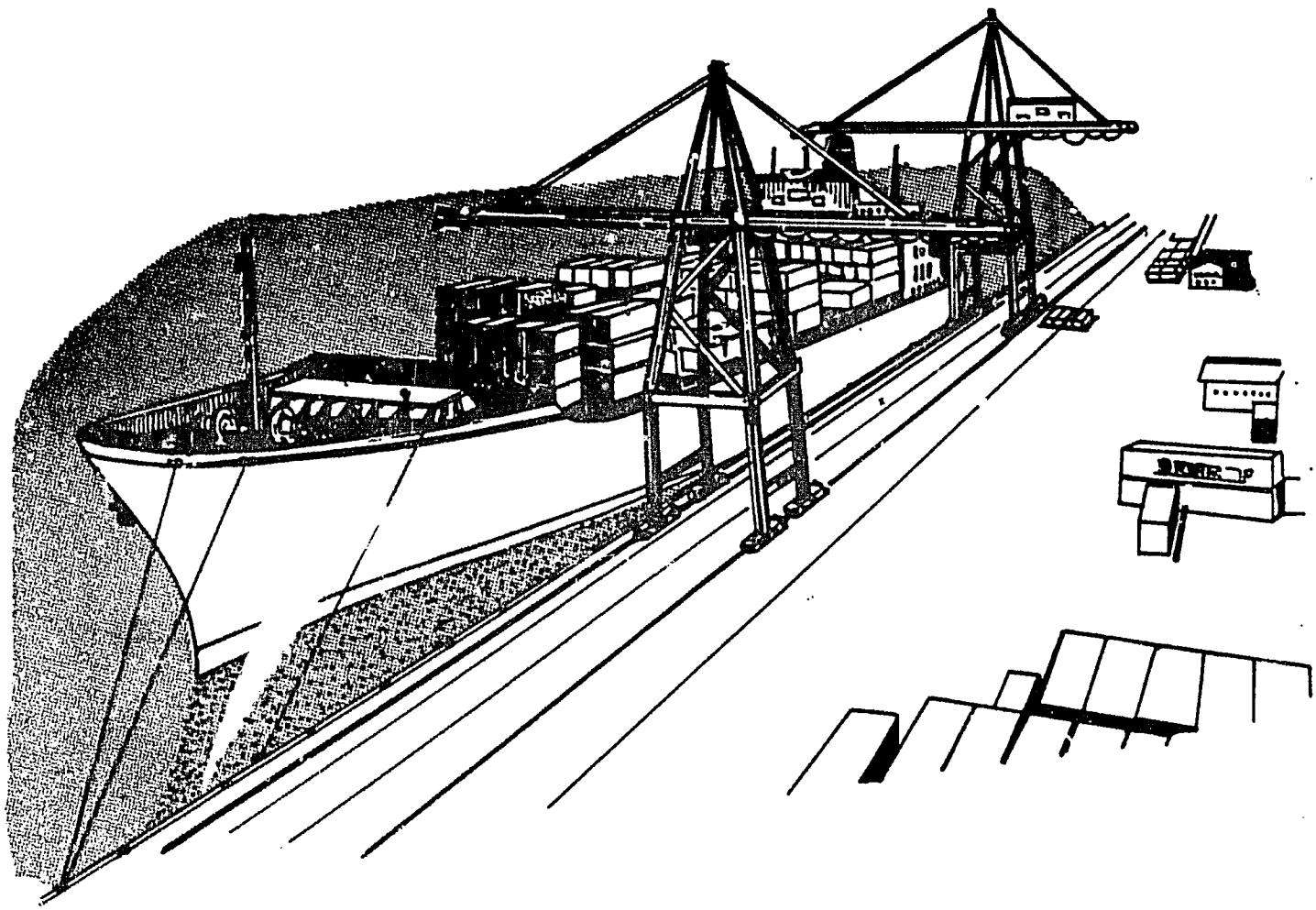
PORT SAID

CONTAINER TERMINAL STUDY



submitted to:

U.S.Agency for International Development
and
Port Said Port Authority

by:

THE MAGUIRE GROUP

CE MAGUIRE, INC.
Architects • Engineers • Planners
One Davol Square, Providence, Rhode Island 02903

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PORT SAID CONTAINER TERMINAL STUDY

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Submitted to:

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

CAIRO, EGYPT

By

CE Maguire, Inc.

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EXECUTIVE SUMMARY

A site within the existing port area of Port Said has been proposed for modernization as a new container terminal. Construction of an extended 345 meter wharf will provide the land-water interface for container cargo handling at Egypt's principal northeast ocean gateway. The proposed rehabilitation project will also consist of approximately 140,000 m^2 of adjacent back-up land for container storage, staging, and ancillary terminal buildings.

CONTAINER TRAFFIC

The proposed port investments are a response to growing volumes of containerr cargoes in Port Said's foreign trade. Even without modern terminal handling equipment, significant and increasing numbers of 20 foot and 40 foot boxes are currently accommodated in Port Said. In 1981, 177,000 tons of general cargo moved in intermodal containers. By mid-1982, approximately 41 percent of total Port Said general cargo was shipped or received in containers. This increasing container "penetration" trend is occurring throughout Egypt and the developing world. Within the next decade, most world trade routes of importance are expected to be containerized. In Port Said, the programmed terminal improvements should facilitate this emerging cargo handling trend.

Thus far, virtually all of the fully loaded container traffic through Port Said have been imports. Most of these containerized imports are destined for consignees located within Port Said's Free Trade Zone. Boxes are re-shipped empty since Egyptian industries, being relatively small and accustomed to traditional technologies, have not employed containers to package containerizable general cargoes. The transshipment of containers at Port Said to adjacent ports remains a potential, as delays in accommodating vessels and handling cargoes have negated any incentive for this business. Modern and efficient container handling facilities, combined with Port Said's close proximity

to major shipping routes, however, should improve the possibility of attracting containers for transshipment.

Containerized imports have more than doubled in volume between 1979 and 1982. While this rapid growth rate will moderate in future years, there will continue to be significant increases in container imports as inbound, loaded boxes will remain dominant in Port Said's unitized trade. Primarily dependent upon the continuing vitality of the Port Said Free Trade Zone, imports in containers should grow to 404,000 tons by 1985, 757,000 tons by 1990, and 1,409,000 tons by 2000. This growth reflects both increasing general cargo imports and escalating container "penetration" ratios. Exports in containers should remain a minor portion of Port Said's business, although a potential clearly exists for containerizing some Egyptian agricultural products and light manufacturing items from the Free Trade Zone. Containerized exports are projected to grow from current minimal levels to 4,600 tons by 1985 and 127,400 tons by 2000. The re-shipment of large numbers of empty boxes is projected to continue throughout the project life cycle.

TERMINAL REQUIREMENTS

A recommended terminal layout and itemizations of required equipment and facilities, commensurate with the projected container growth, have been prepared. Together with detailed cost estimates, these requirements provide direction for proposed capital investment. The terminal requirements are calculated from typical container terminal operating practices as well as for the specific characteristics of Port Said's container traffic and the dimensions of the designated terminal site.

The throughput capacity of the recommended terminal will handle a maximum of approximately 141,000 TEUs (twenty-foot equivalent units) per year. If container cargo forecasts come to fruition, the planned terminal should approach maximum utilization by 1993 or so. Without additional expansion, container flows could again be constrained, particularly regarding the potential facility use conflict between import-export boxes and transshipment business.

In addition to specifying the needs for storage by type of container and the sizes of the container freight station and other on-site buildings, equipment requirements are examined in detail. It is proposed that rail-mounted gantry cranes be employed to handle containers between ship and berth. Rubber-tired gantry cranes will handle and stack containers behind the berth while yard tractor-trailers will move containers within the container yard. Forklift trucks will be used in the CFS and elsewhere. A summary of equipment requirements for the proposed terminal at maximum operating capacity is presented below:

Summary of Equipment Requirements

Equipment	Number
Rail-mounted Gantry Cranes	2
Rubber-tired Gantry Cranes	4
Terminal Tractors	10
Terminal Trailers	23
Modified Forklift Trucks	1
Forklift Trucks	37

The cost estimates for these capital intensive requirements are inherently high. The Port Said Port Authority has estimated that the wharf extension work will cost approximately 20 million L.E. in 1982. The Maguire estimate for terminal buildings, paving, utilities, and other site improvements is approximately $25 million. Required handling equipment totals approximately $12 million and ancillary equipment, company headquarter offices, and contingencies equals another $10 million. In total, the proposed container terminal, including wharf extension, will require a capital investment of approximately $65 million to operate effectively and at maximum capacity.

ECONOMIC AND FINANCIAL ANALYSIS

Container cargo growth rates are impressive. However, the capital requirements to provide modern facilities are equally formidable. A cost-benefit analysis has been performed and tests the economic feasibility of this project from a national perspective. A cash flow analysis depicts the yearly availability of funds and estimates the commercial viability of the proposed improvements from the local port viewpoint. The assumptions and methodologies of each of these analytical techniques also provide guidance for related decisions, such as the timing of investments, the level of suitable tariffs, and the long term planning of future expansions.

The findings of the cost-benefit evaluation reveal a desirable project. At an opportunity cost of capital of 10%, the net present value of the streams of project benefits and costs is $8.6 million. A positive benefit-cost ratio of 1.13 attests to the project's economic viability. Analysis of the sensitivity of these conclusions to changes in the cost of capital, construction costs, or retention of benefits also indicates positive results. The primary benefits of the project are the avoidance of ship waiting costs and savings from the employment of larger container vessels serving Port Said. Project costs include the annual capital investment requirements including needs for normal replacement and net annual operating costs under the new highly mechanized terminal. It is apparent that a detailed study of tariffs and tariff policy at the new terminal is needed to retain the significant savings resulting from improved efficiency and accruing to container steamship companies.

The cash flow analysis also has positive results. Assuming favorable financing and estimated tariff rates, the terminal should produce a positive cash flow over the economic life of the project. Discounted at the opportunity cost of capital, the net present value of the terminal's 20 year cash flow is $20.9 million. During the early years of capacity build-up and large loan repayments, however, cash flow

will be negative. As the terminal reaches maximum capacity utilization, a positive annual cash flow can be anticipated. An appropriate use of these retained earnings may include the reinvestment in container terminal expansion as cargo growth and anticipated capacity begin to merge during the mid-1990's.

IMPACT OF CONTAINERIZATION

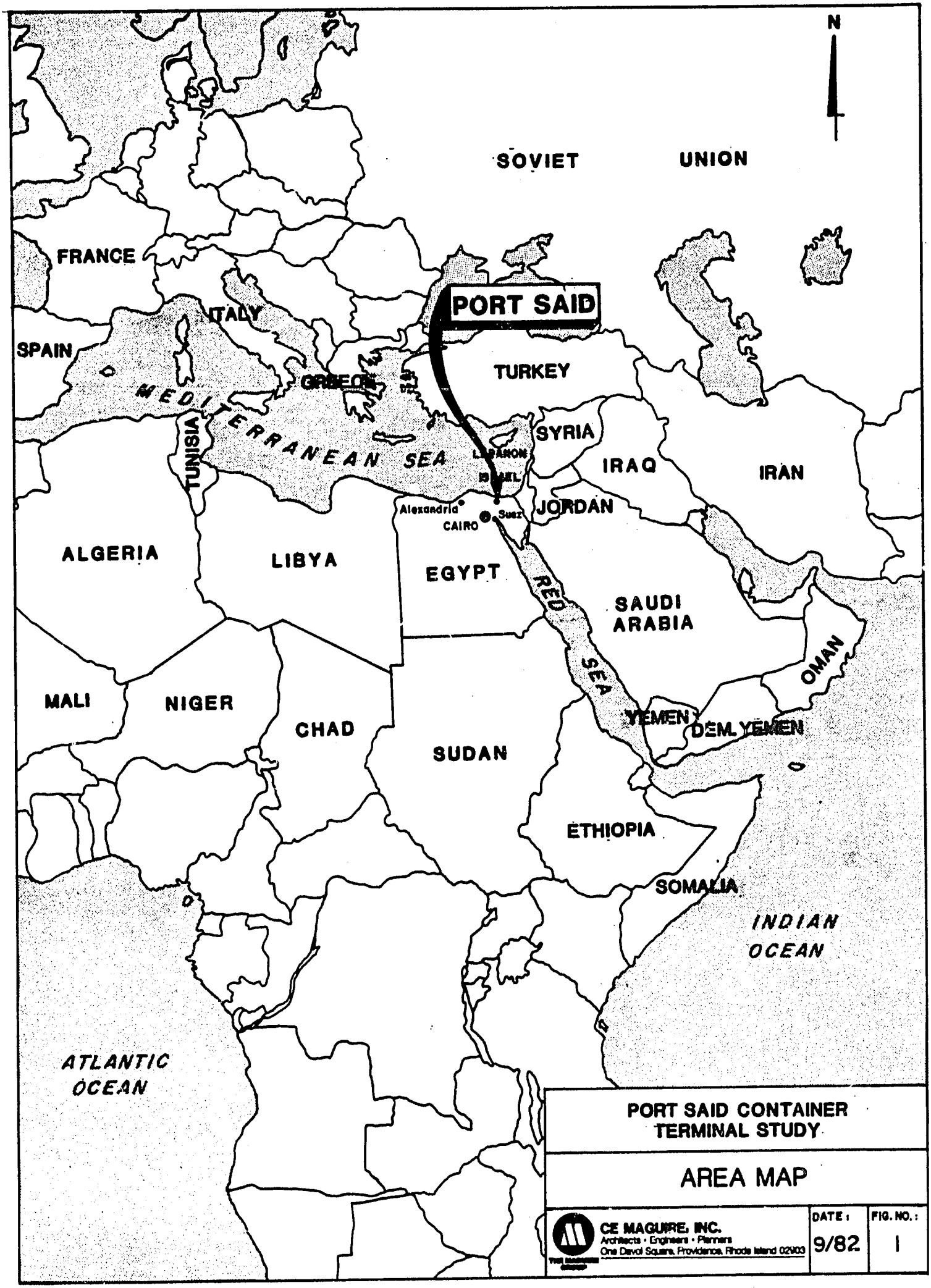
Even with a modern container terminal in Port Said, improvements in hinterland intermodalism, customs documentation, and manpower training are required for the Egyptian economy to reap the benefits of containerization. To promote the through movement of containers, appropriate road and rail equipment should be made available and infrastructure improvements should be made. Additionally, inland consolidation centers should be located in major consuming and manufacturing centers, particularly Cairo, to facilitate the use of this transportation technology. Adjustments to custom laws and intermodal bills of lading need to be reviewed to eliminate constraints to through container movements beyond the Port Said Free Trade Zone. Strains on manpower requirements including work force reductions and needs for training should be anticipated. In sum, the new container terminal should be viewed as only one element in an integrated logistics system. Improvements to the other elements of the system must also be forthcoming.

The proposed joint venture for ownership, and employment of a specialized container terminal company for operation appear to be viable proposals to accomplish the project in the near term. The recommended terminal layout, equipment requirements and cost estimates should facilitate the planning process of the Port Said Port Authority. The container cargo forecasts as well as the affirmative results of detailed economic and financial evaluations bode well for the successful utilization of the new container terminal. Nevertheless, favorable financing arrangements, sound tariff policies, and supportive national government actions, particularly concerning the ultimate use of the new Damietta port, will also be required to ensure the long term success of the Port Said container terminal.

I. INTRODUCTION

The strategic location of Port Said at the crossroads of the northern entrance to the Suez Canal and the northeastern coast of Egypt (Figure 1) accounts for much of its traditional importance as a major cargo port. Since the re-opening of the Suez Canal in 1975 and the designation of Port Said as a Free Trade Zone in 1976, the volume of waterborne commerce accommodated through Port Said has increased dramatically. For example, the 1976 total cargo level of 1.287 million tons had increased to 3.156 million tons by 1979. In addition to this total cargo growth, changes in maritime technology, principally in the form of containerization of general cargoes, have also occurred rapidly. To date, however, the port infrastructure and handling equipment have not kept pace. Numerous recommendations for port modernization, rehabilitation, and even new construction, have been advanced in recent years. Specific actions are beginning to occur, including the construction of a new quay that will provide a new container terminal in Port Said to more efficiently handle this cargo growth and changing cargo handling technology.

The purpose of the Port Said Container Terminal Study is to evaluate the feasibility of the proposed terminal modernization and to depict an efficient layout including equipment requirements and costs. This study serves as a follow-on to previous, broader USAID supported studies of the "Rehabilitation and Modernization of the Existing Port at Port Said". This study provides important data to the Port Said Port Authority in its negotiations and plans to modernize, arrange financing, and oversee the development of these terminal improvements. The project also comes at a significant time as the Port Said Port Authority has recently gained increased autonomy with a more independent relationship with its important neighbor, the Suez Canal Authority.



PORT SAID CONTAINER TERMINAL STUDY

AREA MAP

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FIG. NO.: 1

A. Background

The economy of Egypt has grown at an annual rate of approximately 8% during the past five years. The key money-earners for Egypt are oil exports, tourism, remittances from workers abroad, and Suez Canal tolls. Foreign investment has also been significant in this stable Mideast country. The Egyptian government subsidizes numerous products to support a growing population. Domestic demand for oil products, electricity, foodstuffs, clothing, and other items is rising fast because of cheap prices and the rapidly growing population. Population growth is now at 1.2 million a year.[1]

This growing economy and population are reflected in increased volumes of trade through Egyptian ports. Between 1969 and 1979, the volume of Egypt's foreign trade increased at an average rate of over 8% per year. The rate of growth has increased significantly in recent years, averaging 11% per year over the period 1977-79. There is a marked imbalance of trade flows with imports exceeding exports by a 6 to 1 margin. Bulk cargoes, such as wheat, cement, and fertilizers, account for over 80% of total non-oil imports. Alexandria is Egypt's principal port. Growth rates at Port Said and Suez have accelerated recently as a result of growing congestion at the Port of Alexandria.[2]

The growing trade flows and congested ports have given rise to a multitude of trade forecasts, port expansion plans, and new construction programs. A summary of several of the trade projections for Egypt appears in Table I-1. While each forecaster differs, substantial total cargo growth above the currently estimated 20 million tons per year is envisioned. Port Said's share of national cargo

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[1] "Mubarak Urges Reductions in Energy Use," Journal of Commerce, July 27, 1982.

[2] Port Said Container Terminal Feasibility Study, Marine Transport International Ltd., Co., 1981.

TABLE I-1

TRADE PROJECTIONS FOR EGYPT
(millions of tons)

	1	2	3	4
1985				
Containerizable	2.5	4.5	3.5	
Breakbulk	4.0	3.3	3.3	
Special	2.8	2.2	2.9	
Total General	9.3	10.0	9.7	16.3
Dry Bulk	18.2	16.3	18.1	19.5
Total	27.5	26.3	27.8	35.8
1990				
Containerizable	4.7	5.6	5.5	
Breakbulk	3.8	3.8	4.5	
Special	3.9	2.9	3.5	
Total General	12.4	12.3	13.5	20.4
Dry Bulk	25	27.2	29.4	25.4
Total	37	39.5	42.9	45.8
2000				
Containerizable	12.6	7.0	9.7	
Breakbulk	9.3	5.6	5.6	
Special	7.3	4.4	4.9	
Total General	29.2	17.0	20.2	32.0
Dry Bulk	50.3	46.6	50.9	43.0
Total	79.5	64.4	71.1	75.0

Forecasters:

1. Frederic R. Harris, Development Policy - Ports of Egypt, 1978.
2. BCEOM, WYP, Port Authority of Marseilles, El Dikheila Port Project, 1977.
3. Port Authority of Marseilles, New Port Said Port Project, 1979.
4. Technical Advisory Committee on Ports, National Port Plan, 1976.

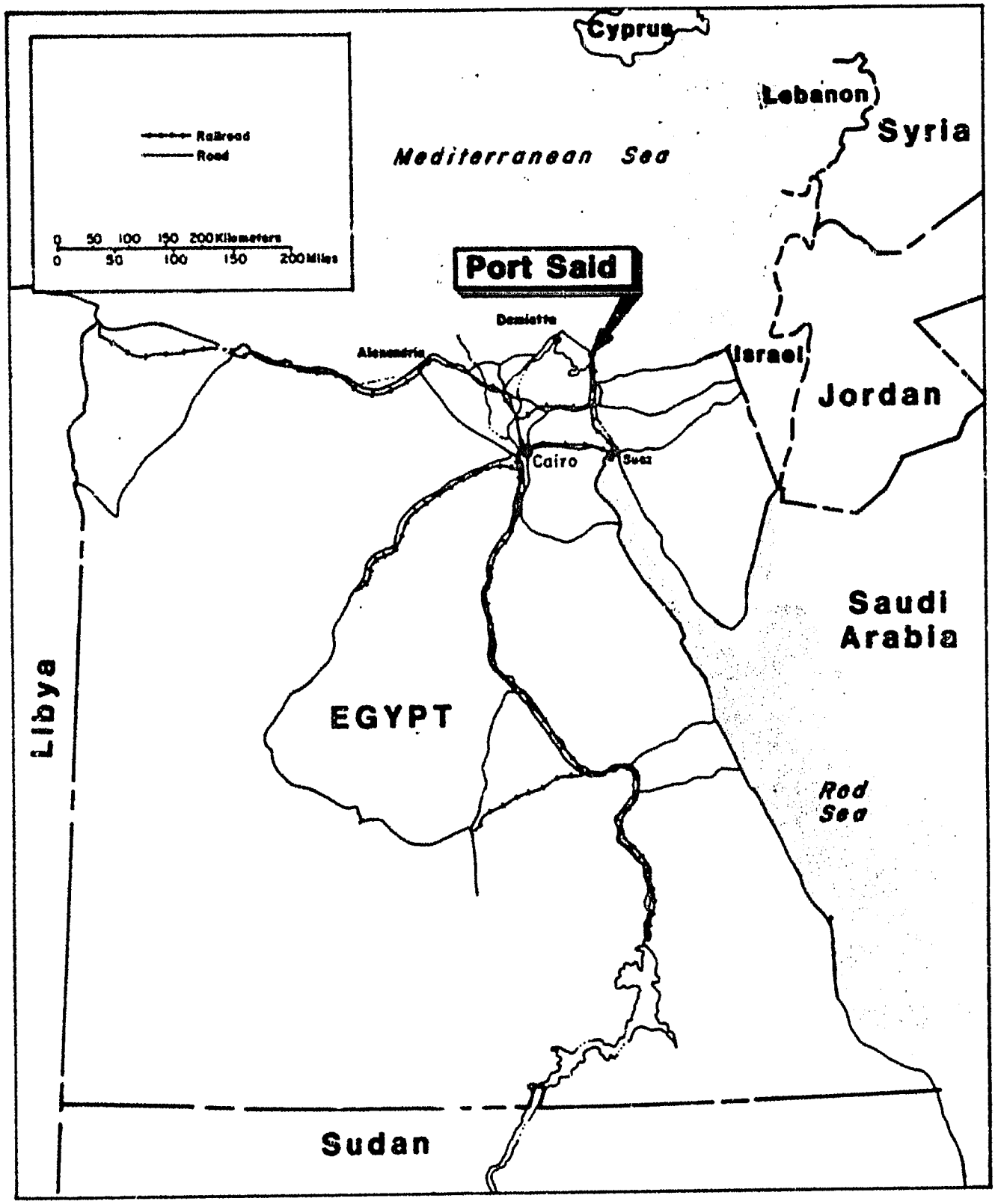
throughput normally averages about 15 percent of all Egyptian ports. Alexandria routinely accommodates over 70 percent of national water-borne commerce.

Congestion at Alexandria, overall trade growth, changing technology, and desires to stimulate related economic development have fostered major port expansion programs throughout Egypt. Large projects are under preparation near Alexandria and in the new area of Damietta, which is located on the Mediterranean coast between Alexandria and Port Said (See Figure 2). Including the current proposal in Port Said, several new container terminals are being planned for the Egyptian coastal area. The following summarizes the status of these major container terminal developments:

Alexandria: A new container terminal is slated for operation by 1983 in the old port area. The new container quay is designed to handle 100,000 containers yearly, most of them twenty-foot in length. The terminal will have three gantry canes, two straddle carriers, and approximately 60,000 square meters of storage space. This relatively small container facility will cost about $45 million with $36 million coming from a World Bank load.[3]

El-Dekheila: This is a major new port facility located west of Alexandria. At Dekheila, there will be a major iron and steel factory and facilities for handling the imported raw materials for the mill as well as the finished iron bars. The new port will contain a mineral quay for the factory's use, in addition to a container quay and its handling equipment. The Dekheila container facilities are planned to accommodate rising container and ro/ro traffic currently overflowing in Alexandria. The first stage of construction at Dekheila includes building a 1,420 meter container quay. Estimates for the timing of this new container port range from 1986 to 1990.

[3] "Egypt Slates New Container Port for 1986", The Journal of Commerce, December 7, 1981.



PORT SAID CONTAINER TERMINAL STUDY		
KEY MAP		
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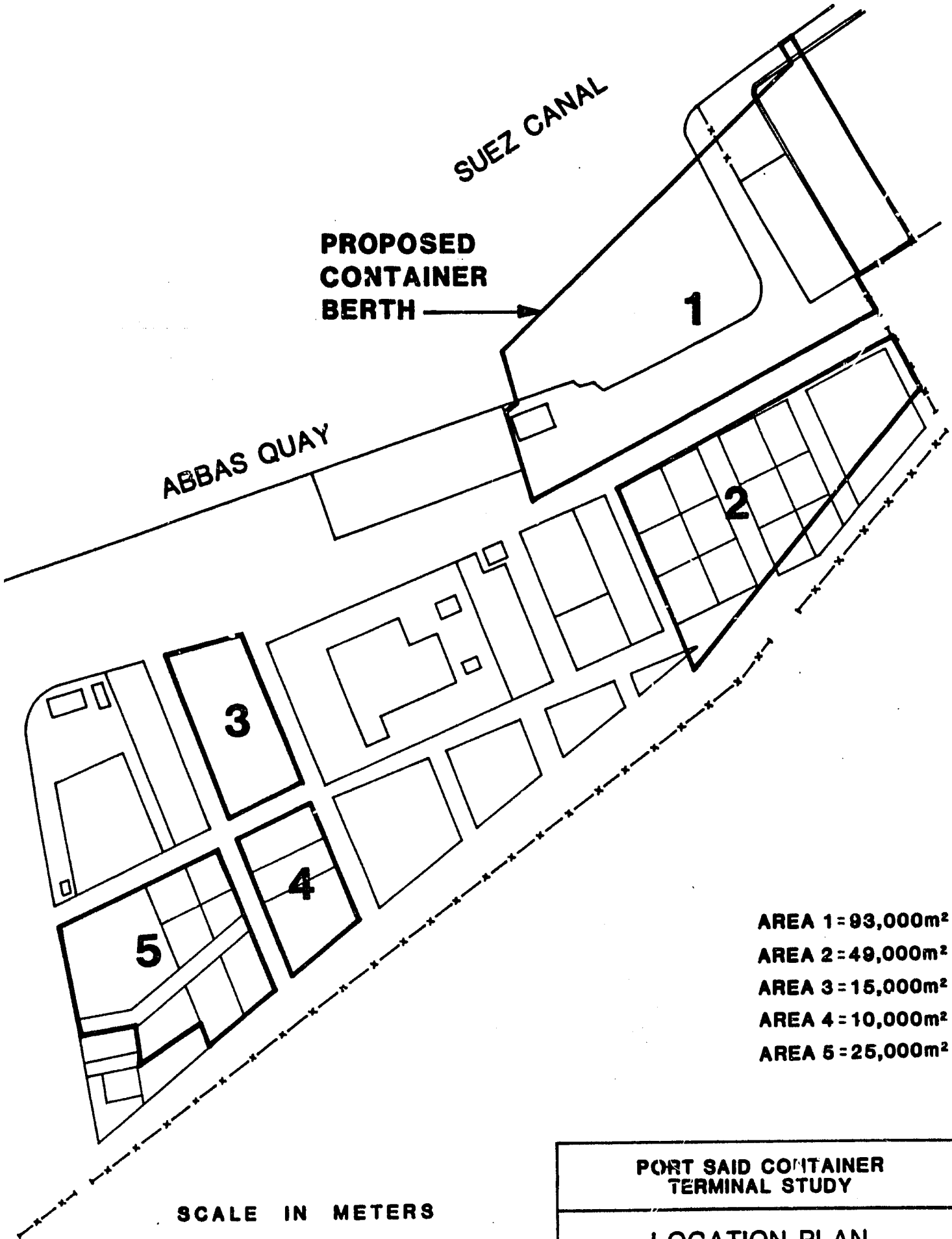
Damietta: Another major port area will be created at the coastal community of Damietta. The project includes the provision of a deepwater container berth. A contract has been awarded to a French consortium and includes major civil engineering work. Additionally, it will be necessary to improve road and rail links between Damietta and other parts of Egypt including Cairo. It may be designed as a container transshipment center, as well. It is unlikely that this facility will be operational before the late 1980's.

The national growth in container trade appears to warrant each of these proposed developments, particularly over the long term. With the proposed facility in Port Said, the container terminals in Alexander, El Dekheila, and Damietta may provide a surplus of handling capacity in the near term. Competition for transshipment business and the relatively close proximity of Damietta and Port Said may cause concern. However, any surplus is normal in port development and if it arose, the surplus would persist for only a short time given the projected rate of increase in both the volume of containerizable traffic and in the degree of penetration of this potential market by containerized services. Section II of this report expands upon the specific projections of container trade that can be expected in Port Said through the year 2000.

B. Proposed Project

A designated site within the existing port of Port Said is the physical subject of this report. The site, shown in Figure 3, consists of a newly created marginal wharf of 345 meters, which is expected to be constructed shortly. The wharf will be supported by an irregularly shaped, 140,000 M^2 storage, staging, and back-up area, with additional space available on the terminal (Areas III, IV, and V). Currently, the berth and land area, which are located adjacent to the Abbas Basin and the Petroleum Basin, are used primarily for import of cement. The Port Said Port Authority expects these substantial cement cargoes to be accommodated elsewhere in the port or to be



AREA 1 = 93,000m²
AREA 2 = 49,000m²
AREA 3 = 15,000m²
AREA 4 = 10,000m²
AREA 5 = 25,000m²

SCALE IN METERS

50 0 200

PORT SAID CONTAINER TERMINAL STUDY

LOCATION PLAN

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FIG. NO.: 3

terminated by the time the major terminal rehabilitation begins. The project area, like all of Port Said's commercial maritime facilities, borders the eastern shore of the Suez Canal. While the Port's operations are subject to some unusual constraints because of its close proximity to the northern end of the Suez Canal, recent changes in the Canal's configuration and operating procedures (one-way traffic through a bypass) have improved access to Port Said.

The existing flow of containers passing through Port Said is loaded/unloaded with ship's gear, moved by forklift trucks and stored in several locations behind the Abbas Quay. Most of the container stripping activities occur in these terminal storage areas. The vast majority of export containers are re-shipped empty.

Companies within the Free Trade Zone of Port Said have been the primary receivers of these containerized cargoes. Indeed, most of the projected growth of this trade depends upon the continued economic vitality and commercial success of the Free Trade Zone. At the close of 1979, the Free Zone in Port Said contained 92 active investment projects with a total declared capital of $132 million. The total area available within the Free Zone is 952,703 square meters, with approximately 44% allocated in 1980.[4] Although intended by law to attract investment in export-oriented activity through the creation of areas outside the customs borders of Egypt for manufacturing, storage and processing, the primary use of the Free Zone has been for receipt of duty-free imported goods for Egyptian use and consumption. Changing policies on import substitution and export promotion could affect existing Free Zone activities.

The Port Said Port Authority intends to attract a joint venture to finance and operate the new container terminal. Although still in the planning stage, this joint venture would consist of 80 percent Egyptian ownership and 20 percent foreign involvement. It is also planned to have an experienced terminal operating company run the

[4] Economic and Feasibility Study of Port Said, PRC Harris, Inc., October 1980.

proposed container terminal. A lease arrangement is planned, although specific details have yet to be finalized. A principal use of the data in this report will be to facilitate the planning for this joint venture and the negotiations with the specialized container terminal operating company.

C. Content of Report

The scope of work of the Port Said Container Terminal Study included four interrelated tasks. The first task involved data collection including in-country field work, numerous meetings with the Port Said Port Authority, Port Said shipping community, and USAID staff in Cairo. These interviews and site visits were supplemented by literature searches including related studies and publications from U.S. government agencies and the U.N. A second task provided for analysis of the collected data including a container traffic forecast through 2000 and the types and costs of terminal development and equipment. The third task requires a cash flow and cost-benefit analysis for the proposed improvements. A conceptual terminal layout within the designated area was required in the final task.

This report responds to the requirements of the study objectives and contractual scope of work. Following this Introduction, details on container cargoes with forecasts are presented in Section II. Section III addresses potential terminal throughput capacity, handling equipment and storage requirements, a proposed terminal layout and cost estimates. Section IV presents the cash flow and cost-benefit analyses while the last section expands upon some of the expected impacts of containerization on Port Said and its surrounding hinterland. Appendices conclude the report and include supporting information on container terminal equipment and costs, a bibliography and a list of people interviewed.

II. CONTAINER CARGO FORECAST

This section estimates future volumes and numbers of containers that can be expected to be accommodated at the upgraded container handling facility at Port Said. The methodology of projections consists of: updating statistics on actual container traffic flows at traditional facilities at the Port to mid-year (June) 1982; evaluating important factors affecting future container and unitized trade in the import, export, and transshipment cargo sectors; presenting relevant findings from the numerous consultant studies regarding potential Port Said container handling potential; and estimating annual growth rates consistent with Port Said's competitive and important geographical location, relevant Egyptian economic characteristics, and familiarity with international container shipping and port development trends.

A. Historical Container Cargo Flows

Analysis of historical containerizable general cargo imports and trade actually received in 20' and 40' boxes reveals a steadily increasing level of unitization in Port Said's inbound foreign trade. While increased consumerism in Egypt, trading and investment policies of developed economies and steamship companies, and Port Said's Free Trade Zone status accounts, essentially, for these rapidly changing types of inbound cargo and packaging, containerized exports and transshipments to/from other ports have been of significantly lesser volumes and annual growth rates.

The table presented below summarizes the estimated volumes of general cargo and containerized traffic accommodated through existing facilities in Port Said.

TABLE II-1

TRENDS IN GENERAL CARGO AND CONTAINER TRADE

(1000 tons)

	TOTAL GEN. CARGO	CONTAINER	% IN CONTAINER
1978	320	39	12
1979	390	97	25
1980	396	110	28
1981	493	177	36
1982 (6 months)	104	84	41

Source: Port Said Port Authority & Canal Shipping Agency

As depicted in Table II-1, while total general cargo has shown steady increases, with a significant fluctuation between 1980 and 1981, the penetration of the container cargo mode has been rapid. The percentage of general cargo carried in containers during the first six months of 1982 (41%) far exceeds earlier projections of possible container conversions in Port Said for forecasts years exceeding 1985 (30%).[1] In fact, container and ro/ro ships represented over 44% of Port Said's general cargo vessel business during 1981, with as many as 2 container ships per day currently calling during many periods of year.[2] It should also be noted that containers have penetrated many waterborne cargo markets throughout the developing world. A recent survey of worldwide container port/terminal facilities and trade growth indicates that while containerized trade throughout the world continues to grow at an annual rate of 5-6%, container trade, with some developing countries, including those of Africa, has grown at as much as 30% per year during the past five years or so.[3] Much of

[1] Projection from PRC Harris report, 1980

[2] Interviews with Port Said Port Authority and Canal Shipping Agency (July 6, 1982).

[3] Container Port/Terminal Facilities and Trade Growth, Cargo Systems Research Consultants Ltd., 1982.

this growth represents "delayed" demand, while reflecting the profit maximization objectives of developed countries through the comprehensive deployment of economical container vessels and other unitization technologies throughout virtually all trade routes in the world. A leading maritime official summarizes these trends by stating, "one thing seems certain, there is no way back from containerization, and most remaining routes of importance are expected to be containerized in the course of this decide."[4]

B. Container Import, Export, and Transshipment Sectors

Historical records of general cargo and, particularly, container traffic depict a marked difference between import tonnages and export and transshipment tonnages. In 1979, for example, while approximately 77% of Port Said's general cargo trade was inbound, an estimated 99% of the container trade was imports.[5] Most of these container imports are for consignees within Port Said's Free Trade Zone. Many boxes are re-shipped empty as Egyptian industries, being relatively small and used to traditional technologies, have not employed containers to package containerizable general cargoes. Although transshipment was quite significant to Port Said in the 1960's (400,000 tons in 1967 and 1.8 million in 1952),[6] current indications of fully loaded containers being transshipped is minimal. However, Port Said's geographical proximity to the entrance of the Suez Canal and major world shipping routes yields clear potential for increased transshipment business pending the provision of modern and efficient container handling and storage facilities.

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[4]"Containerization 'to Rule' Remaining Trade Routes" (R.P.M. deBok, managing director of Nedloyd's ports division), The Journal of Commerce, June 29, 1982.

[5]Harris report, 1980 and Port Said Port Authority interview 7/82.

[6]Port Said Port Authority and Port Said Shipping Agency interviews 7/82.

1. Import Container Cargo

Import container traffic reflects the inbound demands of firms within the Port Said Free Trade Zone Community. Historical records provided by the Port Said Port Authority illustrate the following trends in inbound containers since 1979:

TABLE II-2
IMPORT CONTAINERS

	Ship Numbers	Containers 20'	Containers 40'	Total	Tonnage
1979	178	5,670	1,534	7,204	85,422
1980	210	7,162	2,903	10,065	110,161
1981	248	12,518	3,299	15,817	176,938
1982 (1/2 yr)	102		N.A.	7,174	83,295

Source: Port Said Port Authority & Canal Shipping Agency.

As illustrated in Table II-2, Port Said's primary container business is characterized by increasing ship calls, predominately 20' boxes, and increasing tonnages.

2. Export Container Cargo

Virtually, all export containers are empty. In 1979, some 34 boxes of cotton products and personal items were exported through Port Said.[7] Over the long-term, products such as cotton and fruits/ vegetables may be containerized in export trade through Port Said. However, historical records reveal the number of boxes with tonnage statistics representing primarily the weight of the empty containers.[8]

[7]Harris report, 1980.

[8]Port Said Port Authority interviews 7/82.

TABLE II-3

EXPORT CONTAINERS

	Ship Numbers	Containers 20'	40'	Total	Tonnage
1979	163	5,405	1,357	6,762	20,575
1980	170	6,390	2,923	9,313	37,141
1981	N.A.	11,831	3,110	14,941	47,898
1982 (1/2 yr)	N.A.		N.A.	7,186	23,369

Source: Port Said Port Authority & Canal Shipping Agencies.

The exported containers are slightly fewer than inbound with 40' boxes being a minor, although increasing percentage of the business. It should be again emphasized that very little cargo is exported via containers and that Port Said Port Authority's tonnage estimates reveal, primarily, the weight of the containers themselves as a shipping commodity.

3. Transshipment Container Cargo

Containers for transshipment at Port Said remains a potential. According to Bullen & Partners, local shipping agencies, and others, with the geographical position of Port Said, the availability of efficient, and price-competitive service, transshipment business should be substantial. It should be emphasized that transshipment must meet the demands of international steamship companies and provide very rapid turnaround times for vessels and simplified tariff structures. Still, however, Port Said's position on the Suez Canal yields a competitive advantage to existing (Cyprus and Piraeus) and proposed transshipment sites which can represent substantial steaming time savings for 3rd generation container vessels having $15,000 per day operating costs.[9]

[9]Canal Shipping Agency, 7/82.

C. Previous Container Cargo Forecasts

There have been several recent studies on Port Said that include estimates for future container traffic. The Harris Study of 1980, The Bullen & Partners Study of 1982, and the Marine Transport International Co., Ltd. (MTI) Study of 1981 provide cargo forecasts. The following summarizes the relevant projections for containerizable traffic through the year 2000:

TABLE II-4

COMPARATIVE FORECASTS

PORT SAID: CONTAINERIZABLE TRADE 1985-2000

(Excluding Transshipments)

(1000 tons)

	Harris(1)	MTI(2)	Bullen(3)
1985	930	685	840
1990	1,406	960	1,425
1995	1,943	1,425	2,800
2000	2,530	1,860	4,300

(1) Assumes rehabilitation of existing facility.
(2) Assumes adapting existing facility.
(3) Assumes major new port.

Harris portrays exports of containerizable trade growing to represent over 30% of total volume in 2000, while MTI assumes a more moderate growth of exports to equal 16% of similar total trade by 2000. All three studies portray a dominance of imports throughout the forecast period with continued leadership in the container handling penetration ratio. Critical assumptions regarding the continued penetration of the container handling mode differ between studies. Bullen & Partners are optimistic with containerizable trade actually handled in containers increasing from an assumed 1985 level of 60%, to 65% by 1990, 70% by 1995, and 80% by 2000. MTI displays similar projections for 1985, but with 1990 levels of 80% and 85% for 1995 and 2000. The Harris

estimates reveal a significantly lesser penetration level with 30% predicted for 1985, 50% for 1990 and 60% for 1995.

Each study points to the natural advantages of Port Said for transshipment of containerized trade. Adequate container facilities are essential to the attraction of container transshipment cargo. However, without historical data, projections are not as documented as are forecasts of containerizable foreign trade and imports/exports in boxes. Harris states that transshipment cargo of approximately 100,000 tons can be expected in Port Said by 1990, growing to 300,000 tons by the year 2000. The MTI report identifies the need to re-examine the transshipment trade and depicts transshipped container traffic at 35,000 tons by 1985, 50,000 tons by 1990, 86,000 tons by 1995, and 150,000 tons by the year 2000. Bullen estimates 1,050,000 tons of transshipment cargo in 1985, 1,450,000 tons by 1990, 1,900,000 by 1995, and 2,500,000 by 2000.

D. Projected Container Traffic at Port Said

In the future, Port Said's container traffic should consist of a combination of imports, exports, and transshipments. The container conversion penetration ratio has been very significant, particularly considering the present lack of modern container vessel berthing, box handling, and storage facilities. This penetration ratio should continue to increase with the export sector lagging behind the import and transshipment cargo categories.

1. Import Container Forecast

Containerized imports depend, heavily, upon the continued vitality of the Port Said Free Trade Zone. Movements beyond the local hinterland depend upon improved intermodal facilities, such as inland consolidation centers, land transport, and reduced custom disincentives. Moreover, the containerized import sector has a historical growth pattern in both containerizable trade and penetration ratio. Table II-5 presents CE Maguire's projections of the container import sector.

TABLE II-5

CONTAINER IMPORT SECTOR PROJECTION

	Containerizable[2] Imports (tons)	Penetration Ratio %	Container Imports (tons)	Container[3] (TEU's)
1981[1]	468,000	36	168,000	14,735
1985	736,000	55	404,800	35,509
1990	1,082,000	70	757,400	66,439
1995	1,381,000	80	1,104,800	96,912
2000	1,762,000	80	1,409,600	123,649

(1) Actual; Port Said Port Authority.
(2) 95% of total containerizable trade (Bullen for 1980 trade).
(3) Assuming 11.4 tons per TEU (Twenty foot - equivalent) (1981 estimate of Port Said Port Authority).

Rationale and Assumptions:

- Average rate of containerizable trade growth since 1977 was approximately 19% per year;

- Containerized imports will grow at a steady but slower annual rate of 12% (Harris & MTI estimates (15%)) through 1985 (e.g., as world 1982 tonnage is less than 1981; Egyptian balance of payment difficulties; import substitution policies; etc.);

- Containerized imports will surpass NEDICO rate of 7% to 1990 because of improved facilities, continued advantages of Free Trade Zone and improved intermodalism in extended hinterland. Rate per year through 1985-1990: 8% per year;

- A normal growth of 5% per year (MTI) commensurate with historical waterborne commerce growth worldwide is assumed through 1990 to 2000; and

- Penetration ratios increase gradually through 1985 with provision of container terminal by 1985 or so; ratio will increase more rapidly to 70% by 1990 and to normal world standards of 80% by 1995 and beyond.

2. Export Container Forecast

Containerized exports through Port Said have not grown rapidly. Assumptions regarding potential agricultural products and light manufacturing products from the Free Trade Zone must be optimistic to justify forecasts of significant exports of full containers. Additionally, the lack of historical trend data complicates the forecasting process. The Harris forecast is quite optimistic regarding containerizable export growth, particularly the agricultural sector. The MTI projections for exports are more moderate.

TABLE II-6

CONTAINER EXPORT SECTOR PROJECTION

	Containerizable Export (tons)[1]		Penetration Ratio %[3]	Container Export (tons)	Container TEU's[5]
		(of total)			
1981[2]	25,000	(5%)	6	1,500	131
1985	46,000	(6%)	10	4,600	404
1990	82,000	(7%)	40	32,800	2,877
1995	153,000	(10%)	50	76,500	6,710
2000	196,000	(10%)	65[4]	127,400	11,175

(1) Excludes empty boxes.
(2) Assumes 5% of containerizable traffic and as listed for subsequent years.
(3) Based on 6% estimate for 1979 from MTI.
(4) MTI estimate.
(5) Assuming 11.4 tons per TEU for FLC.

Rationale and Assumptions:

- Assumes increasing percentage of exports of total containerized trade from 5% of total in 1981 to 10% (Bullen) by 2000;

- Assumes more acceptance of intermodal technology throughout Egyptian infrastructure, government, and industry;

- Egyptian exports are destined more for short hauls and thus the advantages of containerization are less apparent;

- Even moderate export growth will depend upon strong economy with greatest potential in fruit, vegetables, other produce, and light manufactured goods; and

- Assumes significantly less penetration and saturation level for percent in containers than for imports.

3. Transshipment Container Forecast

As stated previously, the transshipment of containers is a highly competitive enterprise that must satisfy the needs of international shipping lines. The provision of modern container facilities at Port Said should enhance its natural geographical advantages. The current flow of empty boxes may be indicative of transshipment potential. Additionally, discussions with the Port Said Port Authority, the Canal Shipping Agency, and private shipping agents, reveal many inquiries regarding transshipment. Currently, transshipment is minimal and further growth prospects are somewhat subjective. Bullen predicts a "latent" demand for transshipment of 1.3 million tons with over 95% in containers, as soon as adequate terminal facilities are available. Harris is less optimistic as is MTI.

TABLE II-7

TRANSSHIPMENT SECTOR PROJECTION

	Containerizable Trade (tons)	Penetration Ratio %	Container Tons	Container TEU's
1981	30,000(1)	-	-(2)	-
1985	50,000	95	47,500	4,200
1990(3)	100,000	95	95,000	8,330
1995(4)	250,000	95	237,500	20,833
2000	300,000	95	285,000	25,000

(1) 30,000 tons of general cargo in transshipment in 1979 estimated by Harris.
(2) 500 tons per month in containers for re-shipment to Aqaba in 1980 (Bullen); service cancelled due to Port Said delays in 1982 (Mideast Shipping Company).
(3) With import and export containers, would exceed proposed container terminal capacity by 1990 or so.
(4) Assumes increased container expansion to accommodate transshipment trade after 1990 (impact of proposed Damietta transshipment may alter forecast).

Rationale and Assumptions:

- Transshipment business would include large international vessels, with interline agreements, dropping off and picking-up containers and some feeder services to nearby ports;
- Minimal breakbulk cargo transshipment potential;
- Competition from neighboring ports, including Damietta new facilities with central government's port policy, should determine future of transshipment;
- Assumes no interruption of traffic with waiting line for entrance to Canal;

Needs to gain good reputation in price and cargo handling efficiency to attract substantial transshipment business. Formal commitments from shipping lines should be apparent before further expansion is undertaken.

E. Shipping Types

Containers received at Port Said have been carried on a variety of vessels. The large proportion have been carried on conventional or part-conventional vessels. Fully cellular container ships and feeder vessels carry an increasing percentage of containerized trade. Ro/ro vessels, very significant in Alexandria's unitized trade routes, are not that important in Port Said. However, motor vehicles are received via ro/ro and with adequate storage facilities, Port Said could increase its share of wheeled traffic.

It is estimated that in 1979, approximately 10% of Port Said's containerizable imports consisted of products such as meat and fish which would be suitable for transportation in refrigerated containers (reefers).[10] Potential exports of agricultural produce also could be suitable for reefer transport. Providing adequate facilities at Port Said, reefer cargo could represent 10% of the long-term container business.

Presently, Port Said is served by 16 regularly scheduled container lines, listed below:[11]

- Adriatica Di Nav Sp A, Venice
- Evergreen Marine Corp., Taipei
- Jugoslavenska Linijska Plovidba-Rijeka
- Nippon Yusen Kaisha, Tokyo
- Hellenic Lines, Lt., Piraeus

[10] Harris Report, 1980.

[11] Canal Shipping Agency.

- Mitsui OSK Lines, Ltd., Tokyo
- Danube Shipping, Ismail, U.S.S.R.
- Deutsche Nah OST Linien - Hamburg
- Ellerman Lines, Ltd., London
- Torm Line - Copenhagen
- Foss Shipping Limited, London
- Farrel Lines, Inc., New York
- Brostroms Rederi A/B, Gothenburg
- Polish Ocean Lines, Gdansk
- Shipping Corp. of India, Bombay
- Prudential Lines In., Genoa

The services of these lines and others should ensure the continued penetration of the container handling mode in Port Said and throughout the world's trade routes. However, the cargo growth projections, particularly over the long-run, are vulnerable to change. The most important factors affecting demand are:

- Rate of economic growth in Egypt and Port Said which impacts upon the demand for higher valued (non-bulk) imports;

- The continued vitality of Port Said's Free Trade Zone status; and

- The share of total Egyptian container traffic accounted for by Port Said, particularly concerning central government port policies, future role of the new Damietta Port, and operating procedures of the Suez Canal Authority.

III. CONTAINER TERMINAL REQUIREMENTS

A. Cargo Flows and Capacities

Analysis of cargo flows through the terminal is based on a pipeline-type methodology, with the element in the system having the minimum capacity constraining the flow of cargo. Elements in the cargo flow include:

* Ship/apron transfer (berth capacity);
* Storage areas; and
* Handling and transport equipment

The most capital-intensive elements of a container terminal are the container ship, berth, and berth cranes, so the ship/apron transfer capacity is the determining factor in estimating storage areas and equipment requirements. These less capital-intensive elements should not be allowed to constrain the efficient movement of cargo across the berth apron.

For this study, the following values have been used in estimating berth capacity:

* 350 potential operating days per year
* 24 potential operating hours per day
* 60% berth occupancy rate[1]
* 18 moves per hour for one crane[2]
* 10 moves per hour for a second crane[3]

---

[1]This is the optimal berth occupancy rate desired by the Port Said Port Authority to justify berth construction; 50% is a more commonly accepted optimal operating level for a single-berth container terminal, so 60% may be optimistic.

[2]20 moves/hr. average working capacity for a container crane rated at 22-25 moves/hr., less 10% for non-productive moves such as opening and closing of hatches.

[3]Assumes both cranes are not always able to operate simultaneously due to location of containers on the vessel; 50% of working capacity for second crane.

The proposed berth, as designed, is 345 m. long, capable of accommodating one second-generation container ship with a length of 229 m., beam of 29 m., and a draft of 11.5 m.[4] A minimum berth length of 250 m is required for such a vessel, so the proposed berth could also simultaneously accommodate a small (less than 80 m. long) container feeder vessel or a stern-ramped RO/RO vessel. Such vessels can be berthed at other berths in the port, so their accommodation at the container terminal should not be allowed to hinder the efficient operation of the terminal. RO/RO vessels with ramps in the aft quarter could be accommodated along the 65 m. northern water interface of the terminal. Use of the terminal for RO/RO traffic will be based on the availability of space and equipment, as well as berths.

The capacity of a single container crane at the berth is:

350 x 24 x .6 x 18 = 90,720 TEU/yr. (45,360 incoming, 45,360 outgoing).

Maximum capacity of the berth, with two container cranes, is:

350 x 24 x .6 x 28 = 141,120 TEU/yr. (70,560 each way).

Other elements in the system will be based on this maximum capacity. Figure 4 illustrates the relationship between this capacity and cargo projections presented earlier. Including a spillover capacity, the planned terminal will reach maximum utilization by 1993 or so. If container cargo forecasts come to fruition, a terminal use trade-off between import-export boxes and any transshipment business may be required. In any event, increased terminal capacity, beyond those elements examined in this report, may be required by the mid-1990's.

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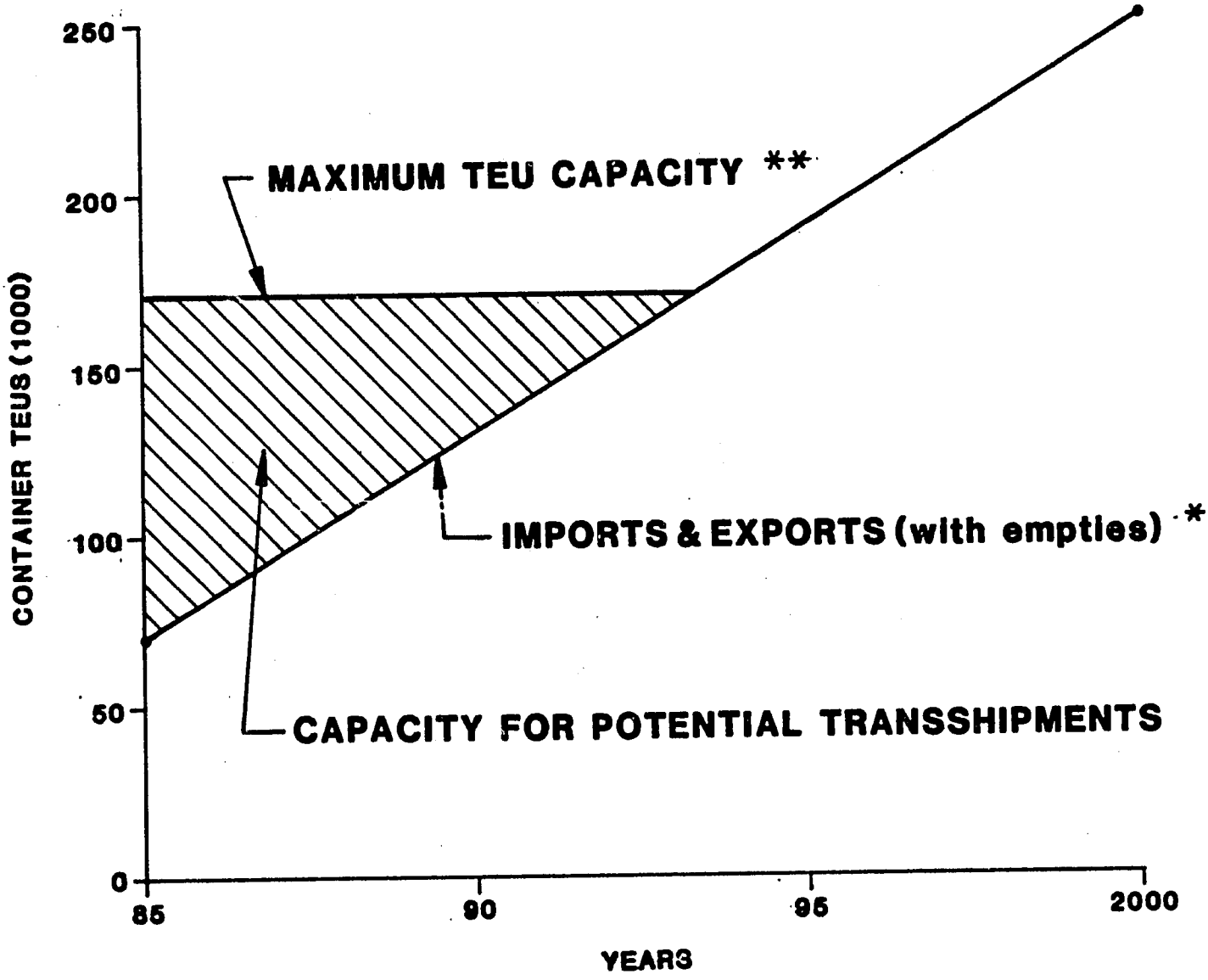
[4]

	Length	Beam	Draft
1st generation	180 m.	25 m.	9.0 m.
2nd generation	225	29	11.5
3rd generation	275	32	12.5
Feeders	75-130	13-19	3.5-7.5



* ASSUMES: EMPTIES & EXPORTS EQUAL IMPORTS

** ASSUMES: 141,000 TEU/Yr. CAPACITY OF NEW FACILITY & 30,000 TEU/Yr. "SPILLOVER" CAPACITY AT EXISTING SITES

PORT SAID CONTAINER TERMINAL STUDY		
FORECAST - CAPACITY		
CE MAGUIRE, INC. Architects · Engineers · Planners One Devol Square, Providence, Rhode Island 02903	DATE: 9/82	FIG. NO.: 4

B. Storage Requirements

Storage requirements are based on the following assumptions:

* Number of incoming containers (70,560) = Number of outgoing containers

* 90% of outgoing containers are empty

* 80% of imports and exports are less-than-container loads (LCL) requiring stripping (unpacking)/stuffing (packing) on the terminal

* 20% of imports and exports are full container loads (FCL) moved intact between terminal storage and inland origins/ destinations

* 10% of imports and exports are refrigerated units; all are FCL

* Assumed dwell times [5]
  FCL imports - 7 days
  LCL imports - 5 days
  FCL exports - 5 days
  LCL exports - 3 days
  empties - 20 days
  refrigerated imports - 5 days
  refrigerated exports - 3 days

* Average stacking of 2 high for non-refrigerated containers, @ 15 m^2/TEU [6]

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[5] Port development, UNCTAD, 1978, and previous reports by Harris, Bullen, and MTI on Port Said.

[6] See Appendix A.

* No stacking of refrigerated containers, @ 30 M^2/TEU

* Containers-on-chassis (RO/RO) @ 65 M^2/TEU

Storage requirements based on these assumptions are presented below:

TABLE III-1
SPACE REQUIREMENTS

Type of Container	TEUs/yr	Ave Dwell Time	M^2/ TEU	Space Requirement
Refrigerated imports	7,056	5 days	30	2,900 m
Non-refr. imports, FCL	12,701	7 days	15	3,654
Non-refr. imports, LCL	50,803	5 days	15	10,439
Refrigerated exports	706	3 days	30	174
Non-refr. exports, FCL	1,270	5 days	15	261
Non-refr. exports, LCL	5,080	3 days	15	626
Empties	63,504	20 days	15	52,195
RO/RO*	-	-	65	-
Totals	141,120			70,249 m

* RO/RO storage will be based on space available and would replace container storage space. Not enough information is available on potential RO/RO cargo to estimate TEU's/yr. or Ave. Dwell Time.

Storage requirements for the Container Freight Station (CFS-generally referred to as the strip/stuff shed, where unpacking of import LCL's and packing of export LCL's takes place) is based on a dwell time in the shed of 3 days for import cargoes and 2 days for export cargoes, and an average of 29 m^2/TEU stripped or stuffed. [7] Space required for the CFS, therefore, is:

[7] From Port Development, UNCTAD.

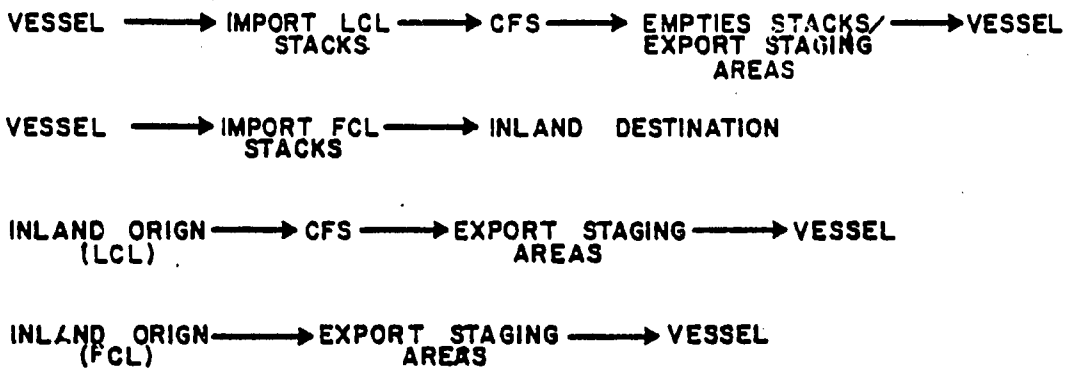
Imports 50,803 TEU/yr x 3 days dwell x 29 m /TEU = 12,109 m^2
Exports 5,080 TEU/yr x 2 days dwell x 29 m /TEU = 807 m^2
12,916 m^2

In addition, space is required for parking of trucks being loaded and containers being unloaded, and vice-versa.

A strip/stuff shed of this size is exceptionally large for a single berth container terminal, reflecting the high percentage of LCL's received at Port Said. Stripping or stuffing such a high percentage of cargo on the terminal reduces the efficiency and benefits of containerization, since the terminal operator not only must handle the container two extra times, but must also provide covered shed space for the cargo as well as open storage space for the containers (in effect doubling the on-terminal storage requirements). Movement of the shed off-terminal, however, increases the transport distances for LCL and empty containers, further reducing terminal efficiency. In view of the limited hinterland of Port Said's primary container traffic, it appears prudent to plan for a continuation of present operating realities. Should RO/RO traffic, in the form of containers-on-chassis, increase, it is likely that the percentage of FCL's allowing direct delivery inland will increase.

C. Equipment Requirements

Cargo flow through the terminal is depicted graphically in the figure below. Equipment recommendations contained in this study are based on analysis of conditions and requirements, previous experience with container terminals, and discussions with the Port Said Port Authority. Additional detail and analysis of equipment alternatives (i.e. straddle carriers vs. gantry cranes vs. forklift trucks, diesel driven equipment vs. electric equipment, etc.) is presented in Appendix A.



Rail-mounted gantry cranes on the dock will unload import containers from vessels onto yard trailers, which will be towed to storage stacks by yard tractors. Rubber-tired gantry cranes[8] will be used to handle and stack containers in the stack and staging areas. Containers will be moved between stack areas and the CFS by yard tractor-trailers. Yard tractor-trailers will also be used to move empty containers to the staging area for loading onto vessels. Stacking and handling within the staging areas will be by rubber-tired gantry cranes.

Export FCL's will be delivered directly to the staging area by road tractor-trailers and unloaded by gantry cranes. Export LCL cargo will be delivered to the strip/stuff shed in break-bulk or containers, where cargoes will be consolidated. Consolidated containers will be delivered to the staging area by yard tractor-trailers.

Based on an assumed average of 18 moves/hr., crane cycle time will be approximately three minutes. Cycle time for yard tractor-trailer units is estimated at approximately four to five minutes, allowing time for delivery, unloading and return. Three tractor-trailer units will be required to support each rail-mounted dock crane, therefore. With a delivery interval at the stacks of three minutes between containers, one rubber-tired gantry crane will be needed to support each dock crane.

---

[8]Commonly referred to as "Transtainers", the registered trademark of Paceco's line of terminal gantry cranes.

At the strip/stuff shed, one rubber-tired gantry crane will be required for handling LCL units. At least two tractors and 16 trailers will be required for movement between the CFS, the stacks and the staging areas. These units can be supplemented by the tractor-trailer units designated primarily for movement of imports and exports, when they are available. A modified forklift truck can be used for handling empty containers in Areas IV and V. As determined in the previous section, approximately 55,883 TEU/yr. will require stripping or stuffing. If the CFS operates 350 days/yr., 20 hrs/day, approximately 8 TEU/hr. will be stripped or stuffed each hour. At an estimated two hours/TEU, 16 container bays and 16 truck-bays will be required. Thirty-two forklift trucks would be required, one for each container and truck.

A summary of equipment requirements is shown in the table below.

TABLE III-2

EQUIPMENT REQUIREMENTS*

	Import/Export	CFS	Maint.	Total
Rubber-tired Gantry Cranes	2	2		4
Terminal Tractors	6	2	+15%	10
Terminal Trailers	6	16	+ 5%	23
Modified Forklift Trailers		1		1
Forklift Trucks		32	+15%	37

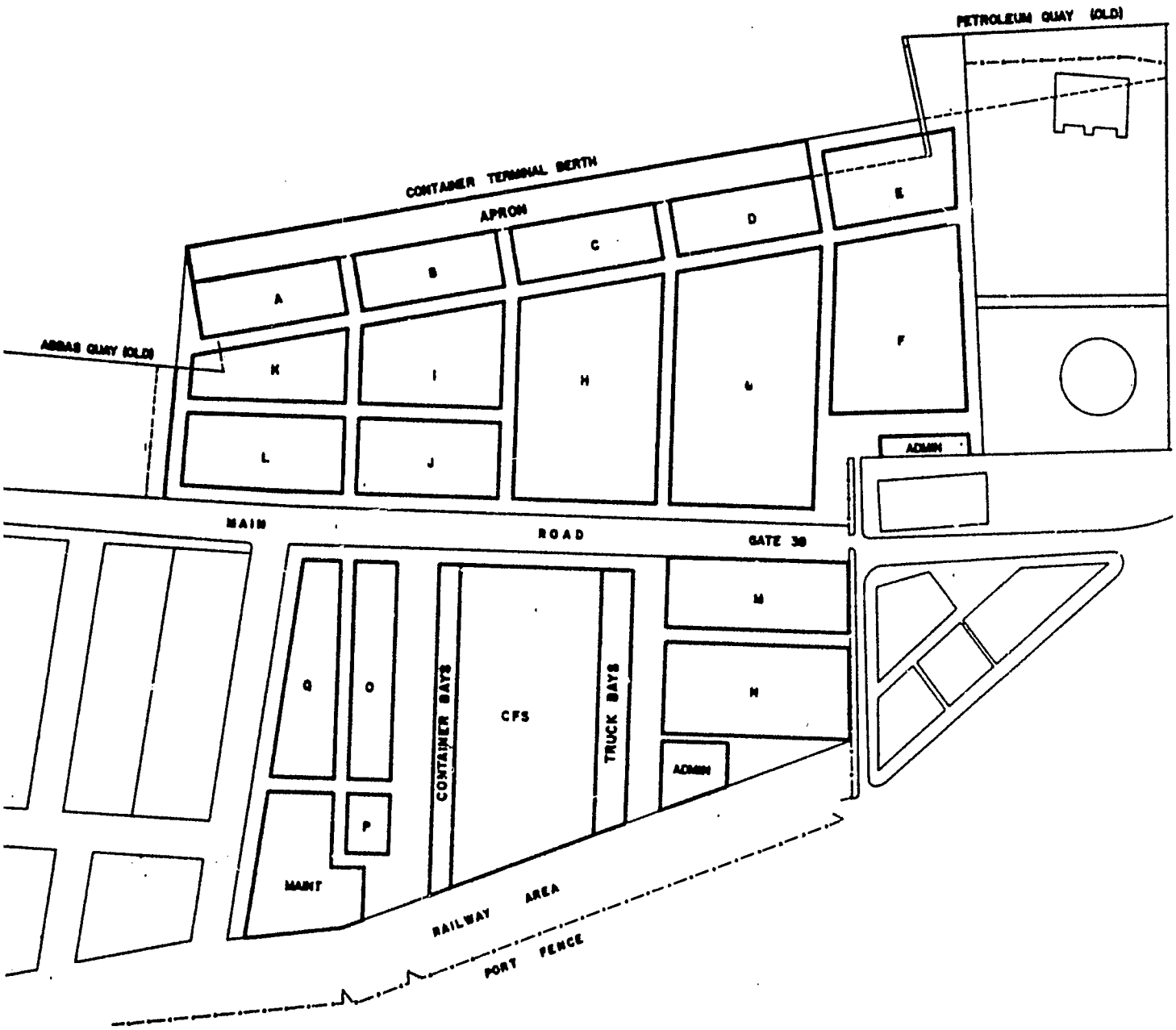
* Assumes two gantry cranes at dockside and terminal operating at maximum capacity = 141,200 TEU/yr. (between 1990 and 1995, based on projections).

D. Terminal Layout

Conceptual layout of the terminal is based on satisfying the storage requirements developed above and optimizing the operational efficiency of the terminal within the constraints of available space and configuration. Areas available for terminal development are indicated in Figure 3. Approximate space available within each area is:

Area I - 93,000 m^2
Area II - 49,000 m^2
Area III - 15,000 m^2
Area IV - 10,000 m^2
Area V - 25,000 m^2

Area III should be dedicated to continuing to support the container traffic currently passing across the berths at Abbas Quay, carried on multi-purpose vessels with ship's gear. Area IV should be used for storage of empty containers. Area V should be used for RO/RO and storage of empties. Self-propelled RO/RO cargo (i.e. cars and trucks) unloaded at either old Abbas Quay or the new container terminal should be moved directly to Area V for storage. Containers-on-chassis unloaded at the container terminal will require a surge storage area adjacent to the berth, but should be moved as soon as possible to Area V for storage. It is estimated that no more than 15,000 m^2 at Area V will be required for RO/RO (self-propelled and containers-on-chassis), leaving 10,000 m^2 available for storage of empties. Areas I and II will serve as the primary container terminal stack areas, with Area I used mainly for stacking of exports and empties, and Area II used mainly for maintenance and strip/stuff facilities, and storage of imports. A conceptual layout of the container terminal is shown on Figure 5. In addition to the storage and CFS areas determined previously, space requirements have been estimated for administration and maintenance. It is anticipated that the CFS and maintenance facilities will be of corrugated steel siding, with structural frames, on concrete foundations; the proposed yard services, terminal administration and electrical buildings will likely be constructed of concrete, brick or masonry. Covered messing and parking areas will be open-sided.



SCALE IN METERS

50 0 200

PORT SAID CONTAINER TERMINAL STUDY

CONCEPTUAL LAYOUT

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One David Square, Providence, Rhode Island 02903

DATE:	FIG. NO.:
9/82	5

Administration

Yard services building----yard foreman's office, security, toilets, storage, vessel services offices, stevedores office	250 m^2
Covered messing area for stevedores	200 m^2
Covered parking area	100 m^2
Electrical substation	15 m^2
	565 m^2

Terminal administration building----terminal administrative offices, terminal services offices, container information management center, training classroom, toilets, storage	350 m^2
Covered messing area for yard workers	200 m^2
Covered parking area	200 m^2
Open parking area	500 m^2
Electrical station	50 m^2
	1,300 m^2

Maintenance

Maintenance/repair facility----container repair shop, diesel shop, electrical shop, machine shop, battery room, hydraulic shop, tool room, garage, spare parts store, office	3,000 m^2
Equipment parking and storage area	800 m^2
Personnel parking area	200 m^2
	4,000 m^2

A summary of space available based on the proposed configuration is presented below:

TABLE III-3
SPACE UTILIZATION

AREA	Area, m^2	Use
A	2,350	Staging area for exports, empties
B	2,350	Staging area for exports, empties
C	2,350	Staging area for exports, empties
D	2,350	Staging area for exports, empties
E	3,280	RO/RO
F	6,470	Empties
G	12,590	Empties
H	10,970	Empties
I	4,750	Empties
J	4,125	Imports - FCL
K	3,560	RO/RO
L	4,050	Empties
M	3,100	Refrigerated units
N	4,875	Imports - FCL
O	3,125	Imports - LCL
P	875	Imports - LCL
Q	3,125	Imports - LCL
III	15,000	Imports, Exports for spillover
IV	10,000	Empties
V	25,000	15,000 - RO/RO 10,000 - Empties

TABLE III-4

SUMMARY OF AVAILABLE AND REQUIRED SPACE

Imports	-	16,125 m^2	available,	14,093 m^2 required
Exports	-	4,700 m^2	available,	887 m^2 required
Refrigerated	-	3,100 m^2	available,	3,074 m^2 required
Empties	-	63,530 m^2	available,	52,195 m^2 required
RO/RO	-	21,840 m^2	available	
Spillover	-	15,000 m^2	available	

E. Cost Estimate

Yard services building - 250 m^2 @ L.E. 500/m^2	=	L.E. 125,000
Messing area (covered) - 200 m^2 @ L.E. 100/m^2	=	20,000
Parking area (covered) - 100 m^2 @ L.E. 100/m^2	=	10,000
Electrical substation - 15 m^2 @ L.E. 300/m^2	=	4,500
Terminal administration building - 350 m^2 @ L.E. 600/m^2	=	210,000
Messing area (covered) - 200 m^2 @ L.E. 100/m^2	=	20,000
Parking area (open) - 500 m^2 @ L.E. 30/m^2	=	15,000
Parking area (covered) - 200 m^2 @ L.E. 100/m^2	=	20,000
Electrical substation - 50 m^2 @ L.E. 300/m^2	=	15,000
Strip/Stuff shed - 13,000 m^2 @ L.E. 350/m^2	=	4,550,000
Maintenance/repair facility - 3,000 m^2 @ L.E. 350/m^2	=	1,050,000
Equipment parking area - 800 m^2 @ L.E. 60/m^2	=	48,000
Personnel parking area - 200 m^2 @ L.E. 30/m	=	6,000
Container stacking and travel areas - 150,000 m^2 @ L.E. 80/m^2	=	12,000,000

Site prep., fencing, utilities -		
@ 10% of constr. costs (est.)	=	1,809,350
SUB-TOTAL	L.E.	19,902,850
Converted to U.S. $ @ L.E. 1.25/$	=	$24,878,563
Equipment for CFS, maintenance (est.)	=	1,000,000
Equipment for electrical stations (est.)	=	500,000
Utility equipment (fire protection systems, electrical, sewage collection and pumping) (est.)	=	500,000
Spare parts inventory (est.)	=	700,000
SUB-TOTAL		$27,578,562
Contingencies @20%	=	5,515,713
SUB-TOTAL	=	$33,094,275
Main Terminal Company Offices (est.)	=	1,000,000
SUB-TOTAL	=	$34,094,275

Equipment* -		
2 gantry cranes @ $3.7 million ea.	=	$7.4 million
4 gantry cranes @ $880,000 ea.	=	3.570
10 yard tractors @ $52,000 ea.	=	.520
23 yard trailers @ $15,000 ea.		.345
1 modified forklift truck @ $78,000 ea.	=	.078
37 Forklift trucks @ $33,000 ea.	=	1.221
Sub-Total		$11,863,000
TOTAL		$45,966,275

* Equipment requirements for terminal operating at full capacity (141,120 TEU/yr.)

IV. ECONOMIC AND FINANCIAL ANALYSIS

This section presents the analyses and conclusions of the economic and financial evaluations of the proposed container terminal. The economic analysis follows typical cost-benefit methodologies to derive the feasibility of the project from a national perspective. The financial evaluation or cash flow analysis, on the other hand, depicts the commercial viability of the project from a local port standpoint. A favorable finding in each procedure is required, if investment is to prove prudent.

A. Economic Evaluation

The methodology employed to produce an order of magnitude cost-benefit analysis consists of comparing the project costs with quantifiable benefits over the life cycle of the new container terminal. As depicted, the project under investigation includes: the new 345 meter wharf; required container handling equipment; paving and other improvements; and various buildings described in detail in Section III. It should be noted that this cost-benefit analysis considers the construction costs of the new wharf even though funds have already been allocated by the Egyptian government. These "sunk" project costs, even if subsidized, are still relevant when assessing the ecomomic costs to the nation.

In addition to the capital costs, the net difference in port operation costs are also included in the stream of project costs. These costs as well as project benefits are discounted to the net present value by using the estimated opportunity cost of capital in Egypt. For purposes of this analysis and based on discussions with both Egyptian national government and USAID sources, a range of 10% - 12% is assumed as the appropriate cost of capital. All costs and benefits are depicted in U.S. dollars with a shadow exchange rate of $U.S. = 0.82 L.E. used.

1. Project Benefits

The estimation of appropriate benefits that will be derived from a public works project in a developing economy can be a controversial issue. A true measurement should include only direct benefits that will have a consequential impact on the developing country's economy. Moreover, the proper measure of beneftis represents the difference between what the level of benefits would be "with" the project and what they would have been "without" it. This modernization project in Port Said has as its main benefit the prevention of cost increases because of ship delays and the economies of scale of accommodating larger container vessels. Each of these benefit categories can be substantial with the envisioned container volume increases that are projected to be handled "with" the project improvements. While other reports have included reductions in cargo handling costs and other similar categories, the consequential impact of these potential savings in a low cost labor surplus area is considered marginal and questionable in the real world. Even the benefits depicted in this analysis depend heavily upon a prudent tariff or leasing policy in Port Said to recoup a portion of the resulting savings from the international shipping community.

a. Ship Waiting Time

The initial step in the calculation of reductions in ship waiting time is the estimation of the annual number of vessels that will call in Port Said through the project forecast period. To determine ship waiting differentials, comparisons of current ship load and forecast ship load factors are presented. Table IV-1 presents statistics regarding vessel load factors during the 1979-1982 period in Port Said.

TABLE IV-1

CURRENT VESSEL LOAD FACTOR

	1979	1980	1981	1982 (six months)
Imports				
Ships	178	210	248	102
Containers	7,204	10,065	15,656	7,174
Tons	85,422	110,161	176,938	83,295
Average Shipload	480	525	713	817
Exports				
Ships	163	170	N.A.	N.A.
Containers	6,762	9,313	14,969	7,186
Tons	20,575	37,141	47,898	23,369
Average Shipload	126	218	N.A.	N.A.

Source: Port Said Port Authority

Container loads for this recent period, for the primary import trade, averaged 634 tons per ship. Container units per ship have been increasing from 40 in 1979 to 70 in 1982.

In forecasting future ship loads, the trend towards larger shipments and more fully containerized vessels is expected to continue. For this analysis, the average projected vessel load is estimated as 2,000 tons per ship by 1985, 4,000 tons per ship by 1990, and 6,000 tons per ship by 1995. This ship load forecast, when compared with the projected container cargo volumes through 2000 yields the number of vessels per year depicted in Table IV-2.

TABLE IV-2

PROJECTED VESSEL NUMBERS

Years	Ships
1985	202
86	219
87	236
88	255
89	276
90	189
91	199
92	209
93	219
94	230
95	184
96	193
97	203
98	213
99	224
2000	235

The sizes of the container vessels plying trade routes involving Port Said will continue to increase reflecting a typical mix of the world merchant fleet. The size of container ships will range from current feeder/combination classes to "second generation" container vessels. Pertinent characteristics of these vessels are presented in Section III. For purposes of this analysis, the following vessel mix is assumed to occur "with" the availability of the programmed improvements:

Year	Feeder Class	1st Generation	2nd Generation
1985 - 1990	50%	25%	25%
1990 - 1995	25%	25%	50%
1995 - 2000	10%	30%	60%

Under the "without" scenario, the primary vessels in operation will consist of the feeder class with greater utilization of first generation container ships as average ship load factors increase around 1990.

Waiting time estimates for the improved facilities are based on terminal productivity factors described in detail in Section III. "With" the new terminal, at a 60% berth occupancy level, estimated waiting time including unloading or loading is assumed to be 40 hours per vessel until 1993 when terminal capacity is reached. From 1993, assumed waiting time has been calculated as 50 hours per vessel "with" the terminal improvements. The continuation of current container handling operations in Port Said, "without" improvements, will result in enormous waiting time per vessel. While diversion to other ports could result at some future date, the present lack of alternate routing for Port Said container cargoes could produce large demurrage payments for Egypt. It is probable, however, that extreme port congestion would occur at some waiting time limit. For purposes of this calculation, a limit of 500 hours of waiting time per ship (also used in a previous analysis)[1] is assumed under the "without" improvements scenario. The current container handling operations are very near an overflow situation, hence the stated waiting time limit is assumed applicable throughout this cost-benefit analysis.

Annual waiting time costs are a product of the number of vessels, average waiting time and costs per appropriate vessel. Although vessel costs per day differ, dependent upon national registry, the following fully allocated costs per day of a vessel waiting in port are used in these calculations:

Vessel Type	Cost/Day	Cost/Hour
Container - Feeder (300 TEU)	$ 7,000	$ 292
First Generation (500 TEU)	9,000	375
Second Generation (1500 TEU)	12,000	500

[1] Harris Report, 1980.

Based on the previously depicted assumptions and calculations, estimated waiting time costs and differentials are presented below:

TABLE IV-3
SHIP WAITING TIME COSTS
($ Thousands)

Year	With Improvements	Without	Savings
1985	$ 2,947	$ 24,200	$ 26,253
86	3,195	31,974	28,779
87	3,443	34,456	31,013
88	3,720	37,230	33,510
89	4,027	40,296	36,269
90	3,151	37,438	32,287
91	3,317	37,313	33,996
92	3,484	39,188	35,704
93	4,562	41,063	36,501
94	4,793	43,125	38,332
95	3,997	34,500	30,503
96	4,263	36,188	31,925
97	4,483	38,063	33,580
98	4,704	39,938	35,234
99	4,947	42,000	37,053
2000	5,190	44,062	38,872
01	5,190	44,062	38,872
02	5,190	44,062	38,872

b. Distribution of Ship Waiting Time Savings

The immediate beneficiaries of these reductions in ship delays will be shipping companies. Since the Egyptian merchant marine does not participate, to any great degree, in these trade routes, the primary savings to Egypt will be in the form of demurrage costs avoidance. Secondary benefits may also accrue to Egypt in avoidance of higher costs passed on to imports and less possible exports. Thus, although the total waiting time savings is very high, only a portion of these benefits is relevant for this economic analysis. For this analysis, a varying distribution of ship waiting time savings is assumed for different periods

of the project life cycle. Because of Port Said's near monopoly position on the growing import container trade to the Free Trade Zone, an estimated 50% of the savings is assumed to have a consequential impact of the Egyptian economy through 1987. With the introduction of a possible port alternative in Alexandria, this estimated savings accrual is reduced to 40% of total savings from 1987 to 1993. During the last ten years of the project life cycle, the applicable savings is further reduced to 10% of total, reflecting the potential impact of the new Damietta container facilities. These portions of total waiting time savings reflect both the need for sound port pricing strategies as liner freight rates will not likely be reduced and possible losses of cargo volume as alternate routings to Port Said's Free Trade Zone are introduced. Again, the principle savings applicable to the economic analysis represents assumed levels of demurrage cost avoidance "with" the programmed improvements.

2. Ocean Transportation Costs

The second area of potential benefits involves the possible economies of scale savings through the employment of larger container vessels in Port Said's various trade routes. The availability of 14 meters depths alongside the new container wharf improves, significantly, the current 8.5 meter draft limitation. As depicted previously, second generation container vessels will be able to utilize the improved container terminal in Port Said. These larger container vessels will yield even higher unit transportation cost savings as sailing distance increases. For purposes of this analysis, the following costs per hour are used in the calculation of various voyage costs:

CONTAINER VESSELS

Size	Speed (Knots)	Cost/Hour	Cost/Ton-Mile
300 TEU	14	$ 366	$ .0074
500 TEU	20	491	.0042
1,500 TEU	23	1,419	.0033

The transport cost differential is derived by the total costs of the mix of vessels "with" improvement as compared to the "without" scenario. As estimated in the waiting time calculations, the existing conditions would allow vessels in the feeder or combination class (300 TEU until 1990 and 500 TEU after 1990). The "with" improvements case would allow second generation container vessel utilization increasing from 25% in 1985 to 60% in 1995. The approximate trade routes and market shares for containerized trade are estimated as follows:

Northern Europe	30%
Mediterranean	25%
North America	15%
Far East	20%
Arabian Gulf	10%

Representative ports were selected for the estimation of voyage distances. Since the closer ports in the Mediterranean and Arabian Gulf would probably be served by the same size ocean carriers in both cases, the differentials resulting from vessel economies of scale will result in the longer voyages to/from Northern Europe, North America, and the Far East.

The distances for these one-way voyages are as follows:

Port Pairs	Distance (Nautical Miles)
New York - Port Said	5128
Rotterdam - Port Said	3366
Yokahama - Port Said	7907

The resulting transport cost differentials need to be adjusted to the shadow exchange rate as these differentials are in foreign exchange. The portion of these economies of scale savings that can be assumed passed on to the economy depends upon a logical and effective tariff policy. For this analysis, it is assumed that 50% of these transport savings can be recouped and are, therefore, applicable as project benefits. Table IV-4 presents the ocean transport cost savings for the various trade routes over the project life cycle.

TABLE IV-4
OCEAN VOYAGE COST DIFFERENTIAL
($ Thousands)

Year	North Europe	Far East	North America	Total
1985	27	43	27	96
86	29	45	30	104
87	32	50	32	114
88	34	54	35	123
89	37	58	38	133
1990	40	62	41	143
91	47	74	48	169
92	49	77	50	176
93	52	81	53	186
94	54	85	55	194
95	57	90	58	205
96	60	94	60	214
97	63	99	63	225
98	66	104	67	237
99	69	109	71	249
2000	73	114	74	261
01	76	117	77	270
02	79	121	80	280

2. Project Costs

The stream of project costs includes the required capital investment for the wharf, facilities and equipment; the net difference in operating and maintenance costs between the new and existing container handling arrangements; and a two-year worker training program.

The yearly itemization of costs is documented in Appendix B. As noted, the required capital equipment includes normal replacement costs and additions to enhance terminal capacity throughout the project life cycle. The net operating cost difference is an estimate that assumes an increase in operating cost "with" the improvements. In essence, the technology transfer involves a shift from a labor-intensive operation to a modern and capital intensive container facility. Labor cost savings will be more than offset by increased equipment operation and maintenance costs. Existing operating costs per ton for containerized cargo have been estimated as $1.14/ton and total port maintenance costs have been estimated at approximately 200,000 L.E. per year[2]. A portion of these high existing costs reflect the use of lighters in some handlings and delays because of priority given to cement or grain handling. The cost differentials vary over time depending upon the forecasted throughput and appear as net operating and maintenance costs in the following cost-benefit calculation.

3. Comparison of Project Costs and Benefits

The complete cost-benefit comparisons for the project are presented in Table IV-5. As a planning tool, the cost-benefit analysis aids in decisions regarding the timing of investments. As illustrated, the project benefits will not commence until two years after the project construction costs have begun. Even with cargo volumes increasing, investment costs need to be spread over the initial three years to be an economically viable undertaking. As an economic tool, the comparison of costs and benefits illustrates the streams of required and resulting funds over a 20 year economic life.

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[2]Harris Report, 1980.

TABLE IV-5

BENEFIT-COST ANALYSIS
($ Thousands)

	BENEFITS					COSTS						
Year	Waiting Time Savings	Econ. of Scale Savings	Total	@ 10%	@ 12%	Year	Capital Investment	Net O & M	Training	Total	@ 10%	@ 12%
1983						1983	20,000		250	20,250	18,407	18,022
84						84	28,864		250	29,114	24,073	23,204
85	13,127	48	13,174	9,894	9,367	85	11,530	108		11,638	8,740	8,286
86	14,390	52	14,441	9,864	9,170	86	165	420		585	400	372
87	15,506	57	15,563	9,649	8,824	87	165	629		794	493	450
88	13,404	62	13,466	7,595	6,827	88	6,035	796		6,831	3,853	3,463
89	14,508	67	14,575	7,477	6,588	89	165	1,337		1,502	771	679
90	12,915	72	12,987	6,065	5,247	90	519	1,750		2,269	1,060	917
91	13,598	84	13,682	5,803	4,939	91	165	1,838		2,003	849	723
92	14,282	88	14,370	5,547	4,627	92	425	1,943		2,368	914	762
93	14,600	93	14,693	5,143	4,217	93	165	2,018		2,183	764	626
94	3,833	97	3,930	1,254	1,010	94	315	2,018		2,333	744	600
95	3,050	103	3,153	914	722	95	165	2,018		2,183	633	500
96	3,192	107	3,299	868	676	96	2,416	2,018		4,434	1,166	909
97	3,358	112	3,470	829	635	97	165	2,018		2,183	522	399
98	3,723	119	3,842	838	626	98	393	2,018		2,411	526	393
99	3,705	125	3,830	758	559	99	165	2,018		2,183	432	319
2000	3,887	130	4,017	723	522	2000	2,380	2,018		4,398	792	572
01	3,887	135	4,022	660	467	01	165	2,018		2,183	358	253
02	3,887	140	4,027	609	419	02	396	2,018		2,414	360	251
			TOTAL	74,479	65,442					TOTAL	65,857	61,700
			NPV @ 10%	8,622	3,742 @ 12%							
			B/C Ratio:	1.13	1.06							

Two analytical conclusions are presented in this economic evaluation. At the opportunity cost of capital of 10%, the net present value of the project is $8.6 million. A positive benefit-cost ratio of 1.13 also attests to the project's economic viability. Even at the higher discount rate of 12%, the project yields a net present value of $3.7 million and a B/C ratio of 1.06.

A sensitivity analysis of this economic evaluation provides additional information on the merits of the project. At a higher opportunity cost of capital, for example, the project could prove vulnerable. With a discount rate of 15%, the net present value would be negative and the B/C ratio below 1.0. Similarly, significant construction or operating cost increases, lower trade flows, or failure to capture the assumed level of benefits could adversely affect the project's economic worth. At the opportunity cost of 10%, the evaluation could tolerate as much as a 10 percent reduction of benefits or a 15 percent increase in total costs. In sum, this cost-benefit analysis documents the positive economic justification for the Port Said Container Terminal Project.

B. Financial Appraisal

The objective of this financial appraisal is to test the commercial viability of the proposed container terminal in Port Said. The procedure includes the preparation of a typical financial package to ascertain the yearly debt service requirements and the anticipated annual operating costs over the life of the project. Required revenues are dependent upon tariff practices and leasing agreements as well as volumes of future container throughput.

1. Typical Financial Package

A combination of foreign and domestic loans are assumed to be the financial sources for the envisioned terminal improvements and equipment purchases. Typically, 70% of the financing will

be in foreign exchange with 30% from Egyptian sources. Of the foreign exchange, 80% is assumed to come from foreign export credit programs, normally for equipment purchases. A "soft" loan from an international lending agency is assumed for 20% of these foreign loans.

The estimated interest rates are listed below:

Export Credit:	U.S.	- 13½% for 5-7 years
	Europe	- 10% for 5-7 years
	Japan	- 9% for 5-7 years
International Agency		- 8% for 10 years
Egyptian Commercial Loan		- 13% for 5 years

Based on other market realities, assumptions regarding loan payments have also been incorporated in the cash flow analysis. For example, for some international loans and export credit arrangements, principal repayment may be delayed until one year after the facility is fully operational. Some loans, thus, give up to a three-year grace period with the client responsible only for interest repayment during the cargo and operations build-up period. For purposes of this analysis, an assumed mix of loans have been formulated. The following summarizes the types of loans and timing of payments utilized in this exercise:

SUMMARY OF LOANS

Year	Amount (Million)	Source	Term
1984	$28.9	Export Credit (80%)	9% for 7 years (3 years grace)
		International (20%)	8% for 10 years (3 years grace)
1985	$11.3	Local "soft" Loan (67%)	8% for 5 years (3 years grace)
		Local Commercial (33%)	13% for 5 years
1988	$5	Export Credit	9% for 7 years (3 years grace)

2. Cash Flow Analysis

From the perspective of the terminal owner, the cash flow analysis will attest to the long range financial success of the proposed terminal improvements. Sources of funds include yearly revenues from operations and loans. Expenditures include annual capital equipment purchases, loan repayments and total operating expenses. The cash flow analysis excludes the wharf construction costs, as the recoupment was considered outside the scope of interest.[1]

For purposes of this analysis, a fixed tariff per TEU has been estimated. A detailed tariff and tariff policy study should be undertaken by the Port Said Port Authority, as soon as possible. With existing container handling rates in the range of $160/20' full box, $60/20' empty box, $225/20' transshipment box and other estimates ranging from $40 to $100 per box, as background, estimated tariffs have been used.[2] The following revenue assumptions have been made:

[1] Port Said Port Authority

[2] Canal Shipping Agency

$100/TEU for full containers
$ 50/TEU for empties
$ 50/TEU for stripping/stuffing

Total estimated revenues have been calculated from the product of these fixed rates per unit and the projected container TEU throughput at yearly intervals. A maximum terminal capacity of 141,000 TEU per year has been used and is applicable for the ninth year and beyond in the cash flow analysis. Differing tariff structures or revenues from leasing arrangements can be substituted in this exercise, once plans are being finalized between the Port Said Port Authority, the proposed joint venture, and the specialized terminal operating company. The cash flow analysis for the proposed terminal is presented in Table IV-6.

The annual cash flow will be negative during the early years of operations, even with favorable financial terms. This is normal for most commercial ventures. As capacity utilization approaches maximum and the burden of loan repayments reduces, however, a positive cash flow can be expected. A net present value of $20.9 million is estimated from the cash flow analysis of this project. As normal retained earnings, these funds should be available for reinvestment in other desirable port improvement projects. If the envisioned container cargo forecasts occur over time, an apparent use of these earnings may be the further development of the proposed terminal by another berth extension and increased container storage capacity during the mid-1990's.

C. Conclusion

Both the economic and financial evaluations have proven the desirability of the proposed terminal improvements. Favorable financing arrangements and the employment of a professional container terminal operating company should ensure a viable long term project in Port

TABLE IV-6

CASH FLOW ANALYSIS
($ Millions)

SOURCES	1984 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
TEU's	-	70K	77K	82K	90K	100K	130K	140K	141K	141K	141K	141K	141K	141K	141K	141K	141K	141K	141K	141K
Est. Revenues	-	6.9	7.5	7.9	8.7	9.8	12.7	13.7	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8
Loans	28.9	11.3	-	-	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	28.9	18.2	7.5	7.9	13.7	9.8	12.7	13.7	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8
EXPENDITURES	1984																			
Capital	28.9	11.3	.165	.300	5.9	.165	1.9	-	.7	.165	2.1	.165	.46	1.7	-	-	2.4	.165	.3	-
Loan Repayments	2.6	4.28	4.28	7.3	9.0	9.0	8	8.5	8.5	6.7	2.1	2.1	1.4	.4	.4	.4	.4	.4	.4	.4
Operating Expenses	-	.7	1.1	1.4	1.5	2.2	2.7	2.9	3.1	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Total	31.5	16.3	5.5	9	16.4	11.4	12.6	11.4	12.3	10.1	7.4	5.5	5.1	5.3	3.6	3.6	6	3.8	3.9	3.6
Annual Cash Flow	-2.6	1.9	2	-1.1	-2.7	-1.6	.1	2.3	1.5	3.7	6.4	8.3	8.7	8.5	10.2	10.2	7.8	10	9.9	10.2
Discounted @ 10%	-2.36	1.6	1.5	-.8	-1.7	-.9	.05	1.1	.6	1.4	2.2	2.6	2.5	2.2	2.4	2.2	1.5	1.8	1.6	1.5

NPV = +$20.9 million

Said. Additionally, any transshipment container cargoes will further enhance the financial success of the terminal, as the previous calculations have assumed only the primary import and export trades as demand factors.

V. GENERAL IMPACTS OF CONTAINERIZATION

To date, containerization, or at least the import of full containers and export of empty containers, has been accommodated by the Port Said Port Authority, Canal Stevedoring and Shipping Companies, and others by conventional means. Containers are unloaded from ocean-going vessels via lighters, as well as directly at the quay. Ship's gear is mostly responsible for vessel unloading and loading while one side-loader and several fork lift trucks move containers within areas adapted for stacking. Import containers are stripped of cargo in storage areas, thereby minimizing the advantages of comprehensive intermodalism. The volume of containers received in Port Said, as documented previously, has increased tremendously in the past few years, even considering the lack of adequate facilities. The economies of scale/technology attributable to containerization have, thus far, mostly gone to the vessel operators and selected importers without substantial benefit to Port Said or the surrounding hinterland.

The construction of the new quay, paving, new buildings, and dedicated container handling equipment will provide the Port Said community with a state-of-the-art container terminal. The provision of this capital-intensive facility will have impacts, possibly both positive and negative, to the Port Said maritime industry and surrounding community. Container shipping technology has advanced throughout the developed economies for over twenty years. Relevant transportation, manpower, documentation, and other institutional issues, related to the movement of waterborne commerce in developed countries, have also adapted to containerization. These same adjustments and impacts will occur in Port Said and throughout Egypt if the advantages of containerization and the new container terminal in Port Said are to be maximized.

A. Intermodalism

The concept of containerization is based on the advantages to be gained from a through transport system. A shipper is able to pack cargo into a container at his factory, warehouse or consolidation center, have it transported by road or rail to a suitable port, where it is loaded on to a containership, transported to an overseas port, unloaded to a similar intermodal system, and delivered to a customer without each individual package being handled at each intermediate stage. This intermodal concept affords economies of scale. Intermodalism allows a through movement of commerce which reduces the need for manpower, alters a labor-intensive service into a capital-intensive venture, reduces risk of damage and pilferage, increases the speed of cargo handling, and allows increased throughput in ports.

Containerization was initiated in the United States by Sea-Land Service and emphasized the compatibility of cargo unit between water and land carrier. While Sea-Land has traditionally employed 35' long containers designed specifically for Sea-Land vessels and trucks, international standards of 20' and 40' boxes have emerged in virtually all trading routes. The inland transport of these units, therefore, requires appropriate truck and railway equipment. Similarly, infrastructure improvements, including road widths and stress bearing capacity, must anticipate the throught movement of containers.

These improvements to the non-port intermodal system will be costly to the public and private sectors of Egypt. The extension of Port Said's hinterland beyond its city boundaries, however, requires significantly improved intermodal facilities and equipment. Current local distribution by horse-carts and small trucks may continue within Port Said, but the existing transport infrastructure is inadequate to allow longer haul, door-to-door delivery. Financial benefits of containerization will not be fully realized without these comprehensive improvements.

B. Inland Consolidation Centers

Inland terminals provide important complementary roles in enhancing efficiencies of containerization. The primary function of inland container depots is to serve as a gathering place for smaller consignments from shippers unable to utilize a full container, and pack or unpack them prior to transport to or from the container terminal of a port. The distance between the water and inland terminal can vary greatly. In addition to moving this stripping and stuffing activity away from the container berth, it is also desirable to undertake this consolidation work as near as possible to areas of production or consumption. Economies of scale can be realized by having full containers move as close to total distance as possible. These inland depots have been financed by groups of shipping companies and other private concerns, while port authorities and governments have also funded inland consolidation centers in conjunction with improvements to other elements of the intermodal system, such as railways, roads, and marine terminals.

The container terminal in Port Said would be well served by the creation of one or more inland consolidation centers. While an inland terminal could be located in Ismailia or other nearby locations, the primary area for development is Egypt's population and consumption center of Cairo. An inland terminal in Cairo could serve container traffic from Alexandria as well as Port Said. Not only would economies of scale be accomplished by this centralized venture, but Egypt's small shippers/ consigners would be encouraged to employ containerization through the availability of lower unit transport costs.

C. Manpower

The economic benefits of containerization assume reductions in manpower costs. However, wage rates in developing countries are significantly lower than those paid to dock workers in more developed countries where containerization has grown historically. Longshoremen unions in virtually all ports have resisted these manpower

reductions. However, over time, containerization has cut dock labor forces throughout the maritime world. The British Ports Association, for example, revealed the results of a survey that indicated that the rapid change over to containerization had reduced the registered dock labor force that totaled 60,000 in 1965 to 16,600 in 1982, with projections to 14,000 by 1985. This reduction happened even while total tonnage handled by U.K. ports rose 33 percent in 1965 and 1980. By 1980, 80 percent of U.K. general cargo and 12 percent of semi-bulk cargoes were unitized.[1]

Similar pressures for manpower reductions should be anticipated in Port Said. Stuffing and stripping activities at the terminal will require continued manpower. However, the requirements for crane operators and other jobs resulting from mechanization will need skilled labor. Training will be essential to retain the employment benefits of the new container terminal in Port Said. These socio-economic pressures resulting from manpower changes could determine the long term viability of increased container traffic through Port Said.

D. Documentation

Supporting institutions of the maritime industry will also need altering to eliminate impediments to through movements of containers. Customs services, for example, should not slow the flow of containers to and from the hinterland. It would be impractical to open every imported container at Port Said if service to an extended hinterland is expected. Similarly, a combined transport bill of lading and documentation can expedite through movements of boxes. Faster transmission of documents should also be encouraged to support rapid vessel turnaround.

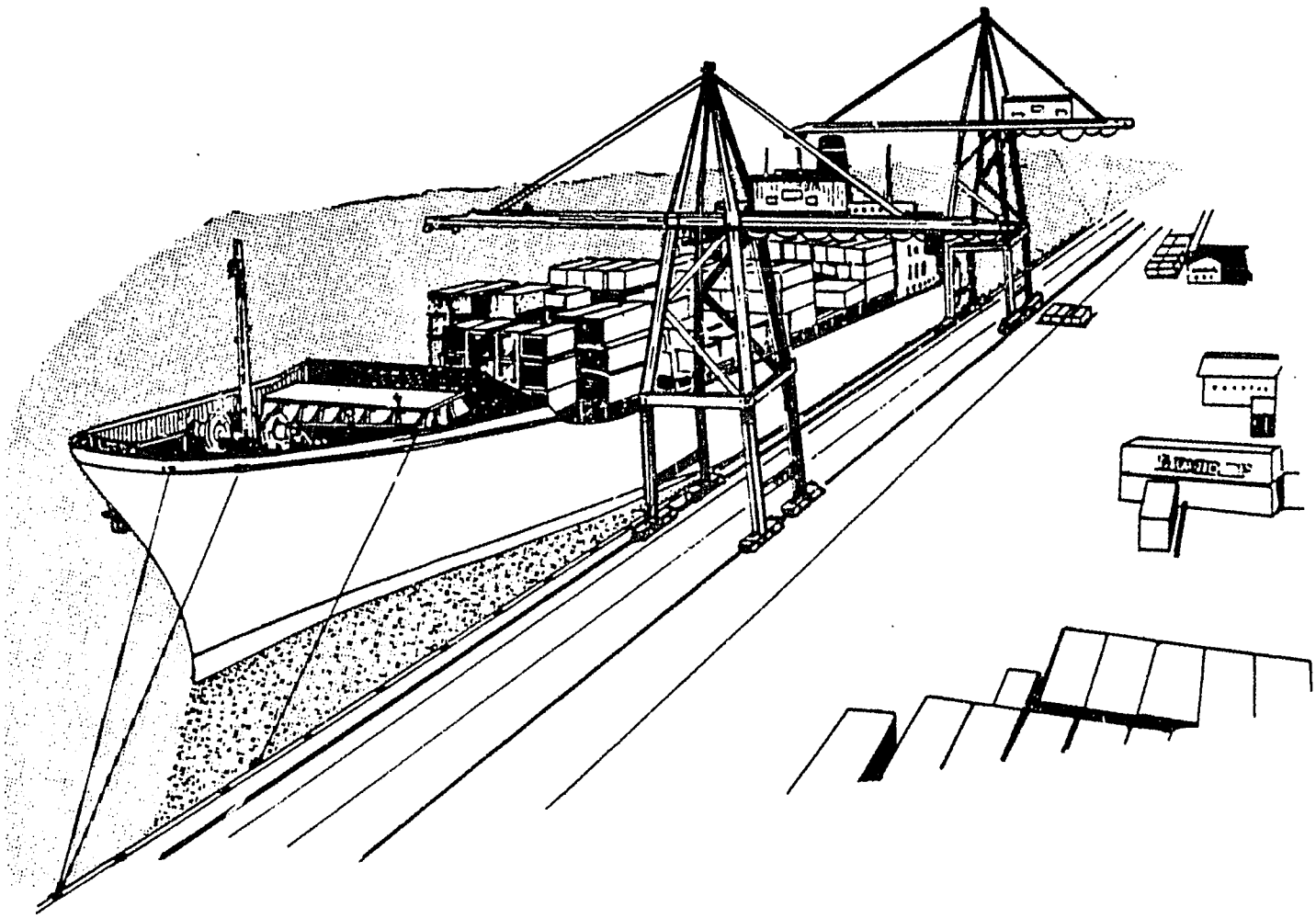
In many existing container terminals, computerized information systems are used extensively for a variety of operational and planning purposes. The most common use of computers in container terminal

[1] "Containerization Cuts UK Dock Labor Force", The Journal of Commerce, August 5, 1982.

operations is for inventory control and container location identification within the terminal complex. Information systems can keep track of individual boxes within storage areas for timely movements and to prevent loss or pilferage.

It would seem advisable to formulate committees composed of representatives of the relevant institutions in Port Said and at the national level that could anticipate changes resulting from a new container terminal in Port Said, as well as other container-related development. A national committee on containerization, for example, could explore adjustments to custom regulations. A local Port Said container terminal user committee including representatives from the Port Authority, steamship agents, stevedoring companies, foreign trade zone, and others could pinpoint difficulties in tariffs, regulations, or other documentation procedures that need adjustments to facilitate the flow of existing and new container traffic.

In sum, containerization must be viewed as a comprehensive logistic system. This intermodal network has had continual development in the United States, Europe, Japan, and elsewhere. Much can be learned from these advances, but particular attention must be paid to Egypt's national priorities, technologies, and customs. In the long run, the container terminal in Port Said is only one element in this modern network. Improvements to land transport, cargo consolidation, documentation, and manpower training must also be made to reap the possible financial benefits of this shipping technology.



APPENDICES

APPENDIX A: EQUIPMENT/OPERATIONAL ANALYSIS

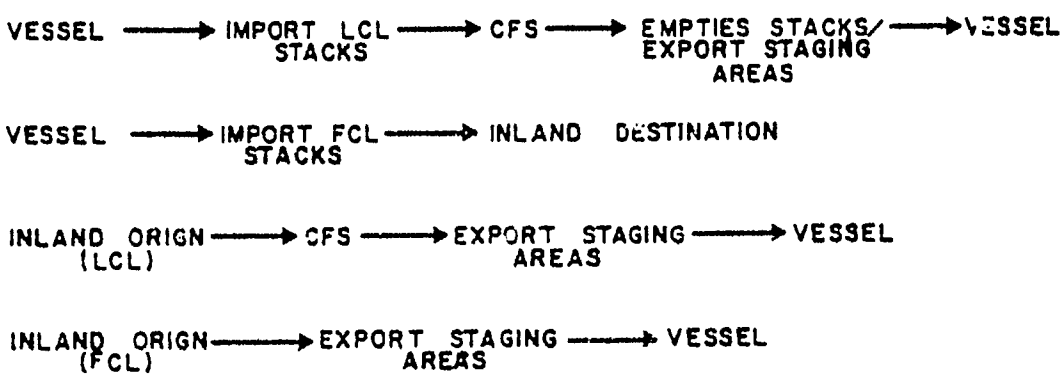
A. INTRODUCTION

This Appendix presents and evaluates equipment alternatives based on:

- Operational requirements;
- Purchase costs; and
- Maintenance requirements.

Product literature is included in order to illustrate the types of equipment discussed. The products shown have good reputations and operational records, but their inclusion in this report should not be construed as an endorsement or recommendation. They are included merely as examples of standard equipment types.

There will be four (4) primary flow patterns through the container terminal, as shown below, requiring equipment for container transport and handling:



Since the proposed terminal is being designed to handle second-generation containerships, ship-apron transfer should be by electric-powered, rail-mounted gantry crane (see Exhibit A). These cranes have higher levels of productivity than multi-purpose deck cranes, assuming the terminal primarily accommodates dedicated container ships. Shore-based electrical power for the cranes is preferable to diesel-electric power because of reduced costs and maintenance requirements.

The basic means of transport within the terminal will be by unlicensed, diesel-powered, tractor-trailer units (see Exhibit B). Tractor-trailer units are preferable to straddle carriers or forklift trucks for distances over approximately 150m. and, given the proposed terminal site, most movements will be greater than 150m.

While loading/unloading and transport equipment types can be determined with relative ease, significant alternatives exist with regard to selection of stacking equipment. Given that back-up space at the terminal is somewhat limited, the two major options for stacking equipment are rubber-tired gantry cranes (see Exhibit C) and straddle carriers (see Exhibit D). Modified forklift trucks and chassis storage were not considered for widespread use due to their higher space requirements. Forklift trucks have been considered for limited use, including handling of empties, and strip/stuff activities in the CFS (see Exhibit E).

In the following sections, the stacking alternatives are synthesized into total terminal operating systems; requirements and costs are estimated; and an optimal system is recommended.

B. ALTERNATIVES

For Alternate A, stacking and retrieval would be performed by diesel-electric, rubber-tired, gantry cranes, capable of moving one container over three, six containers wide with a truck lane. All movement within the terminal would be by means of tractor-trailer units; containers would remain on trailers at the CFS.

For Alternate B, handling in the stack areas would be by diesel-electric straddle carriers, capable of moving one container over two. Transport between import LCL stacks and the CFS would also be by straddle carriers, with the containers placed on piers at the CFS for stripping and/or stuffing. Straddle carriers would place consolidated containers on trailers for movement to the export staging area by terminal tractors. Empty containers would be handled at the CFS by straddle carriers and modified forklift truck, and moved to stack areas by tractor-trailer units.

As determined in the text, berth-apron transfer capacity at the terminal is estimated to be 90,720 TEU for a single crane and 141,120 TEU for two cranes. Crane cycle time will be approximately three minutes, while tractor-trailer travel time for movement of incoming boxes is estimated to be four to six minutes, necessitating three units to support each container crane during unloading operations.

For Alternate A, one gantry crane would be required to support each container crane during unloading operations; under Alternate B, two straddle carriers would be needed to support each crane.

The proposed CFS would have 16 container bays, with eight TEU stripped or stuffed per hour and a container movement approximately every eight minutes for 20 hours per day. For Alternate A, one gantry crane in the import LCL stack and one in the empties stack or export staging area would be required. These could be supplemented at times by the cranes primarily designated to support unloading/loading operations, but loading/unloading and CFS operations will coincide about two-thirds of the time and use of the gantry cranes to support CFS operations cannot be allowed to hinder ship unloading or loading. A modified forklift truck could be used for handling of empties in Areas IV and V, to eliminate the need for rubber-tired gantry cranes to move outside the terminal. At least two terminal tractors and 16 trailers would be required. Feeding of exports from the staging areas and empties from the stacks and staging areas to the container crane would be by gantry cranes and tractor-trailer units used for unloading.

For Alternate B, one straddle carrier will be needed to move LCL containers between import stacks and the CFS; loading of empty containers onto trailers will be by the same straddle carrier, supplemented by a modified forklift truck. At least two tractor-trailer units would be required for transport between the CFS and stacking/staging areas. Handling in the on-terminal empties stacks and export staging areas would be by straddle carrier; handling of empties in Areas IV and V would be by modified forklift truck. Loading operations would utilize the straddle carriers and terminal tractor-trailer units used for unloading.

C. EVALUATION

A summary of equipment requirements and costs is presented below:

	ALTERNATE A		ALTERNATE B	
	#*	$	#*	$
Container Gantry Cranes @ $3.7m.	2	$ 7.4m	2	$ 7.4m
Rubber-Tired Gantry Cranes @ $880,000	4	3,520,000	--	--
Straddle Carriers @ $432,000	--	--	8	3,456,000
Terminal Tractors @ $52,000	10	520,000	10	52,000
Terminal Trailers @ $15,000	23	345,000	8	120,000
Modified Forklift Trucks @ $78,000	1	78,000	2	156,000
		$11,863,000		$11,652,000

*Includes spares for scheduled and unscheduled maintenance.

Average working life of a rubber-tired gantry crane is estimated at approximately 12 years; average working life of a straddle carrier is estimated at approximately 6 years, requiring replacement twice as often as gantry cranes, therefore. Over the 20-year life of the project, replacement costs for the alternatives would be:

Alternate A 20 years ÷ 12 x 4 x $880,000 = $5,870,000

Alternate B 20 years ÷ 6 x 8 x $432,000 = $11,520,000

Initial and replacement costs for purchase of the main elements of each alternative, therefore, are:

Rubber-tired Gantry Cranes	-	$9,390,000
Straddle Carriers	-	$14,976,000

In addition to purchase prices, operational and maintenance considerations must be evaluated. In general, selection of equipment of a common type and from a common manufacturer is recommended in order to minimize personnel training and spare parts inventory requirements.

Maintenance requirements of the alternatives differ considerably. Rubber-tired gantry cranes have very good maintenance histories (in some cases a downtime of less than 1%), while early models of straddle carriers were plagued with maintenance problems, particularly in the hydraulic systems (some terminals utilizing straddle carriers have experienced almost 30% downtime). Recent models, some of which have replaced hydraulic systems with mechanical systems, have much better maintenance records and are more reliable, as long as scheduled maintenance is kept up. The equipment requirements shown include replacements for scheduled and unscheduled maintenance, to reflect any difference in maintenance requirements. Straddle carriers have one maintenance advantage over gantry cranes in that straddle carriers can be moved inside the maintenance shed for repairs. Maintenance costs for rubber-tired gantry cranes average approximately 10% of purchase price per year, while those of straddle carriers average approximately 12% of purchase price per year. Maintenance costs for straddle carriers, therefore, would be approximately $60,000 per year more than those for rubber-tired gantry cranes. Labor costs would also be less for gantry cranes, since fewer operators would be required; operating costs for the alternatives would be approximately equal.

With regard to operational considerations, gantry cranes can provide denser stacking than straddle carriers or forklift trucks, as shown in the table below:

	STACKING HEIGHT	m^2/TEU
Chassis	1	65
Straddle Carriers	2	13
Forklift Trucks	2	18
Rubber-Tired Gantry Crane	2	11
	3	8

SOURCE: CE Maguire, Inc., and Port Development, UNCTAD, 1978.

Straddle carriers and forklift trucks are also capable of stacking three high (and gantry cranes are capable of stacking higher than three), but with reduced efficiency. With regard to access, container storage areas of equal stacking height will have an equal number of unproductive moves, regardless of the type of equipment used. The type of equipment will affect the time required for an unproductive cycle, with gantry cranes more efficient than the straddle carriers (which are more efficient than forklift trucks). The greater number of straddle carrier available on the terminal offsets this advantage, however.

Analysis of available and required space at the terminal based on two-high stacking and an average of $15m^2$/TEU resulted in the following relationships:

	AVAILABLE	REQUIRED
Imports	$16,125m^2$	$14,093m^2$
Exports	4,700	887
Refrigerated	3,100	3,074
Empties	63,530	52,195
RO/RO	21,840	---
Spillover Area	15,000	---

From the above table, it is apparent that space is not a critical factor in evaluation of the alternatives. For the purposes of this study, it will be assumed that average stacking height on the terminal will be two containers. The potential advantage of gantry cranes--allowing three high stacking if necessary to support extension of the container terminal berth--should be noted.

Pavement loadings for straddle carriers are approximately 12 to 18 tons/wheel, those for gantry cranes are approximately 48 tons/wheel. This is somewhat offset by the smaller travelways required for gantry cranes. Gantry crane travelways can be identified and reinforced or, if necessary, supported on piles; straddle carriers require more extensive areas for travelling and maneuvering, necessitating heavy-duty paving throughout the terminal. The ability of the straddle carriers to move anywhere and adapt to changes in terminal use and layout does also provide additional flexibility, however.

For this study, Alternate A will be used to determine equipment requirements, for the following reasons:

- Rubber-tired gantry cranes require less capital investment over the life of the project;

- Maintenance and operating costs are less than for Alternate B; and

- Gantry cranes provide additional capacity to support future terminal expansion.

CAPABILITY
REPORT

Paceco Portainer® Crane Systems

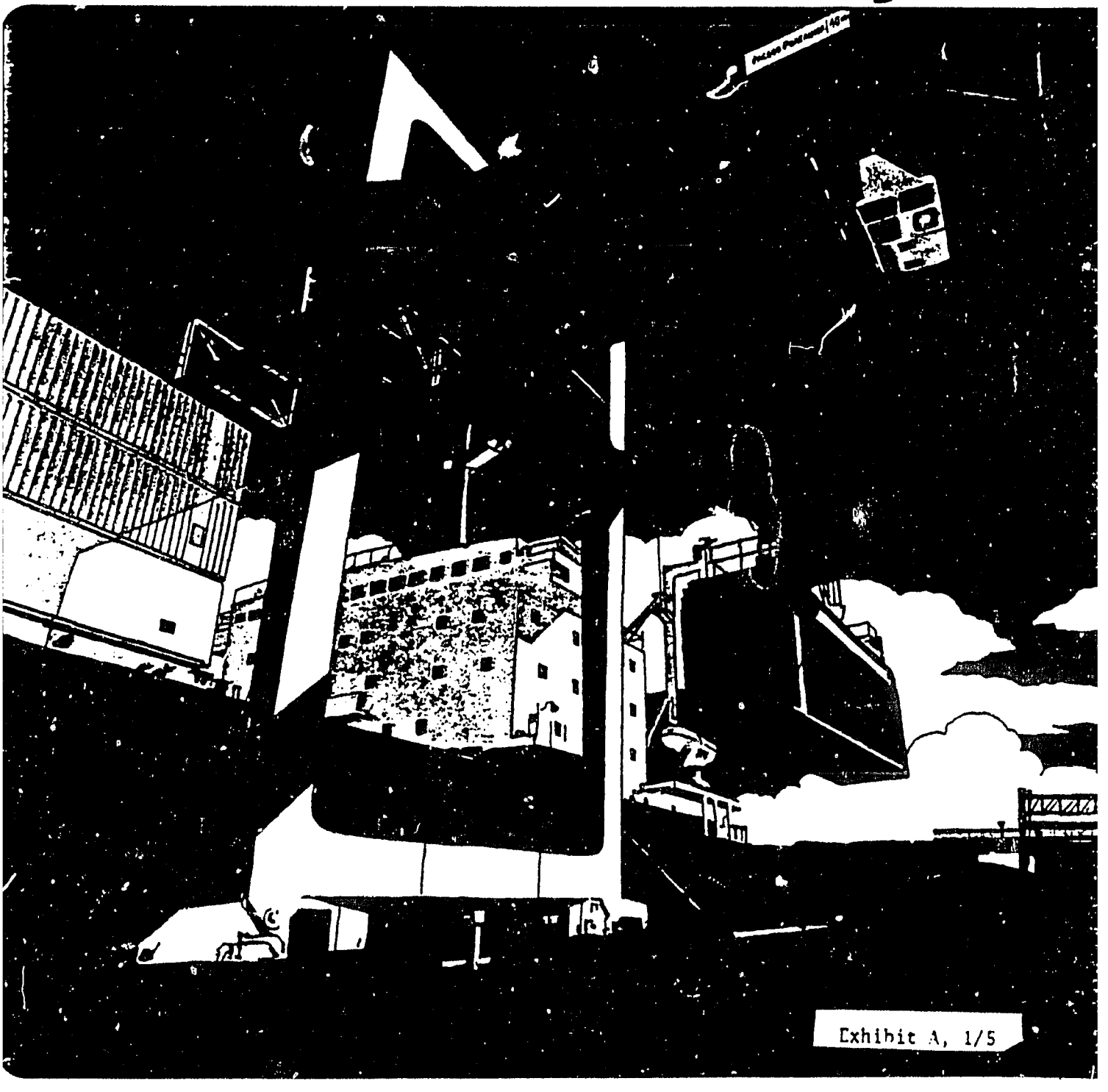
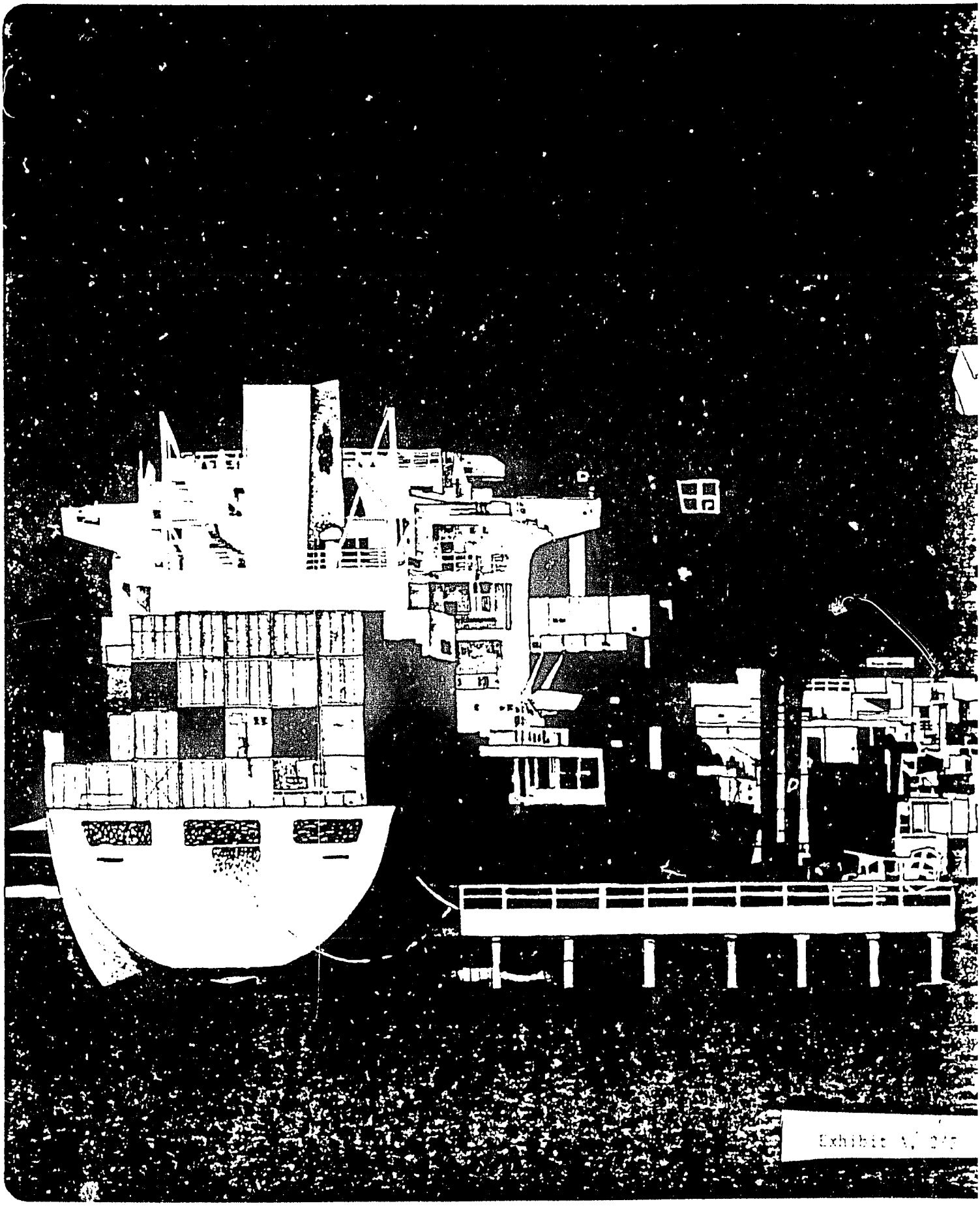


Exhibit A, 1/5

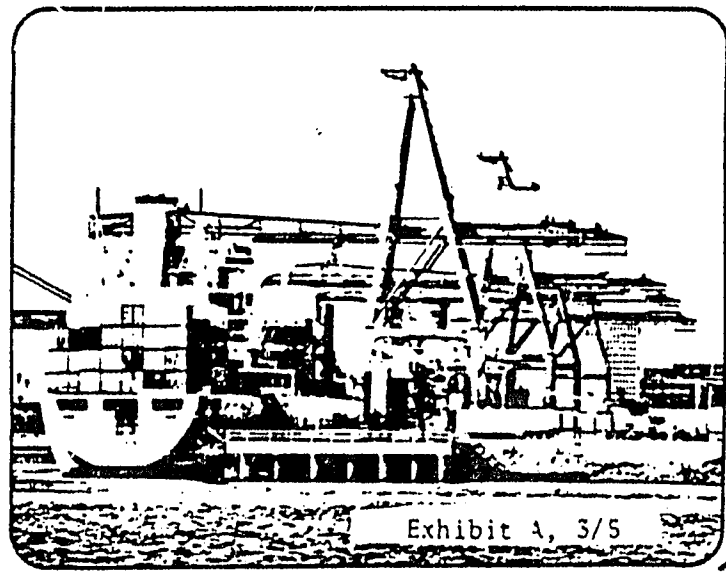


PACECO portainer cranes- the choice of great and growing ports around the world.

From Ports on the United States East Coast - around the world and back - and from harbors as far North and South as container ships travel, PACECO Portainer® Cranes are on the job - working efficiently, productively and dependably. So it has been for over two decades: PACECO - the Pacesetter in Container Handling.

The PACECO tradition of leadership: PACECO designed and built the first shore-based container crane in 1959. Since this important accomplishment, we've earned the reputation as the world leader in design and manufacture of container handling equipment. In fact, we've sold more container cranes than any other company in the entire world.

This position of world leadership didn't come about by chance or luck. It's the result of research, development and plain hard work and dedication to producing and marketing superior products. For example, we created and engineered the revolutionary MACH (Modular Automated Container Handling) system, an idea that represents the "state-of-the-art" in the industry today. Our aggressive response to meeting the needs and solving the problems of container handling is why PACECO Portainer Crane systems are the finest in the world.



The PACECO portfolio

From Feeder Ports to the World's Busiest Ports - There's a model to fulfill your requirements:

Economy Portainer Cranes. Productivity at a low cost, with several models including the multi-purpose. Versatile and highly adaptable. Can handle general cargo, bulk cargo, containers, and can be furnished with magnet capabilities. Excellent for inland or feeder ports.

Long Span Portainer Cranes. Does a big job for smaller ports. Designed to load, unload and service an entire container storage area in a small port. In successful operation at many ports since 1968.

Twin Lift Portainer Cranes. Extend your productivity. Another first by Paceco...twin main hoist system handles two unattached 20-foot containers simultaneously, or one 40-foot container, or even one 20-foot container. Container handling versatility to meet your situation.

Standard Portainer Cranes. Backbone of the world's hardest working ports. Handles 20 to 40-foot containers. Is available in several designs to fit the needs of your terminal: Short and long spans, extra long backreach to service storage areas, articulated gantries for movement on curves, and articulated booms for required low stowage heights - and these are only a few!

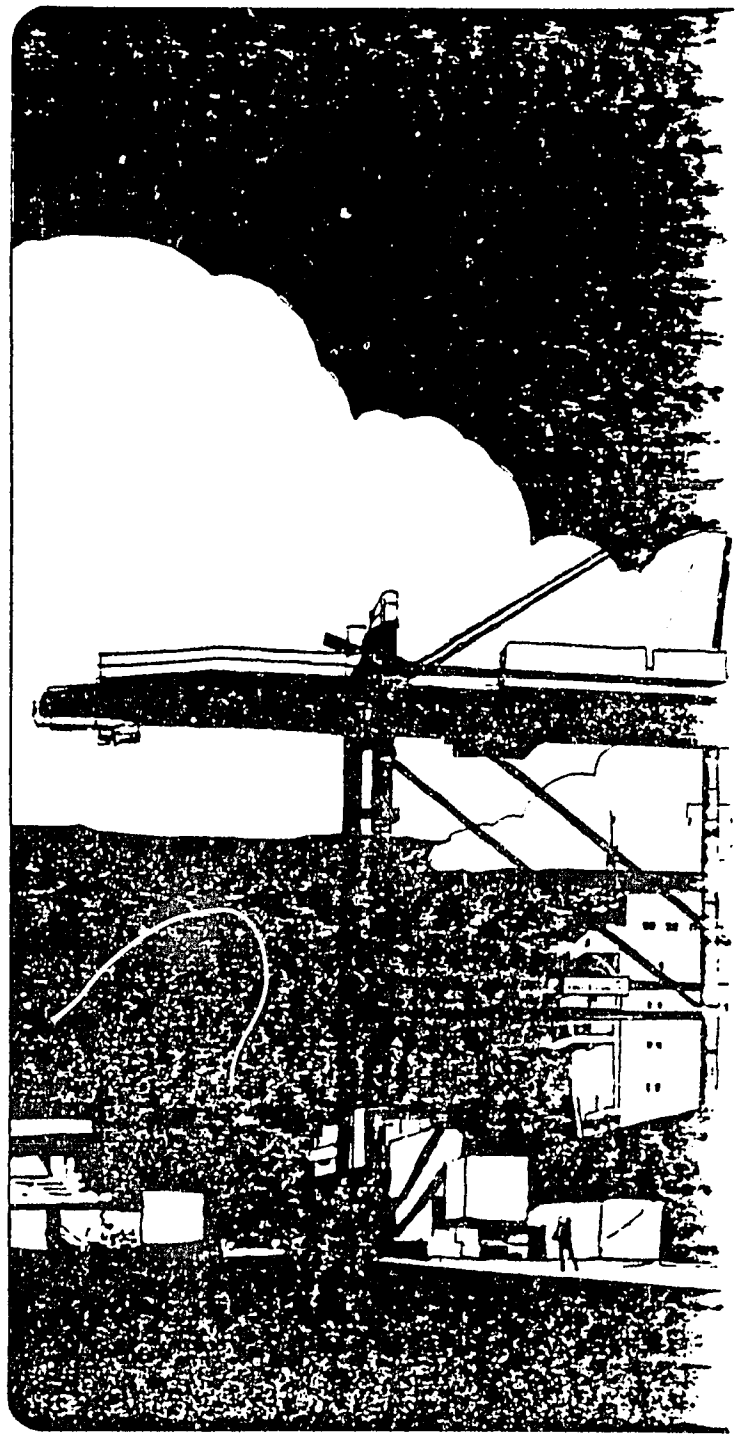
Low Profile Container Cranes. Where the sky has a limit. If you're near an airport with height restrictions, this is your Portainer. Delivers extended outreach and backreach at a very low overall height. Plenty of room for traffic or storage underneath. Sliding boom retracts for ship clearance faster than many other cranes.

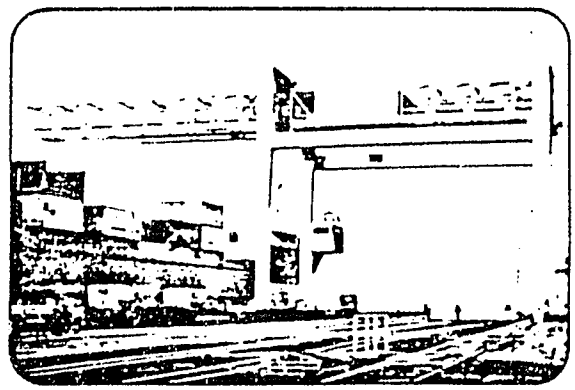
Portainer Crane with Articulated Boom. An economical alternative to the low profile design...has a hinged boom with articulating features to fit height requirements for stowage. Available in several designs.

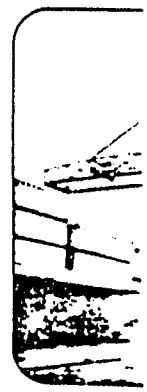
The MACH Portainer Crane...the Heart of the MACH System...delivers everything from higher speed to complete automation. The Portainer Crane incorporates sway-stop and high-speed modules for fast, efficient operation under manual control. Also included in the basic MACH Portainer Crane is the PACECO trim, list and skew module which simplifies positioning containers in a ship's cell, and when positioning containers on truck-trailers.

Other modules can be added to increase productivity over conventional equipment!

From large port to small port - from inland waterway to sea terminals - PACECO has the container handling systems to boost productivity!





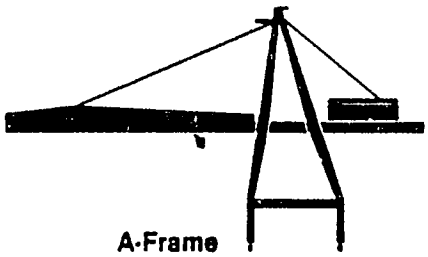


PACECO PORTAINER® CRANE

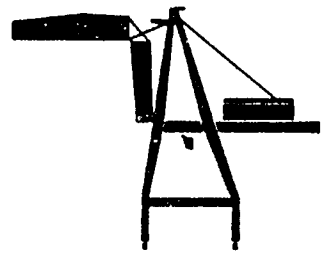
Features and Specifications

All Models Can Be Ordered As MACH, Twin-Lift Or Rotating Trolley Portainer® Cranes.

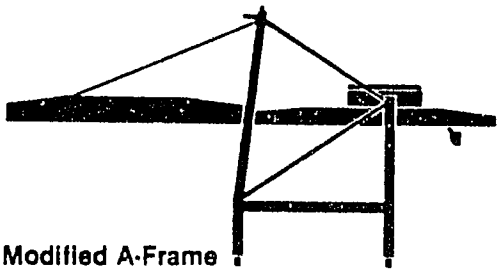
A wide selection of Portainer Crane models with available alternatives and options are shown here. The selection of the most efficient Portainer Crane to meet your specific needs requires consultation with a Paceco sales engineer. Paceco personnel have a wealth of experience in container handling equipment that is unparalleled in the industry, and are best able to recommend the equipment properly tailored to your facility.



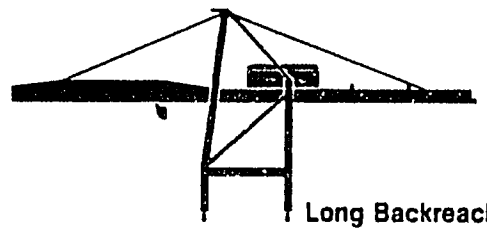
A-Frame



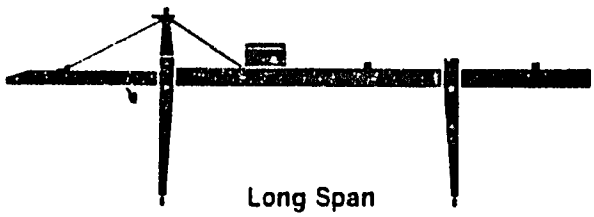
A-Frame w/articulated boom



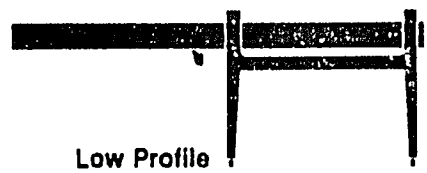
Modified A-Frame



Long Backreach



Long Span



Low Profile

STANDARD SPECIFICATIONS

Cargo capacity	30 or 40 Long Ton
Gauge	50 ft. (15.24m)
Outreach	115 ft. (35.05m)
Backreach	30 ft. (9.14m)
Clear between legs	45 ft. (13.72m)
Clear under spreader	72 ft. (22m)
Clear under portal beam	35 ft. (10.7m)
Wheels per leg	6 or 8

STANDARD SPEEDS

	Hoist with Load	Hoist without Load
30 Long Ton	120 FPM (37 MPM)	295 FPM (90 MPM)
40 Long Ton	100 FPM (30.5 MPM)	245 FPM (75 MPM)

TROLLEY TRAVEL

30 or 40 LT	410 FPM (125 MPM)

GANTRY TRAVEL

30 or 40 LT	150 FPM (46 MPM)

ALTERNATE SPECIFICATIONS

Cargo Capacity	20 Long Ton through 65 Long Ton
Gauge	30 ft. to 150 ft. (9.2m to 46m)
Outreach	72 ft. to 144 ft. (22m to 44m)
Backreach	0 ft. to 115 ft. (0m to 35m)
Clear between legs	45 ft. to 70 ft. (13.72m to 21.3m)
Clear under spreader	64 ft. to 100 ft. (19.5m to 30.5m)
Wheels per leg	6 to 10

MACH SPEEDS

	Hoist w/Load	Hoist without Load
30 Long Ton	180 FPM (56 MPM)	432 FPM (132 MPM)
40 Long Ton	150 FPM (46 MPM)	360 FPM (110 MPM)

TROLLEY TRAVEL

30 or 40 LT	500 FPM (152 MPM)

GANTRY TRAVEL

30 or 40 LT	150 FPM (46 MPM)

Exhibit A, 4/5

PORTAINER® CRANE FEATURES

ANTI-SWAY REEVING
Special reeving arrangements are available which eliminate much of the load sway during acceleration or deceleration. MACH Portainers, however, are equipped with sway stop trolleys which provide for future automation.

SMOOTHER OPERATION
Portainers have stepless DC speed controls. All motions (hoist, trolley, gantry and boom) are controlled by DC adjustable voltage motors with stepless DC speed controls.

FASTER CYCLING WITH AUTOMATIC FIELD WEAKENING
Empty spreader of light container load moves fast. An empty spreader moves more than twice the speed of a loaded hoist to pick up another pay load.

BRAKING POWER PLUS
Portainers have multiple braking systems throughout. They consist of motor regenerative braking and fail-safe electro-magnetic braking. The boom hoist has an additional automatic overspeed braking system.

FLEET THROUGH HOISTING - ROPE HAUL TROLLEY
Proven over thousands of crane years of operation, the fleet through hoisting and rope haul trolley systems provide lower initial crane and dock costs. These systems also provide better control, lower cost operation, and lower maintenance costs.

FAIL-SAFE CONTAINER HOISTING
Limit switch interlocks prevent hoisting unless all latches on lifting spreader are in fully engaged or disengaged positions.

STRENGTH, STABILITY AND FATIGUE RESISTANCE
Portainer design and materials provide the utmost strength in the crane's structure permitting accurate tracking without distortion or racking of the frame.

REDUCED POWER DEMAND
For added economy all Portainer hoist and trolley drive units feature anti-friction bearings requiring less power demand.

SAFETY
Every Paceco Portainer is designed for OSHA or applicable national standards. Electrical safeguards include limit switch protection for all travel directions, plus overload, torque limit, under voltage and short circuit protection.

All Portainers Can Be Equipped With Buckets For Handling Bulk—Magnets for Steel—Cargo Beams for General Cargo And Heavy Lifts.

PACECO, INC.
World Headquarters
2320 Blanding Ave.
Alameda, California 94501
Telephone: (415) 522-6100
Telex: 355-399
Cable: PACECO

PACECO International Ltd.
St. Anne House
20/26 Wellesley Road
Croydon, Surrey
CRO 9XB England
Telephone: 01-681-3031/4
Telex: 946-698

Effective July 1, 1981
World Headquarters will move to:
West Seaway Access Road
Gulfport, MS 39501
Telephone: (601) 896-1012
Telex: 589-924

PACECO, INC.
A subsidiary of Fruehauf Corporation

Exhibit A, 5/5

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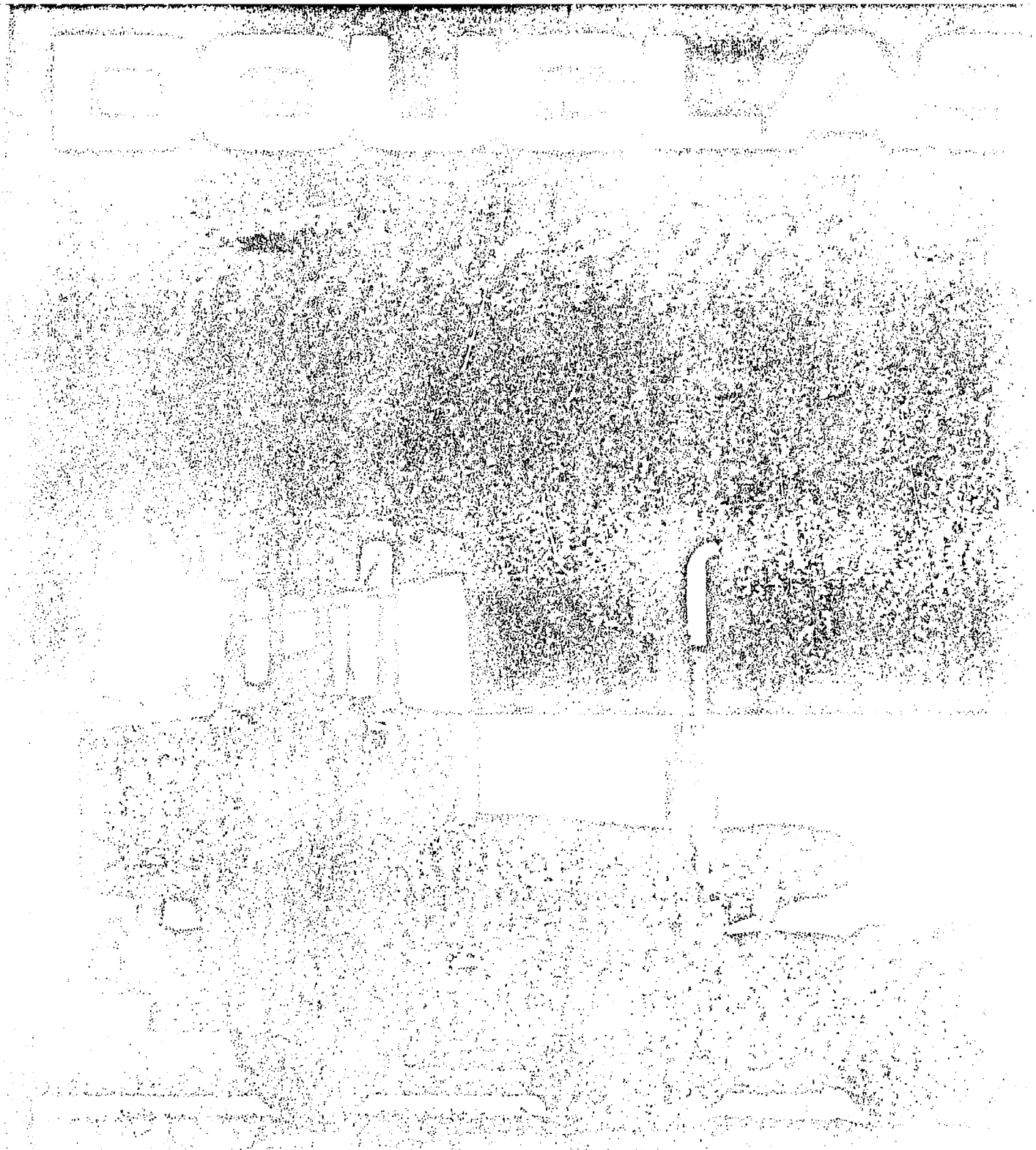
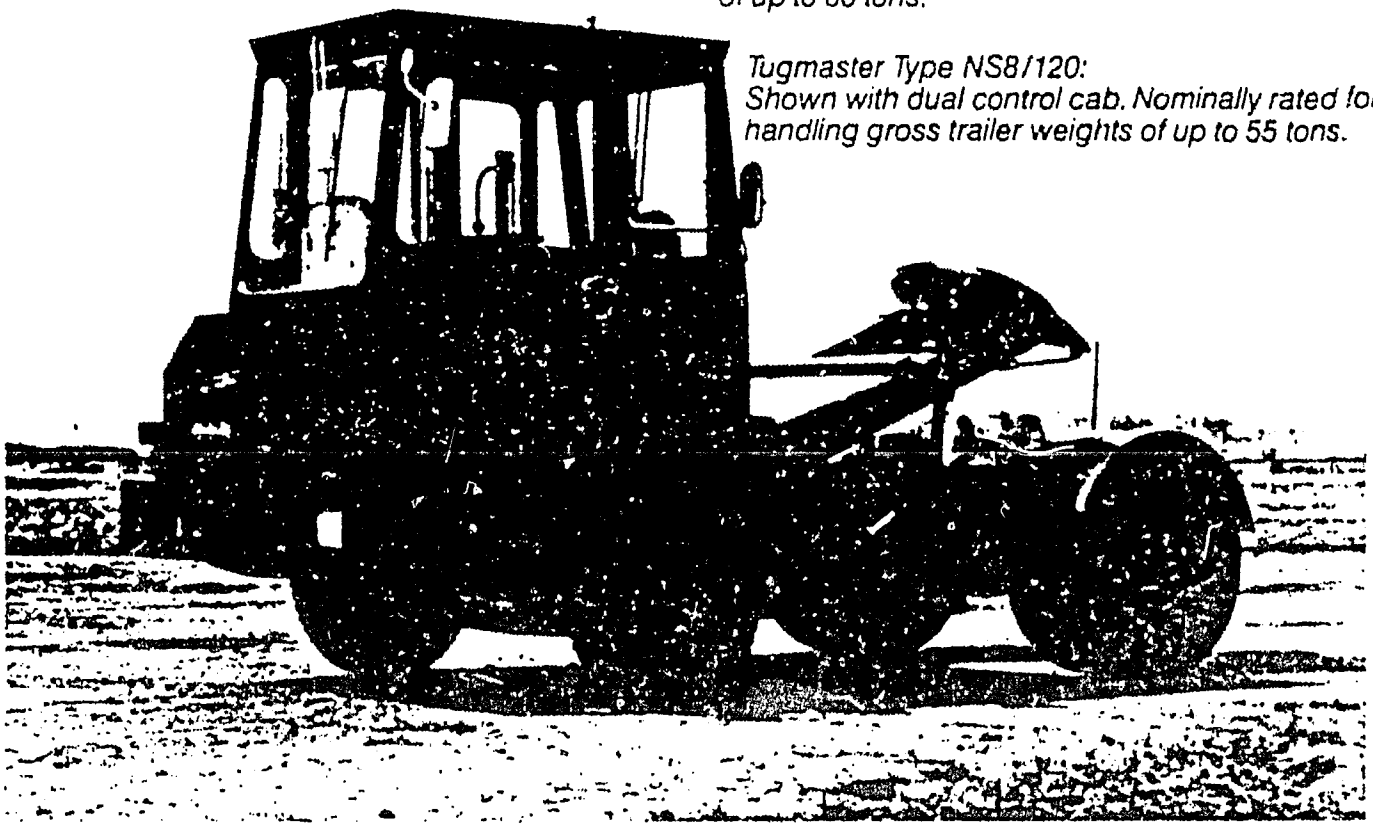


The NS8 designated series of Douglas Tugmasters are designed specifically for Roll-on Roll-off ferry operations and Container Terminal/Yard operations.

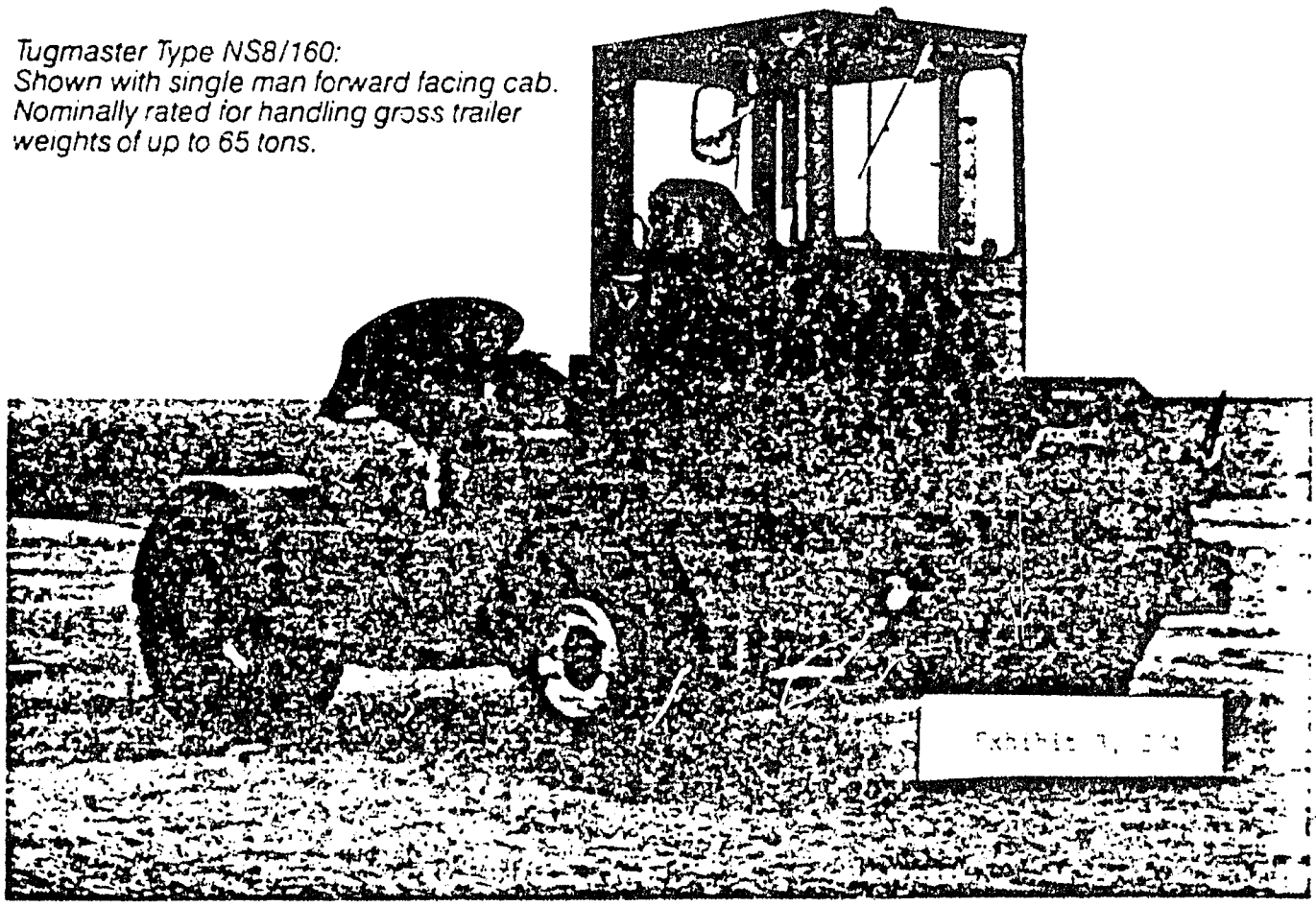
Purpose built, rugged, highly manoeuvrable units fitted with high torque diesel engines, torque converters and powershift or fully automatic transmissions giving high traction, the Tugmasters are capable of handling the heaviest loads on the steepest link span gradients under the most severe conditions.

(front cover)
Tugmaster Type NS8/180:
Shown with dual control cab and inboard door. Nominally rated for handling gross trailer weights of up to 80 tons.



Tugmaster Type NS8/120:
Shown with dual control cab. Nominally rated for handling gross trailer weights of up to 55 tons.

Tugmaster Type NS8/160:
Shown with single man forward facing cab. Nominally rated for handling gross trailer weights of up to 65 tons.

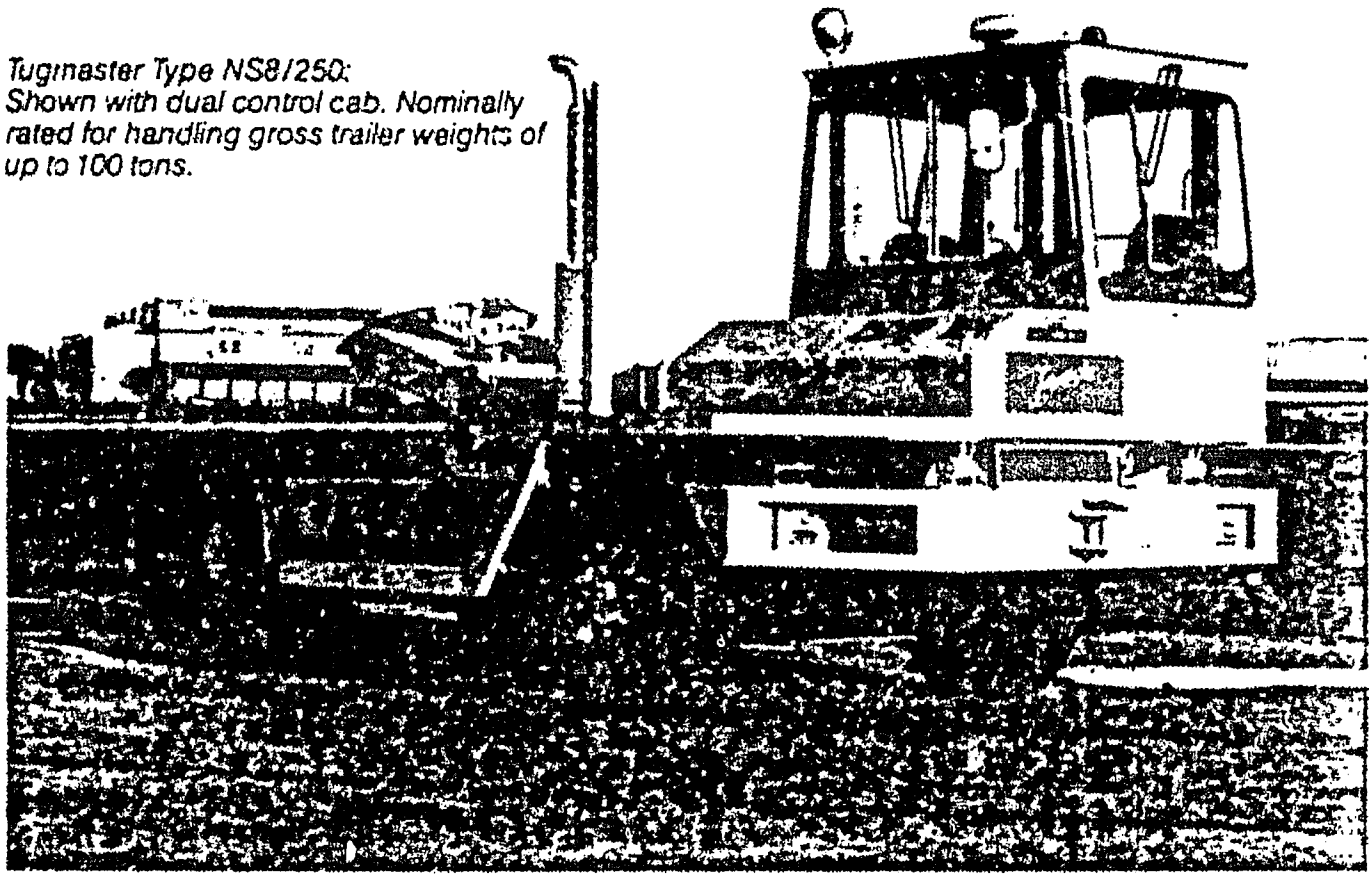


Incorporated in the design is a hydraulically operated elevating fifth wheel fitted with an air operated release, controlled from within the driver's cab, thus allowing rapid shore to ship/ship to shore loading and unloading of semi-trailers, special purpose slave trailers and roll trailers.

Douglas Tugmasters are also to be found in container terminals fulfilling the vital transfer role between quayside and container stacking areas.

A wide range of cab configurations are available on all units to suit operators particular requirements (e.g. single man cabs or dual control cabs). Some models are also available with 4 wheel drive.

Tugmaster Type NS8/250: Shown with dual control cab. Nominally rated for handling gross trailer weights of up to 100 tons.

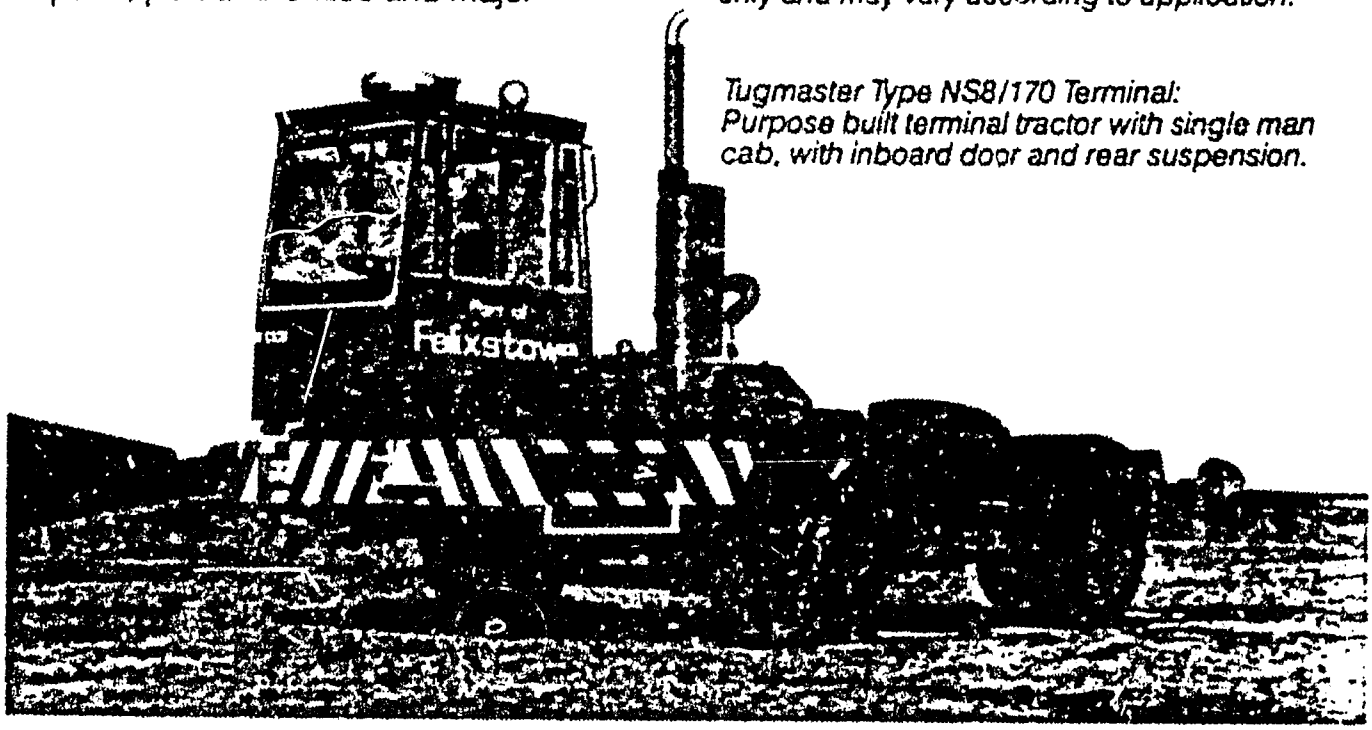


All models of Tugmasters are supplied with single or dual control fully tilting cabs, as shown below.

Douglas Tugmasters — A range of aircraft, industrial and dockside tractors for all applications and spheres of operation. Backed by unrivalled experience, Douglas designed tow tractors and specialised vehicles are built to the highest standard incorporating the finest available components. Tugmasters serve the world's major airlines, shipping companies, airports, port authorities and major industrial undertakings. A standard range of Tugmasters is in regular production together with special units to client's specification.

Douglas — registered contractors to H.M. Armed Forces and many foreign governments.

NOTE: All nominal ratings are given as a guide only and may vary according to application.



Tugmaster Type NS8/170 Terminal: Purpose built terminal tractor with single man cab, with inboard door and rear suspension.

Tugmaster Type NS8/180/4 fitted with 4 wheel drive and shown with dual control cab incorporating swivelling seat/ control console.

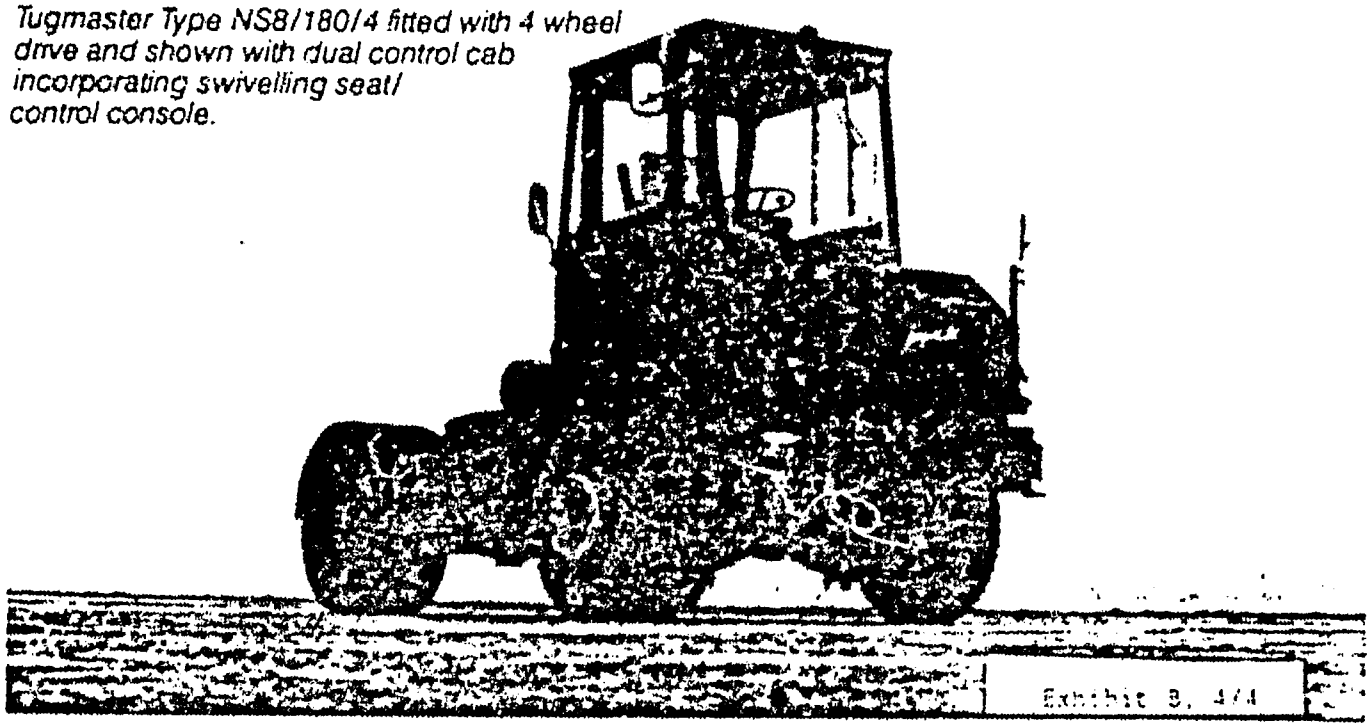


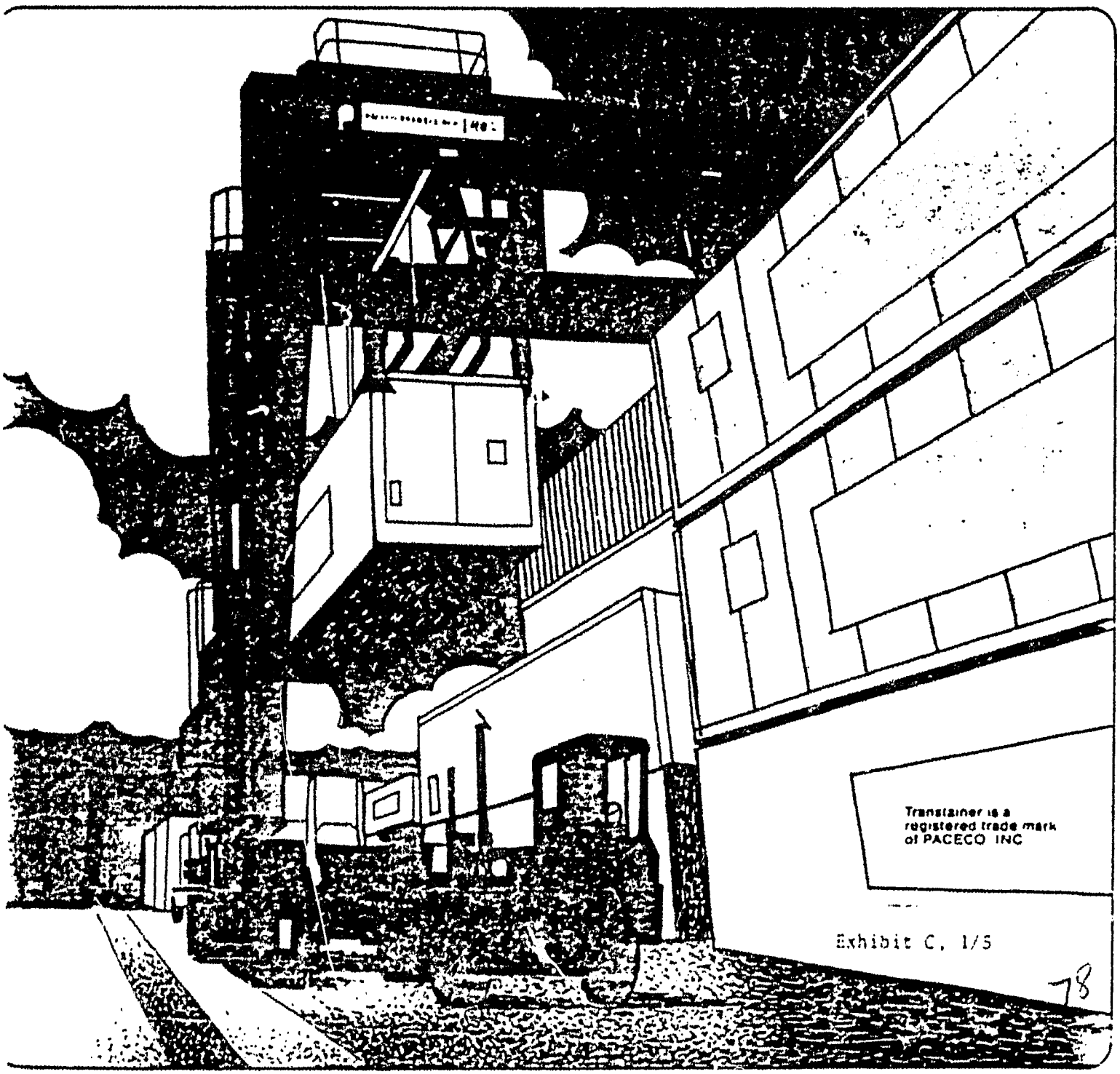
Exhibit B, 4/4

DOUGLAS

F. L. Douglas (Equipment) Limited
Village Road, Arle, Cheltenham, England
Telephone: 27921 Telex: 43182

A PACECO CAPABILITY REPORT

Paceco Transtainer® Crane Systems



Transtainer is a registered trade mark of PACECO INC

Exhibit C, 1/5

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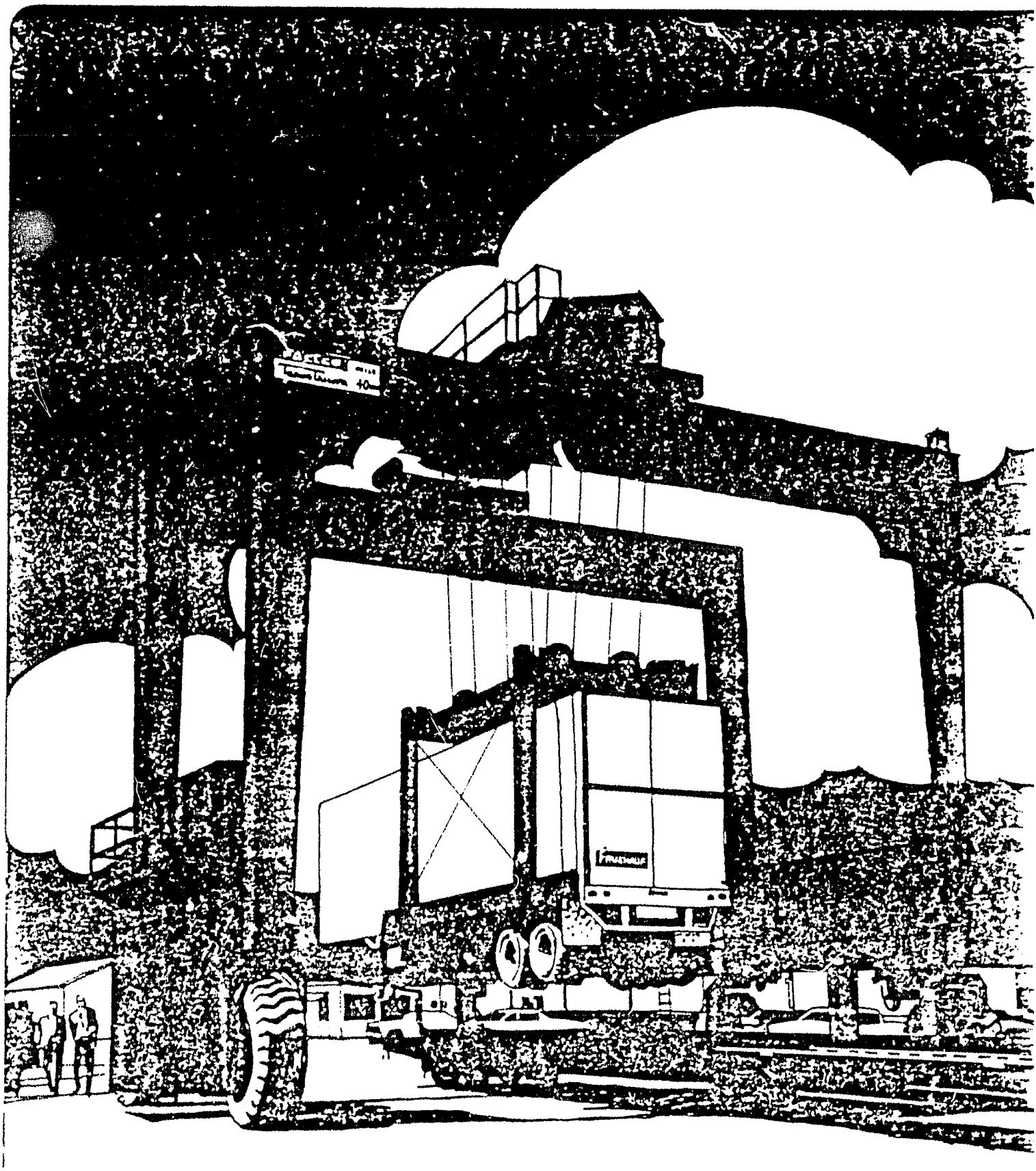
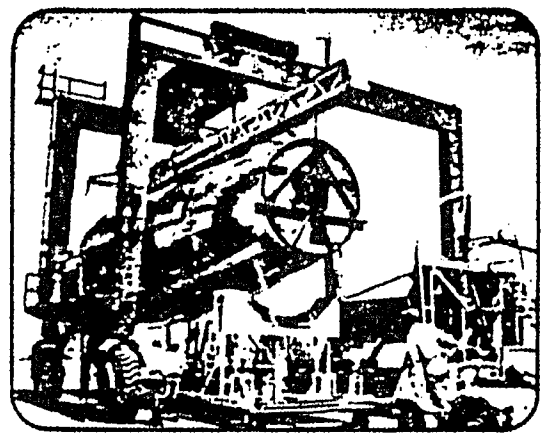


PACECO developed the transtainer crane system



The first PACECO Transtainer Crane - like its big brother, the PACECO Portainer® Crane - was developed to fill the need of Matson Navigation Co. in their introduction of containerization, and was put into service in 1960.

The primary purpose of this first Transtainer Crane was to load and unload rail flat cars. Subsequent Transtainers were of increased size and were used for many purposes, including handling aircraft fuselage sections.

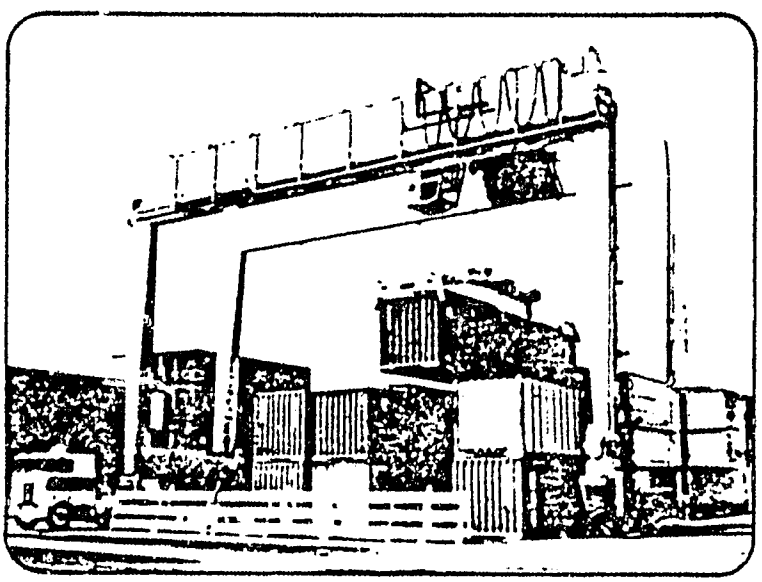
It was some six years after the first Transtainer Crane was built and put into service that the need for this equipment became apparent to port and terminal management. Containerization was embraced by world shippers, but internal terminal handling was lagging behind. PACECO put forth an aggressive marketing program to convert this need into on-the-job equipment by showing the benefits of the Transtainer crane system.

All the time PACECO was busy improving the basic Transtainer crane concept with longer span, higher clearances - and a new 90° four-wheel turning ability.

Container damage was kept to a minimum and maintenance costs were slashed - the PACECO Transtainer Crane System had arrived!

Ports and terminals the world over began phasing out straddle carriers and adding Transtainer Cranes to speed up their operations. Twin-Lift Rail-Mounted Transtainer Cranes were engineered and developed for the expanding ports and terminals planning ahead for container handling needs. Containerization kept growing dynamically!

PACECO has not remained content with developing the Transtainer Crane system, but has continued to consider future port and terminal needs as containerization traffic expands and available land shrinks. PACECO Transtainer cranes were under constant development to drive down the cost per unit handled, and make each unit more productive.



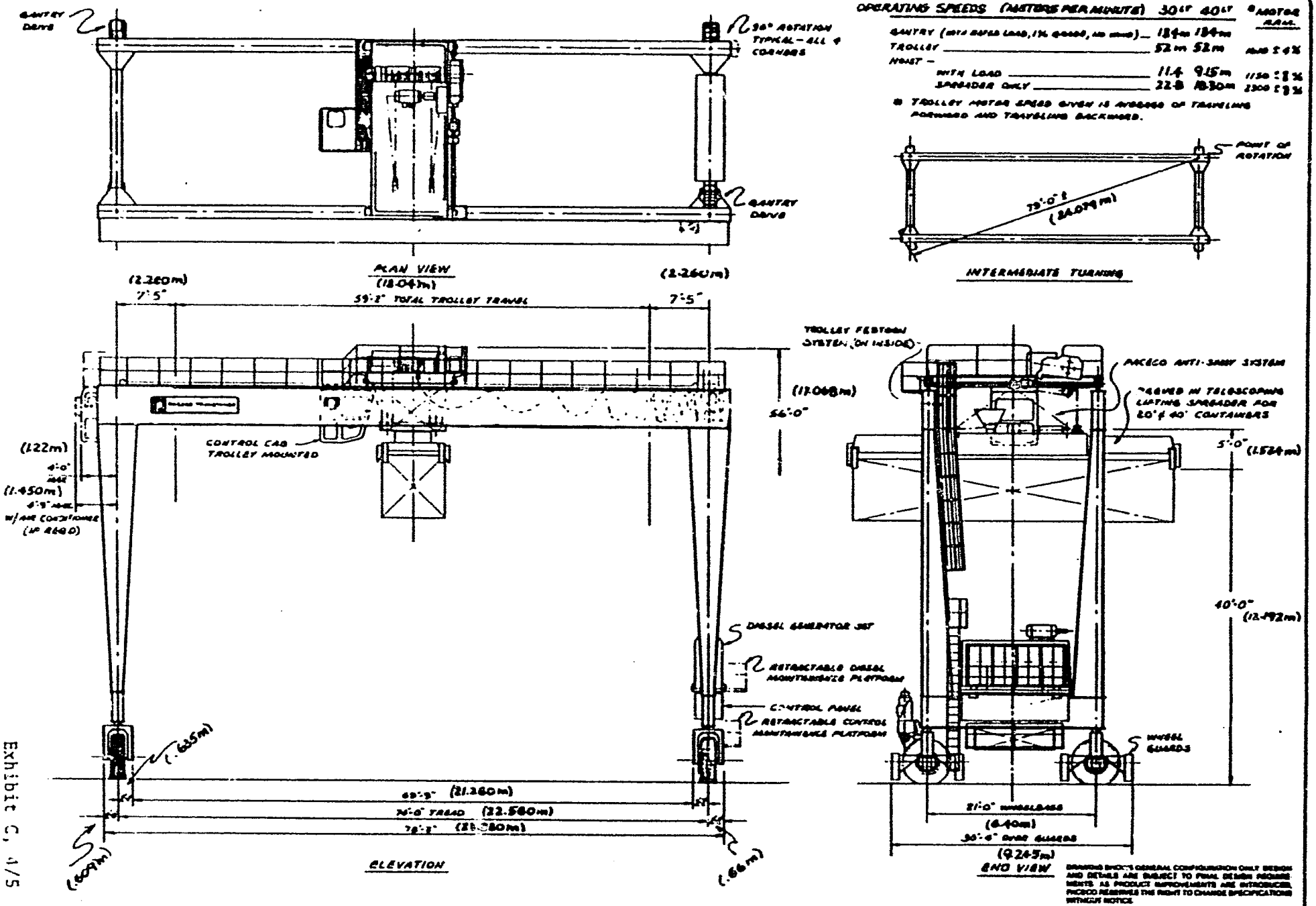


Exhibit C, 4/5

STANDARD TRANSTAINER CRANES
30 AND 40 LT CAPACITY

SCALE: none | DR: S. of Barker | APPROVED

PACECO, INC. A Subsidiary of Fruehauf Corporation

REV NO
EST NO

Paceco is a world of experience.

PACECO is the only manufacturer
offering a complete line of
Container Handling Systems and Equipment -
with World-Wide Sales and Service!

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World Headquarters
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Alameda, California 94501
Telephone: (415) 522-6100
Telex: 355-399
Cable: PACECO

PACECO International, Ltd
St. Anne House
20/26 Wellesley Road
Croydon, Surrey
CRO 9XB England
Telephone: 01-681-3031/4
Telex: 946-698

Effective July 1, 1981
World Headquarters will move to:
West Seaway Access Road
Gulfport, MS 39501
Telephone: (601) 896-1012
Telex: 589-924

Exhibit C, 5/5

PACECO, INC.

82

10.80 2M RAHM

A SUBSIDIARY OF FRUEHAUF CORPORATION

Printed in U.S.A.

Ferranti
Van Carrier
DP35

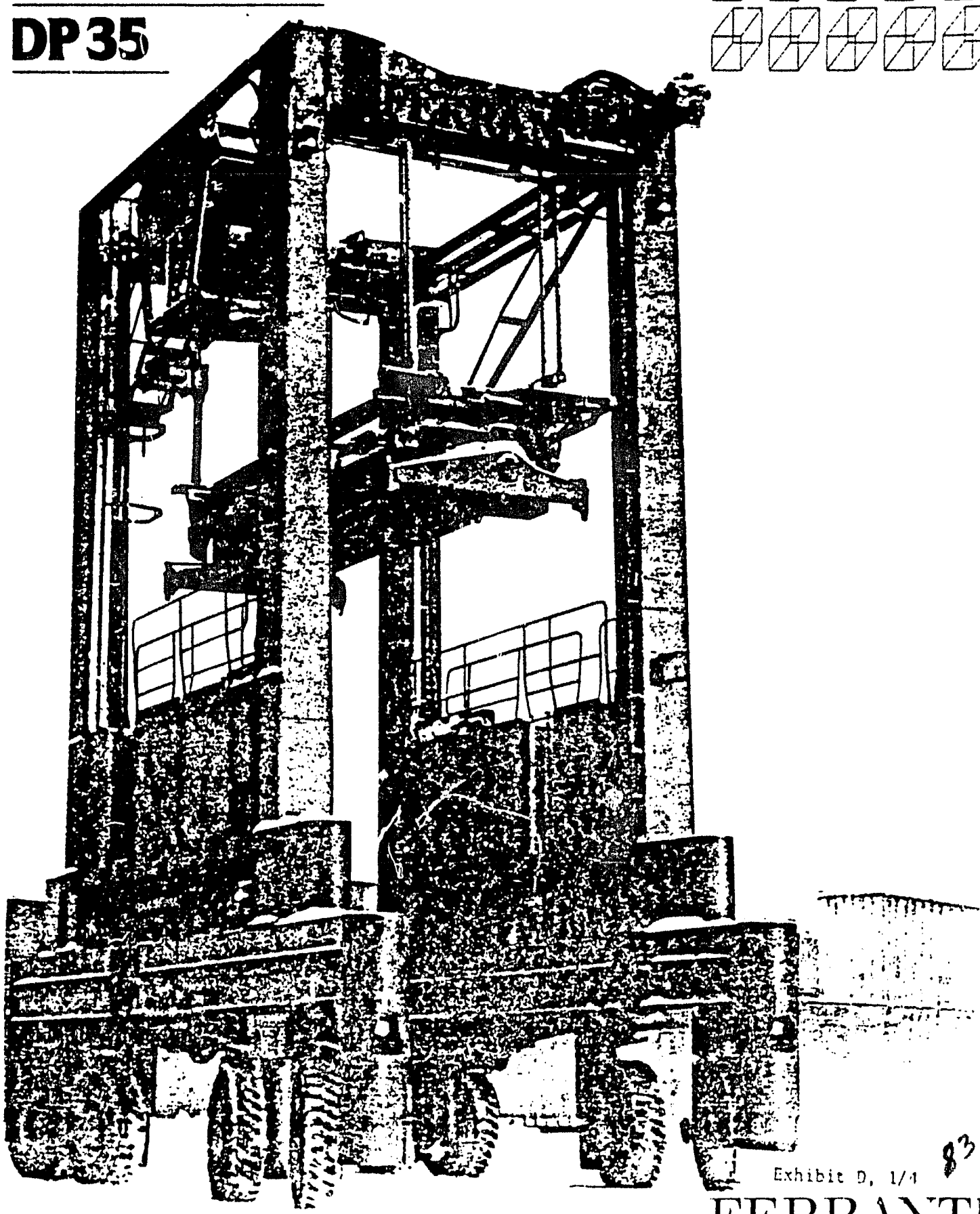


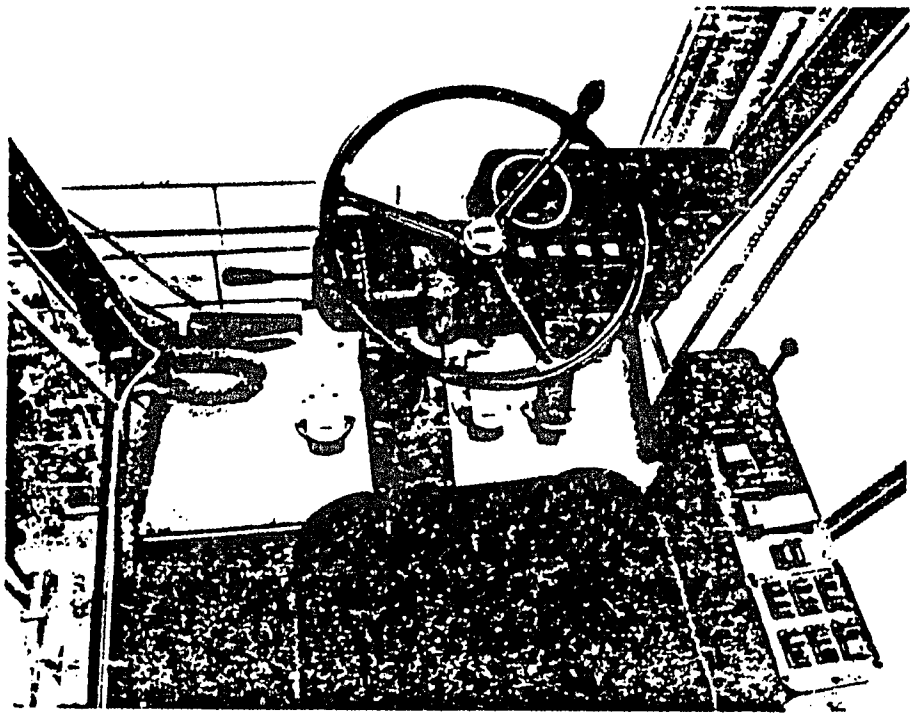
Exhibit D, 1/1

83

FERRANTI
Container Handling

VAN CARRIER DP35
Look at it from the Driver's Point of View!

What will your driver see in the DP35?
Certainly more of the working area than he has ever seen in any other type of container straddle machine. The all-round improvement in visibility in the centrally located 'fullview' cab is just one of the advanced features built into the design of the DP35.



Within the cab, interior fitments and control panel lay-out, have been carefully planned to assist driver efficiency by providing a spacious and comfortable working environment.

Ferranti Van Carrier DP35 series is a range of double portal arch machines which includes both standard and high performance specifications. All machines are designed to hoist 35 tonnes when equipped with a Ferranti lift frame, and to stack 40 ft. x 9 ft. 6 in. containers three-high.
Inside frame widths of 138 in. and 120 in. are available as standard.

Individually proven on many other Van Carrier systems, several principles are combined for the first time to provide a fast, highly stable, and safe machine, capable of twenty-four hour operation before refuelling.

DP35 features include:

Twin Engine power unit

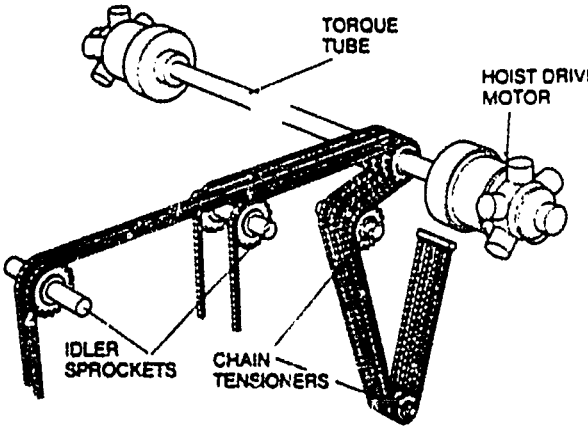
Hydro-dynamic transmission with fully automatic speed selection

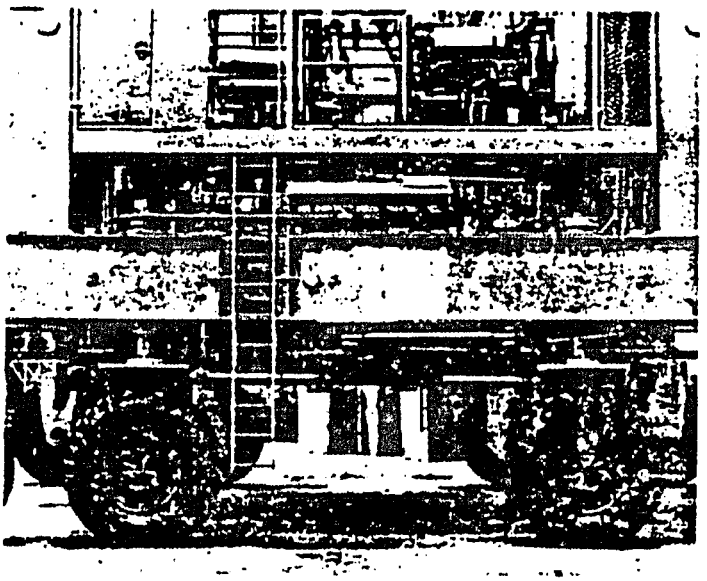
Mechanical shaft drive to epicyclic gear hubs on the driven wheels.

Equipment and container protection fitments include bumpers, rubbing strips, engine shields and deflector plates.

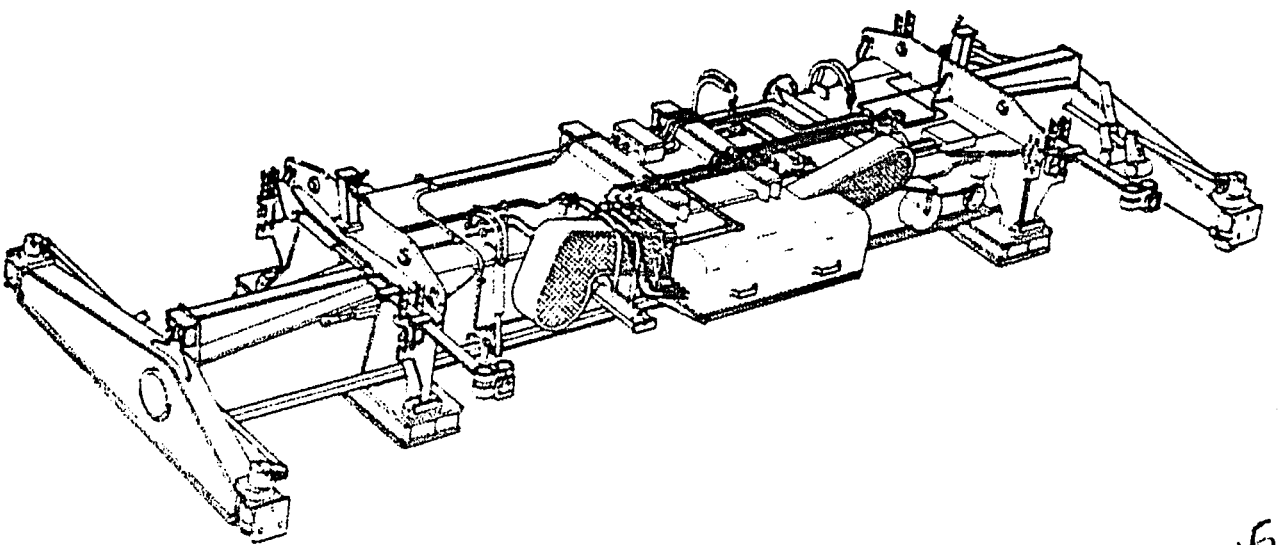
Dual circuit braking system capable of balanced braking on only one engine. Self adjusting disc brakes fitted on all wheels

Lightweight, but robust and reliable components incorporated into a simple design, give smooth and fast hoisting.
The two hydraulic motors provide a high speed drive. The drive units are linked by a torque tube to give uncomplicated but effective hoist equalisation at all times.





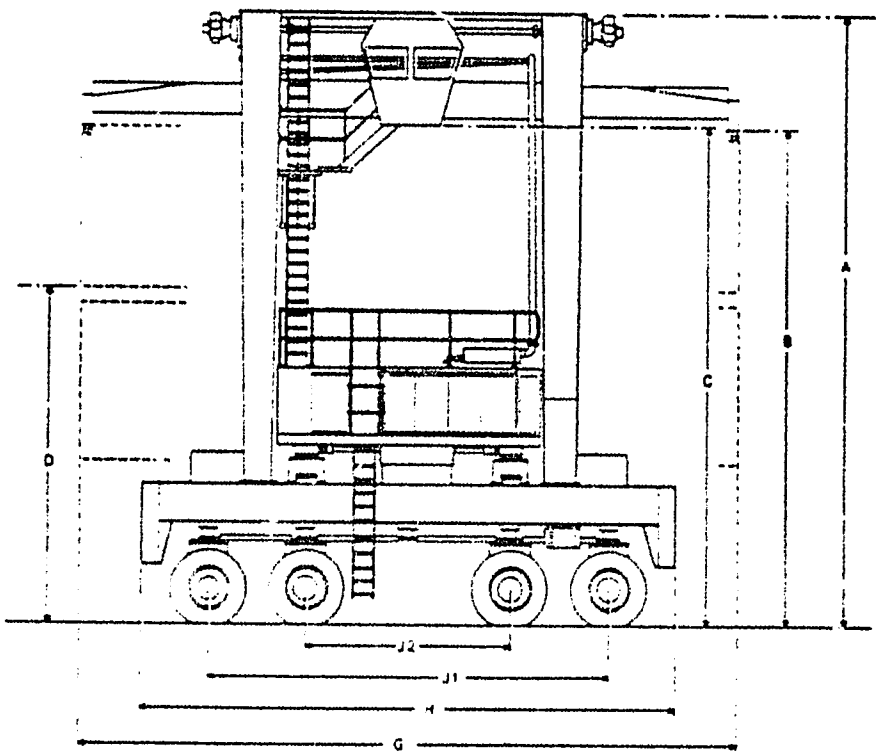
Movement means money:
One of the most effective ways to increase earning potential is to gain from time normally wasted in static hoisting. Two diesel engines power a machine designed t simultaneously hoist and travel at realistic speeds, and to give better equipment utilisation by cutting down cycle times.

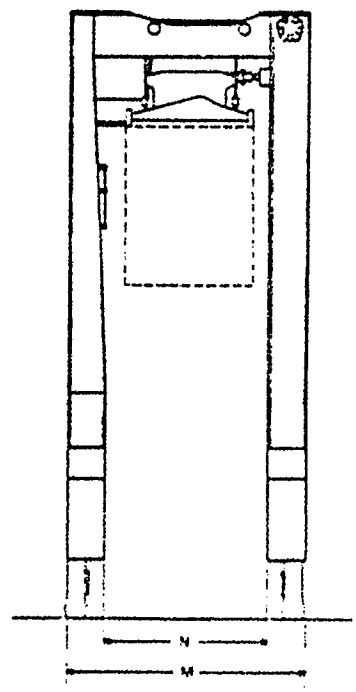


The Ferranti telescopic lift frame provides fast and flexible handling in mixed container systems. Available as either a three or four station unit capable of handling all known ISO, ASA, Sealand type containers between 20 and 40 ft. Change of frame length by push button selection on the driver's control console. Twistlock operation, length selection, and container engagement, are all controlled through safety interlocks and signalled by indicator lamps on the control console. Floating twistlocks are fitted as standard.

General Data

BRIEF SPECIFICATION (High Performance Machine)
Engine: (Two off)
Rating, 228kW (170 hp)
Travel speed
25 km/h (15.5 mile/h)
Hoist speed:
Raise (No load/30 tonne) 15.2 m/min. (50 ft/min)
Raise (35 tonne) 13.7 m/min (45 ft/min)
Lowering speeds equivalent to hoist speeds.
Hoist Capacity:
35 tonnes under Ferranti lift frame.
Acceptable load asymmetry 60:40.
Stacking:
40 ft × 9 ft. 6 in. containers – 3 high.





Dimensions

		Metres	Ft-ins			Metres	Ft-ins
Height	A	11·35	37-3		B	8·940	29-4
	C	9·070	26-9		D	6·045	19-10
Length	G	12·290	40-4		H	9·910	36-6
	J1	7·470	24-6		J2	3·810	12-6
Width (136)	M	4·800	14-8	(136)	N	3·455	11-4
(120)	M	4·470	13-4	(120)	N	3·050	10-0

Turning Circles	136in Wide M/c		120in Wide M/c	
Minimum Inside Radius	3·660m	(12-0ft)	3·860m	(12ft-8)
Minimum Outside Radius	9·730m	(32-0ft)	9·550	(31ft-4)
Minimum Intersecting Aisles	7·140m	(23-5ft)	6·830	(22ft-5)

NOTE: Data and dimensions typical only, representations of machine specification which is subject to improvement and change without notice. This information must not be incorporated into any contractual obligation without the prior permission of Ferranti Engineering Limited.

Ferranti Engineering Limited
Container Handling Division P.O. Box 20,
Hollinwood Avenue, Chadderton, Oldham
Lancashire OL9 8EL, England
Telephone 061-681 2000 Telex 668931

FERRANTI
Container Handling

Exhibit D, 4/4

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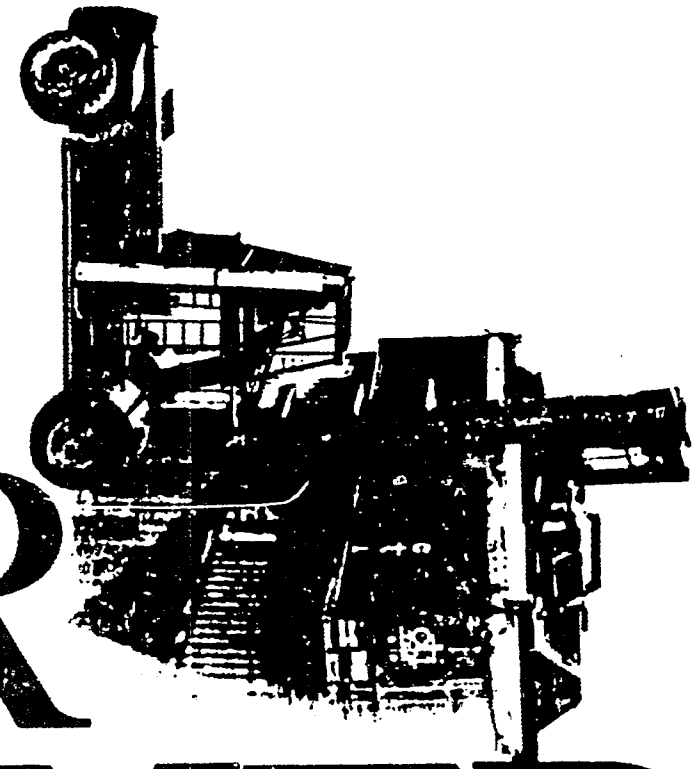
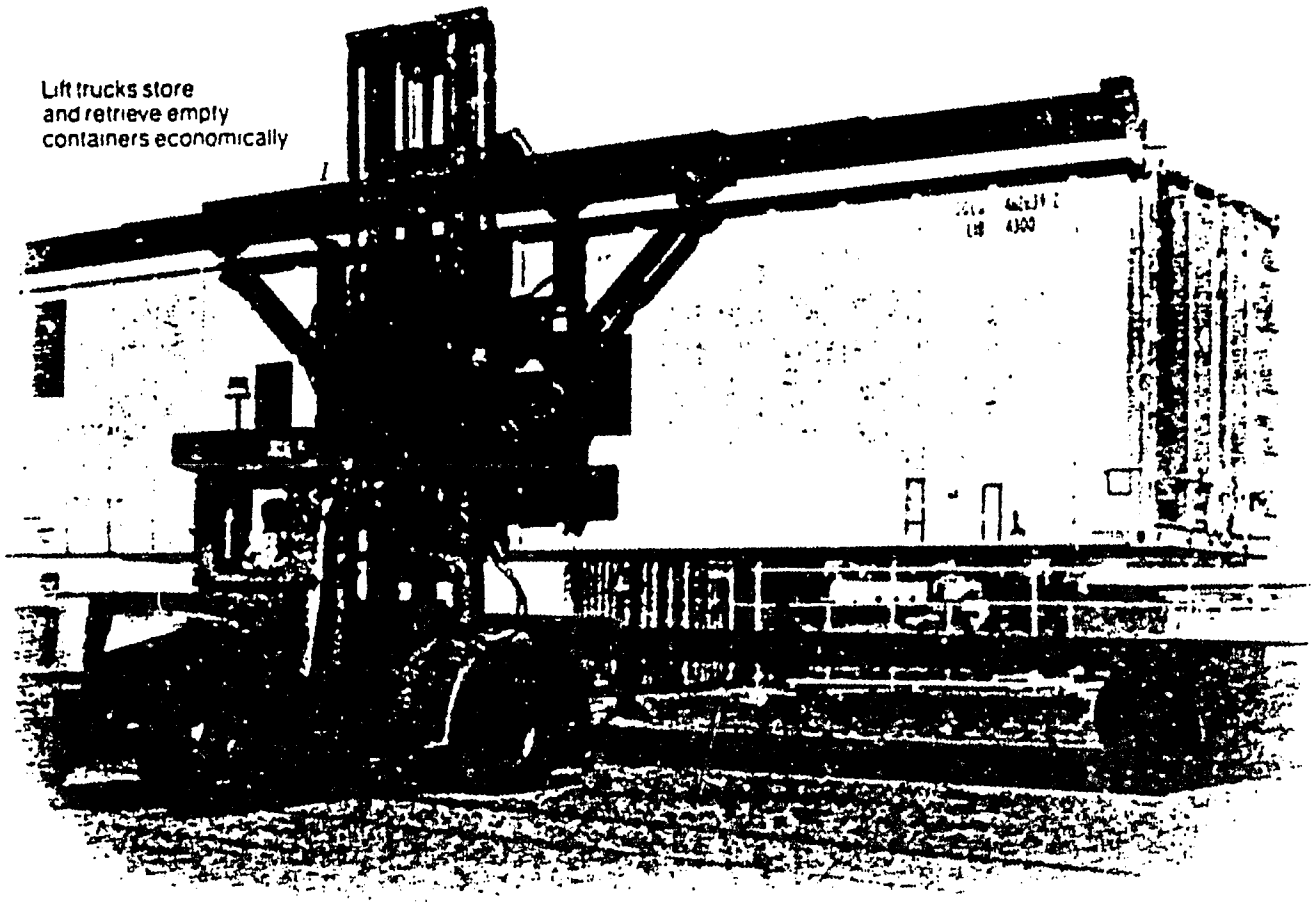


HYSTER CONTAINER HANDLING

Lift trucks store and retrieve empty containers economically



HANDLING EMPTY CONTAINERS

The adaptability of lift trucks from 13,000 lb. (6 000 kg) to 30,000 lb. (13 500 kg) capacity for handling empty containers was recognized early. Hyster trucks equipped with special attachments easily handle a variety of requirements. Some operations are stacking empty 40-footers four high with the H300B.

Empty 20-foot (6 m) containers with fork pockets can be handled and stacked with forks by Challenger 120 and Challenger 150F models, although larger trucks like this H250H are often used. *photo 2* The H120F and

H150F require a special wide side-shift carriage to obtain correct fork spacing and expedite alignment.

Hyster side-lift container attachments are the practical answer to efficient handling of empty container inventory. The side-lifts engage only the top near-side corner pockets, the box heels against a bumper. One type utilizes the side openings of the corner pockets, engaging the container with fixed hooks designed to prevent disengagement when the upright is tilted b[illegible] *photo 1)* This attachment is designed for use with a side-shift or tilt-shift carriage. The tilt-shift provides both side-shift and vertical tilt functions for easier engagement of the side openings. The other attachment type employs powered twist locks which engage the near-side pockets through the top openings. *(photo 4)*

Fixed-length hook and twist-lock attachments for 20-ft. (6 m) containers are available. Where mixed lengths are the rule, Hyster telescoping side-lift attachments accommodate containers 20 feet to 40 feet (6-12 m) long.

Some European container storage systems for empty 20-ft. (6 m) boxes evolved from the side-handling concept. Lifted by the end, the empty 6-meter box can be efficiently stacked and retrieved from "pigeon-hole" storage. This achieves both high storage density and excellent selectivity. The end-lift attachment employs powered twist locks to engage the two top end corner pockets. *photo 3*

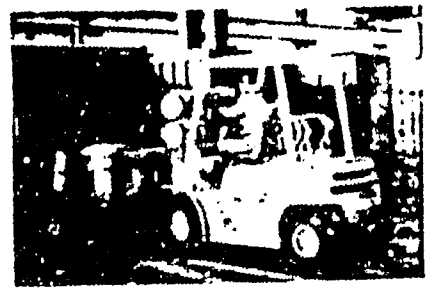
Exhibit F, 2/4

CONTAINER STUFFING

The versatility of the counterbalanced lift truck makes it as useful for stowing container cargo as for handling the loaded container. Trucks of 4,000-6,000 lb. (2 000-3 000 kg) capacity find widespread use in stuffing/stripping operations, although some models to 8,000 lb. (4 000 kg) capacity are used effectively with some cargo. The variety of hydraulic attachments available greatly enhances the forklift's stuffing/stripping capability.

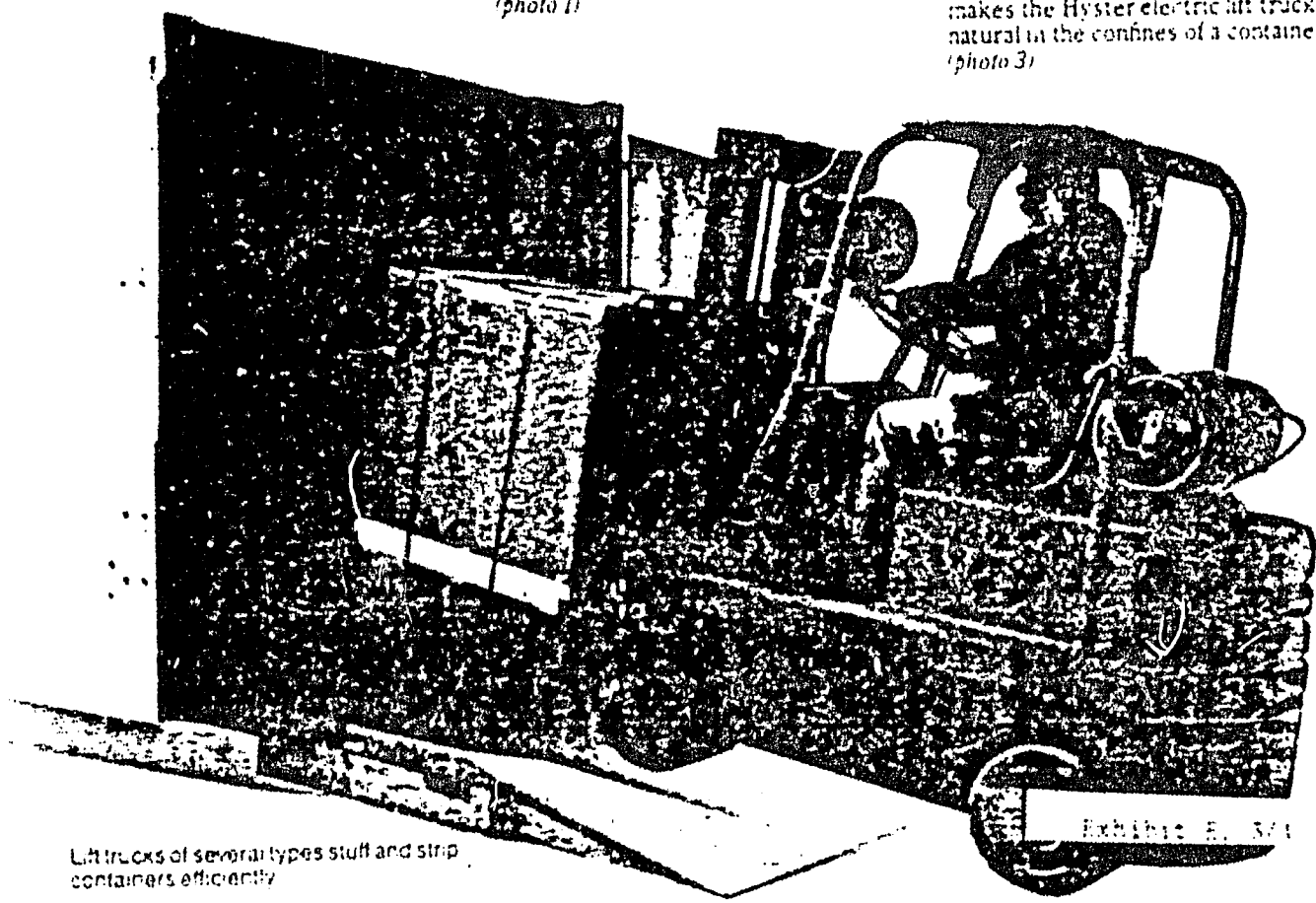
A container imposes several constraints. Door height dictates overall height, and may require a non-standard low-profile overhead guard. Tiering unit loads within the box will call for a full free-lift upright. The dynamic load imposed by the laden truck on the container floor is a critical limitation. A conservative guideline is a maximum drive axle load on the container of 12,000 lb. (5450 kg). Internal combustion exhaust may require special dispersion measures to avoid concentrated "hot spots" and fumes within the container. And operating lights are a "must" whenever the container interior is not illuminated by dock lights.

For applications involving container packing as well as general material handling inside and out, Hyster Company offers the pneumatic-tire Challenger 50. Equipped with a full free-lift upright, this model will handle 4,400 lb. (2 000 kg) at a 24 in. (600 mm) load center without exceeding the recommended maximum container floor loading. Its traction and maneuverability are valuable in any handling situation. *(photo 1)*



Where container cargo and warehouse storage interface, a cushion-tire truck with high-stacking ability is required. The proven Hyster SpaceSaver 50 can be equipped with a 3-stage upright which yields 14 feet (4 300 mm) of stacking height plus the lowered height and full free-lift required for efficient handling inside the container. Including a side-shift carriage attachment, this model is a perfect match for container stuffing and warehousing requirements. *(photo 2)*

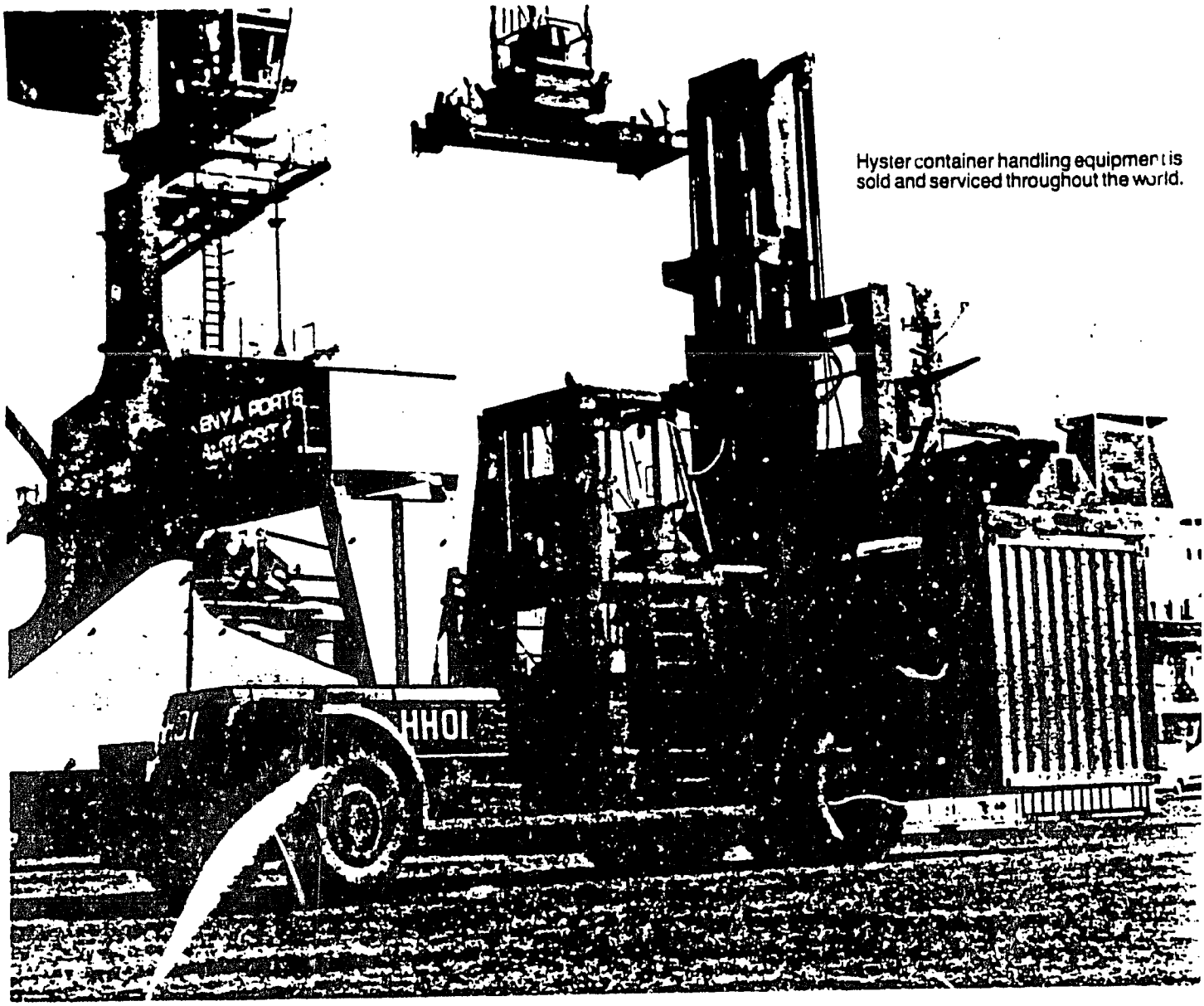
Hyster Company offers counterbalanced electric trucks with *either* cushion or pneumatic tires. SCR control systems yield smooth tractive performance and long shift life. Full free-lift and 3-stage uprights are available on all models. Outstanding productivity without exhaust fumes makes the Hyster electric lift truck a natural in the confines of a container. *(photo 3)*



Lift trucks of several types stuff and strip containers efficiently.

Exhibit E, 3/1

89



Hyster container handling equipment is sold and serviced throughout the world.

AFTER THE SALE... SERVICE

Into this widespread market, Hyster Company is effectively placing versatile container handling equipment with confidence that after-sale support will enhance the solid reputation of the products themselves.

There is reason for this confidence. Hyster products are sold throughout the world by Hyster Company organizations and independent dealers staffed with fully qualified service personnel. These people are linked with a centralized information system through which they continually receive current technical product information. Key replacement parts are stocked locally, and a parts communications network ensures rapid location and shipment of non-stocked components.

The combined talents of a uniquely qualified special engineering force, experienced sales representatives, and dedicated local parts and service people stand behind Hyster products. These specialists can help you solve your container handling problems.

HYSTER

HYSTER COMPANY
Industrial Truck Operations
Box 334, Danville, Illinois 61832

Exhibit E, 4/4

8/80 Litho in U.S.A.

APPENDIX B: EQUIPMENT/OPERATIONAL COSTS

Project costs will include initial and replacement purchase of equipment; equipment and terminal maintenance; equipment operations; and labor, as well as infrastructure and facility development. Infrastructure and facility development costs are estimated in Chapter III, on the basis of available information and discussions with Port Said Port Authority engineering personnel. In this Appendix, a schedule of equipment purchases is presented, along with estimates of annual operating and maintenance costs for the new terminal.

The following average values are assumed for the purposes of this study:

Maximum working hours, loading/unloading operations =

$$350 \times 24 \times .6 = 5040 \text{ hrs/yr.}$$

Maximum working hours, CFS operations =

$$350 \times 20 = 7000 \text{ hrs/yr.}$$

Working Life* =

Rail-mounted dock cranes	-	20 yrs
Rubber-tired gantry cranes	-	12 yrs
Terminal tractors	-	8 yrs
Terminal trailers	-	10 yrs
Modified forklift trucks	-	8 yrs
Forklift trucks	-	6 yrs

*Assumes preventive and scheduled maintanance

Maintenance cost/yr. as a percentage of purchase cost* =

Rail-mounted dock cranes	-	5%
Rubber-tired gantry cranes	-	10%
Terminal tractors	-	10%
Terminal trailers	-	3%
Modified forklift trucks	-	14%
Forklift trucks	-	16%
Facilities, infrastructure	-	1%

*Assumes replenishment of spare parts stores

Downtime for scheduled and unscheduled maintenance =

Rail-mounted dock cranes	-	1%
Rubber-tired gantry cranes	-	10% (1 spare/10 units)
Terminal tractors	-	15% (1 spare/6 units)
Terminal trailers	-	5% (1 spare/20 units)
Modified forklift trucks	-	15% (1 spare/6 units)
Forklift trucks	-	15% (1 spare/6 units)

SCHEDULE OF EQUIPMENT REQUIREMENTS

Year	Rail-Mounted Gantry Cranes	Rubber-Tired Gantry Cranes	Terminal Tractors	Terminal Trailers	Modified Forklift Trucks	Forklift Trucks
1984	1	2	5	10		8
85						+5
86						+5
87						+5
88	+1	+2	+5	+10		+5
89						+5
90				+3	+1	+4, Repl. 8
91						Repl. 5
92			Repl. 5			Repl. 5
93						Repl. 5
94				Repl. 10		Repl. 5
95						Repl. 5
96		Repl. 2	Repl. 5			Repl. 12
97						Repl. 5
98				Repl. 10	Repl. 1	Repl. 5
99						Repl. 5
2000		Repl. 2		Repl. 3		Repl. 5
01						Repl. 5
02						Repl. 12
03						Repl. 5
04	Repl. 1			Repl. 10		Repl. 5
05						Repl. 5

Terminal operating and maintenance costs include:

fuel and oil or electrical power for equipment operation;

equipment maintenance and replenishment of spare parts stores;

maintenance of terminal facilities and infrastructure;

labor, including equipment operators and assistants, and administrative, maintenance, training, security and CFS personnel; and

terminal operation and overhead.

Power for equipment operation was estimated on the basis of the following values:

Dock Cranes	-	$7/hr of operating time
Gantry Cranes	-	$5/hr of operating time
Tractor/Trailers	-	$3/hr of operating time
Modified Forklift Trucks	-	$2/hr of operating time
Forklift Trucks	-	$1/hr of operating time

Source: CE Maguire and product literature.

Equipment operating levels were estimated based on the level of utilization necessary to move the projected cargo, increasing from 50% in 1985 to 90% in 1988, when the second crane and supporting equipment should be added. Utilization is estimated at 60% in 1989, increasing to 100% by 1992.

Terminal and equipment maintenance was estimated on the basis of the values presented earlier in this Appendix. Maintenance costs were assumed to increase with equipment age, resulting in the average maintenance costs as a percentage of purchase costs presented earlier in this Appendix. Terminal operation and overhead was assumed to be approximately 25% of equipment operation and maintenance, terminal maintenance, and labor costs. Labor costs were estimated based on an average salary of $5,000 per year, with the number of terminal employees assumed to increase from 36 in 1985 (16 equipment operators, 20 other terminal personnel) to a maximim of 104 (54 equipment operators, 50 other terminal personnel) by 1990. The average wage of $5,000 was selected to reflect a range of salaries for various types of employee, including approximately $2,500 per year for unskilled help, $4,000 per year for skilled workers, $6,500 per year for technicians, $5,000 per year for middle management, and $9,000 per year for upper-level management.

A summary of annual costs is presented below.*

Year	Equipment Purchase	Equipment Operation	Equipment Maintenance	Terminal Maintenance	Labor	Terminal Op's & Overhead	Total
1984	$ 6,134	--	--	--	--	--	$ 6,134
85	165	86	217	75	180	140	863
86	165	123	460	100	205	225	1,275
87	165	184	500	125	280	270	1,524
88	6,035	221	540	150	305	315	7,611
89	165	392	740	175	420	430	2,322
90	519	490	950	200	520	540	3,219
91	165	588	990	250	520	590	3,103
92	425	653	990	300	520	615	3,503
93	165	653	990	360	520	630	3,318
94	315	653	990	360	520	630	3,468
95	165	653	990	360	520	630	3,318
96	2,416	653	990	360	520	630	5,569
97	165	653	990	360	520	630	3,318
98	393	653	990	360	520	630	3,546
99	165	653	990	360	520	630	3,318
2000	2,380	653	990	360	520	630	5,533
01	165	653	990	360	520	630	3,318
02	396	653	990	360	520	630	3,549
03	165	653	990	360	520	630	3,318
04	4,015	653	990	360	520	630	7,168
05	165	653	990	360	520	630	3,318

*The estimated construction costs of the project, not shown above, include:

1983 - $20 million for wharf; 1984 - $22.73 million and 1985 - $11.365 million for other terminal improvements

APPENDIX C: PERSONS INTERVIEWED

Cairo, Egypt

Roy Robleson, USAID
Jerry Lapittus, USAID

Mahmoud Mokhtar Terry, First Undersecretary of Ministry of Transport
Ragia C. Stino, Indconsult
Assem H. El-Shafie, Indconsult

Port Said, Egypt

Admiral M. Goma Ibrahim, Chairman Port Said Port Authority
Commodore Salah El Deen Mahmoud Shouckry, Managing Director, Port Said Port Authority
Ing. Kamal, Chief Engineer, Port Said Port Authority
Sayed Hegazy Hassan, Director, Port Said Shipping and Navigation Company
Fakhry F. Shehat, Director, Mideast Shipping Agencies
Sayed Thakib, Manager, Canal Shipping Agencies
Louis Tadror, Commercial Advisor, Canal Shipping Agencies

Washington, D.C.

Ron Henrikson, USAID
Cherie Loustaunau, U.S. Department of Commerce
John Pisani, U.S. Maritime Administration
Ray Heinsilman, formerly with PRC Harris, Inc.
Grant Duff, World Bank

APPENDIX D: BIBLIOGRAPHY

Asian Shipping, "Container Port Development and Equipment", 1982.

Bullen and Partners, Interim Report on New Port Development at Port Said, June, 1981.

Bullen and Partners, Master Plan for Port Said, March, 1976.

Bullen and Partners, Draft Final Report on New Port Development at Port Said, May, 1982.

Canal Shipping Agencies Co., Minimum Tariff of Charges at Suez Canal, Gulf of Suez, and A.R.E. Red Sea Ports, January, 1979.

Cargo Systems International, "Bright Future for the Straddle Carrier", June, 1982.

Cargo Systems International, "Sales at Valmet Buoyant", June 1982.

Cargo Systems Research Consultants Ltd., Container Port/Terminal Facilities and Trade Growth, 1982.

Cargo Systems Research Consultants Ltd., Terminal Operations, 1978 and 1980.

Frederic R. Harris, Inc., et.al., Development Policy, Ports of Egypt: Strategy for 1980 through 2000, January, 1978.

Frederic R. Harris, Inc., et.al., Master Planning and Infrastructure Development for the Port of Damietta, July, 1979.

Frederic R. Harris, Inc., et.al., Rehabilitation and Modernization of Existing Port at Port Said, October, 1978.

Jane's Freight Containers, Franklin Watts, Inc., N.Y., 1979.

Marine Transport International Co., Ltd., Port Said Container Terminal Feasibility Study, September, 1981.

PRC Harris, Inc., et.al., Economic and Feasibility Study of Rehabilitation and Modernization of Existing Port at Port Said, October, 1980.

Rath, Eric, Container Systems, John Wiley & Sons, N.Y., 1973.

The Journal of Commerce, "Containerization Cuts UK Dock Labor Force", August 5, 1982.

The Journal of Commerce, "Containerization to Rule Remaining Trade Routes", June 29, 1982.

The Journal of Commerce, "Egypt Slates New Container Port for 1986", December 7, 1981.

The Journal of Commerce, "Mubarak Urges Reductions in Energy Use", July 27, 1982.

United Nations Conference on Trade and Development, Appraisal of Port Investments, 1977.

United Nations Conference on Trade and Development, Port Development (A handbook for planners in developing countries), 1978.

United Nations Conference on Trade and Development, Port Pricing, 1975.

United Nations Conference on Trade and Development, Manual on Port Management, 1976.

U.S. Department of Commerce, Marketing in Egypt, December, 1981.

U.S. Department of Transportation, Maritime Administration, Estimated Vessel Operating Expenses, 1981.

Whittaker, J.R., Containerization, Hemisphere Publishing, Washington, D.C., 1975.

World Wide Shipping/World Ports, "I.T.O. Orders Straddle Carriers for Elizabeth, N.J.", June, 1982.