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# Port Planning for Intermodal Growth

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## INTRODUCTION

The double-stack "revolution" in intermodal container traffic has been widely proclaimed. Whether or not it is a true revolution, it has focused attention on the tremendous growth in ocean-to-rail intermodal traffic, and presented ports with a new and vital planning issue. Ports compete vigorously for discretionary intermodal cargo. As the intermodal volume builds, the costs and delays in ocean-to-rail container transfer come under closer scrutiny. Port planning formerly ended at the marine terminal gate: now it must extend to the rail container transfer facility.

Ports throughout the U.S., and particularly those on the West Coast, are taking a hard look at ways to improve the ocean-to-rail transfer, with "on-dock" facilities being the leading choice in many cases.[1] Yet on-dock facilities are not panaceas, and their development raises a number of serious operational and organizational issues. The handling of domestic container traffic is one potential stumbling block.

The discussion presented in this paper was occasioned by an intermodal planning effort at the Port of Oakland, and draws heavily on that specific situation to illustrate issues that confront all container ports. The analysis begins with a look at potential intermodal growth, with special attention given to the role of domestic container traffic.

The analysis goes on to examine in some detail the operational issues posed by the mix of double-stack and conventional intermodal traffic at port-area rail facilities, and the planning choices that face the Port of Oakland.

### Current Port Intermodal Trade

*Rail Volumes.* Precise data on existing and potential intermodal traffic are not publicly available. Estimates and intermodal volume, and to examine the potential upper bound of growth beyond the baseline. For historical rail data, the primary source is the ICC *Carload Waybill Sample* (CWS), a statistical sample of railroad movements. Table 1 presents the 1986 CWS results for San Francisco Bay Area container traffic to and from the local (west of the Rockies) and "Overland Common Point" (east of the Rockies) regions. As Table 1 shows, the vast majority of rail intermodal movements are to and from the Overland Common Point (OCP) region. The local region is served primarily by truck. Table 1 also shows that the Bay Area has a *westbound* excess. This is consistent with Oakland's historical role as an export port, and with "last-port-of-call" ship rotation.

Because OCP traffic dominates rail intermodal movements, and Asian trade dominates intermodal traffic, the OCP traffic shares for Asian traffic at the three West Coast port regions were used to establish the current traffic mix for West Coast port regions. Table 2 gives the 1986 and 1987 (9 months) local and OCP shares. The OCP region has apparently accounted for a large part of Oakland's recent traffic growth. At San Francisco, OCP recent traffic accounts for a smaller but rising share. Los Angeles and Long Beach, due to their enormous local market, have a smaller OCP share (although a larger total). Data from Seattle and Tacoma suggest that the export and import situations are very different there, and that the local market for imports may be growing faster than the OCP market.

*Baseline Cargo Forecast.* Using the 1987 OCP shares of Oakland's traffic—52 percent for exports, 45 percent for imports—we can estimate the OCP share, and thus the most likely rail intermodal component, of Bay Area cargo projections. Table 3 is derived from a baseline containerizable cargo forecast prepared for the revised *Bay Area Seaport Plan.*[2] It estimates potential rail movements using the 1987 OCP shares and a conversion factor of 1.7 TEU per rail movement, reflecting the predominance of 40-foot units. The annual growth rates implied in Table 3 are roughly 4 percent for imports and 6 percent for exports. The *potential* rail movements estimated for 1987 in Table 3 are higher than the actual movements estimated from the Carload Waybill Sample, as expected. Some OCP movements are made by truck, and others are made on chassis and may appear as "trailers" in the rail data. Table 3 can be considered a *baseline* projection of potential inter-

**TABLE 1**

**1986 Bay Area (Oakland/SF) Rail Container Traffic**

Number of Containers

| Local | OCP | Total | Loads |
|---|---|---|---|
| Eastbound | 3,714 | 37,402 | 41,116 |
| Westbound | 7,032 | 51,432 | 58,464 |
| Subtotal | 10,746 | 88,834 | 99,580 |
| Empties | | | |
| Eastbound | — | — | — |
| Westbound | 240 | 2,484 | 2,724 |
| Subtotal | 240 | 2,484 | 2,724 |
| TOTAL | 10,986 | 91,318 | 102,304 |

Source: 1986 ICC *Carload Waybill Sample* modal volume, assuming that Oakland maintains its existing OCP share.

*Implications of the Westbound Imbalance.* Table 1 showed a 1986 westbound imbalance of 20,072 containers, of which 2,724 were empties. This imbalance can be used as an initial approximation of *potential* domestic eastbound movements. This is a *very* rough estimate, since there is no requirement for eastbound and westbound container counts to match. Table 3 shows that the *projected* westbound imbalances are substantial, and that the more rapid growth of exports increases the imbalance over time.

In Southern California, the strong *eastbound* import imbalance implies a large market for westbound domestic backhauls. The 1986 rail data show a 2.2-to-1 eastbound imbalance for Southern California rail container movements, despite the fact that roughly 10,000 containers returned empty. The situation in the Bay Area differs, since the westbound movement of empties presents only a small potential for westbound domestic backhaul. For 1986, the rail data identify some 2,700 empty westbound movements, less than ten per day.

*Effect of New First-Call Vessels.* A major goal of intermodal port planning is to attract fourth-generation, first-port-of-call vessels. Oakland's export imbalance is due in part to its historic position as last port of call in transpacific vessel rotations. If Oakland becomes the first port of call, it will handle more of the discretionary imports now moving through Southern California and the Pacific Northwest. Potential volume increases due to new first-port-of-call ships are shown in Table 4.

The implications for Oakland's overall directional balance depend on assumptions regarding the rotation and loading of those vessels. If the new ships were operated as shuttles between Oakland and Asia, making no other West Coast calls, their eastbound and westbound cargoes would likely balance. This would initially tend to increase Oakland's container traffic without major changes in the imbalances shown in Table 3. As more of Oakland's traffic was carried in such services, some movement towards an overall import/export balance would be likely.

If instead the ships are assumed to call first at Oakland, and then at either the Pacific Northwest or Southern California ports, the effect would be to reverse the historic port roles, bring more imports to Oakland, and shift some of the present Oakland exports to the north or south. The westbound imbalances shown in Table 3 would be reduced. If enough cargo were shifted, the imbalances might be reversed, creating an Oakland market for westbound domestic backhauls.

**TABLE 2**

**Local and OCP Traffic Shares for West Coast Port Regions**

| | | Local** Share | OCP Share |
|---|---|---|---|
| Oakland | | | |
| 1986 | Exports | 63 | 37 |
| | Imports | 66 | 34 |
| 1987* | Exports | 48 | 52 |
| | Imports | 55 | 45 |
| San Francisco | | | |
| 1986 | Exports | 73 | 27 |
| | Imports | 70 | 30 |
| 1987* | Exports | 67 | 33 |
| | Imports | 63 | 37 |
| Los Angeles/Long Beach | | | |
| 1986 | Exports | 67 | 33 |
| | Imports | 67 | 33 |
| 1987* | Exports | 63 | 37 |
| | Imports | 56 | 44 |
| Seattle/Tacoma | | | |
| 1986 | Exports | 73 | 27 |
| | Imports | 38 | 62 |
| 1987* | Exports | 72 | 28 |
| | Imports | 54 | 46 |

* 9 months.
** Includes AZ, CA, ID, MT, NV, OR, UT, WA, WY.
Source: PIERS data provided by the Port of Oakland.

**TABLE 3**

**SF Bay Area Containerizable Cargo Forecast Potential Rail Intermodal Units***

| | 1987** | 1990 | 1995 | 2000 |
|---|---|---|---|---|
| Imports | 65,831 | 69,503 | 86,170 | 103,705 |
| Exports | 79,996 | 113,794 | 182,167 | 244,276 |
| Total | 145,827 | 183,297 | 268,337 | 347,981 |
| Westbound Imbalance | 14,165 | 44,291 | 95,997 | 140,571 |

Source: Manalytics/WEFA *Bay Area Cargo Forecast*, 1988
* Assumptions—45 percent of imports and 52 percent of exports are OCP traffic by rail.
—1.7 TEU = one rail unit.
** Estimated

**TABLE 4**

**Potential Oakland Rail Intermodal Volumes From Fourth-Generation, First-Call Vessel Deployment**

| | New Vessel Calls Per Week 1 | 2 | 4 |
|---|---|---|---|
| Vessel Capacity—TEU | 3,900 | 7,800 | 15,600 |
| Percent Unloaded | 85 | 80 | 70 |
| Percent Rail Intermodal | 81 | 80 | 73 |
| Eastbound Rail—TEU | 2,685 | 4,992 | 7,972 |
| Eastbound Rail Import Units* | 1,580 | 2,936 | 4,689 |
| Westbound Rail Export Units** | 585 | 1,087 | 1,737 |

* At 1.7 TEU per unit.
** Assuming a 2.7-to-1 import/export ratio.

Source: Estimates compiled by Vickerman-Zachary-Miller for the Port of Oakland.

The Carload Waybill Sample was used to compile a regional breakdown of Southern California and Pacific Northwest rail container traffic. A weighted average of the Southern California and Pacific Northwest OCP figures yielded a 2.7-to-1 import imbalance, which can be used to represent the likely balance of containers in a reverse-rotation scenario. Table 5 shows the implications of the assumptions in Table 4 for the total rail traffic generated by the Port of Oakland. The weekly figures in Table 5 assume that new vessel calls would exhibit the 2.7-to-1 import/export ratio discussed above. Other services exhibit a 1-to-1.4 import/export ratio derived from Oakland's 1987 traffic data. Not all traffic on the new vessels is diverted from Southern California or the Pacific Northwest; some is assumed to be diverted from other Oakland services.

A comparison of Tables 4 and 5 reveals that, under a reverse-port-rotation scenario, the deployment of new ships would reverse the existing Oakland imbalance and create an annual eastbound imbalance, with the attendant potential for westbound domestic traffic.

Statistical tables sometimes obscure a vital point: traffic growth is a function of carrier policy decisions as well as underlying economic growth. In making statistical projections we usually take for granted that the actions of one or two decision-makers will not substantially alter trends established by the multitude. This is not so in ocean-rail intermodal traffic, where on the West Coast there are perhaps six major ocean carriers and four railroads. The bottom half of Table 5 shows what can happen when one or more "megacarriers" (such as APL, Sea-Land, Maersk, or "K" Line) changes their own vessel rotation and cargo routing policies.

In either growth path there will be a large increase in rail intermodal volumes. If the import and export volumes are balanced with domestic movements (eastbound in one scenario, westbound in the other), 25–30 percent of the port-generated traffic will be domestic. Even without port-

**TABLE 5**

**Total Port of Oakland Rail Intermodal Volume Under a Reverse-Rotation Scenario**

| | New Vessel Calls Per Week 1 | 2 | 4 |
|---|---|---|---|
| **Eastbound Rail Units** | | | |
| From New Vessels* | 1,580 | 2,936 | 4,689 |
| From Other Services** | 1,298 | 1,154 | 1,003 |
| Subtotal | 2,878 | 4,090 | 5,692 |
| **Westbound Rail Units** | | | |
| From New Vessels* | 585 | 1,087 | 1,737 |
| From Other Services** | 1,817 | 1,615 | 1,405 |
| Subtotal | 2,402 | 2,702 | 3,142 |
| **Total** | | | |
| From All Services | 5,280 | 6,792 | 8,834 |
| Weekly Imbalance | 476 EB | 1,388 EB | 2,550 EB |

* At a 2.7-to-1 import/export ratio.
** At a 1-to-1.4 import/export ratio.
Source: Estimates compiled by Vickerman-Zachary-Miller for the Port of Oakland.

generated domestic traffic, existing facilities will be strained in the near future. Yet additional *capacity* is not enough. To attract and hold first-port-of-call vessels, the Port must offer *efficient* transfer.

*Additional Domestic Containerization*. Additional *domestic* container traffic can and will come from domestic containerization, beyond that generated by backhaul solicitation. Indeed, the leading carrier of domestic container freight, American President Domestic, initially established its Oakland double-stack trains to serve the eastbound domestic market. There are two prime sources for domestic container traffic that can be easily identified: rail piggyback traffic in trailers, and rail carload traffic in boxcars. Implicit in this view is the generally, but not perfectly accurate assumption that freight that moved in one kind of box can be readily moved in another.[3] The potential for rail containerization of truckload freight is essentially unlimited, and inestimable.

As shown in Table 6, CWS piggyback data for the Bay Area indicate a strong westbound imbalance in local traffic and a significant eastbound imbalance in OCP traffic. Since there appears to be a 20,000–24,000 unit westbound OCP imbalance for containers, the 11,346 unit eastbound trailer imbalance seems a prime candidate for containerization *if* empty containers were provided in Oakland. The right half of Table 6 shows estimated container counts for the trailer volumes. These estimates use average trailer loadings observed in the Carload Waybill Sample, and must be considered as general indicators of magnitude rather than precise estimates. Comparing Table 6 with Table 1, it is apparent that containerization of current piggyback could double the volume of containers moving through Bay Area rail facilities. It must be remembered, however, that the number of *lifts* at those facilities would increase only to the extent that more containers than trailers are needed to carry the same freight.

Table 6 also presents data on boxcar traffic, which shows a large westbound imbalance. Boxcars frequently return empty, however, so the eastbound movements may be containerizable even if it exacerbates the westbound surplus. In rough magnitude, containerization of boxcar movements could nearly equal the existing container traffic, adding still more to the potential burden on rail container transfer facilities.

Space in well-developed ports is scarce, and port authorities would naturally prefer to see it devoted to maritime business. But can we create port-area rail container transfer facilities—on-dock or otherwise—that handle only maritime business? Would such facilities be efficient from the railroad's point of view? Where and how would maritime and domestic traffic be segregated? For insight into these issues, we must delve into railroad intermodal operations.

## Ocean Carrier Rail Traffic Profiles

The necessary intermodal throughput capacity depends upon the traffic *profile*, as well as the overall volume. Westbound containers arrive in an uneven stream over the entire week preceding a ship call, culminating perhaps in the arrival of a dedicated double-stack train just before the ship. The high-priority containers moving eastbound will be transferred immediately to an empty double-stack train, while other eastbound traffic will be stretched out over several shifts or even days.

Containers from a single large ocean carrier such as APL or Sea-Land will be split among these categories, in descending order of priority:

- Ocean carrier (MLB, IPI) traffic to or from major hubs (Chicago, Kansas City) via dedicated double-stack trains.
- Ocean carrier (MLB, IPI) traffic to or from major or secondary hubs via common-user or regular intermodal trains, including overflow from dedicated trains.
- Third-party traffic to major hubs or secondary points moving on common-user regular intermodal trains (with or without chassis). The rail facility handling of these three categories may be radically different. The rail carrier does not consider the third category to be "maritime" traffic at all, since the rail customer is a shipper or third party. To the extent that containers are returned empty, yet another category must be added.

Where does domestic container traffic fit in the list? On days when no ship is in port, westbound domestic loads may have priority, followed by westbound empties to be positioned for eastbound loads. Westbound exports will have lower priority, since they must await the ship arrival a day or more later. Eastbound domestic loads may be available in small number during the week (not being tied to ship arrival). On dedicated trains, the railroad may not know what is domestic and what is international, since all containers are travelling under the ocean carrier's contract. They will therefore be treated alike. On common-user trains, domestic containers could be travelling under ocean carrier, third-party, or railroad bills of lading (under a capacity buy-back arrangement). The extent to which the railroad can segregate domestic traffic will therefore depend on information from its customers, and by extension on the customer's interest in having them segregated.

## Transfer Facility Operations

*Existing Operations: Drayage and Gates*. Intermodal transfer in Oakland currently depends on drayage, as it does at the great majority of ports nationwide. Draymen using over-the-road tractors pick up containers on chassis in the marine terminals and move them to the rail transfer facilities. It is necessary to use a road-equipped and licensed tractor for drayage over public streets. Because the drayman takes possession of the container, no matter how briefly, the transfers include inspection of the container and completion of an Equipment Interchange Report (EIR). Two interchange inspections and documentation are needed for an eastbound container: one exiting the marine terminal gate, and one entering the rail facility gate (vice versa for a westbound). The distances between facilities in Oakland are short, so a substantial portion of the time and cost entailed in drayage is due to these gate functions.

**TABLE 6**

**Potential Bay Area Domestic Container Traffic: 1986 Piggyback and Carload Freight**

| | Loaded Trailers | | | Estimated Containers | | |
|---|---|---|---|---|---|---|
| | Local | OCP | Total | Local | OCP | Total |
| Eastbound | 4,920 | 86,906 | 91,826 | 5,256 | 112,420 | 117,676 |
| Westbound | 10,600 | 75,560 | 86,160 | 10,600 | 75,560 | 86,160 |
| Total | 15,520 | 162,466 | 177,986 | 15,856 | 187,980 | 203,836 |

Conversions: EB Local—12.5 net tons/trailer—11.7 net tons/container
EB OCP—14.1 net tons/trailer—10.9 net tons/container
WB Local—7.0 net tons/trailer—7.0 net tons/container*
WB OCP—7.4 net tons/trailer—7.4 net tons/container*

* Assuming that trailers were cube-limited, and that high cube containers could replace trailers one-for-one at best.

| | Carload-Short Tons** | | | Estimated Containers | | |
|---|---|---|---|---|---|---|
| | Local | OCP | Total | Local | OCP | Total |
| Eastbound | 247,140 | 675,372 | 922,512 | 21,123 | 61,961 | 83,084 |
| Westbound | 902,920 | 987,352 | 1,890,272 | 97,088 | 81,599 | 178,688 |
| Total | 1,150,060 | 1,662,724 | 2,812,784 | 118,211 | 143,560 | 261,771 |

** All boxcar and refrigerated boxcar movements except grain, fresh fruit, and fresh vegetables.

Conversions: EB Local—11.7 net tons/container
EB OCP—10.9 net tons/container
WB Local—9.3 net tons/container
WB OCP—12.1 net tons/container

Source: ICC 1986 *Carload Waybill Sample*

The use of over-the-road tractors, the change of possession, and the time-consuming gate functions are major factors in the cost of intermodal transfer. The reduction or elimination of these cost factors should be a major goal in port plans for intermodal traffic. Possible approaches include the establishment of on-dock transfers, or the use of organizational and informational strategies to streamline transfer between existing facilities.

*Rail Transfer Efficiency.* Three basic principles govern the efficiency of intermodal facility operations:

1. Maximize lift equipment productivity.
2. Minimize railcar movements.
3. Minimize trailer, chassis, and container movements.

For maximum lift machine productivity, each machine should have a steady stream of equipment to be moved with minimal disruptions to the lift cycle. This may be accomplished by staging containers ahead of the lift machine, or by waiting until there is a large enough backlog of containers to keep the lift machine busy for an extended period.

There are three reasons to minimize movements of railcars. First, moving the cars incurs labor and switch engine costs. Second, moving the cars interrupts loading or unloading. Third, moving the cars disrupts other rail or road movements in the vicinity. But there is a trade-off between railcar movements and throughput capacity. If eastbound loads are not immediately available for a recently emptied train, the train will tie up capacity if it is not moved. Trackage in the container transfer facility itself is generally too valuable to use for railcar storage. Because there *will* be a need for short-term car storage, provisions must be made for a railcar buffer as well as a container and chassis buffer. Minimizing railcar movements also leads railroads to favor long, unbroken trackage, which may be difficult to attain in crowded ports.

The operating costs of an intermodal transfer facility depend largely on the number of times a container or chassis must be moved in the transfer process. The more often each unit is moved, the more labor and moving/lifting equipment must be provided. Ideally, there would be no containers on the ground at the rail yard. A driver would arrive with an eastbound container or chassis, drive directly to a train slot, wait momentarily while the container was transferred, move the empty chassis to receive a westbound container, and depart. This kind of non-stop operation requires either very good organization, management, and communication, or a significant amount of slack in the operation. The waiting time of draymen and the handling of containers can be minimized through random access. Yet random access may require lift equipment to follow the drayman to the waiting train slot, and then to the waiting westbound load. Such a procedure minimizes drayage cost and storage needs, but at increased labor and lift equipment cost.

It is not likely that such efficiency can be achieved for domestic containers, or for containers moving in either direction under shipper or third party bills of lading. Westbound domestic containers moving under steamship line auspices may be co-mingled with westbound export containers on either dedicated or common-user trains, according to the steamship line's preferences. Eastbound domestic containers (a significant volume of traffic from Oakland, and a growth area for the future) are difficult to organize. The railroad's own container movements will be well organized westbound, but spread out eastbound. The efficiency with which they can be handled depends on whether the railroad or another party is arranging drayage, since that determines the railroad's control over handling and the number of parties that need to be notified and organized.

## Complexity and Flexibility

The central message of this discussion is the need for flexibility. It is tempting to base preliminary facility designs on simple assumptions regarding the relationship between ships and trains. An on-dock facility that handled only dedicated unit trains and containers in well-organized shipload lots could achieve a very high throughput, if the real world worked that way. But for all the reasons above, the real world does *not* work that way.

Even if a port-area facility could be devoted exclusively to maritime traffic, the complexity of that traffic alone may force planners away from single-purpose designs, and force them to dedicate precious acreage to the storage areas and buffer zones needed to cope with that complexity. Recognizing that some domestic container traffic will be irretrievably mixed with maritime traffic, at least for the foreseeable future, provision must be made to handle such traffic without unnecessary disruption to the maritime flow. While a simplified view of ocean-rail intermodal transfer connects one inbound ship with one double-stack unit train, the actual relationship is more complex, and the port development alternatives must accommodate that complexity.

The analysis and discussion presented here leaves a confusing set of signals for port intermodal planning. Major container ports face tremendous potential growth and demands for ever-increasing efficiency. At the same time, the most completely developed ports have the least space, and perhaps the most restricted rail and highway access. As exciting as domestic containerization may be, port planners may rightfully perceive it as yet more pressure on a system already stretched tight.

The temptation is strong to create large, single-purpose rail transfer facilities ccommodate the different types of trains and container traffic, the facilities that are built must be designed with the realities of ocean and rail intermodal traffic in mind.

## On-dock, Off-dock, or Near-dock?

On-dock rail transfer facilities have become *de rigeur* for container ports. Those ports that have on-dock facilities promote them, and those that do not have them pursue them. The potential advantages of on-dock facilities over more distant rail yards are well known: elimination of over-the-road drayage; simplification of interchange and gate functions; and increased control over the transfer process. The potential disadvantages of on-dock facilities are not as widely discussed: increased rail switching costs; use of scarce marine terminal space; and congestion from domestic container traffic.

Off-dock rail transfer facilities are, by and large, preexisting intermodal yards equipped to handle containers. To reach such facilities, ocean carriers must have containers drayed over public streets or highways, and must interchange and inspect containers twice: once at the marine terminal gate, and once at the rail terminal gate. Costs go up, and perceptions of control go down in comparison to on-dock facilities.

The variety of port-railroad arrangements actually in use has given rise to the term "near-dock" to describe facilities near enough to marine terminals (typically 5 miles or less) to offer significant drayage savings over the more distant off-dock facilities (10–20 miles or farther). There is no precise dividing line between "near-dock" and "off-dock." The distinction tends to be relative rather than absolute: the SP ICTF in Southern California is "near-dock" (4 miles) while the UP and ATSF facilities are "off-dock" (20 miles or more); the new BN Seattle International Gateway (about 1 mile) is "near-dock" while BN's older facility at Tukwilla (over 10 miles) is "off-dock."

The proximity of near-dock facilities can yield more than just reduced drayage costs. The ocean carrier's perception of control over the transfer operation is affected by the length of time chassis, tractors, and draymen "disappear" from the terminal and the frequency with which they reappear for more trips or reassignment. Most significantly, dramatic reduction in distance, down to 1–2 miles or even less, drastically reduces the perceived likelihood of delay, damage, or theft. This, in turn, permits near-dock operations to streamline gate procedures and inspections, and attain some of the benefits of on-dock facilities. BN's new Seattle facility, for example, accepts marine terminal gate documentation (transmitted electronically, whenever possible) as input to its own system, and foregoes the time-consuming walk-around inspection of containers. This is acceptable to the railroad because the expected gate-to-gate drayage time is only a matter of a few minutes, and traffic accidents or theft would cause noticeable and questionable delays.

The Port of Oakland presently has a mixture of on-dock, near-dock, and off-dock rail facilities. Most of Oakland's container terminals have rail trackage, and in at least one terminal that trackage has been regularly used for on-dock transfer of small numbers of overweight export containers that cannot be drayed over public highways. As shown in Figure 1, the Southern Pacific and Union Pacific rail facilities in Oakland are "near-dock." In fact, they are separated from the nearest marine terminals by only the width of a city street, and are within about 1.5 miles of even the most distant terminals. The Santa Fe facility is off-dock, some 10 miles to the north in Richmond.

## Intermodal Development Choices

Given the projections for intermodal traffic, the potential influx of domestic container traffic, the fierce competition among West Coast container ports, and the long lead time required for port projects, the Port of Oakland must plan now for intermodal growth over the next 10–20 years. The Port of Oakland, like other major West Coast ports, must give careful consideration to the future use of the limited land available for port development to insure that near-term commitments are consistent with long-term goals.

The intermodal planning options available to the Port of Oakland can be narrowed to two basic approaches. One approach is to maximize the use of existing near-dock rail facilities by improving connections to marine terminals and streamlining gate operations. The second approach is to add on-dock rail facilities and rail access, maximizing rail intermodal capacity and potential on-dock benefits.

*Near-dock Approach.* The near-dock road and access improvements under consideration include:

- expansion of Middle Harbor Road and Ferro Street to provide separate, non-public port road connecting between Berths 60–68 and adjacent rail facilities;
- creation of a non-public road parallel to Maritime Street to provide hostler access between Berths 20–26 and the two rail facilities;
- creation of a non-public, port road parallel to Seventh Street to provide hostler access between Berths 30–38 and the two rail facilities; and
- an extensive grade separation (tunnel) to separate the public traffic on Seventh Street from port drayage movements.

These streets and terminals are shown in Figure 1. The intent is to provide unimpeded movements, or at least minimize impedance, for marine-rail transfer movements on chassis. By separating port transfer traffic from public street traffic, the near-dock proposal would be expected to:

- drastically reduce drayage time, and thus drayage cost;
- permit a sizable reduction in the number of container inspections, the gate time required for documentation, and thus the costs of gate operations and drayage delays; and
- increase real and perceived carrier control over the transfer process.

By overlaying a cluster of marine terminals and adjacent rail facilities with a system of port roads for the exclusive use of draymen or yard tractors transferring containers, this approach attempts to treat the entire port complex as a single large terminal with unimpeded access between its major ports.

*On-dock Approach.* Conceptual studies indicate that the configuration of the Port of Oakland would permit the construction of one very large on-dock transfer facility to serve the "Outer Harbor" and "Seventh Street" container berths (Berths 20 to 38 on Figure 1). This much more ambitious approach would yield a massive increase in the intermodal transfer capacity of the Port of Oakland. If such a facility could indeed be built and operated as anticipated, it would effectively turn some eight separate terminals into one continuous terminal served by two centralized truck gates and backed by an on-dock rail facility capable of accepting the largest double-stack trains intact. Operated by the Port of Oakland (most likely through a contractor), the on-dock facility could

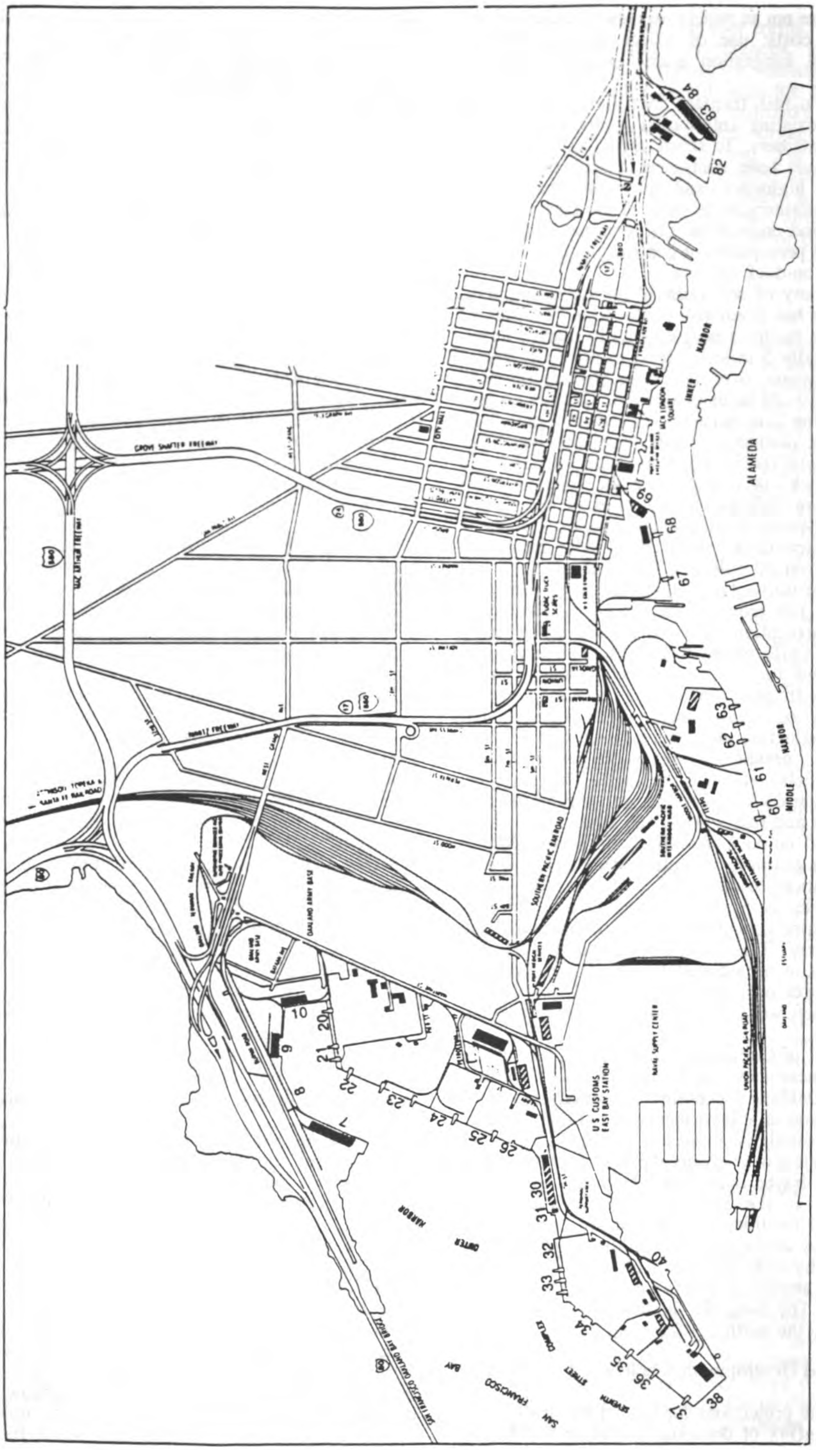


FIGURE 1 Port of Oakland Marine Terminals and Rail Facilities

conceivably connect ocean carriers with any of the three Bay Area railroads via trackage rights or new connections.

The on-dock facility would not serve Berths 60–68, the Middle Harbor terminals, some of which are presently used by the Port's largest intermodal customer. The on-dock approach therefore includes those portions of the near-dock approach required to connect these terminals to rail yards via controlled-access port roads. To avoid grade crossings in the on-dock rail transfer, the on-dock approach also includes a tunnel to carry Seventh Street beneath the rails.

The on-dock proposal thus includes the following major components:

- transformation of separate, self-contained marine terminals into a large-scale multi-user configuration;
- construction of an 8,000–12,000 linear foot on-dock rail transfer facility;
- expansion of Middle Harbor Road and Ferro Street, as in the near-dock approach;
- a grade separation (tunnel) for Seventh Street, as in the near-dock approach; and
- operation of the new on-dock yard by the Port, or its contractor, to connect with all three line-haul railroads (SP, UP, ATSF).

The on-dock approach also requires some strong assumptions:

- domestic container traffic can be "filtered out" at outlying rail yards;
- access for all three line-haul railroads can be arranged in the face of conflicting commercial incentives;
- increased intermodal throughput will permit the Port to devote potential marine terminal expansion space to rail transfer facilities; and, perhaps most of all,
- transformation of multi-purpose terminals into high-capacity intermodal transfer facilities will be necessary to compete for and accommodate the intermodal growth depicted in the preceding sections.

*Two Kinds of Risk*. Each approach entails different risks, and those risks must be given serious consideration in planning for intermodal growth.

The near-dock approach runs the risk of insufficient capacity for the kind of intermodal growth possible from fourth-generation, first-port-of-call vessels and increased domestic containerization. Although none of the existing near-dock rail facilities are operating at full capacity, neither could they presently accommodate the growth depicted in Table 5. Because there would be no separate international container facilities, these yards would have to accommodate both international and domestic growth. The Port would depend on the railroads to aggressively expand their facilities, equipment, and services to keep the Port of Oakland competitive in the intermodal market.

The near-dock approach also relies heavily on coordination and cooperation between parties to approach the benefits routinely expected from on-dock facilities. Such cooperation seldom comes easy, and sometimes it simply cannot be had.

The on-dock approach is vulnerable to failure of its assumptions. If more marine terminal space is required to accommodate marine intermodal growth, devoting potential expansion room to on-dock rail facilities may *reduce* the Port's total intermodal capacity. If access for all three railroads cannot be efficiently arranged and operated, the facility may not benefit from rail competition. If domestic traffic remains intermingled with international traffic, the on-dock facility may not be able to operate efficiently.

The most fundamental risk with the on-dock approach, however, is that it may not be able to cope with the coming complexity of intermodal movements. The demands for flexibility implicit in the earlier discussion would seem to argue against heavy commitments to single-purpose facilities.

No data are available to reveal which risks are real, and which will evaporate with more experience with intermodal growth. Anyone reviewing the recent history of intermodalism will be struck by its dynamicism and changeability: we are now contemplating the indefinite growth of services and technologies that barely existed five years ago. In such an environment, is decisive planning even possible?

Yet the greatest risk of all is to do nothing. If we cannot describe the future with certainty, we can at least be certain that the present is not enough. Because of the long lead times alluded to earlier, the Port of Oakland—and every other port that intends to remain competitive—must plan and act for the future before it can be clearly seen.

## A Common Near-term Development Path

Does the lack of decisive knowledge force us to choose prematurely between divergent development paths? No. The two choices facing the Port of Oakland—and perhaps choices facing other ports or carriers as well—contain common elements that may permit the Port to pursue near-term intermodal development without foreclosing either long-term options.

The two lists of project features had two key items in common:

- expansion of Middle Harbor Road and Ferro Street to provide controlled-access roads between marine terminals and adjacent existing rail yards; and
- an extensive grade separation (tunnel) to separate public traffic on Seventh Street from whatever development, rail or controlled-access roads, that takes place on the surface.

These items alone are multi-million dollar, multi-year projects that will provide both benefits in themselves and a common basis for either near-dock or on-dock development.

By undertaking these common preliminary steps, the Port may be able to take positive steps to accommodate intermodal growth while gaining the experience needed to discern the ultimate direction of intermodal growth.

This paper does not describe a finished planning effort: the analysis remains on a conceptual level, and much study and detailed planning remains to be done. The Port, however, has taken other steps that are compatible with this "common features" approach. The Port is engaged in a cooperative effort with the City of Oakland to transfer control over major port-area streets (including Maritime Street and Middle Harbor Road in Figure 1) to the

Port. The Port has already established a permit system to dray overweight containers on specific routes. The "common features" approach may grow from these short-term measures.

**Two Kinds of Flexibility**

The complexity of intermodal operations calls for one kind of flexibility: the ability of a facility or system of facilities to handle the full range of intermodal operations efficiently. The commitments and risks involved in intermodal planning call for another kind of flexibility: the ability to make progress, and to remain competitive in a highly competitive industry, and still accommodate a dimly seen future.

Intermodal growth, by virtue of its complexity and dynamicism, demands both kinds of flexibility. In those circumstances, port planning gains both a spatial and a time dimension. Port planning must extend beyond the terminal gates, and it must accommodate and shape the future, if ports are to cope with the intermodal "revolution."

**ENDNOTES**

* Manalytics, Inc., San Francisco, CA.

1. Smith, D. "On-Dock Transfer: Facing The Issues," *Canadian Transportation Research Forum Proceedings*, 1986.
2. Forecasts prepared by Manalytics, Inc. and The WEFA Group, Inc., under contract to the Bay Conservation and Development commission and the Bay Area Metropolitan Transportation Commission.
3. For a more complete discussion of commodities and loading densities, see Smith, D., "Domestic Containerization: How Big Can It Get?," *Transportation Research Forum Proceedings*, 1986.