DCN 78

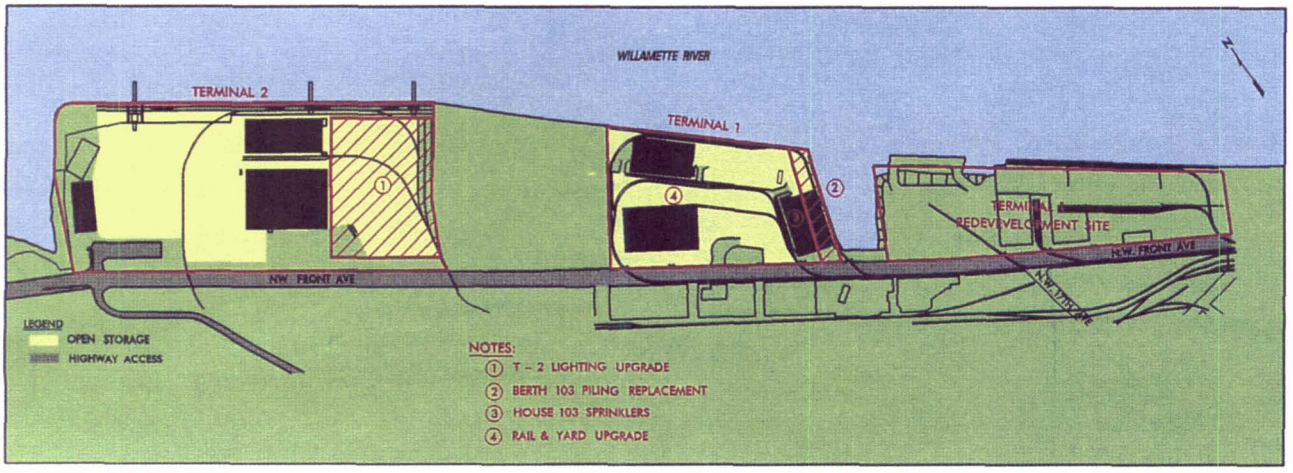
FUTURE DEVELOPMENT

The Port of Portland lists several projects for future development that would impact military deployments.

For terminal 1, the plans are to replace berth 103 piling, repave the storage yard, and upgrade the railroad tracks.

Terminal 2 lighting will be upgraded by installing new high mast poles and fixtures.

Several future developments are planned for terminals 4 and 6.

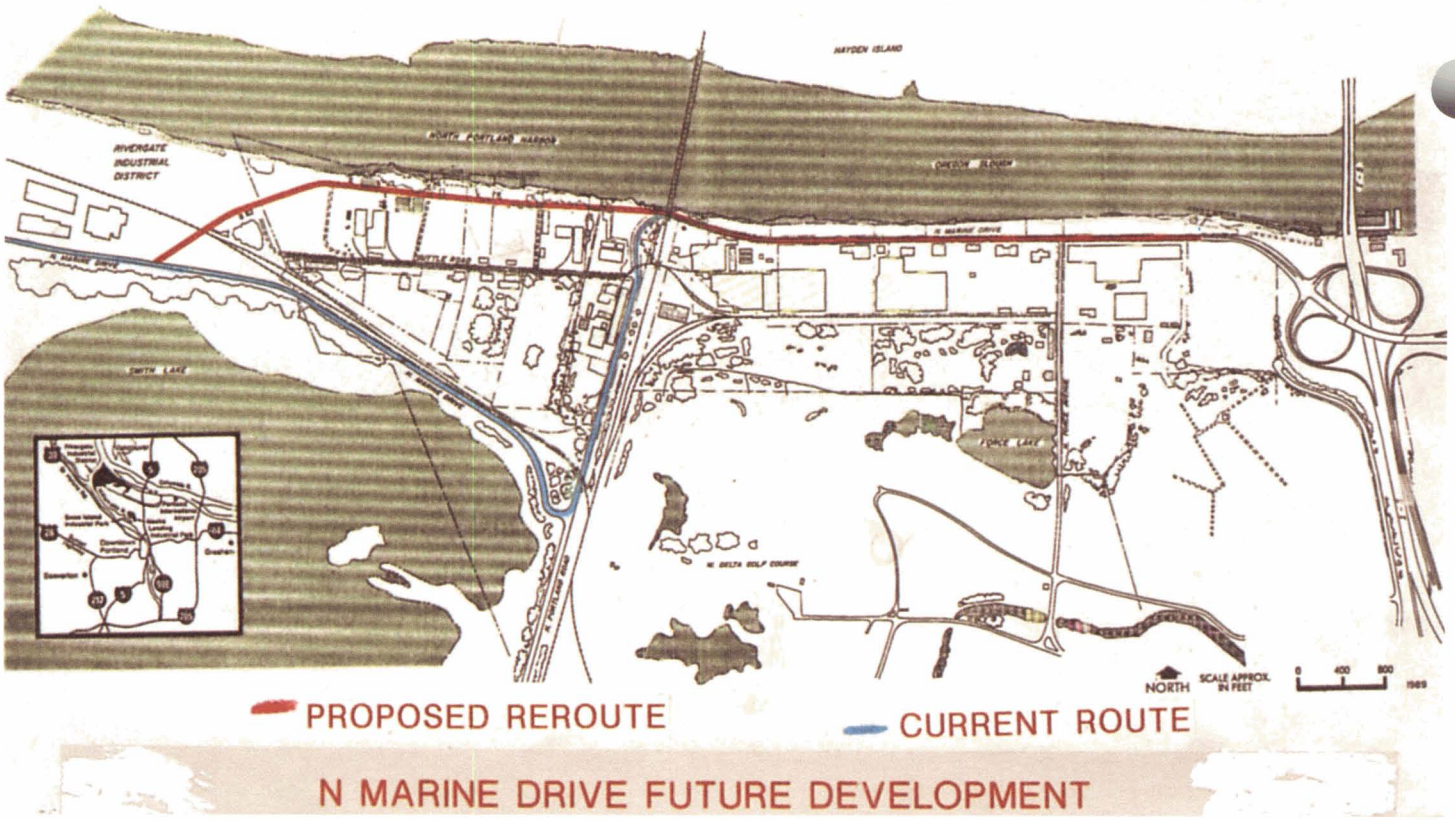


Future Development for Terminals 1 and 2

For terminal 4, the plans are to demolish warehouses 1, 2, 3, and 4 along berths 403-405 and the Matson warehouse along berths 406-407. A 25-railcar storage expansion will be located near the demolished warehouses at berths 403-405. The port also plans to demolish berth 412, extend berths 414 and 415, and add a new floating auto RORO dock upstream from berths 414 and 415. The steel yard will be expanded about 10 to 12 acres and a covered storage facility will be constructed in this area. The new covered storage area will have 100,000 square feet of storage space. Other possibilities are to develop another access road to terminal 4 by extending North Roberts Avenue and adding additional apron tracks to berths 414 and 415.

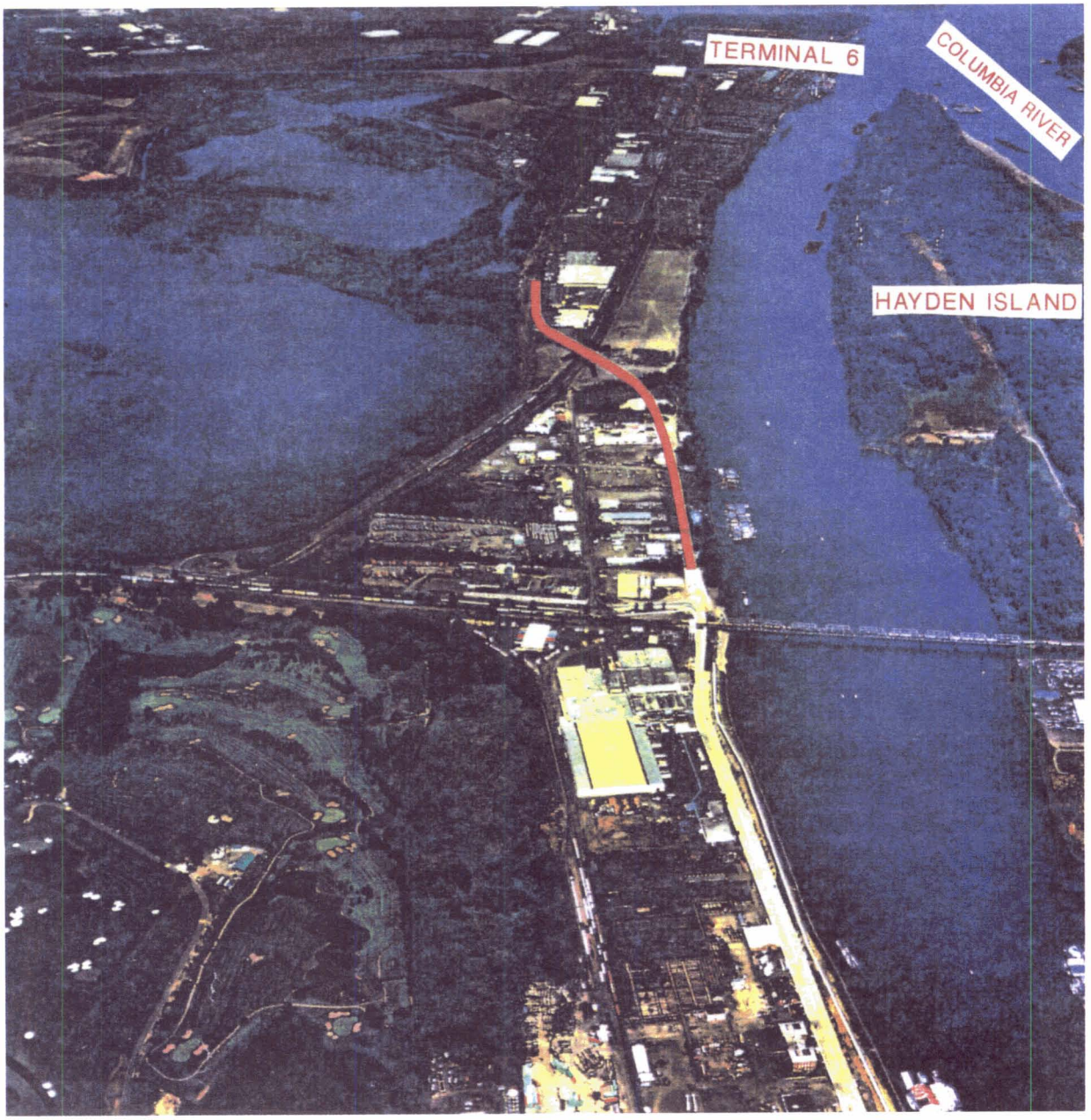
For terminal 6, plans are to widen and straighten North Marine Drive, the main access road to this terminal. This project is scheduled for completion in July 1995.

MARINE DRIVE PROJECT



N MARINE DRIVE FUTURE DEVELOPMENT

Other future projects for terminal 6 include extending the east and west ends of the wharf, adding another container crane to the east end of the wharf, expanding the new intermodal facility, and acquiring Hayden Island.

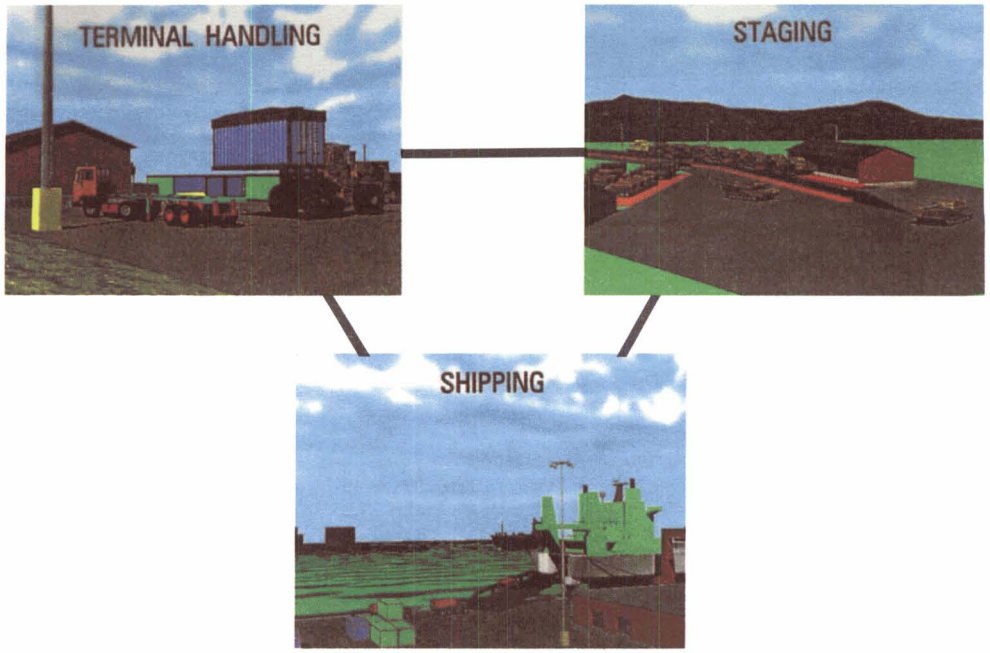


N Marine Drive Reroute and Hayden Island

II. THROUGHPUT ANALYSIS

GENERAL

This section evaluates the throughput capability of the Port of Portland with the port operational performance simulator (POPS) computer model. The model is based on a weak-link analysis in which each subsystem is analyzed separately and then compared to find the least capable subsystem. The weakest subsystem defines the maximum throughput capability of the terminal. The model yields throughput values for three subsystems - shipping, staging, and terminal processing/handling in terms of measurement tons (MTON) per day.

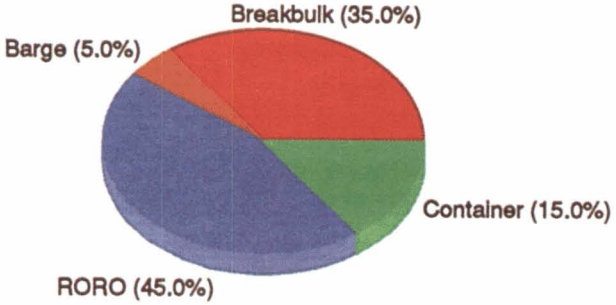


Terminal Throughput Subsystems

The analysis assumes that 80 percent of the port facilities will support military deployments. Also, the ship mix is based on Desert Shield and Desert Storm statistics. We weighted the percentages to adjust for differences in cargo deadweights and expectations for future deployments.

Since Terminal 1 is leased out, we assumed that only 30 percent of the Terminal 1 port facilities will support a military deployment.

SHIP MIX PERCENTAGES

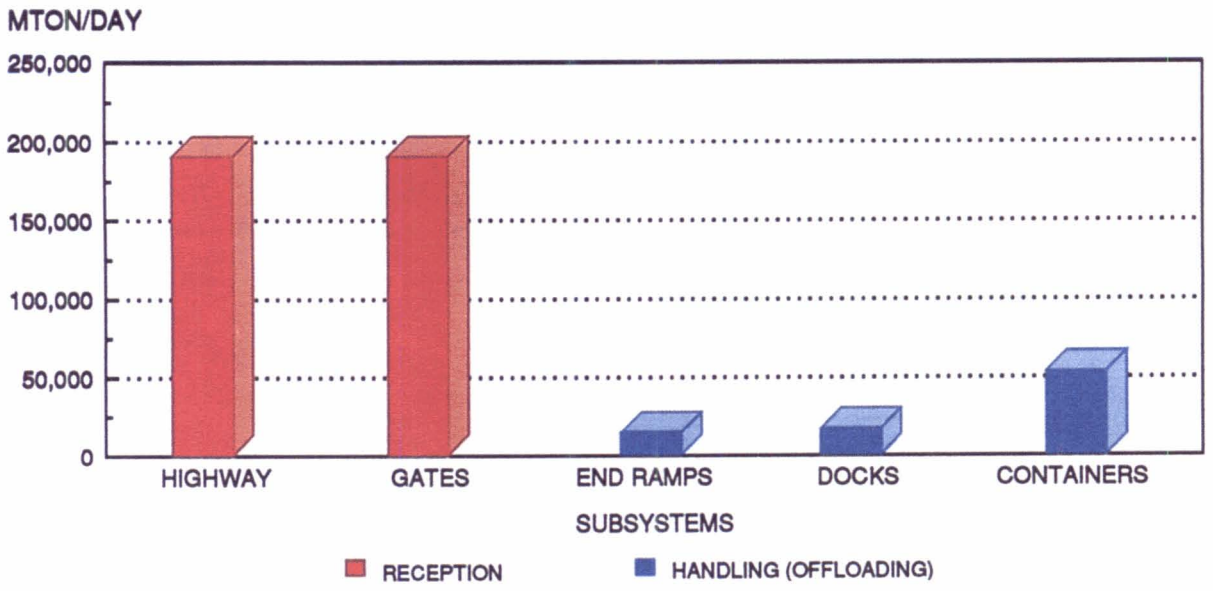


TERMINAL RECEPTION/HANDLING

Highway. Interstates 5 and 405, plus the major connectors of North Marine Drive, North Columbia Boulevard, North Burgard and North Lombard Streets, Northwest Yeon, and Northwest Front Avenues all provide good access to the Port of Portland. Each terminal has at least one gate allowing access to the wharf area. The road network in and out of the port, including the gate processing of vehicles, could handle almost 189,730 MTON of equipment and supplies per day.

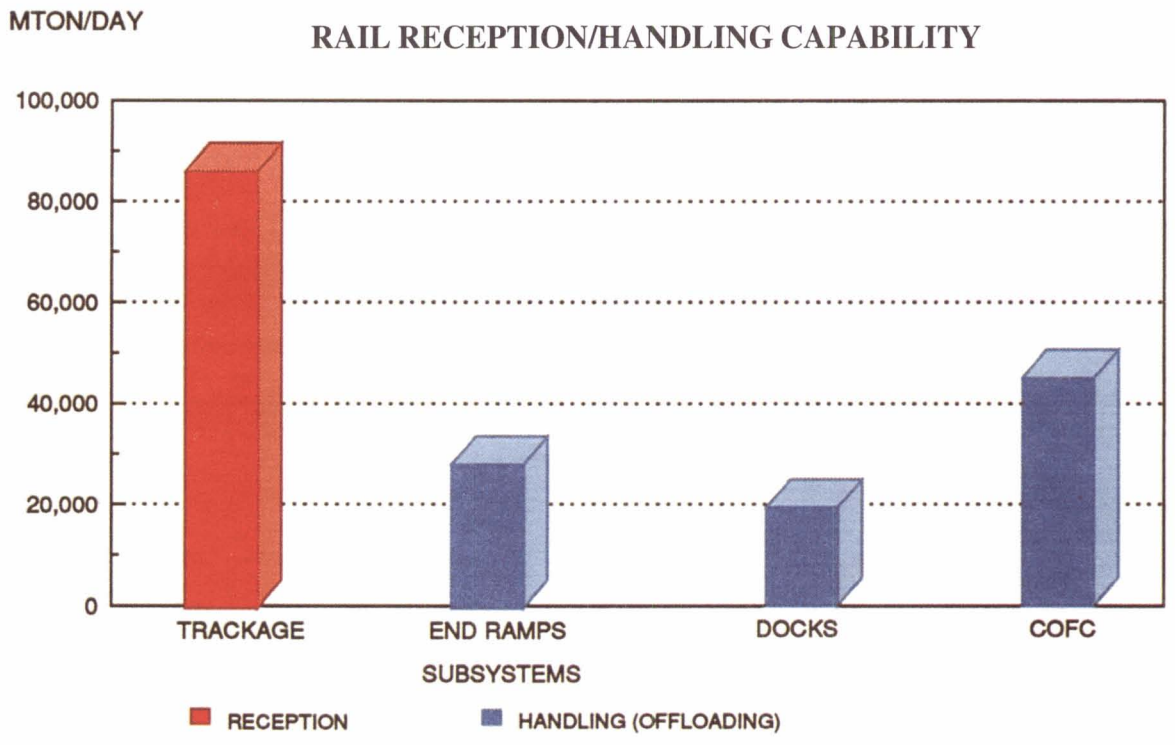
Roadable vehicles in convoys can proceed directly to staging areas. Vehicles on commercial or military flatbed semitrailers will first offload at the permanent end ramps at terminals 2, 4, and 6. Wide vehicles may have difficulty offloading at the truck end ramp at terminal 2 because of the side rails (see picture in the end ramps portion of section I of this study). The end ramp at terminal 4 is in need of repair. Assuming offloading operations occur at these end ramps, about 14,400 MTON of equipment could be offloaded per day. Supplies in van semitrailers will proceed to the warehouse docks for offloading. These facilities provide 63 handling positions (some of these double as rail dock facilities) and could offload about 16,640 MTON of cargo per day. Containers on trucks will likely proceed to terminal 6, which is specially equipped with container cranes and other container handling equipment. The container handling facilities could offload almost 52,800 MTON of cargo per day.

HIGHWAY RECEPTION/HANDLING CAPABILITY



Rail. Rail reception at the Port of Portland is very good with three commercial carriers serving the Portland area. The PTRR performs switching for terminals 1 and 2. The other terminals have reciprocal switching agreements. The port storage tracks could store about 570 railcars. The commercial railyards in the Portland area could store about 4,210 additional railcars. Availability of this storage space varies from 25 to 50 percent for the port yards and 10 to 30 percent for commercial yards. Current rail service to the port (all terminals combined) is about 16 trains per day. The number of cars per train varies from five to sixty 89-foot flatcars to 40 containers-on-flatcars (COFC).

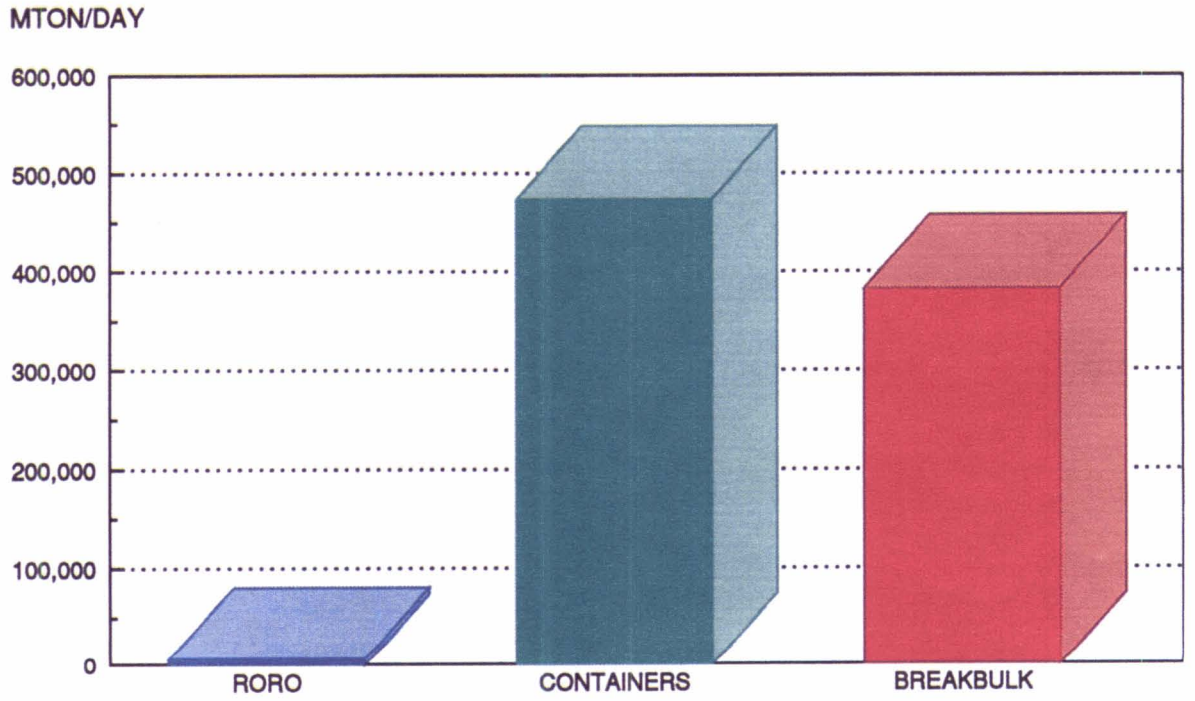
Vehicles on flatcars could offload at two permanent end ramps at terminals 2 and 6 and a light portable end ramp at terminal 4. The light end ramp at terminal 4 is too light for heavy equipment. Because the two permanent end ramps are connected to docks at covered storage facilities, deploying units must exercise care in offloading to avoid hitting posts or other portions of the facility. The end ramp at the SP Brooklyn Yard is too far away from the port to offload tracked equipment. Boxcars could offload at the warehouses where 21 rail handling positions are available. Some of these positions double as truck docks. Containers would offload at any of the container handling facilities.



STAGING

The Port of Portland has about 167.8 acres of open storage for vehicles and/or containers. This acreage has the capability to store about 6,975 MTONs of rolling stock, or 473,555 MTONs of containers, or 382,647 MTONs of breakbulk cargo. Also, 1,002,317 square feet of covered storage provides protection for about 33,525 MTONs of palletized cargo. If a combination cargo mix is expected, then a portion of each involved capability should be assumed.

OPEN STAGING CAPABILITY

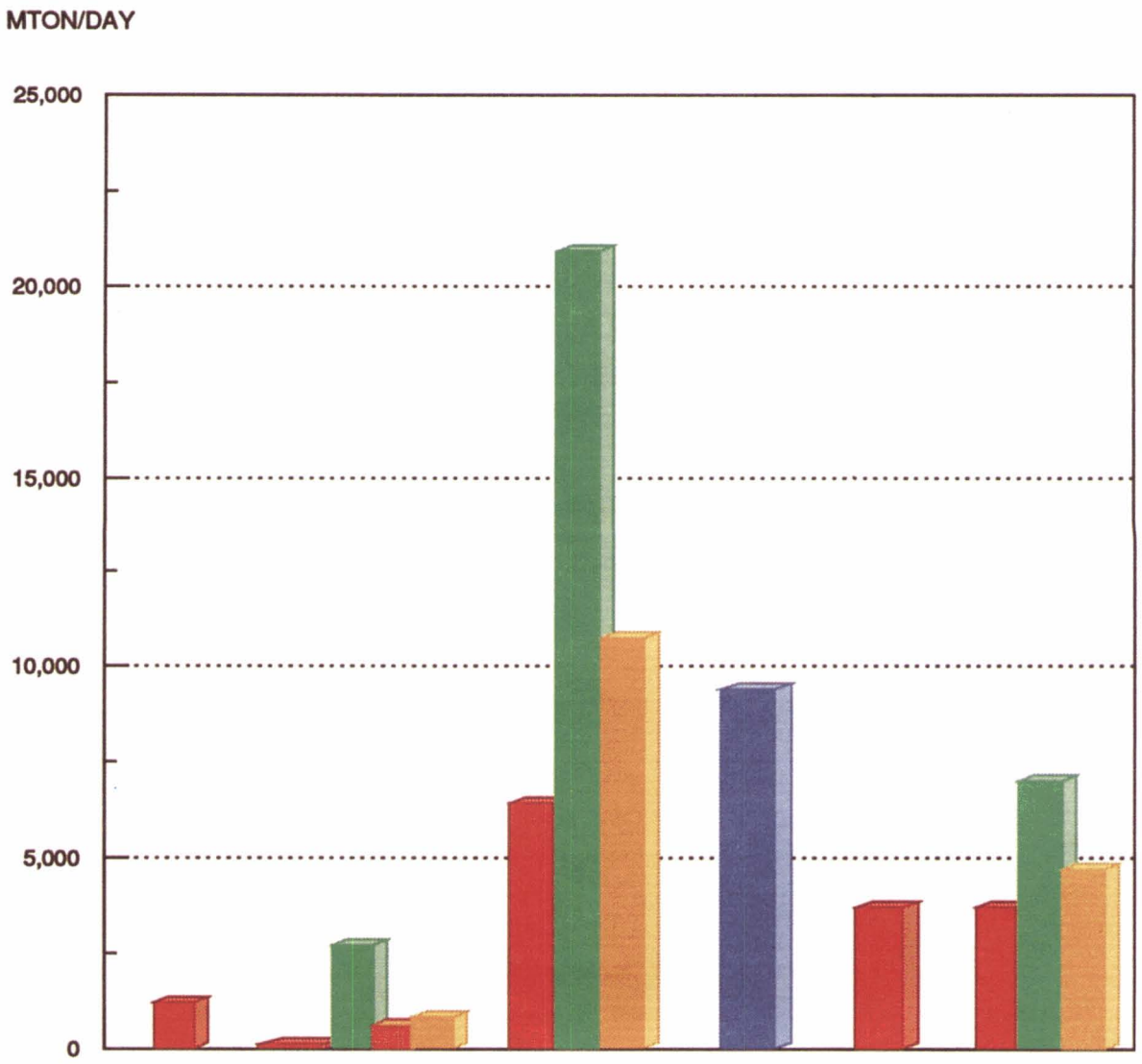


SHIPPING

We identified the throughput capability per berth in MTON per day for breakbulk, RORO, container, and mixed vessels. Various factors including MHE used, loading, operational, and berth usage rates as well as berth/ship compatibility provide the basis for these results.

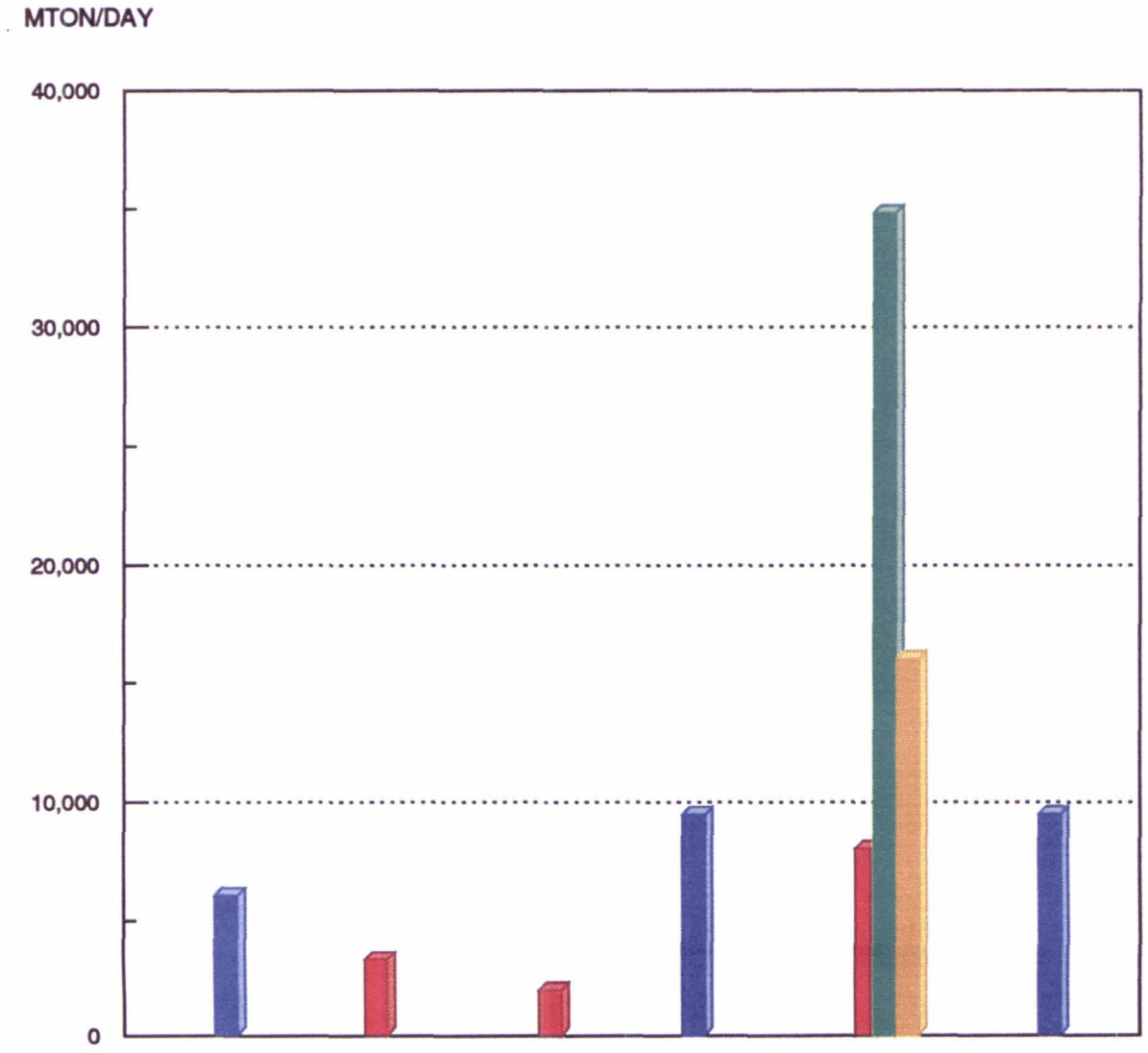
CONVERSION FACTORS		
Breakbulk:	0.4	STON per MTON
RORO:	0.25	STON per MTON
Containers:	0.4	STON per MTON

BERTH THROUGHPUT CAPABILITY



BERTH	101-102	103	203	204-206	204RORO	403-405	406-408
BREAKBULK	1,200	0	100	6,400	0	3,700	3,700
RORO	0	0	0	0	9,400	0	0
CONTAINER	0	0	2,700	20,900	0	0	7,000
BARGE	0	0	600	0	0	0	0
MIXED	1,200	0	800	10,700	9,400	3,700	4,700

BERTH THROUGHPUT CAPABILITY



BERTH	408RORO	410-411	414-415	601RORO	603-605	607RORO
BREAKBULK	0	3,200	1,900	0	8,000	0
RORO	6,000	0	0	9,437	0	9,437
CONTAINER	0	0	0	0	34,800	0
MIXED	0	3,200	1,900	9,437	16,000	9,437

Table 1 shows the compatibility for various vessel types. This table indicates for each type of ship, the number of vessels that can berth at a particular wharf. The table also provides the limitations that can hinder shipping operations.

A methodology that gives a snapshot view of the current physical characteristics of the berths and the MHE available provides the basis for the type of ship preferred at each berth. The evaluation gives no considerations for enhancements, such as equipment.

Terminal 2 berths 204-206 (to include the RORO portion of berth 204)is the best choice for all-around loading operations. Terminal 6 is the best choice for container operations.

PREFERENCE TERMINAL SELECTION

	TERMINALS			
LOADING TYPE	101-102	103	203	204-206
Breakbulk	2	-	-	1
RORO	-	-	-	-
Container	5	-	-	2
Barge	5	6	4	1

	TERMINALS			
LOADING TYPE	204 (RORO) (204-206)	403-405	406-408	408 (RORO) (406-408)
Breakbulk	-	7	4	-
RORO	1	-	-	4
Container	-	7	3	-
Barge	-	9	3	-

	TERMINALS				
LOADING TYPE	410-411	414-415	601 (RORO)	603-605	607 (RORO)
Breakbulk	6	5	-	3	-
RORO	-	-	2	-	2
Container	6	4	-	1	-
Barge	7	8	-	2	-

Notes:

1. The numbers refer to the terminal ranking in terms of terminal preference. For example, berth 603-605 has number 1 ranking for container loading. Hence, it is the preferred terminal for these operations.

2. Berths marked with "-" are not recommended for these operations.

TABLE 1
SUMMARY OF BERTHING CAPABILITIES OF PORTLAND 1

VESSEL	*BERTHS* 101-102	103
Breakbulk		
C3-S-33a	2	a
C3-S-37c	2	a
C3-S-37d	2	a
C3-S-38a	2	a
C4-S-1a	1	a,c
C4-S-1qb and 1u	1	a,c
C4-S-58a	1	a,c
C4-S-65a	1	a,c
C4-S-66a	1	a
C4-S-69b	1	a,c
Seatrain		
GA and PR-class	1	a,c
Barge		
LASH C8-S-81b	1	a,c,f
LASH C9-S-81d	a	a,c
LASH lighter	7	3
SEABEE C8-S-82a	a	a,c
SEABEE barge	5	2
RORO		
Comet	d,i,j	a,d,o
C7-S-95a/Maine-class	i,j	a,b,c
Ponce-class	h	a,b,c,h
Great Land-class	h	a,b,c,h
Cygnus/Pilot-class	i,j	a,b,c
Meteor	d,i,j	a,d,o
AmEagle/Condor	i,j	a,b,c
MV Ambassador	d	c,d
FSS-class	i,j	a,b,c
Cape D-class	i,j	a,b,c
Cape H-class	a	a,b,c
Container		
C6-S-1w	1,e	a,c,e
C7-S-68e	1,e	a,c,e
C8-S-85c	1,e	a,c,e
Combination		
C5-S-78a	1,e	a,c,e
C5-S-37e	1,e	a,c,e

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

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

TABLE 1 - Cont
SUMMARY OF BERTHING CAPABILITIES OF PORTLAND 2

VESSEL	*BERTHS*		
	203	204-206	204 (RORO)
Breakbulk			
C3-S-33a	a,c	4	
C3-S-37c	a,c	4	
C3-S-37d	a,c	4	
C3-S-38a	a,c	4	
C4-S-1a	a,c	3	
C4-S-1qb and 1u	a,c	3	
C4-S-58a	a,c	3	
C4-S-65a	a,c	3	
C4-S-66a	a,c	4	
C4-S-69b	a,c	3	
Seatrain			
GA and PR-class	a,c	3	
Barge			
LASH C8-S-81b	a,c,f	2	
LASH C9-S-81d	a,c	2	
LASH lighter	2	16	
SEABEE C8-S-82a	a,c	2	
SEABEE barge	2	11	
RORO			
Comet	a,c,d	d,i,j	d,i,j
C7-S-95a/Maine-class	a,c	i,j	1,i
Ponce-class	a,ch	h	h
Great Land-class	a,c,h	h	h
Cygnus/Pilot-class	a,c	i,j	1,i
Meteor	a,c,d	d,i,j	d,i,j
AmEagle/Condor	a,c	i,j	i,j
MV Ambassador	c,d	d	d
FSS-class	a,c	i,j	1,i
Cape D-class	a,c	i,j	i,j
Cape H-class	a,c	i,j	1,i
Container			
C6-S-1w	a,c,e	3	
C7-S-68e	a,c,e	3	
C8-S-85c	a,c,e	2	
Combination			
C5-S-78a	a,c,e	3	
C5-S-37e	a,c,e	3	

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

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

TABLE 1 - Cont
SUMMARY OF BERTHING CAPABILITIES OF PORTLAND 4

VESSEL	*BERTHS*				
	403-40	406-408	408 (RORO)	410-411	414-415
Breakbulk					
C3-S-33a	2	2		2	1
C3-S-37c	2	2		2	1
C3-S-37d	2	2		2	1
C3-S-38a	2	2		2	1
C4-S-1a	2	2		1	1
C4-S-1qb and 1u	2	2		1	1
C4-S-58a	2	2		1	1
C4-S-65a	2	2		1	1
C4-S-66a	2	2		2	1
C4-S-69b	2	2		1	1
Seatrain					
GA and PR-class	2	2		1	1
Barge					
LASH C8-S-81b	1	1		1	1
LASH C9-S-81d	a	a		1	1
LASH lighter	10	10		8	6
SEABEE C8-S-82a	a	a		1	1
SEABEE barge	7	7		5	4
RORO					
Comet	d,o	d,o	d,i,j	d,o	d,i,j
C7-S-95a/Maine-class	b	b	1	i,j	i,j
Ponce-class	b,h	b,h	h	b,h	h
Great Land-class	b,h	b,h	h	b,h	h
Cygnus/Pilot-class	b	b	1	i,j	i,j
Meteor	d,o	d,o	d,i,j	d,o	d,i,j
AmEagle/Condor	b	b	i,j	i,j	i,j
MV Ambassador	d	d	c,i	d	d
FSS-class	b	b	d	i,j,n	c
Cape D-class	b	b	c	i,j	i,j
Cape H-class	a,b	a,b	a	i,j	i,j
Container					
C6-S-1w	2,e	2		1,e	1,e
C7-S-68e	2,e	1		1,e	1,e
C8-S-85c	1,e	1		1,e	1,e
Combination					
C5-S-78a	2,e	2		1,e	1,e
C5-S-37e	2,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.

TABLE 1 - Cont
SUMMARY OF BERTHING CAPABILITIES OF PORTLAND 6

VESSEL	*BERTHS*		
	603-605	601 (RORO)	607 (RORO)
Breakbulk			
C3-S-33a	5		
C3-S-37c	5		
C3-S-37d	5		
C3-S-38a	5		
C4-S-1a	5		
C4-S-1qb and 1u	4		
C4-S-58a	4		
C4-S-65a	4		
C4-S-66a	5		
C4-S-69b	4		
Seatrain			
GA and PR-class	4		
Barge			
LASH C8-S-81b	3		
LASH C9-S-81d	3		
LASH lighter	20		
SEABEE C8-S-82a	3		
SEABEE barge	14		
RORO			
Comet	d,i,j	d,i,j	d,i,j
C7-S-95a/Maine-class	i,j	1	1
Ponce-class	h	h	h
Great Land-class	h	h	h
Cygnus/Pilot-class	i,j	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	i,j	1,n	1,n
Cape D-class	i,j	i,j	i,j
Cape H-class	i,j	a	a
Container			
C6-S-1w	4		
C7-S-68e	3		
C8-S-85c	3		
Combination			
C5-S-78a	4		
C5-S-37e	4		

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

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

III. APPLICATION

GENERAL

This section of the report will evaluate the throughput capability for deploying a notional mechanized infantry division using primarily FSS vessels. The MARAD Planning Orders Digest does not call for the use of Port of Portland facilities during national emergencies. Therefore, the analysis will use only those berths and accompanying facilities that can accommodate an FSS. These facilities include berths 204-206 of terminal 2, berths 414-415 of terminal 4, and berths 603-605 of terminal 6 (see figs 3 through 5 to locate these facilities).

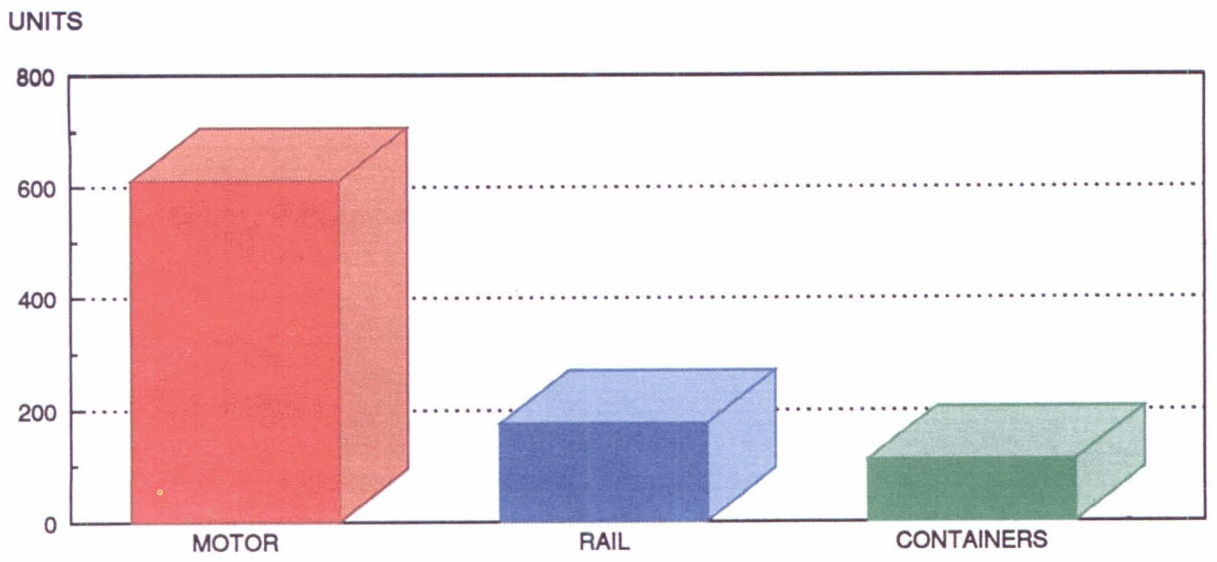
REQUIREMENTS

The most likely requirement for the Port of Portland is to deploy a notional mechanized infantry division in 6 days. The division has to move about 7,800 vehicles and 660 containers. The movement of this division to the port will require 1,055 (176 per day) railcars using a convoy/rail option. Under this option, the deploying units would drive about 3,650 (610 per day) roadable vehicles and tow another 2,320 (387 per day) pieces of equipment.

MECHANIZED INFANTRY DIVISION DEPLOYMENT DATA

Total Equipment	
Volume	274,518 MTON
Weight	95,010 STON
Area	1,422,844 SQ FT
Vehicles	7,800
Containers	660

DAILY REQUIREMENTS

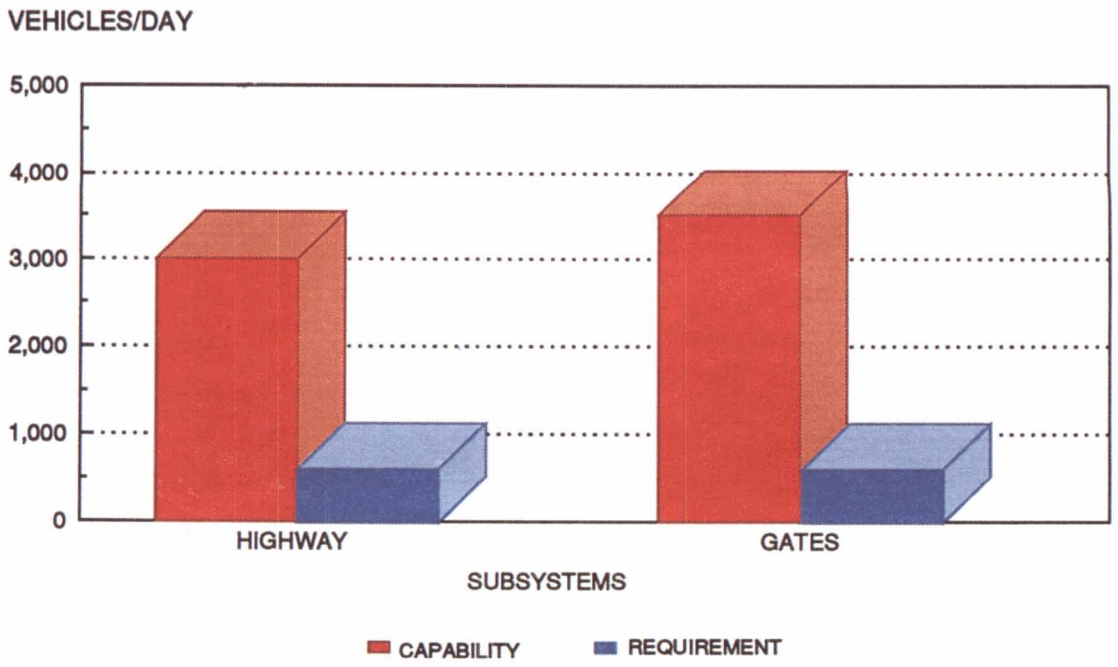


TERMINAL INPROCESSING/HANDLING

Highway. Vehicles would access the Port of Portland using I-5 and North Marine Drive for terminal 6; I-5, North Columbia Boulevard, N Burgard Street, and North Lombard Street for terminal 4; and I-5 and -405, Northwest Yeon and Northwest Front Avenues for terminals 1 and 2. Each terminal has at least one gate providing access to the wharf areas.

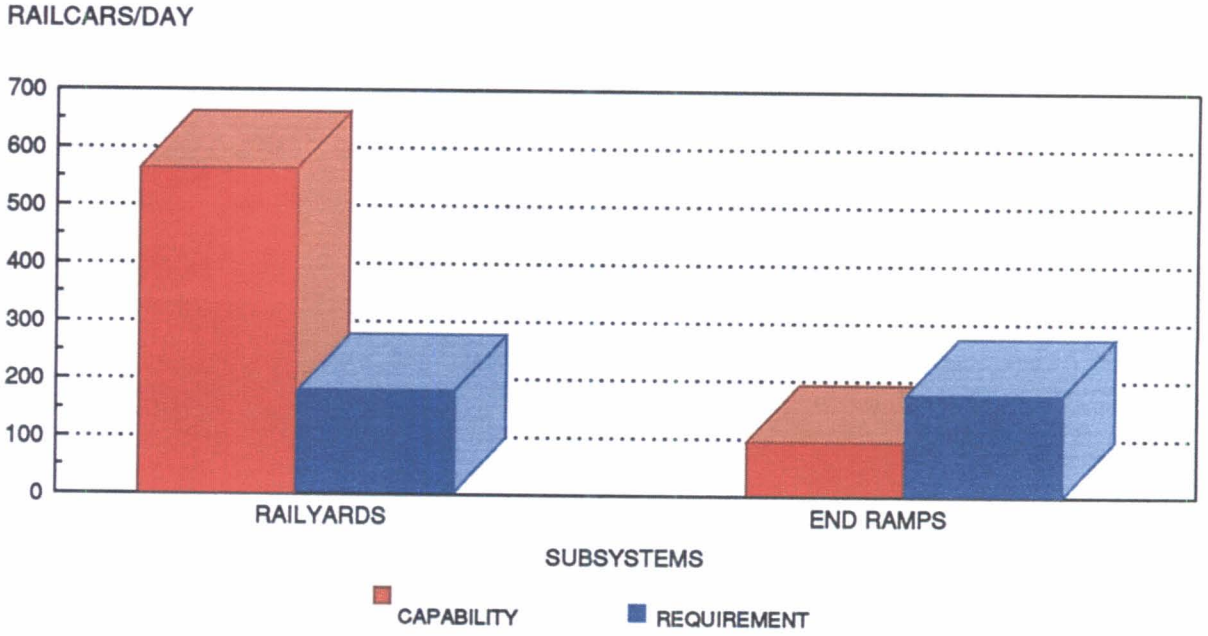
We estimate (based on existing traffic volume) that the access roads to the four terminals can handle an additional 3,000 vehicles per day. Also, the terminal gates can handle an additional 3,500 vehicles per day.

HIGHWAY INPROCESSING CAPABILITY



Rail. The classification yards on and off port have a combined total of about 4,780 railcars per day. However, about 25 to 50 percent of the port railyards capacity and only 10 to 30 percent of the commercial railyards capacity would normally be available for military use. This means that normal daily storage would be about 563 railcars per day. With the three available end ramps at the port, stevedores or military personnel could offload about 23 railcars every 5 hours. This equates to 92 railcars per day. We assumed that lighter vehicles will offload at the light portable end ramp at terminal 4 and the heavy vehicles will offload at terminals 2 and 6. At least one additional portable heavy-duty end ramp at terminals 2, 4, and 6 will allow the port to more adequately meet rail reception requirements. The portable end ramp at terminal 4 is too light for offloading heavy equipment. Deploying units must exercise caution in using the permanent end ramps at terminals 2 and 6. These end ramps are part of the rail/truck docks for the warehouses they serve. Heavy military equipment could damage the buildings and/or dock areas at these ramps.

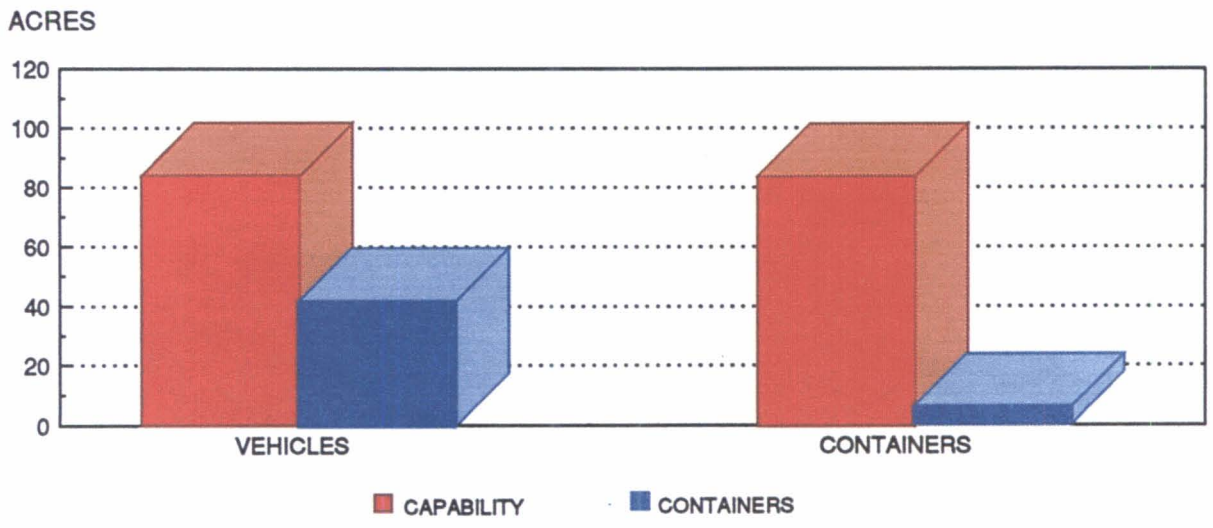
RAIL INPROCESSING/HANDLING CAPABILITY



STAGING

The Port of Portland has almost 168 acres of open staging available. We estimate that a mechanized infantry division needs about 48 acres of open staging to support the concurrent sustained loading of three FSS vessels. Divided between vehicles and containers, the staging area requirement becomes 42 and 6 acres for vehicles and containers, respectively.

OPEN STAGING CAPABILITY



SHIPPING

The number of ships needed to load this requirement depends on the shipping mix selected. The best ship mix would require all eight FSS's and two Cape H RORO ships. Berths 204-206 (2), 406-408 (1), 414-415 (1), and 603-605 (2) combined can accomodate six FSS vessels. Assuming 2 days to load a ship, a division can outload within the 6-day requirement from the Port of Portland.

UNIT MOVEMENT REQUIREMENTS
MECHANIZED DIVISION

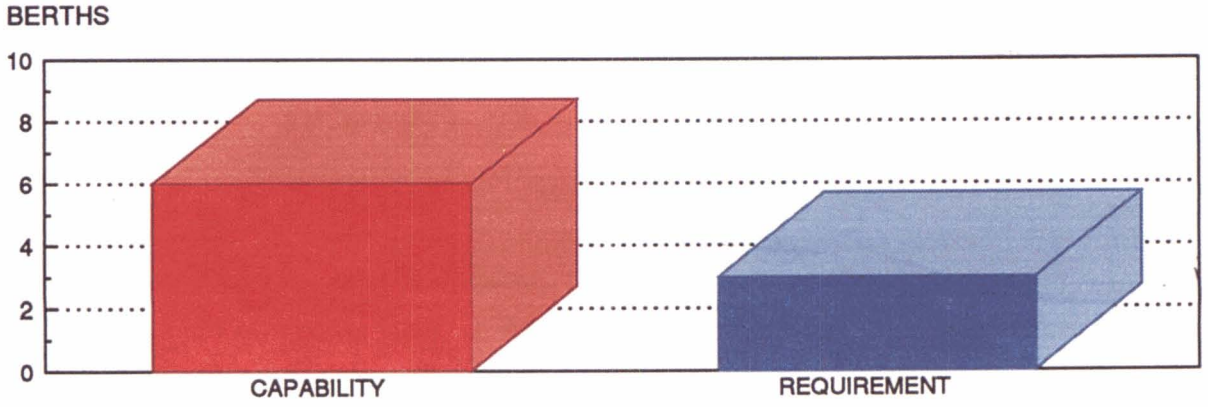
LOADING CONDITION/ SAMPLE SHIP MIX	*VESSEL TYPES* FSS (RORO/COMB)	CAPE H (RORO/COMB)	C3/C4 (BREAKBULK)	C6/C7/C8 (CONTAINER)
Minimum Containerization				
All FSS*	8.00	1.90		
FSS and Cape H	6.64	3.00		
All Breakbulk			37.70	
Maximum Containerization				
FSS and Container	7.90			2.00
FSS, Cape H , and Container	4.62	3.00		2.00
Breakbulk and Container			29.58	2.00

*Only eight FSS are available. Unit shipping requirements exceed the capacity of these eight vessels. Other vessel types are required to make up the FSS shortfall (Cape H).

Legend:
RORO - roll on/roll off
FSS - fast sealift ship

Source: MTMCTEA Report OA 90-4f-22, Deployment Planning Guide, Aug 91.

FSS SHIPPING CAPABILITY



SUMMARY

Terminal 2 is the preferred terminal of use for deployment because it is the best for all-around operations and has the best RORO shipping capability. Terminal 6 is the preferred terminal for container shipments because it has the most modern facilities, is the easiest to access by highway, and is the most compatible for containerized shipments.

The Port of Portland can outload a mechanized infantry division within the 6-day outloading requirement. This conclusion is contingent upon procurement of at least three (one for each terminal) portable heavy-duty end ramps to complement end ramps already at the port.

RECOMMENDATIONS

We recommend that the Port of Portland obtains at least three heavy-duty portable end ramps to more adequately meet rail reception requirements and allow flexibility in offloading heavy equipment from both railcars and semitrailers. If desired, the port may construct these end ramps in lieu of purchasing them.

PORT OF SAN DIEGO
SAN DIEGO, CALIFORNIA

I. GENERAL DATA

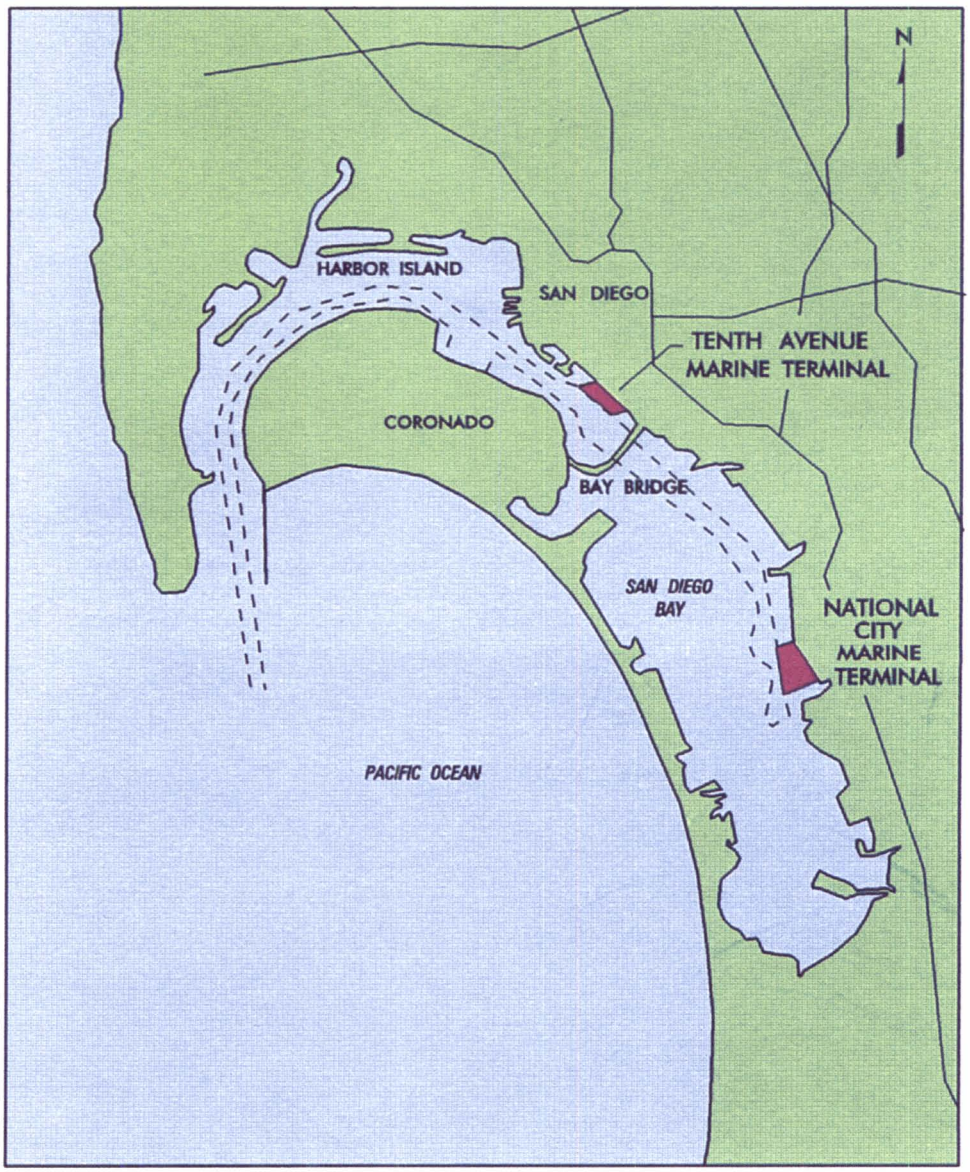
TRANSPORTATION ACCESS

Water

This report evaluates two terminals at the Port of San Diego - Tenth Avenue Marine Terminal and National City Marine Terminal. Both terminals are suitable for military operations and may be available if such a need arises. The water access map below shows these terminals.

The Port of San Diego, California, is just north of the Mexican border. The entrance to the channel is 43 feet deep at mean low water (MLW). The channel continues past the two terminals at depths of at least 35 feet. One bridge crosses the channel before a ship can access National City Terminal.

The Coronado Bay Bridge is 195 feet above the water at mean high water (MHW). The channel widens at each of the two terminals to allow ships to turn. The tidal variation is 4.1 feet.

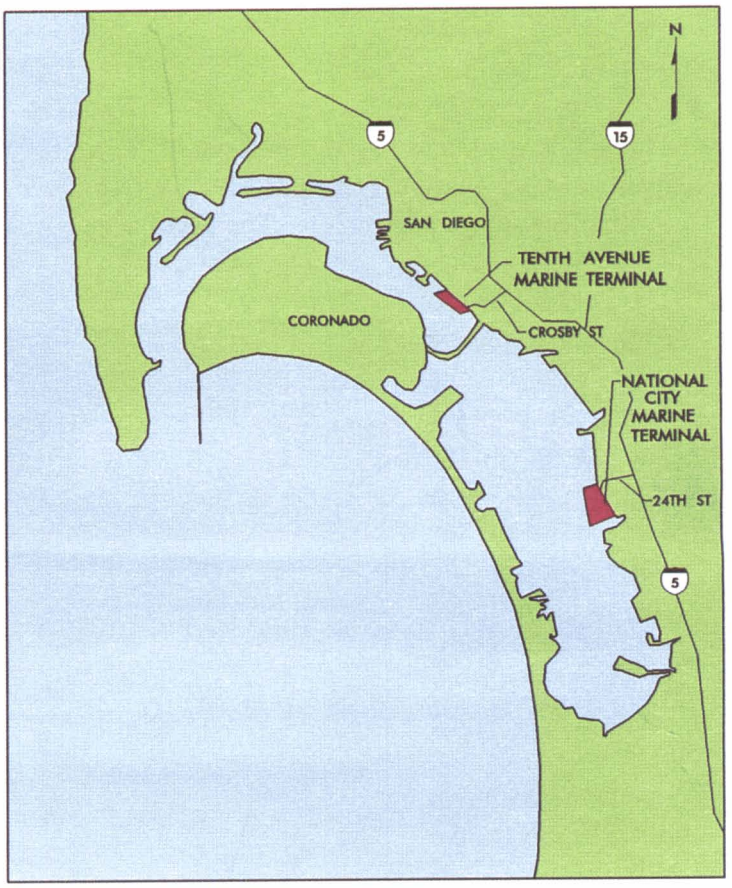


Water Access

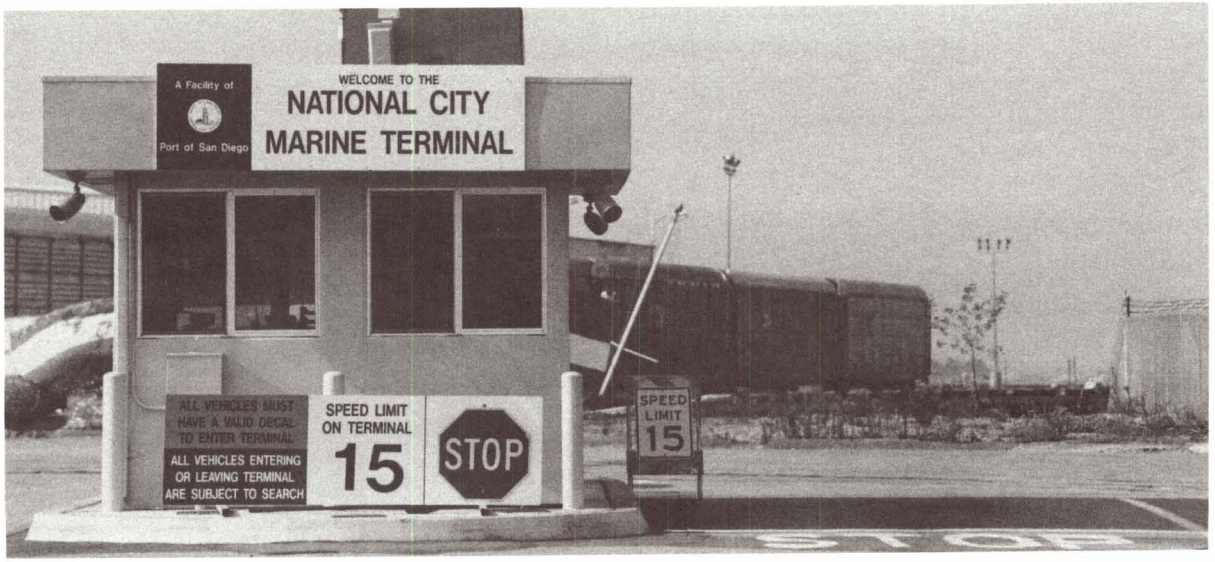
Highway

Heavy highway congestion usually prevails in the San Diego area. Both terminals have access to Interstate Route 5, which is less than 2 miles to the east.

Crosby Street Gate to 10th Avenue Terminal



Highway Access



Gate to National City Terminal

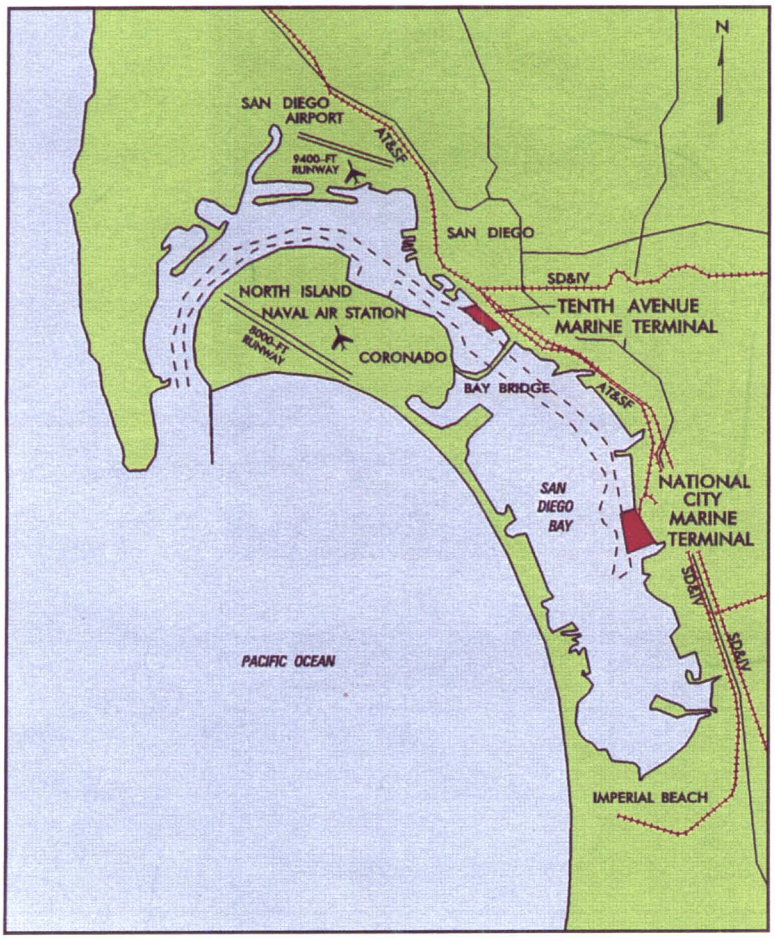
Rail

The Atchison, Topeka, and Santa Fe (AT&SF) is the only major railroad that serves the Port of San Diego. The local rail line is the San Diego and Imperial Valley Railway (SDIV). The port and nearby private railyards can store about 500 89-foot railcars. Most of this capacity is at 10th Avenue Marine Terminal.

Air

San Diego International Airport Lindbergh Field is northwest of 10th Avenue Terminal. North Island Naval Air Station is west of 10th Avenue Terminal, across the Coronado Bay Bridge. Both airports are about 5 miles away.

Bilevel POV Loading at the National City Terminal



Rail and Air Access

PORT FACILITIES

Berthing

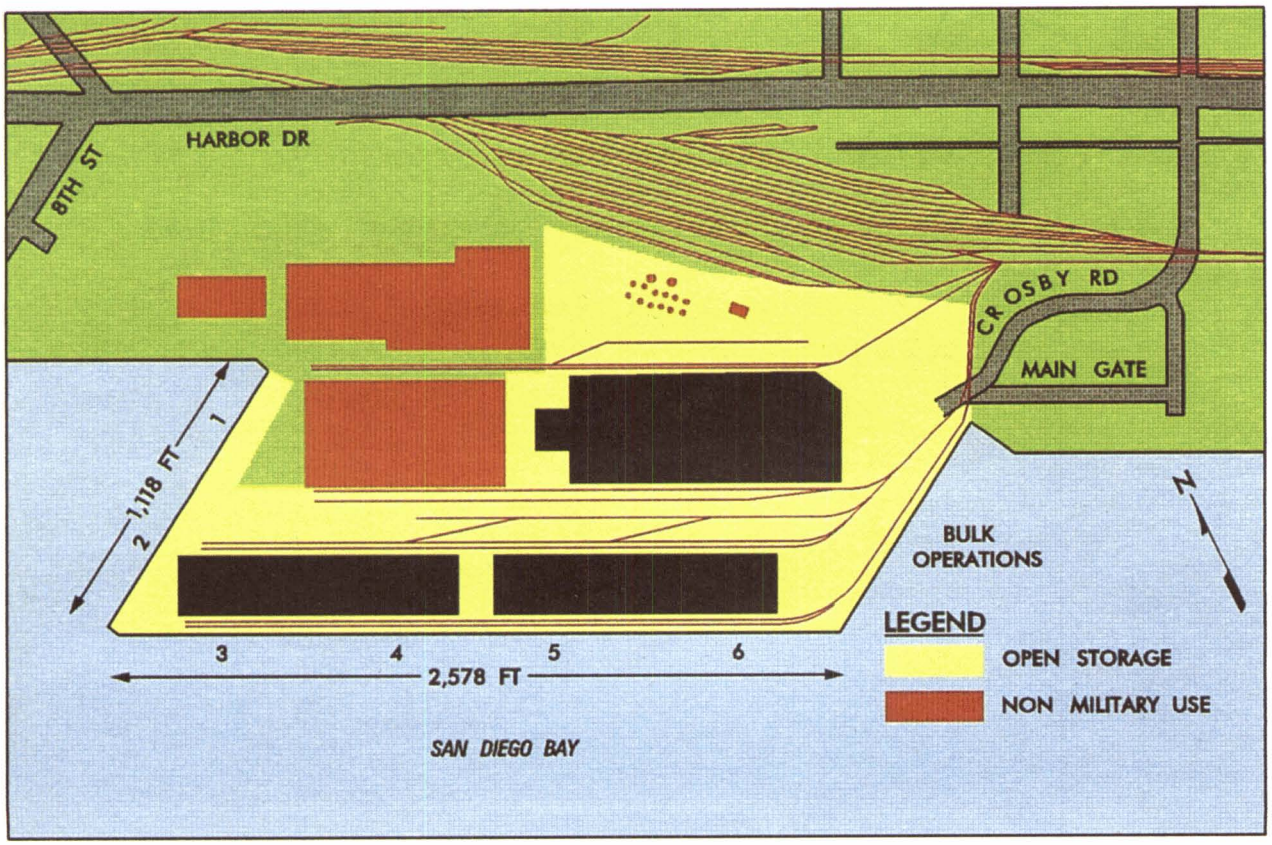
Pier construction is generally concrete piles, fronting a concrete bulkhead. Fendering is generally timber or rubber, and the surface is either asphalt or concrete. Both terminals have lighting for night operations and increased security.

TERMINAL OPERATIONS

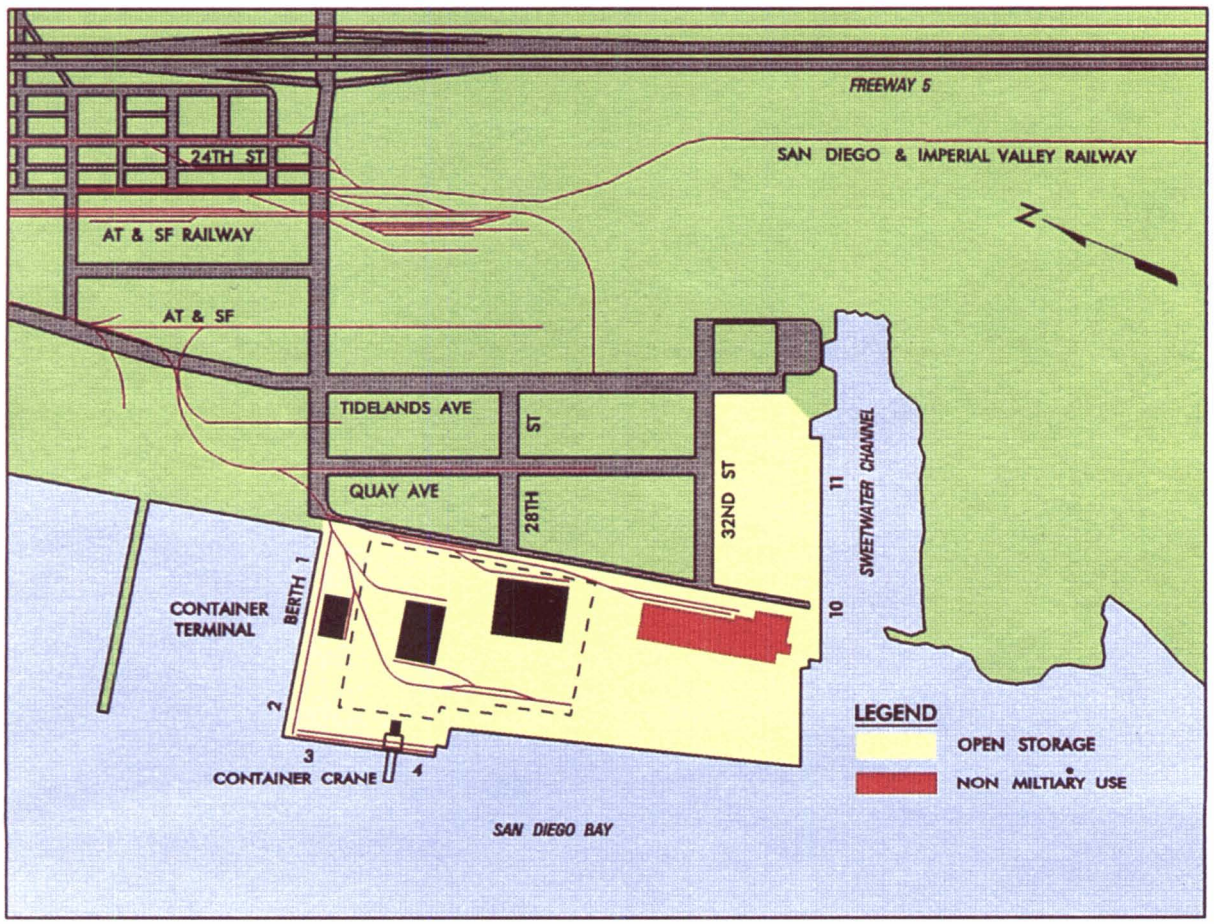
TERMINAL	USE
10th Ave	Breakbulk and bulk
National City	Containers and POVs
Legend:	
POV - privately owned vehicles	

The gates at both terminals are manned 24 hours by port police officers. Both terminals are fenced with 8-foot-high chain link and barbed wire above. The police force includes 125 sworn officers.

Below are land-use maps of the two terminals. Figures 1 and 2 are aerial views of the terminals. They include tables identifying the berth characteristics.



10th Avenue Marine Terminal



National City Marine Terminal

BERTH CHARACTERISTICS OF TENTH AVENUE TERMINAL

CHARACTERISTICS	BERTHS	
	1-2	3-6
Length (ft)	1,118	2,578
Depth alongside at MLW (ft)	31	35
Deck strength (psf)	1,000	600
Apron width (ft)	Open	Open
Apron height above MLW (ft)	12	12
Number of container cranes	0	0
Number of wharf cranes	0	0
Apron lighting	Yes	Yes
Straight-stern RORO facilities	No	No
Apron length served by rail (ft)	0	2,578

Figure 1. Aerial view of 10th Avenue Terminal.

BERTH CHARACTERISTICS OF NATIONAL CITY TERMINAL

CHARACTERISTICS	BERTHS		
	2	3-4	10-11
Length (ft)	720	1,000	1,500
Depth alongside at MLW (ft)	35	35	35
Deck strength (psf)	1,000	1,000	1,000
Apron width (ft)	Open	Open	Open
Apron height above MLW (ft)	12	12	12
Number of container cranes	0	1	0
Number of wharf cranes	0	0	0
Apron lighting	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No
Apron length served by rail (ft)	0	0	0

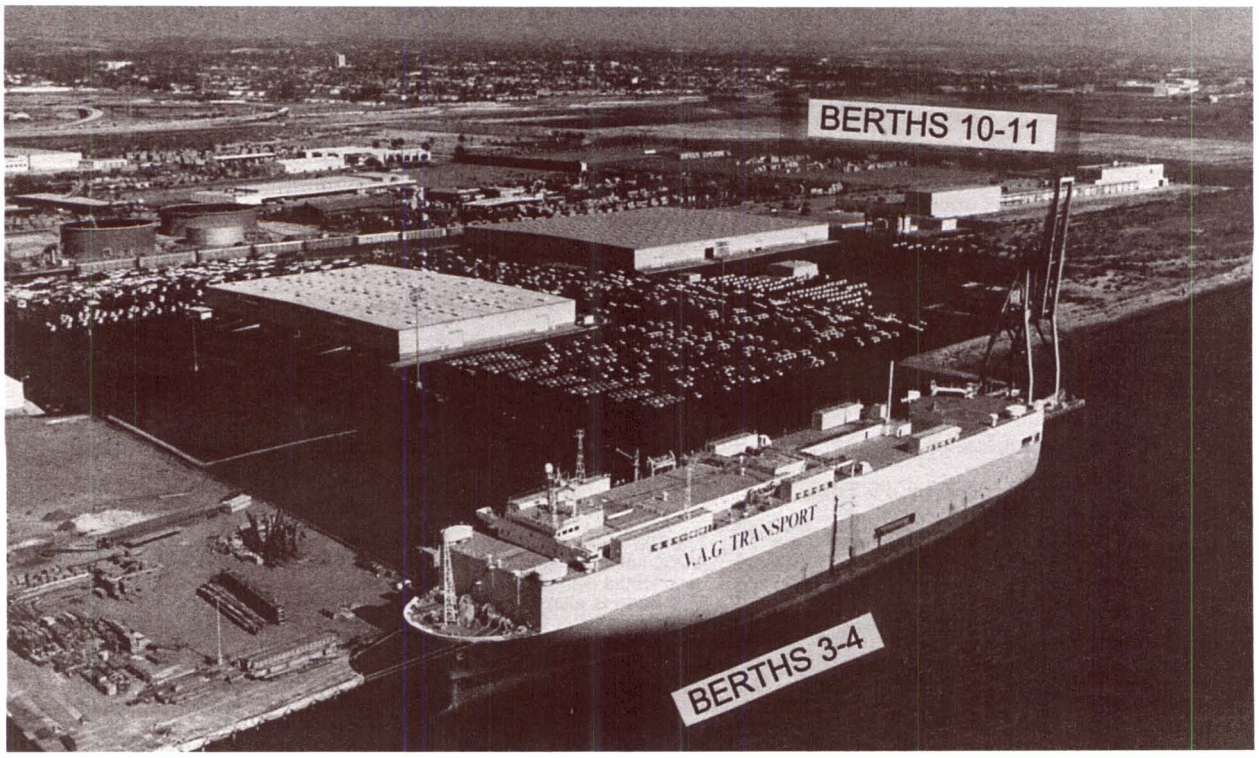


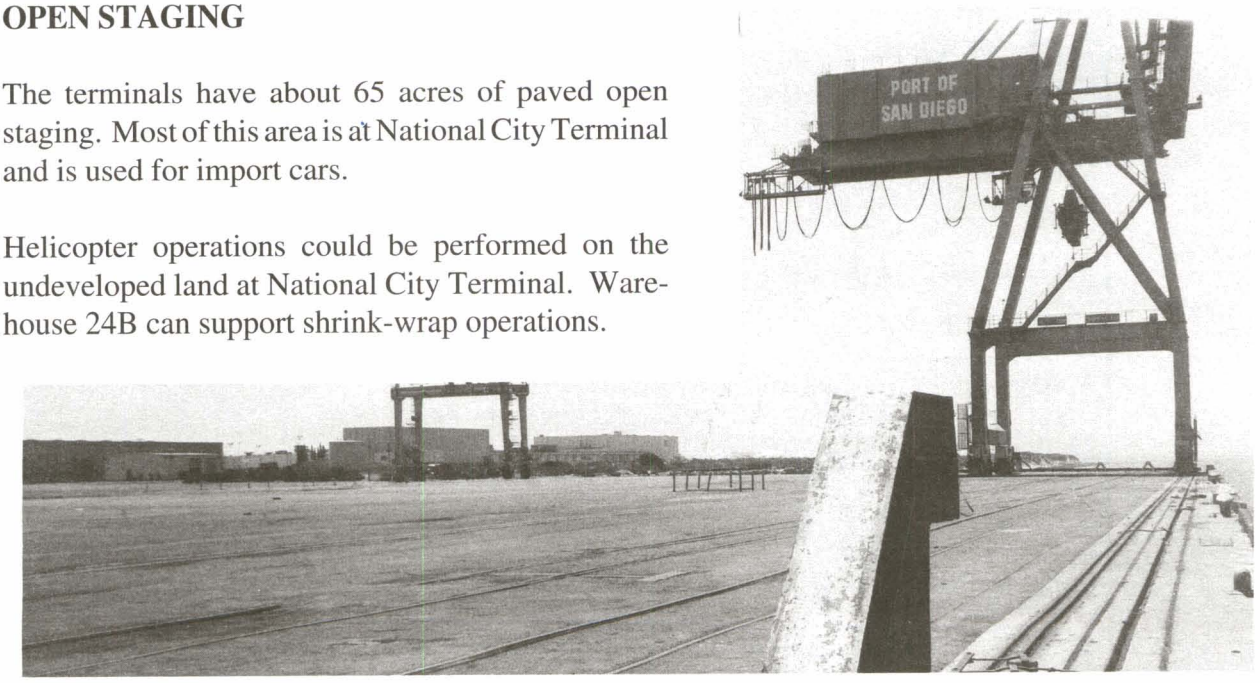
Figure 2. Aerial view of National City Terminal.

Staging

OPEN STAGING

The terminals have about 65 acres of paved open staging. Most of this area is at National City Terminal and is used for import cars.

Helicopter operations could be performed on the undeveloped land at National City Terminal. Warehouse 24B can support shrink-wrap operations.



Paved Open Storage at National City Terminal Berth 3-4 (Southward View)

COVERED STAGING

Each terminal has three covered storage buildings that could support military operations. The three buildings at 10th Avenue Terminal are much larger than those at National City Terminal. These six sheds cover more than a million square feet of space.

Covered Storage at 10th Avenue Terminal Berth 3-6 (Southeastward View)

Rail

Railyards on or near the terminals can store about 500 89-foot railcars. Most of this capability is at the 10th Avenue Terminal.

An automobile importer routinely performs bilevel operations at National City Terminal.

The port has no clearance problems.

APRON TRACKS

TERMINAL	BERTH
10th Ave	3-4
National City	2

PRIVATELY OWNED TRUCK SCALES

TERMINAL	SCALES
10th Ave	3
National City	1

Unloading/Loading Positions

RAMPS

Neither terminal has permanent rail or truck end ramps. Several locations exist that could support offloading with temporary or portable end ramps. Some locations block van and boxcar handling stations.

DOCKS

All six covered storage buildings have truck handling positions and platform-level tracks for boxcar operations. These tracks can handle about 65 boxcars.

Marshaling Areas

WITHIN PORT

No marshaling areas are available within the port area. All open areas within the port are required for staging military or commercial cargo.

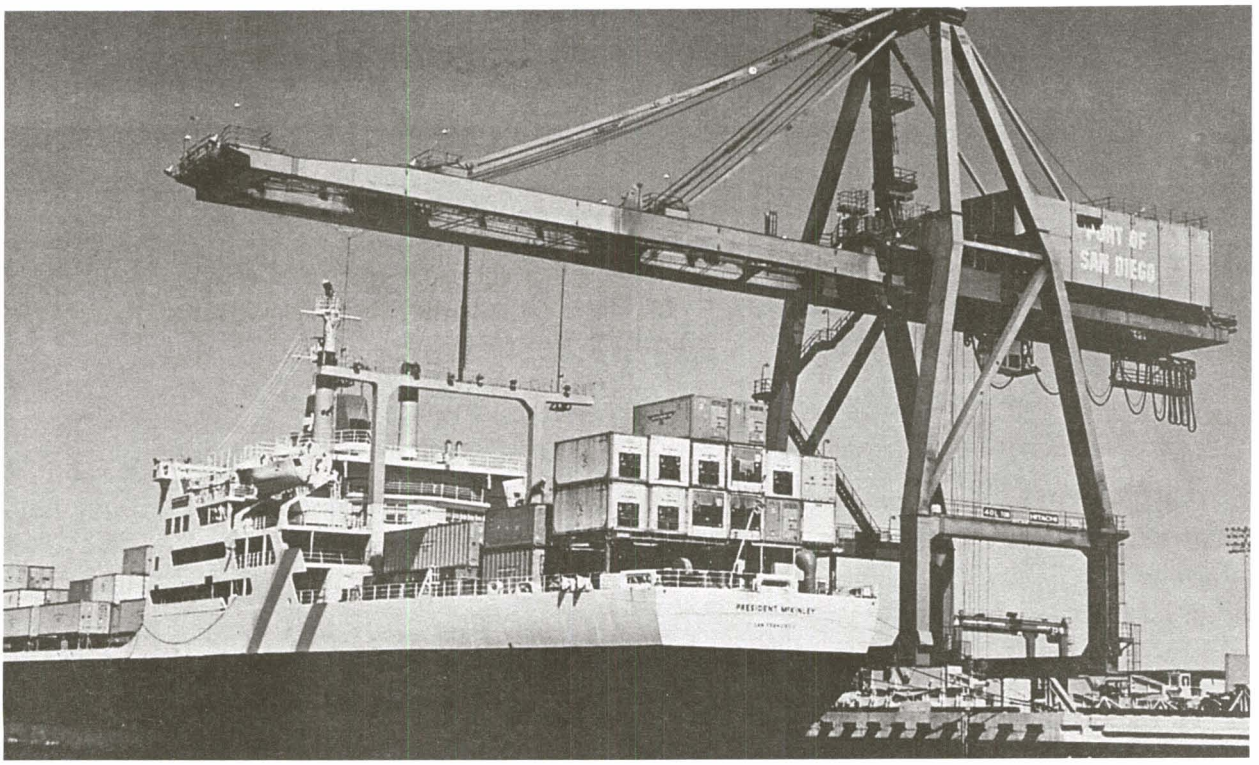
OFFSITE

San Diego is highly developed. No areas are near the port that could support marshaling. If deploying units need offsite marshaling, they should consider Naval Air Station, Miramar, about 15 miles north of the port. ATSF has a rail spur at the northern edge of the air station. It can support offloading of about 15 railcars.

MATERIALS HANDLING EQUIPMENT (MHE)

The port's only container crane is at berth 3-4 of National City Terminal. National City Terminal also has a transtainer to support container operations. Additional MHE and container handling equipment are available from local rental and stevedore companies. Equipment can also come from the Los Angeles area.

Forklift



Container Crane at National City Terminal

INTERMODAL FACILITIES

ATSF has intermodal railyards just outside 10th Avenue and National City Terminals. Other larger, intermodal railyards are in the Los Angeles or San Bernadino areas.

ATSF INTERMODAL YARD AT 10TH AVENUE TERMINAL

Storage	240	spots
MHE	1	transtainer
Throughput	100	lifts per day

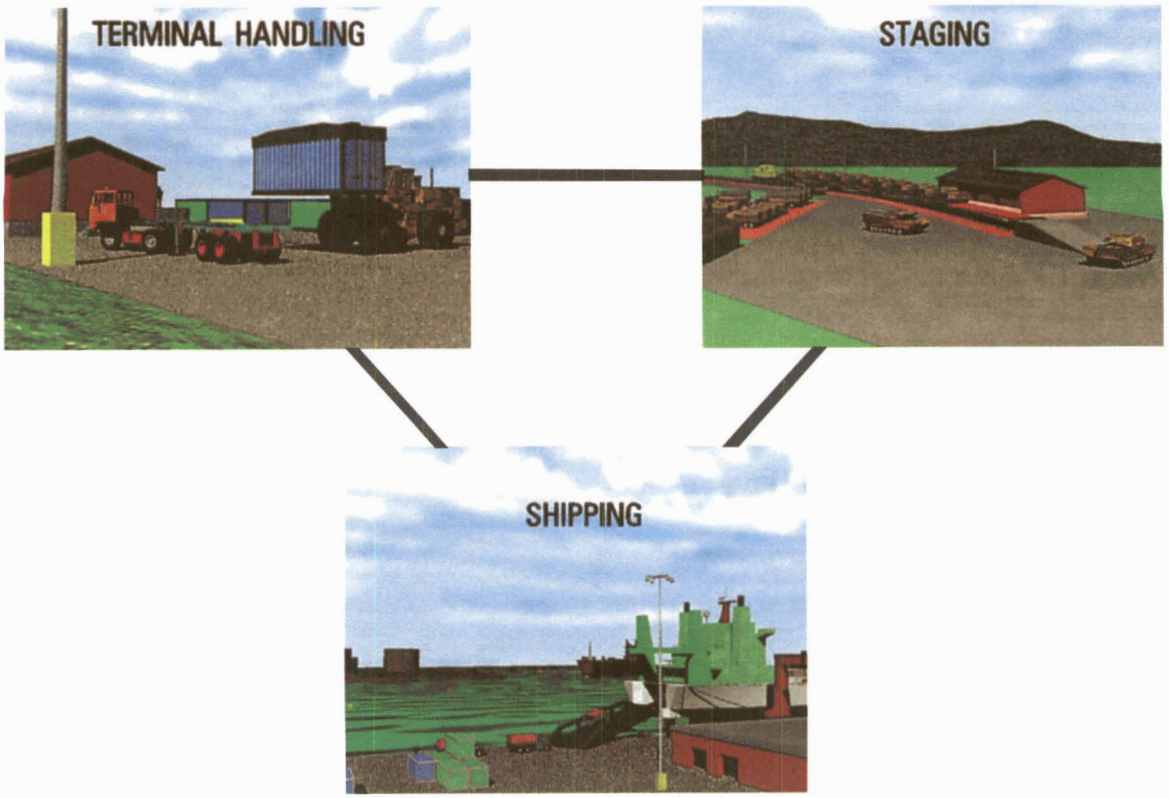
FUTURE DEVELOPMENT

The Port of San Diego expects to develop the 20 acres of unimproved land at National City Terminal. This area will be used for staging import POVs. The development might include an additional 500 feet of wharfage. No estimate of completion is available.

II. THROUGHPUT ANALYSIS

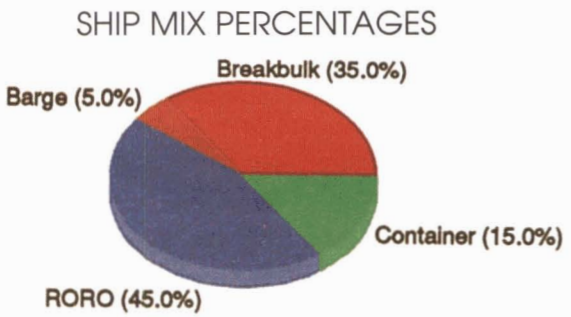
GENERAL

Using the port operational performance simulator (POPS) computer model, we evaluated the throughput capability of the Port of San Diego. The model is based on a weak-link analysis in which each subsystem is analyzed separately and then compared to find the least capable subsystem. The weakest subsystem defines the maximum throughput capability of the terminal. The model yields throughput capability values for three subsystems - shipping, staging, and terminal processing/ handling - in measurement tons (MTON) per day.



Terminal Throughput Subsystems

The analysis assumes that 80 percent of the port facilities will support military deployments. Also, the ship mix is based on Desert Shield and Desert Storm statistics. We weighted the percentages to adjust for differences in cargo deadweights and expectations for future deployments.



RECEPTION AND HANDLING

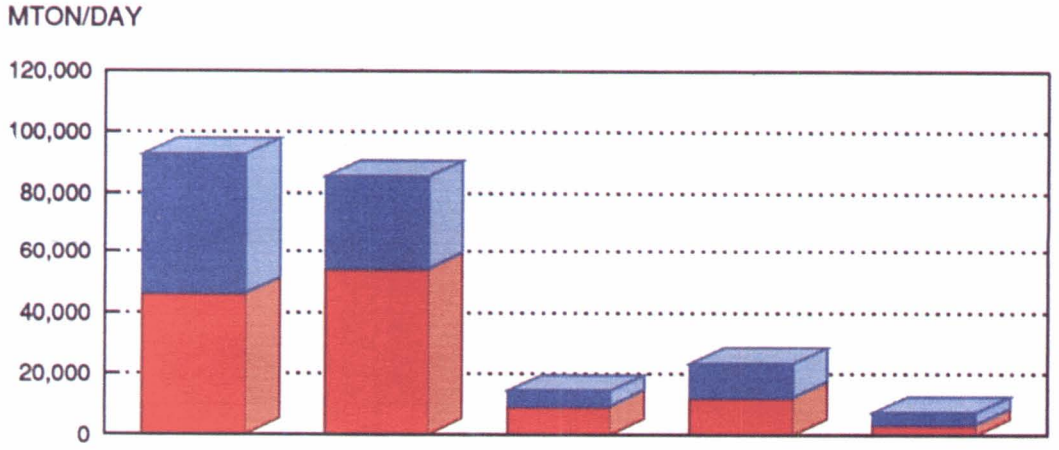
Highway

Interstate 5 provides access to both terminals. Each terminal has a designated entrance for trucks. The roads and gates leading into the terminals limit the highway reception to about 77,000 MTON of equipment and supplies per day.

Roadable vehicles in convoys will process directly to the staging areas. Vehicles on commercial or military flatbed trailers without integral ramps will offload at portable ramps. Neither terminal has permanent truck end ramps. Our analysis assumes one portable ramp is available at each terminal. These ramps could offload about 14,000 MTON of equipment from flatbed trailers per day.

Supplies in van semitrailers will proceed to the 52 van handling positions. These docks can offload about 23,000 MTON of van semitrailer-shipped materials per day. Containers on chassis will move to the staging areas. Two container handlers (one at each terminal) can offload about 7,400 MTON of cargo from chassis per day.

HIGHWAY RECEPTION/HANDLING CAPABILITY



SUBSYSTEMS	HIGHWAY	GATES	END RAMPS*	DOCKS	CONTAINERS
10TH AVENUE	46,400	54,300	9,600	12,500	3,700
NATIONAL CITY	46,400	31,100	4,800	10,800	3,700

*TWO PORTABLE END RAMPS ARE ASSUMED AVAILABLE

Rail

Only one major rail line serves the Port of San Diego. Railyards at or near the two terminals can hold about 500 railcars.

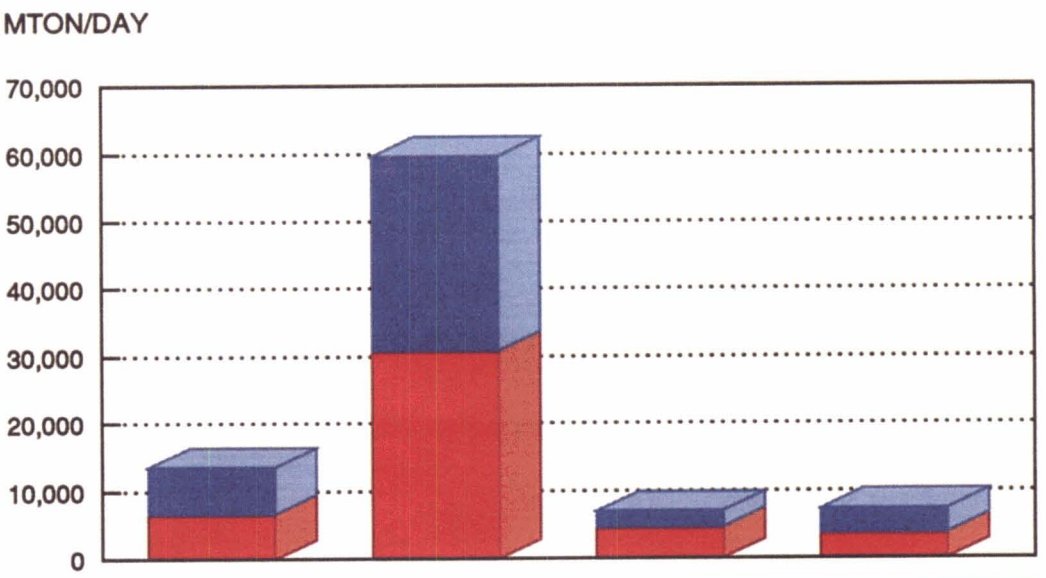
For this analysis, we assumed the ports or units can rent, build, or provide six portable rail end ramps. We also assumed one container handler will operate at each terminal.

RAIL DELIVERY

TERMINAL	TRAIN LENGTH	TRAINS PER DAY
10th Avenue	60	1
National City	60	1

Boxcars could offload at either terminal. The two terminals have about 65 boxcar handling positions.

RAIL RECEPTION/HANDLING CAPABILITY



SUBSYSTEMS	TRACKAGE	END RAMPS*	DOCKS	COFC
10TH AVENUE	6,700	30,800	4,600	3,700
NATIONAL CITY	6,900	28,800	2,400	3,700

*SIX PORTABLE END RAMPS ARE ASSUMED AVAILABLE

STAGING

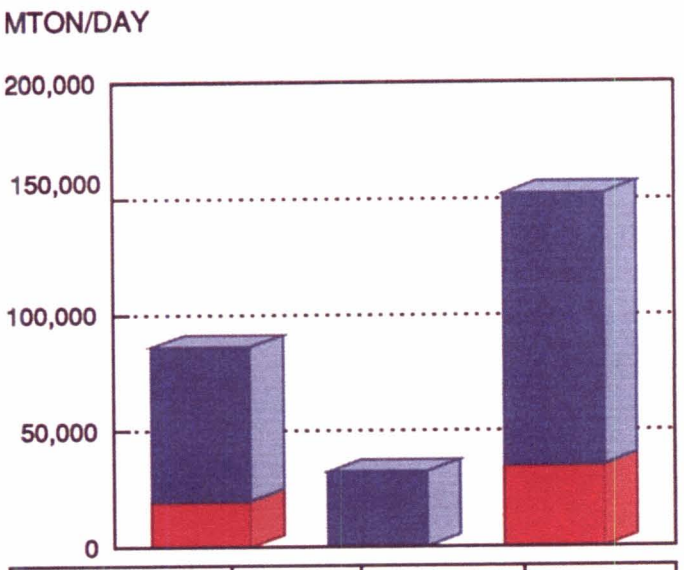
Together, the terminals have about 56 acres of paved open staging that could support military operations. Most of it is at the National City Terminal.

Together, the terminals have more than a million square feet of covered storage. Most of it is at the 10th Avenue Terminal.

SHIPPING

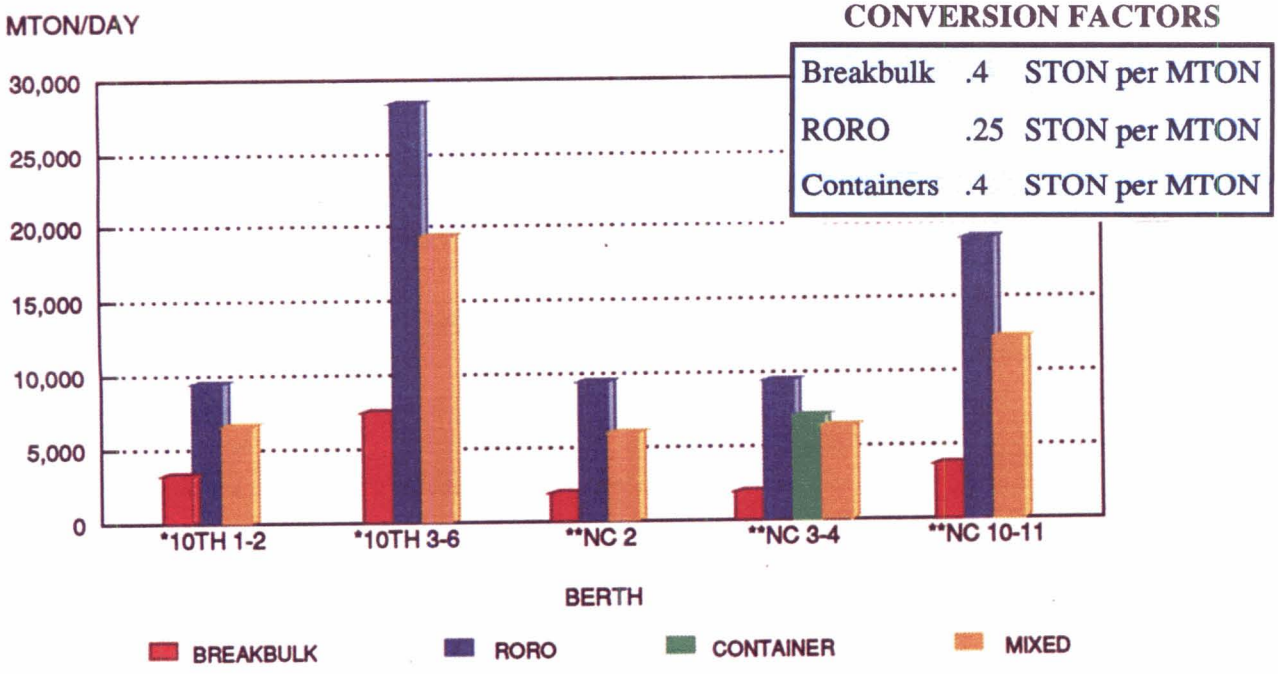
Throughputs for each berth are shown below. They are based on various factors, including MHE used; loading, operational, and berth usage rates; and berthing capabilities for various vessel types.

STAGING CAPABILITY



	VEHICLES	CONTAINERS	PALLETIZED
10TH AVENUE	19,900	0	35,000
NATIONAL CITY	66,400	32,200	117,100

BERTH THROUGHPUT CAPABILITY



CONVERSION FACTORS

Breakbulk	.4	STON per MTON
RORO	.25	STON per MTON
Containers	.4	STON per MTON

*10TH - 10TH AVENUE TERMINAL
**NC - NATIONAL CITY TERMINAL

The type of ship preferred at each berth is based on the methodology described in the appendix. The evaluation is based on a snapshot view of the current physical characteristics of the berths and the MHE available. The evaluation to the right gives no considerations for enhancements, such as equipment. The lower the number for a berth, the better the berth is suited for the loading operation.

PREFERENCE BERTH SELECTION

BERTH	BB	RORO	CONT
10th Avenue Terminal			
1-2	5	4	-
3-6	1	1	-
National City Terminal			
2	2	3	-
3-4	3	3	1
10-11	4	1	-

Legend:

BB - Breakbulk

RORO - Roll on/roll off

Cont - Container

SUMMARY OF BERTHING CAPABILITIES OF TENTH AVENUE TERMINAL

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

SUMMARY OF BERTHING CAPABILITIES OF NATIONAL CITY TERMINAL

VESSEL	BERTHS 2	3-4	10-11
Breakbulk			
C3-S-33a	1	1	2
C3-S-37c	1	1	2
C3-S-37d	1	1	2
C3-S-37a	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	c	1	1
LASH C9-S-81d	a,c	a	a
LASH lighter	5	7	10
SEABEE C8-S-82a	a,c	a	a
SEABEE barge	3	5	7
RORO			
Comet	d,i,j	d,i,j	d,i,j
C7-S-95a/Maine-class	c	1	1
Ponce-class	h	h	h
Great Land-class	c,h	h	h
Cygnus/Pilot-class	1	1	2
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	c	1	1
Cape D-class	i,j	i,j	i,j
Cape H-class	a,c	1	1
Container			
C6-S-1w	1,e	1	2,e
C7-S-68e	1,e	1	2,e
C8-S-85c	c,e	1	1,e
Combination			
C5-S-78a	1,e	1	2,e
C5-S-37e	1,e	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
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i = insufficient ramp clearance at low tide
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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

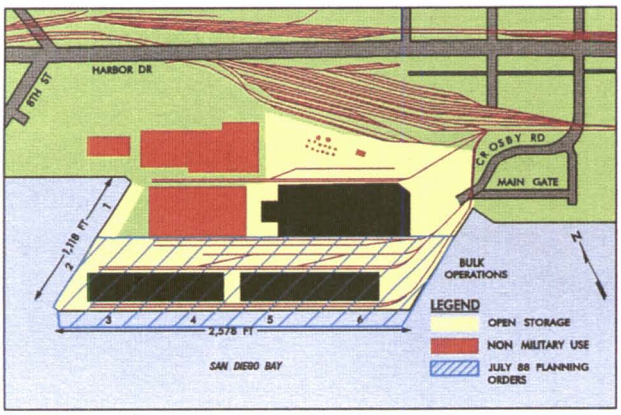
Note: Ramp clearance and ramp angle based on maximum vessel draft.

III. APPLICATION

GENERAL

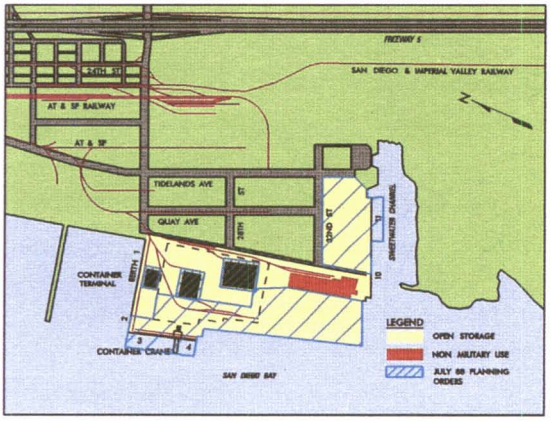
In this section, we evaluate the port's throughput capability for deploying a notional mechanized infantry division mainly by FSS vessels. The MARAD *Planning Orders Digest* provides agreements for military use of the Port of San Diego. The upcoming revision will likely provide for additional open staging area, but less covered staging area. This analysis uses the facilities that are expected to be in the next *Planning Orders Digest*.

TENTH AVENUE



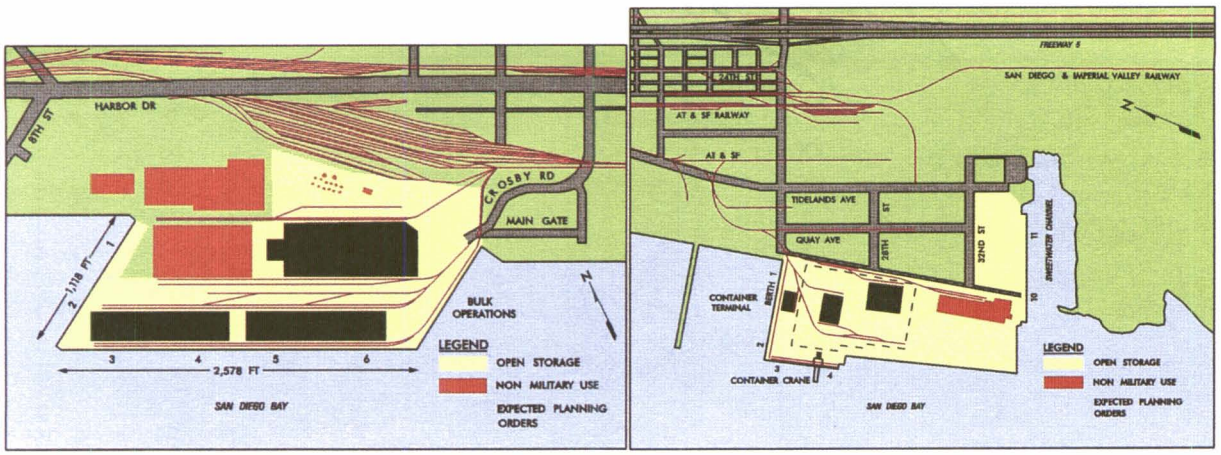
Covered: 424,000 sq ft
Open: 8 acres

NATIONAL CITY



Covered: 330,000 sq ft
Open: 50 acres

Facilities in the July 1988 *Planning Orders Digest*



Covered: 120,000 sq ft
Open: 15 acres

Covered: 180,000 sq ft
Open: 50 acres

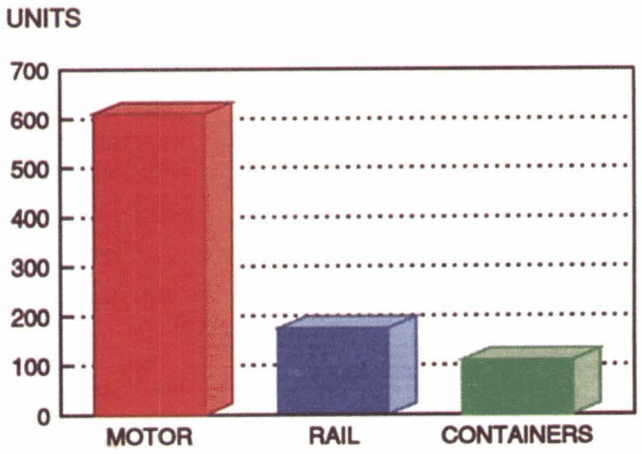
Facilities Expected in the next Revision of the *Planning Orders Digest*

REQUIREMENTS

MECHANIZED INFANTRY DIVISION

Total Equipment	
Volume	274,518 MTON
Weight	95,010 STON
Area	1,422,844 SQ FT
Vehicles	7,800
Containers (20 ft)	660

DAILY REQUIREMENTS



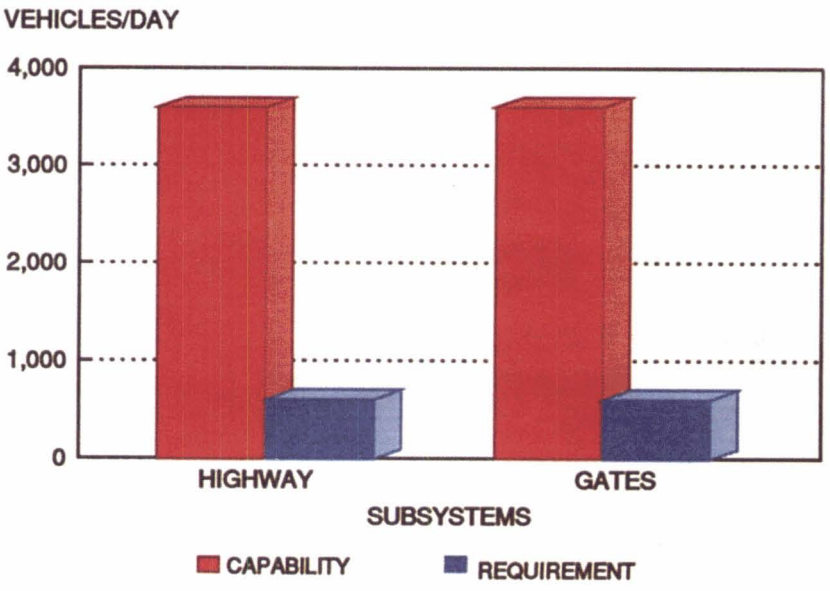
The likely requirement for the Port of San Diego is to deploy a notional mechanized infantry division in 6 days of reception and throughput. The division has to move about 7,800 vehicles and 660 containers. The movement to the port will require 1,055 (176 per day) railcars, using the convoy and rail option. Under this option, about 3,650 (610 per day) roadable vehicles would be driven, and about 2,320 (387 per day) would be towed.

TERMINAL HANDLING

Highway

Vehicles and containers on chassis would enter the terminals through the gates. The gate for the 10th Avenue Terminal has two lanes. The gate for the National City Terminal has only one lane. These gates can handle an additional 3,600 vehicles per day.

HIGHWAY INPROCESSING CAPABILITY



Rail

Each terminal can receive about 60 railcars of military equipment per day, without disrupting the simultaneous commercial business within the area. This reception is insufficient to meet the requirement.

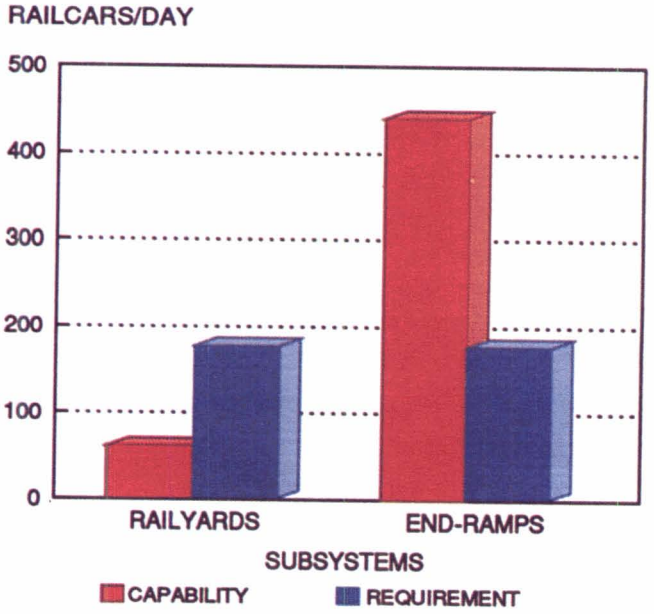
Trackage at the terminals can support offloading about 110 railcars at a time. This will allow for about 440 railcars per day. This offloading capability meets the requirement.

STAGING

This analysis assumes that the current downsizing will continue and nine FSS-sized ships will deploy an entire notional mechanized infantry division. Three ships will depart every 2 days. Because of this, the staging requirement is to support three sustained loading operations. Although an FSS load of cargo can be staged and loaded on 10 acres, 16 acres are required for sustained loading operations. Of these 16 acres, about 2 are required for staging the 73 containers for each FSS. Thus, the three simultaneous shiploading operations will require 48 acres of open staging, of which about 6 acres are dedicated to containers.

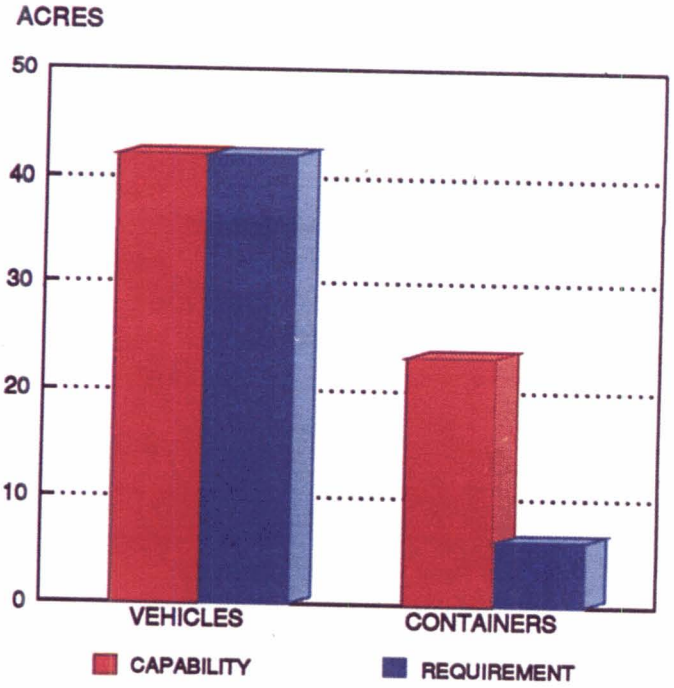
The terminals have 65 acres available, including grass and unimproved land. Although shiploads may be broken into separate areas, this is enough staging area for the deployment.

RAIL INPROCESSING AND HANDLING CAPABILITY*



*ASSUMES SIX PORTABLE END RAMPS ARE MADE AVAILABLE.

OPEN STAGING CAPABILITY



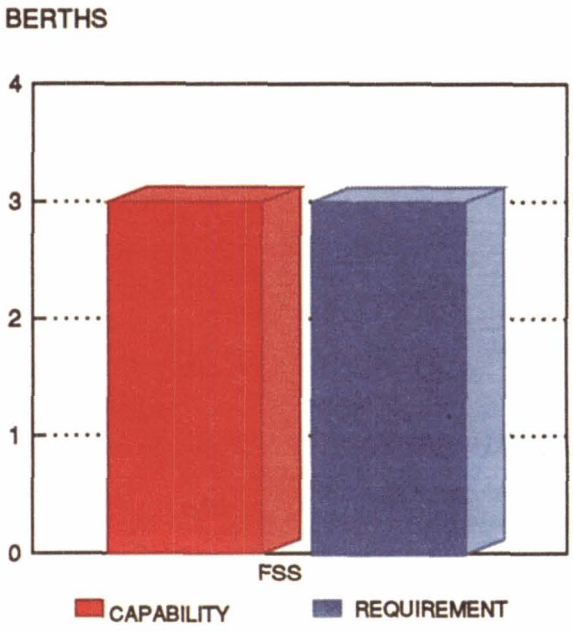
SHIPPING

Although this analysis assumes that nine FSS-sized ships can deploy the notional mechanized infantry division, the table below provides ship quantities for the current division size. The number of ships required depends on the shipping mix selected. The best ship mix would consist of all eight FSS ships, plus two Cape H RORO ships.

Two FSS's can berth at berth 3-6 of the 10th Avenue Terminal. This report assumes only one will berth there. This will allow its ramp to lie between the two sheds, for easier RORO loading.

Two more FSS's can berth at berths 3-4 and 11 of National City Terminal. The capability to berth three FSS's meets the requirement.

FSS SHIPPING CAPABILITY



UNIT MOVEMENT REQUIREMENTS
MECHANIZED DIVISION

LOADING CONDITION/ SAMPLE SHIP MIX	*VESSEL TYPES*			
	FSS (RORO/COMB)	**CAPE H (RORO/COMB)**	**C3/C4 (BREAKBULK)**	**C6/C7/C8 (CONTAINER)**
Minimum Containerization				
All FSS*	8.00	1.90		
FSS and Cape H	6.64	3.00		
All Breakbulk			37.70	
Maximum Containerization				
FSS and Container	7.90			2.00
FSS, Cape H, and Container	4.62	3.00		2.00
Breakbulk and Container			29.58	2.00

*Only 8 FSSs are available. Unit shipping requirements exceed the capacity of these 8 vessels. Other vessel types are required to make up the FSS shortfall (Cape H).

Legend:

RORO - roll on/roll off

FSS - fast sealift ship

Source: MTMCTEA Report OA 90-4f-22, Deployment Planning Guide, Aug 91.

SUMMARY

The two terminals together have adequate open storage and berthing to support the deployment of the division. The rail service, however, cannot support the deployment.

RECOMMENDATION

We recommend deploying a larger percentage of the equipment by highway. This will prevent the need for offsite rail offloading facilities.

SEATTLE

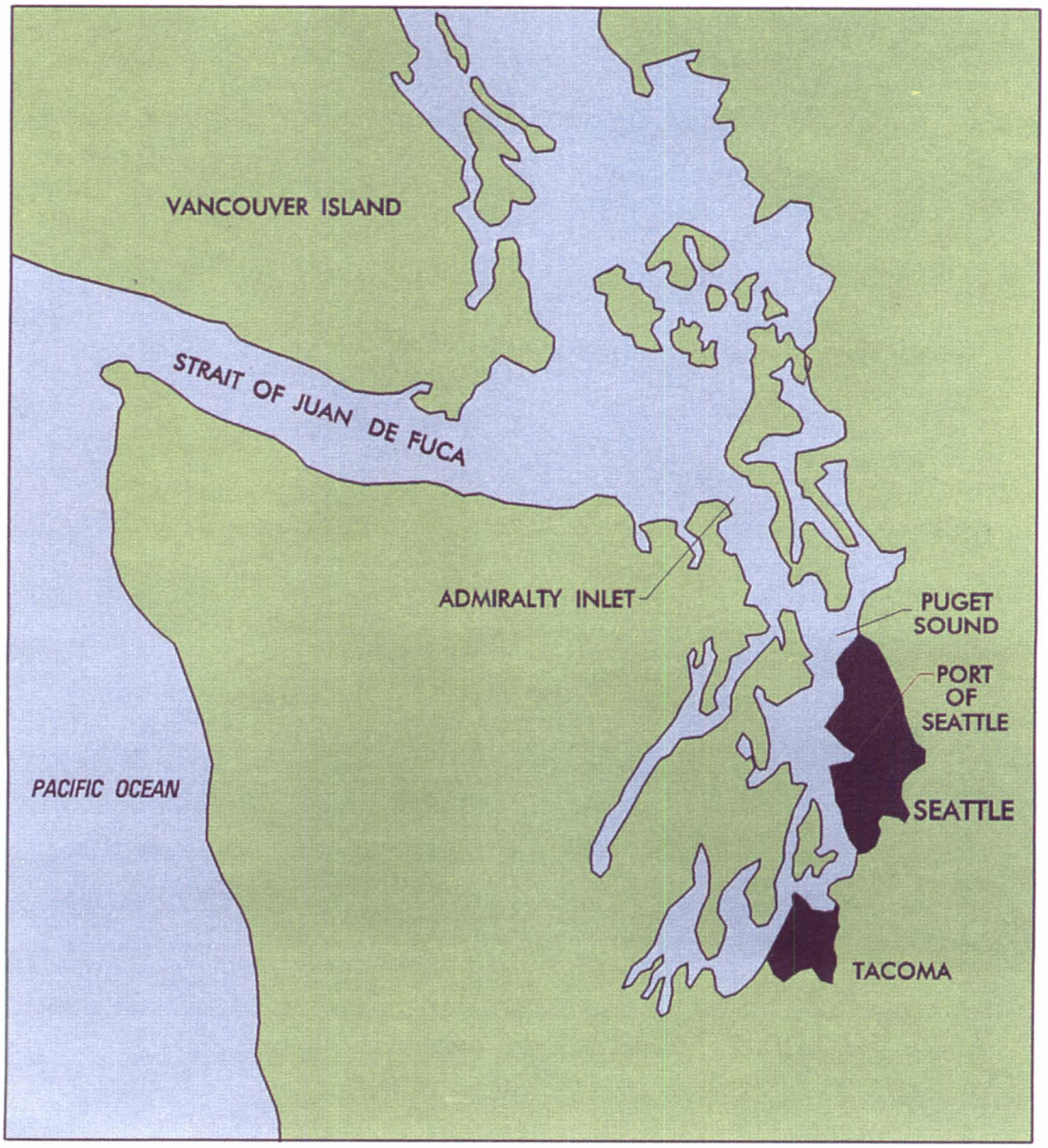
PORT OF SEATTLE
SEATTLE, WASHINGTON

I. GENERAL DATA

TRANSPORTATION ACCESS

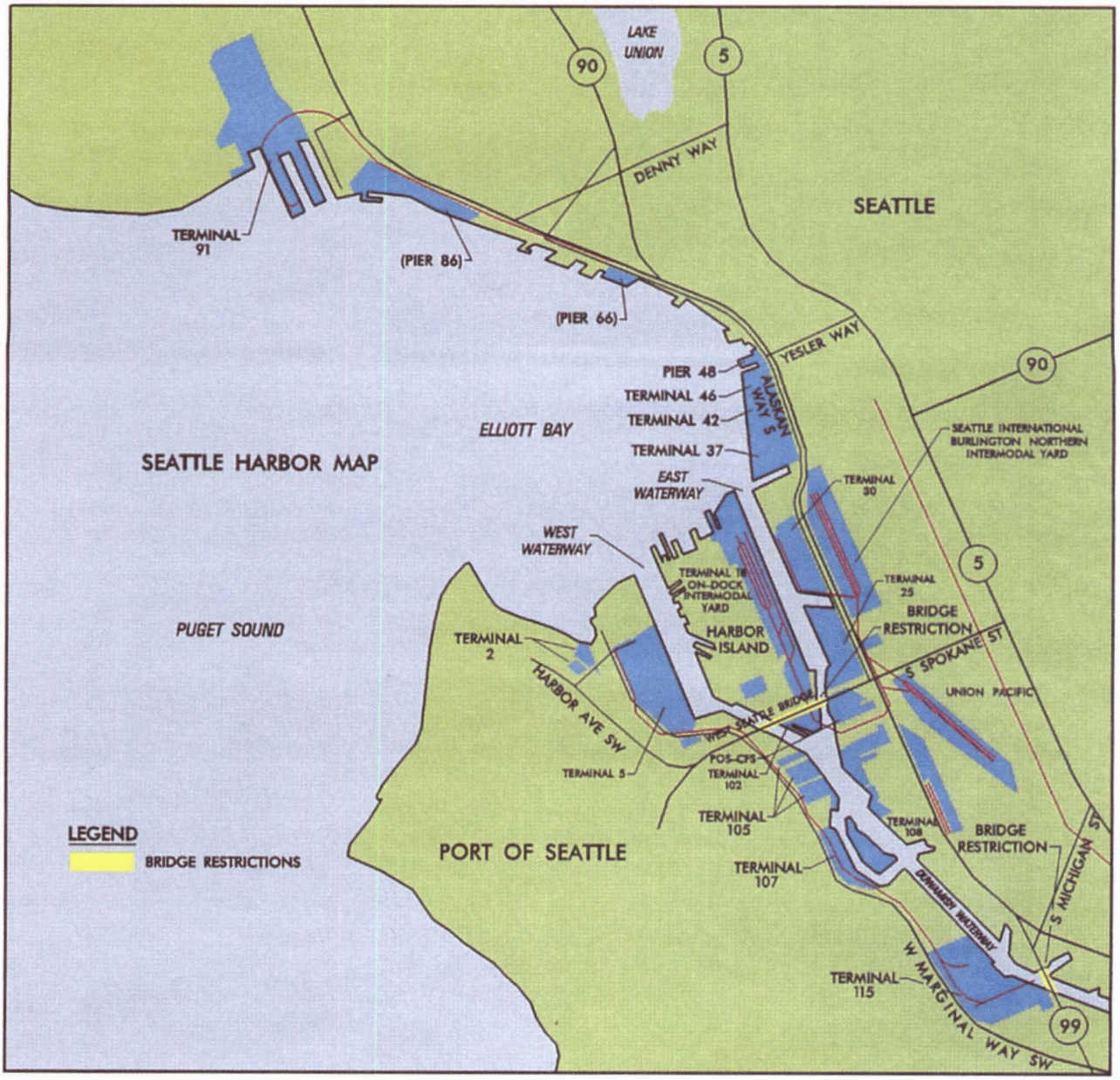
Water

The Port of Seattle is in northwest Washington state on Puget Sound. Ships may access this port from the Pacific Ocean via Strait of Juan de Fuca, Admiralty Inlet, and Puget Sound. The Port of Seattle is 124 nautical miles from the Pacific Ocean.



Water Access

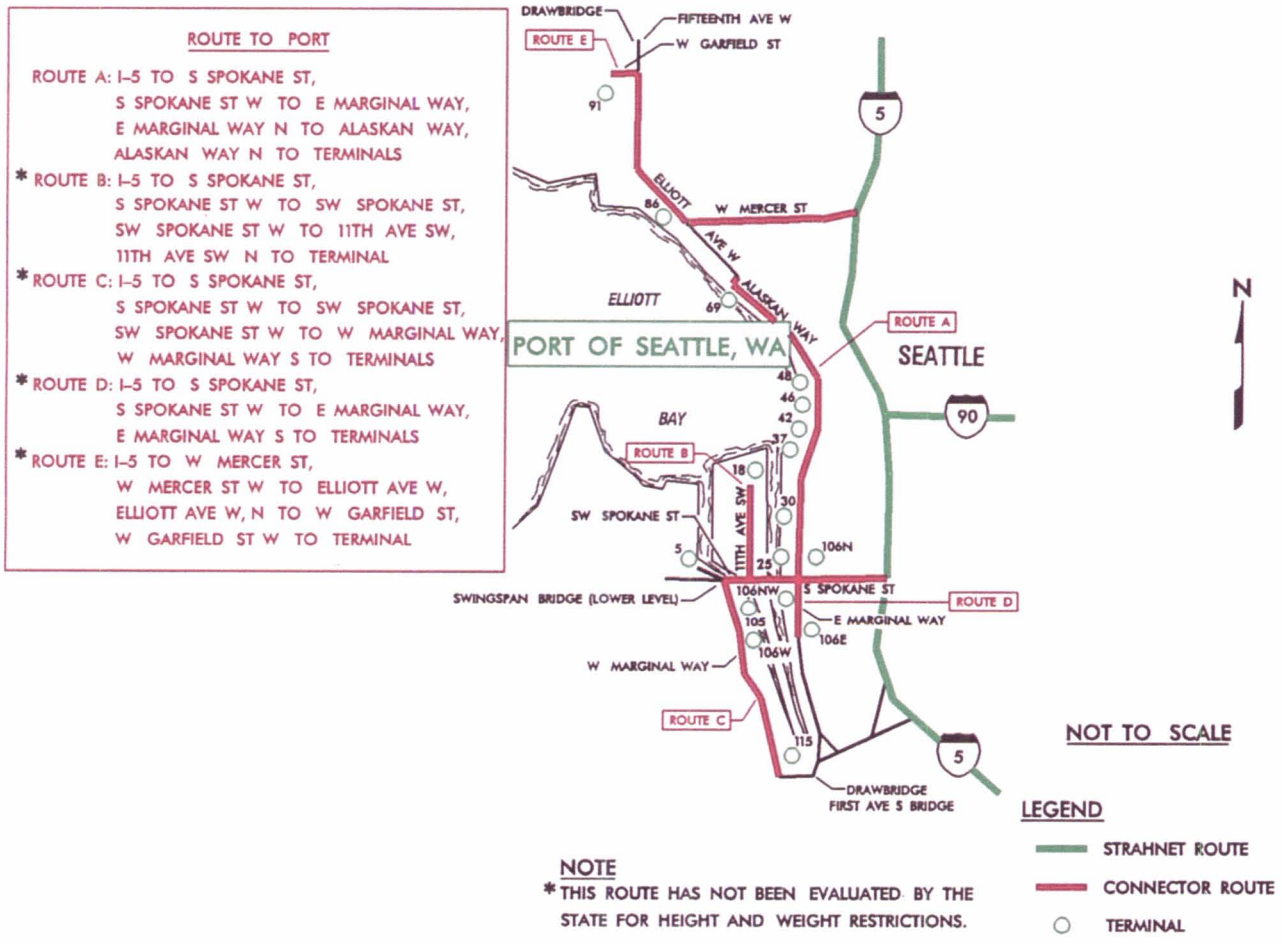
The Port of Seattle has three bridge restrictions on the Duwamish Waterway, with 142 feet mean high water (MHW) vertical clearance and 145 feet horizontal clearance being the critical dimensions.



Water Access Restrictions

Highway

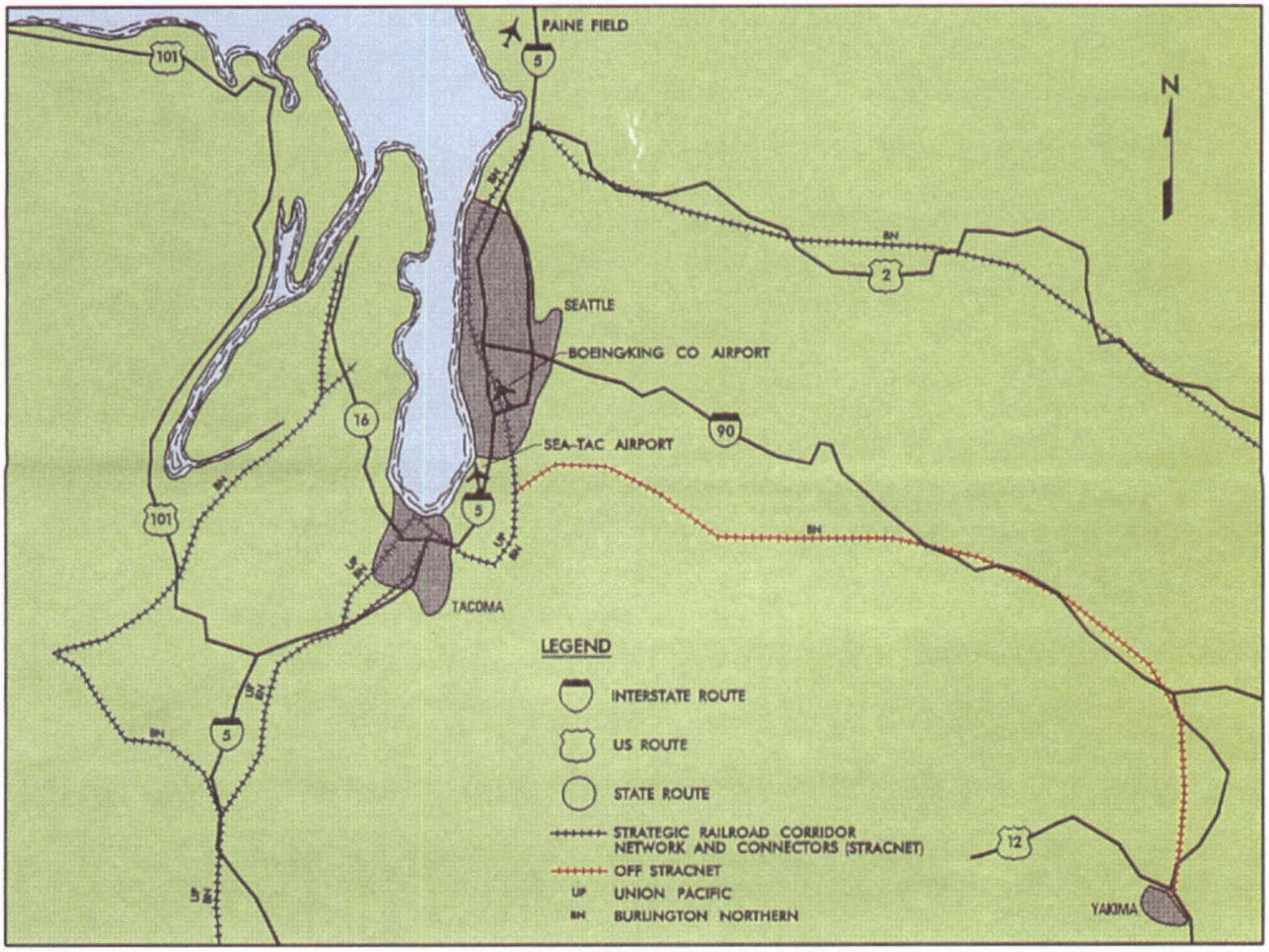
The Strategic Highway Corridor Network (STRAHNET) routes to the Port of Seattle are Interstate Routes 5 and 90. The connector routes to the Port of Seattle are S and SW Spokane Street, E and W Marginal Way, 11th Avenue SW, Alaskan Way, Elliott Avenue W, W Mercer Street, and W Garfield Street. The only highway restrictions are three bridges, which could cause traffic delays when opened for ships. These bridges are First Avenue South Bridge (near Terminal 115), Fifteenth Avenue West Bridge (near Terminal 91), and the low level bridge on SW Spokane Street (near Terminal 5). Traffic can still access Terminal 5 via the high-rise bridge on SW Spokane Street when the low-level swing-span is open.



Highway Access

Rail

The Burlington Northern (BN) and Union Pacific (UP) railroads serve the Port of Seattle. Both railroads have railyards near the port. Rail clearances are sufficient for bilevel and trilevel railcars to access the port.



Rail and Airport Access

Airports

Two commercial airfields and one military airfield are near the Port of Seattle. The following chart provides information on these airfields. (See the Rail and Airport Access Map on the previous page for locations of these airfields.)

AIRFIELDS NEAR SEATTLE

NAME	TYPE	NO. OF RUNWAYS	LONGEST RUNWAY DIM (ft)	DISTANCE FROM PORT (mi)
Sea-Tac	Commercial	2	11,900 x 150	13
Boeing/ King Co	Commercial	2	10,000 x 200	4
Paine Field	Military	4	9,010 x 150	15

PORT FACILITIES

Berthing

The Port of Seattle is a multicargo operation port with a specialization in shipping containers. The port consists of marginal wharves and finger piers. Pier construction varies from terminal to terminal, but generally involves concrete or timber piles, concrete or timber decking, and asphalt, concrete, or timber surfacing. Lighting is good for night operations.

Figure 1 is a land-use map for the Port of Seattle. Figures 2 through 7 are aerial views of the Port of Seattle. These figures include tables identifying berth characteristics.

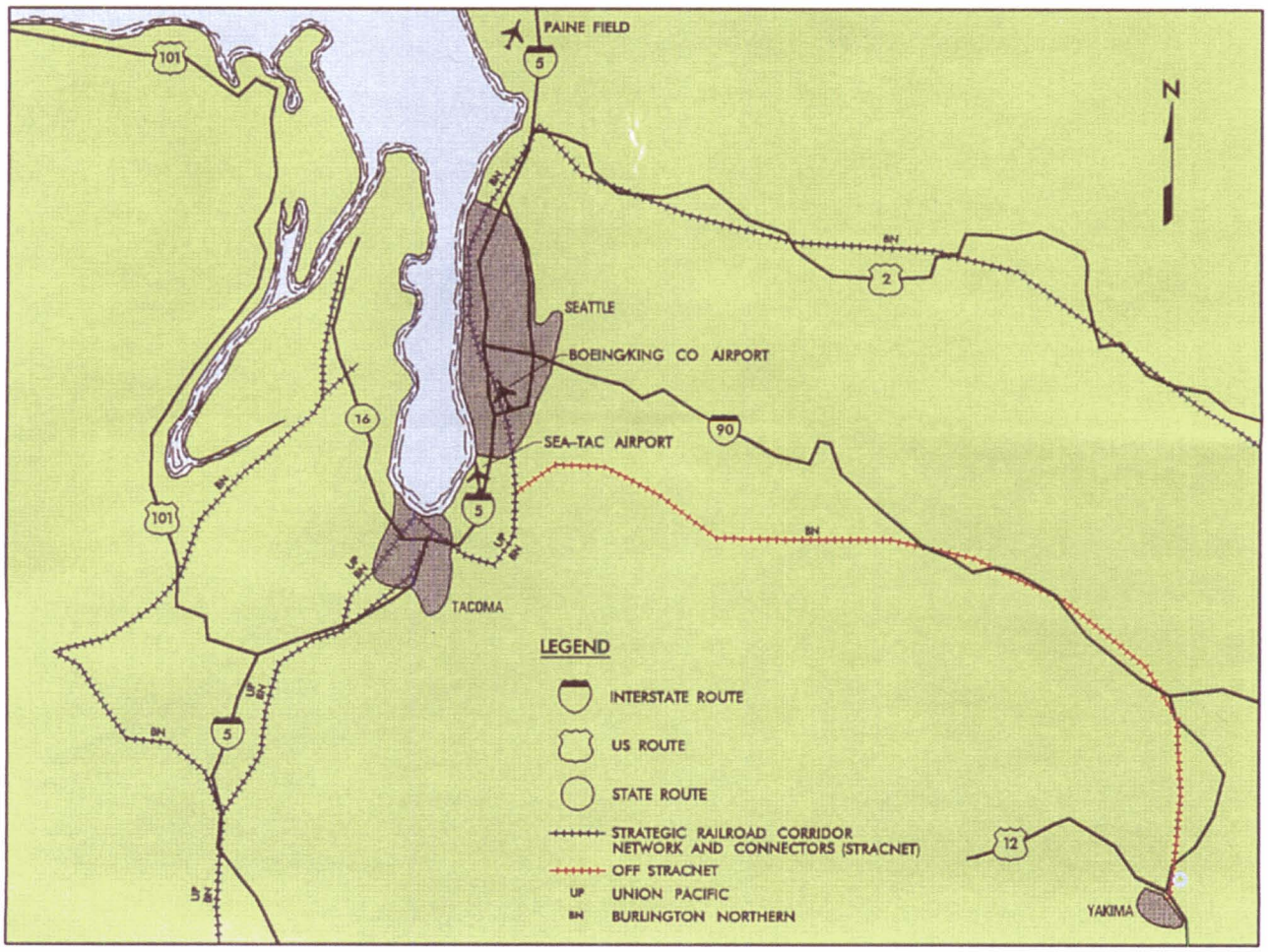
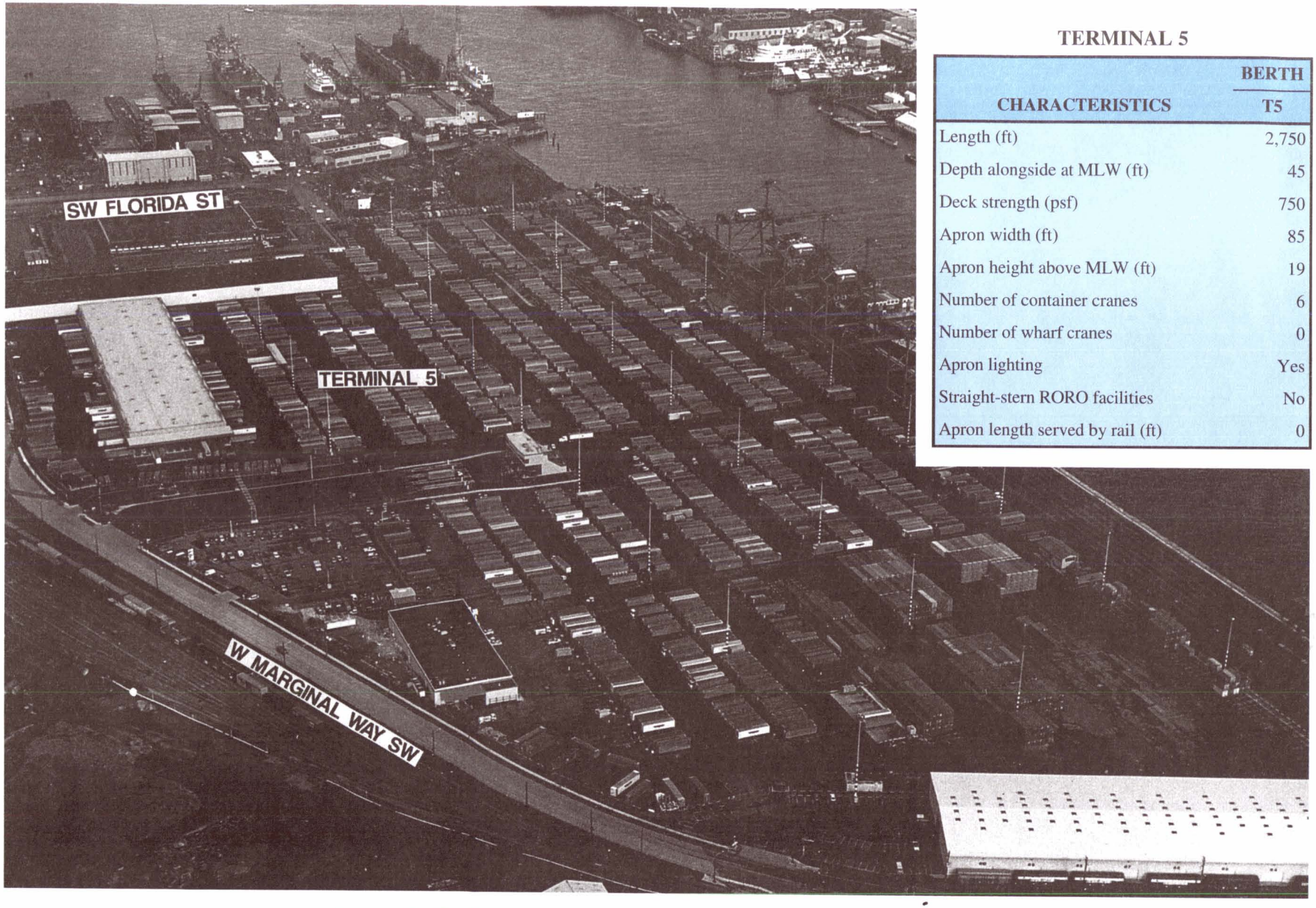


Figure 1. Land-use map.

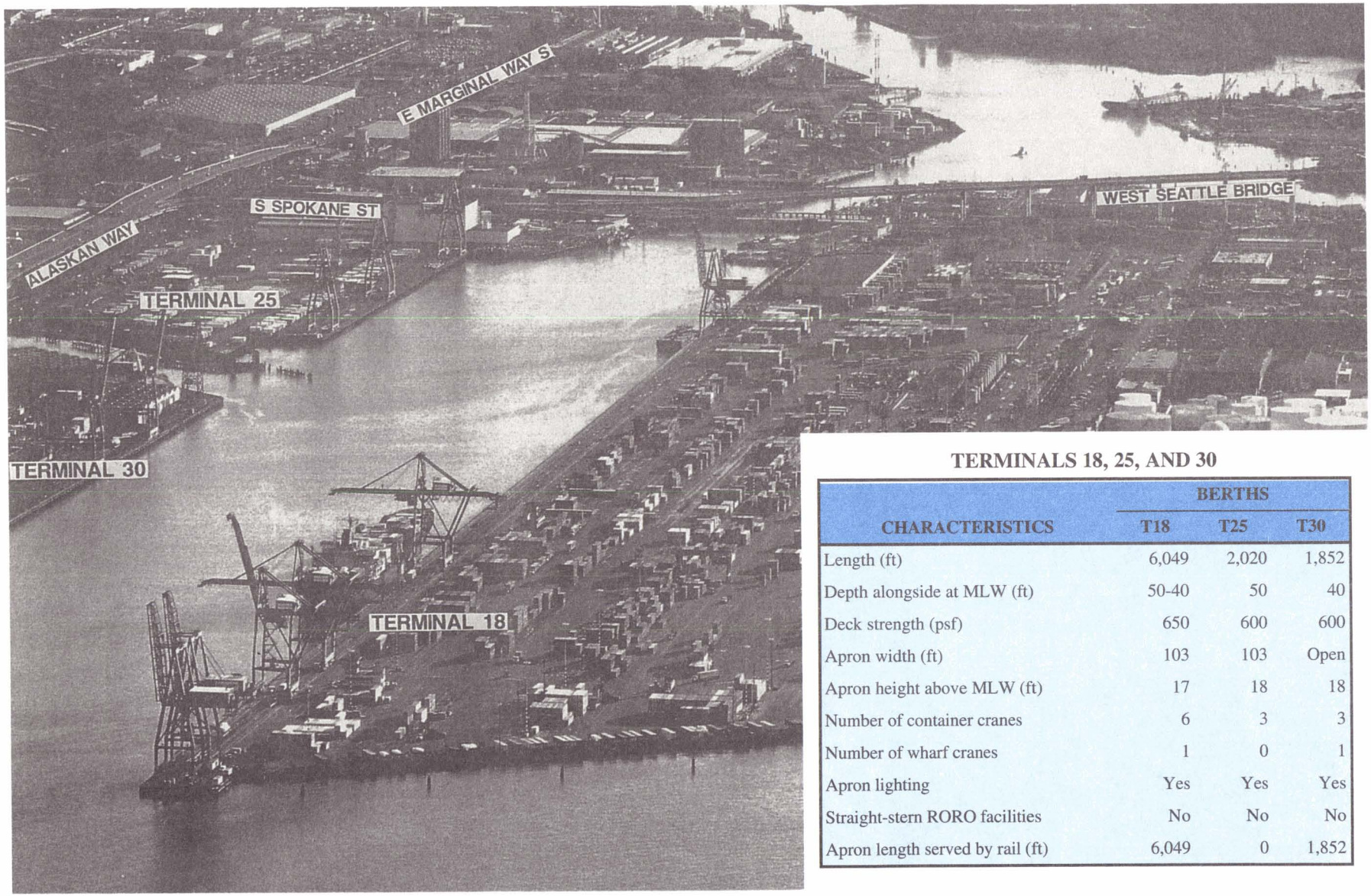
Figure 2. Terminal facilities for Port of Seattle.



TERMINAL 5

CHARACTERISTICS	BERTH T5
Length (ft)	2,750
Depth alongside at MLW (ft)	45
Deck strength (psf)	750
Apron width (ft)	85
Apron height above MLW (ft)	19
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

Figure 3. Berth characteristics for Terminal 5 (northeastward view).



TERMINALS 18, 25, AND 30

CHARACTERISTICS	BERTHS		
	T18	T25	T30
Length (ft)	6,049	2,020	1,852
Depth alongside at MLW (ft)	50-40	50	40
Deck strength (psf)	650	600	600
Apron width (ft)	103	103	Open
Apron height above MLW (ft)	17	18	18
Number of container cranes	6	3	3
Number of wharf cranes	1	0	1
Apron lighting	Yes	Yes	Yes
Straight-stern RORO facilities	No	No	No
Apron length served by rail (ft)	6,049	0	1,852

Figure 4. Berth characteristics of Terminals 18, 25, and 30 (southeastward view).