1
C7-S-68e	a,c	1	1	1
C8-S-85c	a,c	1	1	1
Combination				
C5-S-78a	a	1	1	1
C5-S-37e	1	1	1	1

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

(2) LASH and SEABEE Operations. The terminal has 26 LASH lighter or 18 SEABEE barge loading positions. The C9-S-81d LASH and the C8-S-82a SEABEE vessels can load at berths 1 through 3. Loading of the C8-S-81b LASH vessel may be restricted because of the ship's draft.

(3) RORO and FSS Operations. No shore-based ramps are available for RORO operations. Berths 1 through 3 can accommodate the side- and slewed-ramp RORO vessels and FSS vessels.

(4) Container Operations. Seagirt Marine Terminal is primarily designed as a container terminal. All berths, except the Sea-Land berth, can handle containerships with no restrictions. Three of the terminal's container cranes include a dual-hoist system and can lift up to 55 containers an hour. With 100 feet between their legs, the 50-ton-capacity cranes can accommodate seven lanes of truck traffic.

b. Materials Handling Equipment (MHE). Table II-BAL-3 indicates equipment available at the Port of Baltimore. Additional MHE is available from local stevedoring agencies.

c. Staging

(1) Open Storage. The terminal has 135 acres of open storage areas. All areas are well lighted.

(2) Covered Storage. This terminal is a new container facility and no covered storage space is presently available.

d. Security. Maryland Port Authority provides 24-hour security personnel to the terminal. Entry to the facility is gate controlled, and fencing encloses its perimeter. Lighting further enhances security.

e. Rail Operations. The terminal has no apron track. Rail service consists of four loading tracks, 3,850 feet long, next to the marine terminal. This trackage provides an intermodal container transfer facility (ICTF), which is discussed in paragraph D.

f. Truck Operations. Trucks enter the terminal from Broening Avenue. The gate complex (fig II-BAL-8) has a number of features. These include a sign bridge, 13 entrance lanes, and weighing stations. The gate is also computer connected. This computer network makes the movement of cargo easier and the complex more efficient.

g. Helicopter Operations. The 135 acres of open storage could easily allow aircraft to fly directly into the terminal. The lights are adequately spaced and conspicuous enough that they should cause no problems.

h. Marshaling Area. No suitable locations are available for this purpose. The Port of Baltimore is in a heavily populated region. However, the large, open storage site within the terminal provides significant marshaling area.

C. SUPPORT SERVICE

1. Pilotage

The Maryland and Delaware Pilots Associations provide pilotage into and out of the Port of Baltimore. Ships traveling the C&D Canal use the Delaware pilots up to Chesapeake City, Maryland. There, the pilots change, and Maryland pilots bring the ships through the remainder of the canal and down the Chesapeake Bay into the Port of Baltimore. Ships traveling the Chesapeake Bay route pick up Maryland pilots at the Virginia Capes. Tugs meet all ships at the Francis Scott Key Bridge and accompany the vessels until they dock.

2. Harbor Craft

Two commercial companies provide shifting, docking, and towing services in the port area. These companies have tugs rated at 1,300 to 3,000 horsepower.

3. Stevedores

About 2,850 longshoremen are available in the Port of Baltimore area. MTMC International Traffic has determined that enough longshoremen will be available to meet mobilization needs.

4. Heavy-Lift Equipment

As shown in table II-BAL-3, the Port of Baltimore owns and operates fixed, mobile, and floating heavy-lift cranes. The three heavy-lift floating cranes range in capacity from 250 to 275 tons.

D. INTERMODAL CONTAINER TRANSFER FACILITIES (ICTF)

An ICTF is next to the Seagirt Marine Terminal. Recently constructed, it consists of four loading tracks, 3,850 feet long. The ICTF also has one turnaround track and two storage tracks. The 70-acre facility is capable of handling 200,000 units a year. Other features at the ICTF include two overhead cranes for loading double-stack trains and trailers on flatcars (TOFC). Also, two rubber-tired gantry cranes are located on the site.

E. FUTURE DEVELOPMENT

Both the newly constructed facilities of Seagirt Marine Terminal and the nearby ICTF are undergoing improvements.

The Maryland Port Administration (MPA) approved master plans for the modernization of Dundalk Marine Terminal. The modernization, planned over the next 5 to 10 years, includes a new entrance facility, redesign of the open storage area, and the elimination of some of the unused warehouses.

MPA plans to purchase new property to expand North Locust Point Marine Terminal. This will enhance the terminal's breakbulk capability.

Channel improvements are also soon to be underway. Work is being done on the port's southern approach. Forty miles of channel in the Chesapeake Bay, from Baltimore to the Atlantic Ocean, are being deepened to 50 feet.

In addition, the port's northern approach is slated for improvements. The US Army Corps of Engineers finalized plans for the widening of Brewerton Extension Angle. This is an important channel between the Port of Baltimore and the C&D Canal.

F. REQUIREMENTS AND RECOMMENDATIONS

1. Requirements

This section analyzes the deployment of a mechanized infantry division through the Port of Baltimore. The outloading time is 5 days. The vessels available to support the deployment are in appendix A. The vessel requirements for each ship mix are:

- Ship mix 1 (modern ships): 10 ships.
- Ship mix 2 (combination of ship types): 13 ships.
- Ship mix 3 (breakbulk ships): 28 ships.
- Ship mix 4 (fast sealift ships): 8 + 2 ships from another ship mix*.

*The division's ship requirement exceeds the current inventory. Two additional ships are required to deploy the division.

2. Recommendations

Tables II-BAL-12 through II-BAL-15 show the berthing recommendations for ship mixes 1 through 4. For these ship mixes, the Port of Baltimore can support the deployment of the division within 5 days.

TABLE II-BAL-12
BERTHING RECOMMENDATIONS FOR SHIP MIX 1
(MECHANIZED INFANTRY DIVISION)

Ship Mix 1 (Modern Ships)

Terminal: / Berth:	Dundalk 1	Dundalk 7-10	Dundalk 11-13	Dundalk 1-3
Day 1	AM Eagle	Cape D-1 Cape D-2	Cape H-2 FSS-1	FSS-2 FSS-3
Day 2	AM Condor	Cape H-1		
Day 3			MV Ambassador	
Day 4				
Day 5				

TABLE II-BAL-13
BERTHING RECOMMENDATIONS FOR SHIP MIX 2
(MECHANIZED INFANTRY DIVISION)

Ship Mix 2 (Combination of Ship Types)

Terminal: / Berth:	Dundalk 1	Dundalk 2-6	Dundalk 7-10	Seagirt 1-3	South Locust Point 10-11
Day 1	AM Eagle	C3-S-37d C4-S-65a C3-S-38a C4-S-58a C4-S-58a	FSS-1 FSS-2	Cape H-1 FSS-3	C3-S-33a
Day 2					
Day 3			Cape D-1 Cape D-2		
Day 4					
Day 5					

TABLE II-BAL-14
BERTHING RECOMMENDATIONS FOR SHIP MIX 3
(MECHANIZED INFANTRY DIVISION)

Ship Mix 3 (Breakbulk Ships)

Terminal: Berth:	Dundalk 1	Dundalk 2-6	Dundalk 7-10	Dundalk 11-13	South Locust Point 9-11	Seagirt 1-3	North Locust Point Pier 3W	North Locust Point Pier 4	North Locust Point Pier 5
Day 1	C4-S-65a	C4-S-65a C4-S-65a C3-S-33a C3-S-33a C3-S-37d	C3-S-37d C3-S-37d C3-S-37d C4-S-37c C4-S-58a	C4-S-58a C4-S-58a C3-S-38a C3-S-38a C3-S-38a	C4-S-65a C4-S-65a C4-S-65a	C4-S-58a C4-S-1u C3-S-38a C3-S-33a C3-S-33a	C3-S-37d	C3-S-37c C3-S-37c	C4-S-58a
Day 2									
Day 3									
Day 4									
Day 5									

TABLE II-BAL-15
BERTHING RECOMMENDATIONS FOR SHIP MIX 4
(MECHANIZED INFANTRY DIVISION)

Ship Mix 4 (Fast Sealift Ships)			
Terminal: Berth:	Seagrit 1-3	Dundalk 7-10	Dundalk 11-13
Day 1	FSS-1 FSS-2	FSS-3 FSS-4	FSS-5 FSS-6
Day 2			
Day 3	AM Condor	AM Eagle	FSS-7 FSS-8
Day 4			
Day 5			

PORT OF BOSTON (1990)

A. GENERAL

1. Location and Harbor Description (fig II-BOS-1)

The Port of Boston is on the western side of Massachusetts Bay, about 50 nautical miles northwest of the tip of Cape Cod. The port complex consists of six major terminals. These terminals handle a wide range of cargo, including container, RORO, general, bulk, liquids, chemicals, scrap, and passengers. For this study, only three terminals, Moran Container Terminal, Conley Terminal, and the Massport Marine Terminal/Harbor Gateway Complex, are being analyzed.

Entrance to the port is via one of several channels from the Atlantic Ocean to President Roads at the mouth of Outer Harbor. From President Roads, entrance is via the main ship channel into Inner Harbor. The three main channels are: Boston North Channel, Boston South Channel, and the Narrows. The depths of the channels range from 26 feet for the Narrows Channel to 40 feet for the Boston North and South Channels. The main ship channel is 40 feet deep. Its width varies from 600 to 900 feet.

President Roads is the principal deep water anchorage and is the common point at which all important channels of Outer Harbor converge.

The mean tidal range at the Port of Boston varies from 9 feet at Boston Light to 9.6 feet at the Mystic River Bridge.

The Mystic River Bridge crosses the main ship channel just east of the Moran Container Terminal. This is a fixed bridge with a horizontal clearance of 575 feet mean high water (MHW) and a vertical clearance of 135 feet over the channel.

Three tunnels extend under the main ship channel between Boston and East Boston. Two, the Summer and Callahan, are for vehicles. The other, the East Boston, is operated by the Massachusetts Bay Transportation Authority for rapid transit trains.

2. Highway Access

An extensive network of highways serves the Port of Boston. The port area has access to Interstate Routes 90, 93, and 95; US Routes 1 and 3; and Massachusetts Routes 2, 3, 9, 28, 30, and 99.

Access to the Moran Container Terminal, in the suburb of Charlestown, is best gained from the northwest, off I-93 at Exit 28 (southbound) or Exit 29 (northbound), to Terminal Street via Mystic and Medford Streets.

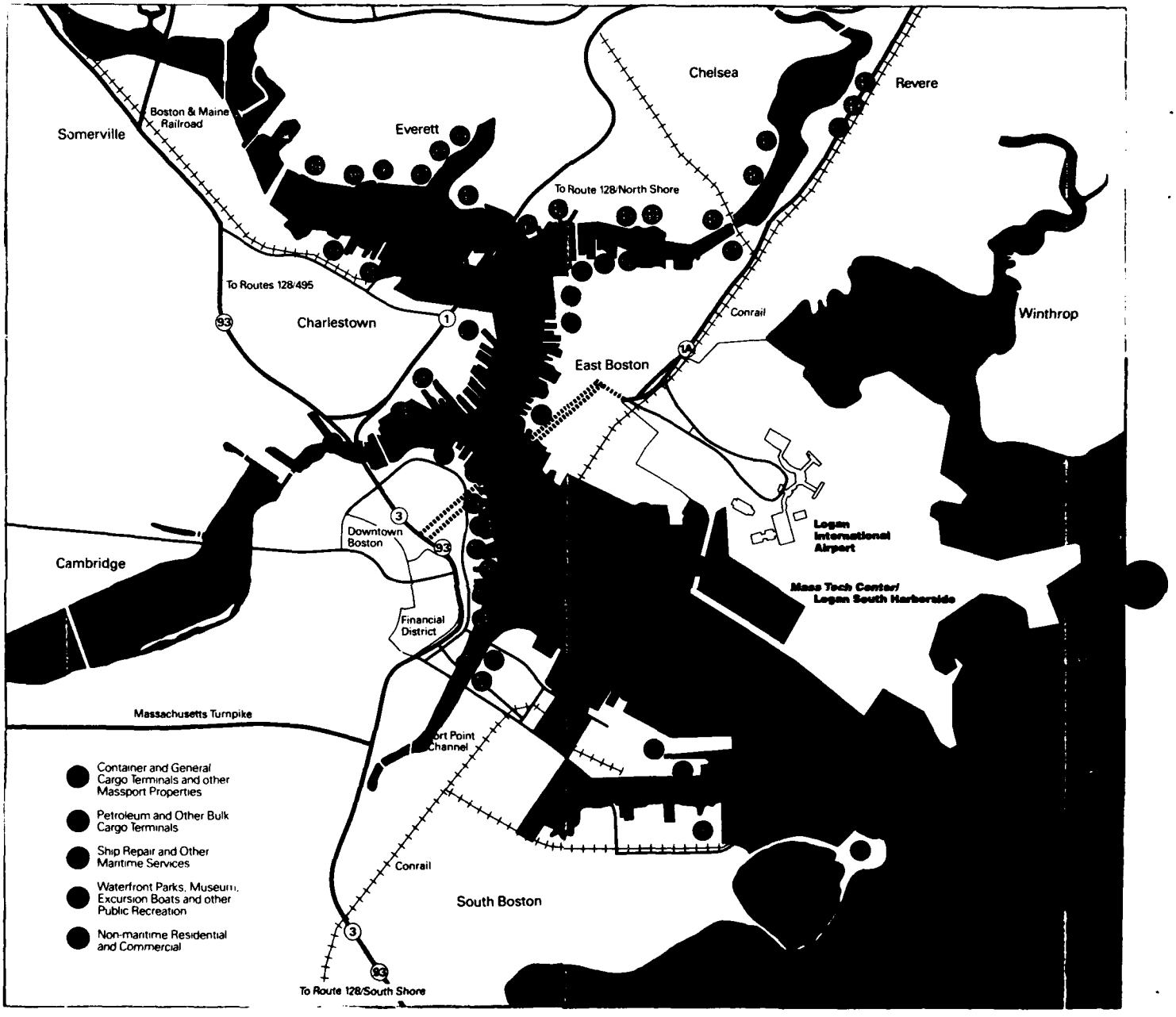


Figure II-BOS-1. Port of Boston.

Access to the Conley Terminal and Massport Marine Terminal/Harbor Gateway Complex is off I-93 at Exit 15, to William J. Day Boulevard. The gate to Conley Terminal is on William J. Day Boulevard. Massport Marine Terminal/Harbor Gateway Complex is reached by turning onto Summer Street from William J. Day Boulevard. The gate is at the Summer and Terminal Streets intersection.

Traffic congestion is chronic for the entire port area. Normal congestion is aggravated by construction projects that eventually will alleviate most of the problem. The South Boston Bypass Road is scheduled for completion in 1995.

3. Rail Access

Two major railroad companies serve the Port of Boston, the Conrail system and the Boston and Maine Railroad. The Moran Container Terminal, served by the Boston and Maine Railroad, has direct rail service into the terminal proper. However, rail is not now used to move cargo into or out of the terminal. Rail service at Massport Marine Terminal/Harbor Gateway Complex is marginal at best. Conrail does have trackage into the terminal, but most lines have been cut or paved over. The existing usable line runs between two storage sheds in the former Boston Army Base and does not offer the access needed for military cargo operations. Conley Container Terminal is no longer served by rail directly. The trackage there has been cut in several spots and paved over in others.

4. Airports

The Port of Boston is served by Logan International Airport. The airport has four concrete-paved runways, 150 feet wide. The shortest of these runways is 7,600 feet long, and the longest is 9,800 feet long. The airport is within 6 road miles of all terminal facilities.

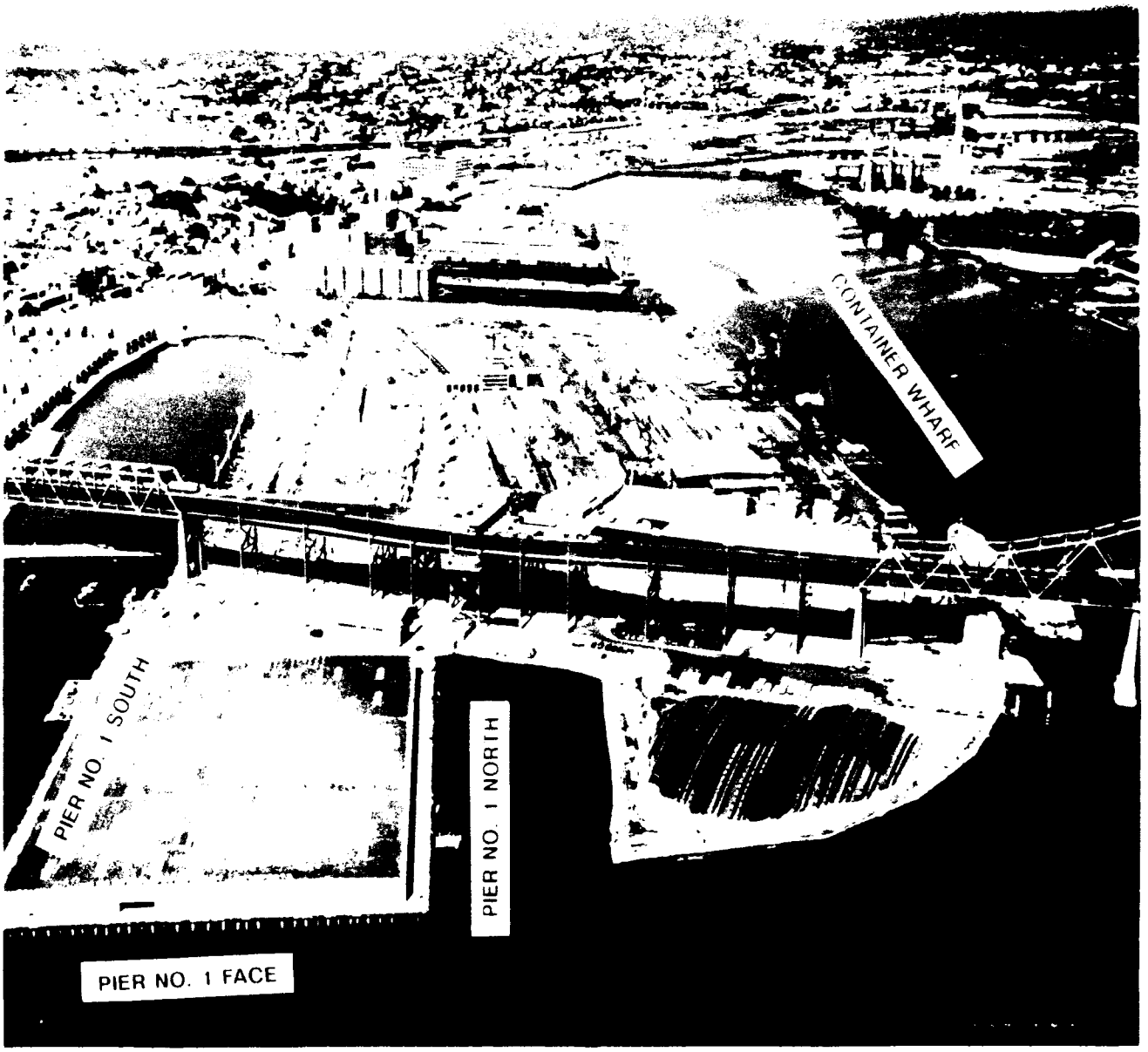
B. PORT FACILITIES

1. Moran Container Terminal (figs II-BOS-2 and II-BOS-3)

a. Berthing. The Moran Container Terminal consists of marginal wharves and piers, which range in length from 468 to 1,100 feet. Apron width varies from 20 feet to open, while apron height ranges from 16 to 18 feet above mean low water (MLW). Deck strength is 600 pounds per square foot. A container freight station of 150,100 square feet is immediately next to piers No. 1F and 1S. This facility also serves the container wharf.

Wharf and pier construction at the Moran Container Terminal consists of masonry bulkhead and retaining walls with solid fill. They are fronted by concrete-filled steel pipe (container wharf) and steel pile (pier 1) concrete-decked extensions and a timber fendering system.

One 40-ton and one 70-ton container crane serve the container wharf. Both cranes have telescopic spreaders. The 70-ton crane has twin-lift capability. Local stevedoring companies can also supply the Moran Container Terminal with a number of mobile cranes, ranging from 50- to 250-tons capacity.



massport

Figure II-BOS-2. Moran Container Terminal.

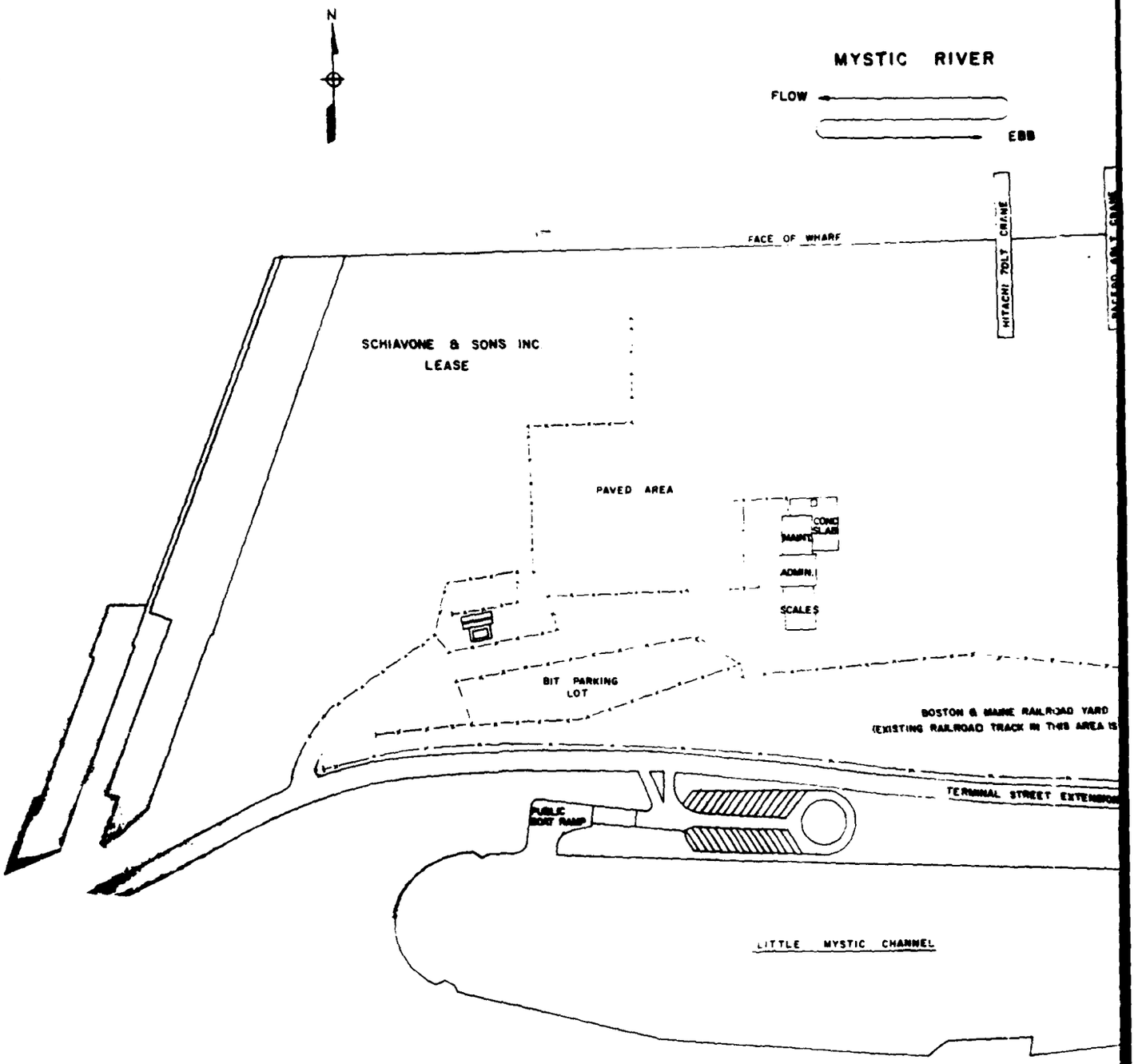
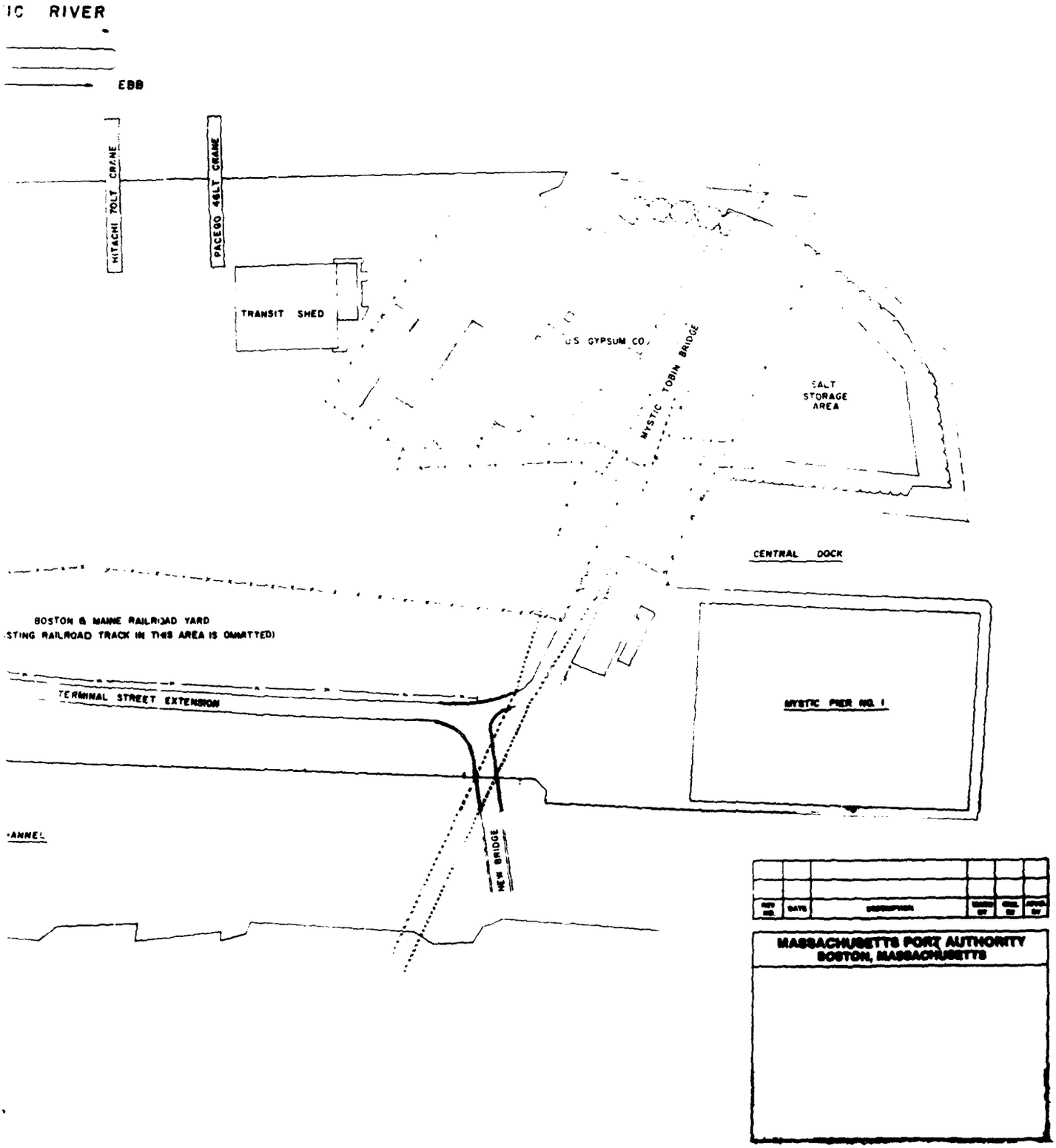


Figure II-BOS-3. Moran Container Terminal site map.


IC RIVER
EBB
HITACHI 70LT CRANE
PACECO 45LT CRANE
TRANSIT SHED
US GYPSUM CO.
MYSTIC TOBIN BRIDGE
SALT STORAGE AREA
CENTRAL DOCK
BOSTON & MAINE RAILROAD YARD
STING RAILROAD TRACK IN THIS AREA IS OMMITTED)
TERMINAL STREET EXTENSION
MYSTIC PIER NO. 1
ANNEL
NEW BRIDGE
MASSACHUSETTS PORT AUTHORITY
BOSTON, MASSACHUSETTS

Lighting at the Moran Container Terminal is adequate to conduct night operations.

Tables II-BOS-1 and II-BOS-2 show the berthing characteristics and capabilities of the Moran Container Terminal. The terminal's potential to support various shipping modes is described below.

(1) Breakbulk Operations. Breakbulk operations can be performed at all berths, except No. 1F, where the 468-foot length is inadequate for breakbulk vessels. Mobile cranes, furnished by stevedoring companies, can assist in accomplishing breakbulk operations at the terminal.

TABLE II-BOS-1
PORT OF BOSTON
BERTH CHARACTERISTICS OF MORAN CONTAINER TERMINAL

	Berths			
Characteristics	Cntnr Whf	Pier No 1F	Pier No 1N	Pier No 1S
Length (ft)	1,100	468	672	897
Depth alongside at MLW (ft)	40	40	35	35
Deck strength (psf)	600	600	600	600
Apron width (ft)	Open	20	25	Open
Apron height above MLW (ft)	18	16	16	35
Number of container cranes	2	0	0	0
Number of wharf cranes	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	No
Apron length served by rail (ft)	0	0	0	0

Notes:
1. Terminal open storage area is 50 acres
2. Terminal covered storage area is 0 square feet

TABLE II-BOS-2
PORT OF BOSTON
SUMMARY OF BERTHING CAPABILITIES OF MORAN CONTAINER TERMINAL

Vessel	Berths			
	Cntnr Whf	Pier No 1F	Pier No 1N	Pier No 1S
Breakbulk				
C3-S-33a	2	c	1	1
C3-S-37c	2	c	1	1
C3-S-37d	2	c	1	1
C3-S-38a	2	c	1	1
C4-S-1a	1	c	1	1
C4-S-1qb and 1u	1	c	1	1
C4-S-58a	1	c	1	1
C4-S-65a	1	c	1	1
C4-S-66a	1	c	1	1
C4-S-69b	1	c	1	1
Seatrain				
GA and PR-class	1	c	1	1
Barge				
LASH C8-S-81b	a,g	a,c,g	a,c,g	a,g
LASH C9-S-81d	1	c	a,c	a
LASH lighter	7	3	4	6
SEABEE C8-S-82a	1	c	a,c	a
SEABEE barge	5	2	3	4
RORO				
Comet	d,i,j	c,d,o	d,o	d,i,j
C7-S-95a/Maine-class	i,j	b,c	b,c	i,j
Ponce-class	h	b,c,h	b,c,h	h
Great Land-class	h	b,c,h	b,c,h	h
Cygnus/Pilot-class	i,j	b,c	b	i,j
Meteor	d,i,j	c,d,o	d,o	d,i,j
AmEagle/Condor	i,j	b,c	b	i,j
MV Ambassador	d	c,d,o	d	d
FSS-class	i,j	b,c	b,c	c
Cape D-class	i,j	b,c	b,c	i,j
Cape H-class	i,j	b,c	a,b,c	a
Container				
C6-S-1w	1	c,e	1,e	1,e
C7-S-68e	1	c,e	c,e	1,e
C8-S-85c	1	c,e	c,e	1,e
Combination				
C5-S-78a	1	c,e	1,e	1,e
C5-S-37e	1	c,e	1,e	1,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

(2) LASH and SEABEE Operations. LASH lighters and SEABEE barges can be loaded at all berths. The terminal has 20 LASH lighter or 14 SEABEE barge loading positions. A C9 LASH or a SEABEE barge mother ship can use the container wharf without restriction. Berth length and/or depth alongside, or channel depth, may restrict other types of vessels or additional mother ships from using the terminal. These vessels would have to discharge and retrieve their respective lighters in stream.

(3) RORO and FSS Operations. Table II-BOS-2 gives detailed information on the types of vessels that may or may not conduct RORO operations at the terminal. This table also lists any restrictions that may apply.

The container wharf is the best location for FSS operations. This site has 50 acres of paved marshaling area to support FSS operations. However, the 9.6-foot tidal range at Boston might result in insufficient ramp clearance at low tide to sustain RORO operations. This is also true for RORO operations on No. 1S, the only other berth at Moran Container Terminal suitable for RORO.

(4) Container Operations. The Moran Container Terminal can accommodate any containership at the container wharf, as well as ships up to C8 at pier No. 1S and C6 at pier No. 1N. However, container handling equipment is only available at the container wharf. Container operations at pier No. 1N are impractical because of the limitations of the apron width.

b. Materials Handling Equipment (MHE). MHE assets available at the terminal exceed any requirements generated by the Port of Boston. The stevedoring companies serving the port can provide any additional MHE required. Listing the available MHE would be impractical.

c. Staging

(1) Open Storage. The Moran Container Terminal has 50 acres of paved storage space. This space is primarily for container staging and transshipment.

(2) Covered Storage. The terminal has 150,100 square feet of covered storage space (container freight station), serving all four berths. The building, the central feature of pier No. 1, provides truck access ramps from the shortened platform, as well as two 100- by 17-foot platforms along each side.

d. Security. Massport Transit Police maintains a guard force that controls entry gates and provides mobile patrols 24 hours a day. A well-lighted, 7-foot-high chain link fence with three strands of barbed wire protects the port's perimeter.

e. Rail Operations. The Boston and Main Railroad serves the Moran Container Terminal. No usable apron tracks or permanent end ramps are at the terminal; however, several suitable locations are available for temporary end ramps. The track provides direct access into the area most suitable for cargo staging.

f. Truck Operations. Commercial truck access to the terminal is by I-93 to Exit 28 (southbound) or Exit 29

(northbound), Mystic Street to Medford Street, and then to Terminal Street. The only active gate is the Terminal Street gate (Gate 1). A second gate at the foot of Terminal Street near pier No. 1 is normally closed. No permanent ramps other than these at the container freight station are available.

g. Helicopter Operations. The best location for helicopter operations is in the northeastern end of the cargo staging area of the container wharf.

h. Marshaling Area. The 50 acres of open, paved staging area is sufficient for marshaling requirements.

2. Conley Terminal (figs II-BOS-4 and II-BOS-5)

a. Berthing. The Conley Terminal consists of marginal wharves, which range in length from 600 to 2,000 feet. Apron width for the entire terminal is open. Apron height is 15 feet above MLW. The depth alongside is 40 feet (MLW) for all berths. Deck strength is 600 pounds per square foot, or greater. The terminal has no covered storage space

Wharf and pier construction at the terminal varies. Some are steel pile, concrete-decked wharves fronted by a timber fendering system (berth 11). Others are either part timber pile, asphalt-surfaced timber docks or part timber pile, concrete-decked wharves fronted by a timber fendering system (berths 12 through 17).

Two 40-ton-capacity gantry container cranes serve berth 11. One 30-ton-capacity gantry container crane serves berth 17. Local stevedoring companies can also supply additional mobile cranes with capacities ranging from 50 to 250 tons, if required.

The Conley Terminal is well lighted, and night operations can be conducted.

Tables II-BOS-3 and II-BOS-4 show the berthing characteristics and capabilities of the Conley Terminal. The terminal's potential to support various shipping modes is described below:

(1) Breakbulk Operations. Breakbulk operations can be performed at all berths, provided ship cranes and/or mobile cranes are adequately available. However, the lack of covered storage space or transit sheds will impede staging of cargo for breakbulk operations.

(2) LASH and SEABEE Operations. Except for the C8 LASH vessels, LASH and SEABEE mother ships can load at berths 11 through 15 without restriction. Also, up to 29 LASH lighter or 21 SEABEE barge loading positions are available at the terminal. This mode of operation will require the mother ships to discharge and retrieve their respective lighters/barges instream. Mobile cranes will also be required. LASH and SEABEE operations will be adversely affected by the lack of covered storage/staging areas.

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Figure II-BOS-4. Conley Terminal.

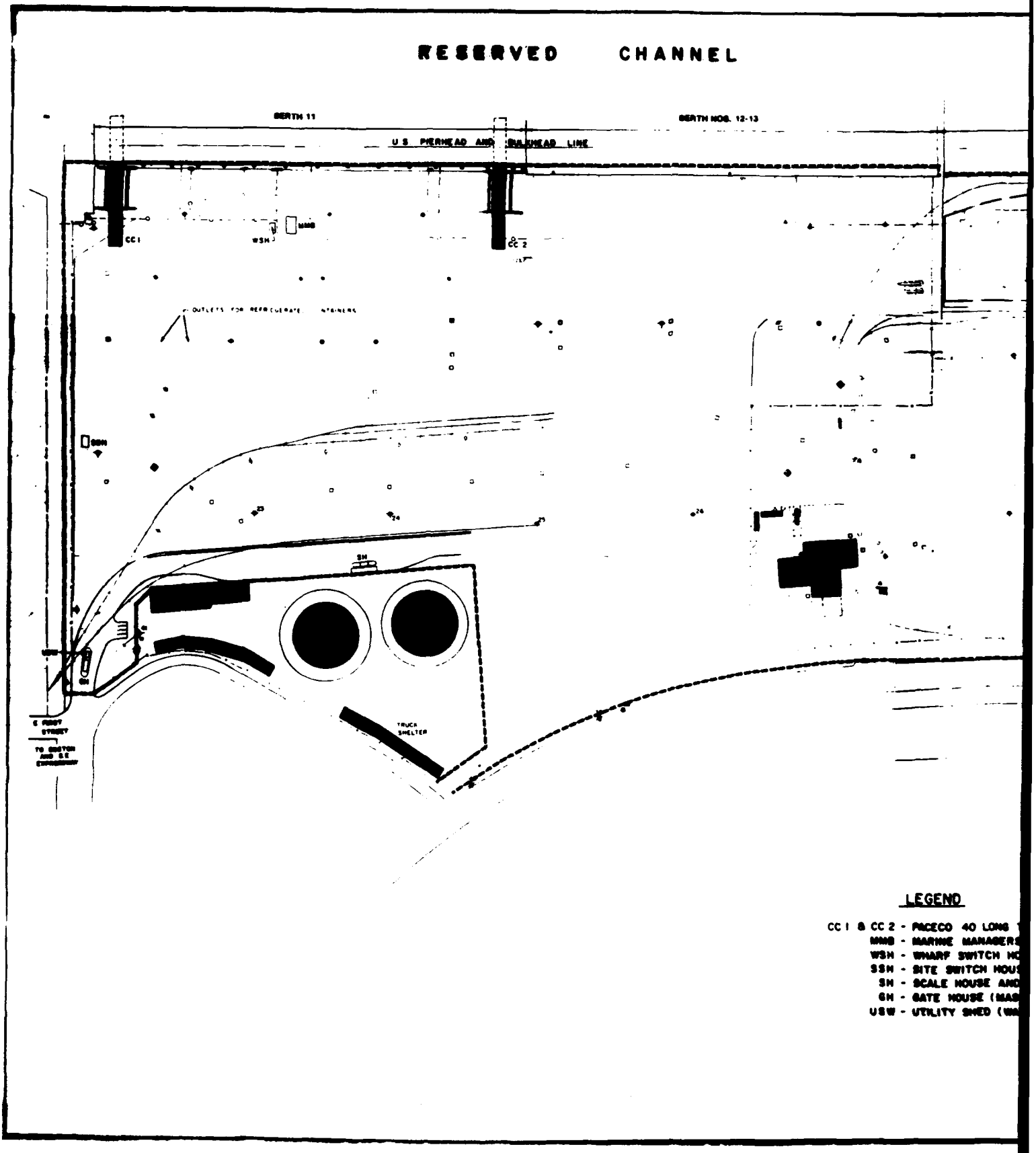
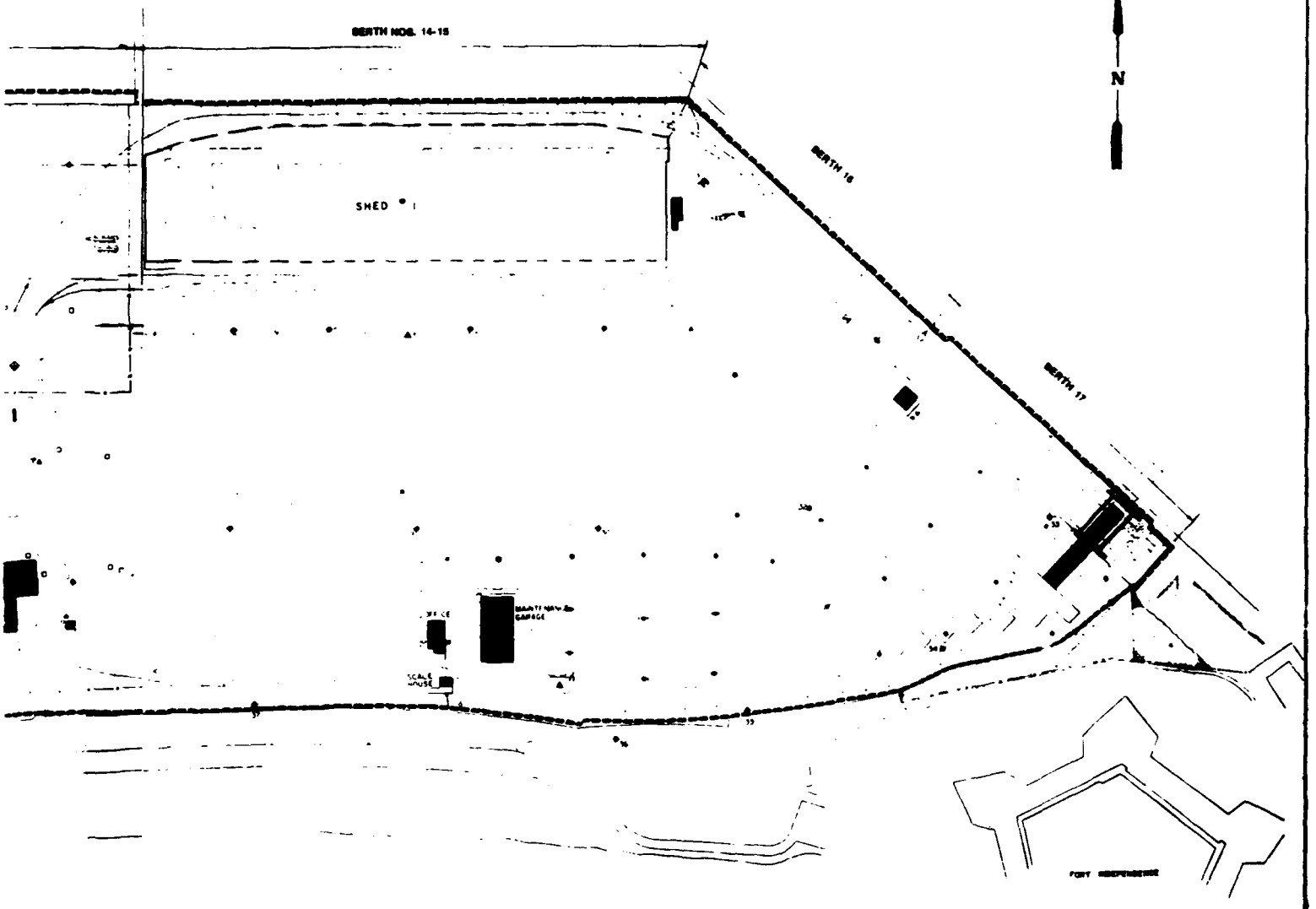


Figure II-BOS-5. Conley Terminal site plan.



LEGEND

CC 1 & CC 2 - PACECO 40 LONG TON LOW PROFILE CONTAINER CRANES
MMB - MARINE MANAGERS BUILDING
WSH - WHARF SWITCH HOUSE (ELECTRICAL GEAR)
SSH - SITE SWITCH HOUSE (ELECTRICAL GEAR)
SH - SCALE HOUSE AND TOLEDO 100 TON TRUCK SCALE
GH - GATE HOUSE (MASSPORT SECURITY)
USW - UTILITY SHED (WATER SUPPLY EQUIPMENT)

100 0 100 200 300
SCALE IN FEET

MASSACHUSETTS PORT AUTHORITY
SOUTH BOSTON - MASSACHUSETTS

TABLE II-BOS-3
PORT OF BOSTON
BERTH CHARACTERISTICS OF CONLEY TERMINAL

Characteristics	Berths			
	Berth 11	Berth 12-15	Berth 16	Berth 17
Length (ft)	1,000	2,000	610	600
Depth alongside at MLW (ft)	40	40	40	40
Deck strength (psf)	600	600	600	600
Apron width (ft)	Open	Open	Open	Open
Apron height above MLW (ft)	15	15	15	15
Number of container cranes	2	0	0	1
Number of wharf cranes	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	No
Apron length served by rail (ft)	0	0	0	0

Notes:
1. Terminal open storage area is 101 acres
2. Terminal covered storage area is 0 square feet

(3) RORO and FSS Operations. Table II-BOS-4 gives detailed information on the types of vessels that may or may not conduct RORO operations at Conley Terminal. The table also lists any restrictions that may apply. Berths 12 through 15 are the best locations for FSS operations. Two FSS vessels could be berthed and worked concurrently. The terminal's 101 acres of paved, open storage area will more than adequately support the marshaling requirements for FSS operations.

(4) Container Operations. The Conley Terminal can accommodate any containership at berths 11 and 12 through 15. By combining berths 16 and 17, any containership can be berthed there as well. However, only berth 11 with two container cranes and the 600 feet of berth 17 with one gantry crane are equipped to conduct container operations.

TABLE II-BOS-4
PORT OF BOSTON
SUMMARY OF BERTHING CAPABILITIES OF CONLEY TERMINAL

Vessel	Berths			
	Berth 11	Berth 12-15	Berth 16	Berth 17
Breakbulk				
C3-S-33a	1	3	1	1
C3-S-37c	1	3	1	1
C3-S-37d	1	3	1	1
C3-S-38a	1	3	1	1
C4-S-1a	1	3	1	1
C4-S-1qb and 1u	1	3	1	1
C4-S-58a	1	3	1	1
C4-S-65a	1	3	1	1
C4-S-66a	1	3	1	1
C4-S-69b	1	3	1	1
Seatrain				
GA and PR-class	1	3	1	1
Barge				
LASH C8-S-81b	a,g	a,g	a,c,g	a,c,g
LASH C9-S-81d	1	2	c	c
LASH lighter	7	14	4	4
SEABEE C8-S-82a	1	2	c	c
SEABEE barge	5	10	3	3
RORO				
Comet	d,i,j	d,i,j	d,i,j	d,i,j
C7-S-95a/Maine-class	1	2	c	c
Ponce-class	h	h	c,h	c,h
Great Land-class	h	h	c,h	c,h
Cygnus/Pilot-class	1	3	c	c
Meteor	d,i,j	d,i,j	d,i,j	d,i,j
AmEagle/Condor	i,j	i,j	c	c
MV Ambassador	d	d	d	d
FSS-class	1,i	2,i	c	c
Cape D-class	i,j	i,j	c	c
Cape H-class	1,i	2,i	c	c
Container				
C6-S-1w	1	2,e	c,e	c,e
C7-S-68e	1	2,e	c,e	c,e
C8-S-85c	1	2,e	c,e	c,e
Combination				
C5-S-78a	1	3,e	1,e	c,e
C5-S-37e	1	3,e	1,e	1,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

b. Materials Handling Equipment (MHE). MHE assets exceed any requirements generated by the Port of Boston. Additional MHE can be provided by the stevedoring companies serving the terminal. Listing the available MHE would be impractical.

c. Staging

(1) Open Storage. The Conley Terminal has 101 acres of paved, open storage space. This space is mainly used to store/stage containers and automobiles.

(2) Covered Storage. No covered storage exists at the Conley Terminal.

d. Security. Massport Transit Police controls entry gates and provides mobile patrols 24 hours daily. A lighted, 7-foot-high chain link fence with three strands of barbed wire protects the terminal's perimeter.

e. Rail Operations. Conrail has trackage to the vicinity of the terminal. However, the track into the terminal proper has been cut in several places and paved over in others. These factors make rail operations at the terminal impossible.

f. Truck Operations. Commercial truck access to the terminal is from I-93, Exit 15, to William J. Day Boulevard. Gate 2, into the berths 16 and 17 area of the terminal, is at the foot of Day Boulevard.

g. Helicopter Operations. The best location for helicopter operations is near berth 12 in the cargo staging area.

h. Marshaling Area. The 101 acres of open, paved staging area is sufficient for marshaling requirements.

3. Massport Marine Terminal/Harbor Gateway Complex (fig II-BOS-6)

a. Berthing. The Massport Marine Terminal/Harbor Gateway Complex consists of marginal wharves and piers, which range in length from 540 to 1,641 feet. Apron width varies from 53 feet to open, while apron height ranges from 16 feet at the Massport Marine Terminal berth to 18 feet above MLW at the Harbor Gateway berths (old Army base piers). Deck strength is 500 pounds per square foot, or greater. The depth alongside is 35 feet MLW for all berths. Several of the old Army base warehouses provide more than 850,000 square feet of covered storage for the terminal.

Wharf and pier construction is of concrete-capped steel sheet pile bulkhead with solid fill, fronted by a timber fendering system at the Massport Marine Terminal berth. Some of the Harbor Gateway Complex berths are concrete wall with cantilevered concrete deck, fronting steel sheet pile bulkhead with solid fill and timber pile supporting a concrete deck. Others are concrete wall supported by steel pile and fronted by a timber and rubber-chock fendering system.

No container cranes are at any of the berths. Local stevedoring companies can provide mobile cranes ranging from 50 to 250 tons, as required.

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Figure II-BOS-6. Harbor Gateway Terminal.

The terminal is well lighted, and night operations can be conducted.

Tables II-BOS-5 and II-BOS-6 show the berthing characteristics and capabilities of the terminal. The terminal's potential to support various shipping modes is described below:

(1) Breakbulk Operations. Breakbulk operations can be performed at all berths, provided sufficient ship's gear or mobile cranes are available.

TABLE II-BOS-5
PORT OF BOSTON
BERTH CHARACTERISTICS OF HARBOR GATEWAY TERMINAL

	Berths				
Characteristics	Marine Term	Army 1-3	Army 4-5	Army 6	Army 7-9
Length (ft)	800	964	974	540	1,641
Depth alongside at MLW (ft)	35	35	35	35	35
Deck strength (psf)	750	500	500	500	500
Apron width (ft)	Open	53	55	Open	61
Apron height above MLW (ft)	16	18	18	18	18
Number of container cranes	0	0	0	0	0
Number of wharf cranes	0	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	No	No
Apron length served by rail (ft)	0	0	0	0	0

Notes:
1. Terminal open storage area is 40 acres
2. Terminal covered storage area is 850000 square feet

TABLE II-BOS-6
PORT OF BOSTON
SUMMARY OF BERTHING CAPABILITIES OF HARBOR GATEWAY TERMINAL

Vessel	Berths				
	Marine Term	Army 1-3	Army 4-5	Army 6	Army 7-9
Breakbulk					
C3-S-33a	1	1	1	1	3
C3-S-37c	1	1	1	1	3
C3-S-37d	1	1	1	1	3
C3-S-38a	1	1	1	1	3
C4-S-1a	1	1	1	c	2
C4-S-1qb and 1u	1	1	1	c	2
C4-S-58a	1	1	1	c	2
C4-S-65a	1	1	1	c	2
C4-S-66a	1	1	1	1	2
C4-S-69b	1	1	1	c	2
Seatrain					
GA and PR-class	1	1	1	c	2
Barge					
LASH C8-S-81b	a,c,g	a,g	a,g	a,c,g	a,g
LASH C9-S-81d	a,c	a	a	a,c	a
LASH lighter	5	6	6	3	11
SEABEE C8-S-82a	a,c	a	a	a,c	a
SEABEE barge	4	4	4	2	8
RORO					
Comet	d,i,j	d,o	d,o	d,i,j	d,o
C7-S-95a/Maine-class	1,i	b	b	c	2,i
Ponce-class	h	b,h	b,h	c,h	b,h
Great Land-class	h	b,h	b,h	c,h	b,h
Cygnus/Pilot-class	1,i	b	b	c	2,i
Meteor	d,i,j	d,o	d,o	d,i,j	d,o
AmEagle/Condor	i,j	b	b	c	i,j
MV Ambassador	d	d	d	c,d	d
FSS-class	c	b	b	c	1,i,n
Cape D-class	i,j	b	b	c	i,j
Cape H-class	a	a,b	a,b	a,c	a
Container					
C6-S-1w	1,e	1,e	1,e	c,e	2,e
C7-S-68e	1,e	1,e	1,e	c,e	2,e
C8-S-85c	c,e	1,e	1,e	c,e	1,e
Combination					
C5-S-78a	1,e	1,e	1,e	c,e	2,e
C5-S-37e	1,e	1,e	1,e	c,e	2,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

(2) LASH and SEABEE Operations. LASH lighters and SEABEE barges can be loaded at all berths. The LASH and SEABEE mother ships cannot use any of the berths without restrictions. These restrictions include inadequate channel depth, maximum vessel draft limited to the berth depth, and inadequate berth length. The terminal has 31 LASH lighter or 22 SEABEE barge loading positions. The LASH or SEABEE mother ships would have to discharge and retrieve their respective lighters instream.

(3) RORO and FSS Operations. Table II-BOS-6 gives detailed information on the types of vessels that may or may not conduct RORO operations at the terminal. This table also lists any applicable restrictions. The Massport Marine Terminal berth is the best location for FSS operations, even though the berth is only 800 feet long and would normally be too short for an FSS vessel. This berth is next to the terminal's 40 acres of open storage and is the only one that can adequately support the marshaling requirement for FSS operations. Berths 7 through 9, while long enough to berth an FSS vessel, are too far away from the marshaling area to be practical.

(4) Container Operations. The terminal has no container handling capability.

b. Materials Handling Equipment (MHE). See paragraph 2b above.

c. Staging

(1) Open Storage. The terminal has 40 acres of paved, open storage space. This space is primarily used to store/stage automobiles and general cargo.

(2) Covered Storage. Two large warehouses (formerly part of the Boston Army Base) provide more than 1 million square feet of covered storage space, of which 850,000 square feet can be used.

d. Security. See paragraph 2d above.

e. Rail Operations. See paragraph 2e above.

f. Truck Operations. Commercial truck access to the terminal is best gained via I-93, Exit 15, to William J. Day Boulevard, to Summer Street. The principal gate is at the intersection of Summer and Terminal Streets.

g. Helicopter Operations. The best location for helicopter operations is near the Massport Marine Terminal berth in the cargo staging area.

h. Marshaling Area. No designated storage area exists outside the terminal complex. The 40 acres of open, paved staging area is sufficient for marshaling requirements.

C. SUPPORT SERVICES

1. Pilotage

The Boston Pilots Association provides pilotage for the Port of Boston. Use of pilots is mandatory. Pilots are available 24 hours a day.

2. Harbor Craft

The Boston Tow Boat Company provides harbor tugs for the Port of Boston. The company has 16 boats with ratings up to 3,000 horsepower for towing, docking, undocking and shifting vessels.

3. Stevedores

A 25-man general gang is used in the Port of Boston. Twelve general gangs are available. About 400 workers are available for emergency work. These gangs can handle general cargo and military wheeled vehicles, but are not presently able to handle military tracked vehicles. Local longshoremen could be trained, given sufficient lead time, or qualified personnel could be brought in.

4. Heavy-Lift Equipment

For the most part, heavy-lift equipment in the Port of Boston is for the sole use of private companies. To a limited extent, these same facilities may be used to satisfy the heavy-lift requirements of the public. Single lifts of up to 1,200 tons can be made at the General Dynamics Corporation's Quincy Yard. Crawler and mobile cranes, with lifting capabilities up to 150 tons, may also be obtained from crane rental services located in the port area.

D. INTERMODAL CONTAINER TRANSFER FACILITIES (ICTF)

Conrail conducts a trailer-on-flatcar (TOFC) operation near all the terminals. The intermodal facility then trucks containers to terminals. Rail clearance restrictions prohibit double stacking of containers on flatcars. ICTF is located just off Market Street under I-90 in Brigton.

E. FUTURE DEVELOPMENT

The Port of Boston has an aggressive program of improvements and expansion. In recent years, more than $116 million has been spent on the port complex. Of paramount importance are the efforts Massport Marine Terminal/Harbor Gateway Complex officials are making with city and State officials to maintain accessibility to the waterfront. Efforts to improve truck access to the terminals during the construction phase of the Third Harbor Tunnel and Central Artery projects are ongoing. Truck access to the terminals will be via the Bypass Harbor Road in South Boston, a route specifically designed to handle truck traffic to and from the waterfront.

F. REQUIREMENTS AND RECOMMENDATIONS

1. Requirements

This section analyzes the deployment of a light infantry division from the Port of Boston. The outloading time is 5 days. The vessels necessary to support deployment are in appendix A. The vessel requirements for each ship mix are:

- ship mix 1 (modern ships): 3 ships.
- ship mix 2 (combination of ship types): 5 ships.
- ship mix 3 (breakbulk ships): 9 ships.
- ship mix 4 (fast sealift ships): 3 ships.

2. Recommendations

Tables II-BOS-7 through II-BOS-9 show the berthing recommendations for all ship mixes. The port can load all ship mixes within 5 days.

TABLE II-BOS-7
BERTHING RECOMMENDATIONS
FOR SHIP MIX 1 AND 4
(LIGHT INFANTRY DIVISION)

Ship Mix 1 (Modern Ships) Ship Mix 4 (Fast Sealift Ships)		
Terminal: Berth:	Conley 11	Conley 12-15
Day 1	FSS-1	FSS-2 FSS-3
Day 2		
Day 3		
Day 4		
Day 5		

TABLE II-BOS-8
BERTHING RECOMMENDATIONS FOR SHIP MIX 2
(LIGHT INFANTRY DIVISION)

Ship Mix 2 (Combination of Ship Types)				
Terminal: Berth:	Conley 11	Conley 12-15	Conley 16	Conley 17
Day 1	FSS-1	FSS-2 FSS-3	C3-S-33a	C3-S-37c
Day 2				
Day 3				
Day 4				
Day 5				

TABLE II-BOS-9
BERTHING RECOMMENDATIONS FOR SHIP MIX 3
(LIGHT INFANTRY DIVISION)

Ship Mix 3 (Breakbulk Ships)

Terminal: / Berth:	Conley 11	Conley 12-15	Conley 16	Conley 17	Moran Cntnr Whf	Moran Pier 1-N
Day 1	C3-S-33a	C3-S-33a C3-S-33a C3-S-37c	C3-S-33a	C3-S-37c	C3-S-37c C3-S-37d	C3-S-37d
Day 2						
Day 3						
Day 4						
Day 5						

PORT OF CHARLESTON (1990)

A. GENERAL DISCUSSION

1. Location and Harbor Description (fig II-CHA-1)

The Port of Charleston is on a peninsula at the confluence of the Cooper and Ashley Rivers. The rivers flow into a bay known as Charleston Harbor. The port is 102 nautical miles northeast of Savannah, Georgia, and 170 miles southwest of Wilmington, North Carolina.

Two terminals, Columbus Street Intermodal Terminal and Union Pier Terminal, are near downtown Charleston, about 7 miles from the open Atlantic. A 35-foot-deep by 600-foot-wide channel provides access to these facilities. This channel continues about 8 miles up the Cooper River, at a minimum width of 600 feet, to the North Charleston Container Terminal. Just north of the North Charleston Container Terminal is the MTMC South Atlantic Outport.

Another major terminal, the Wando Container Terminal, is on the lower reach of the Wando River. It is about 5 miles northwest of the Columbus Street Intermodal Terminal. The 450-foot-wide and 35-foot-deep Wando River Channel branches off the Cooper River Channel south of Daniel Island and leads to the terminal.

Berths at the terminals are dredged on a 2-year rotational basis. The channel has a tidal range from 4.3 feet to 6.5 feet. The channel going north to the North Charleston Container Terminal and the Wando Container Terminal flows under a pair of Cooper River bridges. The bridge over Town Creek has a clearance of 136 feet mean high water (MHW). The bridge over Hog Island Reach has a vertical clearance of 150 feet MHW.

The Columbus Street Intermodal Terminal has a 1,200-foot-wide turning basin. All the other terminals have 1,400-foot-wide turning basins. Charleston Harbor has four major anchorage areas (A through D).

Charleston Harbor forms part of the route of the Atlantic Intracoastal Waterway. The waterway enters Charleston Harbor from the northeast through the Sullivan's Island Narrows. It continues southwestward from the harbor by way of Wappoo Creek.

2. Highway Access

The major highway to Charleston from the northwest is Interstate Route 26. Charleston is about 50 miles from Interstate Route 95, the major east coast north-south artery. US Route 17 connects Charleston with nearby coastal cities.

To reach the main gate of the Columbus Street Intermodal Terminal, exit from I-26 to four-lane East Bay Street. Then exit to two-lane Immigration Street. The distance traveled is about 2 miles.

Access to the main gate of Union Pier Terminal is via I-26 to two-lane Calhoun Street. Then exit to two-lane Concord Street. The travel distance is about 2 miles.

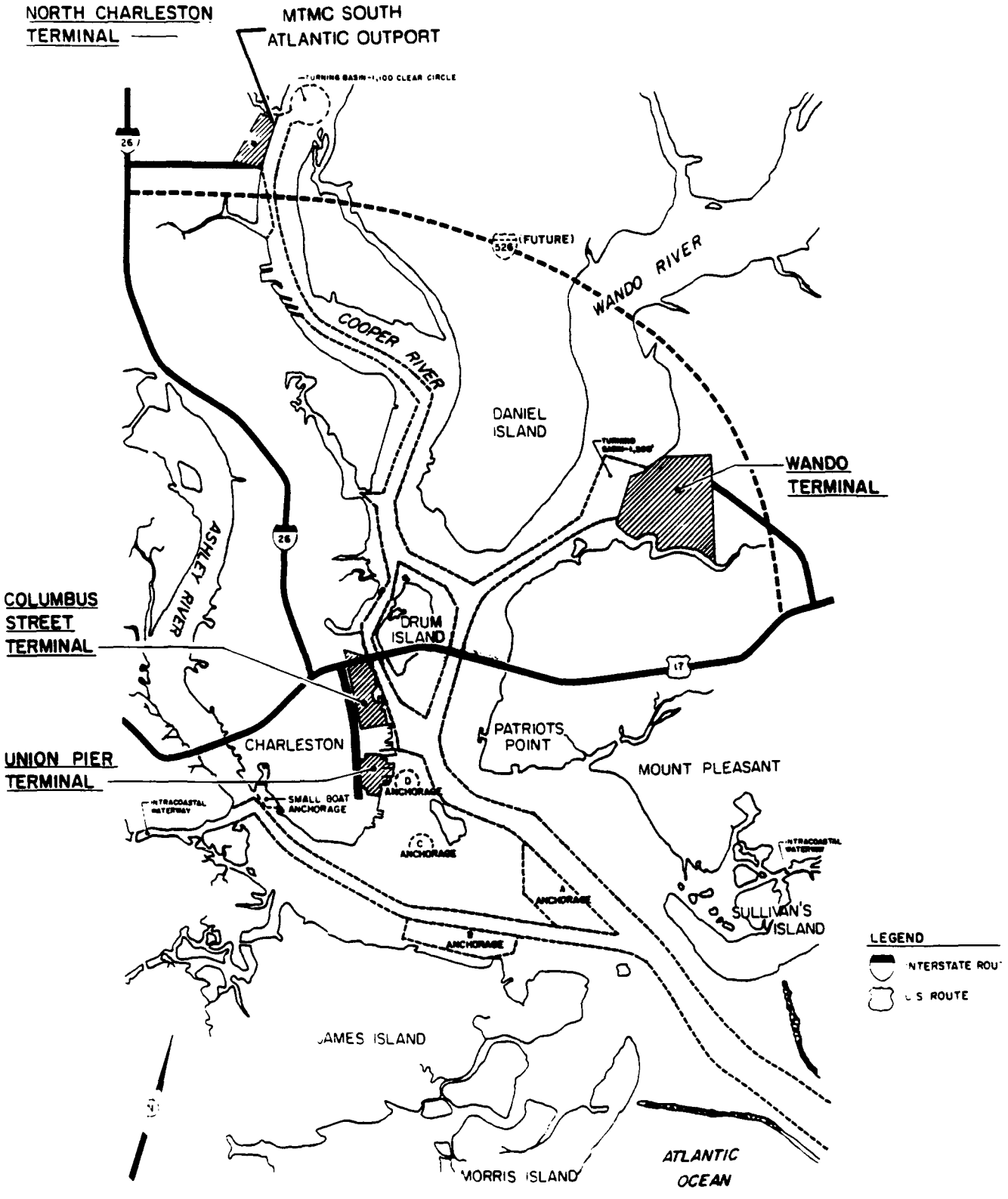


Figure II-CHA-1. Port of Charleston Terminals.

To reach the main gate of the Wando Container Terminal, take I-26 to four-lane US 17. Then exit to the two-lane Port Access Road. The travel distance is about 10 miles.

To reach the North Charleston Container Terminal and the MTMC South Atlantic Outport, exit I-26 to four-lane Remount Road. This road provides access to both facilities. The travel distance is about 4 miles.

3. Rail Access

Two railroads provide service to Charleston. Norfolk Southern Railway operates the Bennett Intermodal Terminal off Dorchester Road near I-26. The rail net serving the port is in good condition.

CSX operates Cooper Yard near the intersection of Meeting Street Extension and Spruill Avenue.

CSX and Norfolk Southern Railway jointly own and operate Cosgrove Switching Yard. This yard has 15 tracks and holds up to 350 cars.

The South Carolina Public Railway Commission provides track between switching yards and each of the terminals, except for the Wando Container Terminal. The commission also switches cars within the terminals. The Wando Container Terminal has no rail service.

4. Airport

Charleston International Airport is about 10 miles north of the Charleston downtown terminals, 5 miles northwest of the North Charleston Container Terminal, and 10 miles northwest of the Wando Container Terminal. The airport shares its runways with Charleston Air Force Base.

B. PORT FACILITIES

1. Columbus Street Intermodal Terminal (fig II-CHA-2)

a. Berthing. With five berths totaling 3,440 feet, the Columbus Street Intermodal Terminal can accommodate breakbulk and containerized cargo. Tables II-CHA-1 and II-CHA-2 show the berthing characteristics and capabilities of the terminal. Berths 1 and 2 have open aprons, while berths 3 through 5 have 45-foot aprons. The terminal has two 40-ton container cranes and a 150-ton, 75-ton, and 30-ton gantry crane. The terminal's ability to support various shipping modes is as follows:

(1) Breakbulk Operations. Berths 3 through 5 are for breakbulk operations. Each has a transit shed. Three gantry cranes are available to assist ship's gear in loading breakbulk cargo.

(2) LASH and SEABEE Operations. The terminal has adequate berthing space, apron width, and cranes to support LASH or SEABEE loading operations. However, the present depth of the channel is not adequate for fully loaded LASH and SEABEE ships.

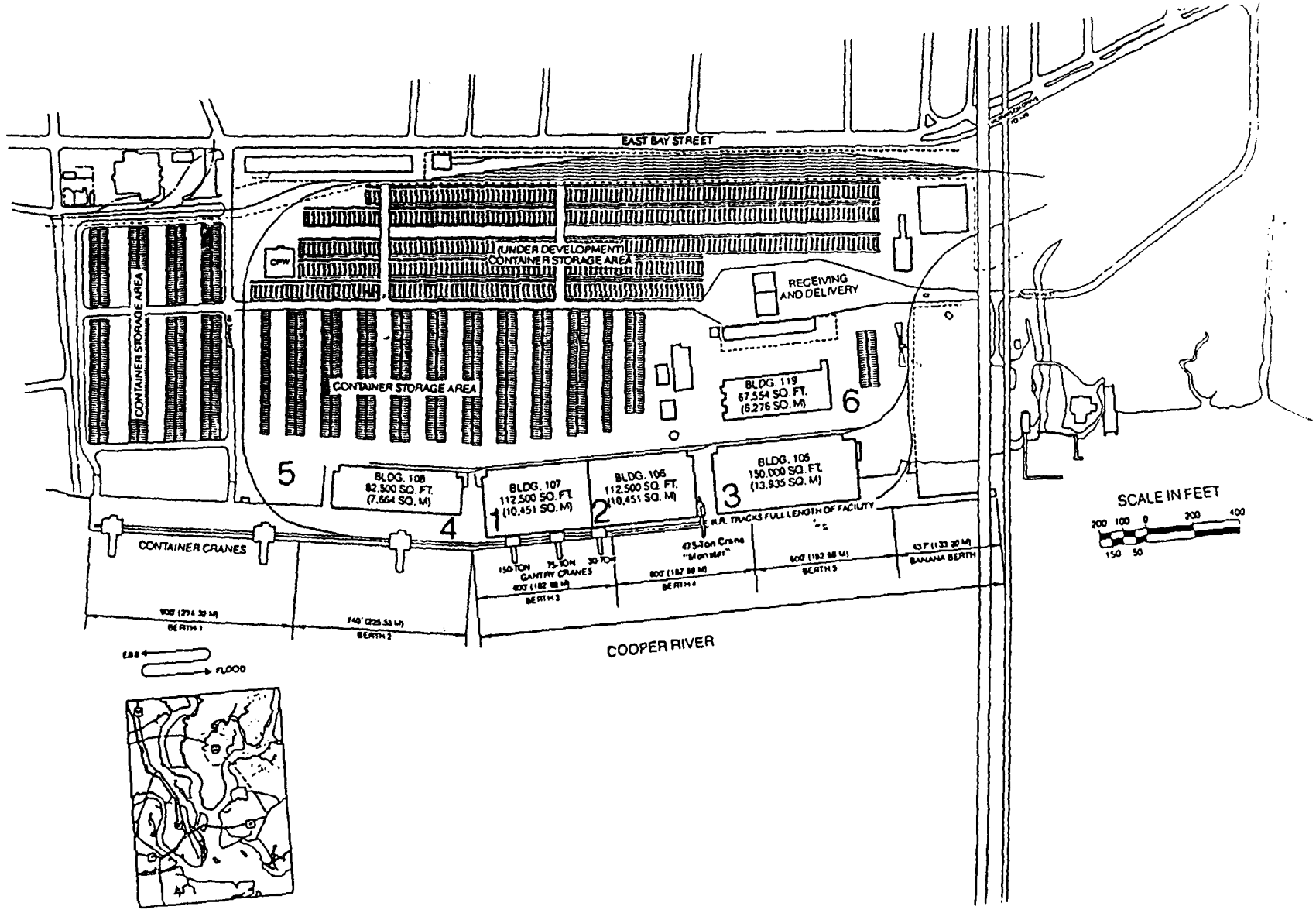


Figure II-CHA-2. Columbus Street Intermodal Terminal.

TABLE II-CHA-1
PORT OF CHARLESTON
BERTH CHARACTERISTICS OF COLUMBUS ST INTERMODAL TERMINAL

Characteristics	Berths		
	1	2	3-5
Length (ft)	900	740	1,800
Depth alongside at MLW (ft)	35	35	35
Deck strength (psf)	1,000	1,000	600
Apron width (ft)	Open	Open	45
Apron height above MLW (ft)	12	12	12
Number of container cranes	1	1	0
Number of wharf cranes	0	0	3
Apron lighting	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No
Apron length served by rail (ft)	900	740	1,800

Notes:
1. Terminal open storage area is 70 acres
2. Terminal covered storage area is 525054 square feet

TABLE II-CHA-2
PORT OF CHARLESTON
SUMMARY OF BERTHING CAPABILITIES OF COLUMBUS ST INTERMODAL TERMINAL

Vessel	Berths 1	2	3-5
Breakbulk			
C3-S-33a	1	1	3
C3-S-37c	1	1	3
C3-S-37d	1	1	3
C3-S-38a	1	1	3
C4-S-1a	1	1	3
C4-S-1qb and 1u	1	1	3
C4-S-58a	1	1	3
C4-S-65a	1	1	3
C4-S-66a	1	1	3
C4-S-69b	1	1	2
Seatrain			
GA and PR-class	1	1	3
Barge			
LASH C8-S-81b	a,g	a,c,g	a,g
LASH C9-S-81d	a,g	a,c,g	a,g
LASH lighter	6	5	12
SEABEE C8-S-82a	a,g	a,c,g	a,g
SEABEE barge	4	3	9
RORO			
Comet	d,i,j	d,i,j	d,o
C7-S-95a/Maine-class	1	1	b
Ponce-class	h	h	b,h
Great Land-class	h	c,h	b,h
Cygnus/Pilot-class	1	1	b
Meteor	d,i,j	d,i,j	d,o
AmEagle/Condor	i,j	i,j	b
MV Ambassador	d	d	d
FSS-class	c	c	b
Cape D-class	i,j	i,j	b
Cape H-class	a,g	a,c,g	a,b,g
Container			
C6-S-1w	1	1	2,e
C7-S-68e	1	1	2,e
C8-S-85c	1	c	2,e
Combination			
C5-S-78a	1	1	2,e
C5-S-37e	1	1	2,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

(3) RORO and FSS Operations. The terminal can load side- and slewed-ramp RORO ships at berths 1 and 2. The wharf aprons at berths 3 through 5 are too narrow for RORO operations. The terminal does not have Ponce/Great Land ramps. However, the port owns the barge-mounted stern-RORO ramp shown in figure II-CHA-3. This floating ramp can handle two stern-ramp RORO ships at once. It is available to all of the Charleston terminals. Berths 1 and 2 can berth and load one FSS.

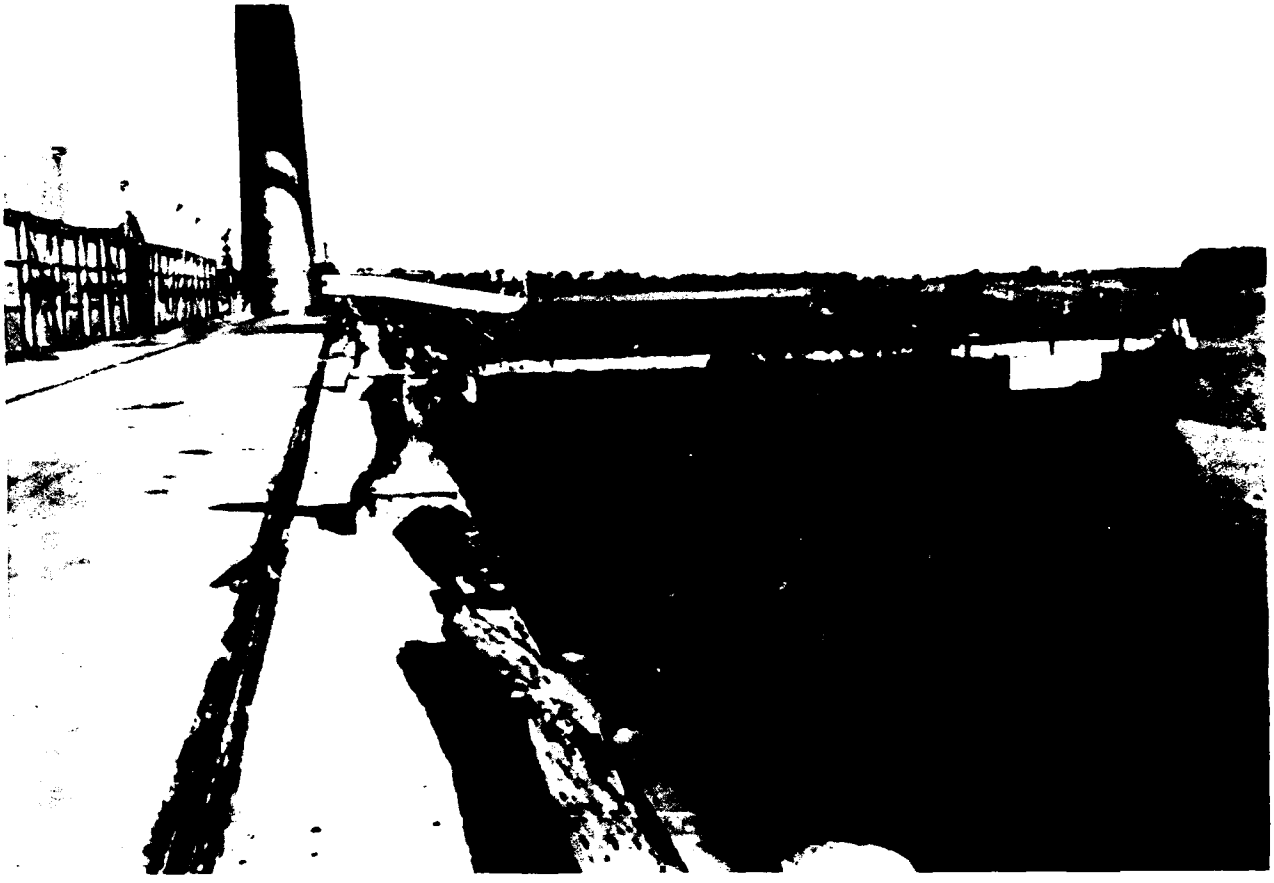


Figure II-CHA-3. Barge-mounted RORO ramp.

(4) Container Operations. Berths 1 and 2 are for container operations. Container handling equipment consists of two 40-ton rail-mounted container cranes and several container handlers.

b. Materials Handling Equipment (MHE). The Port of Charleston owns the specialized MHE in table II-CHA-3. The Columbus Street International Terminal has the mobile cranes, which all the port terminals use. Additional MHE is available from local stevedore contractors.

c. Staging

(1) Open Storage. The terminal has about 70 acres of open storage. Most of this storage is for onground container storage.

TABLE II-CHA-3
MATERIALS HANDLING EQUIPMENT

Type of Equipment	Capacity (STON)	Quantity	Terminal Locations
Truck crane	140	2	Columbus Street
Rough terrain crane	40	1	Columbus Street
Hydraulic truck crane	65		1 Columbus Street
Truck crane	90		1 Columbus Street
Tow tractor	-		5 Columbus Street
Tow tractor	-		5 Columbus Street
Tow tractor	-		2 North Charleston
Forklift	1-5		23 Columbus Street
Forklift	1-5	29	Union Pier
Forklift	1-5	18	North Charleston
Forklift	1-5		5 Wando Container
Forklift	6-12		3 Columbus Street
Forklift	6-12		3 Union Pier
Forklift	6-12		2 North Charleston
Container handlers	40		3 Columbus Street
Container handlers	40		9 North Charleston
Bridge cranes	35		2 North Charleston
Container handlers	40		4 Wando Container

(2) Covered Storage. Four pierside transit sheds and one warehouse provide about 525,000 square feet of covered storage at the terminal.

d. Security. A 7-foot chain link fence topped with barbed wire encloses the terminal. The South Carolina State Police provides security guards and patrols. Also, an automated monitoring system provides additional security and detects fires.

e. Rail Operations. The South Carolina Public Railway Commission operates 5 miles of track within the terminal. Marginal apron tracks serve all berths. Depressed tracks serve the rear of all transit sheds. The terminal has no end ramps.

f. Truck Operations. The depressed rail tracks at the rear of all transit sheds double as truck docks. The area between transit sheds 107 and 108 and transit sheds 105 and 106 include docks for heavy-equipment loading.

g. Helicopter Operations. The terminal has no suitable helicopter landing area. However, sufficient storage areas exist to support the staging of helicopters.

h. Marshaling Areas. No marshaling areas are available outside the terminal complex.

2. Union Pier Terminal (fig II-CHA-4)

a. Berthing. With four marginal wharf berths totaling 2,471 feet, Union Pier Terminal is mainly for breakbulk operations. Berths 1 and 2 have 45-foot-wide aprons. About half of the aprons at berths 3 and 4 are 45 feet wide and the other half are open. The terminal has one 30-ton gantry crane. Tables II-CHA-4 and II-CHA-5 show the terminal's berthing characteristics

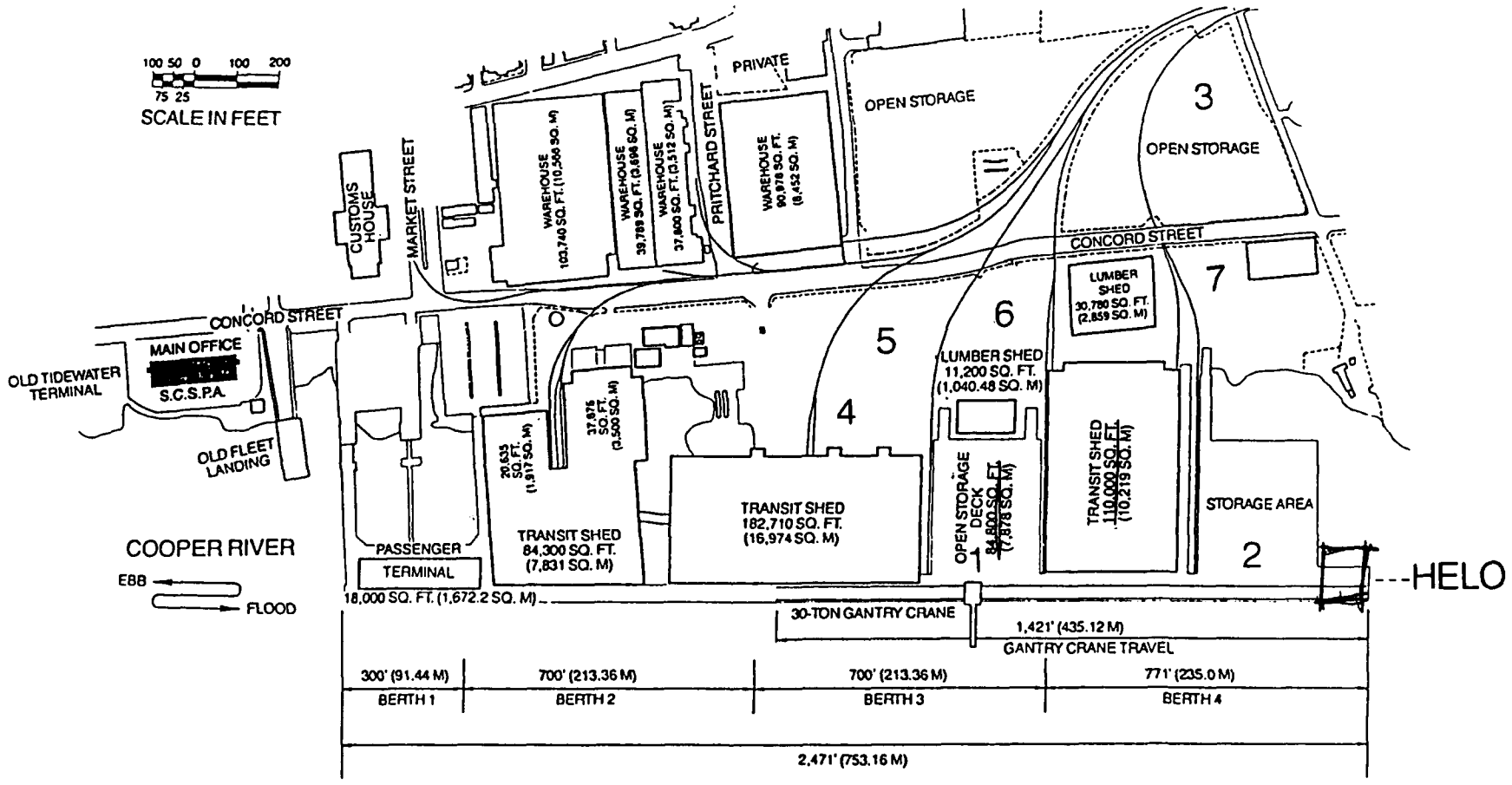


Figure II-CHA-4. Union Pier Terminal.

and capabilities. The terminal's ability to support various shipping modes is as follows:

TABLE II-CHA-4
PORT OF CHARLESTON
BERTH CHARACTERISTICS OF UNION PIER TERMINAL

Characteristics	Berths 1-2	Berths 3-4
Length (ft)	1,000	1,471
Depth alongside at MLW (ft)	35	35
Deck strength (psf)	400	1,000
Apron width (ft)	45	Open
Apron height above MLW (ft)	12	12
Number of container cranes	0	0
Number of wharf cranes	0	1
Apron lighting	Yes	Yes
Straight-stern RORO facilities	No	No
Apron length served by rail (ft)	0	0

Notes:
1. Terminal open storage area is 12 acres
2. Terminal covered storage area is 749607 square feet

(1) Breakbulk Operations. The terminal can load breakbulk cargo at any of the four berths. Ship's gear is the primary means of loading breakbulk cargo. The gantry crane is available for use at berths 3 and 4.

TABLE II-CHA-5
PORT OF CHARLESTON
SUMMARY OF BERTHING CAPABILITIES OF UNION PIER TERMINAL

Vessel	Berths 1-2	Berths 3-4
Breakbulk		
C3-S-33a	1	2
C3-S-37c	1	2
C3-S-37d	1	2
C3-S-38a	1	2
C4-S-1a	1	2
C4-S-1qb and 1u	1	2
C4-S-58a	1	2
C4-S-65a	1	2
C4-S-66a	1	2
C4-S-69b	1	2
Seatrain		
GA and PR-class	1	2
Barge		
LASH C8-S-81b	a,g	a,g
LASH C9-S-81d	a,g	a,g
LASH lighter	7	10
SEABEE C8-S-82a	a,g	a,g
SEABEE barge	5	7
RORO		
Comet	d,o	d,i,j
C7-S-95a/Maine-class	b	1
Ponce-class	b,h	h
Great Land-class	b,h	h
Cygnus/Pilot-class	b	2
Meteor	d,o	d,i,j
AmEagle/Condor	b	i,j
MV Ambassador	d	d
FSS-class	b	1
Cape D-class	b	i,j
Cape H-class	a,b,g	a,g
Container		
C6-S-1w	1,e	2,e
C7-S-68e	1,e	2,e
C8-S-85c	1,e	1,e
Combination		
C5-S-78a	1,e	2,e
C5-S-37e	1,e	2,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

(2) LASH and SEABEE Operations. The terminal has adequate berthing space and apron width to load either 17 LASH lighters or 12 SEABEE barges. Mobile cranes are necessary for lighter loading. Retrieval of lighters by mother ships could be done at berth or anchorage. However, the 35-foot channel depth restricts loading of the mother ships.

(3) RORO and FSS Operations. Berths 1 and 2 are not suitable for RORO or FSS operations because of their narrow wharf aprons. With the use of the port's floating ramp, the open storage deck behind berth 3 can accommodate RORO side-ramp loading operations or stern-ramp operations. FSS vessels can also load at berths 3 and 4. However, the lack of an open storage area makes loading operations impractical for RORO and FSS vessels.

(4) Container Operations. Berths 3 or 4 could accommodate container operations, if necessary. However, no equipment to handle containers is available at the terminal.

b. Materials Handling Equipment (MHE). Table II-CHA-3 lists the MHE at the Port of Charleston.

c. Staging

(1) Open Storage. The terminal contains about 12 acres of paved, open storage.

(2) Covered Storage. The terminal's warehouses and transit sheds have about 750,000 square feet of covered storage. In addition, berth 1 has an 18,000-square-foot passenger terminal.

d. Security. A 7-foot chain link fence topped with barbed wire encloses the terminal. Security measures at the Columbus Intermodal Terminal are in effect at this terminal also.

e. Rail Operations. The South Carolina Public Railway Commission serves the terminal area. No rail access to the aprons exists. The transit transit sheds at berths 2 and 3 have two platform-level tracks inside. The open storage deck at berth 3 and the storage area at berth 4 have depressed rail tracks for the side discharge of flatcars. End discharge of flatcars requires the construction of temporary end ramps.

f. Truck Operations. The terminal's three transit sheds each have platform-level truck docks on their west sides. The terminal has no other fixed or portable truck ramps.

g. Helicopter Operations. The small open storage areas at the terminal are not suitable for helicopter operations.

h. Marshaling Areas. No available marshaling areas exist outside the terminal complex.

3. North Charleston Container Terminal (fig II-CHA-5)

a. Berthing. The North Charleston Container Terminal is for containerized cargo operations. However, the terminal can load other types of ships, for example, RORO and breakbulk ships. Tables II-CHA-6 and II-CHA-7 show the berthing characteristics and capabilities of this terminal. Berths 1, 2, and 3 have open aprons and five 40-ton container cranes. The MTMC South Atlantic Outport

pier at the US Naval Weapons Station has 1,530 feet of concrete-decked wharf. The terminal's ability to support various shipping modes is as follows:

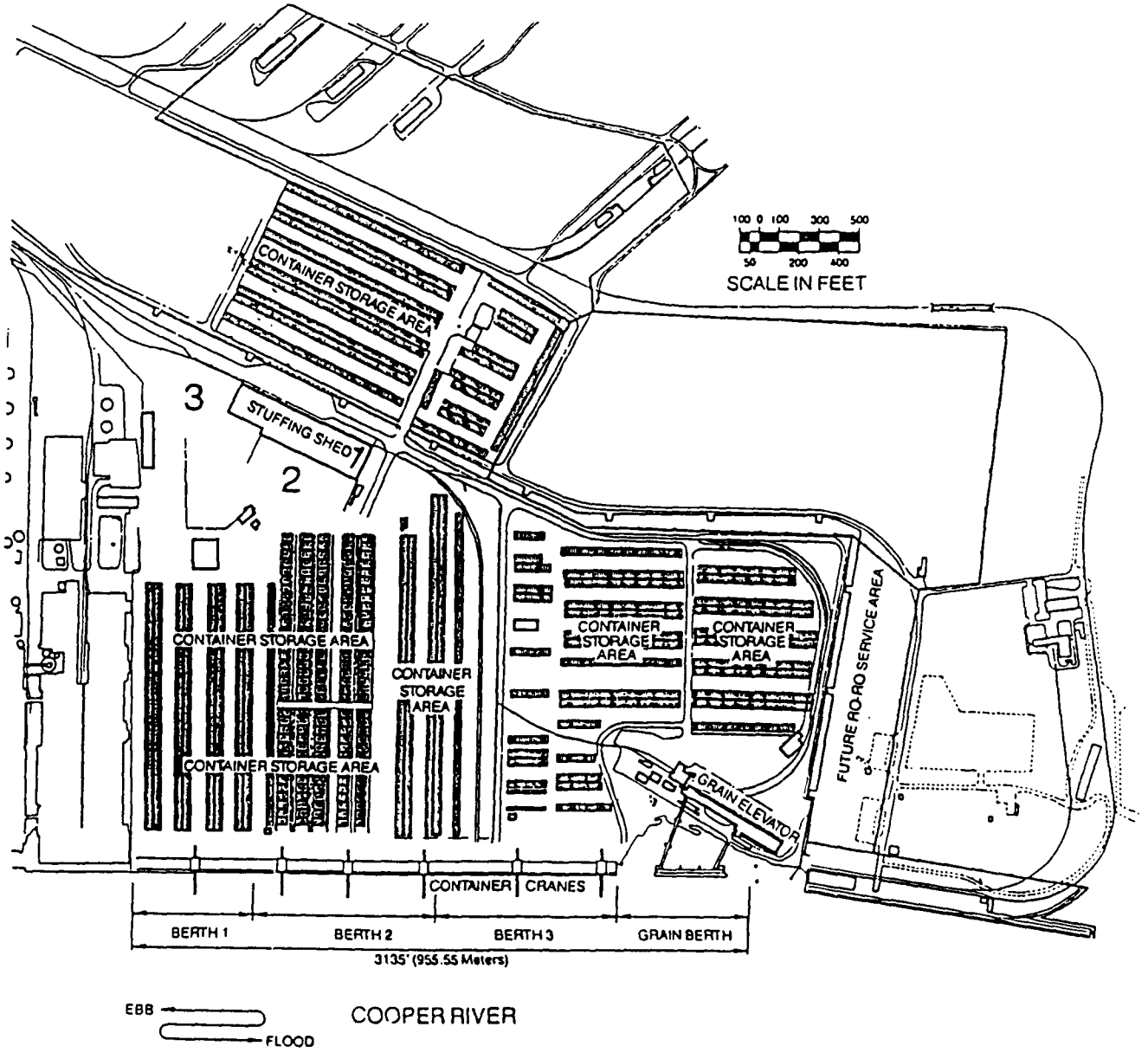


Figure II-CHA-5. North Charleston Container Terminal.

TABLE II-CHA-6
PORT OF CHARLESTON
BERTH CHARACTERISTICS OF NORTH CHARLESTON CONTAINER TERMINAL

Characteristics	Berths 1-3	Berths MTMC
Length (ft)	2,460	1,530
Depth alongside at MLW (ft)	35	35
Deck strength (psf)	1,000	700
Apron width (ft)	Open	100
Apron height above MLW (ft)	12	12
Number of container cranes	5	0
Number of wharf cranes	0	0
Apron lighting	Yes	Yes
Straight-stern RORO facilities	No	No
Apron length served by rail (ft)	0	1,530

Notes:
1. Terminal open storage area is 162 acres
2. Terminal covered storage area is 209500 square feet

(1) Breakbulk Operations. Although the terminal mainly handles containers, all US-flag vessels may berth and load using ship's gear or mobile cranes.

(2) LASH and SEABEE Operations. Berths 1 through 3 have adequate space to berth and load 17 LASH lighters or 12 SEABEE barges. The MTMC outport pier can load 10 LASH lighters or 7 SEABEE barges. The 35-foot water depth in the port's entrance channel restricts loading of the deep-draft LASH vessels.

(3) RORO and FSS Operations. Berths 1 through 3 and the MTMC pier can load RORO vessels with side and slewed ramps. RORO vessels with stern ramps can also load, using the port's floating dock. Berths 1 through 3 can load two FSS vessels. The MTMC outport pier can load one FSS vessel.

(4) Container Operations. Berths 1 through 3 can simultaneously berth and load up to three container ships at one time.

TABLE II-CHA-7
PORT OF CHARLESTON
SUMMARY OF BERTHING CAPABILITIES OF NORTH CHARLESTON CONTAINER TERMINAL

Vessel	Berths 1-3	Berths MTMC
Breakbulk		
C3-S-33a	4	3
C3-S-37c	4	2
C3-S-37d	4	2
C3-S-38a	4	2
C4-S-1a	4	2
C4-S-1qb and 1u	4	2
C4-S-58a	4	2
C4-S-65a	4	2
C4-S-66a	4	2
C4-S-69b	4	2
Seatrain		
GA and PR-class	4	2
Barge		
LASH C8-S-81b	a,g	a,g
LASH C9-S-81d	a,g	a,g
LASH lighter	17	10
SEABEE C8-S-82a	a,g	a,g
SEABEE barge	12	7
RORO		
Comet	d,i,j	d,i,j
C7-S-95a/Maine-class	3	2
Ponce-class	h	h
Great Land-class	h	h
Cygnus/Pilot-class	3	2
Meteor	d,i,j	d,i,j
AmEagle/Condor	i,j	i,j
MV Ambassador	d	d
FSS-class	2	1,n
Cape D-class	i,j	i,j
Cape H-class	a,g	a,g
Container		
C6-S-1w	3	2,e
C7-S-68e	3	2,e
C8-S-85c	2	1,e
Combination		
C5-S-78a	3	2,e
C5-S-37e	3	2,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

b. Materials Handling Equipment (MHE). The port and terminal own the MHE listed in table II-CHA-3.

c. Staging

(1) Open Storage. Berths 1 through 3 have about 150 acres of open storage for onground and chassis storage of containers. The MTMC South Atlantic Outport has about 12 acres of open storage space.

(2) Covered Storage. Berths 1 through 3 have a 118,500-square-foot container storage facility. Additionally, a 91,000-square-foot leased warehouse is just outside the terminal property.

d. Security. A 7-foot chain ink fence topped with barbed wire encloses the terminal. The South Carolina State Police provides security at the North Charleston Container Terminal. The Naval Weapons Station security guard force provides security for the MTMC South Atlantic Outport.

e. Rail Operations. No surface tracks are on the apron at berths 1 through 3. Containers on flatcars (COFC) are lifted from flatcars at two spurs near the center of the terminal. Temporary fixed or portable end ramps could be added to these spurs, if required. One end ramp is behind the container storage area.

While the MTMC pier does have rail tracks on its apron, they have not been used for more than 20 years. Work is necessary to make these tracks operational.

f. Truck Operations. The North Charleston Container Terminal has truck loading/unloading bays at the warehouses.

g. Helicopter Operations. Open storage areas that could support helicopter operations exist both at and near berths 1 through 3.

h. Marshaling Area. No marshaling area is available outside the terminal. However, some space may be available at Charleston Air Force Base, about 3 miles from the terminal.

4. Wando Container Terminal (fig II-CHA-6)

a. Berthing. The Wando Container Terminal has three berths, totaling 2,427 linear feet, and six container cranes. Tables II-CHA-8 and II-CHA-9 show the berthing characteristics and capabilities of this terminal. The apron is open along the length of the wharf. The terminal's ability to support various shipping modes is as follows:

(1) Breakbulk Operations. Although the terminal is mainly a container terminal, four breakbulk vessels could berth and load, using ship's gear.

(2) LASH and SEABEE Operations. The Wando Container Terminal has adequate berthing space and apron width for LASH and SEABEE operations. However, the 35-foot channel depth restricts loading of the mother ships.

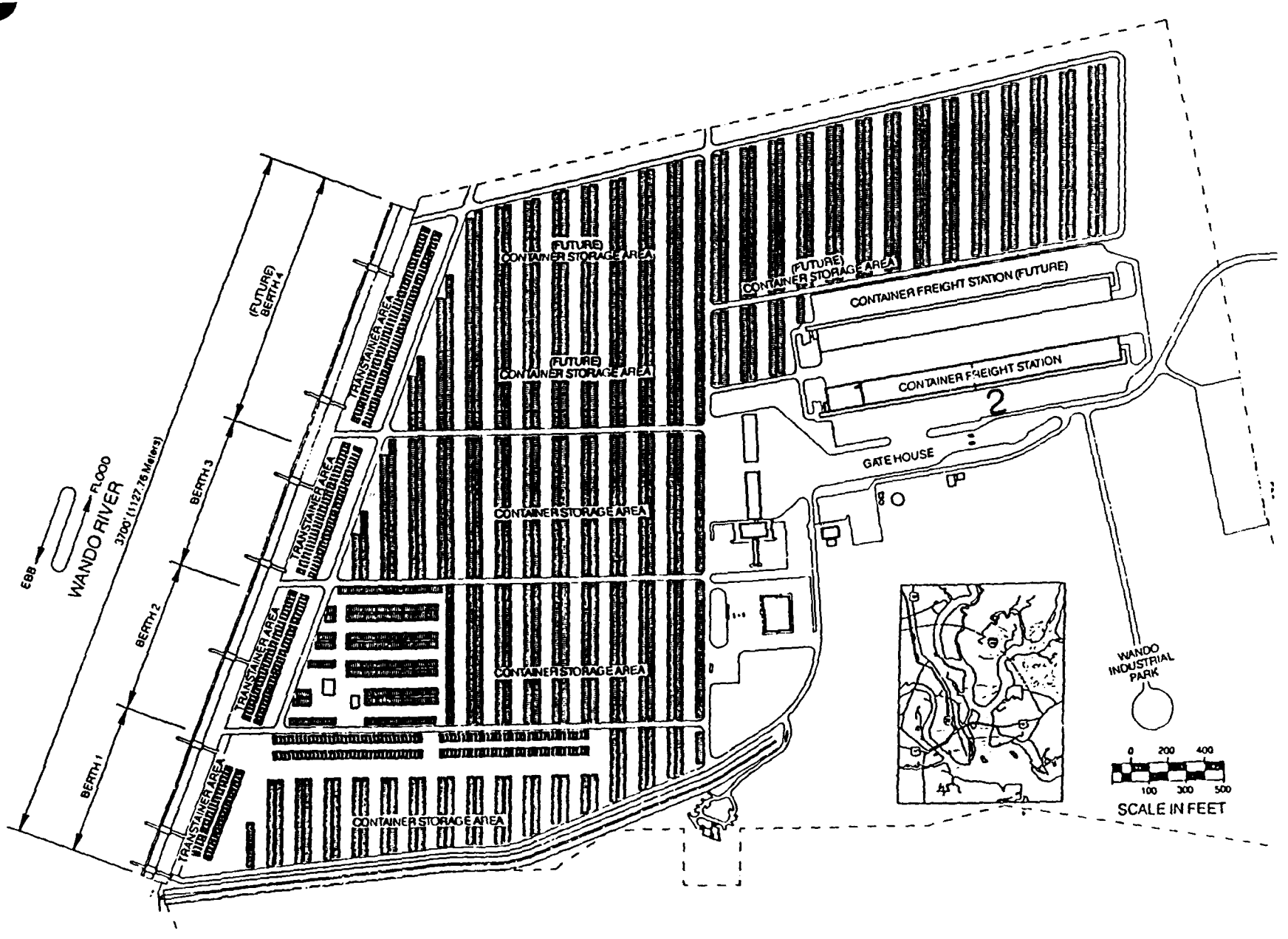


Figure II-CHA-6. Wando Container Terminal.

TABLE II-CHA-8
PORT OF CHARLESTON
BERTH CHARACTERISTICS OF WANDO CONTAINER TERMINAL

Characteristics	Berths 1-3
Length (ft)	2,427
Depth alongside at MLW (ft)	35
Deck strength (psf)	1,000
Apron width (ft)	Open
Apron height above MLW (ft)	16
Number of container cranes	6
Number of wharf cranes	0
Apron lighting	Yes
Straight-stern RORO facilities	No
Apron length served by rail (ft)	0

Notes:
1. Terminal open storage area is 167 acres

2. Terminal covered storage area is 200000 square feet

(3) RORO and FSS Operations. The terminal can accommodate side- and slewed-ramp RORO vessels. However, the 16-foot-high wharf aprons may restrict loading operations for most vessels at low tide. Also, the terminal can use the port's floating stern dock for RORO operations.

(4) Container Operations. The terminal has modern container handling equipment, including six 40-ton container cranes and seven container handlers.

b. Materials Handling Equipment (MHE). The port and terminal own the MHE listed in table II-CHA-3.

c. Staging

(1) Open Storage. The terminal contains about 167 acres of open storage.

TABLE II-CHA-9
PORT OF CHARLESTON
SUMMARY OF BERTHING CAPABILITIES OF WANDO CONTAINER TERMINAL

Vessel	Berths 1-3
Breakbulk	
C3-S-33a	4
C3-S-37c	4
C3-S-37d	4
C3-S-38a	4
C4-S-1a	4
C4-S-1qb and 1u	4
C4-S-58a	4
C4-S-65a	4
C4-S-66a	4
C4-S-69b	4
Seatrain	
GA and PR-class	4
Barge	
LASH C8-S-81b	a,g
LASH C9-S-81d	a,g
LASH lighter	17
SEABEE C8-S-82a	a,g
SEABEE barge	12
RORO	
Comet	d,i,j
C7-S-95a/Maine-class	3,i
Ponce-class	h
Great Land-class	h
Cygnus/Pilot-class	3,i
Meteor	d,i,j
AmEagle/Condor	i,j
MV Ambassador	d
FSS-class	2,i
Cape D-class	i,j
Cape H-class	a,g
Container	
C6-S-1w	3
C7-S-68e	3
C8-S-85c	2
Combination	
C5-S-78a	3
C5-S-37e	3

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

(2) Covered Storage. The terminal has about 200,000 square feet of covered storage in its container freight station.

d. Security. A 7-foot chain link fence topped with barbed wire encloses the terminal. Security measures at the Columbus Street Intermodal Terminal are in effect at this terminal also.

e. Rail Operations. The facility has no rail service.

f. Truck Operations. The Wando Container Terminal has 60 truck loading/unloading bays at the container freight station. The terminal does not have fixed or portable truck end ramps.

g. Helicopter Operations. The terminal has sufficient open storage areas to support helicopter operations.

h. Marshaling Areas. No marshaling areas are available outside the terminal complex.

C. SUPPORT SERVICES

1. Pilotage

The Charleston Branch Pilots Association provides pilots for the Charleston Harbor area. The harbor pilot boards the incoming vessel at buoy C2 and brings it to Castle Pinctney, where a mooring pilot boards.

2. Harbor Craft

The availability of tugs in the port area is good. A commercial fleet of 17 tugs, ranging from 1,000 to 4,200 horsepower, is available.

3. Stevedores

The Port of Charleston area has about 850 longshoremen, excluding checkers and mechanics. MTMC International Traffic has determined that enough longshoremen will be available to meet mobilization needs.

4. Heavy-Lift Equipment

Heavy-lift equipment available in the port area includes the 150-ton, 75-ton, and 30-ton gantry cranes at Columbus Street Intermodal Terminal and a 67-ton floating crane at Union Pier Terminal.

D. INTERMODAL CONTAINER TRANSFER FACILITIES (ICTF)

Charleston has two ICTFs. The Norfolk Southern Railroad operates the Bennett facility off Dorchester Road near I-26. This facility has 23 tracks that hold about 800 cars. Side and end ramps are available. CSX operates the Cooper Yard near the intersection of Meeting Street Extension and Spruill Avenue. This yard has six tracks capable of holding up to 200 cars.

E. FUTURE DEVELOPMENTS

A Federal and State deepening project is underway to increase the harbor entrance channel depth to 42 feet and the main channel and pierside depth to 40 feet.

Highway construction is underway to expand Interstate Route 526. Upon completion, I-526 will connect with I-26 south of the North Charleston Container Terminal and US 17 near the Wando Container Terminal.

Expansion plans at the Wando Container Terminal include an additional container berth and staging area. Also, the port authority plans to build another 200,000-square-foot container freight station.

F. REQUIREMENTS AND RECOMMENDATIONS

1. Requirements

This section analyzes the deployment of an armored division from the Port of Charleston. The outloading time is 5 days. The vessels necessary to support deployment are in appendix A. The vessel requirements for each ship mix are:

- Ship mix 1 (modern ships): 9 ships.
- Ship mix 2 (combination of ship types): 12 ships.
- Ship mix 3 (breakbulk ships): 27 ships.
- Ship mix 4 (fast sealift ships): 8 ships.

2. Recommendations

Tables II-CHA-10 through II-CHA-12 show the berthing recommendations for ship mixes 1, 2, and 4. For these ship mixes, the Port of Charleston can support deployment of the division within 5 days. The floating RORO ramp must be used at North Charleston Container Terminal for RORO ships with stern ramps.

The port cannot support the deployment of the division when ship mix 3 is used. This ship mix requires the concurrent loading of 27 breakbulk ships. However, the port only has a maximum of 19 berths that could be available. For this ship mix, we recommend the use of multiple ports of debarkation (that is Charleston, Savannah, and Jacksonville).

TABLE II-CHA-10
BERTHING RECOMMENDATIONS FOR SHIP MIX 1
(ARMORED DIVISION)

Ship Mix 1 (Modern Ships)			
Terminal: Berth:	NORTH CHARLESTON 1-3	NORTH CHARLESTON 7-10	COLUMBUS STREET 11-13
Day 1	FSS	MV Ambassador Cape Horn	FSS
Day 2		Cape Decision Cape Domingo	
Day 3	FSS		AM Eagle
Day 4			AM Condor
Day 5			

TABLE II-CHA-11
BERTHING RECOMMENDATIONS FOR SHIP MIX 2
(ARMORED DIVISION)

Ship Mix 2 (Combination of Ship Types)					
Terminal: Berth:	NORTH CHARLESTON MTMC	NORTH CHARLESTON 1-2	NORTH CHARLESTON 3	COLUMBUS STREET 1 and 2	COLUMBUS STREET 3-5
Day 1	FSS	MV Ambassador Cape Henry	C4-S-58a	FSS	C4-S-65a C3-S-33a C3-S-37d
Day 2		Cape Domingo Cape Decision			
Day 3	FSS	AM Eagle			
Day 4					
Day 5					

TABLE II-CHA-12
BERTHING RECOMMENDATIONS FOR SHIP MIX 4
(ARMORED DIVISION)

Ship Mix 4 (Fast Sealift Ships)				
Terminal: Berth:	NORTH CHARLESTON MTMC	NORTH CHARLESTON 1-3	WANDO 1-3	COLUMBUS STREET 1 and 3
Day 1	FSS	FSS	FSS	FSS
Day 2				
Day 3	FSS	FSS	FSS	FSS
Day 4				
Day 5				

PORT OF HAMPTON ROADS (1990)

A. GENERAL

1. Location and Harbor Description (fig II-HAM-1)

The Port of Hampton Roads is in southeastern Virginia near the midpoint of the US Atlantic Coast. It is at the southwest corner of the Chesapeake Bay. Hampton Roads is a natural roadstead of 25 square miles formed by the confluence of the James, Nansemond, and Elizabeth Rivers. The port is about 173 nautical miles south of Baltimore. It is 27 nautical miles west of the Virginia Capes, the entrance from the Atlantic Ocean to the Chesapeake Bay.

The Port of Hampton Roads has wharves, piers, and docks on both the east and west sides of the harbor. The commercial facilities on the east side capable of supporting military movements are the Norfolk International Terminal (NIT), the Lamberts Point Docks (LPD), and the Portsmouth Marine Terminal (PMT). The only terminal capable of loading military units on the west side of Hampton Roads is the Newport News Marine Terminal (NNMT).

Entry to the deep waters of Hampton Roads is between the Virginia Capes at the lower end of the Chesapeake Bay. The Thimble Shoal entry channel is 50 feet deep by 1,000 feet wide. From Hampton Roads, the 19.6-mile-long southward channel leads to the terminals at Norfolk and Portsmouth, and the 4.8-mile-long northward channel leads to NNMT. The southward channel is 50 feet deep by 1,500 feet wide to just south of NIT, where it reduces to 800 feet wide. The Newport News Channel is 800 feet wide by 50 feet deep throughout its course.

Hampton Roads has no designated turning basins. The wide channels, in combination with dredged terminal berths, provide ample turning room for the largest cargo ships.

Many anchorages are available within the Hampton Roads roadstead. Most are for general use and suitable for instream loading operations.

The Atlantic Intracoastal Waterway between Norfolk, Virginia, and the St. Johns River, Florida, follows the Elizabeth River and Albemarle and Chesapeake Canal (Virginia Cut) to Albemarle Sound, North Carolina. An alternate route of the waterway is via Deep Creek and the Dismal Swamp Canal.

No bridges or overhead obstructions cross the channels to the Hampton Roads terminals. The Hampton Roads Bridge Tunnel, which connects Norfolk and Hampton, crosses under the natural deepwater channel. The Chesapeake Bay Bridge Tunnel crossing the Chesapeake Bay has two tunnels. One passes under the Chesapeake Channel. The other passes under the Thimble Shoal Channel.

Mean tides at the terminals range from 2.5 feet to 2.8 feet.

2. Highway Access

Interstate Route 64, a major east-west route, serves the Hampton Roads terminals. I-64 meets Interstate Route 95, the main

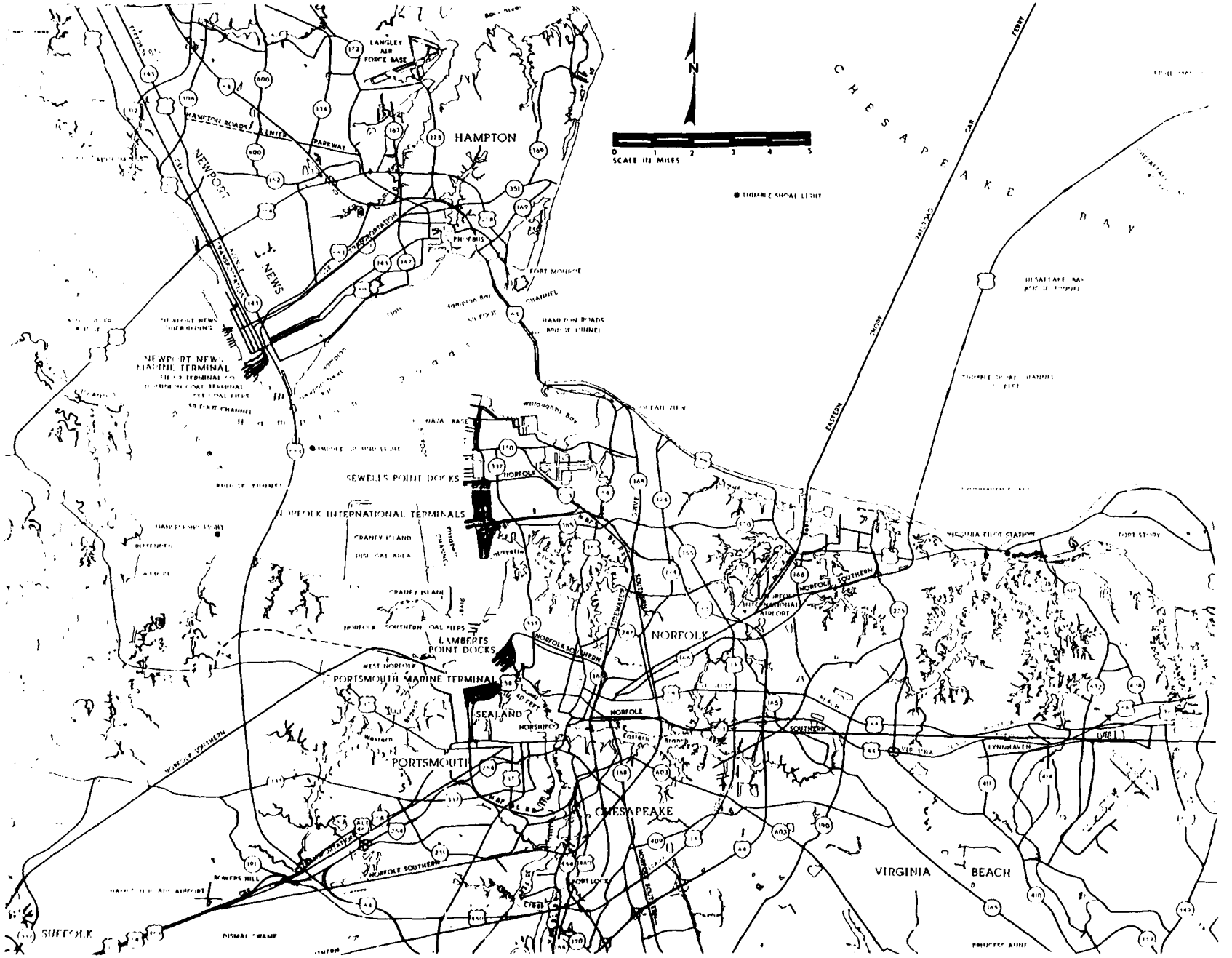


Figure II-HAM-1. Port of Hampton Roads.

east coast north-south artery, about 75 miles west of Hampton Roads.

Convoys can reach NNMT by taking Interstate Route 664 to 39th Street. Then they follow 39th Street to 18th Street, which leads to the terminal gate. By 1991, a new exit from I-664 will provide direct access to the terminal.

Access to LPD, NIT, and PMT is via Interstate Route 564 to Terminal Avenue, which leads to Hampton Boulevard.

Hampton Boulevard provides direct access to NIT. From Hampton Boulevard, PMT traffic takes the congested, four-lane Midtown Tunnel under the Elizabeth River to the terminal. Access to LPD is via Claremont Avenue from Hampton Boulevard to Raleigh Avenue, and Raleigh Avenue to the Drapax Street gate.

3. Rail Access

Three companies comprise the Hampton Roads rail network: Norfolk Southern Corporation, CSX, and Eastern Shore Railroad.

CSX provides rail service to NNMT. Shipside rail service is available with axle loading not to exceed 60,000 pounds on 5-foot centers. No interconnecting railway exists between NNMT and the other three terminals.

NIT rail access consists of a direct connection with the Norfolk Southern Corporation. CSX and Eastern Shore Railroad serve NIT via the Norfolk and Portsmouth Belt Line Railroad. Shipside rail service to NIT is available by prior arrangement.

The Norfolk Southern Corporation provides rail service to LPD. Shipside service is available. PMT rail access consists of a direct connection with CSX and service by the Norfolk Southern Corporation and Eastern Shore Railroad via the Norfolk and Portsmouth Belt Line Railroad. Shipside rail service is available.

4. Airports

Newport News/Williamsburg International Airport and Langley Air Force Base provide air cargo receiving sites for NNMT. Norfolk International Airport and Norfolk Naval Air Station support NIT, LPD, and PMT. Each of these facilities has significant support capabilities.

B. PORT FACILITIES

1. NIT (figs II-HAM-2 and II-HAM-3)

NIT is in the northwestern part of Norfolk, at the mouth of the Elizabeth River. It is bounded on the north by Hampton Roads Sanitation District and the United States Naval Supply Center, on the east by Hampton Boulevard and the residential area of Lochhaven, on the south by the Lafayette River, and on the west by the Elizabeth River. NIT occupies 479 acres of land and pier area.

a. Berthing. NIT consists of piers 1 and 2, the north berth, and container berths.

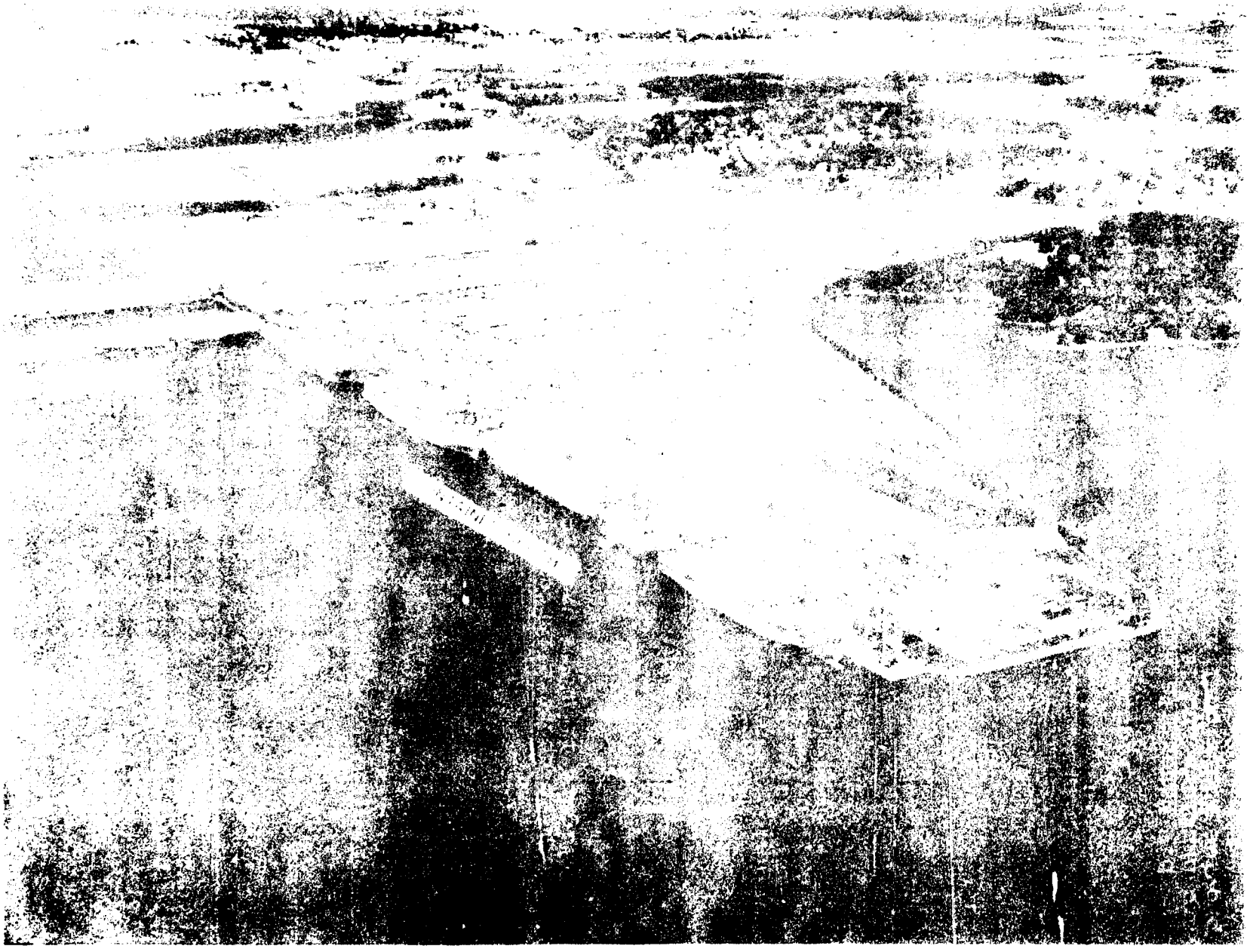
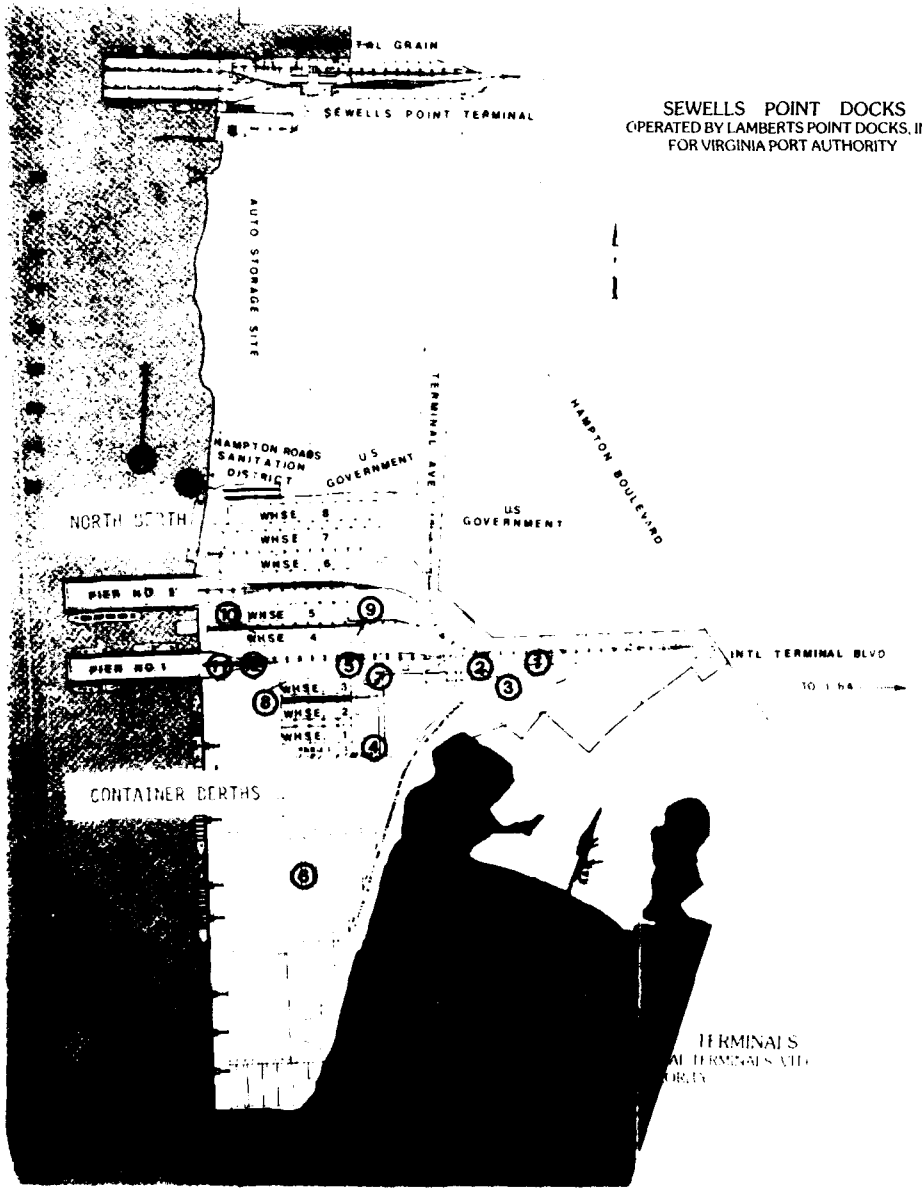


Figure II-HAM-2. Norfolk International Terminal.



SEWELLS POINT DOCKS
OPERATED BY LAMBERTS POINT DOCKS, INC.
FOR VIRGINIA PORT AUTHORITY

CONTAINER BERTHS: 4,230 FT. (1,290m)

CRANES: THREE (3) 40-LT KONE CRANES
TWO (2) 30-LT PACECO CRANES
ONE (1) 45-LT PACECO CRANE
ONE (1) 50-LT PACECO CRANE

PIER 1: LENGTH – 1,320 FT. (402.3m)
WIDTH – 300 FT. (91.4m)
APRON – 40 FT. (12.2m)
COVERED PIER STORAGE – 450,000 SQ. FT.

PIER 2: LENGTH – 1,320 FT. (402.3m)
WIDTH – 300 FT. (91.4m)
APRON – 40 FT. (12.2m)
COVERED PIER STORAGE 450,000 SQ. FT.

(1) MAIN GATE
(2) CONTAINER CONTROL, COMPUTER CENTER
(3) INTERCHANGE
(4) TRUCK CONTROL, U.S. CUSTOMS (WHSE. 1A)
(5) SCALES, STUFF/STRIP
(6) REEFER AREA
(7) SAFETY BUILDING
(8) REFRIGERATED WAREHOUSE (3E)
(9) VPA POLICE OFFICE
(10) VIT OFFICES, STEAMSHIP LINE OFFICES
(11) OPERATIONS OFFICE
(12) FUMIGATION CHAMBERS
(13) NORTH BERTH
(14) FUTURE EXPANSION

Figure II-HAM-3. Norfolk International Terminal site plan.

Pier 1, 1,320 feet long and 300 feet wide, is elevated 9.3 feet above mean low water (MLW). Water depth is 35 feet along the south side and 40 feet on the north side. The pier is paved with asphalt and has a timber fendering system. A 450,000-square-foot transit shed rests on the pier. This shed restricts apron width to 40 feet on each side. Pier 1 has no cranes on its wharf.

Pier 2 is similar to pier 1. The only difference is a water depth of 32 feet along its south side. Both piers have rail tracks on their aprons.

The north berth is a 900-foot-long marginal wharf used for side-ramp RORO operations. Apron height is 10 feet, and water depth is 32 feet. The RORO-side ramp is made of concrete and the rest of the wharf. Rubber fendering is along the wharf. The north berth has no cranes or rail tracks.

The container berths make up 4,230 feet of marginal wharf, elevated 9 feet above 41 feet of water. Rubber fendering protects vessels from the concrete wharf. Seven container cranes ranging from 30- to 50-long tons (LTON) serve the berths. Storage for 23,930 twenty-foot equivalent units (TEUs) is behind the cranes, where containers can be stacked four high. There is no rail service along the container berths.

Tables II-HAM-1 and II-HAM-2 show the terminal's berthing characteristics and capabilities. The terminal's ability to support various shipping modes is as follows:

(1) Breakbulk Operations. Breakbulk loading is normally done at piers 1 and 2. Pier 1 can accommodate two vessels of any type on each side. Pier 2 can accommodate two vessels, also, but C4-S-66a vessels cannot load to maximum draft on the south side because of shallow water. Ship's gear or mobile cranes are needed to handle cargo. Rail track on the aprons and more than 20 acres of transit shed storage on the piers simplify breakbulk operations.

(2) LASH and SEABEE Operations. A total of 72 LASH lighter or 49 SEABEE barge loading positions are available. Mobile cranes would be needed to load cargo into lighters or barges at all berths except the container berths. The seven container cranes could be adapted to load lighters or barges. Mother ships can also berth at several locations within the terminal, as shown in table II-HAM-2. In addition, LASH and SEABEE ships can conduct instream operations while at anchor.

(3) RORO and FSS Operations. The container berths are suitable for side- or slewed-ramp RORO ships. The RORO ramp at the north berth serves the Cygnus/Pilot-class vessel, but no others. This ramp connects to a large, paved, open area used for the temporary storage of vehicles. The container berths are the most favorable location for FSS ships. Four vessels can berth at the same time. Ship's gear, as well as container cranes, can handle cargo. The apron width restricts the loading of FSS vessels at piers 1 and 2. Vessel draft and berth length prevent FSS vessels from docking along the north berth.

(4) Container Operations. NIT has 4,230 feet of marginal wharf for container shipping. The wharf is serviced by four PACECO portainer cranes (50-, 45-, and two 30-LTON) and three 40-LTON Kone cranes. The Kone cranes have a dual hoist feature that

TABLE II-HAM-1
PORT OF HAMPTON ROADS
BERTH CHARACTERISTICS OF NORFOLK INTERNATIONAL TERMINAL

Characteristics	Berths					
	Pier 1-N	Pier 1-S	Pier 2-N	Pier 2-S	North	Cntnr
Length (ft)	1,320	1,320	1,320	1,320	900	4,230
Depth alongside at MLW (ft)	40	35	40	32	32	41
Deck strength (psf)	750	750	750	750	750	750
Apron width (ft)	40	40	40	40	Open	Open
Apron height above MLW (ft)	9	9	9	9	10	9
Number of container cranes	0	0	0	0	0	7
Number of wharf cranes	0	0	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	No	No	No
Apron length served by rail (ft)	1,320	1,320	1,320	1,320	0	0

Notes:
1. Terminal open storage area is 220 acres

2. Terminal covered storage area is 1900000 square feet

TABLE II-HAM-2
PORT OF HAMPTON ROADS
SUMMARY OF BERTHING CAPABILITIES OF NORFOLK INTERNATIONAL TERMINAL

Vessel	Berths					
	Pier 1-N	Pier 1-S	Pier 2-N	Pier 2-S	North	Cntnr
Breakbulk						
C3-S-33a	2	2	2	2	1	8
C3-S-37c	2	2	2	2	1	8
C3-S-37d	2	2	2	2	1	8
C3-S-38a	2	2	2	2	1	8
C4-S-1a	2	2	2	2	1	7
C4-S-1qb and 1u	2	2	2	2	1	7
C4-S-58a	2	2	2	2	1	7
C4-S-65a	2	2	2	2	1	7
C4-S-66a	2	2	2	a	a	7
C4-S-69b	2	2	2	2	1	7
Seatrain						
GA and PR-class	2	2	2	2	1	7
Barge						
LASH C8-S-81b	a,f	a,f	a,f	a,f	a,f	5
LASH C9-S-81d	1	a	1	a	a	4
LASH lighter	9	9	9	9	6	30
SEABEE C8-S-82a	1	a	1	a	a	4
SEABEE barge	6	6	6	6	4	21
RORO						
Comet	d,o	d,o	d,o	d,o	d,i,j	d,i,j
C7-S-95a/Maine-class	b	b	b	a,b	a	5
Ponce-class	b,h	b,h	b,h	b,h	h	h
Great Land-class	b,h	b,h	b,h	b,h	h	h
Cygnus/Pilot-class	b	b	b	b	1	6
Meteor	d,o	d,o	d,o	d,o	d,i,j	d,i,j
AmEagle/Condor	b	b	b	b	i,j	i,j
MV Ambassador	d	d	d	d	d	d
FSS-class	b	b	b	a,b	a,c	4
Cape D-class	b	b	b	a,b	a	i,j
Cape H-class	b	a,b	b	a,b	a	5
Container						
C6-S-1w	1,e	1,e	1,e	1,e	1,e	6
C7-S-68e	1,e	1,e	1,e	1,e	1,e	5
C8-S-85c	1,e	1,e	1,e	a,e	a,e	4
Combination						
C5-S-78a	2,e	2,e	2,e	a,e	a,e	6
C5-S-37e	2,e	2,e	2,e	2,e	1,e	6

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

allows them to operate faster and more efficiently than the other cranes. Figure II-HAM-4 shows container operations at NIT.

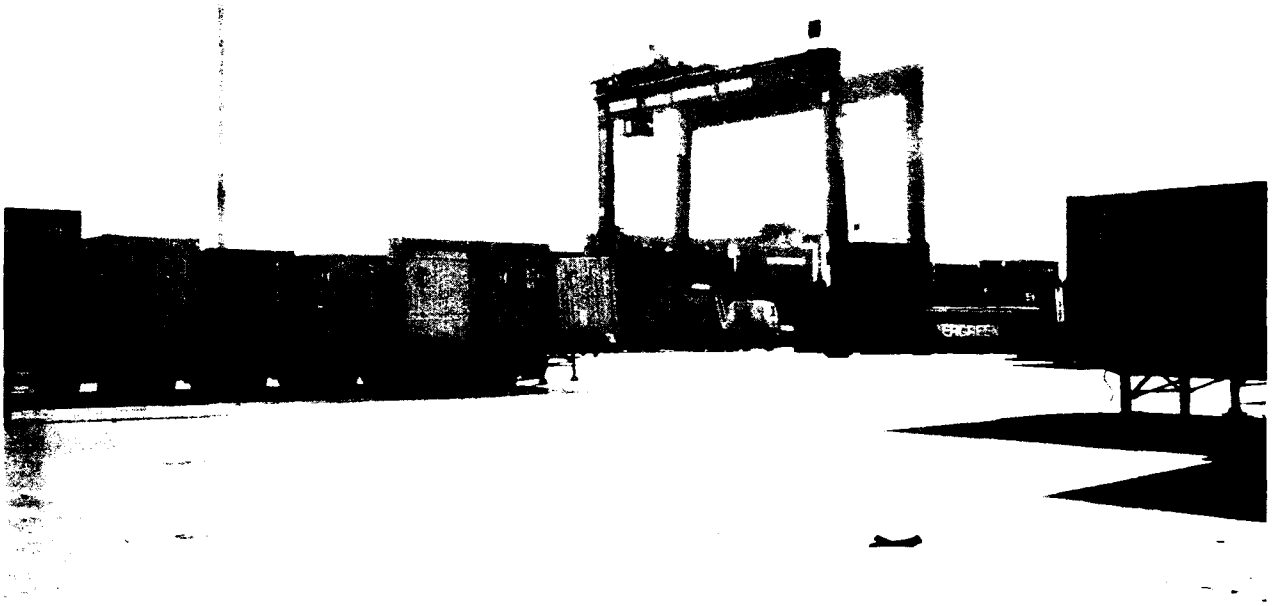


Figure II-HAM-4. Container operations.

b. Materials Handling Equipment (MHE). The terminal has 32 yard hustlers and 16 transtainers. Local stevedoring companies can provide additional MHE.

c. Staging

(1) Open Storage. Terminal open storage is 220 acres, paved, and well lighted, with no unusual obstructions within the area.

(2) Covered Storage. Piers 1 and 2 each have 450,000-square-foot transit sheds. These sheds have ample truck-loading docks. Recessed rail tracks run down their centers, allowing cars to unload at floor-level height (fig II-HAM-5). NIT also has 1 million square feet of warehouse space with truck loading docks and rail service.

d. Security. A chain link fence encloses the terminal. Virginia Port Authority police provide 24-hour gate and patrol services.

e. Rail Service. Three parallel tracks are near the container berth. A COFC area is available and can accommodate 39 railcars with seventy-eight 40-foot containers. Shipside rail service is also available. One seldom used fixed-rail end ramp is between piers 1 and 2.

f. Truck Operations. Roadway access is via Terminal Avenue, which connects to I-64 (a major east-west corridor). Trucks enter and exit the terminal area via the 10-lane truck gate, shown in figure II-HAM-6. The transit sheds and warehouses have sufficient truck-loading positions that can also be used as end ramps.

Figure II-HAM-5. Transit shed.

Figure II-HAM-6. Truck gate.

g. Helicopter Operations. NIT has large open storage areas that would allow aircraft to fly directly into the terminal.

h. Marshaling Areas. No suitable locations for marshaling equipment are available near the terminal.

2. NNMT (figs II-HAM-7 and II-HAM-8)

NNMT is in Newport News at the mouth of the James River, a major tributary of the Chesapeake Bay.

a. Berthing. NNMT consists of two piers, piers B and C. Pier B is 620 feet long and 550 feet wide with 34-foot aprons. Wharf elevation is 15 feet with water depth of 28 feet on the north side and 34 feet on the south side. A 270,000-square-foot transit shed rests on the pier. Each side of the pier has apron track and a timber fendering system.

The north side of pier C is 750 feet long with an apron width of 34 feet. One 30-LTON PACECO and one 40-LTON Le Tourneau crane are on the north side. A rail line runs along the apron and beneath the cranes. Water depth is 35 feet along both sides, and a timber fendering system is used. The south side of pier C is 930 feet long with a 184-foot-wide apron. This side has one 40-LTON PACECO crane and one 50-LTON CMI crane capable of a 182-LTON heavy lift. Rail track runs the length of the pier. Pier C has a 205,000-square-foot transit shed and a deck elevation of 14 feet.

Tables II-HAM-3 and II-HAM-4 show the berthing characteristics and capabilities of the terminal. The terminal's ability to support various shipping modes is described below:

(1) Breakbulk Operations. The south side of pier B and both sides of pier C can accommodate one breakbulk vessel each. Ship's gear or mobile cranes are necessary to load cargo. The south face of pier C, with its 182-LTON heavy-lift CMI crane is a good choice for heavy-lift loading.

(2) LASH and SEABEE Operations. NNMT has 19 LASH lighter or 13 SEABEE barge loading positions. Mother ships may need to conduct instream operations because of shallow berth depths.

(3) RORO and FSS Operations. The versatile C7-S-95a/Maine-class and Cygnus/Pilot-class vessels with their slewed-stern ramps perform best at NNMT. These vessels can berth on the south side of pier C. Pier C south also has a straight-stern ramp (fig II-HAM-9). FSS ships can load at pier C south.

(4) Container Operations. Pier C south is the best location for container operations. The pier has one 40-LTON PACECO crane and one 50-LTON CMI crane capable of a 182-LTON heavy lift. Pier C south can accommodate one container vessel regardless of type. Containers can be stacked in the open storage area, using the terminal's two yard gantries. This gives a stacking capacity (two high) of 790 containers.

b. Materials Handling Equipment (MHE). The terminal has the following MHE:

2 - yard gantries
2 - 80,000-pound top loaders
1 - 45,000-pound forklift
2 - 40-LTON forklifts
25 - 5,000- to 8,000-pound forklifts

Local contractors also have MHE available.

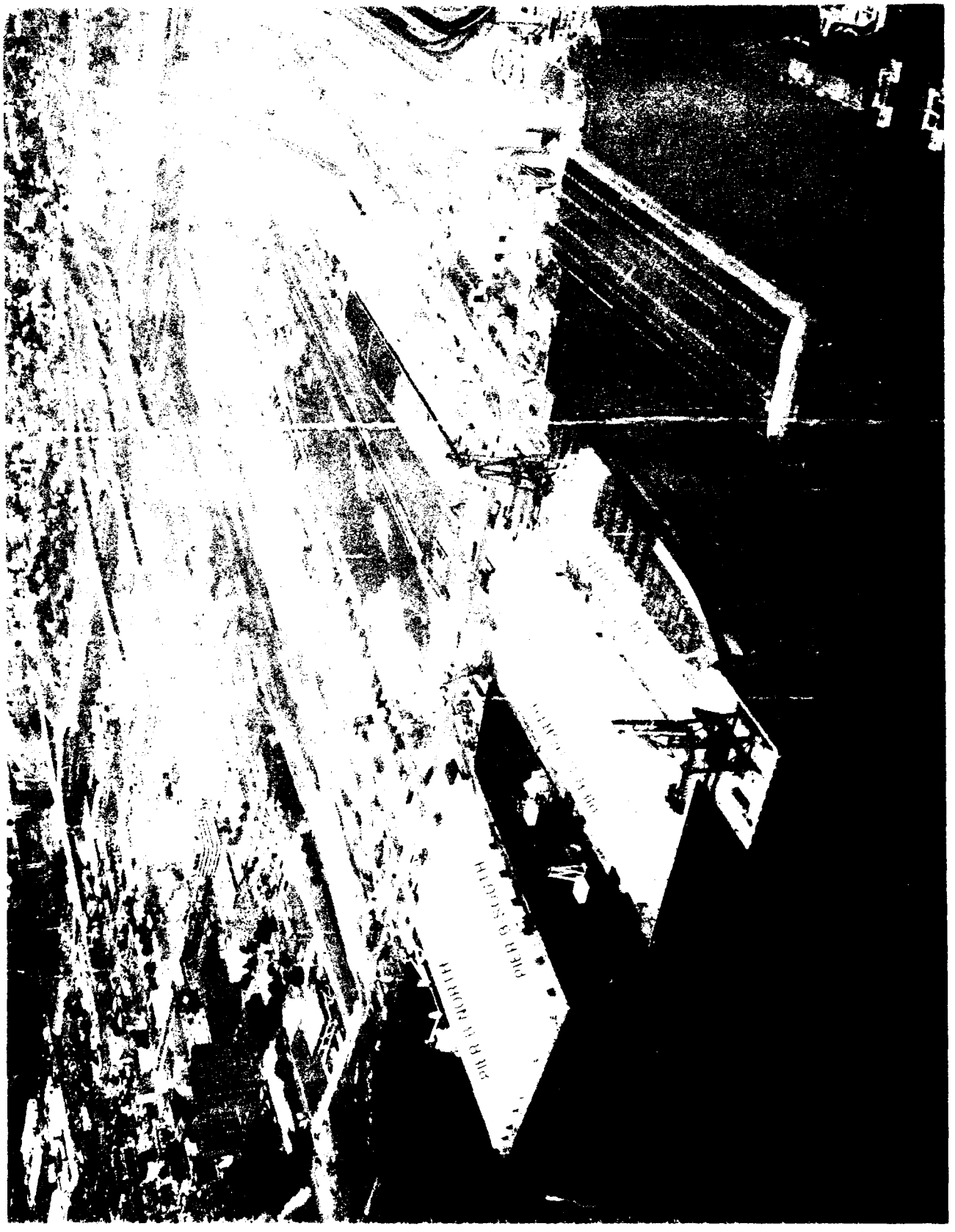


Figure II-HAM-7. Newport News Marine Terminal.

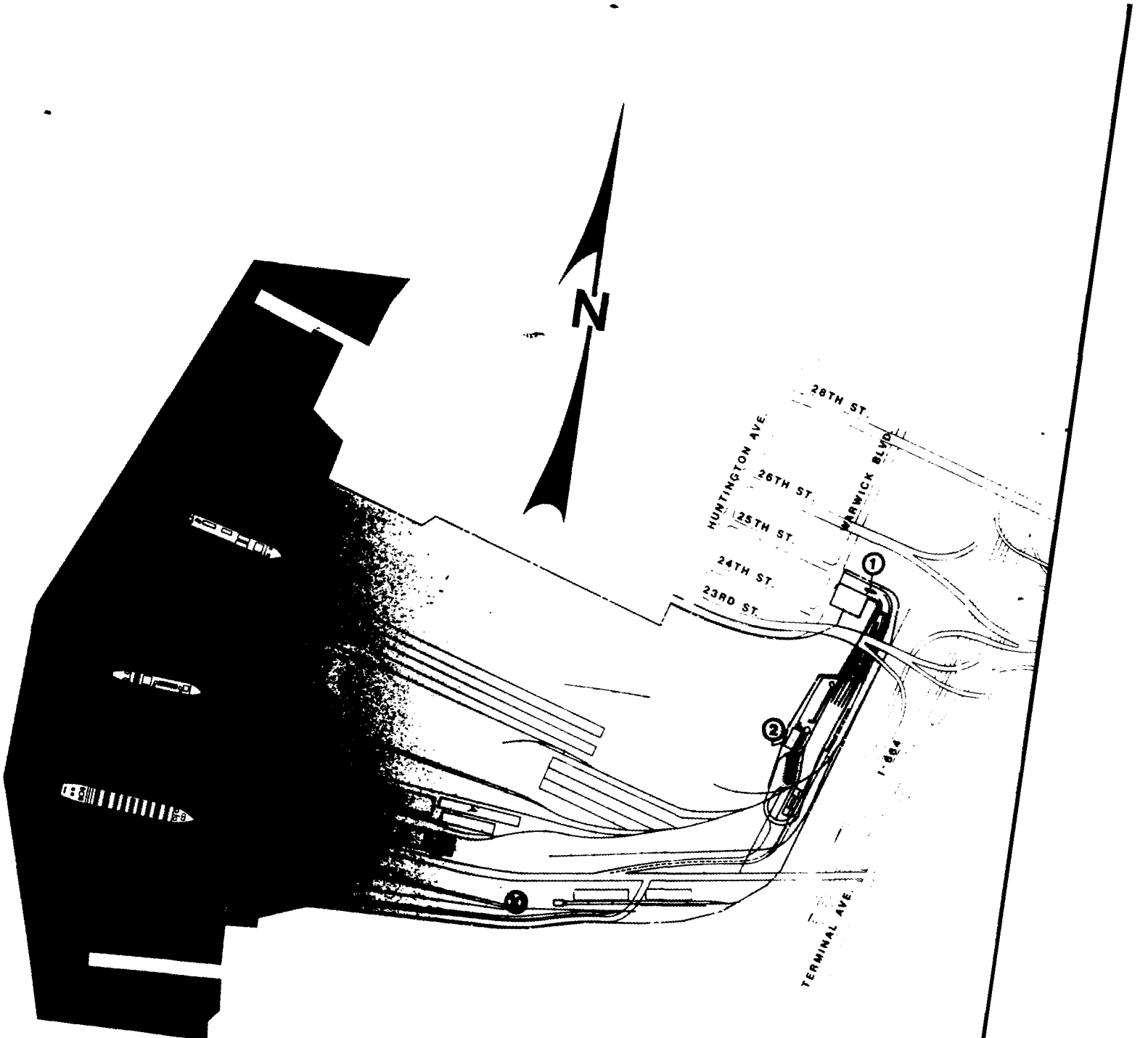
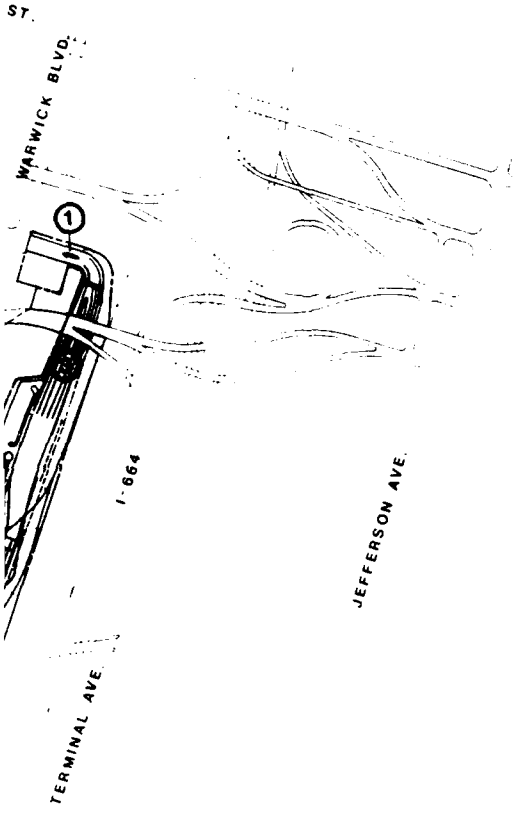


Figure II-HAM-8. Newport News Marine Terminal site plan.

PIER B: LENGTH—620 FT. (189m)
WIDTH—550 FT. (167.6m)
APRONS—34 FT. (10.4m)
COVERED PIER STORAGE—270,000 SQ. FT.

PIER C: SOUTH SIDE:
LENGTH—930 FT. (283.5m)
WIDTH—540 FT. (164.6m)
APRON—184 FT. (56.1m)
CRANES—ONE (1) 40-LT PACECO CRANE
ONE (1) 50-LT/182 LT HEAVY LIFT CMI CRANE

NORTH SIDE:
LENGTH—750 FT. (228.75m)
WIDTH—540 FT. (164.6m)
APRON—184 FT. (56.1m)
CRANES—TWO (2) 30-LT PACECO CRANES
ONE (1) 40-LT Le TOURNEAU CRANE
COVERED PIER STORAGE—205,000 SQ. FT.



(1) MAIN GATE
(2) CENTRAL OFFICE
(3) INTERCHANGE/SCALES
(4) WAREHOUSES 37, 39, 41, 43
(5) WAREHOUSES 36, 38, 40, 42
(6) FUMIGATION CHAMBERS
(7) HEAVY LIFT WAREHOUSE
(8) VIT MAINTENANCE
(9) U.S. CUSTOMS
(10) REEFER AREA

plan.

OPERATED BY: VIRGINIA INTERNATIONAL TERMINALS (VIT)
FOR: VIRGINIA PORT AUTHORITY (VPA)

TABLE II-HAM-3
PORT OF HAMPTON ROADS
BERTH CHARACTERISTICS OF NEWPORT NEWS MARINE TERMINAL

Characteristics	Berths			
	Pier B-N	Pier B-S	Pier C-N	Pier C-S
Length (ft)	620	620	750	930
Depth alongside at MLW (ft)	28	34	35	35
Deck strength (psf)	750	750	750	750
Apron width (ft)	34	34	34	184
Apron height above MLW (ft)	15	15	14	14
Number of container cranes	0	0	2	1
Number of wharf cranes	0	0	0	1
Apron lighting	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	Yes
Apron length served by rail (ft)	620	620	750	930

Notes:
1. Terminal open storage area is 67 acres
2. Terminal covered storage area is 615000 square feet

TABLE II-HAM-4
PORT OF HAMPTON ROADS
SUMMARY OF BERTHING CAPABILITIES OF NEWPORT NEWS MARINE TERMINAL

Vessel	Berths			
	Pier B-N	Pier B-S	Pier C-N	Pier C-S
Breakbulk				
C3-S-33a	a	1	1	1
C3-S-37c	a	1	1	1
C3-S-37d	a	1	1	1
C3-S-38a	1	1	1	1
C4-S-1a	a	1	1	1
C4-S-1qb and 1u	a	1	1	1
C4-S-58a	a	1	1	1
C4-S-65a	a	1	1	1
C4-S-66a	a	1	1	1
C4-S-69b	a	1	1	1
Seatrain				
GA and PR-class	1	1	1	1
Barge				
LASH C8-S-81b	a,c,f	a,c,f	a,c,f	a,f
LASH C9-S-81d	a,c	a,c	a,c	a
LASH lighter	4	4	5	6
SEABEE C8-S-82a	a,c	a,c	a,c	a
SEABEE barge	3	3	3	4
RORO				
Comet	d,o	d,o	d,o	i,j
C7-S-95a/Maine-class	a,b,c	b,c	b	1
Ponce-class	b,c,h	b,c,h	b,h	h
Great Land-class	b,c,h	b,c,h	b,c,h	h
Cygnus/Pilot-class	b,c	b,c	b	1
Meteor	a,d,o	d,o	d,o	i,j
AmEagle/Condor	a,b,c	b,c	b	i,j
MV Ambassador	d	d	d	1
FSS-class	a,b,c	b,c	b,c	c
Cape D-class	a,b,c	b,c	b	i,j
Cape H-class	a,b,c	a,b,c	a,b	a
Container				
C6-S-1w	a,c,e	c,e	1	1
C7-S-68e	a,c,e	c,e	1	1
C8-S-85c	a,c,e	c,e	c	1
Combination				
C5-S-78a	a,e	1,e	1	1
C5-S-37e	a,e	1,e	1	1

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

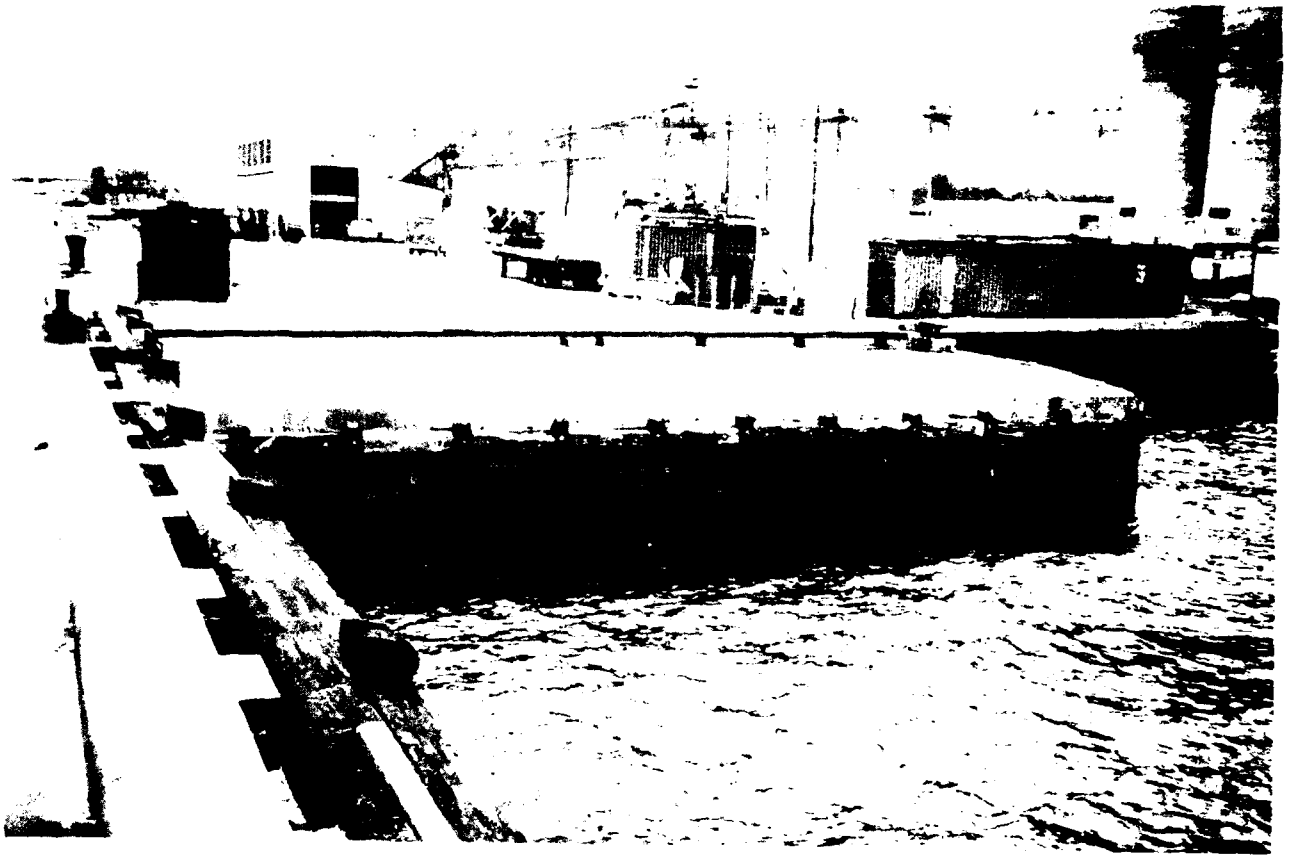


Figure II-HAM-9. RORO straight-stern ramp.

c. Staging

(1) Open Storage. The terminal's paved, open storage area consists of 40 acres (fig II-HAM-10). Paving of an additional 27 acres is in progress.

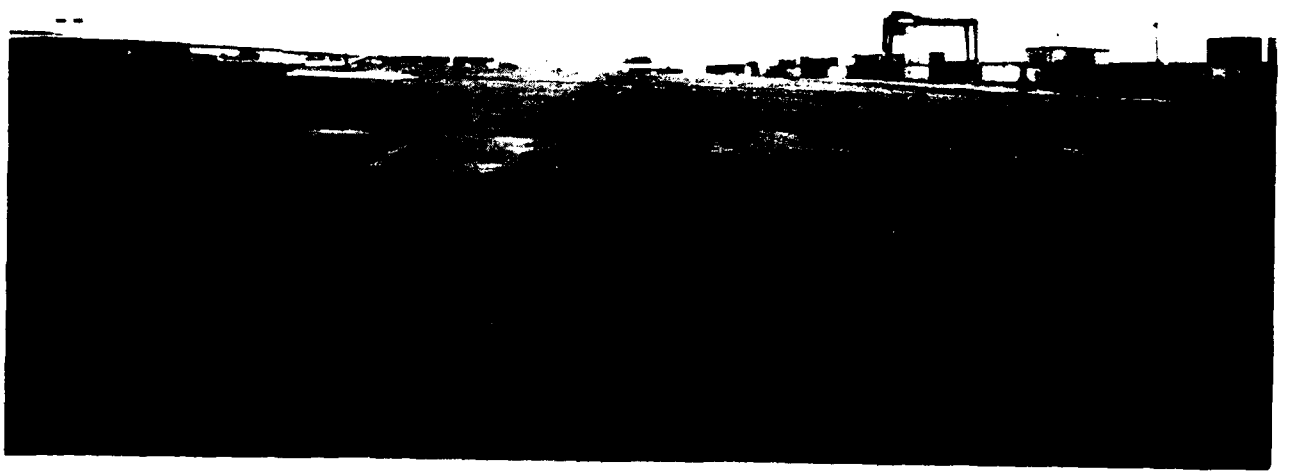


Figure II-HAM-10. Open storage.

(2) Covered Storage. Pier B has a 270,000-square-foot transit shed, and pier C has a 205,000-square-foot transit shed. The terminal also has 140,000 square feet of warehouses behind pier C.

d. Security. NNMT is enclosed by fence, and security personnel patrol the terminal continuously.

e. Rail Operations. Both piers have apron track on each side. Recessed tracks inside the transit sheds allow the cars to unload at floor-level height.

f. Truck Operations. Each transit shed has adjustable docks. Six portable end ramps are also available.

g. Helicopter Operations. As figure II-HAM-10 shows, unobstructed open area is available for helicopters to land.

h. Marshaling Areas. NNMT rests at the end of a densely populated peninsula. No suitable marshaling area exists near the terminal. However, if necessary, vehicles and equipment could be marshaled at Fort Eustis, about 19 miles away.

3. LPD (figs II-HAM 11 and II-HAM-12)

LPD is in Norfolk, south of NIT, on the Elizabeth River. Immediately north of the docks are the Norfolk Southern Corporation coal storage yards. The terminal serves as a breakbulk facility.

a. Berthing. LPD has three finger piers available for use, piers L, N, and P. Pier S is unsuitable for berthing. The south side of pier L is the layberth for FSS vessels. The north side of the pier is for loading bulk liquids and is not usable for any other cargo operations. Piers N and P are for loading breakbulk cargo. Pier N has two gantry cranes on the south side. Pier P has two gantry cranes that can operate on both sides of the pier.

Tables II-HAM-5 and II-HAM-6 show the berthing characteristics and capabilities of the terminal. The terminal's ability to support various shipping modes is as follows:

(1) Breakbulk Operations. Piers N and P are suitable for all breakbulk vessels, except the C4-S-66a class. For this class, the vessel draft cannot exceed the berth's depth. The south side of pier L is also available for breakbulk operations. However, modifications to the present fendering system may be necessary.

(2) LASH and SEABEE Operations. The terminal can load up to 35 LASH lighters or 25 SEABEE barges. LASH and SEABEE ships can dock at all berths. However, vessel draft cannot exceed the berth's depth.

(3) RORO and FSS Operations. The south side of pier L is capable of handling slewed- or side-ramp RORO vessels. However, the vessel draft cannot exceed 32 feet. The use of piers N and P for RORO or FSS operations, although possible, is impractical because of the narrow aprons. Additionally, the lack of open storage area at LPD makes RORO and FSS loading impractical.

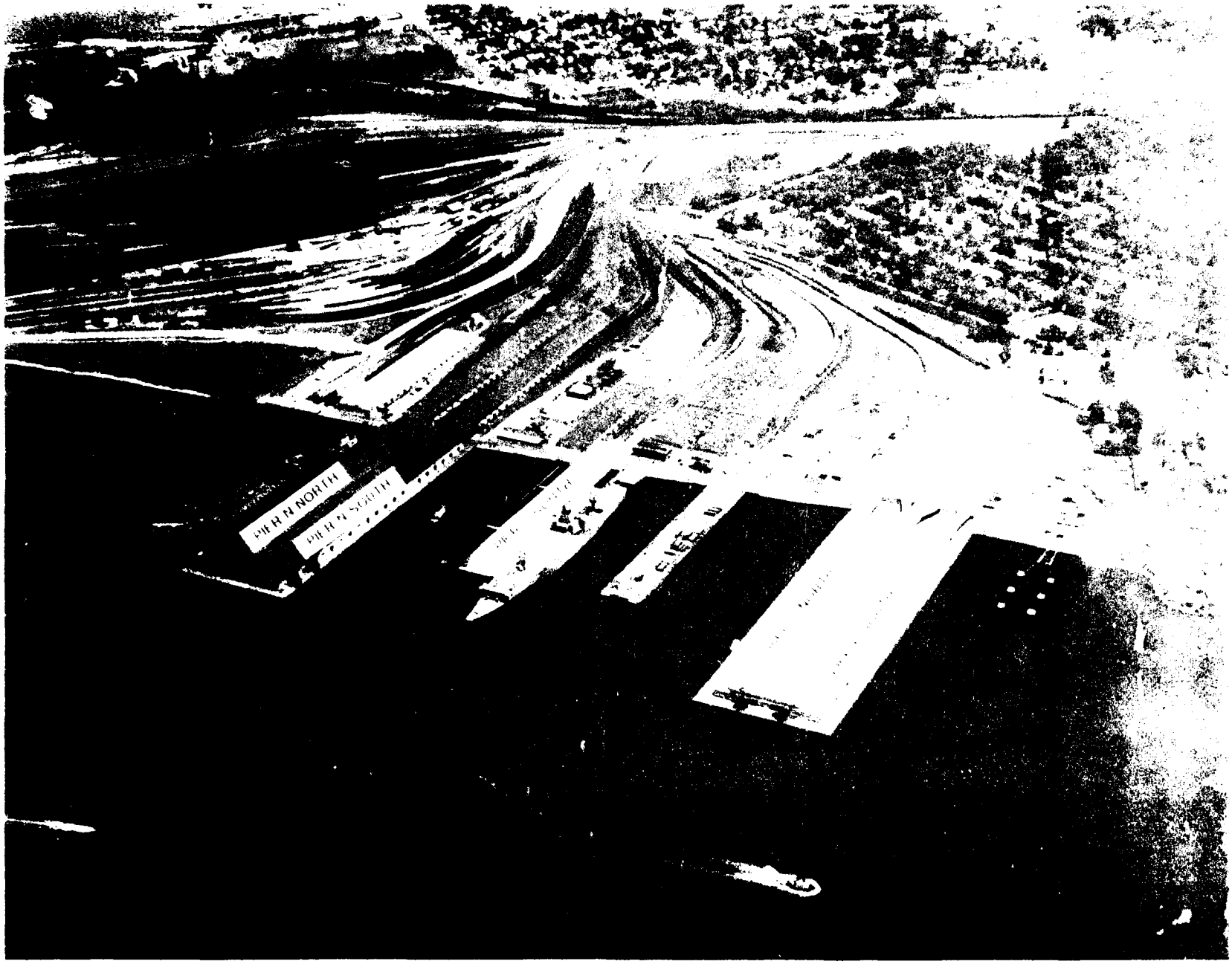
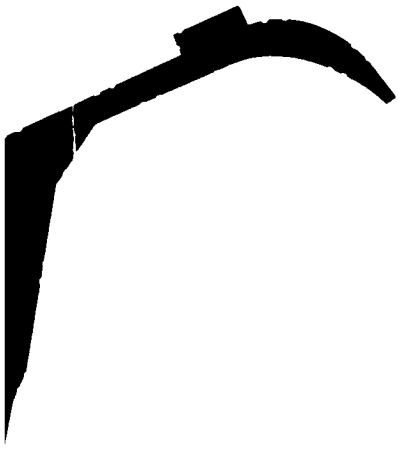


Figure II-HAM-11. Lamberts Point Docks.

Figure II-HAM-12. Lamberts Point Docks site plan.



PIER L: LENGTH—725 FT. (221m)

PIER N: LENGTH—1,100 FT. (335m)
WIDTH—390 FT. (119m)
APRONS—35 FT. (11m)
COVERED PIER STORAGE—320,000 SQ. FT.
CRANES—TWO (2) 15 LT GANTRY CRANES

PIER P: LENGTH—1,200 FT. (366m)
WIDTH—400 FT. (122m)
APRONS—45 FT. (14m)
COVERED STORAGE—326,000 SQ. FT.
CRANES—TWO (2) 25 LT GANTRY CRANES

PIER S: LENGTH—725 FT. (221m)

1. MAIN GATE
2. CENTRAL OFFICE
3. OIL HANDLING BERTH
4. LAY BERTH
5. 115,000 CU. FT. FREEZER STORAGE
6. FUMIGATION PLANT (FOUR CHAMBER)
7. FUMIGATION PLANT (TWO CHAMBER)

OPERATED BY: LAMBERTS POINT DOCKS, INC.
FOR: VIRGINIA PORT AUTHORITY (VPA)

plan.

TABLE II-HAM-5
PORT OF HAMPTON ROADS
BERTH CHARACTERISTICS OF LAMBERTS POINT DOCKS

Characteristics	Berths				
	Pier N-N	Pier N-S	Pier L-S	Pier P-N	Pier P-S
Length (ft)	1,100	1,100	725	1,200	1,200
Depth alongside at MLW (ft)	32	32	32	32	32
Deck strength (psf)	750	750	650	700	700
Apron width (ft)	35	35	Open	43	43
Apron height above MLW (ft)	11	11	13	11	11
Number of container cranes	0	0	0	0	0
Number of wharf cranes	0	2	0	1	1
Apron lighting	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	No	No
Apron length served by rail (ft)	1,100	1,100	0	1,200	1,200

Notes:
1. Terminal open storage area is 8 acres
2. Terminal covered storage area is 2146600 square feet

TABLE II-HAM-6
PORT OF HAMPTON ROADS
SUMMARY OF BERTHING CAPABILITIES OF LAMBERTS POINT DOCKS

Vessel	Berths				
	Pier N-N	Pier N-S	Pier L-S	Pier P-N	Pier P-S
Breakbulk					
C3-S-33a	2	2	1	2	2
C3-S-37c	2	2	1	2	2
C3-S-37d	2	2	1	2	2
C3-S-38a	2	2	1	2	2
C4-S-1a	1	1	1	2	2
C4-S-1qb and 1u	1	1	1	2	2
C4-S-58a	1	1	1	2	2
C4-S-65a	1	1	1	2	2
C4-S-66a	a	a	a	a	a
C4-S-69b	1	1	1	1	1
Seatrain					
GA and PR-class	1	1	1	2	2
Barge					
LASH C8-S-81b	a,f	a,f	a,c,f	a,f	a,f
LASH C9-S-81d	a	a	a,c	a	a
LASH lighter	7	7	5	8	8
SEABEE C8-S-82a	a	a	a,c	a	a
SEABEE barge	5	5	3	6	6
RORO					
Comet	d,o	d,o	d,i,j	d,o	d,o
C7-S-95a/Maine-class	a,b	a,b	a,c	a,b	a,b
Ponce-class	b,h	b,h	h	b,h	b,h
Great Land-class	b,h	b,h	c,h	b,h	b,h
Cygnus/Pilot-class	b	b	1	b	b
Meteor	d,o	d,o	d,i,j	d,o	d,o
AmEagle/Condor	b	b	i,j	b	b
MV Ambassador	d	d	d	d	d
FSS-class	a,b	a,b	a,c	a,b	a,b
Cape D-class	a,b	a,b	a	a,b	a,b
Cape H-class	a,b	a,b	a,c	a,b	a,b
Container					
C6-S-1w	1,e	1,e	1,e	1,e	1,e
C7-S-68e	1,e	1,e	1,e	1,e	1,e
C8-S-85c	a,e	a,e	a,c,e	a,e	a,e
Combination					
C5-S-78a	a,e	a,e	a,e	a,e	a,e
C5-S-37e	1,e	1,e	1,e	1,e	1,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

(4) Container Operations. The terminal does not have the physical configuration or container handling equipment for container loading operations.

b. Materials Handling Equipment (MHE). The terminal owns several heavy-duty forklifts and tractors. Also, LPD has one 30-LTON van carrier and one 30-LTON transtainer for limited container movements.

c. Staging

(1) Open Storage. The terminal has 8 acres of gravel-surfaced open storage. This storage is split into several parts by an extensive terminal rail system. A small holding area for containers is south of pier P. This area is for the temporary storage of containers awaiting stripping or stuffing at the warehouses.

(2) Covered Storage. Pier N has a 320,000-square-foot transit shed. The shed has covered drives connecting it to warehouses H and J. Warehouse K is also near pier N. Pier P, with a 326,000-square-foot transit shed, has covered drives connecting it to warehouses Q and R. The combined storage area of warehouses H, J, K, L, Q, and R is 1.5 million square feet. These buildings provide 2,146,600 square feet of covered storage.

d. Security. Chain link fencing encloses the terminal. The terminal operator provides gate guards and security patrols.

e. Rail Operations. The terminal has more than 3 miles of rail track. Rail service is provided by the Norfolk Southern Corporation. Piers N and P have rail tracks on their aprons. Also, the transit sheds on piers N and P have twin depressed tracks running through the center of each shed. A rail end spur suitable for setting up a portable ramp is available in the open area south of pier P.

f. Truck Operations. Warehouses Q and R have raised truck docks for truck loading. All warehouses and transit sheds have cargo doors that permit trucks to drive into the storage areas.

g. Helicopter Operations. Insufficient open area in the terminal prohibits the landing of helicopters.

h. Marshaling Areas. No ample open areas are available near LPD to marshal unit equipment.

4. PMT (fig II-HAM 13)

PMT, which includes the Sea-Land berth, is in Portsmouth, on the south bank of the Elizabeth River.

a. Berthing. PMT has a 2,490-foot marginal wharf with four container cranes and one 110-STON gantry crane. The Sea-Land berth has a 600-foot facing pier with onramps and offramps and two container cranes. Tables II-HAM-7 and II-HAM-8 show berthing characteristics and capabilities. The terminal's ability to support various shipping modes is as follows:

(1) Breakbulk Operations. Both PMT and Sea-Land can berth breakbulk vessels. However, loading at the Sea-Land berth will be time-consuming because of the configuration of the pier.

Figure II-HAM-13. Portsmouth Marine Terminal.

TABLE II-HAM-7
PORT OF HAMPTON ROADS
BERTH CHARACTERISTICS OF PORTSMOUTH MARINE TERMINAL

Characteristics	Berths	
	Sealand	1-3
Length (ft)	600	2,490
Depth alongside at MLW (ft)	38	38
Deck strength (psf)	1,000	1,000
Apron width (ft)	Open	Open
Apron height above MLW (ft)	12	12
Number of container cranes	2	4
Number of wharf cranes	0	1
Apron lighting	Yes	Yes
Straight-stern RORO facilities	No	Yes
Apron length served by rail (ft)	0	2,200

Notes:
1. Terminal open storage area is 147 acres
2. Terminal covered storage area is 190400 square feet

TABLE II-HAM-8
PORT OF HAMPTON ROADS
SUMMARY OF BERTHING CAPABILITIES OF PORTSMOUTH MARINE TERMINAL

Vessel	Berths	
	Sealand	1-3
Breakbulk		
C3-S-33a	1	4
C3-S-37c	1	4
C3-S-37d	1	4
C3-S-38a	1	4
C4-S-1a	1	4
C4-S-1qb and 1u	1	4
C4-S-58a	1	4
C4-S-65a	1	4
C4-S-66a	1	4
C4-S-69b	1	4
Seatrain		
GA and PR-class	1	4
Barge		
LASH C8-S-81b	a,c,f	a,f
LASH C9-S-81d	c	2
LASH lighter	4	17
SEABEE C8-S-82a	a,c	a
SEABEE barge	3	12
RORO		
Comet	d,i,j	i,j
C7-S-95a/Maine-class	c	3
Ponce-class	c,h	h
Great Land-class	c,h	h
Cygnus/Pilot-class	c	3
Meteor	d,i,j	i,j
AmEagle/Condor	c	i,j
MV Ambassador	d	4
FSS-class	c	2
Cape D-class	c	i,j
Cape H-class	c	3
Container		
C6-S-1w	c	3
C7-S-68e	c	3
C8-S-85c	c	2
Combination		
C5-S-78a	c	3
C5-S-37e	1	4

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

(2) LASH and SEABEE Operations. PMT has 21 LASH lighter or 15 SEABEE barge loading positions. The use of mobile cranes is necessary to load the lighters.

The C9-S-81d LASH ship is capable of docking at PMT. However, the berth depth may restrict loading of the larger LASH and SEABEE ships. If necessary, these ships can lift their lighters aboard at a nearby anchorage.

(3) RORO and FSS Operations. PMT can berth up to four slewed- or side-ramp RORO ships or two FSS vessels. The terminal also has a ramp for straight-stern loading RORO ships. However, ramp-angle clearance problems may occur at low or high tide.

(4) Container Operations. PMT can load up to three containerships at once, and Sea-Land can load one containership. While the Sea-Land pier is 600 feet long, mooring and breasting dolphins are available to permit the docking of ships up to 1,000 feet long.

b. Materials Handling Equipment (MHE). PMT has fourteen 30-LTON transtainers, eleven yard hustlers, two 40-STON forklifts, and one 22.5-STON forklift. Additionally, Sea-Land has two 40-STON forklifts and one transtainer.

c. Staging

(1) Open Storage. PMT has 117 acres of paved and lighted open storage area. This area is chiefly for containers loaded on chassis and containers stacked three high. An additional 160 acres of unimproved storage is available near the terminal entrance. The Sea-Land area has 30 acres of graveled storage area for storing containers on chassis.

(2) Covered Storage. Two warehouses on PMT provide more than 160,000 square feet of covered storage. Sea-Land has a 30,000-square-foot container-stuffing facility.

d. Security. Fencing encloses PMT on the east and west sides. The rail tracks on the south side act as a barrier against vehicle entry and exit. Armed Virginia Port Authority police provide gate and security patrol service.

e. Rail Operations. Rail access for PMT consists of a direct connection of CSX and service by the Norfolk Southern Corporation via the Norfolk and Portsmouth Belt Line Railroad. Shipside rail service is available for two berths at PMT. Vehicles on flatcars are offloaded at a 60- by 65-foot concrete end ramp. Railyards next to PMT can hold more than 2,000 freight cars.

f. Truck Operations. The two warehouses at PMT have 20 access doors and a drive-in capability. The Sea-Land warehouse has 26 loading bays.

g. Helicopter Operations. PMT does not have a dedicated helicopter landing and staging area. However, helicopter operations could take place at the open storage area.

h. Marshaling Areas. The Virginia Port Authority has access to about 160 acres of unimproved area next to PMT. This area could be used to stage equipment, if necessary.

C. SUPPORT SERVICES

1. Pilotage

Pilotage is compulsory and requires advance notice of 24 hours prior to the estimated time of arrival.

2. Harbor Craft

The Port of Hampton Roads has 17 tugs with up to 4,300 horsepower.

3. Stevedores

Stevedoring contractors provide cargo-handling services. About 3,200 longshoremen are in the Hampton Roads area. MTMC International Traffic has determined that enough longshoremen will be available to meet mobilization needs.

4. Heavy-Lift Equipment

A commercial construction company operates a 350-ton floating crane. This crane can accommodate heavy loads from ships at any terminal.

D. INTERMODAL CONTAINER TRANSFER FACILITIES (ICTF)

The Virginia Inland Port (VIP) in Front Royal recently became operational. It serves as an ICTF, providing an interface between truck and rail for transfer of oceangoing containers from Hampton Roads. Containers are transported by truck to VIP for immediate loading upon a rail-spine car or for short-term storage prior to loading. The rail-spine car consists of 60 platforms with space for about 78 containers. Rail service is provided by the Norfolk Southern Corporation. VIP equipment includes two straddle carriers, scales, and spine cars for rail operations.

E. FUTURE DEVELOPMENTS

At NIT, preliminary steps are underway to build the first of four additional berths. The first berth, expected to be completed by 1992, will include five "under the crane" operating lanes for containers being towed into position. Construction is also underway for a chassis storage system allowing stacking of 18 chassis in the space normally required for 2.

NNMT plans include the grading and paving of a new, large open storage area. Expected to be completed in mid-1990, a portion of the area will be used as an automobile handling facility.

At PMT, design and construction has begun for development of the 35-acre tract of land on the east waterfront. A 15-acre portion of the parcel is now under construction for packing and stacking containers. In addition, dredging has begun for expansion of the fourth wharf.

F. REQUIREMENTS AND RECOMMENDATIONS

1. Requirements

The berthing requirements to outload an engineer company (port construction) through the port of Hampton Roads in 5 days are considered. See appendix A for a list of the vessels required to support this unit. The ship requirements for the unit are:

- Ship mix 1 (modern ships): 1 ship.
- Ship mix 2 (combination of ship types): 2 ships.
- Ship mix 3 (breakbulk ships): 2 ships.
- Ship mix 4 (fast sealift ships): 1 ship.

2. Recommendations

Tables II-HAM-9 and II-HAM-10 show that the NNMT facilities are adequate to deploy a unit.

TABLE II-HAM-10
BERTHING RECOMMENDATIONS FOR SHIP MIXES 3 AND 4
(ENGINEER COMPANY)

Ship Mix 3 (Older Ships)			Ship Mix 4 (Fast Sealift Ships)
Terminal:	Newport News Marine	Newport News Marine	Newport News Marine
Berth:	Pier C-S	Pier C-N	Pier C-S
Day 1	C4-S-65a	C4-S-58a	FSS-1
Day 2			
Day 3			
Day 4			
Day 5			

TABLE II-HAM-10
BERTHING RECOMMENDATIONS FOR SHIP MIXES 3 AND 4
(ENGINEER COMPANY)

Ship Mix 3 (Older Ships)			Ship Mix 4 (Fast Sealift Ships)
Terminal:	Newport News Marine	Newport News Marine	Newport News Marine
Berth:	Pier C-S	Pier C-N	Pier C-S
Day 1	C4-S-65a	C4-S-58a	FSS-1
Day 2			
Day 3			
Day 4			
Day 5			

PORT OF JACKSONVILLE (1990)

A. GENERAL

1. Location and Harbor Description (fig II-JAX-1)

The Port of Jacksonville, Florida, is on the St. Johns River, 145 nautical miles south of Savannah, Georgia, and 345 nautical miles north of Miami, Florida. The port has two main terminals, Blount Island Marine Terminal and Talleyrand Docks and Terminals.

Blount Island Marine Terminal is 11 nautical miles from the river's mouth. Talleyrand Docks and Terminals is another 8 nautical miles inland. The Atlantic Intracoastal Waterway crosses the St. Johns River about 6 miles downstream from Blount Island Marine Terminal.

Access to the terminals is via a 400- to 1,200-foot-wide channel that has a depth of 38 feet at mean water level (MWL). Although no turning basins exist, the channel width in front of the terminals is sufficient for a vessel to turn.

Vessels awaiting entrance to the St. Johns River may anchor in 36- to 50-foot-deep water, north-northeastward of the river's entrance jetties. Four anchorages in 31 feet of water are available near the Talleyrand Docks and Terminals.

The mean tidal range varies from about 2 feet at the Talleyrand Docks and Terminals to 3 feet at Blount Island Marine Terminal. Tidal currents are strong in the St. Johns River, ranging from 3.1 knots at Mayport to 1.0 knot next to downtown Jacksonville.

Overhead power cables crossing the channel east of the Blount Island Marine Terminal have a 175-foot vertical clearance at mean high water (MHW). The Interstate Route 295 bridge at Dames Point also has a 175-foot MHW restriction.

2. Highway Access

Interstate Route 10 from the west and Interstate Route 95 and US Route 17 from the north and south provide access to the Jacksonville area.

Access to Talleyrand Docks and Terminals, which is 3 miles from I-95, is via US Route 1 to either 8th Street or 11th Street and then via four-lane Talleyrand Avenue. The terminal's three gates are immediately off Talleyrand Avenue. Access to Blount Island Marine Terminal, which is 2 miles off Interstate Route 295, is via Heckscher Drive.

3. Rail Access

Three rail carriers provide rail service to Jacksonville: Seaboard System Rail (CSX Transportation, Inc.), Florida East Coast Railway, and Norfolk Southern Corporation (Southern Railway System). CSX provides rail service into the terminals (one track).

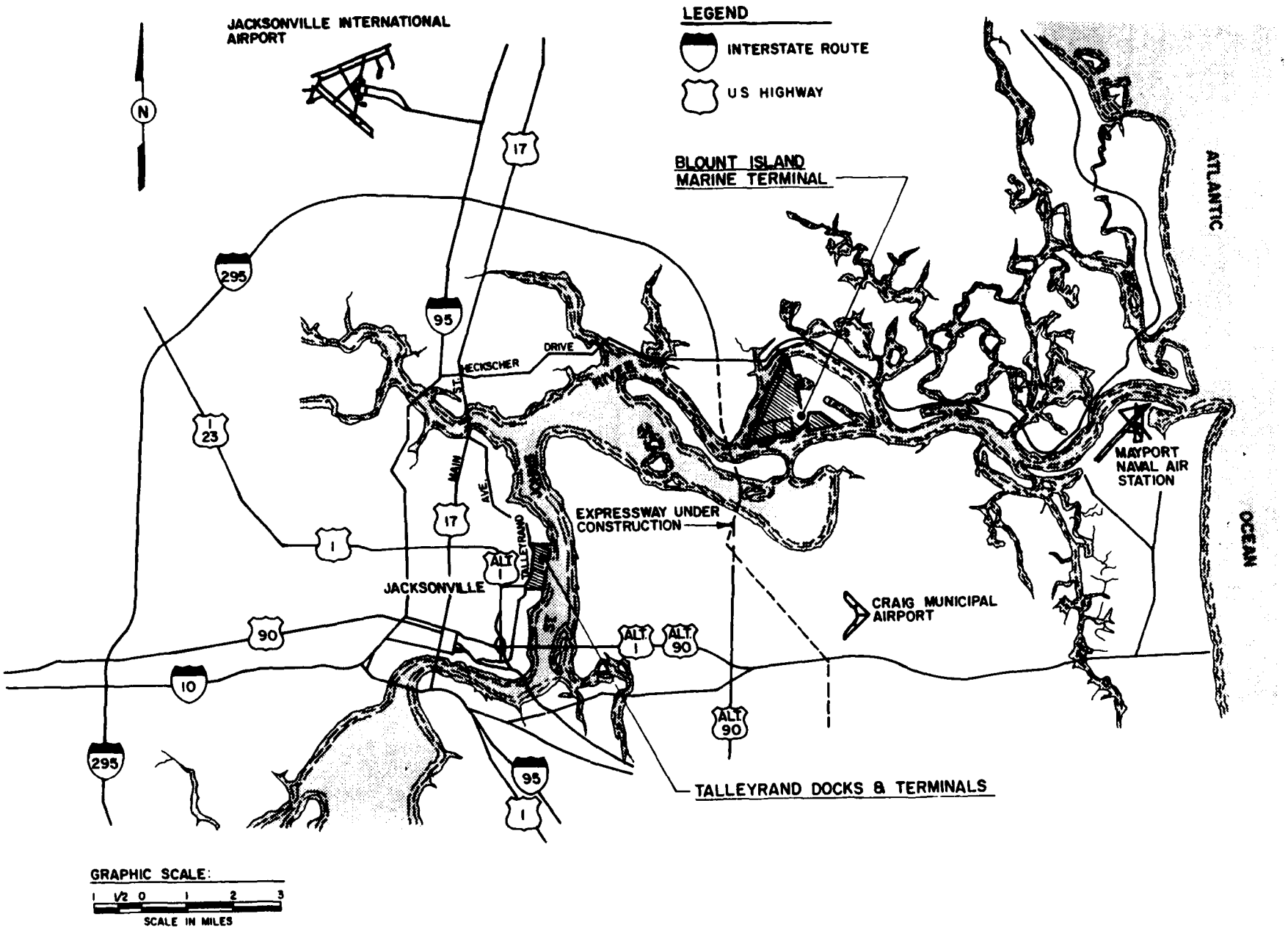


Figure II-JAX-1. Port of Jacksonville vicinity map.

4. Airports

The Jacksonville International Airport, Mayport Naval Air Station, Cecil Field, and Jacksonville Naval Air Station are all within 30 minutes driving time of the terminals. They can receive any incoming helicopters and cargo.

B. PORT FACILITIES

1. Talleyrand Docks and Terminals (figs II-JAX-2 and II-JAX-3)

a. Berthing. The Talleyrand Docks and Terminals have a 4,800-foot-long marginal wharf with three adjoining terminals.

The Jacksonville Port Authority (JPA) operates the Talleyrand Avenue Terminal and the 11th Street Terminal. JPA leases the Eighth Street Terminal to an automobile importer.

The five berths at the Talleyrand Avenue Terminal range between 500 and 1,200 feet long. The dock structure consists of a cast-in-place concrete wharf apron supported by prestressed concrete piling. The docks have an allowable loading capacity of 800 pounds per square foot. Apron heights vary from 7 feet at berth 5 to 9 feet mean low water (MLW) at berths 1 through 4. All berth depths are 36 feet at MLW. Apron widths vary from 80 feet at berths with transit sheds, to open. Four cranes serve the berths: one 112-short ton (STON) gantry, one 50-STON gantry, and two 45-STON container cranes.

The 1,200-foot-long 11th Street Terminal berth is similar in construction to the Talleyrand Avenue Terminal berths. It has one container crane and open wharf aprons.

The Eighth Street Terminal is 700 feet long. It is built on solid fill behind a steel sheet pile bulkhead. It has no cranes, since it is an automobile import facility.

Lighting at the Talleyrand Docks and Terminals is adequate for round-the-clock operations.

Tables II-JAX-1 and II-JAX-2 show the berthing characteristics and capabilities of the terminal. The terminal's ability to support various shipping modes is as follows:

(1) Breakbulk Operations. Berths 1 and 2 at Talleyrand Avenue Terminal are the best berths for breakbulk operations because they have access to transit sheds and gantry cranes.

(2) LASH and SEABEE Operations. All berths are suitable to support LASH or SEABEE loading operations. The terminal can load up to 32 LASH lighters or 23 SEABEE barges. The water depth at the loading berths limits the draft of the mother ships.

(3) RORO and FSS Operations. Side- and slewed-ramp RORO ships can load at all berths. Berths 3 and 4 at Talleyrand Avenue Terminal and the 11th Street Terminal berth are the most suitable for FSS operations. The terminal does not have ramps for stern-ramp RORO ships and Ponce-class ships.

Figure II-JAX-2. Talleyrand Docks and Terminals.

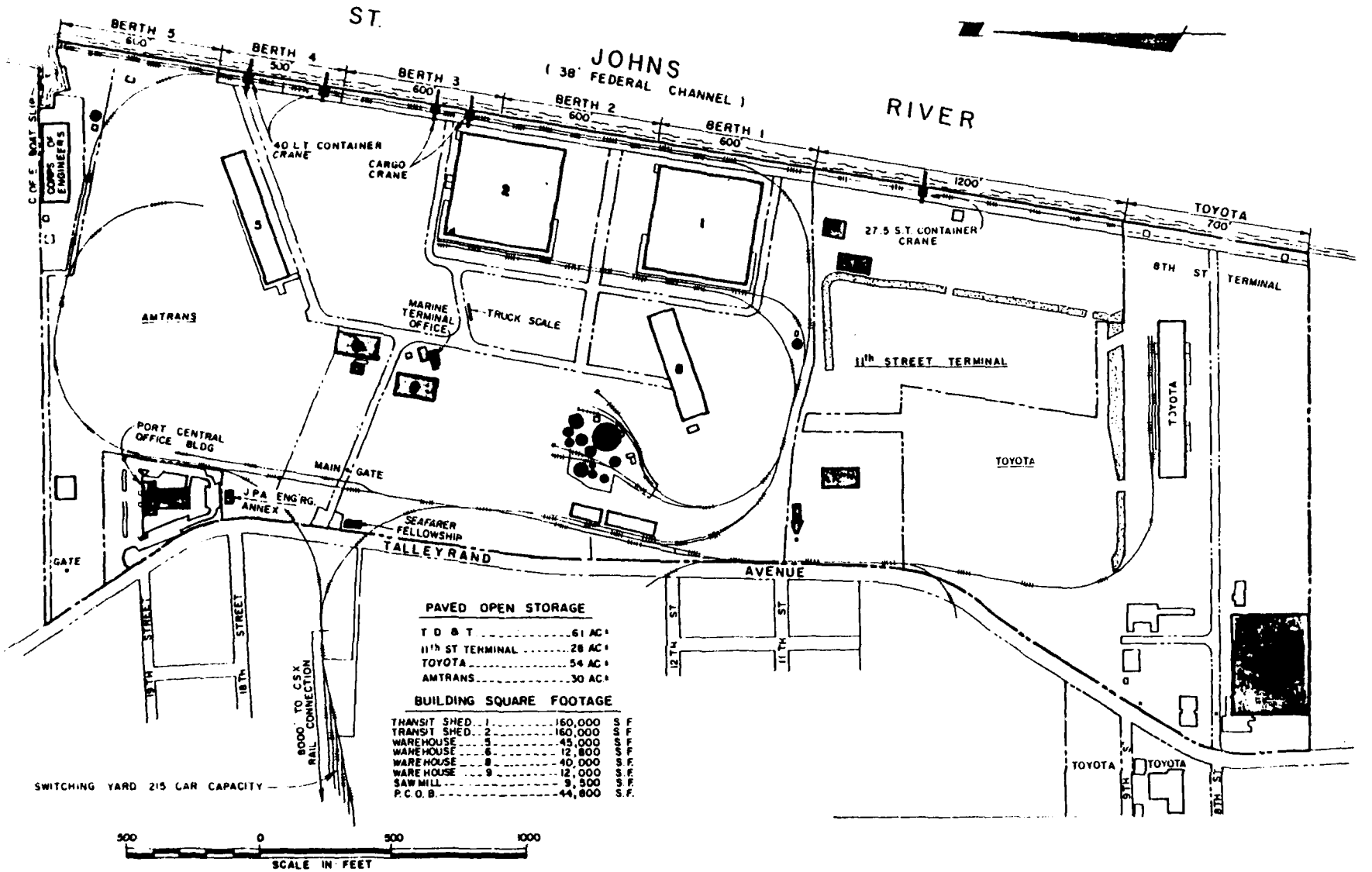


Figure II-JAX-3. Talleyrand Docks and Terminals site plan.

TABLE II-JAX-1
PORT OF JACKSONVILLE
BERTH CHARACTERISTICS OF TALLEYRAND DOCKS AND TERMINALS

Characteristics	Berths				
	1-2	3-4	5	11TH ST	8TH ST
Length (ft)	1,200	1,100	600	1,200	700
Depth alongside at MLW (ft)	36	36	36	36	36
Deck strength (psf)	800	800	800	800	1,000
Apron width (ft)	80	Open	Open	Open	Open
Apron height above MLW (ft)	9	9	7	9	9
Number of container cranes	0	2	2	1	0
Number of wharf cranes	0	2	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	No	No
Apron length served by rail (ft)	1,200	1,100	600	0	0

Notes:
1. Terminal open storage area is 173 acres.
2. Terminal covered storage area is 429800 square feet.

TABLE II-JAX-2
PORT OF JACKSONVILLE
SUMMARY OF BERTHING CAPABILITIES OF TALLEYRAND DOCKS AND TERMINALS

Vessel	Berths				
	1-2	3-4	5	11TH ST	8TH ST
Breakbulk					
C3-S-33a	2	2	1	2	1
C3-S-37c	2	2	1	2	1
C3-S-37d	2	2	1	2	1
C3-S-38a	2	2	1	2	1
C4-S-1a	2	1	1	2	1
C4-S-1qb and 1u	2	1	1	2	1
C4-S-58a	2	1	1	2	1
C4-S-65a	2	1	1	2	1
C4-S-66a	2	1	1	2	1
C4-S-69b	1	1	1	1	1
Seatrain					
GA and PR-class	2	1	1	2	1
Barge					
LASH C8-S-81b	a,f,g	a,f,g	a,c,f,g	a,f,g	a,c,f,g
LASH C9-S-81d	a	a	a,c	a	a,c
LASH lighter	8	7	4	8	5
SEABEE C8-S-82a	a,g	a,g	a,c,g	a,g	a,c,g
SEABEE barge	6	5	3	6	3
RORO					
Comet	d,i,j	d,i,j	1,d,i	d,i,j	d,i,j
C7-S-95a/Maine-class	1	1	c	1	c
Ponce-class	b,h	h	c,h	h	h
Great Land-class	b,h	h	c,h	h	c,h
Cygnus/Pilot-class	1	1	c	1	1
Meteor	d,i,j	d,i,j	d,i,j	d,i,j	d,i,j
AmEagle/Condor	i,j	i,j	c	i,j	i,j
MV Ambassador	d	d	d	d	d
FSS-class	1,n	1	c	1	c
Cape D-class	i,j	i,j	c	i,j	i,j
Cape H-class	1	1	c	1	c
Container					
C6-S-1w	1,e	1	c	1	1,e
C7-S-68e	1,e	1	c	1	c,e
C8-S-85c	1,e	1	c	1	c,e
Combination					
C5-S-78a	1,e	1	c	1	1,e
C5-S-37e	1,e	1	1	1	1,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

(4) Container Operations. Berths 3 and 4 at Talleyrand Avenue and 11th Street Terminals have three container cranes and are the most suitable for container operations. These berths have open aprons and access to the paved open storage areas.

b. Materials Handling Equipment (MHE). The MHE owned by the port is listed in table II-JAX-3. Additional MHE is available from local stevedore contractors.

TABLE II-JAX-3
MATERIALS HANDLING EQUIPMENT
TALLEYRAND DOCKS AND TERMINALS

Type of Equipment	Capacity (STON)	Quantity
Dump truck	10	1
Road-rail tractor	NA	1
Straddle cranes	35-40	12
Forklift truck	5	6

c. Staging

(1) Open Storage. Berths 1 through 5 at Talleyrand Avenue Terminal have 91 acres of paved open storage. The 11th Street Terminal berth has 28 acres of paved open storage, and the Eighth Street Terminal berth has 54 acres of paved open storage.

(2) Covered Storage. At Talleyrand Avenue Terminal, berths 1 and 2 have two transit sheds that have a total of 320,000 square feet of storage. Berths 1 through 5 share an additional 109,800 square feet of warehouse storage.

d. Security. Security at the Talleyrand Docks and Terminals consists of 8-foot-high perimeter fencing topped with barbed wire. Security guards monitor the gates and patrol the terminal 24 hours per day.

e. Rail Operations. Talleyrand Avenue Terminal berths 1 through 5 have rail tracks on the apron for rail-to-ship loading. Transit sheds 1 and 2 have rail loading docks. The terminal's railcar capacity is 150 cars. Additionally, CSX operates a 215-car switching yard less than 1,000 feet from the terminal's main gate.

f. Truck Operations. Transit sheds 1 and 2 each have 35 loading positions for commercial trailers.

g. Helicopter Operations. The northwest corner of the port, between warehouse 5 and berth 5, is available for a helicopter landing and staging area. Craig Air Field can also receive and stage large numbers of helicopters.

2. Blount Island Marine Terminal (figs II-JAX-4 and II-JAX-5)

a. Berthing. The terminal has six berths along a 4,700-foot-long marginal wharf. It also has a stern-RORO dock (berth 6)

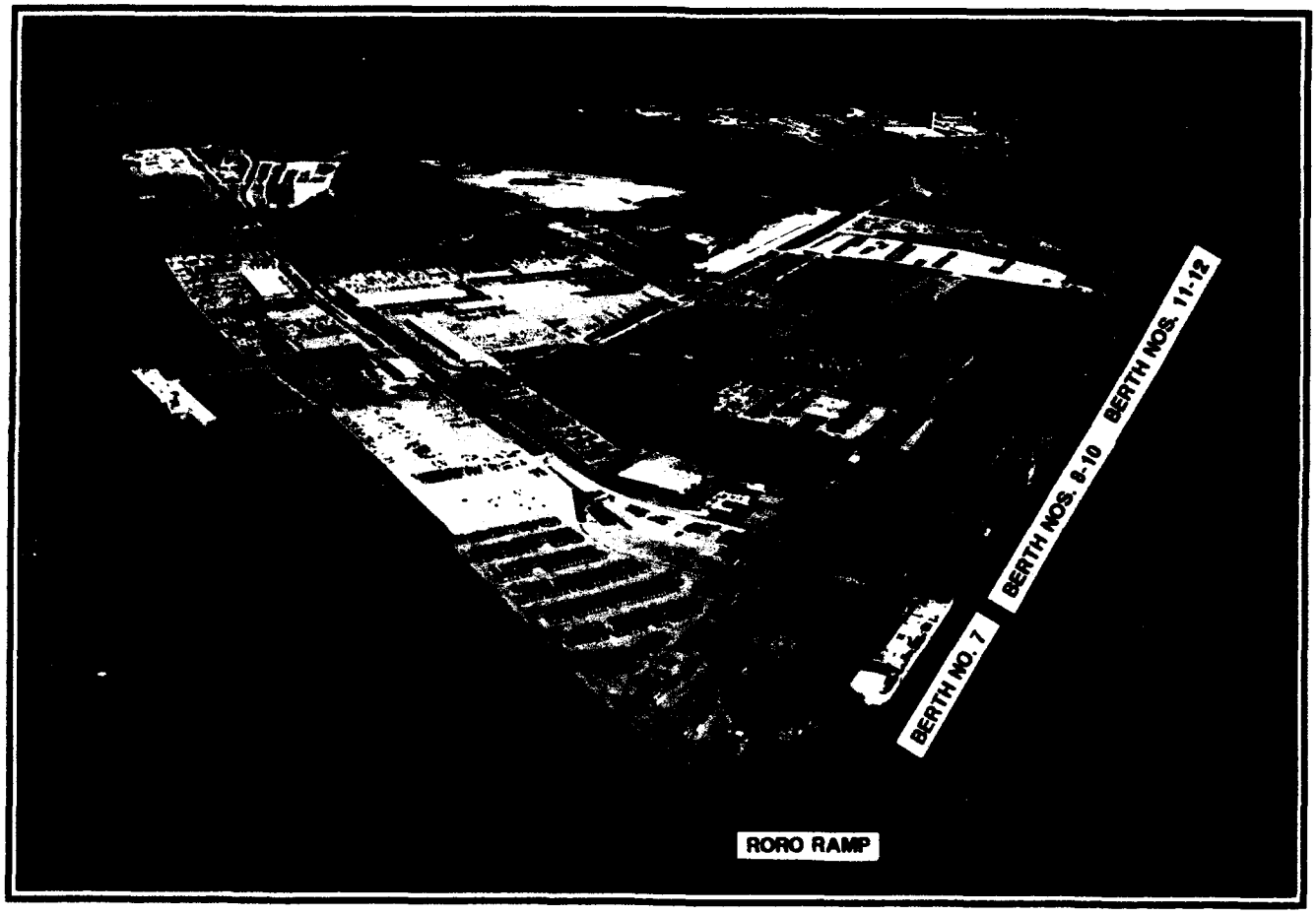


Figure II-JAX-4. Blount Island Marine Terminal.

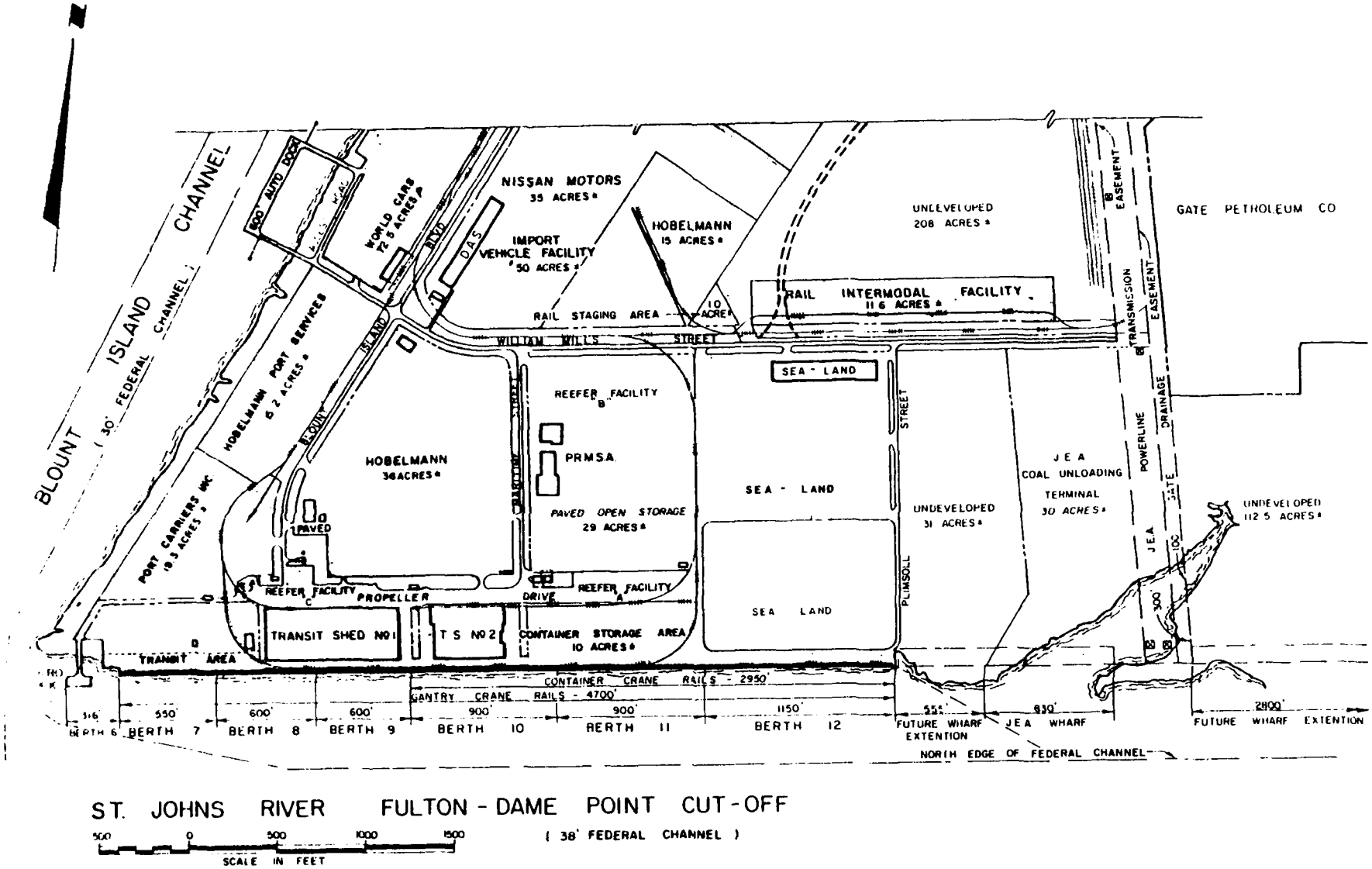


Figure II-JAX-5. Blount Island Marine Terminal site plan.

next to berth 7. The wharf aprons are solid fill over a concrete slab. The aprons are supported by prestressed concrete piling. Berths 8 through 10 have transit sheds and 80-foot-wide wharf aprons. Berths 7 through 12 have one 50-STON and one 112-STON gantry crane. Berths 10 through 12 have two 45-STON container cranes.

The Blount Island Marine Terminal can load hazardous cargo during evenings and weekends.

The quality of lighting varies throughout the terminal. Temporary lighting is necessary in certain areas to sustain round-the-clock operations.

Tables II-JAX-4 and II-JAX-5 show the berthing characteristics and capacities of the terminal. The terminal's ability to support various shipping modes is as follows:

TABLE II-JAX-4
PORT OF JACKSONVILLE
BERTH CHARACTERISTICS OF BLOUNT ISLAND TERMINAL

	Berths		
Characteristics	7	8-10	11-12
Length (ft)	550	2,100	2,050
Depth alongside at MLW (ft)	38	38	38
Deck strength (psf)	800	800	800
Apron width (ft)	Open	80	Open
Apron height above MLW (ft)	9	9	9
Number of container cranes	0	0	2
Number of wharf cranes	1	1	0
Apron lighting	Yes	Yes	Yes
Straight-stern RORO facilities	Yes	No	No
Apron length served by rail (ft)	550	2,100	2,050

Notes:
1. Terminal open storage area is 367 acres.
2. Terminal covered storage area is 379200 square feet.

TABLE II-JAX-5
PORT OF JACKSONVILLE
SUMMARY OF BERTHING CAPABILITIES OF BLOUNT ISLAND TERMINAL

Vessel	Berths 7	8-10	11-12
Breakbulk			
C3-S-33a	1	4	4
C3-S-37c	1	4	3
C3-S-37d	1	4	3
C3-S-38a	1	4	3
C4-S-1a	c	3	3
C4-S-1qb and 1u	c	3	3
C4-S-58a	c	3	3
C4-S-65a	c	3	3
C4-S-66a	1	3	3
C4-S-69b	c	3	3
Seatrain			
GA and PR-class	c	3	3
Barge			
LASH C8-S-81b	a,c,f,g	a,f,g	a,f,g
LASH C9-S-81d	c	2	2
LASH lighter	3	15	14
SEABEE C8-S-82a	a,c,g	a,g	a,g
SEABEE barge	2	10	10
RORO			
Comet	i,j	d,i,j	d,i,j
C7-S-95a/Maine-class	c	2	2
Ponce-class	c	b,h	h
Great Land-class	c	b,h	h
Cygnus/Pilot-class	c	3	3
Meteor	i,j	d,i,j	d,i,j
AmEagle/Condor	c	i,j	i,j
MV Ambassador	c,k,m	d	d
FSS-class	c	2,n	2
Cape D-class	c	i,j	i,j
Cape H-class	c	2	2
Container			
C6-S-1w	c,e	3,e	2
C7-S-68e	c,e	2,e	2
C8-S-85c	c,e	2,e	2
Combination			
C5-S-78a	c,e	3,e	3
C5-S-37e	c,e	3,e	3

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

(1) Breakbulk Operations. Berths 7 through 10 have access to cranes and transit sheds and are the most suitable for breakbulk operations.

(2) LASH and SEABEE Operations. The terminal can load up to 32 LASH lighters or 22 SEABEE barges. The channel depth restricts the maximum draft of the larger mother ships.

(3) RORO and FSS Operations. Berth 6 has an excellent stern-RORO dock (fig II-JAX-6). Two Ponce/Great Land-side ramps are also available (fig II-JAX-7). Berths 7 through 12 can accommodate a variety of side- and slewed-stern-ramp RORO vessels or up to four FSS vessels.

(4) Container Operations. Two 45-LTON container cranes serve berths 10 through 12. These cranes, along with the container storage areas and container handling equipment make these berths the most suitable for container operations.

b. Materials Handling Equipment (MHE). Table II-JAX-6 shows the Blount Island Marine Terminal MHE owned by JPA. Local stevedore contractors can supply additional MHE, if necessary.

c. Staging

(1) Open Storage. The terminal has 367 acres of open storage space.

Figure II-JAX-6. Stern-RORO berth.

Figure II-JAX-7. Ponce/Greatland-side ramps.

TABLE II-JAX-6
MATERIALS HANDLING EQUIPMENT
BLOUNT ISLAND MARINE TERMINAL

Type of Equipment	Capacity (STON)	Quantity
Straddle cranes	35	2
Container stacker	35	5
Forklift trucks	1.5 - 15	36
Auto ramp (Ponce)	40	2
Drawbar tractor	2.5	1
Rail tractor	NA	1
Dump truck	10	2

(2) Covered Storage. Two transit sheds and a container freight station, with a combined floor area of 379,200 square feet, provide storage space for the terminal.

d. Security. Blount Island Marine Terminal does not have perimeter fencing. The highway and rail bridges restrict access. A guard station, on the island side of the highway bridge, controls access 24 hours per day.

e. Rail Operations. Rail access to Blount Island Marine Terminal is by a single-track rail bridge to the island. The railcar-holding capacity on the island is 60 cars. Rail sidings that can hold 60 additional cars are available near the terminal.

One light-duty, multilevel loading ramp is available. Also, a specially constructed heavy-duty steel ramp is available for loading heavy equipment.

Rail tracks are on the apron and provide a rail-to-ship loading capability. Depressed rails at the north side of transit sheds 1 and 2 are available for boxcar unloading. An 11.6-acre intermodal rail facility is just north of berth 12.

f. Truck Operations. Blount Island Marine Terminal has space to store a large number of truck trailers. Van unloading docks are available at the north side of transit sheds 1 and 2.

g. Helicopter Operations. A helicopter landing zone is on the island. Also, some undeveloped acreage suitable for helicopter landing and staging is available.

h. Marshaling Areas. Most of the island's undeveloped acreage is suitable for marshaling equipment.

C. SUPPORT SERVICES

1. Pilotage

Pilots from the St. Johns Bar Pilots Association at Mayport board incoming vessels at the sea buoy.

2. Harbor Craft

Between 35 and 40 tugboats, ranging from 400 to 3,000 horsepower, are available in the Port of Jacksonville.

3. Stevedores

Union locals have 1,300 registered longshoremen. Stevedores in the area have experience with RORO operations and require very little training to load military equipment. MTMC International Traffic has determined that enough longshoremen are available to meet mobilization needs.

4. Heavy-Lift Equipment

A commercially operated floating crane with a 350-STON lift capacity is available at the port. Local contractors also have numerous crawler cranes with 100- to 150-STON capacity.

D. INTERMODAL CONTAINER TRANSFER FACILITIES (ICTF)

Norfolk Southern has an ICTF for standard piggyback and double-stack service that is close to Interstate Route 10 near the Talleyrand Docks and Terminals. The ICTF has tracks for 60 railcars, three top-lift cranes, and 600 parking spaces.

CSX operates the Duval Terminal, 15 and 18 miles, respectively, from Talleyrand Docks and Terminals and Blount Island Marine Terminal. The Duval Terminal has 2 loading tracks with a capacity of 80 cars and 7 supporting tracks capable of storing 200 flatcars. It has three sideloaders for loading operations. The terminal also has 450 paved and 900 unpaved parking spaces.

Florida East Coast Railway has an ICTF on Jacksonville's south side, near I-95 and I-295. This facility handles trailers-on-flatcar and containers-on-flatcar cargo.

E. FUTURE DEVELOPMENT

A bridge, adding two lanes of highway access, is under construction to provide additional access to Blount Island Marine Terminal. The JPA plans to extend the Blount Island Marine Terminal marginal wharf 575 feet in the near future.

F. REQUIREMENTS AND RECOMMENDATIONS

1. Requirements

This section analyzes the deployment of an infantry division (air assault) from the Port of Jacksonville. The outloading requirement is 5 days. The vessels necessary to support movement are in appendix A. The vessel requirements for each ship mix are:

- Ship mix 1 (modern ships): 6 ships.
- Ship mix 2 (combination of ship types): 9 ships.
- Ship mix 3 (breakbulk ships): 18 vessels
- Ship mix 4 (fast sealift ships): 6 ships.

2. Recommendations

Tables II-JAX-7 through II-JAX-9 show the berthing requirements for ship mixes 1, 2, and 4. The port can deploy the division within 5 days using these ship mixes. However, the port cannot meet the 5-day criteria using ship mix 3. This mix requires the concurrent loading of 18 ships. The maximum number of ships the port can load at one time is 17. For this ship mix, we recommend use of multiple seaports, such as Jacksonville, Savannah, and Charleston, to deploy the division.

TABLE II-JAX-7
BERTHING RECOMMENDATIONS FOR SHIP MIX 1
(AIR ASSAULT DIVISION)

Ship Mix 1 (Modern ships)						
Terminal: Berth:	Talleyrand 1 and 2	Talleyrand 3 and 4	Talleyrand 11th St	Blount 7	Blount 8 - 10	Blount 11 - 12
Day 1	Am Eagle	Am Condor	FSS-1	Cape D	FSS-2	FSS-3
Day 2						
Day 3						
Day 4						
Day 5						

TABLE II-JAX-8
BERTHING RECOMMENDATIONS FOR SHIP MIX 3
(AIR ASSAULT DIVISION)

Ship Mix 2 (Combination of ship types)							
Terminal:	Talleyrand				Blount	Blount	Blount
Berth:	1 and 2	3 and 4	5	11th St	7	8 - 10	11 - 12
Day 1	C3-S-37d	C4-S-65a	C4-S-58a	FSS-1	MV Ambass-ador	C4-S-58a	FSS-2
Day 2							
Day 3				Am Eagle			
Day 4							
Day 5							

TABLE II-JAX-9
BERTHING RECOMMENDATIONS FOR SHIP MIX 1
(AIR ASSAULT DIVISION)

Ship Mix 4 (Fast sealift ships)			
Terminal:	Talleyrand	Blount	Blount
Berth:	11th St	8 - 10	11 - 12
Day 1	FSS-1	FSS-2	FSS-3
Day 2			
Day 3			
Day 4			
Day 5			

PORT OF MOREHEAD CITY (1990)

A. GENERAL

1. Location and Harbor Description (figs II-MOR-1 and II-MOR-2)

The Port of Morehead City is about 100 miles northeast of the Port of Wilmington, North Carolina, and 225 miles south of Norfolk, Virginia. Fort Bragg, North Carolina, is 140 miles west of the port. Marine Corps Base (MCB), Camp Lejeune and Marine Corps Air Station (MCAS), Cherry Point, North Carolina, are 45 and 20 miles, respectively, west of the port. The port is at the tip of a peninsula that extends easterly from the mainland between Bogue Sound, Calico Creek, and Newport River. The port is 2.5 miles from the Atlantic Ocean.

Access to the port is through a 42-foot-deep and 450-foot-wide channel. The channel begins at the ocean bar and traverses the 1.5-mile-wide Beaufort Inlet. At the ocean bar, the channel is 600 feet wide and 40 feet deep. It decreases to 400 feet wide and 40 feet deep in the harbor. Off the southeast corner of the Morehead City wharf is a Y-shaped approach. It includes a 40-foot-deep and 1,200-foot-wide turning basin. The west leg of the wye, which is 850 feet wide and 35 feet deep at mean low water (MLW), runs west about 3,500 feet to the west turning basin. This basin is 850 feet wide and 950 feet long, with a 35-foot depth at MLW. No bridges or other overhead obstructions cross the deepwater channel between the terminal and ocean.

The harbor has no designated anchorages. Ships anchor outside the inlet, east of the sea buoy and south of Shackleford Banks. This area has 46 anchorages. Anchorages A through J each have five anchorages, except anchorage G, which has only one. The anchorages vary from 42 to 48 feet deep at MLW. These anchorages receive some protection from Shackleford Banks. However, their suitability for instream loading operations is questionable.

North of the port, the entry into Newport River and Calico Creek is via the Atlantic Intracoastal Waterway. The entry is maintained at a 12-foot depth.

The mean tidal range at Morehead City is 3 feet, with current velocities of 2 to 3 knots, except in the Beaufort Inlet, where heavy swells and currents of 4 to 5 knots make negotiation of the channel difficult during severe weather and tidal conditions.

2. Highway Access

The main routes leading to Morehead City are US Route 70 from the northwest and US Route 24 from the southwest. About 3 miles west of the city, US 24 and US 70 become Arendell Street, which continues through Morehead City into the port.

US 24 links the port to MCB Camp Lejeune, and US 70 leads to MCAS Cherry Point.

3. Rail Access

The Norfolk Southern Railroad serves the Port of Morehead City with one set of tracks. The port has a railyard with a 200-railcar capacity.

Figure II-MOR-1. Port of Morehead City.

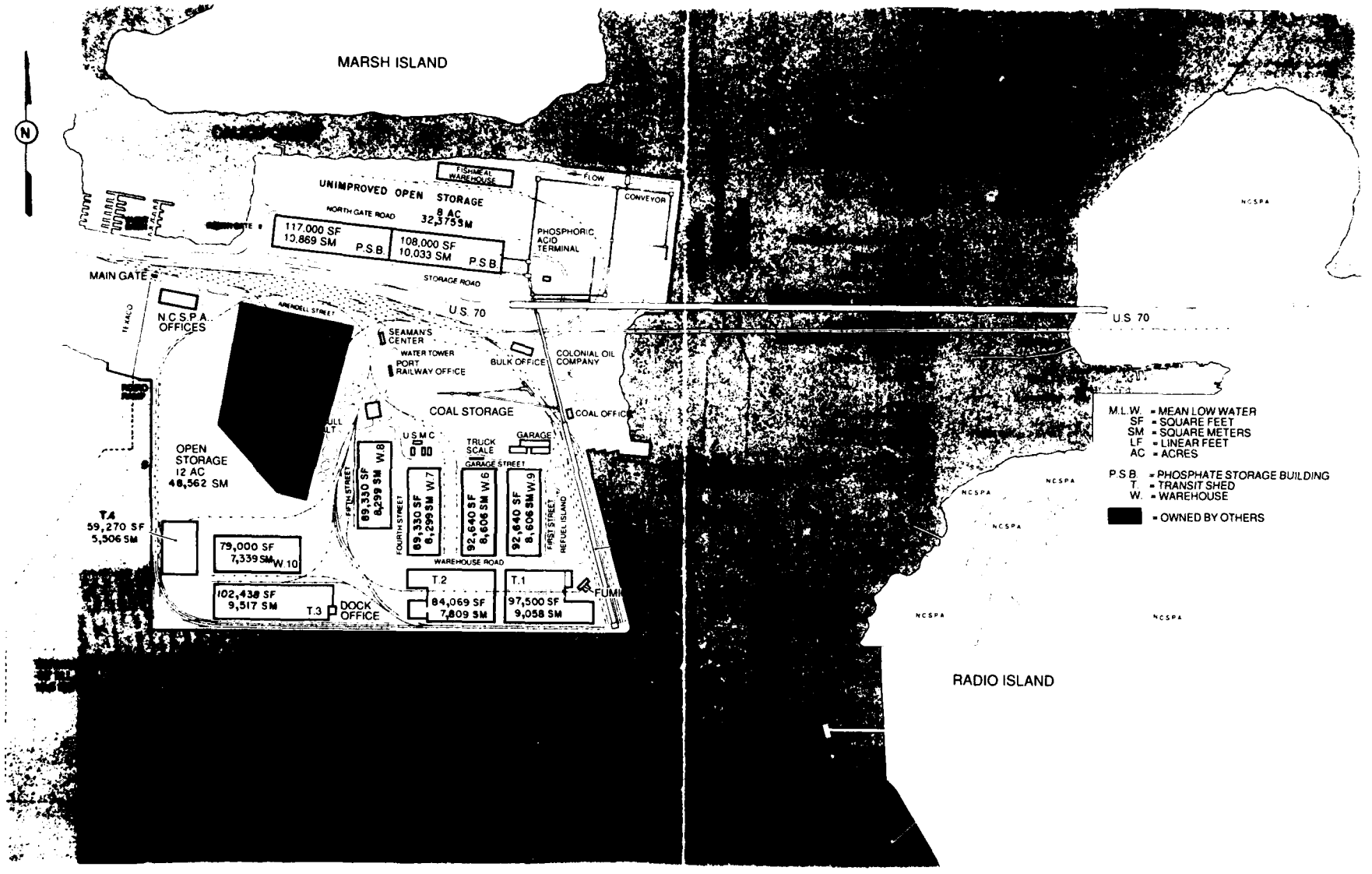


Figure II-MOR-2. Port of Morehead City site plan.

Switching for Morehead City is performed at Goldsboro, North Carolina, about 85 miles to the west.

4. Airports

The New Bern North Carolina Airport, 30 miles northwest of Morehead City, is the nearest commercial airfield. With its 4,800-foot runway, the airport can receive C-130 aircraft, with prior approval. The smaller, private Beaufort Airfield, with a 4,200-foot runway, can also receive C-130 aircraft, with prior approval. MCAS Cherry Point can receive all aircraft, including the C-5.

B. PORT FACILITIES

1. Berthing

The port has nine berths, providing 5,050 feet of wharfage. Berths 2 and 3 total 1,000 feet in length. An elevated conveyor for loading/unloading bulk cargoes parallels these berths. Berths 4 through 7 are mostly for breakbulk operations. Berths 8 and 9 are for roll on/roll off (RORO) operations. The berths range from 350 to 1,000 feet long. The bulkhead on the wharves is concrete capped/steel sheet piling. The bearing capacity of the concrete deck over the compacted fill is 1,000 pounds per square foot. Rubber and/or timber fenders are on the bulkheads. The wharf apron height averages 10 feet above MLW. All berth depths are 35 feet MLW, except berths 2 and 3, which have a 40-foot depth.

Berths 6 through 9 are served by two 115-STON gantry cranes. Berths 2 and 3 have no fixed cranes. The port presently does not own large mobile cranes.

Two marginal rail tracks serve all berths. Lighting is available at all berths for night operations.

Tables II-MOR-1 and II-MOR-2 show the berthing characteristics and capabilities of the terminal. The terminal's ability to support various shipping modes is as follows:

a. Breakbulk Operations. Berths 6 through 9 are suitable for loading breakbulk ships. They have access to gantry cranes, apron tracks, and transit sheds. At berths 2 through 5, breakbulk loading would have to be performed with ship's gear or mobile cranes, since no gantry cranes serve these berths. The bulk cargo conveyor at berths 2 and 3 may restrict loading.

b. LASH and SEABEE Operations. Thirty-five LASH lighter or 24 SEABEE barge loading positions are possible at the port. However, the two gantry cranes and few locally available mobile cranes would not support a barge loading program of this scale. Loaded lighters could be staged at the 1,200-foot phosphoric terminal wharf, northeast of the main port facilities.

Lighters could be loaded aboard the mother vessel at any berth. However, the water depth may limit the loading of deep-draft mother vessels. Depending on sea conditions, loading the mother vessel at the anchorage south of Shackleford Banks is possible.

TABLE II-MOR-1
MOREHEAD CITY
BERTH CHARACTERISTICS OF MOREHEAD CITY

Characteristics	Berths		
	2-3	4-7	8-9
Length (ft)	1,000	2,700	1,350
Depth alongside at MLW (ft)	40	35	35
Deck strength (psf)	1,000	1,000	1,000
Apron width (ft)	50	35	Open
Apron height above MLW (ft)	10	10	10
Number of container cranes	0	0	0
Number of wharf cranes	0	1	1
Apron lighting	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	Yes
Apron length served by rail (ft)	1,000	2,700	1,350

Notes:
1. Terminal open storage area is 20 acres.
2. Terminal covered storage area is 786217 square feet

TABLE II-MOR-2
MOREHEAD CITY
SUMMARY OF BERTHING CAPABILITIES OF MOREHEAD CITY

Vessel	Berths 2-3	4-7	8-9
Breakbulk			
C3-S-33a	1	5	2
C3-S-37c	1	5	2
C3-S-37d	1	5	2
C3-S-38a	1	5	2
C4-S-1a	1	4	2
C4-S-1qb and 1u	1	4	2
C4-S-58a	1	4	2
C4-S-65a	1	4	2
C4-S-66a	1	4	2
C4-S-69b	1	4	2
Seatrain			
GA and PR-class	1	4	2
Barge			
LASH C8-S-81b	a,f,g	a,f,g	a,f,g
LASH C9-S-81d	1	a	a
LASH lighter	7	19	9
SEABEE C8-S-82a	1	a	a
SEABEE barge	5	13	6
RORO			
Comet	d,o	d,o	i,j
C7-S-95a/Maine-class	b	b	1
Ponce-class	b,h	b,h	h
Great Land-class	b,h	b,h	h
Cygnus/Pilot-class	b	b	2
Meteor	d,o	d,o	i,j
AmEagle/Condor	b	b	i,j
MV Ambassador	d	d	2,m
FSS-class	b	b	1
Cape D-class	b	b	i,j
Cape H-class	b	a,b	a
Container			
C6-S-1w	1,e	3,e	1,e
C7-S-68e	1,e	3,e	1,e
C8-S-85c	1,e	3,e	1,e
Combination			
C5-S-78a	1,e	4,e	2,e
C5-S-37e	1,e	4,e	2,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

c. RORO and FSS Operations. Berths 8 and 9, with a stern-RORO dock and open wharf apron, provide an excellent RORO berth (fig II-MOR-3). However, the narrow channel width and small turning basins prevent, for planning purposes, the berthing of FSS vessels. To date, the largest ship to dock at this berth is the 820-foot-long LHA-class vessel. None of the other Morehead City berths are suitable for RORO operations.

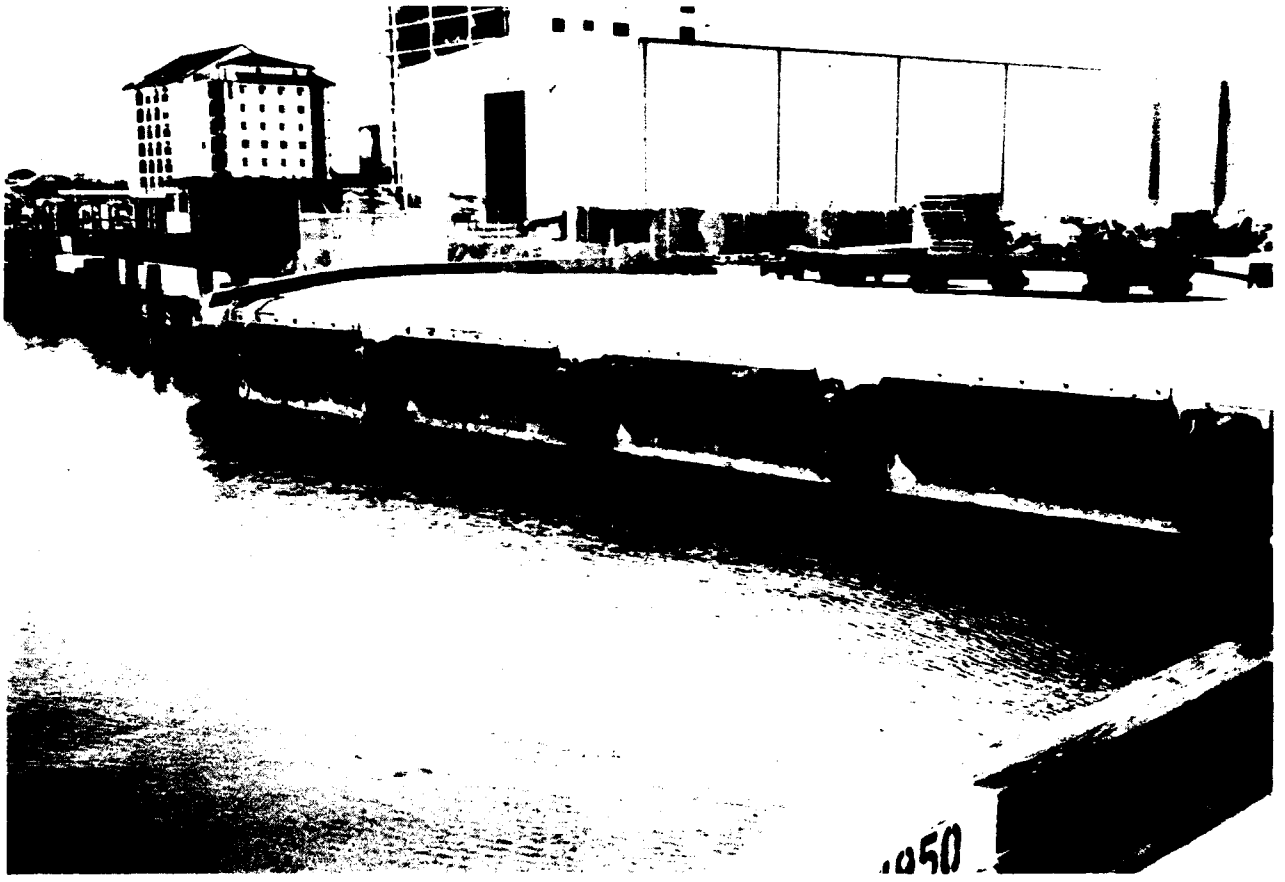


Figure II-MOR-3. RORO ramp at berths 8 and 9.

d. Container Operations. The terminal is not equipped to handle container operations. It lacks specialized container cranes and yard handling equipment. Limited container loading could take place at berths 6 through 9 by using the breakbulk gantry cranes.

2. Materials Handling Equipment (MHE)

The port authority owns and operates the MHE listed in table II-MOR-3. Additional rental equipment is available, in limited supply, from contractors in the Morehead City area. MCB Camp Lejeune may also be able to provide additional mobile crane support.

3. Staging

a. Open Storage (table II-MOR-4). The terminal has 12 acres of paved open storage next to berths 8 and 9. Another 8 acres of unimproved open storage is just north of the port, on

TABLE II-MOR-3
MATERIALS HANDLING EQUIPMENT

Type of Equipment	Capacity (STON)	Quantity
Forklift	2-7.5	55
Mobile crane	5	1
Flat trailer, 16-ft	12	22
Road trailer, 42-ft, with tractor	22	3
Towing tractor	6	3
Towing tractor	4.5	1
Spreader frames for lifting containers	30	1 set

TABLE II-MOR-4
OPEN STORAGE

Location	Area (acres)	Surface Material	Lighting	Current Use
Port Storage				
Near berth 9	12	Paved	Yes	General cargo
Nearby Storage				
Calico Creek - immediately north of port	8	Unpaved (good bearing)	Yes	Marine vehicle
Radio Island - 5 miles east of port	38	Loose sand (soft bearing)	No	Vacant
Camp Lejeune - immediately west of downtown Morehead City	40	Unpaved (fair bearing)	No	Vacant

Calico Creek across Arendell Street. This area is available for staging military vehicles.

A parcel of 38 acres of unimproved open storage is available west of Morehead City. About 60 acres of undeveloped land on Radio Island is usable for marshaling tactical equipment.

b. Covered Storage (table II-MOR-5). Within the port-owned area are five warehouses and four transit sheds. The warehouses have 442,940 square feet of dry-cargo storage. The transit sheds have 343,277 square feet of storage. All of these storage buildings have both truck and rail access.

TABLE II-MOR-5
COVERED STORAGE

Storage Facility Designation	Area (ft})	Number of Unloading Positions (nonconcurrent use) Trucks	Railcars
T-shed 1	92,060	8	8
T-shed 2	84,060	8	6
T-shed 3	102,438	15	10
T-shed 4	59,270	8	4
Whs 6	92,640	12	7
Whs 7	89,330	12	7
Whs 8	89,330	12	7
Whs 9	92,640	12	0
Whs 10	92,769	10	7

Note: All covered storage is used for general cargo.

4. Security

An unlighted, 7-foot chain link fence, topped with barbed wire, partially encloses the port. The North Carolina State Port Police Department provides 24-hour gate and patrol security.

5. Rail Operations

The port uses two 1,200-horsepower locomotives to move railcars from the Goldsboro, North Carolina, switching yard to the port area. It has 5 miles of track, with a storage capacity of 200 railcars (fig II-MOR-4). Except for warehouse 9, all warehouses and transit sheds at the port have depressed rail tracks along one side for unloading boxcars. Depressed tracks run through the center of transit sheds 1 and 2.

A fixed rail ramp is immediately west of warehouse 6. A portable rail end ramp is also available and could be used at one of several end spurs within the terminal.

Radio Island can store 125 cars and has a fixed end ramp. Also, the Morehead City railyard, just west of the port, can store 200 cars.

6. Truck Operations

All warehouses have depressed rail tracks to offload trucks. Transit sheds 1 through 3 each have a truck dock at one end. The port also has one portable end ramp for offloading trucks (fig II-MOR-5).

Figure II-MOR-4. Railyard at Port of Morehead City.

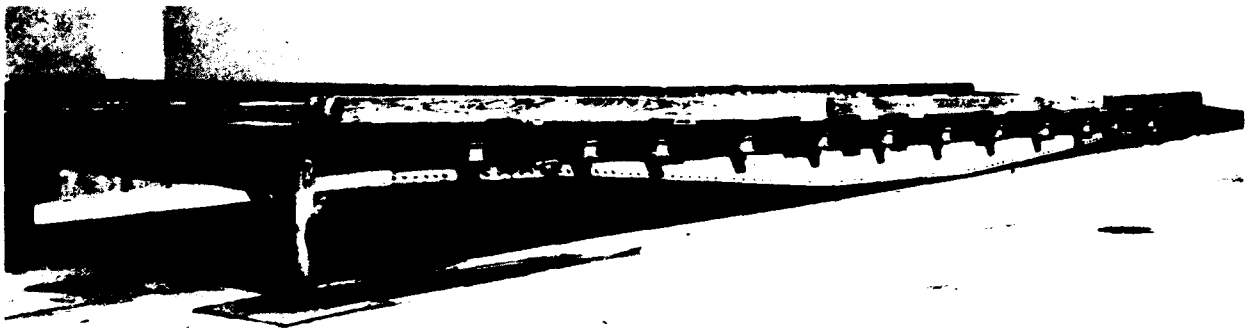


Figure II-MOR-5. Portable end ramp.

7. Helicopter Operations

The designated helipad is at the north end of the paved open storage near berths 8 and 9. Helicopters could land and then be staged for shipment in this area.

8. Marshaling Areas

Once in the port area, unit equipment is generally marshaled on Radio Island or Calico Creek, just north of the port. MCB Camp Lejeune and MCAS Cherry Point are potential locations for additional marshaling areas.

C. SUPPORT SERVICES

1. Pilotage

A pilot vessel meets incoming vessels at the sea buoy and escorts them to the port. The pilots are from the Morehead City Pilots Association.

2. Harbor Craft

Two commercial towing companies are in the area. These companies have a total of eight tugboats, ranging from 350 to 1,200 horsepower.

3. Stevedores

On short notice, 12 gangs of 20 longshoremen each are available locally. MTMC International Traffic has determined that enough longshoremen will be available to meet mobilization needs.

4. Heavy-Lift Equipment

Except for the two gantry cranes at the port, no specialized heavy-lift equipment is available in the area.

D. INTERMODAL CONTAINER TRANSFER FACILITIES (ICTF)

No ICTF exists in the Morehead City area. However, the North Carolina State Ports Authority operates ICTFs at Greensboro and Charlotte. These facilities are available to transport containerized cargo to and from the port when necessary.

E. FUTURE DEVELOPMENT

The port authority has no major improvements scheduled for the Port of Morehead City.

F. REQUIREMENTS AND RECOMMENDATIONS

1. Requirements

This section analyzes the deployment of a light infantry division through the Port of Morehead City. The outloading time is 5 days. The vessels necessary to support deployment are in appendix A. The vessel requirements for each ship mix are:

- Ship mix 1 (modern ships): 3 ships.
- Ship mix 2 (combination of ship types): 5 ships*.
- Ship mix 3 (breakbulk ships): 9 ships.
- Ship mix 4 (fast sealift ships): 3 ships.

*When FSS or RORO ships are available, only three ships are required.

2. Recommendations

As shown in table II-MOR-6, a light infantry division can deploy within 5 days using ship mixes 1 or 2. However, the division cannot deploy within 5 days using ship mixes 3 or 4. Ship mix

3 requires the concurrent loading of nine breakbulk ships. The port only has berthing space for a maximum of eight breakbulk ships. Ship mix 4 requires loading three FSS ships. As previously stated, the port cannot accommodate FSS vessels.

TABLE II-MOR- 6
BERTHING RECOMMENDATIONS FOR SHIP MIXES 1 AND 2
(LIGHT INFANTRY DIVISION)

Ship Mixes 1 (Modern Ships) 2 (Combination of Ship Types)	
Terminal:	Morehead City
Berth:	8-9
Day 1	Cape D-1
Day 2	
	Cape D-2
Day 3	
Day 4	AM Eagle
Day 5	

We recommend the port of Morehead City be used for ship mixes 1 and 2 only. For ship mix 3, we recommend the use of multiple ports of debarkation; that is, Morehead City and Wilmington. For ship mix 4, we recommend the use of the Port of Wilmington or the Ports of Hampton Roads.

PORTS OF NARRAGANSETT BAY (1990)

A. GENERAL

1. Location and Harbor Description (fig II-NAR-1)

The Ports of Providence and Davisville, Rhode Island, lie within Narragansett Bay. The bay is 50 miles south of Boston and 185 miles northeast of New York City.

The Port of Providence is at the mouth of the Providence River, at its entry to Narragansett Bay. The port is about 27 nautical miles inland from the Atlantic Ocean.

The Port of Davisville piers are on the west side of Narragansett Bay, about 10 miles upstream from the Brenton Reef Light Tower.

From the natural deepwater of Narragansett Bay, a 600-foot-wide by 40-foot-deep channel extends northward to the Port of Providence berths. The channel starts just south of the Prudence Island Light. It widens to 1,700 feet in front of the berths. This wide channel at the Port of Providence berths provides enough room to turn any vessel in the US-flag dry-cargo fleet.

A 31-foot-deep and 1,000-foot-wide channel extends eastward to Quonset Point from the natural deepwater of the bay. From Quonset Point, a 31-foot-deep and 500-foot-wide channel extends northward to the Port of Davisville piers. The 27 foot-deep turning basin in front of these piers is 1,500 feet by 800 feet.

Anchorages for the ports are near Jamestown and Conicut Islands. An anchorage for explosives-laden vessels is near Conicut Island.

The mean tidal range is 4.5 feet at the Port of Providence and 4 feet at the Port of Davisville.

The Newport Bridge connecting Conicut and Jamestown Islands is the only bridge that crosses the channel. It has a center vertical height of 213 feet mean high water (MHW).

2. Highway Access

Access to the Port of Providence is via Interstate Route 95, Exit 18, which leads to Allens Avenue. The entrance to the port is about one-half mile south on Allens Avenue. Three roads provide access to the terminal from Allens Avenue: Terminal Road, Ernest Street, and Harborside Boulevard.

Exit 9 off I-95 is about 7 miles from the Port of Davisville piers. Rhode Island Route 4, a four-lane divided highway, leads to the piers. The last 3 miles to the port is via Rhode Island Route 403, a two-lane, paved road.

3. Rail Access

The main rail service for the Port of Providence is a spur track operated by the Providence/Worchester Railroad. The spur track connects the port with Conrail lines in the Providence area.

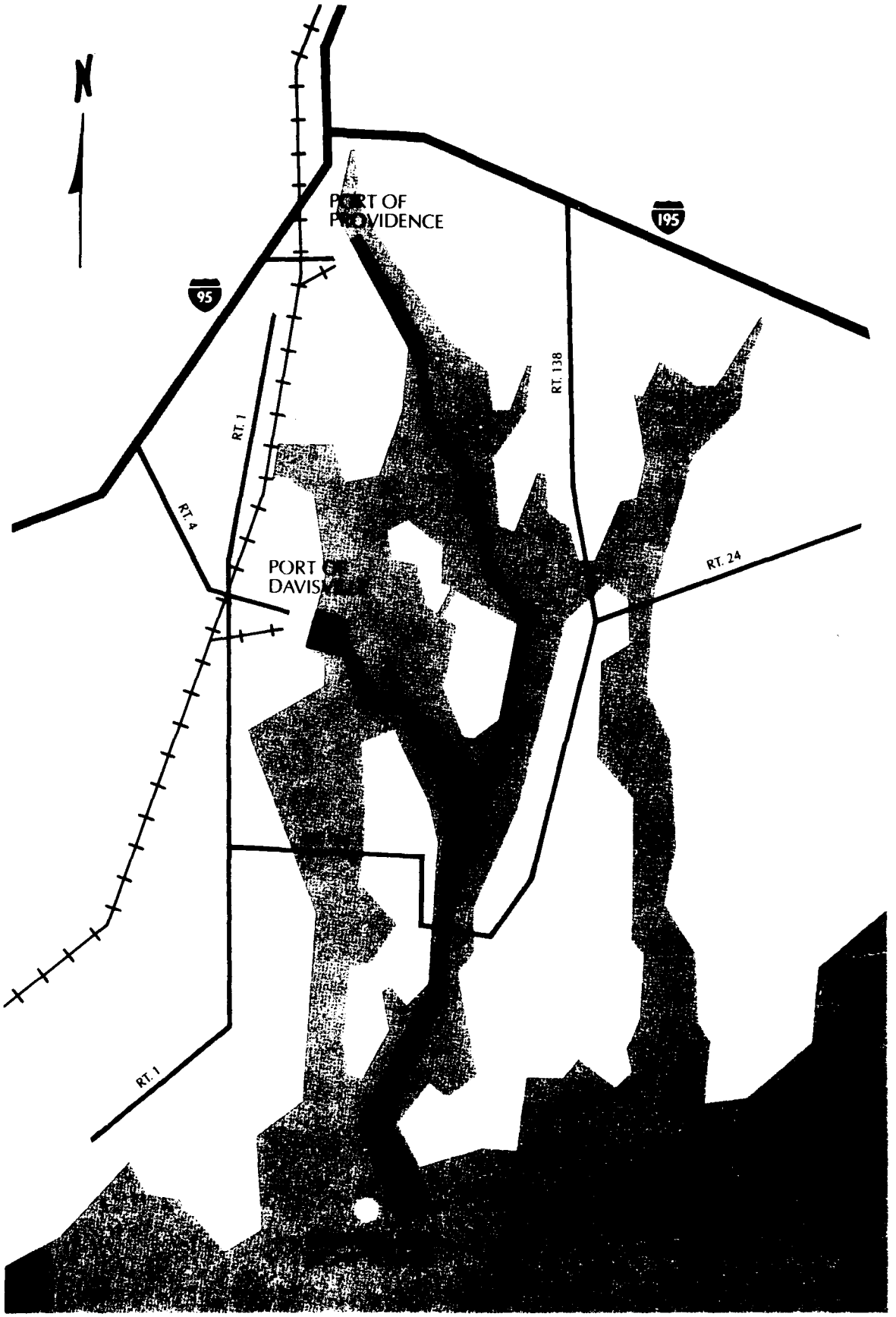


Figure II-NAR-1. Ports of Narragansett Bay.

The Conrail classification yard in Providence is about 5 miles from the port. The Branch Avenue Bridge, about 2 miles from the piers, imposes a height restriction of 20 feet for rail cargo. The Seaview Transportation Company provides railcar switching at the piers.

The Providence/Worchester Railroad operates a 20-mile-long rail network that connects the Port of Davisville to the Conrail system. The Seaview Transportation Company provides rail service into the port. Trackage to the piers is in poor condition. The holding yard in west Davisville can hold 150 railcars.

4. Airports

The T. F. Green Airport is about 10 miles south of the Port of Providence. It can receive and stage incoming helicopters.

The nearest airport to the Port of Davisville is Quonset State Airport, next to the Naval Construction Battalion Center. The airport has an 8,000-foot runway. Cargo planes, including the C-5, can use this airport.

B. PORT FACILITIES

1. Port of Providence

a. Berthing. The Port of Providence (figs II-NAR-2 and II-NAR-3) has six berths totaling 3,473 feet. Table II-NAR-1 shows the individual characteristics of the berths. Table II-NAR-2 shows the overall berthing capabilities of the port. The Port of Providence mainly supports breakbulk operations and limited container operations. The terminal's ability to support various shipping modes is as follows.

(1) Breakbulk Operations. No gantry cranes are available at dockside for breakbulk operations. Ship's gear and mobile cranes load cargo. The 30-foot depth alongside berths 1 through 3 limits the maximum draft of most breakbulk ships. Berth 4, because of its length, cannot accommodate the C4-S-69b ships. Berths 5 and 6 can accommodate all the breakbulk ships listed in appendix A.

(2) LASH and SEABEE Operations. The port is highly suitable for barge operations and can accommodate 24 LASH lighters or 15 SEABEE barges. Berths 5 and 6 can accommodate SEABEE ships. No berths have water deep enough for LASH ships. However, LASH ships could load lighters at the Jamestown Island anchorages.

(3) RORO and FSS Operations. RORO capacity is limited to side-ramp or slewed-stern-ramp operations. No Ponce/Great Land ramps or stern-RORO docks exist. Currently, the port receives a large number of imported automobiles on RORO vessels. One FSS can load at berths 5 and 6.

(4) Container Operations. Berth 6 is equipped for container operations, with two 45-ton rail-mounted container cranes. However, neither crane is in working condition. The port plans to repair the cranes in the future. When operational, the cranes will be used to load scrap metal.

b. Materials Handling Equipment (MHE). Stevedore companies supply MHE to the terminal as required.

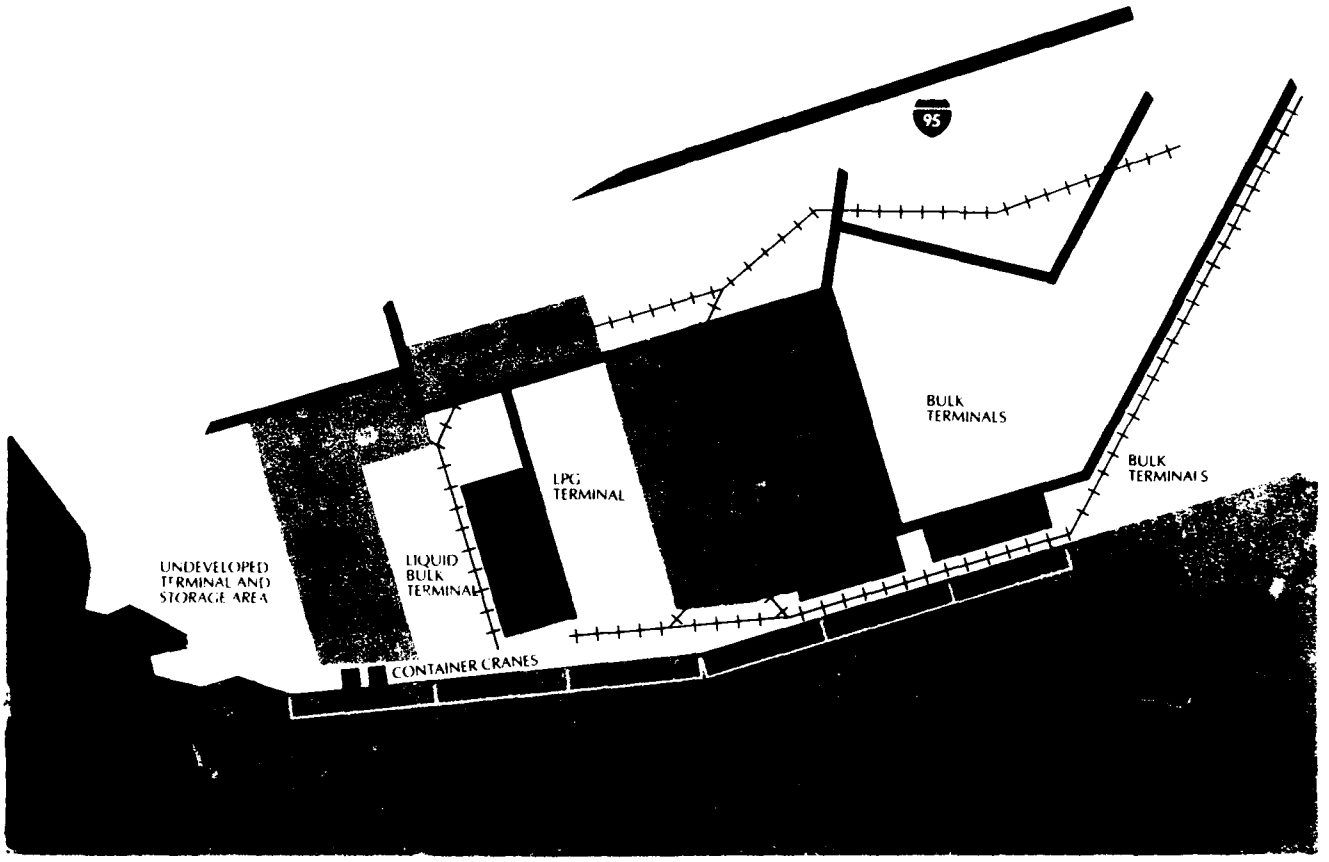


Figure II-NAR-2. Port of Providence.

Figure II-NAR-3. Port of Providence.

TABLE II-NAR-1
NARRAGANSETT BAY PORTS
BERTH CHARACTERISTICS OF PROVIDENCE

Characteristics	Berths 1-3	4	5-6
Length (ft)	1,740	575	1,158
Depth alongside at MLW (ft)	30	40	40
Deck strength (psf)	600	600	600
Apron width (ft)	35	Open	Open
Apron height above MLW (ft)	11	11	11
Number of container cranes	0	0	0
Number of wharf cranes	0	0	0
Apron lighting	No	No	No
Straight-stern RORO facilities	No	No	No
Apron length served by rail (ft)	0	0	0

Notes:
1. Terminal open storage area is 14 acres
2. Terminal covered storage area is 298600 square feet

c. Staging

(1) Open Storage. The terminal has 14 acres of usable open storage. Most of the terminal's open area is unpaved and marginally suitable for deployment operations. However, five paved acres of staging area exist between Fields Point and Shipyard Street. Also, a large parking lot at the Naval Reserve Center, 2 miles south of the terminal, provides space for about 1,000 vehicles.

(2) Covered Storage. The marine terminal building behind berth 2, on New York Avenue, is a modern, multipurpose facility with two main freight-storage areas. One area is 85,000 square feet and the other is 30,000 square feet. The larger area parallels the dock and has direct access to the berths across an 85-foot apron. It also has a railcar reception area with a capacity to concurrently unload four freight cars inside the building. The smaller area, which is heated, has 10 truck docks with weather closures and tailgate levelers. This area also provides the Port

TABLE II-NAR-2
NARRAGANSETT BAY PORTS
SUMMARY OF BERTHING CAPABILITIES OF PROVIDENCE

Vessel	Berths 1-3	Berths 4	Berths 5-6
Breakbulk			
C3-S-33a	a	1	2
C3-S-37c	a	1	2
C3-S-37d	3	1	2
C3-S-38a	3	1	2
C4-S-1a	2	1	1
C4-S-1qb and 1u	a	1	1
C4-S-58a	a	1	1
C4-S-65a	2	1	1
C4-S-66a	a	1	2
C4-S-69b	a	c	1
Seatrain			
GA and PR-class	2	1	1
Barge			
LASH C8-S-81b	a,g	a,c,g	a,g
LASH C9-S-81d	a	c	1
LASH lighter	12	4	8
SEABEE C8-S-82a	a	c	1
SEABEE barge	8	2	5
RORO			
Comet	d,o	d,i,j	d,i,j
C7-S-95a/Maine-class	a,b	c	1
Ponce-class	b,h	c,h	h
Great Land-class	b,h	c,h	h
Cygnus/Pilot-class	b	c	1
Meteor	d,o	d,i,j	d,i,j
AmEagle/Condor	b	c	i,j
MV Ambassador	d	d	d
FSS-class	a,b	c	1
Cape D-class	a,b	c	i,j
Cape H-class	a,b	c	1
Container			
C6-S-1w	2,e	c,e	1,e
C7-S-68e	a,e	c,e	1,e
C8-S-85c	a,e	c,e	1,e
Combination			
C5-S-78a	a,e	c,e	1,e
C5-S-37e	2,e	c,e	1,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

of Providence with container stuffing capability. Transit shed 1 and the warehouse have 63,600 and 120,000 square feet of storage space, respectively.

d. Security. A State-contracted security service patrols the docks and staging areas. Although some fencing exists and the gates are suitable for commercial security, no controlled gates exist to monitor access to the port.

e. Rail Operations. No end ramps exist at the terminal. However, these could be improvised in a short time. A single rail line divides 300 feet before reaching the marine terminal, providing two terminal rail spurs. These spurs provide apron tracks at berths 1 through 4. However, these tracks are not serviceable. The warehouse has a concrete side dock that can accommodate 10 boxcars offloading general cargo.

f. Truck Operations. The 10 docks at the marine terminal building are too small to offload rolling stock from flatbed trucks, but they are suitable to handle breakbulk cargo. Portable end ramps would be required for offloading rolling stock. The ramps could be spotted at suitable locations within the terminal.

General cargo could be offloaded at the warehouse. It has a continuous truck dock capable of serving 18 to 20 trucks.

g. Helicopter Operations. The paved container area is a possible site for helicopter operations. T. F. Green Airport can also accept incoming helicopters.

h. Marshaling Areas. No adequate marshaling areas were identified.

2. Port of Davisville

The Port of Davisville piers are owned by the State of Rhode Island. The Rhode Island Port Authority operates the terminal. During World War II and the Vietnam conflict, the Navy used the Port of Davisville extensively. The Navy retains priority right for occasional use.

a. Berthing. The Port of Davisville (figs II-NAR-1 and II-NAR-4) consists of two piers.

Pier 1 (fig II-NAR-4) is 1,200 feet long and 250 feet wide, with 2,650 linear feet of berthing. It has a concrete deck supported on wood pilings. The deck strength is an estimated 300 pounds per square foot. This low deck strength limits pier 1 as a loading site.

Pier 2 is 1,200 feet long and 650 feet wide. It consists of a concrete apron over an earth-filled base, providing a deck strength of 600 pounds per square foot. Although the pier has no fixed cranes, heavy-lift mobile cranes are commercially available in the area. Because of shoaling problems, the north side of the pier lacks sufficient water for cargo operations. No floating cranes are available, although one 60-ton Navy floating crane is in Newport, 7 miles away.

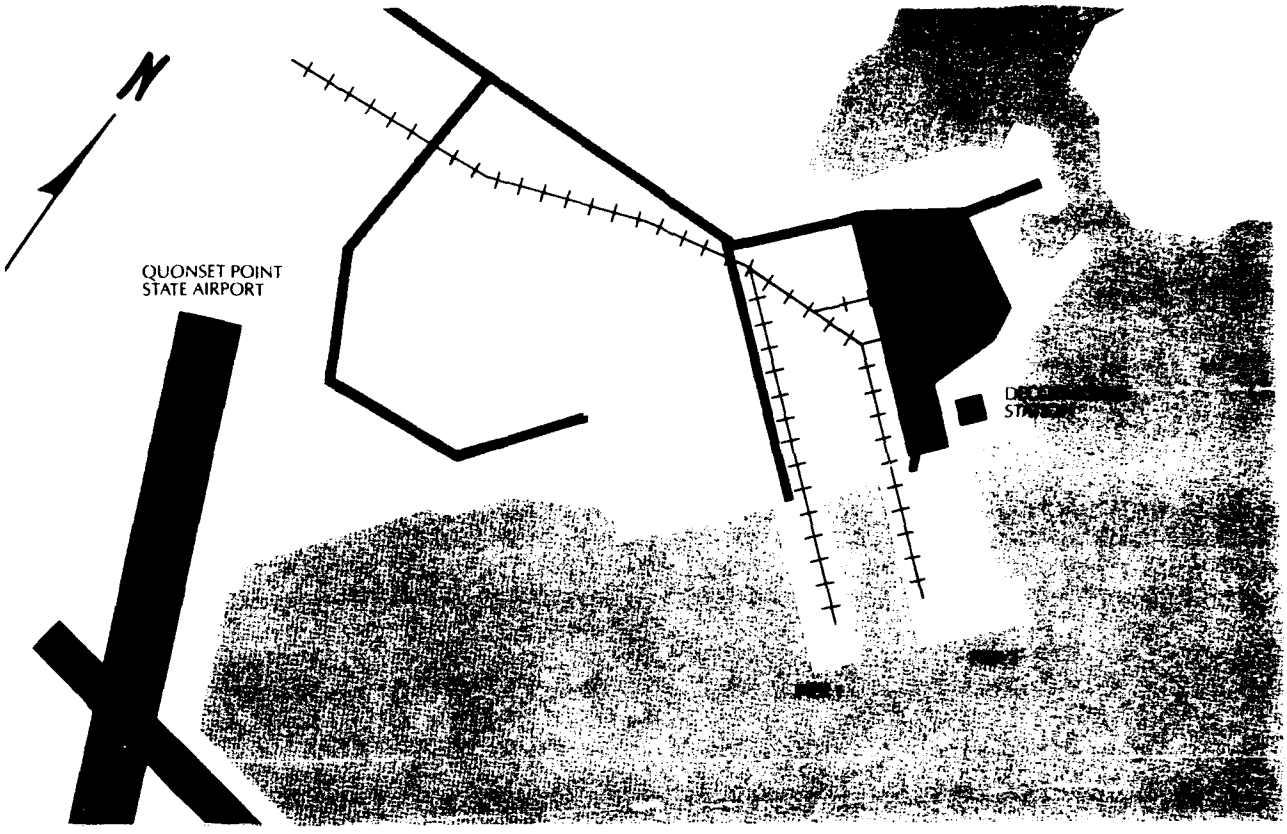


Figure II-NAR-4. Port of Davisville.

Tables II-NAR-3 and II-NAR-4 show the berthing characteristics and capabilities of the port. The port's ability to support various shipping modes is as follows:

(1) Breakbulk Operations. Pier 2 is a strong pier with a large surface area for handling cargo. The south and east sides are suitable for breakbulk operations. However, the 29-foot water depth at the pier restricts the loading of many breakbulk vessels.

(2) LASH and SEABEE Operations. The port has 28 LASH lighter or 21 SEABEE barge loading positions. Mobile cranes would be needed for their loading. Lighters and barges must load aboard mother ships at a nearby anchorage.

(3) RORO and FSS Operations. Pier 2 south, with its stern-RORO dock, is good for RORO operations. However, the relatively shallow water depth at the berth would restrict loading the large utility RORO vessels. Only smaller RORO vessels, such as the Cygnus/Pilot class are suitable for the Port of Davisville. FSS operations are restricted by the 29-foot water depth.

(4) Container Operations. The port has no container handling equipment. Also, the draft required by most container ships is greater than the 29-foot depth alongside the piers.

b. Materials Handling Equipment (MHE). Stevedore companies supply MHE to the terminal as required.

TABLE II-NAR-3
NARRAGANSETT BAY PORTS
BERTH CHARACTERISTICS OF PORT OF DAVISVILLE

Characteristics	Berths			
	Pier 1-S	Pier 1-N	Pier 2-S	Pier 2-E
Length (ft)	1,200	1,200	1,200	650
Depth alongside at MLW (ft)	29	29	29	29
Deck strength (psf)	300	300	600	600
Apron width (ft)	250	250	650	650
Apron height above MLW (ft)	12	12	12	12
Number of container cranes	0	0	0	0
Number of wharf cranes	0	0	0	0
Apron lighting	No	No	No	No
Straight-stern RORO facilities	No	No	Yes	No
Apron length served by rail (ft)	1,200	1,200	1,200	0

Notes:
1. Terminal open storage area is 123 acres
2. Terminal covered storage area is 0 square feet

c. Staging

(1) Open Storage. Each pier is completely open, allowing for storage directly on it. However, the last third of pier 2 is obstructed by construction materials for a nearby bridge. Next to the two piers are 123 acres of open staging area. An additional 400 acres of industrial land within a 1-mile radius of the piers could complement this open storage area.

(2) Covered Storage. No warehouse near the piers is available for unit deployment. Navy-owned warehouses at the Port of Davisville store only Naval Reserve equipment.

d. Security. The State of Rhode Island contracts security service. A chain link fence provides a perimeter barrier. The piers have adequate lighting, but the open storage areas do not.

TABLE II-NAR-4
NARRAGANSETT BAY PORTS
SUMMARY OF BERTHING CAPABILITIES OF PORT OF DAVISVILLE

Vessel	Berths			
	Pier 1-S	Pier 1-N	Pier 2-S	Pier 2-E
Breakbulk				
C3-S-33a	a	a	a	a
C3-S-37c	a	a	a	a
C3-S-37d	a	a	a	a
C3-S-38a	2	2	2	1
C4-S-1a	a	a	a	a
C4-S-1qb and 1u	a	a	a	a
C4-S-58a	a	a	a	a
C4-S-65a	a	a	a	a
C4-S-66a	a	a	a	a
C4-S-69b	a	a	a	a
Seatrain				
GA and PR-class	2	2	2	1
Barge				
LASH C8-S-81b	a,g	a,g	a,g	a,c,g
LASH C9-S-81d	a	a	a	a,c
LASH lighter	8	8	8	4
SEABEE C8-S-82a	a	a	a	a,c
SEABEE barge	6	6	6	3
RORO				
Comet	d,i,j	d,i,j	i,j	d,i,j
C7-S-95a/Maine-class	a	a	a	a,c
Ponce-class	h	h	h	c,h
Great Land-class	h	h	h	c,h
Cygnus/Pilot-class	1	1	1	1
Meteor	d,i,j	d,i,j	i,j	d,i,j
AmEagle/Condor	a	a	a	a
MV Ambassador	d	d	2,m	d
FSS-class	a	a	a	a,c
Cape D-class	a	a	a	a,c
Cape H-class	a	a	a	a,c
Container				
C6-S-1w	1,e	1,e	1,e	c,e
C7-S-68e	a,e	a,e	a,e	a,c,e
C8-S-85c	a,e	a,e	a,e	a,c,e
Combination				
C5-S-78a	a,e	a,e	a,e	a,e
C5-S-37e	a,e	a,e	a,e	a,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

e. Rail Operations. One fixed end ramp that can serve two railcars at once is south of Building 40. Three portable side ramps are also available. Rail tracks on pier 1 are not usable because of the condition of the pier.

f. Truck Operations. The port has two portable ramps for loading and unloading trucks.

g. Helicopter Operations. Either the Quonset State Airport or the T. F. Green Airport can receive and stage incoming helicopters.

h. Marshaling Areas. Although no one large marshaling area was identified, several smaller areas exist in the nearby Quonset Point/Davisville Industrial Park. Such sites include a golf course and several other smaller sites.

C. SUPPORT SERVICES

1. Pilotage

The Narragansett Bay ports require pilots. The pilots board at the Brenton Reef Light Tower. Northeast Marine Pilots in Newport provides the service.

2. Harbor Craft

Providence Steamboat Company operates nine tugs ranging from 1,600 to 3,200 horsepower. Vessels may dock and undock without tugs; however, tugs are required for turning vessels in the harbor.

3. Stevedores

The John J. Orr Company provides stevedores for the terminals. The membership of the International Longshoremen's Association (ILA) Local 1329 is about 180.

4. Heavy-Lift Equipment

The port has no specialized heavy-lift equipment.

D. INTERMODAL CONTAINER TRANSFER FACILITIES (ICTF)

The port has no dedicated intermodal facility.

E. FUTURE DEVELOPMENT

No major capital development plans exist for the Ports of Narragansett Bay.

F. REQUIREMENTS AND RECOMMENDATIONS

1. Requirements

The outloading requirements for the Ports of Narragansett Bay are relatively small. The 5-day deployment of a notional light

infantry division and a notional naval construction battalion deployment is considered for the Narragansett Bay Ports. The vessels required to support the outloading of these units are shown in appendix A.

The summary vessel requirements for the light infantry division are:

- Ship mix 1 (modern ships): 3 vessels.
- Ship mix 2 (combination of ship types): 5 vessels.
- Ship mix 3 (breakbulk ships): 9 vessels.
- Ship mix 4 (fast sealift ships): 3 vessels.

The vessel requirements for the naval construction battalion are:

- Ship mix 1: 1 vessel.
- Ship mix 2: 2 vessels.
- Ship mix 3: 2 vessels.
- Ship mix 4: 1 vessel.

2. Recommendations

a. Light Infantry Division. Tables II-NAR-5 and II-NAR-6 show the recommended berths for outloading this unit. The Port of Providence berths are the preferred sites for most of the ship loading. The Port of Davisville piers should be used to fill berth shortfalls.

The two terminals can support ship mixes 1 through 3. However, the positioning of the large RORO vessels of ship mix 1 at the Port of Providence is critical in making the mix workable. Ship mix 4 requires three FSS vessels. The Port of Providence has only one berth and can only load two vessels in the 5-day time allowance.

b. Naval Construction Battalion. Table II-NAR-7 shows that the combined Narragansett Bay ports can easily handle the outloading requirements of this unit. The Port of Davisville pier 2 south is recommended for breakbulk operations, and the Port of Providence berths 5 and 6 for FSS loading.

TABLE II-NAR-5
BERTHING RECOMMENDATIONS FOR SHIP MIX 1 AND 2
(LIGHT INFANTRY DIVISION)

Ship Mix 1 (Modern ships)			Ship Mix 2 (Combination of ship types)		
Terminal: Berth:	Providence 4	Providence 5-6	Providence 1-3	Providence 4	Providence 5-6
Day 1	Cape D-1	FSS-1	C3-S-37d C3-S-38a C4-S-65a	Am Eagle	FSS-1
Day 2					
Day 3		FSS-2			
Day 4					
Day 5					

Note: The Cape D vessel will extend into berths 3 and 5-6.

TABLE II-NAR-6
BERTHING RECOMMENDATIONS FOR SHIP MIX 3 AND 4
(LIGHT INFANTRY DIVISION)

Ship Mix 3 (Breakbulk ships)					Ship Mix 4 (FSS)
Terminal: / Berth:	Providence 1-3	Providence 4	Providence 5-6	Davisville P2 South	Davisville P2 East	Providence 5-6
Day 1						
Day 2	C3-S-37d	C4-S-65a	C3-S-37c	C3-S-38a	C3-S-38a	FSS-1
Day 3	C3-S-37d C3-S-37d		C3-S-37d	C3-S-38a		FSS-2
Day 4						
Day 5						

Note: Providence has a one berth shortfall for this mix. The third vessel may be able to berth at Davisville.

TABLE II-NAR-7
BERTH RECOMMENDATIONS
(NAVAL CONSTRUCTION BATTALION)

SHIP MIX 1 (Modern Ships)	SHIP MIX 2 (Combination of ship types)	SHIP MIX 3 (Older Ships)	SHIP MIX 4 (Fast Sealift Ships)
TERMINAL: PROVIDENCE BERTH: S-6	TERMINAL: DAVISVILLE BERTH: P2 South	TERMINAL: DAVISVILLE BERTH: P2 South	TERMINAL: PROVIDENCE BERTH: S-6
DAY 1 FSS-1 DAY 2 DAY 3 DAY 4 DAY 5	DAY 1 DAY 2 C3-S-37d C3-S-33a DAY 3 DAY 4 DAY 5	DAY 1 DAY 2 C4-S-65a C3-S-33a DAY 3 DAY 4 DAY 5	DAY 1 FSS-1 DAY 2 DAY 3 FSS-2 DAY 4 DAY 5

PORT OF NEW YORK AND NEW JERSEY (1990)

A. GENERAL

1. Location and Harbor Description (fig II-NYJ-1)

The Port of New York and New Jersey is 386 nautical miles southwest of Boston Harbor and 240 nautical miles northeast of Philadelphia. The port consists of several terminals. This report will only look at Port Newark, Elizabeth Port Authority Marine Terminal, and Military Ocean Terminal Bayonne (MOTBY).

Vessels arriving from the ocean to either of these destinations use the 2,000-foot-wide by 45-foot-deep Ambrose Channel. This channel connects the Lower New York Bay to the Upper. Along the way, vessels must pass under the Verrazano-Narrows Bridge. The Verrazano-Narrows Bridge has a vertical clearance of 217 (MHW) feet for a distance of 2,000 feet.

MOTBY is only 3 miles north of the Verrazano-Narrows Bridge. Vessels bound for the Port Newark or Elizabeth Port Authority Marine Terminal turn west 2 miles north of the bridge and continue through the Kill Van Kull Channel. This channel is 500 feet wide and 40 feet deep and passes beneath the Bayonne Bridge. The Bayonne Bridge has a horizontal clearance of 800 feet and a vertical clearance of 151 feet (MHW).

Forty-seven anchorages exist in the lower and upper bays. Of these, eight are general anchorages and two are explosives anchorages.

The mean tidal range of New York Harbor is 4.7 feet. The extreme range is 14.8 feet MLW.

2. Highway Access

An extensive network of highways exists in and around the New York and New Jersey Port District, with traffic congestion a constant problem. Highways entering the port district from the north and south are Interstate Routes 95, 495, and 295; US Routes 1 and 9; and the New Jersey Turnpike. Entering the port district from the east and west are Interstate Routes 78, 278, and 280 and New Jersey Route 440. I-95 runs behind and parallel to the Port Newark and Elizabeth Port Authority Marine Terminal. These terminals have access to I-78, the New Jersey Turnpike, US 1, and US 9. MOTBY has access to I-78 and I-278 via Avenue E and New Jersey 440. Traffic congestion is compounded by numerous toll plazas.

3. Rail Access

Conrail is the major carrier providing rail service. Conrail provides direct rail service to Elizabeth Port Authority Marine Terminal, Port Newark, and MOTBY. Ample railcar storage exists in the rail holding and classification yards within the port district. Within 3 miles of the three terminals analyzed are eight railyards. The capacities of these yards range from 300 to more than 1,100 railcars each. This storage potential is in addition to railcar storage within the terminals.

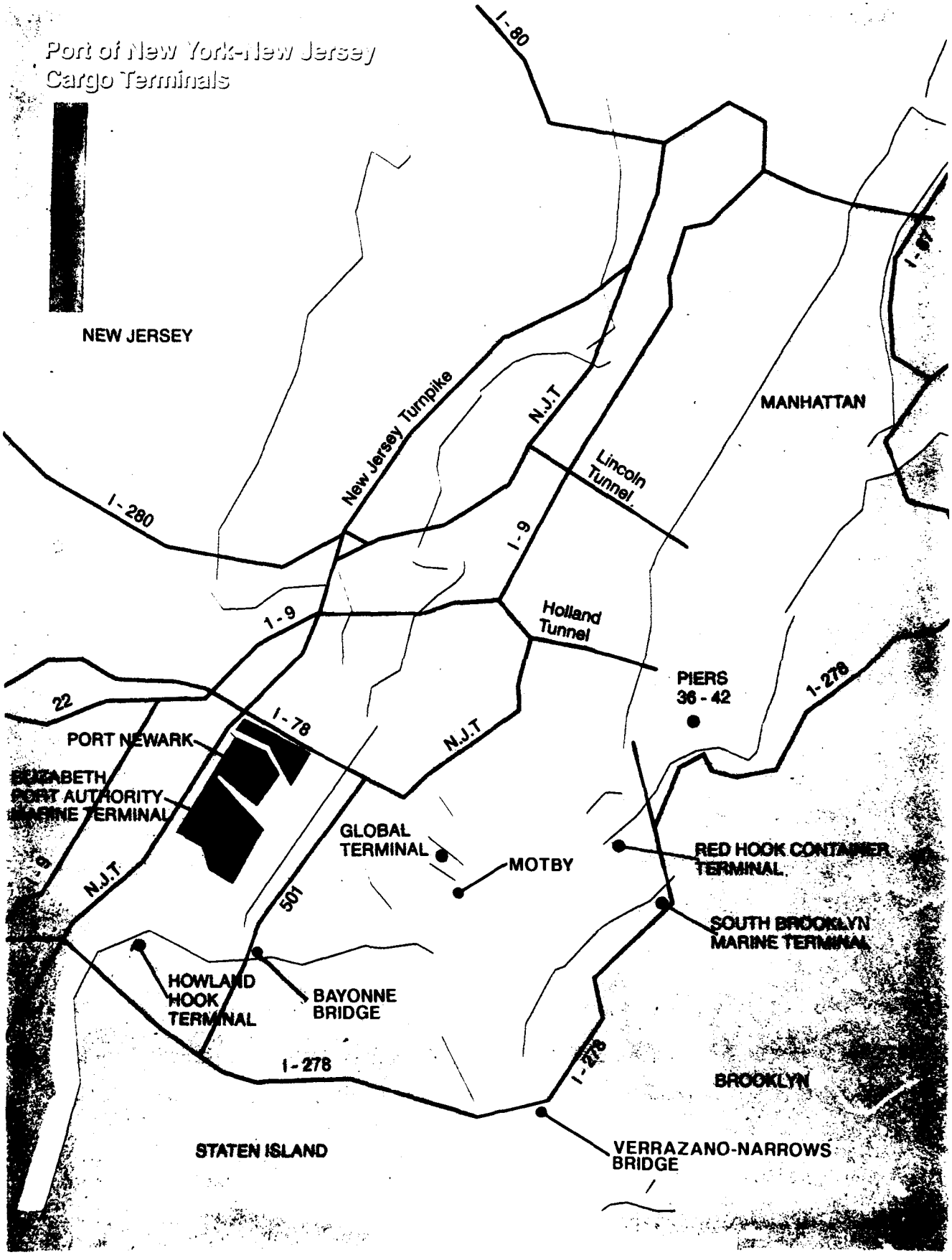


Figure II-NYJ-1. Port of New York and New Jersey.

4. Airports

The New York and New Jersey Port District has four major airports: Newark International, John F. Kennedy International, La Guardia, and Teterboro. Newark International Airport is directly opposite Port Newark and Elizabeth Port Authority Marine Terminal. I-95 separates these marine terminals from the airport. Newark International Airport can handle large cargo aircraft and helicopter operations.

B. PORT FACILITIES

1. Port Newark (fig II-NYJ-2)

a. Berthing. Port Newark is a waterfront terminal development on the western shore of Newark Bay in Newark, New Jersey. The terminal contains about 930 acres and includes wharves, deepwater ship berths (about 23,600 linear feet), transit sheds, open storage areas, more than 3 million square feet of distribution buildings, specialized facilities, roadways, and railroad trackage.

Port Newark construction consists of concrete retaining walls with asphalt-surfaced solid fill over concrete relieving platforms. The relieving platforms are supported by steel, concrete, or timber piles. The entire structure is fronted by a timber fender system.

Tables II-NYJ-1 and II-NYJ-2 show the berthing characteristics and capabilities of the terminal. The terminal's ability to support various shipping modes is shown below.

(1) Breakbulk Operations. Port Newark is ideally suited for breakbulk operations. Excellent MHE and transit shed assets are available. Steel scrap processing operations could interfere with operations at berths 36, 61, and 63.

(2) LASH and SEABEE Operations. Port Newark has 157 LASH lighter or 109 SEABEE barge loading positions. Their draft prevents mother ships from berthing, so instream operations are necessary. Newark Bay is a suitable location for the mother ships.

(3) RORO and FSS Operations. The C7-S-95a/Marine-class vessels operate without restrictions from all open-aproned berths. Berths 51 through 63 in the Elizabeth Channel can accommodate up to six of these vessel types. Cygnus/Pilot-class RORO vessels also fare well at Port Newark. Up to eight of these ships can use berths 51 through 63. Inadequate apron width prevents all vessels from operations next to berths with transit sheds alongside. Further restrictions arise from the port's lack of straight-stern berths.

(4) Container Operations. Two shipping companies, Maersk Lines and Universal Maritime Service Company, conduct container operations at Port Newark. They are adequately equipped to sustain operations using their own MHE. Maersk Lines operates berth 51, which has two PACECO 45-ton-capacity container cranes.

b. Materials Handling Equipment (MHE). Port Newark has sufficient MHE to handle any cargo need.

Figure II-NYJ-2. Port Newark.

TABLE II-NYJ-1
PORT OF NEW YORK AND NEW JERSEY
BERTH CHARACTERISTICS OF PORT NEWARK

Characteristics	Berths						
	5-7	9-17	19-25	2-14	16-22	24-36	51-63
Length (ft)	1,374	2,923	2,790	4,144	2,150	4,010	5,308
Depth alongside at MLW (ft)	35	35	35	35	35	35	35
Deck strength (psf)	500	500	1,000	1,000	500	500	500
Apron width (ft)	Open	56	Open	Open	50	50	Open
Apron height above MLW (ft)	11	11	11	11	11	11	11
Number of container cranes	0	0	0	0	0	0	5
Number of wharf cranes	0	0	0	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	No	No	No	Yes
Apron length served by rail (ft)	1,374	2,923	2,790	4,144	2,150	4,010	5,308

Notes:
1. Terminal open storage area is 306 acres
2. Terminal covered storage area is 1568160 square feet

TABLE II-NYJ-2
PORT OF NEW YORK AND NEW JERSEY
SUMMARY OF BERTHING CAPABILITIES OF PORT NEWARK

Vessel	Berths					
	5-7	9-17	19-25	2-14	16-22	24-36
Breakbulk						
C3-S-33a	2	5	5	8	4	7
C3-S-37c	2	5	5	7	4	7
C3-S-37d	2	5	5	7	4	7
C3-S-38a	2	5	5	8	4	7
C4-S-1a	2	4	4	7	3	6
C4-S-1qb and 1u	2	4	4	7	3	6
C4-S-58a	2	4	4	6	3	6
C4-S-65a	2	4	4	7	3	6
C4-S-66a	2	5	4	7	3	7
C4-S-69b	2	4	4	6	3	6
Seatrain						
GA and PR-class	2	4	4	7	3	6
Barge						
LASH C8-S-81b	a,g	a,g	a,g	a,g	a,g	a,g
LASH C9-S-81d	a	a	a	a	a	a
LASH lighter	9	20	19	29	15	28
SEABEE C8-S-82a	a	a	a	a	a	a
SEABEE barge	6	14	13	20	10	20
RORO						
Comet	d,i,j	d,o	d,i,j	d,i,j	d,o	d,o
C7-S-95a/Maine-class	1	b	3	5	b	b
Ponce-class	h	b,h	h	h	b,h	b,h
Great Land-class	h	b,h	h	h	b,h	b,h
Cygnus/Pilot-class	2	b	4	6	b	b
Meteor	d,i,j	d,o	d,i,j	d,i,j	d,o	d,o
AmEagle/Condor	i,j	b	i,j	i,j	b	b
MV Ambassador	d	d	d	d	d	d
FSS-class	1	b	2	4	b	b
Cape D-class	i,j	b	i,j	i,j	b	b
Cape H-class	a	a,b	a	a	a,b	a,b
Container						
C6-S-1w	2,e	4,e	4,e	6,e	3,e	5,e
C7-S-68e	1,e	4,e	3,e	5,e	2,e	5,e
C8-S-85c	1,e	3,e	3,e	4,e	2,e	4,e
Combination						
C5-S-78a	2,e	4,e	4,e	6,e	3,e	6,e
C5-S-37e	2,e	4,e	4,e	6,e	3,e	6,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

TABLE II-NYJ-2 (CONTINUED)
PORT OF NEW YORK AND NEW JERSEY
SUMMARY OF BERTHING CAPABILITIES OF PORT NEWARK

Vessel	Berths 51-63
Breakbulk	
C3-S-33a	10
C3-S-37c	10
C3-S-37d	10
C3-S-38a	10
C4-S-1a	9
C4-S-1qb and 1u	8
C4-S-58a	8
C4-S-65a	9
C4-S-66a	9
C4-S-69b	8
Seatrain	
GA and PR-class	9
Barge	
LASH C8-S-81b	a,g
LASH C9-S-81d	a
LASH lighter	37
SEABEE C8-S-82a	a
SEABEE barge	26
RORO	
Comet	i,j
C7-S-95a/Maine-class	6
Ponce-class	h
Great Land-class	h
Cygnus/Pilot-class	8
Meteor	i,j
AmEagle/Condor	i,j
MV Ambassador	9,m
FSS-class	5
Cape D-class	i,j
Cape H-class	a
Container	
C6-S-1w	7
C7-S-68e	7
C8-S-85c	6
Combination	
C5-S-78a	8
C5-S-37e	8

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

c. Staging

(1) Open Storage. The port has 306 acres of open storage. The acreage is paved and well lighted. This area is divided into several small parcels, each belonging to a different terminal.

(2) Covered Storage. Covered storage consists of warehouses and transit sheds, which provide 36 acres of space. Each building has rail access via side car platforms. Ample truck docks serve each building also.

d. Security. A 7-foot chain link fence topped with three strands of barbed wire encloses the terminal. Security personnel control all gates 24 hours a day. Lighting further enhances security at Port Newark.

e. Rail Operations. Conrail serves the terminal, providing rail service through an extensive port rail network. The rail system extends directly to and along every berth. Also, each warehouse and transit shed has direct rail access. Rail spurs exist throughout the terminal for rail storage. Just outside Port Newark and parallel to Corbin Street is a large railcar classification yard. This facility provides significant railcar staging potential. In addition to this yard, many other classyards are within the immediate port area.

f. Truck Operations. Commercial trucks can enter or leave the terminal by any of 10 gates. The multilane container gate serving Maersk Lines is off Tyler Street. The main, multilane container gate serving Universal Maritime Service Corporation is off Starboard Street. All of the transit sheds and warehouses have truck platform-level docks.

g. Helicopter Operations. No designated helicopter operations are within Port Newark. However, the port complex has large, unobstructed, open staging areas sufficient to land these aircraft. Newark International Airport is also next to the port, separated by the New Jersey Turnpike.

h. Marshaling Areas. Port Newark Marine Terminal has enough staging and support systems that additional marshaling areas are not necessary.

2. Elizabeth Port Authority Marine Terminal (figs II-NYJ-3 and II-NYJ-4)

a. Berthing. Elizabeth Port Authority Marine Terminal lies next to Port Newark. The two terminals form one large complex separated by the Elizabeth Channel. Elizabeth Port Authority Marine Terminal consists of three marginal wharves totaling 16,169 feet. All 24 berths within the terminal are suitable for military shipping operations. Apron heights average 12 feet above MLW. Depths alongside berths 52 through 66 are maintained at 35 feet MLW. Berths 68 through 98 have depths of 40 feet MLW.

Wharf construction consists of concrete retaining walls with asphalt-surfaced solid fill, supported on concrete relieving platforms. Concrete-capped timber piles support the platforms. The entire structure is fronted by a timber fender system.

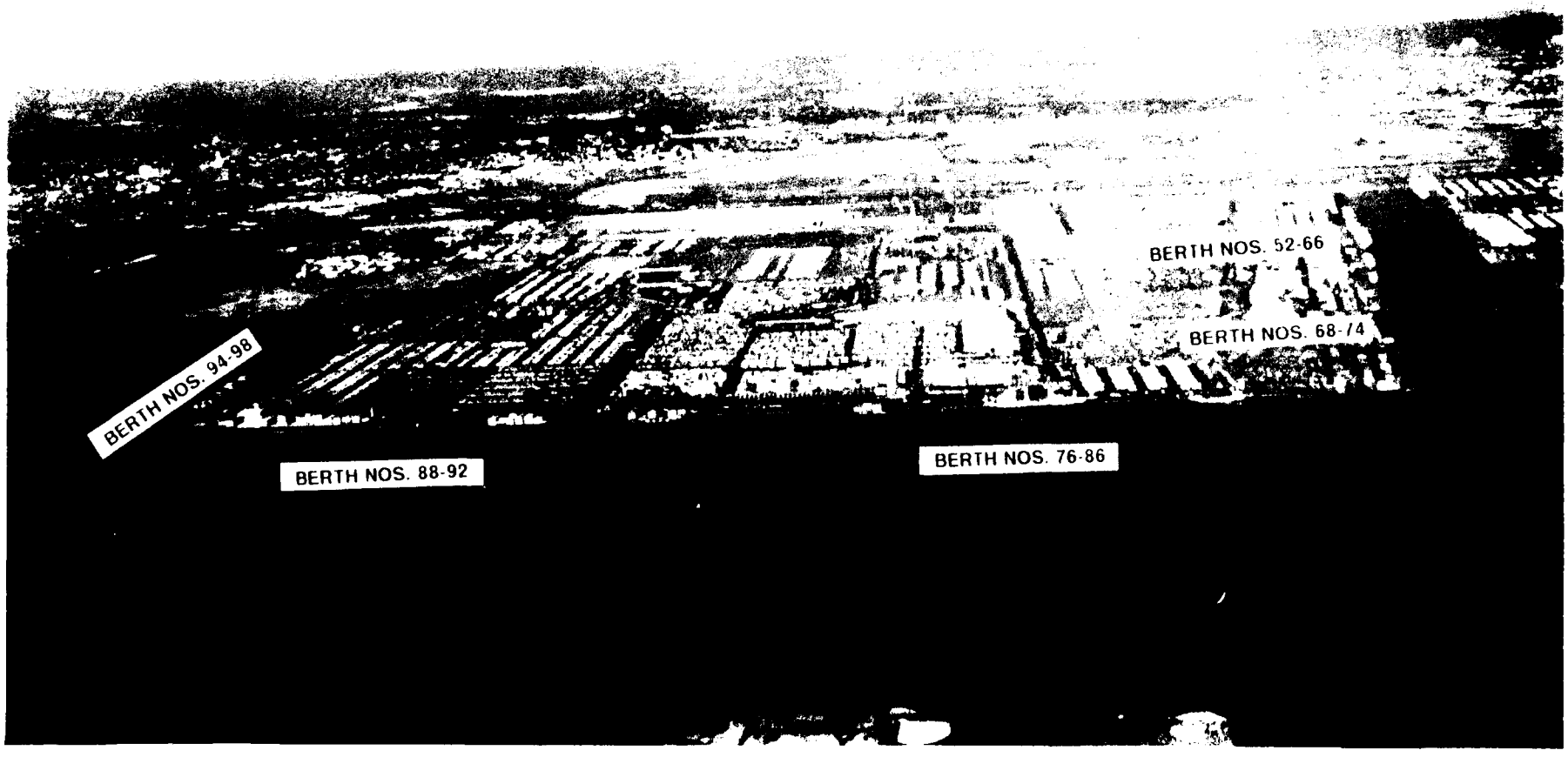


Figure II-NYJ-3. Elizabeth Port Authority Marine Terminal (westward view).

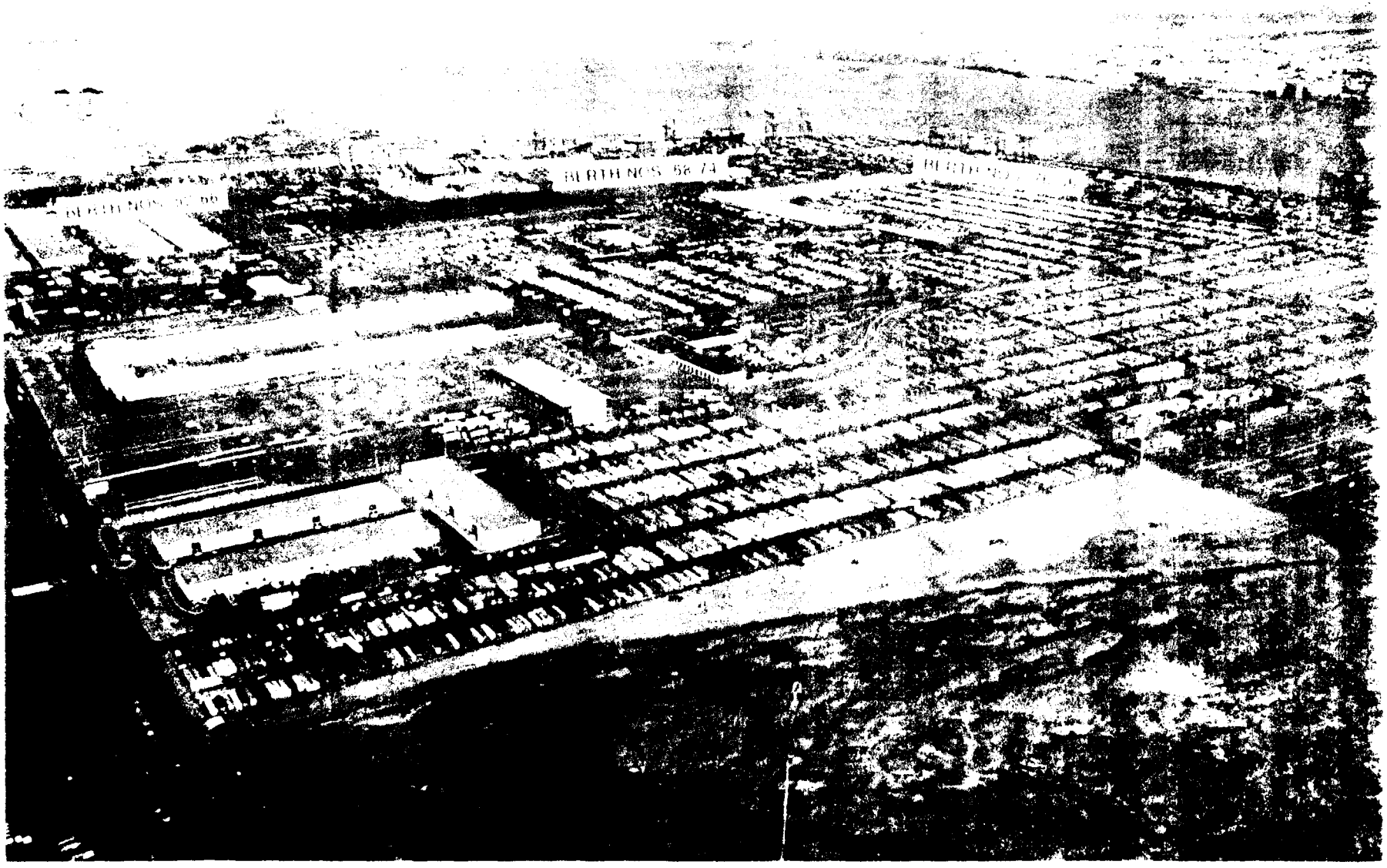


Figure II-NYJ-4. Elizabeth Port Authority Marine Terminal (northward view).

Tables II-NYJ-3 and II-NYJ-4 show the berthing characteristics of the port. The terminal's ability to support various shipping modes is described below.

TABLE II-NYJ-3
PORT OF NEW YORK AND NEW JERSEY
BERTH CHARACTERISTICS OF ELIZABETH PORT AUTHORITY MARINE TERMINAL

	Berths				
Characteristics	52-66	68-74	76-86	88-92	94-98
Length (ft)	4,875	2,825	3,950	2,019	2,500
Depth alongside at MLW (ft)	35	39	40	40	40
Deck strength (psf)	500	500	500	500	500
Apron width (ft)	Open	Open	Open	Open	Open
Apron height above MLW (ft)	12	12	12	12	12
Number of container cranes	6	3	1	4	2
Number of wharf cranes	0	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	Yes	Yes	No	No	Yes
Apron length served by rail (ft)	2,000	0	0	0	0

Notes:
1. Terminal open storage area is 586 acres
2. Terminal covered storage area is 1185680 square feet

(1) Breakbulk Operations. Breakbulk operations can be performed at all berths. Ship's gear or container cranes can handle cargo. No transit sheds and few warehouses complement the port. Lighting enhances operations at nighttime.

(2) LASH and SEABEE Operations. Elizabeth Port Authority Marine Terminal has 113 LASH lighter and 79 SEABEE barge loading positions. The LASH C9-S-81d and SEABEE C8-S-82a mother ships can operate at all berths except 52 through 66. Instream operations are also possible in the Newark Bay.

(3) RORO and FSS Operations. C7-S-95a/Maine-, Cygnus/Pilot-, and Cape H-class vessels can conduct highly successful RORO operations. FSS operations are possible at all berths. Elizabeth Port Authority Marine Terminal is well suited to these vessels. Plenty of open staging areas supplement operations.

TABLE II-NYJ-4
PORT OF NEW YORK AND NEW JERSEY
SUMMARY OF BERTHING CAPABILITIES OF ELIZABETH PORT AUTHORITY MARINE TERMINAL

Vessel	Berths				
	52-66	68-74	76-86	88-92	94-98
Breakbulk					
C3-S-33a	9	5	7	3	4
C3-S-37c	9	5	7	3	4
C3-S-37d	9	5	7	3	4
C3-S-38a	9	5	7	3	4
C4-S-1a	8	4	6	3	4
C4-S-1qb and 1u	8	4	6	3	4
C4-S-58a	8	4	6	3	4
C4-S-65a	8	4	6	3	4
C4-S-66a	8	5	6	3	4
C4-S-69b	8	4	6	3	4
Seatrain					
GA and PR-class	8	4	6	3	4
Barge					
LASH C8-S-81b	a,g	a,g	a,g	a,g	a,g
LASH C9-S-81d	c	3	4	2	2
LASH lighter	34	20	28	14	17
SEABEE C8-S-82a	a	3	4	2	2
SEABEE barge	24	14	19	10	12
RORO					
Comet	i,j	i,j	d,i,j	d,i,j	i,j
C7-S-95a/Maine-class	6	3	5	2	3
Ponce-class	h	h	h	h	h
Great Land-class	h	h	h	h	h
Cygnus/Pilot-class	7	4	5	3	3
Meteor	i,j	i,j	d,i,j	d,i,j	i,j
AmEagle/Condor	i,j	i,j	i,j	i,j	i,j
MV Ambassador	8,m	4,m	d	d	4,m
FSS-class	5	2	4	2	2
Cape D-class	i,j	i,j	i,j	i,j	i,j
Cape H-class	a	3	5	2	3
Container					
C6-S-1w	7	4	5	2	3
C7-S-68e	6	3	5	2	3
C8-S-85c	5	3	4	2	2
Combination					
C5-S-78a	7	4	6	3	3
C5-S-37e	7	4	6	3	4

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

(4) Container Operations. Elizabeth Port Authority Marine Terminal is mainly a container terminal. Maher Terminals, Inc, operates berths 52 through 66, using six container cranes. It also operates berths 78 through 86, using seven container cranes. Atlantic Container Line operates berths 68 through 72, using three PACECO 30-ton-capacity container cranes. Finally, berths 88 through 98 are operated by Sea-Land, using six PACECO 40-ton-capacity container cranes. Both ports have ample MHE to handle containers.

b. MHE. The Elizabeth Port Authority Marine Terminal is well supported by cranes and RORO ramps. It has adequate yard hustlers, straddle carriers, and forklifts for any outload need. Stevedoring companies can also supply additional MHE as required.

c. Staging

(1) Open Storage. The Elizabeth Port Authority Marine Terminal has 586 acres of open storage. All of this is paved and well lighted. RORO cargo, general cargo, and containers are all presently stored at the port. Containers are stacked three to five high.

(2) Covered Storage. Covered storage consists of only warehouses. The port has no transit sheds. The terminal's covered storage area is more than 1 million square feet.

d. Security. A 7-foot chain link fence with barbed wire encloses the port. Each terminal provides security for its own respective area. All gates within the port are guard controlled, and security personnel patrol 24 hours a day.

e. Rail Operations. Conrail provides rail service to Elizabeth Port Authority Marine Terminal through an extensive port rail network. The only berths with apron tracks are 60 through 66. However, all the warehouses have direct rail access and side rail platforms. The port has rail spurs and rail end ramps where trailer-on-flatcar (TOFC) operations are performed.

f. Truck Operations. Commercial trucks access the port through any of six multilane container gates. These gates range from 6 to 20 lanes each.

g. Helicopter Operations. No designated helicopter operation areas exist within the port. However, large, paved open storage areas exist where helicopters could be staged. Newark International Airport can also handle helicopters.

h. Marshaling Areas. The Elizabeth Port Authority Marine Terminal has enough staging and support systems for any marshaling requirement.

3. Military Ocean Terminal, Bayonne (MOTBY) (fig II-NYJ-5)

a. Berthing. MOTBY is a manmade, timber pile pier. The pier has a timber-decked platform supporting a concrete retaining wall with asphalt-surfaced solid fill. MOTBY has 19 berths, totaling 11,083 linear feet. Ten berths are on the north side, seven on the south side, and two on the east face of the terminal. Apron widths vary from 60 feet to open. Apron height averages 8 feet above MLW, and the depth alongside the berths is 35 feet MLW.

Figure II-NYJ-5. Military Ocean Terminal, Bayonne (MOTBY).

Over the years, the MOTBY berths have been allowed to become badly deteriorated. This deterioration has been so severe that none of the original berths are usable for cargo operations. Extensive repairs and reconstruction are underway. Berth N4, 633 feet long, has been completed, and 993 feet of berths N1 and N2, as well as 1,501 feet of berths N8 through N10 will soon be operational. (These projects may be completed prior to publication of this report.) A new RORO-stern ramp has also been completed on the west side of berth N10. The completion of these ongoing projects, as well as others planned for the future, will greatly increase MOTBY's cargo throughput and mission capability. MOTBY is well lighted, and night operations can be conducted.

Tables II-NYJ-5 and II-NYJ-6 show the berthing characteristics and capabilities of MOTBY today. Tables II-NYJ-7 and II-NYJ-8 show the berthing characteristics and capabilities of MOTBY upon completion of those reconstruction projects underway and to be completed within the near future.

(1) Breakbulk Operations. Breakbulk operations can be performed at all operational berths at MOTBY. Mobile and floating cranes furnished by the stevedoring contractor can assist in accomplishing breakbulk mission requirements.

(2) LASH and SEABEE Operations. LASH lighters and SEABEE barges can be loaded at all operational berths. Mobile cranes would be required to accomplish these operations. The port has four LASH lighter or three SEABEE barge loading positions. (It will have 21 LASH lighter or 14 SEABEE barge loading positions when the current reconstruction is completed.) The LASH and SEABEE mother ships cannot use any of the current or future berths without restrictions. These vessels would have to discharge and retrieve their respective lighters in stream.

(3) RORO and FSS Operations. Tables II-NYJ-7 and II-NYJ-8 give detailed information on the types of vessels that may or may not, both now and in the future, conduct RORO operations at the terminal. These tables also list any restrictions that may apply. While inadequate berth length makes berth N4 (currently the only operational berth) unusable for FSS operations, berths N1 and N2 and N8 through N10, scheduled for completion soon, can each accommodate an FSS vessel. The terminal has enough open storage area to adequately support the marshaling requirements for FSS operations.

(4) Container Operations. MOTBY has no container crane, thus, container operations are severely limited. Container operations are occasionally undertaken at MOTBY with mobile/floating cranes.

b. MHE. Contractor- and Government-owned MHE assets meet or exceed any requirements generated by MOTBY. Additional MHE can be acquired (rent/lease) by the stevedore contractor.

c. Staging

(1) Open Storage. MOTBY has 101 acres, or more, of open storage areas. Most of these areas have a paved or graveled surface. Most areas are also fenced, well lighted, and suitable for any staging requirement.

TABLE II-NYJ-5
PORT OF NEW YORK AND NEW JERSEY
BERTH CHARACTERISTICS OF MOTBY (CURRENT)

Characteristics	Berths N4
Length (ft)	633
Depth alongside at MLW (ft)	35
Deck strength (psf)	600
Apron width (ft)	Open
Apron height above MLW (ft)	8
Number of container cranes	0
Number of wharf cranes	0
Apron lighting	Yes
Straight-stern RORO facilities	No
Apron length served by rail (ft)	0

Notes:
1. Terminal open storage area is 101 acres
2. Terminal covered storage area is 3444197 square feet

TABLE II-NYJ-6
PORT OF NEW YORK AND NEW JERSEY
SUMMARY OF BERTHING CAPABILITIES OF MOTBY (CURRENT)

Vessel	Berths N4
Breakbulk	
C3-S-33a	1
C3-S-37c	1
C3-S-37d	1
C3-S-38a	1
C4-S-1a	1
C4-S-1qb and 1u	1
C4-S-58a	1
C4-S-65a	1
C4-S-66a	1
C4-S-69b	1
Seatrain	
GA and PR-class	1
Barge	
LASH C8-S-81b	a,c,g
LASH C9-S-81d	a,c,g
LASH lighter	4
SEABEE C8-S-82a	a,c,g
SEABEE barge	3
RORO	
Comet	1,d,i
C7-S-95a/Maine-class	c
Ponce-class	c,h
Great Land-class	c,h
Cygnus/Pilot-class	c
Meteor	1,d,i
AmEagle/Condor	c
MV Ambassador	d
FSS-class	c
Cape D-class	c
Cape H-class	a,c,g
Container	
C6-S-1w	c,e
C7-S-68e	c,e
C8-S-85c	c,e
Combination	
C5-S-78a	1,e
C5-S-37e	1,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

TABLE II-NYJ-5

TABLE II-NYJ-7
PORT OF NEW YORK AND NEW JERSEY
BERTH CHARACTERISTICS OF MOTBY (AFTER RECONSTRUCTION)

Characteristics	Berths		
	N1-2	N4	N8-10
Length (ft)	993	633	1,501
Depth alongside at MLW (ft)	35	35	35
Deck strength (psf)	600	600	600
Apron width (ft)	Open	Open	Open
Apron height above MLW (ft)	8	8	8
Number of container cranes	0	0	0
Number of wharf cranes	0	0	0
Apron lighting	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	Yes
Apron length served by rail (ft)	0	0	0

Notes:
1. Terminal open storage area is 101 acres
2. Terminal covered storage area is 3444197 square feet

(2) Covered Storage. MOTBY has more than 3.4 million square feet of covered storage. Transit sheds and general warehouses with truck and boxcar handling positions serve all of the berths.

d. Security. Chain link fencing topped with barbed wire encloses the terminal. Cargo staging areas within MOTBY are also secured with additional fencing. The terminal is patrolled by Department of Defense (DOD) police 24 hours a day. Police also man the main gate (32d Street Gate) around the clock. The 40th Street Gate and cargo storage area gates are manned as required. The police force is trained and armed. The terminal's perimeter is well lighted, as are the berths, staging, and open areas.

e. Rail Operations. The Central Railroad of New Jersey, Lehigh Valley, and Penn Central Rail oad Lines are connected to the terminal by an entrance spur at 40th Street and Avenue E. All rail access parallels Stanley Boulevard. Railcars pass through a classification yard and are controlled by the yardmaster while they are on the terminal.

TABLE II-NYJ-8
PORT OF NEW YORK AND NEW JERSEY
SUMMARY OF BERTHING CAPABILITIES OF MOTBY (AFTER RECONSTRUCTION)

Vessel	Berths		
	N1-2	N4	N8-10
Breakbulk			
C3-S-33a	1	1	2
C3-S-37c	1	1	2
C3-S-37d	1	1	2
C3-S-38a	1	1	2
C4-S-1a	1	1	2
C4-S-1qb and 1u	1	1	2
C4-S-58a	1	1	2
C4-S-65a	1	1	2
C4-S-66a	1	1	2
C4-S-69b	1	1	2
Seatrain			
GA and PR-class	1	1	2
Barge			
LASH C8-S-81b	a,g	a,c,g	a,g
LASH C9-S-81d	a,g	a,c,g	a,g
LASH lighter	7	4	10
SEABEE C8-S-82a	a,g	a,c,g	a,g
SEABEE barge	4	3	7
RORO			
Comet	1,d,i	1,d,i	2,i
C7-S-95a/Maine-class	1	c	1
Ponce-class	h	c,h	h
Great Land-class	h	c,h	h
Cygnus/Pilot-class	1	c	2
Meteor	1,d,i	1,d,i	2,i
AmEagle/Condor	1,i	c	2,i
MV Ambassador	d	d	k,m
FSS-class	1	c	1
Cape D-class	1,i	c	2,i
Cape H-class	a,g	a,c,g	a,g
Container			
C6-S-1w	1,e	c,e	2,e
C7-S-68e	1,e	c,e	2,e
C8-S-85c	1,e	c,e	1,e
Combination			
C5-S-78a	1,e	1,e	2,e
C5-S-37e	1,e	1,e	2,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

MOTBY has its own railcrew, who under direction of the yardmaster, accomplish delivery and pickup of inbound or outbound railcars. Most berths, warehouses, and other storage areas at the terminal are served by the 23.82 miles of trackage at the terminal. About 400 railcars can be staged at MOTBY. The terminal has both permanent and portable end ramps.

f. Truck Operations. Trucks and commercial traffic enter the terminal via 32d Street Gate. The gate is a four-lane, guard-controlled point for terminal access. Two open staging areas provide parking for 66 trucks. Many truck handling ramps/positions are at transfer sheds and warehouses throughout the terminal. Also, mobile truck ramps are available.

g. Helicopter Operations. MOTBY has two authorized helicopter operation areas. The primary area is on the east side of the terminal near the drydock area. The softball field is also used for helicopter operations. Only daylight operations are allowed.

h. Marshaling Areas. MOTBY has sufficient storage and staging areas for any marshaling requirement.

C. SUPPORT SERVICES

1. Pilotage

Ambrose Channel, 2,000 feet wide, is the main entrance from the sea to Lower New York Bay and the Narrows between Staten Island and Brooklyn, 15 miles from Ambrose Tower. The depth of this channel is 45 feet MLW. Pilots require 24 hours' notice of a vessel's arrival.

2. Harbor Craft

More than 50 private towing and transportation companies are registered in the port.

3. Stevedoring

Thirteen stevedoring firms are active in the port, many of which operate terminals. Normal working hours are from 0800 to 1700 hours. Bulk cargo work usually continues 24 hours a day.

MTMC International Traffic has determined that enough longshoremen will be available at the port to meet mobilization needs.

4. Heavy-Lift Equipment

Mobile floating cranes with lifting capacities up to 500 tons are available.

D. INTERMODAL CONTAINER TRANSFER FACILITY (ICTF)

Port Newark and Elizabeth Port Authority Marine Terminal have a 930-acre intermodal facility. It is in Newark along the west shore of Newark Bay. Highway connections to the New Jersey Turnpike (I-95) are excellent. Conrail is the rail carrier serving this

facility. MHE includes three transtainers, a large variety of top and side loaders, straddle carriers, and yard hustlers. The total storage area of 2,230 acres includes 3-1/2 million square feet of sheds.

E. FUTURE DEVELOPMENT

No improvements are planned that will significantly improve the throughput of this port.

F. REQUIREMENTS AND RECOMMENDATIONS

1. Requirements

The berthing requirements for outloading a notional heavy mechanized infantry division are considered for the Port of New York and New Jersey. The vessels required to support this unit are shown in appendix A. In summary, the vessel requirements are:

- Ship mix 1 (modern ships): 10 vessels.
- Ship mix 2 (combination of ship types): 13 vessels.
- Ship mix 3 (older ships): 28 vessels.
- Ship mix 4 (fast sealift ships): 8 plus 2* vessels from another ship mix.

*The division's ship requirement exceeds the current inventory. Two additional vessels are required to deploy the division.

2. Recommendations

Tables II-NYJ-9 through II-NYJ-12 show the recommended berths for ship mixes 1 through 4. The tables also show the expected time each vessel would remain at berth.

The Port of New York and New Jersey has excellent facilities for the movement of military cargo. Breakbulk vessels could be routed to the older Newark Terminal, with its good transit shed support. The Elizabeth Port Authority Marine Terminal can handle all the RORO vessels required by the deploying unit.

Once the ongoing refurbishment projects at MOTBY are completed, the possibility of unit deployments moving through MOTBY will be greatly enhanced. This is particularly true for RORO and breakbulk movements.

TABLE II-NYJ-9
BERTHING RECOMMENDATIONS FOR SHIP MIX 1
(MECHANIZED INFANTRY DIVISION)

Ship Mix 1 (Modern ships)					
Terminal:	Elizabeth Port Authority Marine Terminal				
Berth:	52-66	68-74	76-86	88-92	94-98
Day 1	FSS-1 FSS-2 FSS-3	Cape D-1 Cape D-2	Am Eagle Am Condor	Cape H-1 Cape H-2	MV Ambassador
Day 2					
Day 3					
Day 4					
Day 5					

TABLE II-NYJ-10
BERTHING RECOMMENDATIONS FOR SHIP MIX 2
(MECHANIZED INFANTRY DIVISION)

Ship Mix 2 (Combination of ship types)					
Terminal:	Elizabeth Port Authority Marine Terminal				
Berth:	52-66	68-74	76-86	88-92	94-98
Day 1	FSS-1 FSS-2 FSS-3	Cape D-1 Cape D-2	Am Eagle Am Condor	Cape H-1 Cape H-2	MV Ambassador
Day 2					
Day 3					
Day 4					
Day 5					

TABLE II-NYJ-11
BERTHING RECOMMENDATIONS FOR SHIP MIX 3
(MECHANIZED INFANTRY DIVISION)

Ship Mix 3 (Breakbulk Ships)

Terminal:	Elizabeth Port Authority Marine Terminal					Port Newark
Berth:	52-66	68-74	76-86	88-92	94-98	5-7
Day 1	FSS-1 FSS-2 FSS-3	Cape D-1 Cape D-2	Am Eagle Am Condor	Cape H-1 Cape H-2	Motor Vessel Ambassador	C4-S-58a
Day 2						
Day 3						
Day 4						
Day 5						

TABLE II-NYJ-12
BERTHING RECOMMENDATIONS FOR SHIP MIX 4
(MECHANIZED INFANTRY DIVISION)

Ship Mix 4 (Fast sealift ships)					
Terminal:	Elizabeth Port Authority Marine Terminal				
Berth:	52-66	68-74	76-86	88-92	94-98
Day 1	FSS-1 FSS-2 FSS-3 FSS-4 FSS-5	FSS-6 FSS-7	FSS-8 FSS-9 FSS-10		
Day 2					
Day 3					
Day 4					
Day 5					

PORT OF PHILADELPHIA (1990)

A. GENERAL

1. Location and Harbor Description

The Port of Philadelphia (fig II-PHI-1) is along the Delaware River. It is about 80 nautical miles above the Delaware Capes. Camden, New Jersey, is on the east bank of the Delaware River, opposite Philadelphia. From the 10-mile-wide entrance to the Delaware Bay, a 40-foot-deep channel leads upstream to the terminals. Three bridges span the Delaware River - Delaware Memorial, Walt Whitman, and Benjamin Franklin Bridges. These bridges impose height restrictions on vessels sailing into port. The Delaware Memorial Bridge at Wilmington, Delaware, imposes a 175-foot-mean high water (MHW) vertical restriction for all vessels entering the Port of Philadelphia. The Walt Whitman Bridge has a 150-foot vertical clearance at the port's southern end. Vessels continuing to the Tioga Marine Terminals must pass beneath the Benjamin Franklin Bridge, which has a 135-foot-MHW vertical clearance. Anchorage is available in the river and in the bay.

This report looks at four terminal complexes within the Port of Philadelphia. Three of these complexes are along the west bank of the Delaware River: piers 80, 82, 84, and 96; Tioga Marine Terminals; and Packer Avenue Marine Terminal. The fourth complex is on the east bank of the river and beneath the Walt Whitman Bridge - Holt Marine Terminal.

The mean tidal range is 6 feet at the Port of Philadelphia. The velocity of spring tidal currents at the terminals is 2-1/2 knots.

2. Highway Access

Interstate Route 95 from the north and south and Interstate Route 76 from the east and west serve the port. Delaware Avenue, a four-lane urban street, connects all the terminals on the west side of the river.

Entry to the Packer Avenue Terminal is 1 mile south of the Walt Whitman Bridge. Piers 80, 82, 84, and 96 are 2 miles north of this bridge, on Delaware Avenue. The Tioga Marine Terminals are on both sides of Delaware Avenue, 20 miles past the Benjamin Franklin Bridge.

From the city of Philadelphia, access to the Holt Marine Terminal, in Gloucester City, New Jersey, is via I-76 across the Walt Whitman Bridge to the Morgan Boulevard exit ramp. This exit leads into the terminal.

3. Rail Access

Three trunkline railroads serve the city of Philadelphia: Conrail, Chesapeake and Ohio Railway (Chessie System), and Baltimore and Ohio Railroad. The city has one belt line, the Philadelphia Belt Line Railroad, that performs switching and operates transfer facilities for the railroad lines with the city.

Figure II-PHI-1. Site map of Port of Philadelphia.

Philadelphia has four major classification yards: 44th Street, Frankford Junction, Pavonia, and Greenwich. The Greenwich yard can store 1,800 cars. The other three have a combined capacity of 5,000 cars.

4. Airports

Philadelphia has two commercial airports that could receive incoming military aircraft. One is the Philadelphia International Airport, located southwest of the Packer Avenue Terminal, is near all the terminals. The other is Northeast Philadelphia Airport, which is the closer airport to the Tioga Marine Terminals.

B. PORT FACILITIES

1. Packer Avenue Marine Terminal (fig II-PHI-2)

The Packer Avenue Marine Terminal is owned by the Philadelphia Regional Port Authority and operated by Holt Cargo Systems, Inc. Typical cargoes include containers, steel products, and RORO.

a. Berthing. The Packer Avenue Marine Terminal has five contiguous berths that form 3,916 feet of marginal wharf. The south side of the terminal has an 816-foot-long RORO berth. Berths 1 and 2 are breakbulk berths with a 40-foot-wide apron. Berths 3, 4, and 5 are container berths served by three container cranes. These container berths have open aprons. Tables II-PHI-1 and II-PHI-2 show the berthing characteristics and capabilities of the terminal. The terminal's ability to support various shipping modes is described below.

(1) Breakbulk Operations. Breakbulk operations could be conducted at all six berths. Mobile cranes would be necessary at berths 1 and 2 and the RORO berth.

(2) LASH and SEABEE Operations. The terminal has sufficient berthing to provide 26 LASH lighter or 19 SEABEE barge loading positions. Berths 1, 2, and 6 would require mobile cranes.

(3) RORO and FSS Operations. Berth 6, the 816-foot-long side berth with a stern ramp, is normally used for RORO operations. However, container berths 3 through 5 can also support side-loading RORO vessels. The narrow apron along breakbulk berths 1 and 2 precludes RORO operations there. FSS ships are well suited for container berths 3 through 5. Vessels can use the container cranes and open apron.

(4) Container Operations. Two container vessels can operate along berths 3 through 5. Ships load using three 45-ton-capacity container cranes. All container handling machines are the latest generation models and equipped with 30/40-foot hydraulic spreaders. The terminal has the ability to stack containers three high.

b. Materials Handling Equipment (MHE). Sufficient forklifts are available with capacities ranging from 2,000 to 95,000 pounds. Local stevedoring contractors can supply additional MHE as required.

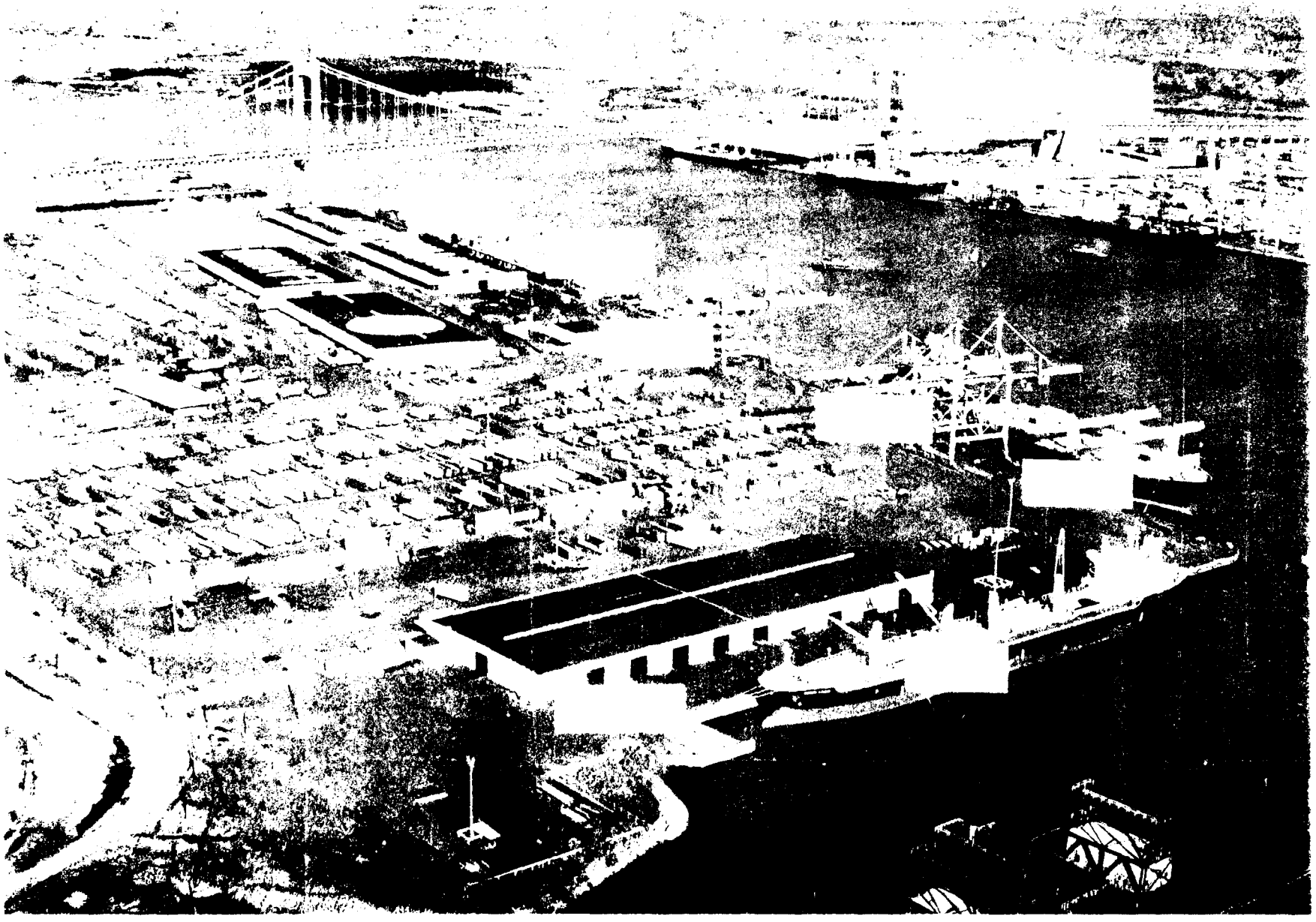


Figure II-PHI-2. Aerial view of Port of Philadelphia.

TABLE II-PHI-1
PORT OF PHIADELPHIA
BERTH CHARACTERISTICS OF PACKER AVENUE MARINE TERMINAL

Characteristics	Berths		
	Cntnr 3-5	RORO 6	1-2
Length (ft)	1,860	816	1,240
Depth alongside at MLW (ft)	40	40	40
Deck strength (psf)	1,000	1,000	1,000
Apron width (ft)	Open	Open	40
Apron height above MLW (ft)	13	13	13
Number of container cranes	3	0	0
Number of wharf cranes	0	0	0
Apron lighting	Yes	Yes	Yes
Straight-stern RORO facilities	No	Yes	No
Apron length served by rail (ft)	1,860	0	0

Notes:
1. Terminal open storage area is 63 acres
2. Terminal covered storage area is 600000 square feet

c. Staging

(1) Open Storage. The terminal has 63 acres of paved open storage. Lighting enhances nighttime visibility.

(2) Covered Storage. Two transit sheds and a storage warehouse comprise 600,000 square feet of covered storage.

d. Security. Chain link fencing surrounds the terminal. Entry is via a security-guarded main gate.

e. Rail Operations. Conrail, CSX, and Philadelphia Belt Line Railroad serve the terminal. These railroads have direct links to the railroad networks in North America. All berths have rail access and apron track. Transit sheds along berths 1 and 2 have rail docks. No rail end ramps are within the terminal, but they could be constructed in a nearby railyard or within the terminal.

TABLE II-PHI-2
PORT OF PHIADELPHIA
SUMMARY OF BERTHING CAPABILITIES OF PACKER AVENUE MARINE TERMINAL

Vessel	Berths		
	Cntnr 3-5	RORO 6	1-2
Breakbulk			
C3-S-33a	3	1	2
C3-S-37c	3	1	2
C3-S-37d	3	1	2
C3-S-38a	3	1	2
C4-S-1a	3	1	2
C4-S-1qb and 1u	3	1	2
C4-S-58a	3	1	2
C4-S-65a	3	1	2
C4-S-66a	3	1	2
C4-S-69b	3	1	2
Seatrain			
GA and PR-class	3	1	2
Barge			
LASH C8-S-81b	a,f,g	a,c,f,g	a,f,g
LASH C9-S-81d	2	c	1
LASH lighter	13	5	8
SEABEE C8-S-82a	2	c	1
SEABEE barge	9	4	6
RORO			
Comet	d,i,j	i,j	d,o
C7-S-95a/Maine-class	2	1	b
Ponce-class	h	h	b,h
Great Land-class	h	h	b,h
Cygnus/Pilot-class	2	1	b
Meteor	d,i,j	i,j	d,o
AmEagle/Condor	i,j	i,j	b
MV Ambassador	d	1,m	d
FSS-class	1	c	b
Cape D-class	i,j	i,j	b
Cape H-class	2	1	b
Container			
C6-S-1w	2	1,e	1,e
C7-S-68e	2	1,e	1,e
C8-S-85c	2	c,e	1,e
Combination			
C5-S-78a	2	1,e	1,e
C5-S-37e	3	1,e	2,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

f. Truck Operations. A reconstructed gate provides 10 lanes for increased throughput and faster turnaround time. Each building has ample docking. The terminal has close access to I-95, I-76, and other major highways.

g. Helicopter Operations. The terminal is not an ideal helicopter landing site. Obstructions (for example, the Walt Whitman Bridge and lighting poles) pose a collision threat to aircraft. Helicopter activities may be better conducted off the terminal. Philadelphia International Airport, only 3 miles away, could land helicopters.

2. Holt Marine Terminal (fig II-PHI-3)

a. Berthing. The privately owned Holt Marine Terminal is a modern, multimode marine terminal located in Gloucester City, New Jersey. The terminal has 4,725 feet of wharfage served by two container cranes, a 300-STON mobile crane, and a 170-STON mobile crane. Tables II-PHI-3 and II-PHI-4 show the berthing characteristics and capabilities of the terminal.

(1) Breakbulk Operations. Berths 7A, 7B, and 7C are normally used for breakbulk loading. These berths can serve three breakbulk vessels at the same time. Cargo loading would mainly be with ship's gear, with some assistance from the terminal's two large mobile cranes.

(2) LASH and SEABEE Operations. The terminal has 32 LASH lighter or 22 SEABEE barge loading positions. The terminal's two mobile cranes would have to be supplemented with rental cranes to support the LASH lighter loading operations. The loading of lighters onto mother ships could take place at wharfside or at a nearby downstream anchorage.

(3) RORO and FSS Operations. Most of the side-loading vessels in the representative fleet shown in appendix A can berth at the terminal. However, the terminal does not have special ramps for loading Ponce and Great Land-class vessels. The container berths are long enough to berth and load FSS vessels. Because the continuity of berths 7A and 7B is broken by the overhead Walt Whitman Bridge, FSS vessels cannot use the combined length of these berths.

(4) Container Operations. Berthing exists for up to three container vessels. Two container cranes can serve these vessels. FSS vessels are unrestricted from utilizing the container berths.

b. Materials Handling Equipment (MHE). Two mobile cranes with up to 300 tons of lifting capacity are available. Other equipment may be obtained from local stevedore contractors.

c. Staging

(1) Open Storage. The terminal has 104 acres of paved, open storage. Containers stored on chassis normally occupy this area. All the areas are well lighted.

(2) Covered Storage. The terminal has 800,000 square feet of covered storage.

Figure II-PHI-3. Holt Marine Terminal.

TABLE II-PHI-3
PORT OF PHILADELPHIA
BERTH CHARACTERISTICS OF HOLT MARINE TERMINAL

Characteristics	Berths			
	Cntnr	7A	7B	7C
Length (ft)	2,100	900	1,325	400
Depth alongside at MLW (ft)	40	40	40	40
Deck strength (psf)	1,000	1,000	1,000	1,000
Apron width (ft)	Open	75	75	Open
Apron height above MLW (ft)	12	12	12	12
Number of container cranes	2	0	0	0
Number of wharf cranes	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	No
Apron length served by rail (ft)	0	0	0	0

Notes:
1. Terminal open storage area is 104 acres
2. Terminal covered storage area is 800000 square feet

d. Security. An 8-foot chain link fence encloses the terminal. The Holt Corporation provides its own 24-hour gate and patrol security.

e. Rail Operations. Three rail spurs from the main Conrail line serve the terminal. Portable end ramps could be located at the end of any of the spurs. The terminal's locomotive switches cars within the terminal.

The warehouses do not have depressed tracks for unloading boxcars. Temporary ramps could be set up for boxcar unloading. The berth aprons do not have rail access.

f. Truck Operations. Trucks enter the terminal via a controlled gate. Once inside, they have access to all points within the terminal. Warehouses have truck docks for trailer unloading. However, no truck end ramps were identified.

TABLE II-PHI-4
PORT OF PHILADELPHIA
SUMMARY OF BERTHING CAPABILITIES OF HOLT MARINE TERMINAL

Vessel	Berths			
	Cntnr	7A	7B	7C
Breakbulk				
C3-S-33a	4	1	2	c
C3-S-37c	4	1	2	c
C3-S-37d	4	1	2	c
C3-S-38a	4	1	2	c
C4-S-1a	3	1	2	c
C4-S-1qb and 1u	3	1	2	c
C4-S-58a	3	1	2	c
C4-S-65a	3	1	2	c
C4-S-66a	3	1	2	c
C4-S-69b	3	1	2	c
Seatrain				
GA and PR-class	3	1	2	c
Barge				
LASH C8-S-81b	a,f,g	a,f,g	a,f,g	a,c,f,g
LASH C9-S-81d	2	1	1	c
LASH lighter	15	6	9	2
SEABEE C8-S-82a	2	1	1	c
SEABEE barge	10	4	6	2
RORO				
Comet	4,d,i	1,d,i	2,d,i	c,d
C7-S-95a/Maine-class	2	1	1	c
Ponce-class	h	b,h	b,h	c,h
Great Land-class	h	b,h	b,h	c,h
Cygnus/Pilot-class	3	1	2	c
Meteor	d,i,j	d,o	d,o	c,d
AmEagle/Condor	3,i	1,i	2,i	c
MV Ambassador	d	d	d	c,d
FSS-class	2	c	1,n	c
Cape D-class	2,i	1,i	1,i	c
Cape H-class	2	1	1	c
Container				
C6-S-1w	3	1,e	1,e	c,e
C7-S-68e	2	1,e	1,e	c,e
C8-S-85c	2	1,e	1,e	c,e
Combination				
C5-S-78a	3	1,e	2,e	c,e
C5-S-37e	3	1,e	2,e	c,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

g. Helicopter Operations. The terminal does not have a dedicated helicopter landing and staging area. However, a portion of the container storage yard could be cleared for this purpose.

3. Piers 80, 82, 84, and 96 (figs II-PHI-4 through II-PHI-6)

a. Berthing. Pier 80 is owned by the Philadelphia Port Authority and operated by Independent Pier Company. The pier specializes in paper products. RORO ramps at the ends of each side of pier 80 make it useful.

Piers 82 and 84, operated by Seagate Corporation, mainly handle fruit. Both piers have a large transit shed with a 30-foot apron and apron track. These two piers are suited for breakbulk activity.

Pier 96, operated by Pasha Auto, is an automobile terminal. Vehicles discharge from vessels via straight stern ramp to a 58-acre storage yard.

Tables II-PHI-5 and II-PHI-6 show the berthing characteristics and berthing capabilities of each pier. The terminal's ability to support various shipping modes is described below.

(1) Breakbulk Operations. The 4 piers can berth up to 10 breakbulk vessels at a time. Ships's gear normally would be used for loading. However, mobile cranes could be used effectively for loading operations on the wide aprons at the south side of pier 82. The relatively shallow water depth at the piers restricts the loading of deep-draft breakbulk vessels.

(2) LASH and SEABEE Operations. The 23-foot-wide wharf aprons at pier 84 are considered too narrow for lighter loading. At piers 80 and 82, 29 LASH lighters or 18 SEABEE barges could be loaded at the same time. Loading of lighters aboard their mother vessels would have to take place instream because the water depth at the piers is inadequate.

(3) RORO and FSS Operations. Pier 96 could load a small stern-loading RORO vessel such as MV Ambassador, but will experience excessive ramp angle problems at high tide. FSS vessels are prohibited from the piers because of their draft.

(4) Container Operations. The piers are not equipped for container operations. However, small-scale container loading could be carried out at pier 82 south with mobile cranes.

b. MHE. Each pier has its own MHE. Additional equipment is obtainable from local stevedoring companies.

c. Staging

(1) Open Storage. A total area of 75 acres is available. This is the combined amount from each terminal.

(2) Covered Storage. Pier 82 has a 78,000-square-foot, single-deck transit shed on its north half. Pier 84 has a double-deck transit shed with 503,000 square feet of storage. This transit shed has four 5-STON elevators and a truck ramp to the second floor. Pier 80 has a 456,000-square-foot transit shed.

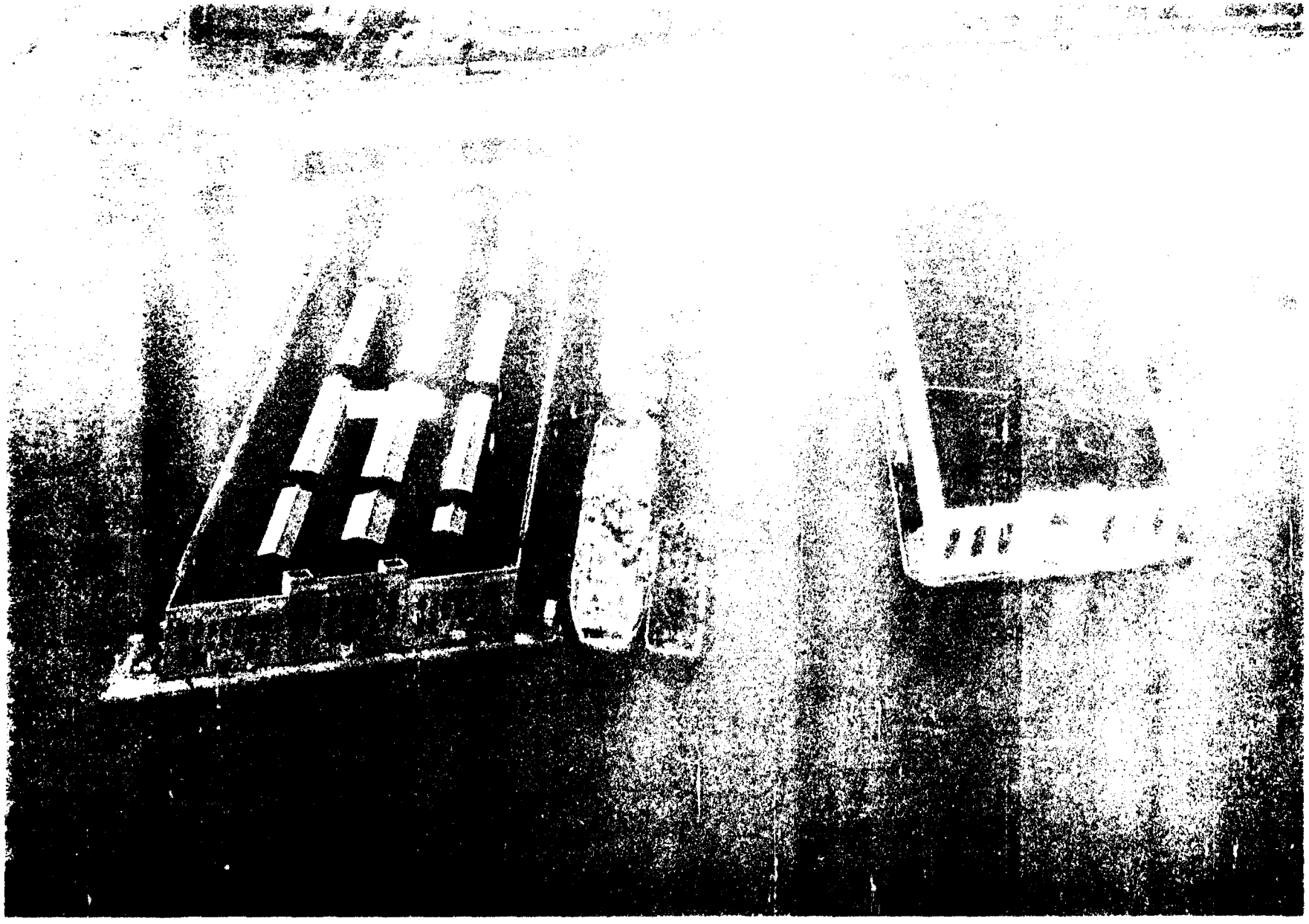


Figure II-PHI-4. Pier 80.

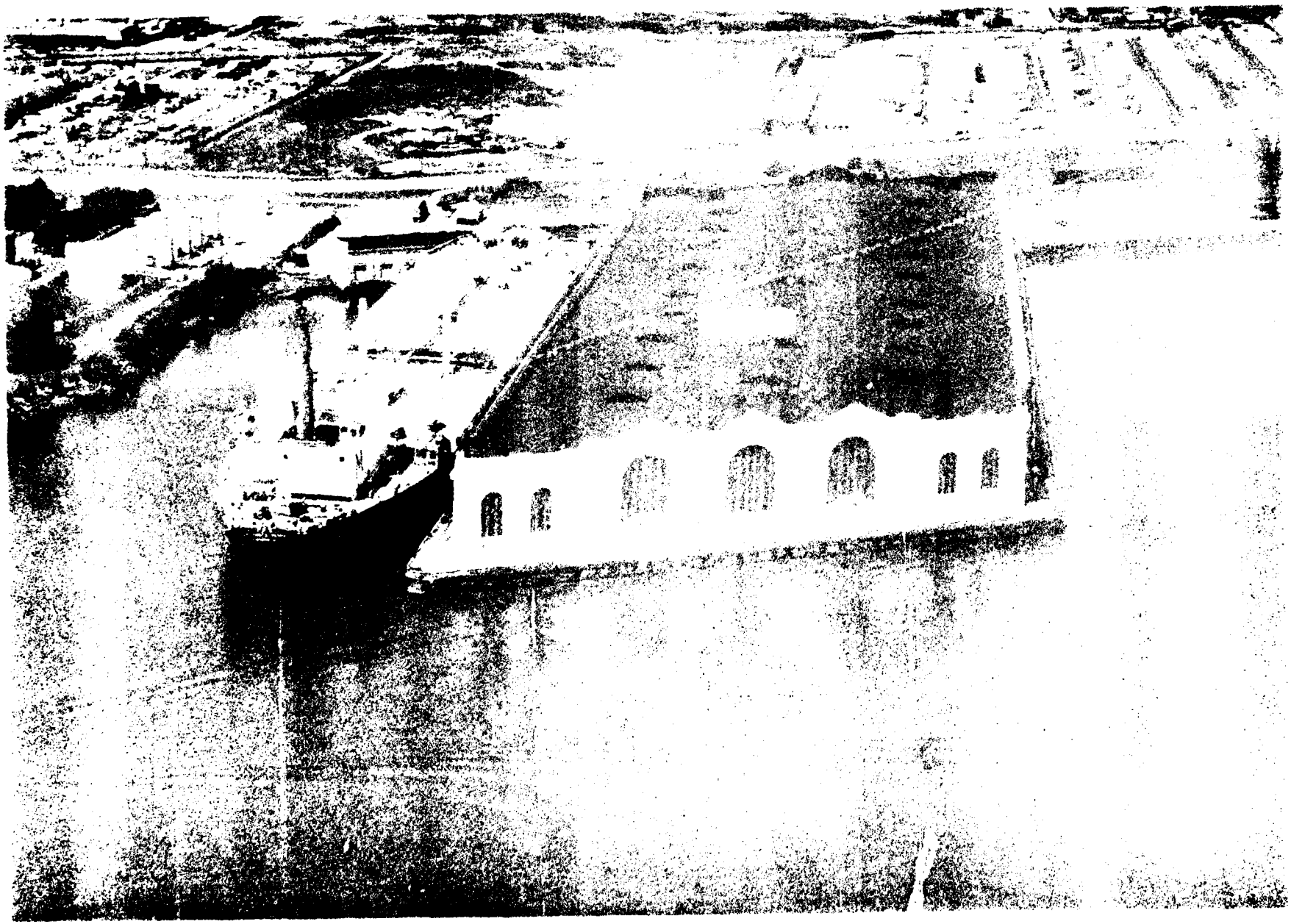


Figure II-PHI-5. Piers 82 and 84 south.

Figure II-PHI-6. Auto Terminal.

TABLE II-PHI-5
PORT OF PHILADELPHIA
BERTH CHARACTERISTICS OF PIERS 80, 82, 84 AND 96

Characteristics	Berths						Berths
	Pier 80-N	Pier 80-S	Pier 82-N	Pier 82-S	Pier 84-N	Pier 84-S	Pier 96-N
Length (ft)	994	1,144	1,139	855	855	855	1,320
Depth alongside at MLW (ft)	30	30	30	30	30	30	32
Deck strength (psf)	1,000	1,000	800	800	800	800	500
Apron width (ft)	38	38	30	Open	23	23	Open
Apron height above MLW (ft)	11	11	12	8	10	10	14
Number of container cranes	0	0	0	0	0	0	0
Number of wharf cranes	0	0	0	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	Yes	Yes	No	No	No	No	Yes
Apron length served by rail (ft)	994	1,144	1,139	855	0	0	1,220

Notes:
1. Terminal open storage area is 75 acres

2. Terminal covered storage area is 1037000 square feet

TABLE II-PHI-6
PORT OF PHILADELPHIA
SUMMARY OF BERTHING CAPABILITIES OF PIERS 80, 82, 84 AND 96

Vessel	Berths					
	Pier 80-N	Pier 80-S	Pier 82-N	Pier 82-S	Pier 84-N	Pier 84-S
Breakbulk						
C3-S-33a	a	a	a	a	a	a
C3-S-37c	a	a	a	a	a	a
C3-S-37d	1	2	2	1	1	1
C3-S-38a	1	2	2	1	1	1
C4-S-1a	1	1	1	1	1	1
C4-S-1qb and 1u	a	a	a	a	a	a
C4-S-58a	a	a	a	a	a	a
C4-S-65a	1	1	1	1	1	1
C4-S-66a	a	a	a	a	a	a
C4-S-69b	a	a	a	a	a	a
Seatrain						
GA and PR-class	1	1	1	1	1	1
Barge						
LASH C8-S-81b	a,f,g	a,f,g	a,f,g	a,f,g	a,f,g	a,f,g
LASH C9-S-81d	a	a	a	a,c	a,c	a,c
LASH lighter	7	8	8	6	6	6
SEABEE C8-S-82a	a	a	a	a,c	a,c	a,c
SEABEE barge	4	5	5	4	4	4
RORO						
Comet	1,i	2,i	d,o	1,d,i	d,o	d,o
C7-S-95a/Maine-class	a,b	a,b	a,b	a	a,b	a,b
Ponce-class	b,h	b,h	b,h	h	b,h	b,h
Great Land-class	b,h	b,h	b,h	h	b,h	b,h
Cygnus/Pilot-class	b	b	b	1	b	b
Meteor	i,j	i,j	d,o	1,d,i	d,o	d,o
AmEagle/Condor	b	b	b	1,i	b	b
MV Ambassador	1,m	1,m	d	d	d	d
FSS-class	a,b	a,b	a,b	a,c	a,b,c	a,b,c
Cape D-class	a,b	a,b	a,b	a	a,b	a,b
Cape H-class	a,b	a,b	a,b	a	a,b	a,b
Container						
C6-S-1w	1,e	1,e	1,e	1,e	1,e	1,e
C7-S-68e	a,e	a,e	a,e	a,e	a,e	a,e
C8-S-85c	a,e	a,e	a,e	a,e	a,e	a,e
Combination						
C5-S-78a	a,e	a,e	a,e	a,e	a,e	a,e
C5-S-37e	1,e	1,e	1,e	1,e	1,e	1,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

TABLE II-PHI-6 (CONTINUED)
PORT OF PHILADELPHIA
SUMMARY OF BERTHING CAPABILITIES OF PIERS 80, 82, 84 AND 96

Vessel	Berths Pier 96-N
Breakbulk	
C3-S-33a	2
C3-S-37c	2
C3-S-37d	2
C3-S-38a	2
C4-S-1a	2
C4-S-1qb and 1u	2
C4-S-58a	2
C4-S-65a	2
C4-S-66a	a
C4-S-69b	2
Seatrain	
GA and PR-class	2
Barge	
LASH C8-S-81b	a,f,g
LASH C9-S-81d	a
LASH lighter	9
SEABEE C8-S-82a	a
SEABEE barge	6
RORO	
Comet	i,j
C7-S-95a/Maine-class	a
Ponce-class	h
Great Land-class	h
Cygnus/Pilot-class	2
Meteor	i,j
AmEagle/Condor	i,j
MV Ambassador	2,m
FSS-class	a
Cape D-class	a
Cape H-class	a
Container	
C6-S-1w	1,e
C7-S-68e	1,e
C8-S-85c	a,e
Combination	
C5-S-78a	a,e
C5-S-37e	2,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

d. Security. Piers 82 and 84 are enclosed by 8-foot chain link fencing. In-house security personnel provide gate and patrol security services when the terminal is operational.

e. Rail Operations. The open south apron of pier 82 is served by rail tracks. Twin railroad tracks serve the 30-foot-wide north wharf apron. The transit shed on the pier has one set of depressed tracks running along its center line. Pier 84 has three short, depressed tracks inside its transit shed. The terminal does not have fixed or portable rail end ramps.

f. Truck Operations. The pier 82 transit shed has 24 van-loading positions on its south side. The transit shed on pier 84 has 12 cargo doors and a continuous dock at its inshore end. It also has an entry ramp for trucks. The terminal does not have fixed or portable end ramps.

g. Helicopter Operations. The terminal does not have a designated location to receive and stage helicopters.

4. Tioga Marine Terminals (figs II-PHI-8 and II-PHI-9)

a. Berthing. The Tioga Marine Terminals are in north Philadelphia. Berths 1 and 2 form the Tioga Fruit Terminal. This terminal is specifically designed for the highly efficient movement of time-sensitive fruit cargoes. The Tioga Container Terminal is next to the fruit terminal. It is a dedicated container terminal with 50 acres of paved marshaling area and two container cranes. It features seven berths, including one RORO and two container berths.

Tables II-PHI-7 through II-PHI-8 show the berthing characteristics and capabilities of the Tioga Marine Terminals. The ability of these terminals to support various shipping modes is described below.

(1) Breakbulk Operations. Berths 1 through 3 are considered the most suitable breakbulk berths at the Tioga Container Terminal. The berths are supported by a transit shed and have apron rail tracks. The berths do not have gantry crane service. Ship's gear or mobile cranes are needed for cargo loading.

Berth 1 is the preferred breakbulk berth at the Tioga Fruit Terminal. Ship's gear would be needed for loading at this berth. Berth 2 at the Tioga Fruit Terminal is also suitable for breakbulk operations.

(2) Barge Operations. The Tioga Marine Terminals have 40 LASH lighter or 27 SEABEE barge loading positions. The water depths are not sufficient to load mother ships dockside at either terminal. However, loading could be done at anchorages in the Delaware River.

(3) RORO and FSS Operations. Berth B and RORO A berths are too shallow for RORO operations. Berths 1 through 5 are suitable for side-loading RORO vessels. Berths 4 and 5 are more suitable than berths 1 through 3 because of their greater apron widths. Berth 1 at the Tioga Fruit Terminal can berth and load smaller RORO vessels such as the Cygnus/Pilot-class. It is not long enough for larger RORO vessels, such as FSS. FSS operations are most suited to berths 4 and 5.

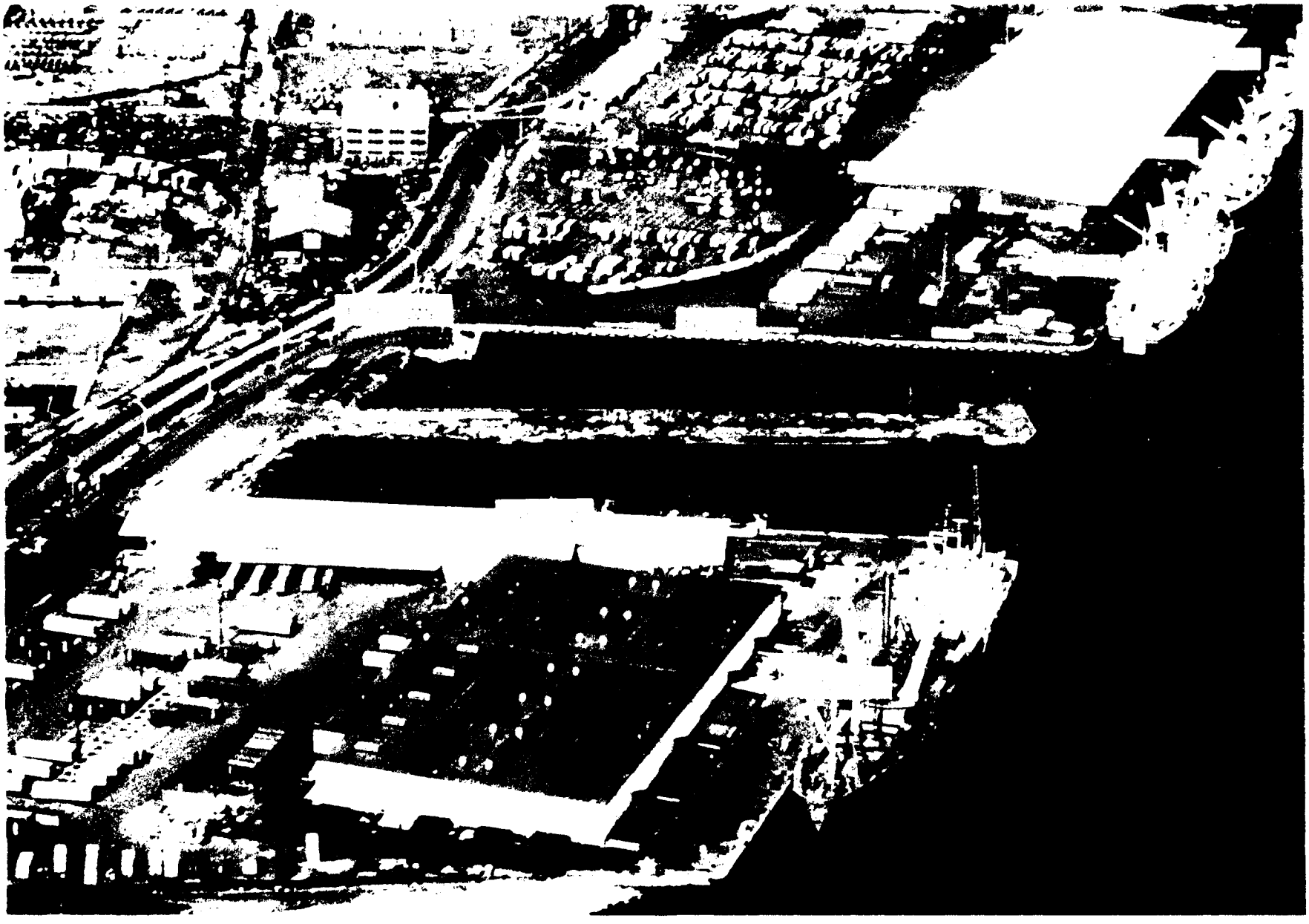


Figure II-PHI-7. Tioga Fruit Terminal.

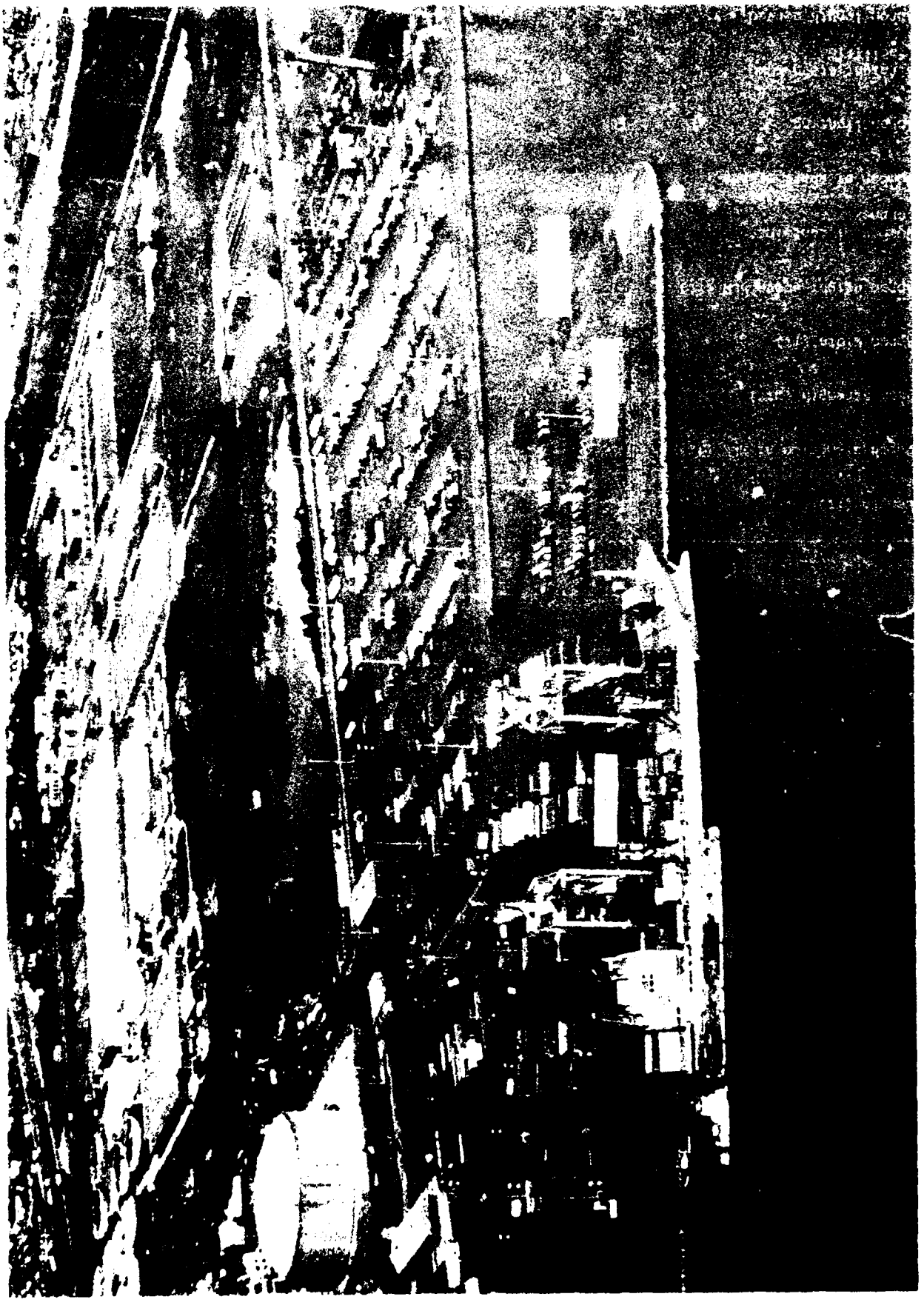


Figure II-PHI-8. Tioga Container Terminal.

TABLE II-PHI-7
PORT OF PHILADELPHIA
BERTH CHARACTERISTICS OF TIOGA MARINE TERMINALS

Characteristics	Berths					
	Berth B	RORO A	1-3	4-5	1	2
Length (ft)	725	610	1,902	1,268	736	620
Depth alongside at MLW (ft)	28	28	37	40	32	32
Deck strength (psf)	1,000	1,000	1,000	1,000	1,000	1,000
Apron width (ft)	Open	Open	100	Open	Open	45
Apron height above MLW (ft)	12	12	12	12	11	11
Number of container cranes	0	0	0	2	0	0
Number of wharf cranes	0	0	0	0	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	Yes	No	No	No	No
Apron length served by rail (ft)	725	610	1,902	1,268	736	620

Notes:
1. Terminal open storage area is 0 acres
2. Terminal covered storage area is 0 square feet

(4) Container Operations. Berths 4 and 5 at the Tioga Container Terminal have two container cranes and can load one container vessel. None of the other berths are suitable for container operations.

b. MHE. The Tioga Container Terminal has four 50-ton top loaders, one 25-ton forklift, and 25 yard hustlers. Additional MHE is available through local stevedoring agencies.

c. Staging

(1) Open Storage. The Tioga Fruit Terminal has 47 acres of paved, open storage. The Tioga Container Terminal has 50 acres of paved, open storage.

(2) Covered Storage. The transit shed at the Tioga Fruit Terminal has 300,000 square feet of heated cargo storage

TABLE II-PHI-8
PORT OF PHILADELPHIA
SUMMARY OF BERTHING CAPABILITIES OF TIOGA MARINE TERMINALS

Vessel	Berths					
	Berth B	RORO A	1-3	4-5	1	2
Breakbulk						
C3-S-33a	a	a	3	2	1	1
C3-S-37c	a	a	3	2	1	1
C3-S-37d	a	a	3	2	1	1
C3-S-38a	1	1	3	2	1	1
C4-S-1a	a	a	3	2	1	1
C4-S-1qb and 1u	a	a	3	2	1	1
C4-S-58a	a	a	3	2	1	1
C4-S-65a	a	a	3	2	1	1
C4-S-66a	a	a	3	2	a	a
C4-S-69b	a	a	3	2	1	1
Seatrain						
GA and PR-class	1	1	3	2	1	1
Barge						
LASH C8-S-81b	a,c,f,g	a,c,f,g	a,f,g	a,f,g	a,c,f,g	a,c,f,g
LASH C9-S-81d	a,c	a,c	a	1	a,c	a,c
LASH lighter	5	4	13	9	5	4
SEABEE C8-S-82a	a,c	a,c	a	1	a,c	a,c
SEABEE barge	3	3	9	6	3	3
RORO						
Comet	1,d,i	1,i	3,d,i	2,d,i	1,d,i	d,o
C7-S-95a/Maine-class	a,c	a,c	2	1	a	a,b,c
Ponce-class	h	c,h	h	h	h	b,c,h
Great Land-class	c,h	c,h	h	h	c,h	b,c,h
Cygnus/Pilot-class	1	c	2	1	1	b,c
Meteor	a,d	a,i,j	d,i,j	d,i,j	d,i,j	d,o
AmEagle/Condor	a	a,c	2,i	1,i	1,i	b,c
MV Ambassador	d	1,m	d	d	d	d
FSS-class	a,c	a,c	1,n	1	a,c	a,b,c
Cape D-class	a	a,c	2,i	1,i	a	a,b,c
Cape H-class	a,c	a,c	2	1	a,c	a,b,c
Container						
C6-S-1w	a,e	a,c,e	2,e	1	1,e	c,e
C7-S-68e	a,e	a,c,e	2,e	1	1,e	c,e
C8-S-85c	a,c,e	a,c,e	2,e	1	a,c,e	a,c,e
Combination						
C5-S-78a	a,e	a,e	3,e	2	a,e	a,e
C5-S-37e	a,e	a,e	3,e	2	1,e	1,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

area. The Tioga Fruit Terminal has a 25,000-square-foot container freight station at berth 1.

d. Security. Chain link fencing encloses both terminals. The terminals provide their own patrol and gate security personnel.

e. Rail Operations. Rail tracks serve the transit shed with depressed rails. All berths have apron tracks. Although no end ramps exist, several suitable locations are available for erecting temporary end ramps.

f. Truck Operations. The rear of the Tioga Fruit Terminal transit shed has 100 truck docks. Neither terminal has temporary end ramps.

g. Helicopter Operations. The Tioga Marine Terminals do not have a dedicated helicopter landing and staging area. A vacant container storage location at the north end of container berth 5 could possibly be used for these operations.

C. SUPPORT SERVICES

1. Pilotage

Pilots from the Delaware Bay and River Pilots Association provide pilotage for the Port of Philadelphia. Pilots board incoming vessels at the mouth of the Delaware Bay, off Cape Henlopen, between entrance buoys 5 and 6. The association currently has eight pilot boats.

2. Harbor Craft

The following companies provide docking and towing services along the Delaware River:

- Curtis Bay Towing Company of Pennsylvania.
- McAllister Brothers, Inc.
- Taylor and Anderson Towing and Lighthouse Company.

These companies operate 17 vessels ranging from 800 to 3,000 horsepower.

3. Stevedores

The following companies provide stevedoring services at the port:

- Delaware Operating Company.
- Independent Pier Company.
- ITO Corporation.
- Northern Shipping.
- Holt Terminals.

4. Heavy-Lift Equipment

No floating heavy-lift cranes are dedicated to the port. Terminals such as the Holt and Packer Avenue Marine Terminals have their own heavy-lift gantry and mobile cranes. In special cases, the floating 350-STON crane at the Naval Shipyard may be used.

D. INTERMODAL CONTAINER TRANSFER FACILITY (ICTF)

Holt Marine Terminal is an ICTF. The terminal is in Gloucester City, New Jersey. It has good highway connections to the New Jersey Turnpike (I-95) and the Pennsylvania Turnpike (I-76). Conrail and CSX are the rail carriers serving the port. The terminal has adequate container handling equipment.

E. FUTURE DEVELOPMENT

No improvements are planned that will significantly improve the throughput of this port.

MTMC International Traffic has determined that sufficient longshoremen would be available at the Port of Philadelphia to meet mobilization needs.

F. REQUIREMENTS AND RECOMMENDATIONS

1. Requirements

The berthing requirements for outloading a notional heavy mechanized infantry division are considered at the Port of Philadelphia. The vessels required to support this unit movement are shown in appendix A. In summary, the vessel requirements are:

- Ship mix 1 (modern ships): 10 vessels.
- Ship mix 2 (combination of ship types): 13 vessels.
- Ship mix 3 (older ships): 28 vessels.
- Ship mix 4 (fast sealift ships): 8 plus 2* vessels from another ship mix.

*The division's ship requirement exceeds the current inventory. Two additional vessels are required to deploy the division.

2. Recommendations

Tables II-PHI-9 through II-PHI-12 show the recommended berths for ship mixes 1 through 4. They also show the estimated berthing time for each vessel.

The Port of Philadelphia offers good facilities for outloading large military units. The versatile Packer Avenue and Holt Marine Terminals are the preferred locations for loading any type of cargo. The Tioga Fruit Terminal, farther upriver, would be the next choice. Piers 82, 84, and 96 should be brought into service, as needed, to add breakbulk berths.

TABLE II-PHI-9
BERTHING RECOMMENDATIONS FOR SHIP MIX 1
(MECHANIZED INFANTRY DIVISION)

Ship Mix 1 (Modern ships)				
Terminal: Berth:	Packer Cntnr 3-5	Packer RoRo 6	Holt 7A	Holt Container
Day 1	FSS-1	MV Ambassador	Cape H-1	Cape D-1
Day 2				
				Cape D-2
Day 3	FSS-2		Cape H-2	
Day 4				FSS-3
Day 5			Am Eagle Am Condor	

TABLE II-PHI-10
BERTHING RECOMMENDATIONS FOR SHIP MIX 2
(MECHANIZED INFANTRY DIVISION)

Ship Mix 2 (Combination of ship types)								
Terminal:	Packer	Packer	Holt	Holt	Holt	Philadelphia		
Berth:	Cntnr 3-5	RoRo 6	7A	7B	7C	Pier 82-S	Pier 84-N	Pier 84-S
Day 1	FSS-1	MV Ambassador	Cape H-1	C3-S-37d C3-S-58a	Cape D-1	C4-S-65a	C3-S-37d	C3-S-38a
Day 2		C3-S-33a			Cape D-2			
Day 3	FSS-2		Am Eagle					
Day 4								
Day 5								

TABLE II-PHI-11
BERTHING RECOMMENDATIONS FOR SHIP MIX 3
(MECHANIZED INFANTRY DIVISION)

Ship Mix 3 (Breakbulk ships)

Terminal:	Packer	Packer	Packer	Holt	Holt	Holt	Philadelphia				Tioga	Tioga	Tioga	Tioga	Tioga
Berth:	1-2	Cntnr 3-5	RoRo 6	7A	7B	Cntnr	Pier 82N	Pier 82S	Pier 84N	Pier 84S	RoRo A	1-3	4-5	1	2
Day 1	C3-S-33a C3-S-33a	C4-S-65a C4-S-65a C4-S-65a	C3-S-38a	C4-S-65a	C3-S-33a C3-S-33a	C4-S-65a C4-S-1a C4-S-1a	C3-S-38a C3-S-38a	C3-S-38a	C3-S-37a	C4-S-65a	C4-S-58a	C3-S-37c C3-S-37d C4-S-58a	C4-S-58a	C3-S-37c	C3-S-37c
Day 2															
Day 3															
Day 4															
Day 5															

TABLE II-PHI-12
BERTHING RECOMMENDATIONS FOR SHIP MIX 4
(MECHANIZED INFANTRY DIVISION)

Ship Mix 4 (Fast sealift ships)			
Terminal: Berth:	Packer Container (3-5)	Holt Container	Tioga 4-5
Day 1	FSS-1	FSS-3 FSS-4	FSS-7
Day 2			
Day 3	FSS-2	FSS-5 FSS-6	FSS-8
Day 4			
Day 5			

PORT OF SAVANNAH (1990)

A. GENERAL

1. Location and Harbor Description (fig II-SAV-1)

The Port of Savannah is on the Savannah River, about 15 miles from the Atlantic Ocean. The port is 102 nautical miles south of Charleston, South Carolina, and 145 miles north of Jacksonville, Florida. Its two main facilities, Ocean Terminal and Containerport/Garden City Terminal, are on the right bank of the river. Ocean Terminal is about 4 miles downstream from the Containerport/Garden City Terminal.

The deepwater entrance to the mouth of the Savannah River is across the ocean bar through Tybee Roads. At the ocean bar, the channel is 40 feet deep and 600 feet wide. From the ocean bar to the first turning basin, about 1 mile below Ocean Terminal, the channel is 38 feet deep and 500 feet wide. From the turning basin to the Containerport/Garden City Terminal, the channel is 38 feet deep and 400 feet wide. The mean tidal variation is about 7 feet. Silting is a serious problem in the Savannah River. Dredging is carried out on a continuous basis. Floodgates and a sediment basin are also used in the Back River to reduce silt buildup in the main channel of the Savannah River. A fixed bridge (Talmadge Memorial Bridge) at the Ocean Terminal location restricted channel sailing headroom to a vertical clearance of 135 feet at mean high water (MHW). This bridge has been replaced by a new structure that provides 175 feet of clearance.

The characteristics of the turning basins in the Savannah River are outlined below:

Turning Basin	Length (ft)	Width (ft)	Depth (ft)
Kings Island	1,600	1,500	38
Marsh Island	1,000	900	34
Fig Island	1,000	900	34
Argyle Island	600	600	30
Port Wentworth	600	600	30

The Atlantic Intracoastal Waterway crosses the Savannah River about 11 miles below Ocean Terminal. A shallow-draft vessel channel extends 181 miles up the Savannah River to Augusta, Georgia. The channel's controlling depth is 9 feet, while its controlling width is 90 feet.

A LASH lighter fleeting area is in slip 3, just across from the Ocean Terminal and slightly downriver. The Back River area is also used for lighter marshaling. LASH lighter marshaling and loading at the mooring dolphins downriver near Cockspur Island have been discontinued because of strong currents at the dolphins.

No anchorages are available in the Savannah River. Vessels may anchor outside the ocean bar northward or northwestward of the Tybee sea buoy, in water depths of 19 to 45 feet.

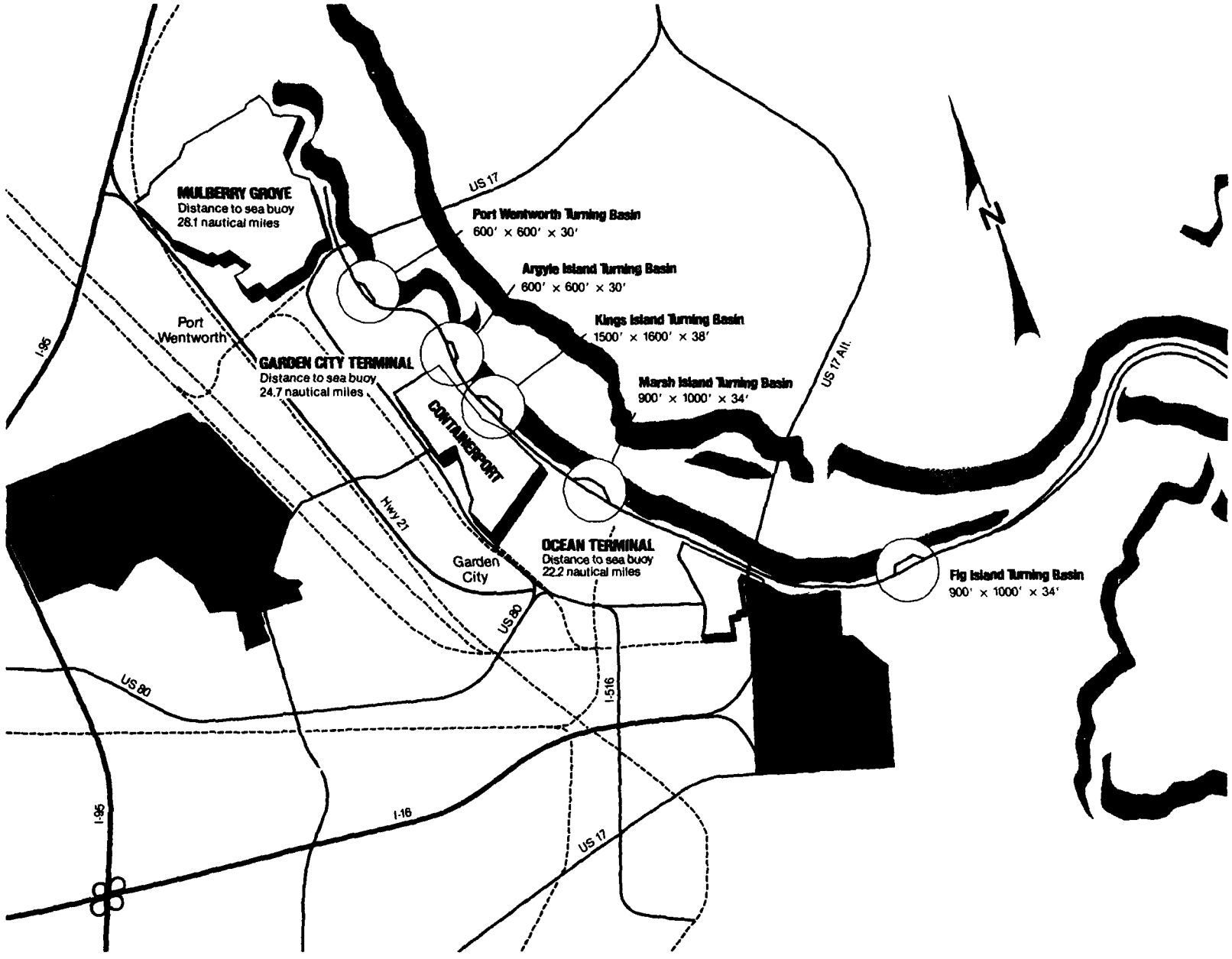


Figure II-SAV-1. Port of Savannah.

2. Highway Access

The major highway access to the port is Interstate Route 16. I-16 continues to Macon, Georgia, where it joins Interstate Route 75 to Atlanta, Georgia. Just a few miles from Savannah, I-16 joins Interstate Route 95, the major north-south corridor on the east coast. To reach the Ocean Terminal from I-16, exit onto four-lane Georgia Route 21 north and then exit onto two-lane Lathrop Avenue. Lathrop Avenue leads to the main gate on River Street. The Containerport/Garden City Terminal may be reached from either I-95 or I-16 using Georgia 21. From I-95, take the Georgia 21 south exit, and from I-16, take the Georgia 21 north exit. Then take two-lane Georgia Route 307 to the terminal.

3. Rail Access

The Norfolk Southern Railway and CSX serve Savannah. The Savannah State Docks Railroad performs switching at the Containerport/Garden City Terminal. This terminal has a 600-car holding capacity. Ocean Terminal has no railcar holding capacity, although the adjacent Norfolk Southern Railway yard can hold 600 cars.

4. Airports

Savannah International Airport is 5 miles west of the Containerport/Garden City Terminal. The airport is about 10 miles northwest of the Ocean Terminal. The two other airports in the area are Travis Field and Hunter Army Airfield.

B. PORT FACILITIES

1. Containerport/Garden City Terminal (figs II-SAV-2 and II-SAV-3)

a. Berthing. The Containerport/Garden City Terminal is separated into two areas. A container facility, called Containerport, has five berths totaling 4,675 linear feet. These berths have open wharf aprons. Next to the container berths are two general cargo berths totaling 1,447 linear feet with aprons of 46 feet. Tables II-SAV-1 and II-SAV-2 show the berthing characteristics and capabilities of the Containerport/Garden City Terminal. Containerport has nine 45-STON container cranes. Two 35-STON gantry cranes and two mobile cranes ranging in capacity from 100 to 300 tons assist ship's gear in loading at the breakbulk berths. The terminal's ability to support various modes of shipping is described below.

(1) Breakbulk Operations. Berths 50 through 53 are equipped to handle breakbulk operations. The container berths at Containerport also can be used for breakbulk operations. All breakbulk vessels listed in appendix A may berth and fully load at any of the terminal's berths. Breakbulk operations are aided by two 35-ton gantry cranes, a 100-ton mobile crane, and a 300-ton mobile crane.

(2) LASH and SEABEE Operations. Although the terminal has no specific facility to handle LASH and SEABEE operations, it can easily accommodate them. The terminal has 43 LASH lighter or 30 SEABEE barge loading positions. The maximum draft of SEABEE and some LASH vessels is restricted by the channel and berth depths.

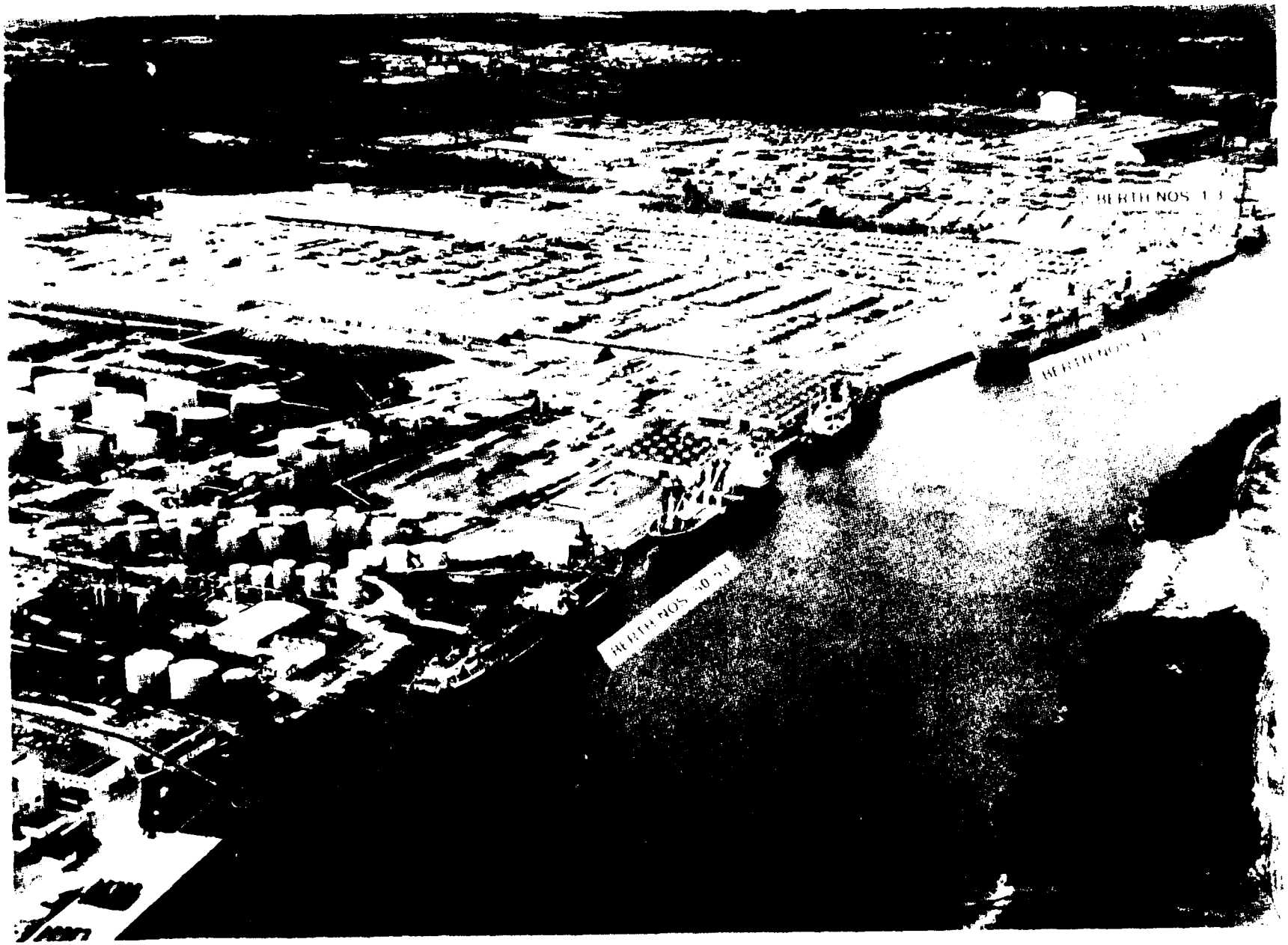


Figure II-SAV-2. Aerial view of Containerport/Garden City Terminal.

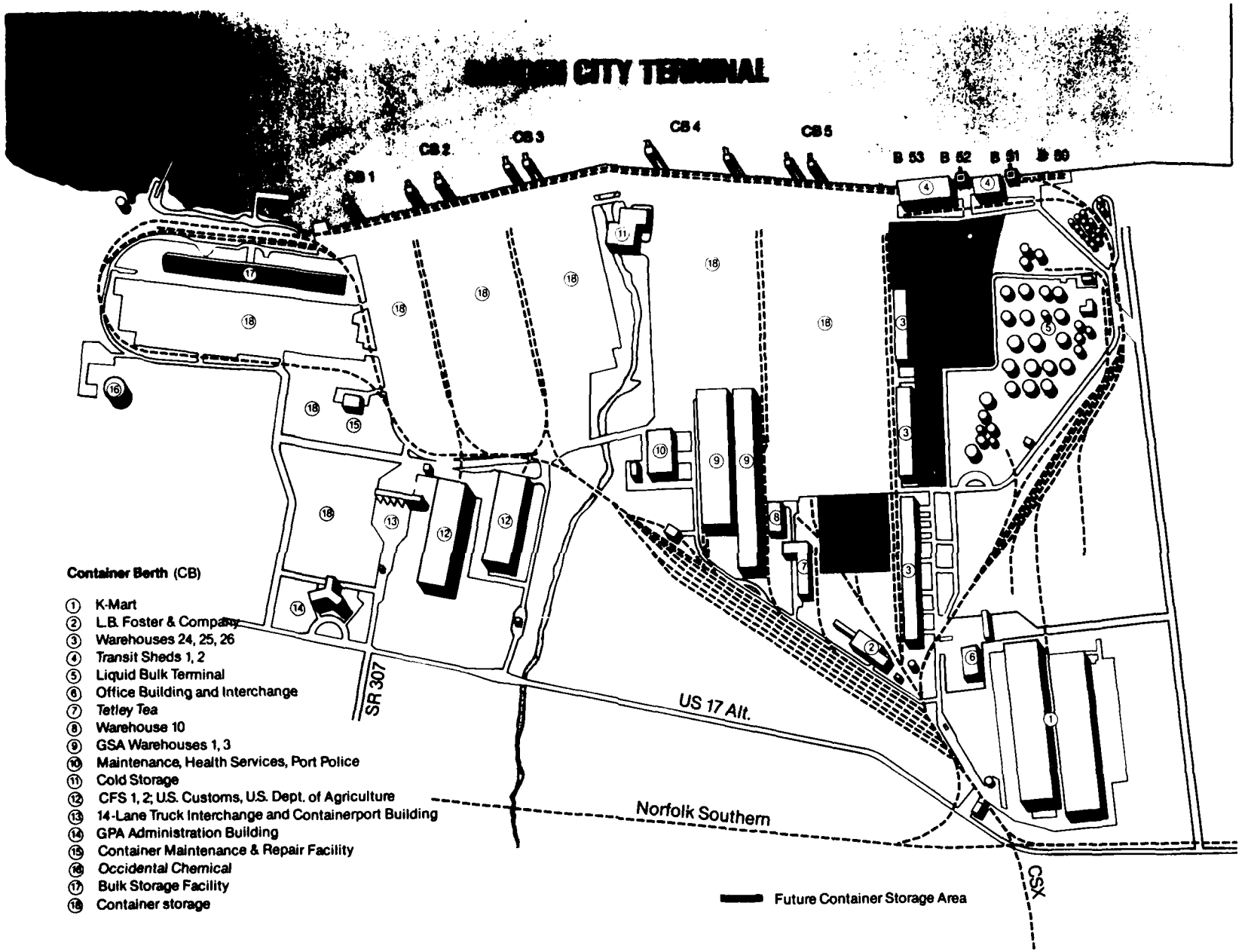


Figure II-SAV-3. Site map of Containerport/Garden City Terminal.

TABLE II-SAV-1
PORT OF SAVANNAH
BERTH C"ARACTERISTICS OF CONTAINER PORT/GARDEN CITY TERMINAL

Characteristics	Berths		
	1-3	4-5	50-53
Length (ft)	2,402	2,273	1,447
Depth alongside at MLW (ft)	38	38	36
Deck strength (psf)	1,000	1,000	750
Apron width (ft)	Open	Open	46
Apron height above MLW (ft)	8	8	15
Number of container cranes	5	4	0
Number of wharf cranes	0	0	2
Apron lighting	Yes	Yes	Yes
Straight-stern RORO facilities	Yes	No	No
Apron length served by rail (ft)	2,402	2,273	1,447

Notes:
1. Terminal open storage area is 306 acres
2. Terminal covered storage area is 200500 square feet

(3) RORO and FSS Operations. The Containerport/Garden City Terminal can accommodate side-, stern-, and slewed-stern-ramp RORO vessels. The Containerport berths, with their open aprons, are adequate for side-ramp and slewed-ramp RORO operations. The terminal also has one stern dock at berth 1 for stern-ramp RORO vessels. The breakbulk berths are not adequate for RORO operations, because their aprons are too narrow. FSS vessels have no restrictions at berths 1 through 5. Sufficient berth lengths exist for two vessels at berths 1 through 3 and at berths 4 and 5. However, berths 50 through 53 do not provide enough apron width to properly handle FSS vessels.

(4) Container Operations. The five berths that make up Containerport are well suited to container operations. Up to six container vessels could berth and load concurrently at the container berths. These vessels are loaded by nine container cranes. The Containerport's nine straddle cranes can stack containers up to four high. Fifteen top-lift trucks with capacities from 26 to 55 tons can stack containers up to three

TABLE II-SAV-2
PORT OF SAVANNAH
SUMMARY OF BERTHING CAPABILITIES OF CONTAINER PORT/GARDEN CITY TERMINAL

Vessel	Berths		
	1-3	4-5	50-53
Breakbulk			
C3-S-33a	4	4	2
C3-S-37c	4	4	2
C3-S-37d	4	4	2
C3-S-38a	4	4	2
C4-S-1a	4	3	2
C4-S-1qb and 1u	4	3	2
C4-S-58a	4	3	2
C4-S-65a	4	3	2
C4-S-66a	4	4	2
C4-S-69b	3	3	2
Seatrain			
GA and PR-class	4	3	2
Barge			
LASH C8-S-81b	a,g	a,g	a,g
LASH C9-S-81d	2	2	a
LASH lighter	17	16	10
SEABEE C8-S-82a	a,g	a,g	a,g
SEABEE barge	12	11	7
RORO			
Comet	4,i	4,d,i	d,o
C7-S-95a/Maine-class	3	2	b
Ponce-class	h	h	b,h
Great Land-class	h	h	b,h
Cygnus/Pilot-class	3	3	b
Meteor	4,i	4,d,i	d,o
AmEagle/Condor	3,i	3,i	b
MV Ambassador	k,m	d	d
FSS-class	2	2	b
Cape D-class	3,i	3,i	b
Cape H-class	3	2	b
Container			
C6-S-1w	3	3	2,e
C7-S-68e	3	3	1,e
C8-S-85c	2	2	1,e
Combination			
C5-S-78a	3	3	2,e
C5-S-37e	3	3	2,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

high. These top-lift trucks adjust to 20-, 35- and 40-foot containers.

b. Materials Handling Equipment (MHE). Containerport has specialized rigging attachments available, including buckets, slings, and roll lifts. Additional MHE is available from local stevedore contractors as needed.

c. Staging

(1) Open Storage. The terminal has 306 acres of paved, open storage. Most of this storage, which is behind the five container berths, is used for chassis and stacked-container storage.

(2) Covered Storage. The port has 1,637,800 square feet of covered storage. Two transit sheds at berths 50 through 53, comprising 77,000 square feet, contribute to this total. The terminal's two container stuffing/stripping sheds add another 402,800 square feet. The remaining 1,158,000 square feet of covered storage is in the six dry-cargo warehouses at the terminal.

d. Security. Chain link fencing encloses the terminal, except at rail access points. All gates are controlled 24 hours a day by armed Georgia Port Authority Police. A security and fire protection unit patrols the terminal 24 hours a day.

e. Rail Operations. The Savannah State Docks Railroad provides all rail switching services within the terminal areas. The aprons of the breakbulk berths have two surface tracks. Two platform-level tracks run along the rear of the two transit sheds. Twin surface tracks along the length of the apron provide rail access to the berths. The port has no fixed or portable rail end ramps. For previous military exercises, earth ramps were temporarily constructed at end spurs for offloading flatcars.

f. Truck Operations. The six warehouses at the terminal provide 124 platform-height loading positions for trucks. The terminal has one truck end ramp.

g. Helicopter Operations. The terminal has no designated helicopter landing area, but it has sufficient open storage to support helicopter operations. A recommended location is at the rear of container berth 1.

h. Marshaling Areas. No designated marshaling areas exist outside the terminal complex.

2. Ocean Terminal (figs II-SAV-4 and II-SAV-5)

a. Berthing. A total of 10 berths provide 6,166 feet of berthing at the Ocean Terminal. This terminal, just north of downtown Savannah, is designed mainly to handle breakbulk cargo. Berths 1, 2, 13, and 18 through 20 are all marginal wharfs. Berths 14 through 17 enclose a large slip. Berth 13 has an open apron, while all the others have 52-foot-wide aprons in front of transit sheds. Water depths vary from 32 feet at berths 14 through 17 to 38 feet at berths 1, 2, and 13. Tables II-SAV-3 and II-SAV-4 show the berthing characteristics and capabilities of this terminal. The terminal's ability to support various shipping modes is described below.

Figure II-SAV-4. Aerial view of Ocean Terminal.

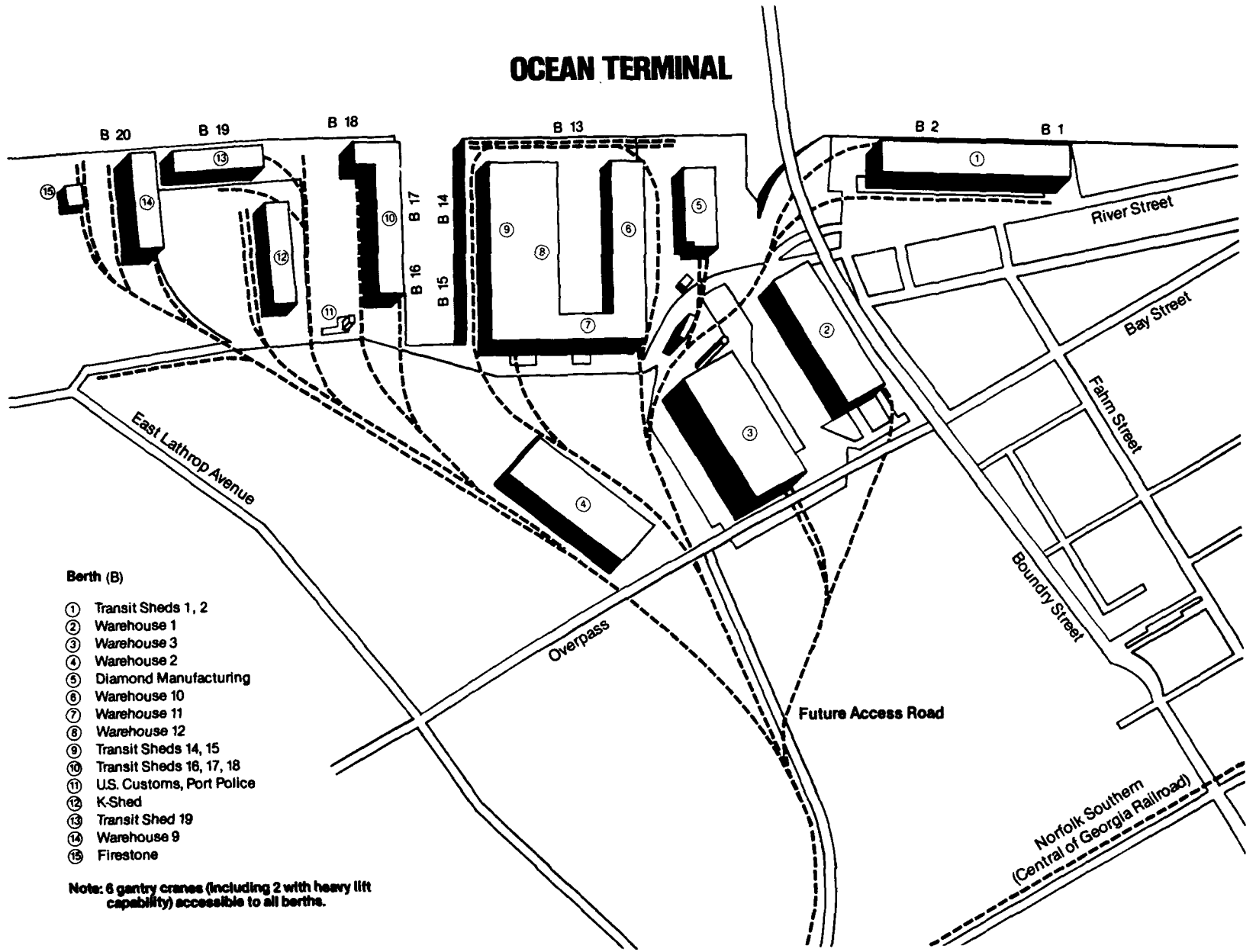


Figure II-SAV-5. Site map of Ocean Terminal.

TABLE II-SAV-3
PORT OF SAVANNAH
BERTH CHARACTERISTICS OF OCEAN TERMINAL

Characteristics	Berths				
	1-2	13	14-15	16-17	18-20
Length (ft)	1,178	1,100	1,143	1,046	1,699
Depth alongside at MLW (ft)	38	38	32	32	34
Deck strength (psf)	1,000	1,000	1,000	1,000	1,000
Apron width (ft)	52	Open	52	52	52
Apron height above MLW (ft)	15	15	15	15	15
Number of container cranes	0	0	0	0	0
Number of wharf cranes	1	2	1	1	1
Apron lighting	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	Yes	Yes	No
Apron length served by rail (ft)	1,178	1,100	1,143	1,046	0

Notes:
1. Terminal open storage area is 138 acres
2. Terminal covered storage area is 1822760 square feet

(1) Breakbulk Operations. The terminal is designed mainly for breakbulk operations. All berths can be used for breakbulk loading. Breakbulk ships load using either ship's gear or the terminal's cranes. The terminal has six gantry cranes with capacities of 30 to 175 tons. The Ocean Terminal also uses a 30-ton mobile crane and a 100-ton mobile crane for ship loading.

(2) LASH and SEABEE Operations. Although the terminal has no specific facility for LASH and SEABEE operations, it can accommodate them. However, the water depths at some berths would limit the loading of deep-draft mother ships. As shown in table II-SAV-4, 40 LASH lighter or 27 SEABEE barge loading positions are available.

(3) RORO and FSS Operations. RORO operations are quite limited at this terminal. Problems range from inadequate apron widths, shallow water depth, insufficient ramp clearances, and no straight-stern ramp facilities. FSS vessels are also quite limited at the Ocean Terminal. The restrictions of inadequate apron width apply at all berths, except berth 13.

TABLE II-SAV-4
PORT OF SAVANNAH
SUMMARY OF BERTHING CAPABILITIES OF OCEAN TERMINAL

Vessel	Berths				
	1-2	13	14-15	16-17	18-20
Breakbulk					
C3-S-33a	2	2	2	2	3
C3-S-37c	2	2	2	2	3
C3-S-37d	2	2	2	2	3
C3-S-38a	2	2	2	2	3
C4-S-1a	2	1	1	1	2
C4-S-1qb and 1u	1	1	1	1	2
C4-S-58a	1	1	1	1	2
C4-S-65a	2	1	1	1	2
C4-S-66a	2	1	a	a	3
C4-S-69b	1	1	1	1	2
Seatrain					
GA and PR-class	2	1	1	1	2
Barge					
LASH C8-S-81b	a,g	a,g	a,g	a,g	a,g
LASH C9-S-81d	1	1	a	a	a
LASH lighter	8	7	8	7	12
SEABEE C8-S-82a	a,g	a,g	a,g	a,g	a,g
SEABEE barge	5	5	5	5	8
RORO					
Comet	d,o	d,i,j	i,j	i,j	d,o
C7-S-95a/Maine-class	b	1	a,b	a,b	b
Ponce-class	b,h	h	b,h	b,h	b,h
Great Land-class	b,h	h	b,h	b,h	b,h
Cygnus/Pilot-class	b	1	b	b	b
Meteor	d,o	d,i,j	i,j	i,j	d,o
AmEagle/Condor	b	i,j	b	b	b
MV Ambassador	d	d	1,m	1,m	d
FSS-class	b	1,i	a,b	a,b	b
Cape D-class	b	i,j	a,b	a,b	b
Cape H-class	b	1,i	a,b	a,b	a,b
Container					
C6-S-1w	1,e	1,e	1,e	1,e	2,e
C7-S-68e	1,e	1,e	1,e	1,e	2,e
C8-S-85c	1,e	1,e	a,e	a,e	1,e
Combination					
C5-S-78a	1,e	1,e	a,e	a,e	2,e
C5-S-37e	1,e	1,e	1,e	1,e	2,e

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

(4) Container Operations. All berths at this terminal could accommodate container shipping. However, no container handling equipment is at the terminal.

b. MHE. An extensive lift-truck fleet with capacities to 50 tons assists the terminal. Miscellaneous equipment, including payloaders, tractors, trailers, and specialized lift accessories, are available also. Other equipment requirements of the terminal are supplied by stevedore contractors.

c. Staging

(1) Open Storage. The terminal contains about 138 acres of paved, open storage at several locations. This consists of 29 acres of dockside open storage and 109 acres of backup open storage.

(2) Covered Storage. The terminal has eight transit sheds with 907,160 square feet of capacity. The Ocean Terminal's seven warehouses provide an additional 915,600 square feet of storage.

d. Security. The terminal is completely fenced. All gates are controlled 24 hours a day by armed Georgia Port Authority Police. A security and fire protection unit patrols the terminal 24 hours a day.

e. Rail Operations. Track in the terminal connects with either CSX or Norfolk Southern Railway. Onsite switching is performed by the port-owned and operated Savannah State Docks Railroad. This railroad operates three switch engines at the terminal. All aprons have twin surface tracks for their entire length. All warehouses and transit sheds at the terminal have either side or central platform-level docks for boxcar unloading.

f. Truck Operations. The transit sheds and warehouses at the terminal provide 108 platform-height loading positions for trucks. No truck end ramps are available.

g. Helicopter Operations. Insufficient open storage areas exist at the Ocean Terminal to support helicopter operations.

h. Marshaling Areas. No designated marshaling areas exist outside the terminal complex.

C. SUPPORT SERVICES

1. Pilotage

Pilots from the Savannah Pilots Association board all incoming vessels 1 mile outside the channel entrance buoy. Docking services are provided by the Georgia Docking Pilots, Inc, as required.

2. Harbor Craft

Atlantic Towing Company performs most of the towing and docking services in the port area. The company operates six tugs with ratings up to 3,900 horsepower. Crescent Towing, Falcon Towing, and Savannah Marine also operate tugs in the harbor area.

3. Stevedores

Among the stevedore contractors providing services in the area are Carolina Shipping Company, Ceres Corporation, Eller and Company, Smith and Kelly Company, and Ryan Walsh, Inc. The number of longshoremen in the Savannah International Longshoreman's Association (ILA) Local was not available for this report. MTMC International Traffic has determined that enough longshoremen will be available to meet mobilization needs.

4. Heavy-Lift Equipment

The port has no specialized heavy-lift equipment.

D. INTERMODAL CONTAINER TRANSFER FACILITY (ICTF)

Two ICTFs are in the Savannah area. The Norfolk Southern Railway operates a facility at the Dillard yard, about 3 miles from the port. A straddle crane is available for container-on-flatcar (COFC) and trailer-on-flatcar (TOFC) operations. CSX Transportation operates the Savannah yard. This yard is about 1 mile southwest of the Ocean Terminal. It has two container forklifts for loading COFC.

E. FUTURE DEVELOPMENTS

A cable-stayed bridge has replaced Talmadge Bridge. This bridge has a minimum of 175 feet of sailing headroom at MHW.

Located 2 miles upriver from Containerport, the Georgia Port Authority's Mulberry Grove property is slated for future development as a complete intermodal facility. Preliminary plans call for up to eight container berths, with construction to begin in the 1990's. Each completed berth will be supported by 100 acres of paved storage. The 2,200-acre Mulberry Grove property will have easy access to I-95 and onsite rail connections.

F. REQUIREMENTS AND RECOMMENDATIONS

1. Requirements

This section analyzes the deployment of a mechanized infantry division through the Port of Savannah. The deployment time is 5 days. The vessels necessary to support ship movement are listed in appendix A. The vessel requirements for each ship mix are:

- Ship Mix 1 (modern ships): 10 ships.
- Ship Mix 2 (combination of ship types): 13 ships.
- Ship Mix 3 (breakbulk ships): 28 ships.
- Ship Mix 4 (fast sealift ships): 8 + 2* ships from another ship mix

*Unit shipping requirements exceed the current inventory of this ship mix. The use of two additional ships is necessary to deploy the division.

2. Recommendations

Tables II-SAV-5 through II-SAV-7 show the berthing recommendations for ship mixes 1, 2, and 4. When augmented by two side-ramp or slewed-ramp RORO ships, ship mix 4 can deploy the division within 5 days. The use of ship mix 1 results in a deployment time of 8 days; ship mix 2 results in a deployment time of 6 days. This happens because the port has only one straight-stern RORO ramp.

Also, the deployment time exceeds 5 days when ship mix 3 vessels are used. The division's vessel requirement is 28 ships. However, only 20 berths are available.

We recommend that multiple ports of debarkation (such as Charleston, Savannah, and Jacksonville) be used to deploy the division when either ship mix 1, 2, or 3 is used.

TABLE II-SAV-5
BERTHING RECOMMENDATIONS FOR SHIP MIX 1
(MECHANIZED INFANTRY DIVISION)

Ship Mix 1 (Modern Ships)		
Terminal:	Garden City Terminal	
Berth:	1-3	4-5
Day 1	Cape D-1	FSS-1
		FSS-2
Day 2		
	Cape H-1	
Day 3		FSS-3
		Am Condor
Day 4		Am Eagle
	Cape D-2	
Day 5		
Day 6	MV Ambassador	
Day 7	Cape H-2	
Day 8		
Day 9		

TABLE II-SAV-6
BERTHING RECOMMENDATIONS FOR SHIP MIX 2
(MECHANIZED INFANTRY DIVISION)

Ship Mix 2 (Combination of Ship Types)

Terminal:	Garden City	Garden City	Garden City	Ocean
Berth:	1-3	4-5	50-53	1-2
Day 1	Cape H-1	FSS-3	C3-S-37c	C4-S-58a
	FSS-1	C4-S-58a	C4-S-65a	
		C3-S-33a		
Day 2				
Day 3	Cape D-1			
	FSS-2			
Day 4				
	Cape D-2			
Day 5	Am Eagle			
Day 6	MV Ambassador			
Day 7				

TABLE II-SAV-7
BERTHING RECOMMENDATIONS FOR SHIP MIX 4
(MECHANIZED INFANTRY DIVISION)

Ship Mix 4 (Fast Sealift Ships)			
Terminal:	Garden City	Garden City	Ocean
Berth:	1-3	4-5	13
Day 1	FSS-1 FSS-2	FSS-3 FSS-4	Am Eagle
Day 2			Am Condor
Day 3	FSS-5 FSS-6	FSS-7 FSS-8	
Day 4			
Day 5			

PORT OF WILMINGTON, NORTH CAROLINA (1990)

A. GENERAL

1. Location and Harbor Description (fig II-WNC-1)

The Port of Wilmington is on the east bank of the Cape Fear River, about 3 miles south of the junction of the Cape Fear and Northeast Cape Fear Rivers. It is 25 miles from the sea and 17 miles north of the Military Ocean Terminal, Sunny Point. The Port of Charleston lies 170 miles to the southwest. The Port of Morehead City is 100 miles to the northeast.

Access to the port from the Atlantic Ocean is via a 40-foot-deep and 500-foot-wide channel. From Southport, North Carolina, to the anchorage basin at the Port of Wilmington, the channel is 400 feet wide and 38 feet deep. The anchorage basin is about 2,000 feet long, 38 feet deep, and from 1,000 to 1,200 feet wide. Good anchorage is also available downstream in the Southport area of the river. Both anchorages are suitable for instream loading operations.

A 38-foot-deep, 1,200-foot-long, and 800-foot-wide turning basin lies off the north end of the terminal. The basin extends to 1,350 feet, with a depth of 35 feet, beyond the 1,200-foot limits.

The mean tidal range at Port of Wilmington is 4.2 feet, with tidal currents averaging 1.7 knots at floodtide, and 1.5 knots at ebbtide.

The port maintains a continuous water depth monitoring program and dredges as necessary. Berths A and B have significant silting and require annual dredging.

No bridges cross the Cape Fear River downstream of the terminal. However, a power cable crosses the river about 2-1/2 miles south of the port, restricting sailing headroom to 175 feet 6 inches above mean high water (MHW).

2. Highway Access

The main highways into city of Wilmington are US Route 17 from the north and south, US Route 421 from the north, and US Routes 74 and 76 from the west. Interstate Route 95, the nearest major north-south artery, is about 75 miles to the west.

The intersection of the main highways into the city of Wilmington is about 1.5 miles north of the port. From this intersection, traffic usually takes Front Street and Burnett Boulevard to the port entrances.

3. Rail Access

The Seaboard System (CSX) serves the port with one rail line. The Davisville yard at Navassa, about 25 miles west of the port, is the nearest classification yard.

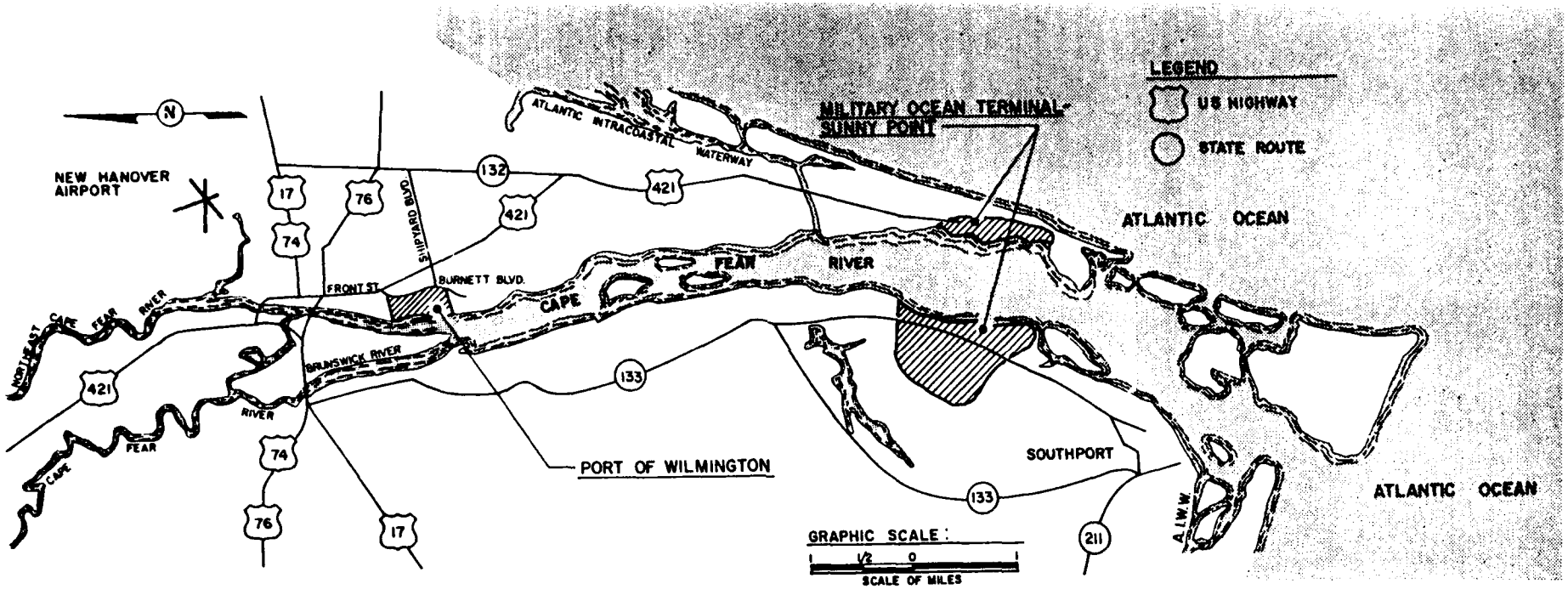


Figure II-WNC-1. Port of Wilmington.

4. Airports

The New Hanover County Airport is about 6 miles north of the port. This airport can handle large cargo carriers and helicopters.

B. PORT FACILITIES (figs II-WNC-2 through II-WNC-4)

1. Berthing

The Port of Wilmington has 6,742 feet of continuous concrete wharf, with 11 berths along the east bank of the Cape Fear River. The berths range in length from 583 to 900 feet. Wharf construction is concrete piling with a compacted-fill apron or concrete apron fronted with a rubber fender system. Dock height averages 12 feet above mean low water (MLW), and the berth depths are 38 feet MLW. Apron widths range from 44 feet, along berths 1 through 4, to 100 feet or more, along the other berths.

Berths A and B and 1 through 5 have two 25-STON, one 115-STON, and one 225-STON gantry cranes for cargo operations.

Berths 5 through 9 have three 40-LTON and two 50-LTON container cranes. The northernmost container crane has an articulated chassis. It can traverse the bend in the crane rails and serve other upstream berths if required. Besides these cranes, the port has a rubber-tired, 140-STON mobile crane.

Adequate fixed lighting is available at each berth for night operations.

Tables II-WNC-1 and II-WNC-2 show the berthing characteristics and capabilities of the terminal. The terminal's ability to support various shipping modes is as follows:

a. Breakbulk Operations. Normally, breakbulk ships load at berths 1 through 5 because they are well supported by transit sheds and gantry cranes. All US-flag vessels listed in appendix A can load at these berths.

b. LASH and SEABEE Operations. The optimal loading locations for LASH lighters and SEABEE barges are berths A and B, where open storage space is available. These berths can support the loading of eight LASH lighters or six SEABEE barges.

The channel and berth depths may restrict pierside loading operations for the SEABEE and large LASH ships. However, these ships can conduct loading operations at the Wilmington anchorage basin or the Southport anchorage.

c. RORO and FSS Operations. Open berths A, B, 7, and 9 are the best areas for loading RORO ships. These berths can load side- and slewed-ramp RORO ships. However, operations on Ponce and Great Land-class and stern-ramp vessels are not possible, because special ramps are not available. Also, tidal variations may limit the loading cycle of some RORO ships because of ramp angle. These restrictions are shown in the berthing capabilities table. One FSS vessel can load at berths A and B, and up to two FSSs can load concurrently at berths 7 through 9, if necessary.

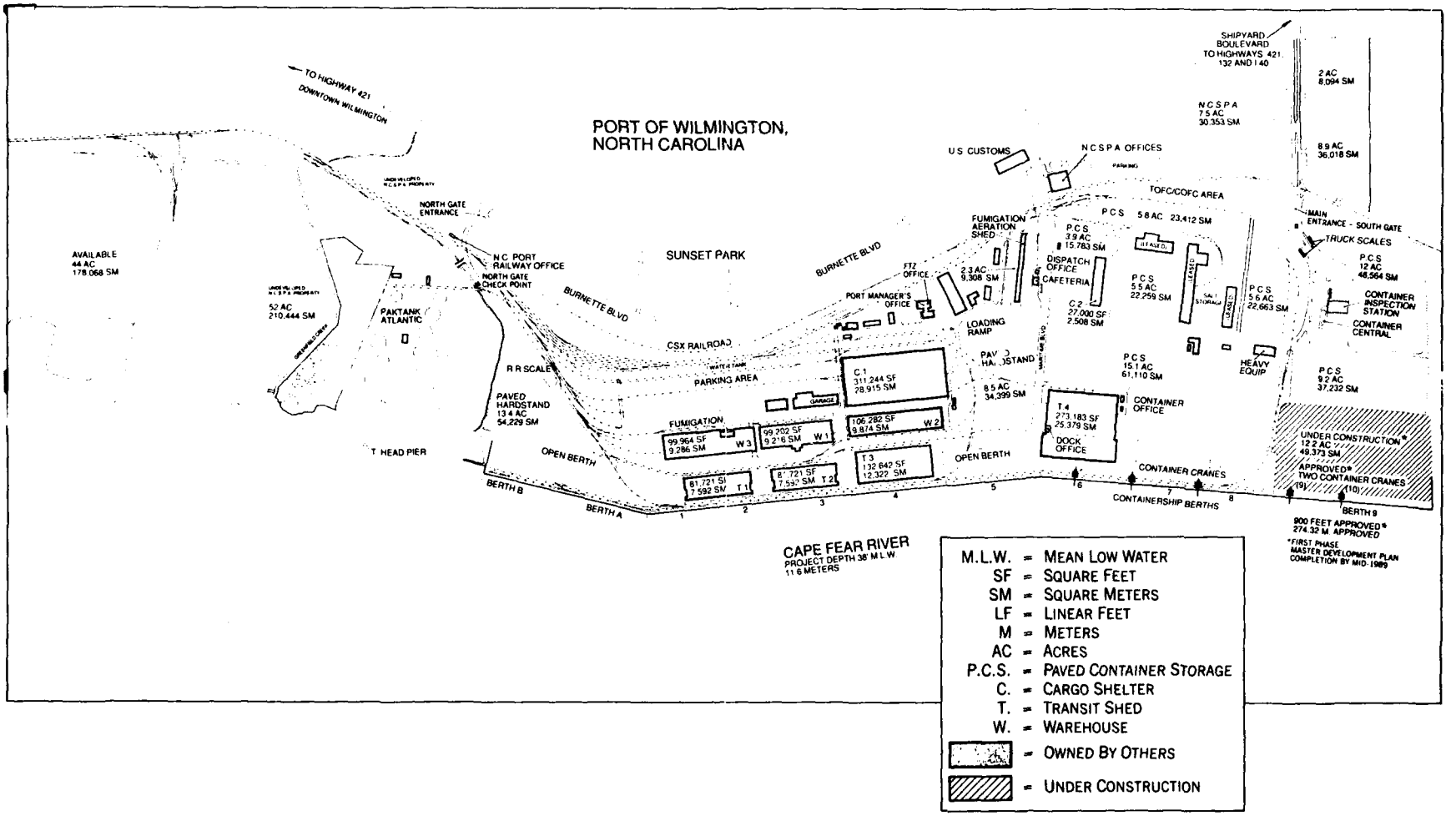


Figure II-WNC-2. Port of Wilmington.

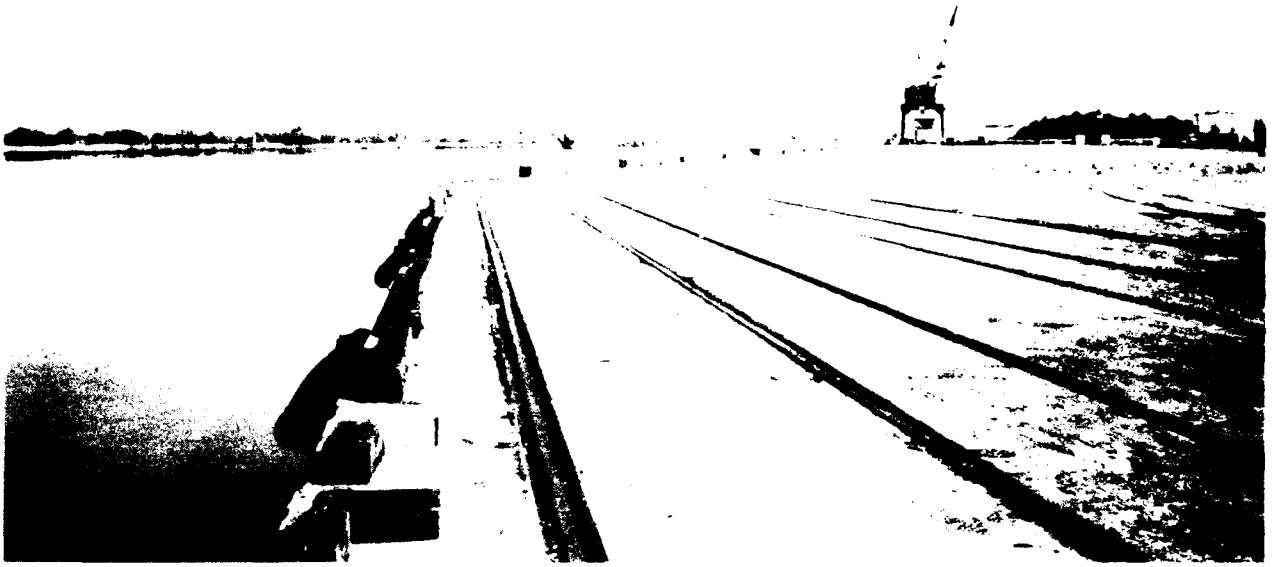


Figure II-WNC-3. Berths A and B.

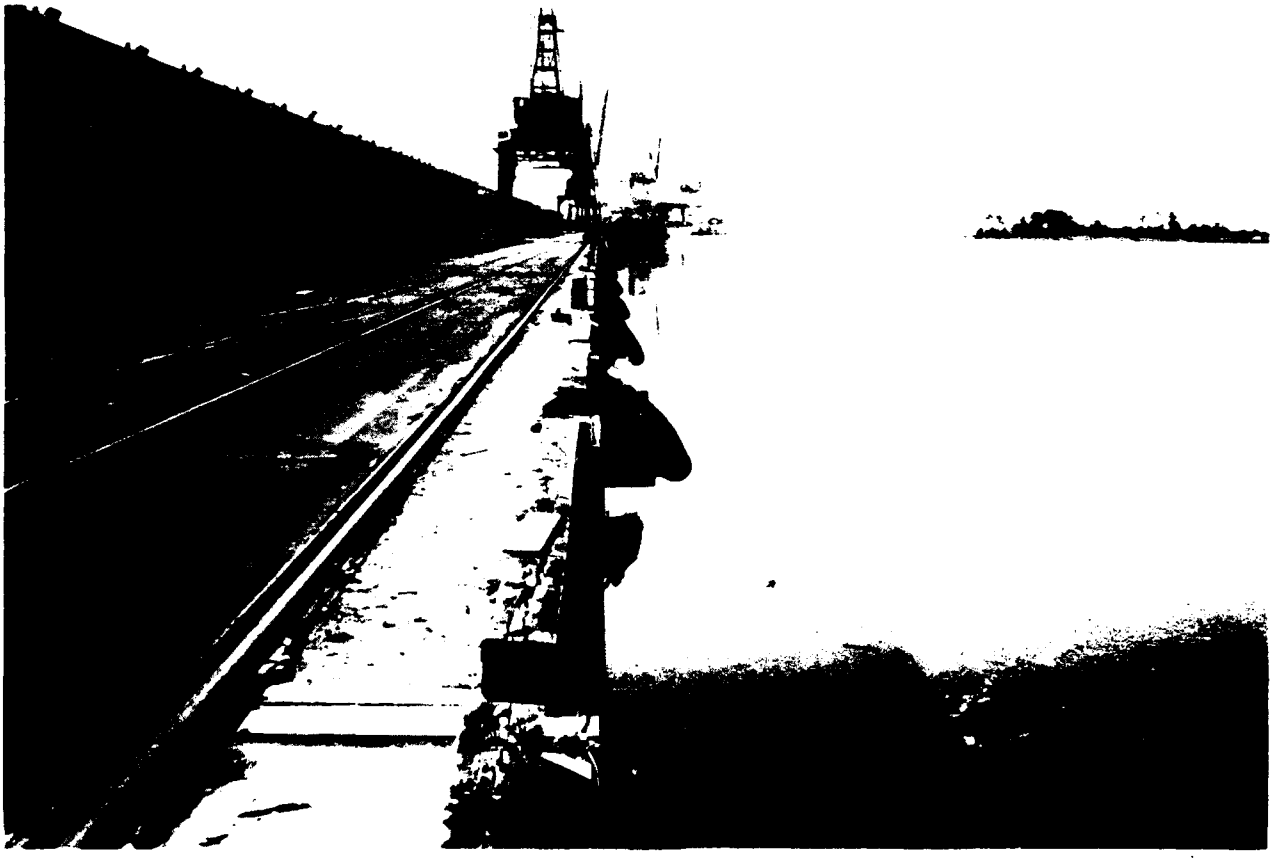


Figure II-WNC-4. Berths 1 through 9.

TABLE II-WNC-1
PORT OF WILMINGTON
BERTH CHARACTERISTICS OF WILMINGTON

Characteristics	Berths				
	A & B	1-4	5	6	7-9
Length (ft)	1,213	2,100	780	583	2,066
Depth alongside at MLW (ft)	38	38	38	38	38
Deck strength (psf)	500	500	500	800	800
Apron width (ft)	Open	44	Open	100	Open
Apron height above MLW (ft)	12	12	12	12	12
Number of container cranes	0	0	1	1	3
Number of wharf cranes	2	1	1	0	0
Apron lighting	Yes	Yes	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No	No	No
Apron length served by rail (ft)	1,213	2,100	780	583	2,066

Notes:
1. Terminal open storage area is 109 acres
2. Terminal covered storage area is 1212959 square feet

d. Container Operations. Berths 5 through 9 provide the best container berths. They have good rail and truck access and access to paved storage next to the berths. Also, five container cranes are available for container operations.

2. Materials Handling Equipment (MHE)

The MHE owned by the Port of Wilmington is in table II-WNC-3. Additional MHE is available from local contractors.

3. Staging

a. Open Storage. The port has about 109 acres of paved, or marl-surfaced, open staging areas. These areas are shown in figure II-WNC-2.

b. Covered Storage. The port has more than 1,212,000 square feet of covered space. Specific characteristics of these facilities are in table II-WNC-4. All warehouses and transit sheds have both road and rail access.

TABLE II-WNC-2
PORT OF WILMINGTON
SUMMARY OF BERTHING CAPABILITIES OF WILMINGTON

Vessel	Berths				
	A & B	1-4	5	6	7-9
Breakbulk					
C3-S-33a	2	4	1	1	4
C3-S-37c	2	4	1	1	3
C3-S-37d	2	4	1	1	3
C3-S-38a	2	4	1	1	3
C4-S-1a	2	3	1	1	3
C4-S-1qb and 1u	2	3	1	1	3
C4-S-58a	2	3	1	1	3
C4-S-65a	2	3	1	1	3
C4-S-66a	2	3	1	1	3
C4-S-69b	2	3	1	1	3
Seatrain					
GA and PR-class	2	3	1	1	3
Barge					
LASH C8-S-81b	a,g	a,g	a,c,g	a,c,g	a,g
LASH C9-S-81d	1	2	c	c	2
LASH lighter	8	15	5	4	14
SEABEE C8-S-82a	a,g	a,g	a,c,g	a,c,g	a,g
SEABEE barge	6	10	3	2	10
RORO					
Comet	d,i,j	d,o	d,i,j	d,i,j	d,i,j
C7-S-95a/Maine-class	1	b	1	c	2
Ponce-class	h	b,h	h	c,h	h
Great Land-class	h	b,h	c,h	c,h	h
Cygnus/Pilot-class	1	b	1	c	3
Meteor	d,i,j	d,o	d,i,j	d,i,j	d,i,j
AmEagle/Condor	i,j	b	i,j	c	i,j
MV Ambassador	d	d	d	d	d
FSS-class	1	b	c	c	2
Cape D-class	i,j	b	i,j	c	i,j
Cape H-class	1	b	1	c	2
Container					
C6-S-1w	1,e	3,e	1	c	3
C7-S-68e	1,e	2,e	1	c	2
C8-S-85c	1,e	2,e	c	c	2
Combination					
C5-S-78a	1,e	3,e	1	c	3
C5-S-37e	1,e	3,e	1	c	3

a = maximum vessel draft limited to berth depth
b = inadequate apron width
c = inadequate berth length
d = no straight stern-ramp facilities
e = no container-handling equipment
f = inadequate berth depth, adequate anchorage depth
g = inadequate channel depth
h = no shore-based ramps available
i = insufficient ramp clearance at low tide
j = insufficient ramp clearance at high tide
k = excessive ramp angle at low tide
m = excessive ramp angle at high tide
n = parallel ramp operation only
o = insufficient apron width for side-ramp operation

Note: Ramp clearance and ramp angle based on maximum vessel draft.

( ) indicates vessels assigned by analyst

TABLE II-WNC-3
MATERIALS HANDLING EQUIPMENT

Type of Equipment	Capacity (STON)	Quantity
Mobile crane	140	1
Cherry picker hydraulic crane	7	1
Forklift	26	2
Forklift	7.5-10	20
Forklift	2-5	52
Straddle carrier	30	6
Yard hustler tractor	30	8
Flatbed trailer, 40-ft	22.5	16
Road trailer, 40-ft, with tractor	22.5	5
Van, 40-ft, with tractor	20	1
Flatbed trailer, 60-ft	25	1
Trucks	0.5-3	57

TABLE II-WNC-4
COVERED STORAGE

Storage Facility Designation	Area (square feet)	Number of Unloading Positions (nonconcurrent use)		Current Use
		Trucks	Railcars	
T-shed 1	81,721	6	8	General cargo
T-shed 2	81,721	6	8	General cargo
T-shed 3	132,642	6	9	General cargo
T-shed 4	273,183	6	6	General cargo
Warehouse 1	99,202	12	9	General cargo
Warehouse 2	106,282	18	11	General cargo
Warehouse 3	99,964	4	11	General cargo
Cargo shelter C-1	311,244	10	0	General cargo
Cargo shelter C-2	27,000	10	0	Trailers

4. Security

A 6-foot chain link fence topped with three strands of barbed wire provides terminal perimeter security. Some areas of the perimeter fence do not have lighting. However, the North Carolina State Port Police provides 24-hour patrol service and gate security.

5. Rail Operations

Three 1,200-horsepower, diesel-electric locomotives or a trackmobile move railcars within the terminal area. The railcar holding capacity is 400 railcars. The switching yard at Navassa has a capacity for an additional 1,750 railcars.

Depressed tracks serve the rear of the transit sheds and at least one side of each warehouse. All ship berths have twin marginal tracks.

A portable steel end ramp, a fixed concrete ramp, and several spanner sets are available for circus-style offloading. The locations of the end ramps appear in figure II-WNC-2.

6. Truck Operations

Commercial trucks usually enter and leave the port through the two-lane Main Gate or the new eight-lane South Gate. North Gate is mainly an exit. All of these gate areas have a weight scale.

All warehouses and transit sheds have multiple depressed roadway stations for offloading. A dock is available at open berths A and B to offload trucks.

7. Helicopter Operations

No adequate areas exist for landing helicopters. However, space is available to stage helicopters near the open berths.

8. Marshaling Areas

Three sites are available near the port for marshaling areas. The Legion Stadium area, consisting of 27.5 acres, is 2 miles from the port. New Hanover County Fairgrounds has 20 unpaved acres. It is 3 miles south of Legion Stadium, on Carolina Beach Road. The National Guard Armory, on North Kerr Avenue, is a 40-acre complex. It consists of a three-story masonry building, 14 primary storage areas, and an ammunition storage area. The complex also has its own water supply treatment plant and emergency power supply.

C. SUPPORT SERVICES

1. Pilotage

Commercial pilots meet all incoming vessels at the sea buoy.

2. Harbor Craft

Two companies in the port area provide shifting, docking, and towing services to the port. Tugboat sizes range from 600 to 4,100 horsepower.

3. Stevedores

Up to 25 stevedore gangs are available in the local area. However, the Military Ocean Terminal, Sunny Point, with its considerably higher wages, may reduce the manpower availability at the Port of Wilmington during an emergency.

MTMC International Traffic has determined that enough longshoremen are available to meet mobilization needs.

4. Heavy-Lift Equipment

The port owns and operates four gantry cranes, ranging from 25-STON to 225-STON capacity.

D. INTERMODAL CONTAINER TRANSFER FACILITIES (ICTF)

Except for the trailer-on-flatcar/container-on-flatcar (TOFC/COFC) area in the port complex, no ICTFs are in the Wilmington area. However, the North Carolina State Ports Authority does operate an ICTF at Greensboro and Charlotte. CSX provides scheduled service from these facilities to the Port of Wilmington.

E. FUTURE DEVELOPMENT

Interstate Route 40 between Raleigh and Wilmington is under construction and scheduled for completion in late 1990. This route will also intersect Interstate Route 95 and significantly improve highway access to Wilmington.

F. REQUIREMENTS AND RECOMMENDATIONS

1. Requirements

This section analyzes the deployment of a light infantry division from the port of Wilmington. The outloading time is 5 days. The vessels necessary to support deployment are listed in appendix A. The vessel requirements for each ship mix are:

- Ship mix 1 (modern ships): 3 ships.
- Ship mix 2 (combination of ship types): 5* ships.
- Ship mix 3 (breakbulk ships): 9 ships.
- Ship mix 4 (fast sealift ships): 3 ships.

*When FSS or RORO vessels are available, only three ships are required.

2. Recommendations

Tables II-WNC-5 and II-WNC-6 show the berthing recommendations for all ship mixes. The port can load all ship mixes within 5 days. When FSS vessels are not available for ship mixes 1 and 2, slewed- or side-ramp RORO ships permit timely loading.

TABLE II-WNC-5
BERTHING RECOMMENDATIONS FOR SHIP MIXES 1, 2 AND 4
(LIGHT INFANTRY DIVISION)

Ship Mixes: 1 (Modern ships) 2 (Combination of ships types) 4 (Fast sealift ships)		
Terminal: Berth:	Wilmington A and B	Wilmington 7 - 9
Day 1	FSS-1	FSS-1 FSS-3
Day 2		
Day 3		
Day 4		
Day 5		

TABLE II-WNC-6
BERTHING RECOMMENDATIONS FOR SHIP MIX 3
(LIGHT INFANTRY DIVISION)

Ship Mix 3 (Breakbulk ships)

Terminal:	Wilmington				
Berth:	A and B	1 to 4	5	6	7 to 9
Day 1	C3-S-33a	C4-S-65a	C4-S-65a	C4-S-58a	C3-S-33a
	C3-S-33a	C4-S-65a			C4-S-58a
					C4-S-65a
Day 2					
Day 3					
Day 4					
Day 5					

APPENDIX

EAST COAST UNIT SEALIFT REQUIREMENTS

A. GENERAL

This appendix describes the basic sealift requirements for each type of unit identified to deploy through the east coast ports analyzed in this study (table A-1). The number and possible names of vessels for several representative ship mixes are identified. Also, the associated vessel support systems for each representative ship mix are noted in the ship mix tables. This report concentrates on division-level movements through the east coast ports.

TABLE A-1
EAST COAST UNIT EQUIPMENT QUANTITIES

Unit/Toe No.	Maneuver Units	Supplies and Equipment	Qty	Helo Landing and Processing Area	Unit (ft)	Staging Area for 100 Pct of Unit (sq ft)	MTON	STON
Light Inf Div 77000L000	9 Inf Bn	Vehicles	2,922	5	313,731	392,164	49,488	10,056
		Aircraft	115		32,809	52,494	6,995	234
		MILVANs	389		31,123	46,995	4,063	709
		Other			25,765	32,206	3,607	1,282
					403,428	523,860	64,153	12,281
Airborne Div 57000L000	9 Inf Bn	Vehicles	4,608	5	422,568	528,210	63,648	12,552
		Aircraft	119		35,580	56,928	7,689	431
		MILVANs	545		44,353	66,973	6,404	1,232
		Other			23,906	29,882	4,352	1,560
					526,407	681,993	82,093	15,775
Air Assault Div 67000L100	9 Inf Bn	Vehicles	5,766	5	614,562	768,202	100,431	20,561
		Aircraft	386		127,508	204,013	28,956	1,427
		MILVANs	957		76,490	115,500	9,288	1,579
		Other			45,072	56,340	6,155	1,798
					863,632	1,144,055	144,830	25,365
Armored Div 87000J430	6 Tank Bn 4 Mech Bn	Vehicles	7,752	5	1,231,187	1,538,984	239,630	79,853
		Aircraft	127		37,707	60,331	8,112	447
		MILVANs	710		56,744	85,683	7,095	1,397
		Other	12		57,058	71,322	9,348	2,481
					1,382,697	1,756,320	264,186	84,178
Armored Cavalry Regt 17051H010	NA	Vehicles	1,616	5	256,248	320,310	50,143	17,113
		Aircraft	81		21,794	34,870	4,713	155
		MILVANs	137		10,948	16,531	1,233	279
		Other			19,391	24,239	2,588	764
					308,381	395,950	58,677	18,311
Heavy Mech Div 87000J420	5 Tank Bn 5 Mech Bn	Vehicles	7,656	5	1,169,500	1,461,875	230,359	71,048
		Aircraft	141		38,268	61,229	8,283	311
		MILVANs	12		56,197	84,857	7,243	1,236
		Other			64,092	80,115	9,654	2,568
					1,328,058	1,688,076	255,539	75,163

B. VESSELS AND BERTH REQUIREMENTS

The number of vessels required for each ship mix is determined by a vessel loading simulation (table A-2). The berth requirements for east coast ports are based on the ships' characteristics. The vessels are listed in tables A-3 through A-6. Ships are drawn from the Military Sealift Command (MSC), the Ready Reserve Force (RRF), and the Sealift Readiness Program (SRP). All ships used in this appendix are described in MTMCTEA Pamphlet 700-4, Vessel Characteristics for Shiploading, September 1991, and are expected to be available for east coast use. The ship mixes consist of the following elements:

TABLE A-2
EAST COAST VESSEL REQUIREMENTS

Unit	Number of Ships Required for Movement Through Port			
	Ship Mix 1 (ships)	Ship Mix 2 (ships)	Ship Mix 3 (ships)	Ship Mix 4 (ships)
Armored Div	9	12	27	8
Air Assault Div	6	9	18	6
Infantry Mech Div	10	13	28	8+2*
Light Infantry Div	3	5	9	3

*Unit shipping requirement exceeds current inventories of this ship mix. The current ship inventory and the additional ships needed are indicated.

TABLE A-3
EAST COAST VESSEL AND BERTH REQUIREMENTS
SHIP MIX 1 (MODERN SHIPS)

Representative Ship	Berth Required for Each Ship (ft)	Days Required to Load Each Ship	Minimum Apron Width (ft)	Minimum Depth Alongside (ft)	Cargo-Handling Requirements
FSS - USNS Algol	995	2	60	38	a
FSS - USNS Denebola	995	2	60	38	a
Cape Decision	730	1.5	80	35	b
American Eagle	685	1	100	32	a
Cape Henry	800	2	100	38	b
Cape Domingo	730	1.5	80	35	b
American Condor	685	1	100	32	a
MV Ambassador	605	1	80	32	b
FSS - USNS Capella	995	2	60	38	a
Cape Horn	800	2	100	38	b

Legend:
a - Shoreside cranes with container-handling apparatus are desirable.
b - Ship requires stern-ramp compatibility at seaports of embarkation/debarkation.

TABLE A-4
EAST COAST VESSEL AND BERTH REQUIREMENTS
SHIP MIX 2 (COMBINATION OF SHIP TYPES)

Representative Ship	Berth Required for Each Ship (ft)	Days Required to Load Each Ship	Minimum Apron Width (ft)	Minimum Depth Alongside (ft)	Cargo-Handling Requirement
C3-S-37D	545	4	20	32	Standard ship gear
FSS - USNS Algol	995	2	60	38	a
C4-S-58A	625	4	20	33	Standard ship gear
C3-S-33A	535	4	20	33	Standard ship gear
American Eagle	685	1	100	32	a
Cape Domingo	730	1.5	80	35	b
FSS - USNS Denebola	995	2	60	38	a
C4-S-65A	610	4	20	32	Standard ship gear
C3-S-37C	545	4	20	34	Standard ship gear
MV Ambassador	605	1	80	32	b
FSS - USNS Capella	995	2	60	38	a
Cape Henry	800	2	100	38	b
Cape Decision	730	1.5	80	35	b
C3-S-38A	535	4	20	30	Standard ship gear
C4-S-58A	625	4	20	33	Standard ship gear

Legend:
a - Shoreside cranes with container-handling apparatus are desirable.
b - Ship requires stern-ramp compatibility at seaports of embarkation/debarkation.

TABLE A-5
EAST COAST VESSEL AND BERTH REQUIREMENTS
SHIP MIX 3 (OLDER BREAKBULK SHIPS)

Representative Ship	Berth Required for Each Ship (ft)	Days Required to Load Each Ship	Minimum Apron Width (ft)	Minimum Depth Alongside (ft)	Cargo-Handling Requirement
C4-S-65A	610	4	20	32	All vessels have standard ship gear.
C4-S-65A	610	4	20	32	
C4-S-65A	610	4	20	32	
C3-S-33A	535	4	20	33	
C3-S-33A	535	4	20	33	
C3-S-37D	645	4	20	32	
C3-S-37D	645	4	20	32	
C3-S-37D	645	4	20	32	
C3-S-37C	645	4	20	34	
C4-S-58A	725	4	20	33	
C4-S-58A	725	4	20	33	
C4-S-58A	725	4	20	33	
C3-S-38A	535	4	20	30	
C3-S-38A	535	4	20	30	
C3-S-38A	535	4	20	30	
C4-S-65A	610	4	20	32	
C4-S-65A	610	4	20	32	
C4-S-65A	610	4	20	32	
C3-S-33A	535	4	20	33	
C3-S-33A	535	4	20	33	
C3-S-37D	545	4	20	32	
C3-S-37D	545	4	20	32	
C3-S-37C	545	4	20	34	
C3-S-37C	545	4	20	34	
C4-S-58A	625	4	20	33	
C4-S-58A	625	4	20	33	
C4-S-1U	615	4	20	34	
C3-S-38A	535	4	20	30	
C4-S-1A	615	4	20	32	
C4-S-1A	615	4	20	32	

TABLE A-6
EAST COAST VESSEL AND BERTH REQUIREMENTS
SHIP MIX 4 (FAST SEALIFT SHIPS)

Representative Ship	Berth Required for Each Ship (ft)	Days Required to Load Each Ship	Minimum Apron Width (ft)	Minimum Depth Alongside (ft)	Cargo-Handling Requirement
FSS - USNS Algol	995	2	60	38	Shoreside cranes with container-handling apparatus are desirable.
FSS - USNS Denebola	995	2	60	38	
FSS - USNS Capella	995	2	60	38	
FSS - USNS Bellatrix	995	2	60	38	
FSS - USNS Regulus	995	2	60	38	
FSS - USNS Altair	995	2	60	38	
FSS - USNS Antares	995	2	60	38	
FSS - USNS Pollux	995	2	60	38	

- Ship Mix 1 (table A-3) - several types of modern ships that might arrive at an east coast port for a deployment. Ship mix 1 has a priority for the use of more modern ships, such as RORO, combination, and other selected ships.

- Ship Mix 2 (table A-4) - combination of ship types.

- Ship Mix 3 (table A-5) - older breakbulk vessels.

- Ship Mix 4 (table A-6) - fast sealift ships (FSS).

C. SUMMARY

The ships used for the previous analyses were selected at random. Requirements may vary based on the actual vessels used and cargo to be transported.

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APO NY 09128-4209 (3)

HQ USEUCOM (MTMC)
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and Seventh Army
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Director of Logistics (J-4/SMD)
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Washington, DC 20318-3000 (2)

Commander
3d Corps
Fort Hood, TX 76544 (3)

Commander
MTMCEUR
APO NY 09159 (2)

Commander
1st Infantry Division (Mech)
Fort Riley, KS 66442 (1)

Commander
1st Cavalry Division
Fort Hood, TX 76544 (1)

Commander
2d Armored Division
Fort Hood, TX 76544 (1)

Commander
4th Infantry Division (Mech)
Fort Carson, CO 80913 (1)

Commander
5th Infantry Division (Mech)
Fort Polk, LA 71459 (1)

Commander
7th Infantry Division
Fort Ord, CA 93941 (1)

Commander
9th Infantry Division
Fort Lewis, WA 98433 (1)

Commander
24th Infantry Division (Mech)
Fort Stewart, GA 31313 (1)

Commander
82d Airborne Division
Fort Bragg, NC 28307 (1)

Commander
1169th US Army Transportation Terminal Unit A
Boston USARC
666 Summer Street
Boston, MA 02210 (1)

Commander
1184th US Army Transportation Terminal Unit A
James H. Wright Jr, USAR Center
PO Box 5037
Mobile, AL 36605 (1)

Commander
1185th USA Transit Control Unit B
USARC, 1135 Ranch Mill Rd
Lancaster, PA 17602 (1)

Commander
1186th USA Transportation Terminal Unit B
4815 N Hubert Ave
Tampa, FL 33684 (1)

Commander
1188th Military Ocean Terminal Unit
2323 Dauphine St
East Point, GA 30337 (1)

Commander
1189th US Army Transportation Terminal Unit B
Thomas Hutson Martin, Jr. USAR Center
Broad and Chisholm St
Charleston, SC 29401 (1)

Commander
1190th USA Deployment Control Unit
Airbase Ave
Ryan Airport
Baton Rouge, LA 70807 (1)

Commander
1191st US Army Transportation Terminal Unit A
4400 Dauphine St
New Orleans, LA 70146 (1)

Commander
1192d US Army Transportation Terminal Unit B
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New Orleans, LA 70146 (1)

Commander
1394th Deployment Control Unit
Sergeant Roark Center, Del Mar Basin Area 21
Camp Pendleton, CA 92055-5000 (1)

Commander
1395th US Army Transportation Terminal Unit
4505 36th Avenue, West
Seattle, WA 98199 (1)

Commander
1170th US Army Transportation Terminal Unit B
Boston USARC
666 Summer St
Boston, MA 02210 (1)

Commander
1172d US Army Transportation Terminal Unit B
Boston USARC
666 Summer St
Boston, MA 02210 (1)

Commander
1173d USA Transit Control Unit
Boston USARC
666 Summer St
Boston, MA 02210 (1)

Commander
1174th US Army Transportation Terminal Unit
Fort Totten USAR Center
Bldg 637
Fort Totten, NY 11359-1016 (1)

Commander
1175th US Army Transportation Terminal Unit A
Sievers - Sandberg USARC
Pedricktown, NJ 08067 (1)

Commander
1176th US Army Transportation Terminal Unit A
Curtis Bay USAR Center
Ordnance Rd and Pennington Ave
Baltimore, MD 21226 (1)

Commander
1179th US Army Deployment Control Unit
Fort Hamilton USARC
Fort Hamilton
Brooklyn, NY 11252 (1)

Commander
1181st US Army Transportation Terminal Unit A
Harris Lockard USAR Center
PO Box 4037
Meridian, MS 39301 (1)

Commander
1182d US Army Transportation Terminal Unit A
Charleston Depot USAR Center
N Charleston, SC 29410 (1)

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1397th Transportation Terminal Unit
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Commander
Military Sealift Command
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Commander
Naval Facilities Engineering Command
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Alexandria, VA 22332-2300 (2)

Commanding Officer
Navy Cargo Handling and Port Group
Williamsburg, VA 23185 (2)

Commanding Officer
Navy Transportation Management School
Oakland, CA 94600 (2)

Chief
Naval Supply System Command
Department of the Navy
Washington, DC 20376 (2)

Commanding Officer
USCG Marine Safety Office
Room 313, Post Office Building
601 Rosenburg
Galveston, TX 77550 (1)

Commanding Officer
Naval Supply Center
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Norfolk, VA 23512-5000 (1)

Commander in Chief
US Transportation Command
ATTN: TCJ3/4-LL (1); TCJ5-D (1)
Scott AFB, IL 62225-7001 (2)

Commanding General
Fleet Marine Force, Atlantic
ATTN: G-5
Norfolk, VA 23511 (2)

Commanding General
Fleet Marine Force, Pacific
ATTN: G-4 PLANS
Camp Smith, HI 96861 (2)

Commanding General
Marine Corps Base
ATTN: TMO
Camp Pendleton, CA 92055-5001 (2)

Commanding General
Marine Corps Base
ATTN: TMO
Camp LeJeune, NC 28533 (1)

Commander General
Marine Corps Development and Education Command
ATTN: CDSA (Development Center)
Quantico, VA 22134 (1)

Commanding General
Marine Corps Air Ground Combat Center
ATTN: G-4 Embark
Twenty Nine Palms, CA 92278 (1)

Commanding General (B840)
Marine Corps Logistics Base
Barstow, CA 92311-5087 (1)

Commander (Code 87)
Marine Corps Logistics Base
Albany, GA 31704-5000 (4)

Commanding General
4th Marine Div, FMF USMCR
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New Orleans, LA 70146 (1)

Commander
1189th USA TTU
9 Chisholm Street
Charleston, SC 29401-1831 (2)

Commander
USA Transportation Railway Services Unit
Middletown USAR Center
Mile Lane
Middletown, CT 06457 (1)

Commander
Transportation Terminal Bay Area
West Coast (Provisional)
Oakland Army Base
Oakland, CA 94626 (3)

Commander
Military Ocean Terminal Sunny Point
Southport, NC 28461 (1)

Commander
Baltimore Outport
Dundalk Marine Terminal
Baltimore, MD 21222 (1)

Commander
South Atlantic Outport
North Charleston, SC 29406 (1)

Commander
Cape Canaveral Outport
PO Drawer C
Cape Canaveral, FL 32920 (1)

Commander
Gulf Outport
New Orleans, LA 70146 (1)

Commander
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PO Box 4043
Beaumont, TX 77704 (1)

Commander
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Commander
Water Resources Support Center
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Kingman Building
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Commander
CASU Library and Information Services
ATTN: US Army Engineer District, St. Louis
1222 Spruce Street
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Commander
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Oakland, CA 94625 (1)

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Commander
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Commander
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Commander
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MTMCSAO
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