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FRUIT AND VEGETABLE COLD STORAGE FACILITY QUEEN ALIA AIRPORT

Amman, Jordan

Prepared for

AGRICULTURAL MARKETING DEVELOPMENT PROJECT

Amman, Jordan

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AGRICULTURAL MARKETING DEVELOPMENT PROJECT

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Background

Perishable fresh fruits and vegetables are exported from Jordan through Queen Alia Airport near Amman. Produce, which is cold at the time it arrives at the airport, soon warms up while it is held in non-refrigerated temporary storage...waiting for the airplane. The "warming up" often results in a reduction in the value and the shelf life of the fresh fruits and vegetables. Produce which was first quality, at the moment of harvest, is ranked second quality at the point of delivery in Europe. Profits fall below the point necessary to support the costs associated with exporting from Jordan.

The lack of refrigerated storage at the airport has fueled the reluctance of farmers to pre-cool the produce soon after harvest to remove the field heat. Also, farmers are reluctant to use refrigerated trucks to transport the produce from the farm to the airport, for fear the produce will simply "warm-up" prior to aircraft departure. Often, the "cold chain" does not get initiated and/or maintained from the field to the consumer. This, too, contributes to fewer shipments and lower income from the exports of high value fruits and vegetables from the Kingdom of Jordan.

This report presents the results of a design and feasibility study for the construction and management of a cold storage facility which will serve the needs of Jordanian fruit and vegetable exporters.

I. Project Constraints

The steps taken to define the broad financial, economic, physical and operational dimensions of the project were relatively simple and were governed by the following constraints:

1. Financial Constraint: USAID has made $350,000. available for this project to pay for goods and services coming from the United States. In addition, various Jordanian parties will provide the equivalent of about $200,000., much of which will be in kind. Thus the size and scope of the project was defined, in part, by these available financial resources.

2. Demand Constraint: The volume of Jordan's air-freighted fruit and vegetable exports peaked in 1990 at 4,530 tons (see p.10). It is anticipated that these will grow over the next few years, and may reach considerably higher levels if regional peace was established. Jordan could, by the end of the decade, be exporting double or triple the 1990 figure. For the purposes of this report, we have assumed a modest increase in exports from the present levels of a few percentage points annually. The size and scope of

this project both anticipates and encourages a simple, gradual growth in Jordan's fruit and vegetable export, including capacity to accommodate seasonal surges in air-freighted exports.

3. Management Constraint: Royal Jordanian Airlines was identified as the sole party presently able to manage and operate the cold storage facility on a day-to-day basis. Hence, the size and scope of this project is linked/constrained by the present size and scope of RJ. The future may be characterized by different management constraints as a result of the privatization of RJ. Also, in the near future, and perhaps more so in the distant future, the management and operation of the cold storage facility will likely be influenced by the users through their membership in the Jordanian Fruit and Vegetable Exporter's Association.

4. Physical Constraint: RJ provides essentially all the present dry and refrigerated cargo services at QAA. Plans are for RJ to also operate the new cold storage facility. With this in mind, the sites considered were limited to those in close proximity to the present RJ cargo facilities. A small parcel of land, which is presently under utilized, was chosen as the site primarily because of it's proximity to present RJ cargo operations. This site will facilitate close-up management and operation of the new facility by RJ staff.

Recommendations - "Outside" Cold Storage Room

Construct a new Cold Storage Room near the southwest corner of the existing Air Cargo building, using pre-fabricated, modular, insulated panels set on a new concrete floor equipped with drains.

This facility would include two receiving dock stations where refrigerated farm vehicles can be off loaded. The cement floor will be at the same elevation as the floor of the refrigerated trailers. Adjustable steel ramps, known as "dock levelers", will be built into the floor to facilitate easy and safe entry of fork-lift trucks into the trailers to expedite unloading.

The dock area will be equipped with facilities for weighing and stacking Euro pallets/cartons of fresh produce onto air-cargo pallets and securing the loads with cargo netting. The airplane ready pallets would be moved on an electrically powered "transit vehicle", which travels on steel rails a short distance, and placed in holding stations. When the airplane is ready for loading, the pallets would be transferred out of the cold room and onto shuttle vehicles which deliver the pallets to the airplane.

Please see Figures 1 through 13 pages 22 to 34.

Recommendations - New Outside Cold Storage Room...continued

A small office would occupy a space inside the building near the north end. The office would be a check-in point for farm vehicle drivers and a management center for the cold room operations.

The new cold room would measure approximately 12m wide x 40m long x 5m high, for a total area of 480 sq. meters with an inside volume of approximately 2300 cubic meters. It would accommodate up to 18 air-cargo pallets, each measuring 2.25m x 3.2m and containing approximately 2.7 metric tons of produce, for a total capacity of approximately 50 metric tons. A fully loaded Boeing 707 Cargo Jet transports 35 metric tons.

Refrigeration would be provided by a modular package designed to maintain temperatures as low as 1 degree C on already pre-cooled fresh fruits and vegetables arriving at the airport with pulp temperatures within 2 degrees C of the set temperature.

The recommended outside cold room would be built using pre-fabricated, modular, insulated panels. The entire building could be easily disassembled, transported, and reconstructed in another location. Please see Figure 4 on page 25.

Since the Refrigeration System is also of modular construction it could be quickly and easily relocated. It would consist of a skid mounted compressor package, measuring approximately 2m wide x 4m long x 4m high, and located outside near the cold room building. Ordinary water pipes would carry the glycol refrigerant to fan-coil units mounted near the ceiling, inside the cold room. The electrical panel would be mounted directly on the skid package. Electrical power and water would be routed from existing sources inside the main air-cargo building.

Alternative "Inside" Location

Serious consideration was given to the alternative of constructing a cold room inside the existing air-cargo building, using pre-fabricated, modular, insulated panels set on the existing concrete floor. It would be located adjacent to the area presently used for receiving, weighing and stacking cartons of fresh produce onto air-cargo pallets.

The Inside Cold Room is illustrated in the Appendix.

The proposed "Inside" Cold Room would measure approximately 8m wide x 34m long x 5m high, for a total area of 272 sq. meters with an inside volume of approximately 1200 cubic meters. It would accommodate up to 18 air-cargo pallets, each measuring 2.25m x 3.2m and containing approximately 2.7 metric tons of produce, for a total capacity of approximately 50 metric tons. A fully loaded Boeing 707 Cargo Jet transports 35 metric tons.

Existing conveyors would be used to automatically move pallets almost to the entrance, and almost to the exit, of the inside cold room. "Ball Mat" type roller conveyors would be added to facilitate the final movements into inside, from the cold room. Ball Mats are presently used at several points in the existing cargo area to manually transfer airline pallets from point-to-point.

The inside alternative would be cost effective in that the concrete floor and much of the unloading and handling equipment is already in place. The location is favorable and would facilitate quick and easy movement of pallets into cold storage soon after the loading was completed.

The inside cold room was rejected in favor of the outside location describe earlier. The outside location would avoid taking space from the existing dry cargo operations.

Alternative Mobile Cold Room "Refrigerated Trailers/Containers

Serious consideration was given to a system which would involve the use of refrigerated containers equipped with a temporary "rolling" floor to accommodate the easy movement of air-cargo pallets in and out of the container. This system is illustrated in the Appendix.

The advantages of this system include:

* High product quality, minimal break in the cold chain.

* Containers are available on relatively short notice.

* Very low investment...rent the containers with refrigeration only during months required. Rolling floor is a minor cost.

* Flexibility...greater or lesser number of containers as demand changes.

* No disruption to existing non-refrigerated air-cargo.

* Containers can be used for hauling and/or storage.

The mobile storage proposal was rejected in favor of the outside location described earlier since the outside location is viewed as a more appropriate long term solution to the need for cold storage facilities and using funds for an interim system would delay construction of the long term facility.

Requests of Civil Aviation Authority/Royal Jordanian Airlines

1) Provide a engineering "Site Plan" drawing which illustrates the major elements of the project.

2) Provide an engineering drawing of the "Concrete Foundation" which includes details of the concrete floor, the waste water drains, the air-cargo pallet vehicle tracks, the details for dock levelers, the details for the steps to the office, etc.

3) Select a location for the refrigeration "compressor/receiver" package and include the foundation details on the foundation drawing.

4) Provide electrical power to the refrigeration package control panel, and to the building for lights, etc.

5) Provide electrical power to the building and wiring within the building for lights, door(s) operating system, the temperature recorders, etc.

6) Provide telephone service lines to the building.

7) Furnish and install all the pallet handling system and equipment. This would include at least an empty aircargo pallet holding station, a carton stacking station with a scale, the conveyors and/or transport vehicle for transporting pallets to the individual storage locations and on to the exit door, and the scissor lifts, etc. for transfer of pallets onto the shuttle vehicle for movement to the airplane.

Economic Feasibility

The following budget estimate, tables and narratives apply to an Outside Cold Storage facility measuring 12m wide x 40m long, located near the S.W. corner of the existing Aircargo Building with the building and refrigeration from the USA.

TABLE I. COLD ROOM - CAPITAL COST ESTIMATE

		(JD)	(USD @ .7)
1)	Cold Room: Modular, Prefab Panels with Doors and Lights, Dock Levelers, Roof Coated, Exterior Painted	130,000	$186,000
2)	Refrigeration Package: Nominal 25 Ton Operating Load, Including Installation	90,000	$128,000
3)	Conveyor System: Includes Re-activating Some Idle RJ Equip., and Purchase of Certain Items. RJ to do Installation	100,000	$143,000
4)	Engineering, Site Prep, Utility Stubs, Permits	5,000	7,000
5)	Concrete Floor with Drains, Fork-Lift Ramp, Refrig. Pad Rails for Transport Vehicle	21,000	30,000
6)	Packing & Ocean Freight (No Customs/Duty) 8 Containers	29,000	41,500
7)	Technical Assistance from USA Suppliers	10,000	14,000

TOTAL ESTIMATED CAPITAL COST JD 385,000

USD $550,000 (@.7JD = 1 USD)

TABLE II. OPERATING COST ESTIMATES

Based on six month export season		(JD) PER AVG. MONTH	(JD) PER YEAR
1)	Utilities: Electricity	1,750	10,500*
2)	Maintenance: Refrig. System	350	2,100
3)	Maintenance: Doors, Curtains and Lights	60	360*
4)	Depreciation Reserve	1,528	18,333
5)	Cost of Capital	7,743	92,913
	TOTAL ESTIMATED OPERATING COSTS	11,431	124,206

* Expenses for only six months of the year.

Depreciation Reserve: Straight line depreciation based on twelve (12) years [or 144 months] of useful life for the Cold Room and Refrigeration package, under normal use and maintenance. Estimated cost for these two Capital Cost items is JD 215,000. This calculation intentionally does not include conveyor equipment or site improvements.

Cost of Capital: A simple 12% annual rate of interest is applied to the Cold Storage Room cost of JD 385,000 over the 12 year depreciation term to determine a level payment investment opportunity cost of capital.

I = P (1 + i)to the "n" th power - P

Where: I = Interest earned on Deposit
n = 12 years
P = JD 385,000
I = 12%

I = JD 385,000 (1 + 12%)12 - 385,000
I = JD 1,115,000 which is JD 7,743/month or JD 92,913/year

TABLE III. ESTIMATED BREAKEVEN OPERATING COSTS

AVERAGE NUMBER OF PALLETS			BREAKEVEN OPERATING COST (JD)	
PER DAY	PER MONTH	PER SEASON	PER PALLET	PER KG.
1	30	180	690.	.345
3	90	540	230.	.115
6	180	1080	115.	.058
9	270	1620	77.	.038
12	360	2160	58.	.029
15	450	2700	46.	.023

Estimated Breakeven cost per kilogram is based on:
Operating Costs of JD 124,206/year
Export Season of 6 months
Average Month of 30 days
Aircargo Pallet (average) of 2.0 MT, or 2,000 Kg.
[NOTE: An aircargo pallet of grapes is 2.7 MT while an aircargo pallet of sweet peppers is 1.3 MT.]

$$\text{Breakeven} = \frac{\text{JD124,206}}{\text{Pal./day} \times 30 \text{ days/mo} \times 6 \text{ mo/season} \times 2000 \text{ Kg/Pal.}}$$

ESTIMATED "VALUE ADDED" by AIRPORT COLD STORES

I. Assumptions:

1) Higher Prices

With proper handling and Cold Storage at Queen Alia Airport, it is estimated that shippers may be able to charge an additional 8%, F.O.B. Amman, for their fresh fruit and vegetable aircargo exports.*

2) Immediate Increase in Tons Shipped

With proper handling and Cold Storage at Queen Alia Airport, it is estimated that shippers may be able to immediately increase the number of tons of fresh fruit and vegetable aircargo exports by 20% compared to the previous 1992 levels.*

3) Continued Increases in Tons Shipped

With proper handling and Cold Storage at Queen Alia Airport, it is estimated that shippers may be able to continue to increase the number of tons of fresh fruit and vegetable aircargo exports by 7% each year.*

* Source

The above information is based on recent interviews with several growers, shippers, and experts who are actively involved in the aircargo export of fresh fruits and vegetables from Jordan. NOTE: The statement includes the term "Proper Handling and"... Not just the availability of a Cold Storage Room at QAA.

II. Base Data:

1) In 1993 approximately 1800 tons of Fresh Fruits and Vegetables were exported via aircargo shipments from Jordan.

2) The value of the Fresh Fruits and Vegetables exported via aircargo shipments from Jordan in 1993 is estimated to average JD 1.00 per Kilogram C.I.F. (Cost Including Freight) London.

3) The total profits to all Jordanian parties derived from aircargo export shipments of Fresh Fruits and Vegetables from Jordan is estimated to average 15% of the C.I.F. London price per Kilogram.

ESTIMATED "VALUE ADDED" by AIRPORT COLD STORES, Continued

III. Estimated Added Value

1) The estimated value of 1993 Aircargo Shipments of FF&V = 1800 x 1000 x JD 1.00 = JD 1,800,000

2) The estimated additional value of 1993 Aircargo Shipments of FF&V, with proper handling and Cold Storage at QAA, = 1800 x 1000 x JD 1.00 x .08 = JD 144,000

3) The estimated additional profits that would have been earned from a 20% increase in the tonnage of aircargo export shipments of FF&V at 8% higher prices =

a) 1800 x 1000 x .2 x JD 1.00 x .15 = JD 54,000

b) 1800 x 1000 x .2 x JD 1.00 x .08 = JD 28,800

c) Summary:

	144,000
	54,000
	28,800
d) Total, Based on 1992 Estimates	JD 226,800

4) Projected Increases in Later Years

Year	Growth Factor	Estimated Value Added
1994	1.07	242,700
1995	1.07	259,600
1996	1.07	277,800
1997	1.07	297,200
1998	1.07	318,100
Estimated 5 year Total		**JD 1,395,500**

TABLE IV. AIRCARGO EXPORTS of FRESH FRUITS and VEGETABLES

	1988	1989	1990	1991	1992	1993
Tons	2116	3022	4530	3839	1574	1824
Pallets*	1058	1511	2265	1920	787	912

Source: Agricultural Marketing Organization

* Based on 2,000 Kg per Pallet

Project Funding

Plans for financing the Capital Cost of the project are as follows:

The Ministry of Agriculture has agreed to the earmarking of $120,000 from the National Agricultural Development Project. USAID has agreed, in principle, to approve the disbursal of $230,000 from the cold storage component of the Sigma One contract for the Agricultural Marketing Development Project. This will finance certain costs related to the establishment of the facility, including items 1, 2, and 6 of Table I - Cold Room Capital Cost Estimate. USAID will also partially finance the bulk of the "dollar" cost of item 7, such that the total USAID contribution for all of the above items is $350,000. The present total estimate for items 1, 2, and 6, as well as the "dollar" component of item 7 total slightly over $350,000, but it is anticipated that these figures will fall to $350,000 as a result of competitive bidding. In case they do not, no extra funding is guaranteed.

The Civil Aviation Authority will be the recipient and owner of the cold store which will become the property of CAA subject to agreements and understandings with the various other parties involved. As such, CAA has agreed, in case of cost overruns, to take the lead in arranging additional financing. CAA has also agreed to finance most of item 5, which amounts to approximately JD13,000 out of a total JD21,000 scheduled for this item, since the facility will be a fixed installation at the airport.

RJ will be required to provide the balance of finance needed which will be mainly, but not totally, in-kind contributions. This will include all of items 3 and 4, as well as the balance of item 5 not covered by the CAA and the "non-dollar" cost of item 7, including travel on RJ from and to the US, as well as the cost of room and board at the Alia Gateway Hotel. In case of cost overrun on these and any other items of the project, RJ must, in coordination with CAA, help arrange for the additional finance.

USAID prerequisites for the release of funds for the project include a memorandum of understanding among USAID, the Ministry of Agriculture, the CAA, the Agricultural Marketing Organization and RJ which describes the obligations and responsibilities to finance, establish and operate the facility.

Sigma One will prepare requests for funding at the appropriate stages in the project.

Ownership

The Civil Aviation Authority will be the owner of the facility and will be the lead agency in the process of tendering, procurement, shipping, construction and installation of the cold storage facility and will monitor, follow-up, facilitate etc. as necessary.

Management

The management of the facility must take into account the three parties involved including the owners (CAA), operators (RJ), and users. Eventually all three will act under the umbrella of, or in coordination with, the Jordanian Fruit and Vegetable Exporter's Association.

Initially, RJ will do all the operation, in coordination with the Exporter's Association and CAA.

I. Functions

The following functions are recommended for consideration in the handling of fresh fruits and vegetables at Queen Alia Airport:

A. Preliminary

1. Accounting for all capital and operating costs
2. Planning, forecasting volume
3. Establishing workloads and operating schedules
4. Establishing prices/profits for services
5. Contracting
6. Staffing

B. Operational

1. Check-in of drivers of farm vehicles on arrival at airport
2. Preparation of "work orders" (W.O.) and recording thermometers
3. Providing truck/trailer parking instructions
4. Calling-up of driver(s) for unloading
5. Measuring and recording arrival pulp temperatures
6. Unloading of farm vehicles
7. Inspecting cartons for security purposes
8. Checking-out drivers to return to farms
9. Retrieval and storage of empty air-cargo pallets
10. Loading Euro-pallets/cartons on air-cargo pallets
11. Activating recording thermometers and placing with cartons
12. Securing loads to air-cargo pallets with safety nets

I. Functions, continued

13. Weighing completed air-cargo pallets
14. Recording weights, temp. recorder nos. and pallet nos. on W.O.
15. Transferring pallets to numbered holding stations
16. Recording and storing pallet location data for later call-up
17. Monitoring storage conditions including refrigeration system
18. Monitoring airplane schedule/readiness
19. Receiving calls to load air-cargo pallets
20. Measuring and recording departure pulp temperatures
21. Transferring pallets from holding stations to shuttle vehicles
22. Moving air-cargo pallets to airplane loading area via shuttles
23. Loading pallets into airplanes
24. Providing "on-board" air-conditioning service prior to takeoff
25. Recording take-off times on W.O.
26. Recording landing times and other arrival data on W.O.
27. Retrieving and examining copies of recording thermometer data
28. Filing copies of recording thermometer data W.O.
29. Completing and distributing copies of W.O.'s
30. Preparing and sending invoices with copies of W.O.'s attached
31. Collecting fees for services
32. Maintaining/replacing equipment
33. Participating in quality control audits
34. Participating in team building and service review programs
35. Note: Records regarding handling at destination and retrieval of recording thermometer data to be arranged by others.

II. Service Provider Considerations

The receiving of cartons, air-cargo palletizing and temporary storage services could be provided by one, or a combination, of the following organizations:

* Royal Jordanian Airlines

* The Civil Aviation Authority

* Third Parties

Certain functions, such as placing the cartons on the air-cargo pallet and securing them with safety netting, could be performed off-site. The pallet would arrive at the airport in "airplane ready condition".

In any case, the work to be done is well defined. It is all service. No new product will be created. The work will all be done by people, with some help from machines. Any number of existing organizations, as well as new organizations, could get the work done...or contribute to delays, higher costs, etc.

What will count most will be the quality and effectiveness of the leadership. Also, the ability of those chosen to lead, to forge and maintain co-operative relationships among all the participants including the farmers, the truckers, the customs people, the dock workers, the maintenance people, the airplane pilots, the distant customers... everyone.

1. Customer Council

A joint council of representatives of the Fresh Fruit and Vegetable Air-Cargo Exporters (customers) and the people who provide the services could work together to maintain and improve the services. Such a council would provide a forum for communications and feed-back between and among those who provide and use the facilities and services.

2. Staff Training

All parties would benefit from occupational training. Farm vehicle drivers and those at the air-cargo area can learn ways to help each other and make the work safer and smooth for everyone. A strong training component is recommended.

3. Quality Audit

A periodic audit of procedures, by a qualified disinterested third party, is recommended with results distributed to both the customers and the leadership of the service organization.

Precautions

1) Cold Storage Room...Not a Pre-Cooler

The refrigeration system at the Airport Cold Room will be designed to maintain the temperature of already pre-cooled product. There will be no provisions for pre-cooling. Product which arrives at the airport with pulp temperatures above the cold room set point will/must be excluded from the cold room, since such product will tend to heat up the lower temperature product.

2) High Humidity Requires Strong Cartons

The relative humidity inside the cold room will be in the range of 85%. The cartons used to package the produce must be able to resist sagging/bulging, and continue to provide mechanical stacking strength and protection for the produce under such high humidity conditions.

3) Temporary Cold Storage...Not a Cold Warehouse

The facility will be designed to accept and hold product for very short periods of time, usually on the order of 4 - 6 hours. It will not be a warehouse for produce to be held for a day or more while the owner waits for the market prices to hopefully increase at the destination. Tight controls with high overtime charges and/or the right to refuse future service will be recommended to insure against "warehousing", which could block others from using the facility as intended.

Outside Cold Room Construction Project

Implementation Plan

1) Prepare preliminary sketches which illustrate the location, the major elements, and the envelope dimensions.

2) Develop estimated capital costs for the Outside Cold Storage Room, the Refrigeration System, the Conveying Equipment, etc.

3) Develop estimated operating and depreciation costs for the Outside Cold Storage Room, the Refrigeration System, the Conveying Equipment, etc.

4) Communicate the nature, scope, estimated capital costs, and estimated operating costs of the QAA Outside Cold Storage Facility to all concerned.

5) Develop a cost sharing proposal to secure the total funding required from among the various interested agencies.

6) Obtain letter of "Approval in Concept" from officials within the Civil Aviation Authority and Royal Jordanian Airlines.

7) Prepare Final Specifications for the Refrigeration System.

8) Prepare Draft Specifications for the Modular Cold Storage Building to include walls, roof, doors, lights, and steel structure. Not to include concrete work and utility stubs.

9) Prepare a Site Plan engineering drawing.

10) Prepare an Equipment Layout engineering drawing.

11) Obtain formal written bids from USA sources for the Modular Cold Room based on the draft specifications.

12) Obtain formal written bids from USA sources for the Refrigeration System.

13) Prepare a Concrete Foundation engineering drawing.

14) Prepare an engineering estimate of the concrete floor and the utility stubs.

15) Review the overall plan and strategy, plus all documents, drawings, bids, etc. with all concerned.

Implementation Plan ...continued

16) Make revisions, obtain new cost information as necessary. Up-date all concerned as appropriate.

17) Submit formal funding request with supporting documents.

18) Obtain Funding Approval, release Purchase Orders.

19) Break Ground, begin clearing space and construction of concrete floor and utility stubs.

20) Pour the concrete floor

21) All materials on-hand at Queen Alia Airport.

22) Complete construction and installation of equipment.

23) Operational test and refinement.

23) Begin Commercial Operation.

Observations

1) The consequences of major uncertainties in the supply of raw product will continue to ripple through the entire system from the small farmer to the final customer...and all those who provide services in between. Stabilizing the supply in quality, quantity, and schedule may be a necessary first step to attracting capital for investments in cooling and handling facilities like the Airport Cold Storage Room described in this report.

2) The privatization of Royal Jordanian Airlines could lead to greater or lesser than present true costs of handling air-cargo shipments of Fresh Fruits and Vegetables through Amman's Queen Alia Airport and air transport to other countries.

3) The Peace Process could lead to Israeli marketing and shipment of certain fresh fruits and vegetables produced in Jordan.

4) The receiving of cartons, air-cargo palletizing and temporary storage services could eventually be provided by a specialized body including RJ and/or others. Given the tendency towards commercialization and privatization of airport services, this will likely eventually happen and should be taken into account early on in the management of the cold storage facility.

5) The consequences of major uncertainties in the supply of raw product will continue to ripple through the entire system from the small farmer to the final customer and all those who provide services in between. Stabilizing the supply in quality, quantity, and schedule will be a necessary first step to attracting capital for additional investments in cooling and handling facilities like the QAI Airport Cold Storage. It is anticipated that the proposed facility will help in this process. Once achieved, the Cold Store could/should become a candidate for privatization.

7) The increasing commercialization of operations at QAI Airport could lead to developing more detailed cost analysis of all air-cargo related operations than is presently available. Such added information could reveal that the total true costs of air-cargo shipments of fresh fruits and vegetables to other countries is perhaps more or less than what is presently thought to be the case.

Thoughts Regarding the Future

A. Some General Factors Involving Macro-economic Change:

1. The Peace Process

Peace in the region will mean massive change in all Jordanian economic sectors. In the long-term, the opportunities presented by peace will vastly outweigh the threats to certain vested interests. In general, the main impact of peace will be a jump in investment, both local and foreign, and an opening up of new trade routes and export opportunities. And we are now talking about rapid change in the direction of peace that will start to make itself apparent during 1994.
On the negative side, peace will also mean more competition with Israeli exports, particularly horticultural production.

2. Economic Liberalization

Preceding, but certainly interacting with the peace process, is the trend towards economic deregulation, commercialization, and privatization. While these have proceeded quite slowly in the recent past, the next few months should see the start of an acceleration in the general area of economic liberalization. With a new Parliament, and a change in government, the chances of this happening have been boosted. In particular, the privatization study now being started for Royal Jordanian airlines (RJ), the appointment of a new chairman, and changes in staff all point to an atmosphere more conducive to innovative projects involving private sector participation.
On the negative side, liberalization could indirectly lead to greater costs of handling exports of horticultural products.

B. More Specific Issues Concerning Horticultural Exports

Inadequate cold storage at Queen Alia International Airport is a major bottleneck to increasing Jordanian exports of horticultural products, especially to Europe. RJ management has been reluctant to expand cold storage facilities because there is not enough business to justify the investment. Growers have been reluctant to increase their production and exports because of the higher risks involved without adequate cold storage facilities. Export opportunities in Europe and elsewhere for Jordanian horticultural products are certainly favorable, and there is potential for tripling fruit and vegetable exports in the short run. Certain constraints, however, must first be overcome. The more important among them are listed below, and it should be kept in mind that most of these constraints are interrelated.

Thoughts Regarding the Future...continued

1. Supply Constraints:

a. Policy, Laws and Regulations

The government in general, and the Ministry of Agriculture in particular, are concerned with increasing agricultural production in the Kingdom. Diversified agriculture and increased horticultural exports are also priority areas. The example of Israel is both a clear reminder of the possibilities, as well as a threat, insofar as the same products are produced in the same season by both countries. But the overall performance of the public sector in enhancing the agricultural sector has been poor, due to a weak policy, inappropriate laws, and confusing regulations. This has also been partly responsible for the lack of grower's and exporter's associations, etc.

b. Input Costs

In general, Jordan is weak in most of the factors involved in horticultural supply, with the exception that labor and some types of fertilizer are cheap. So a top priority that Jordan should consider is long term contracts, at stable prices, with suppliers of raw materials and other inputs. Investment in industries involved in this sector should be encouraged and supported.

c. Institutional Problems

It has proven quite difficult to bring Jordanian horticultural producers together to form associations to cooperate in ensuring expanded and reliable product supply. While the government is partly to blame, a big part of the problem is in the private sector, and will have to be dealt with in an innovative fashion to try to unite the relevant players in this sector.
Another important problem in this area has been the inability to hold farmers to contractual supply agreements. This is partly a function of attitudes towards business relations in general, but is particularly related to the whole question of the position of farmers and their land within the legal system. Once again, this is a longer term problem which will have to be handled innovatively.

2. Demand constraints:

a. Marketing

The days of easy selling for Jordan's fruits and vegetables are over, and exports to "protocol" countries, such as Iraq and Russia, do not reflect the reality of working in an open market. Jordan's biggest advantage is the relative freedom to sell to Europe. But to succeed there, Jordan must take an innovative approach including possible cooperation with international marketing houses. Alternatively, Jordan can market itself through direct contacts or international fairs, but the latter is better done as a joint effort. And as we have noted, such cooperation has not been forthcoming. Whichever the approach to marketing, Jordanians still have to prove that they are serious and reliable. To aid marketing, the government could play a greater role in enabling private sector activity to expand.

****

To sum up, the future prospects for exports from Jordan could be quite promising. To safeguard these prospects, there must continue to be new investment in the Jordanian infrastructure. But this should be seen as both physical (i.e. cold storage facilities, etc.), as well as institutional (encouraging change in the public sector, helping form growers' associations, etc.).

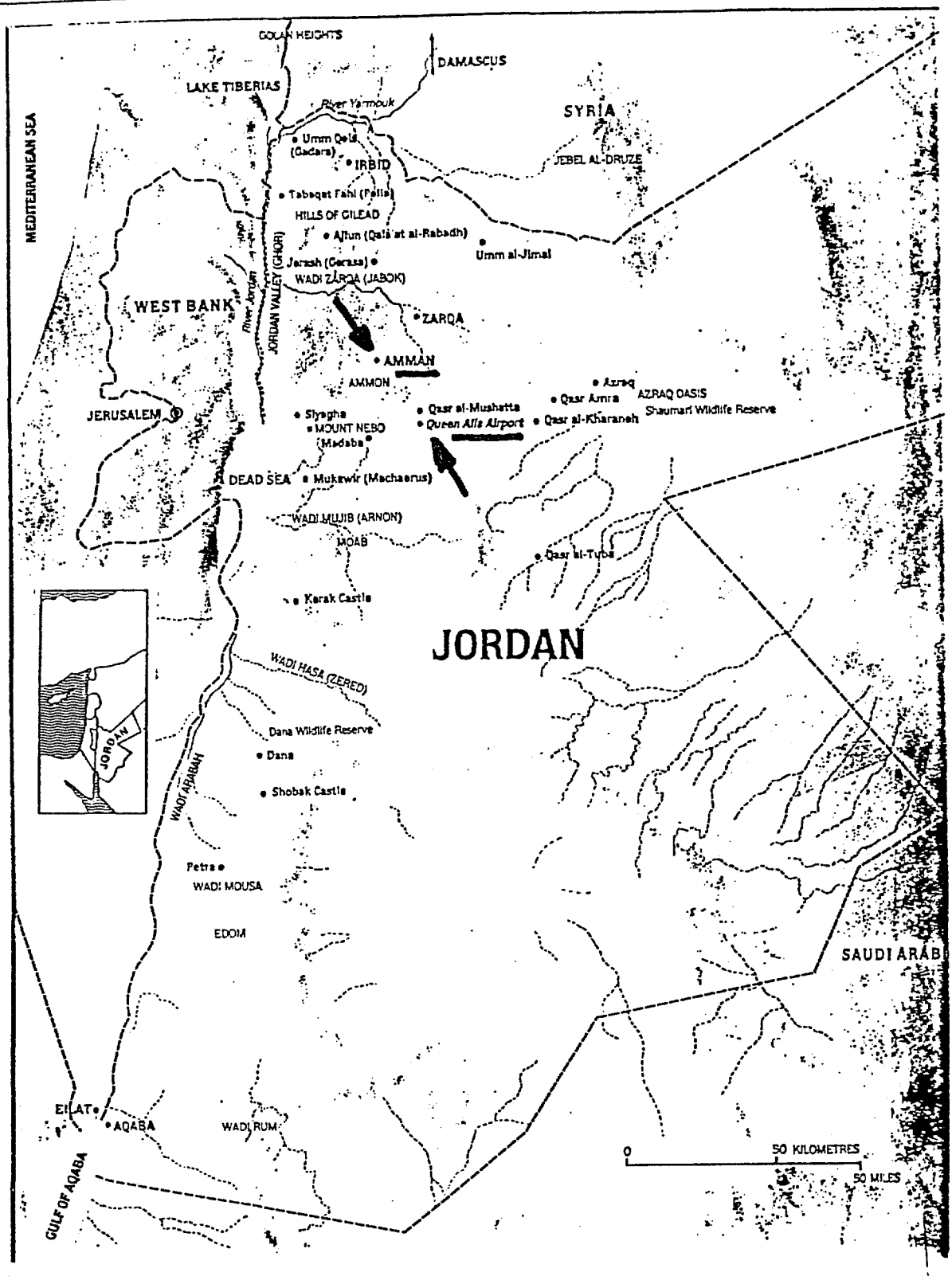


Figure 1
The Hashemite Kingdom of Jordan

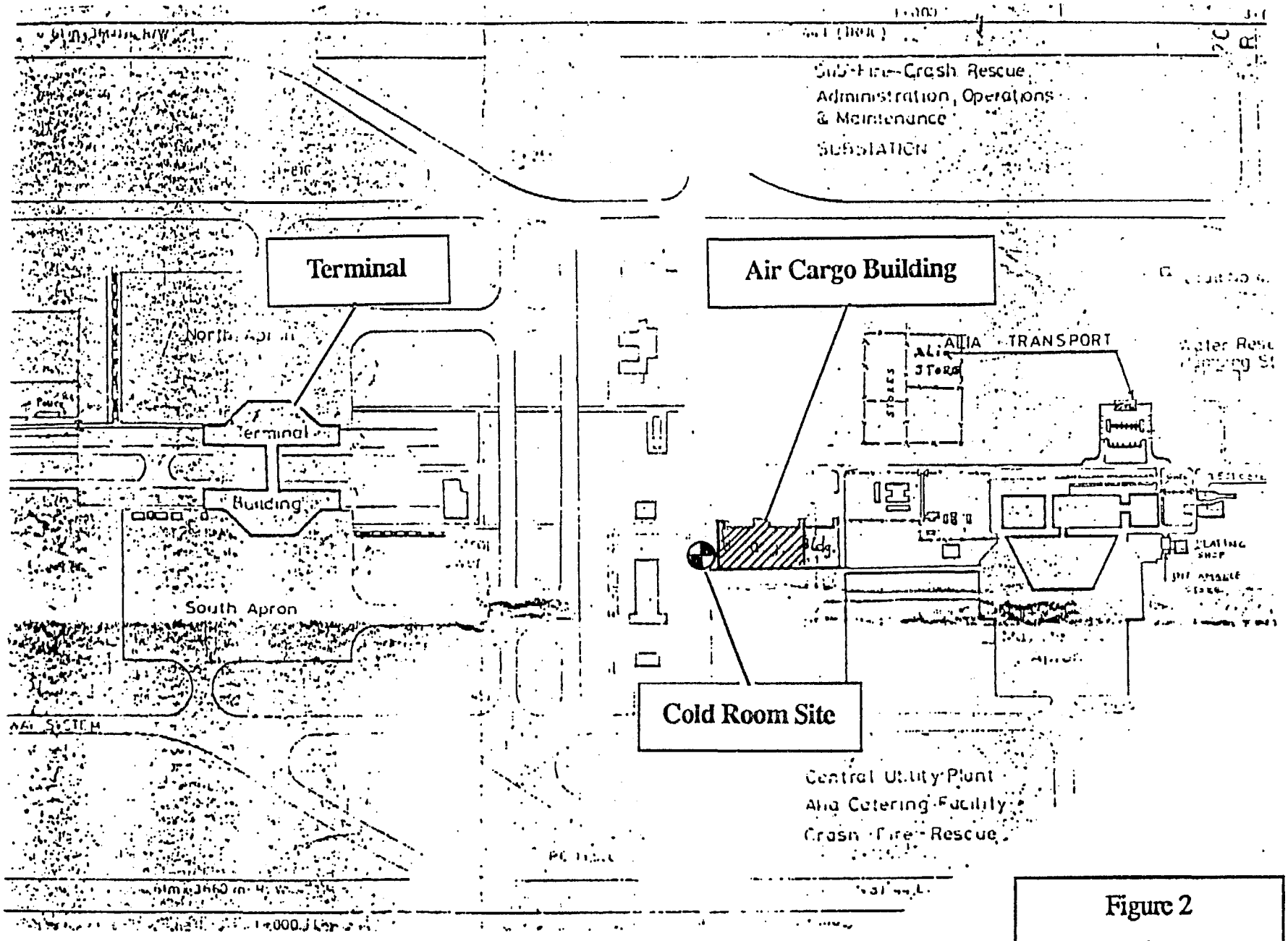


Figure 2

Queen Alia Airport

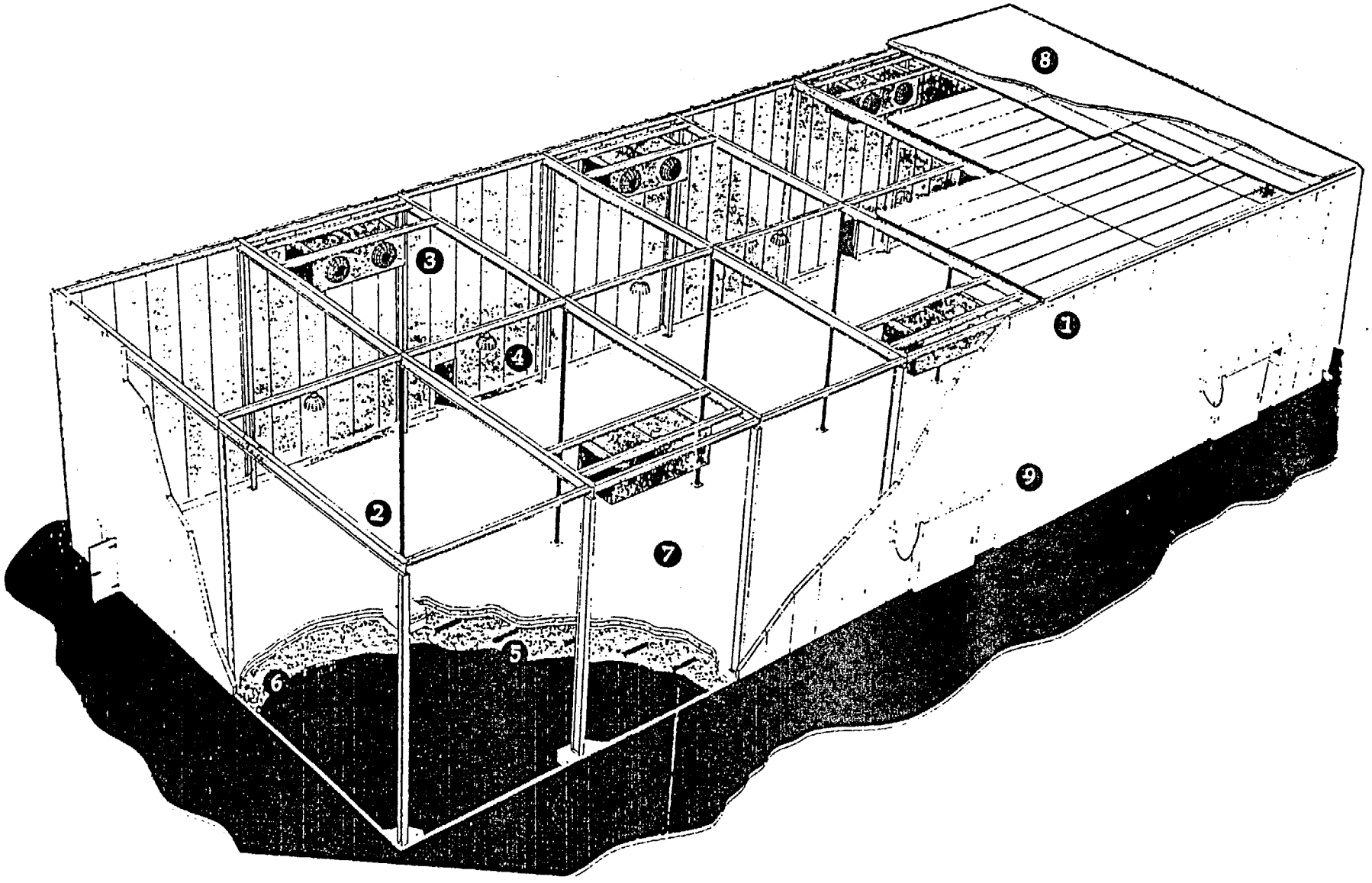


Figure 4
Modular Cold Room Construction

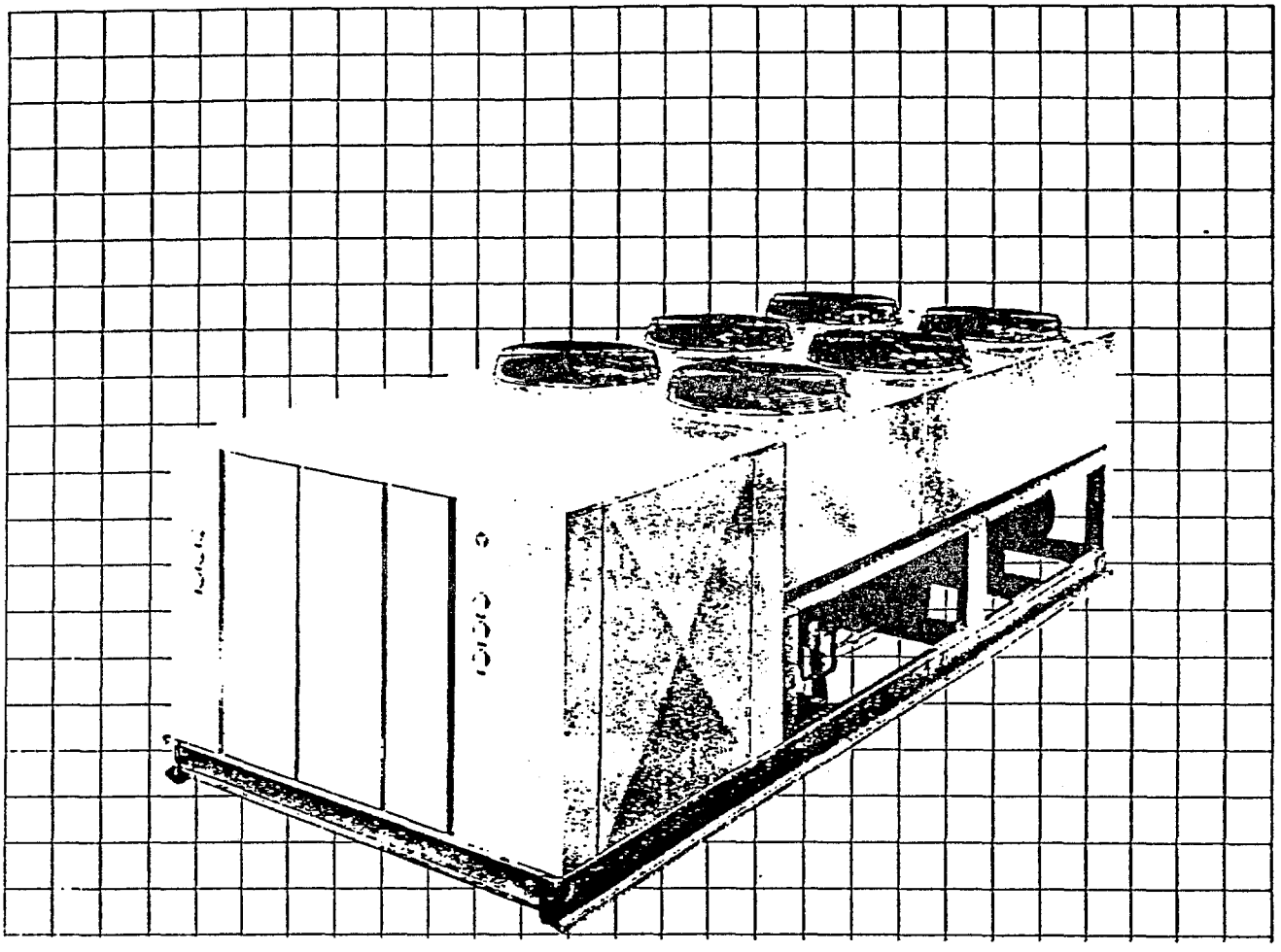


Figure 5
Modular Refrigeration Package

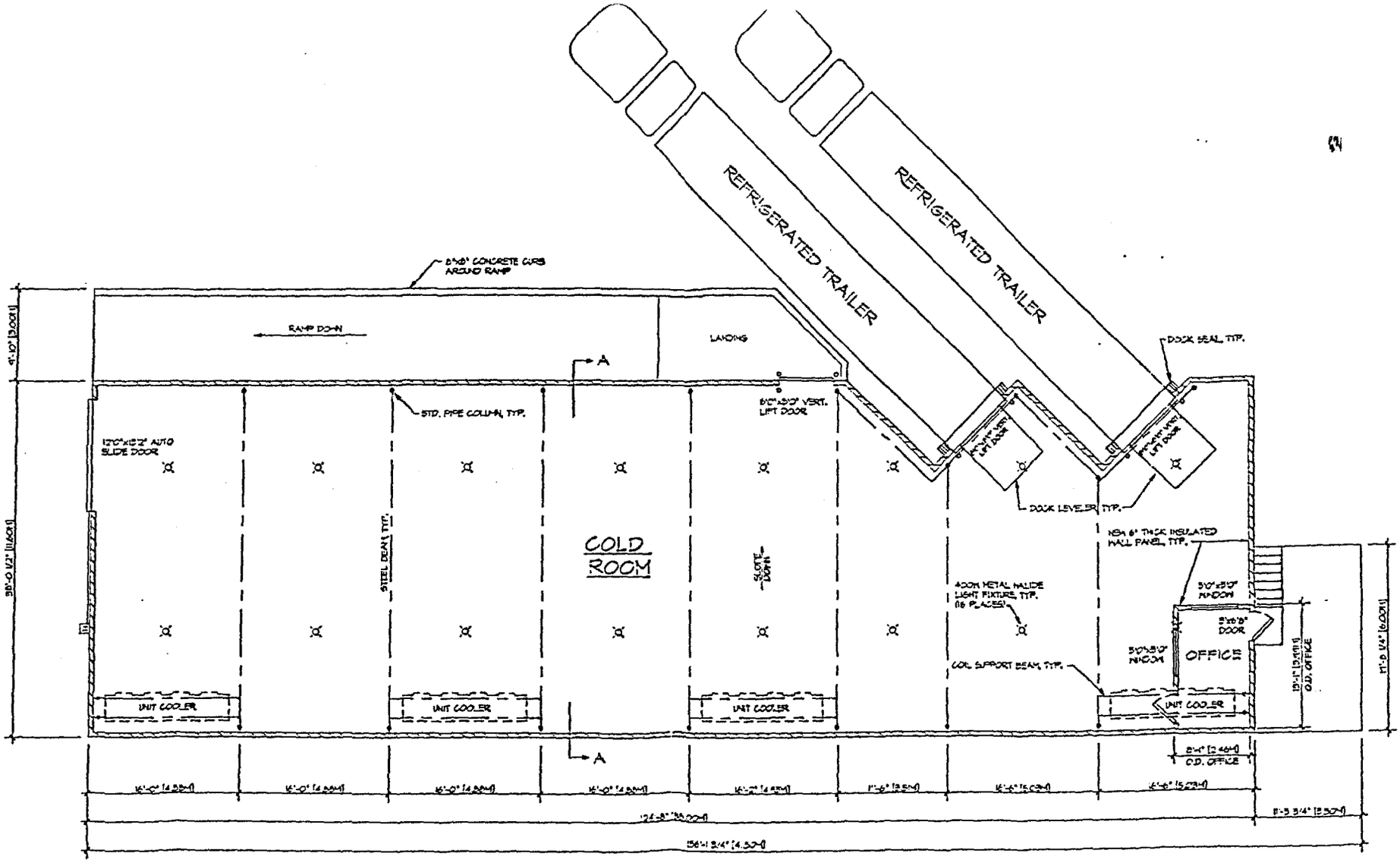


FIGURE #6

COLD ROOM - PLAN VIEW

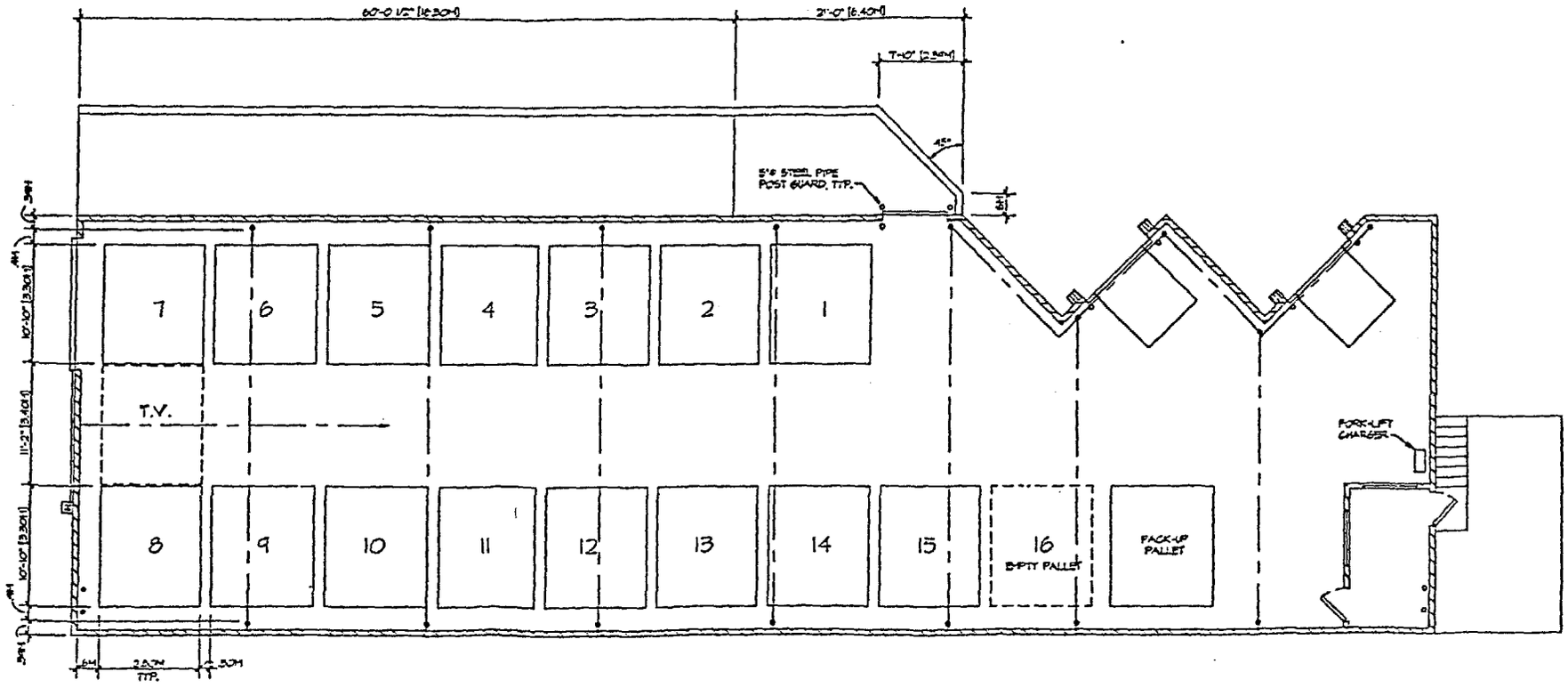
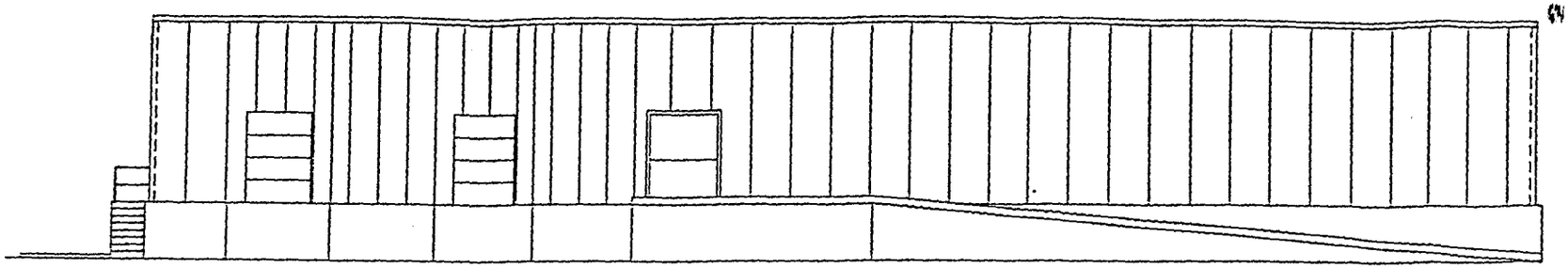
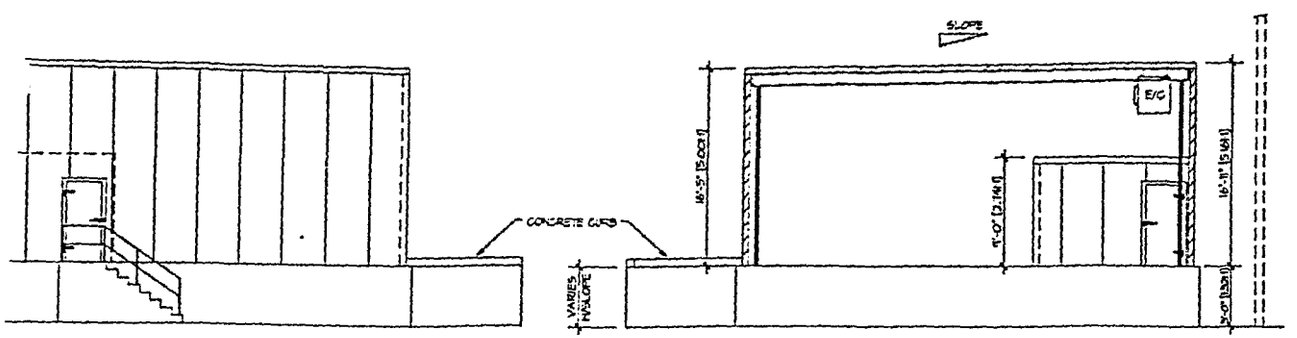


FIGURE #7

AIR CARGO PALLET LAYOUT

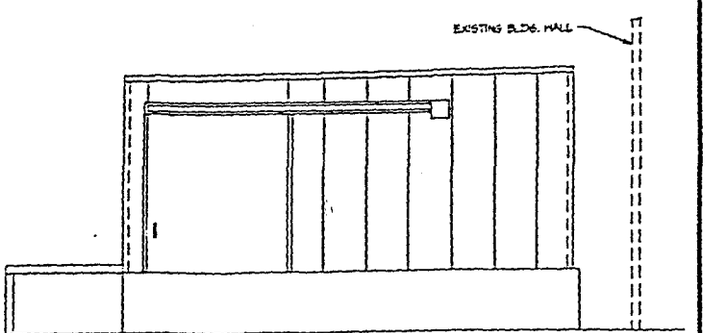


FRONT ELEVATION



L.S. ELEVATION

SECTION AA



R.S. ELEVATION

FIGURE #8

COLD ROOM ELEVATIONS

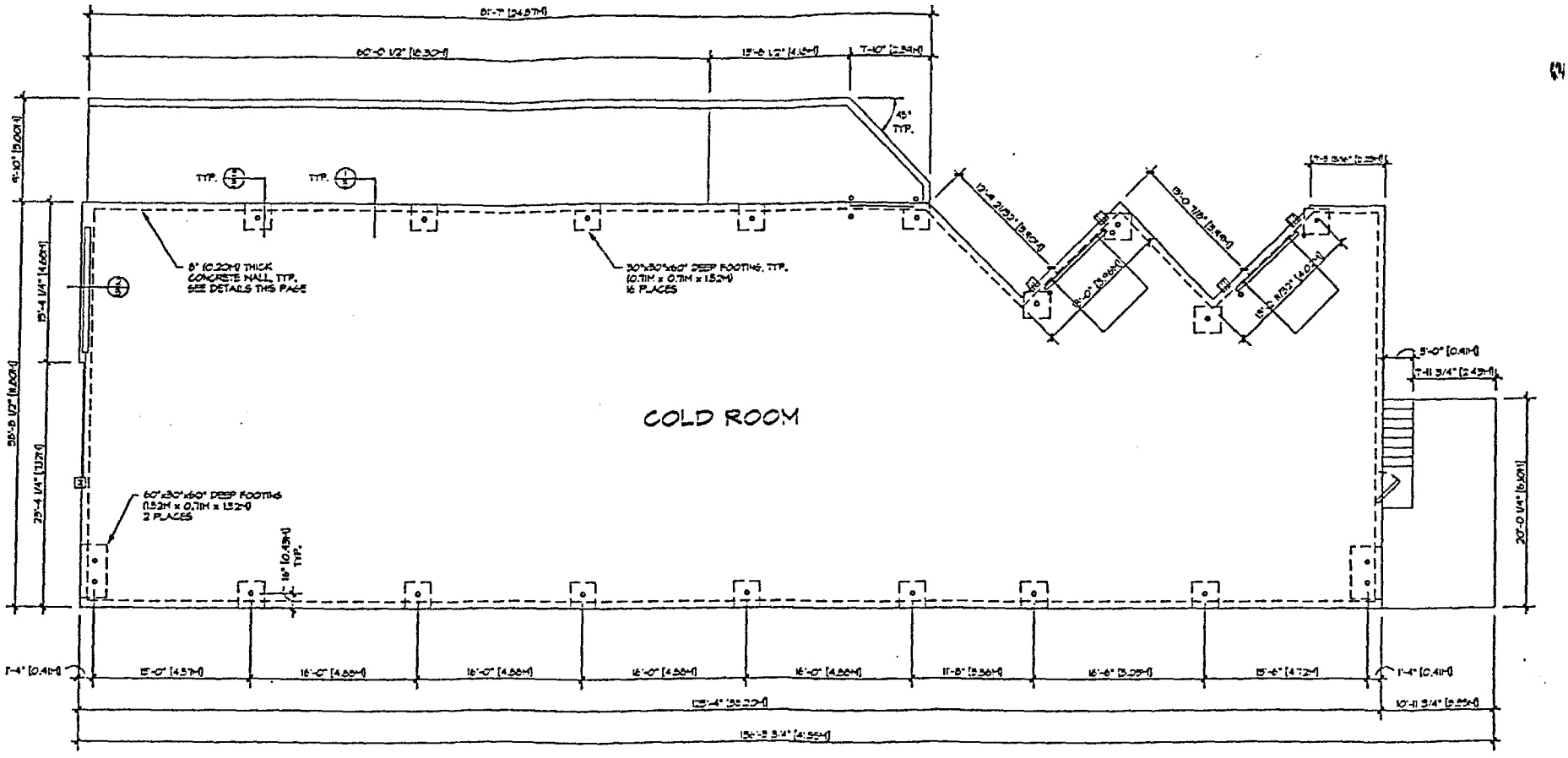
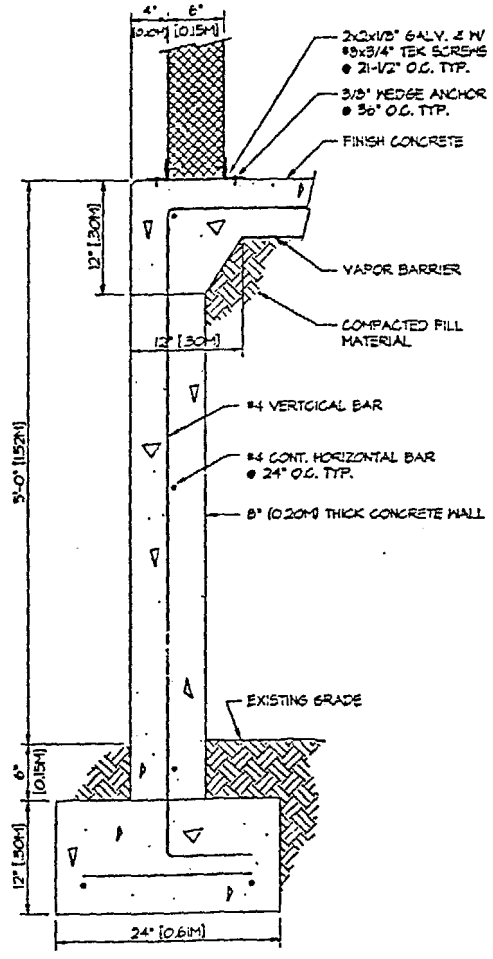
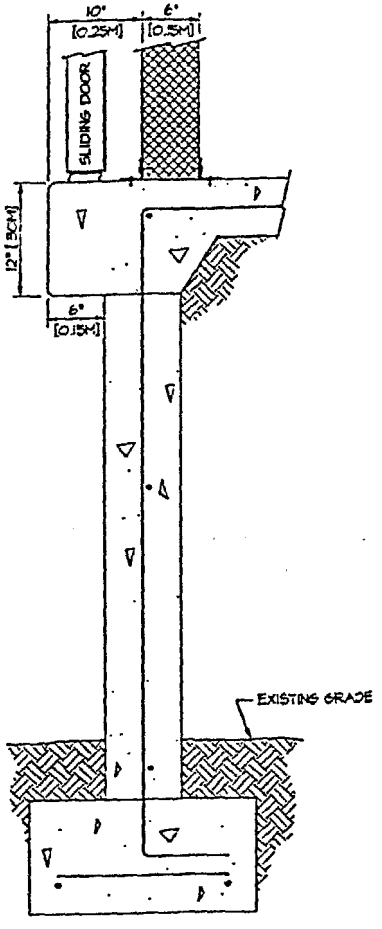


FIGURE #9

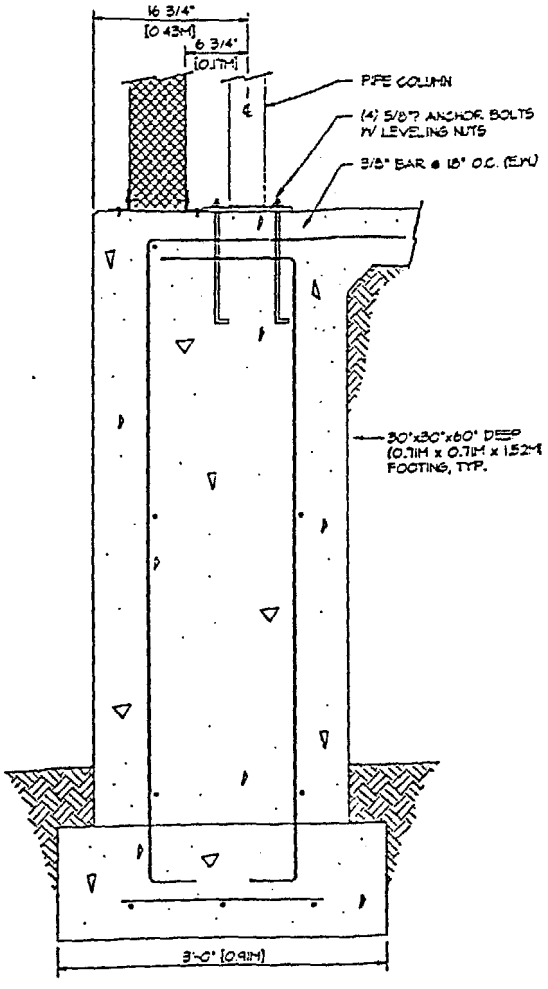
COLD ROOM - FOUNDATION PLAN



(1) TYPICAL FOOTING



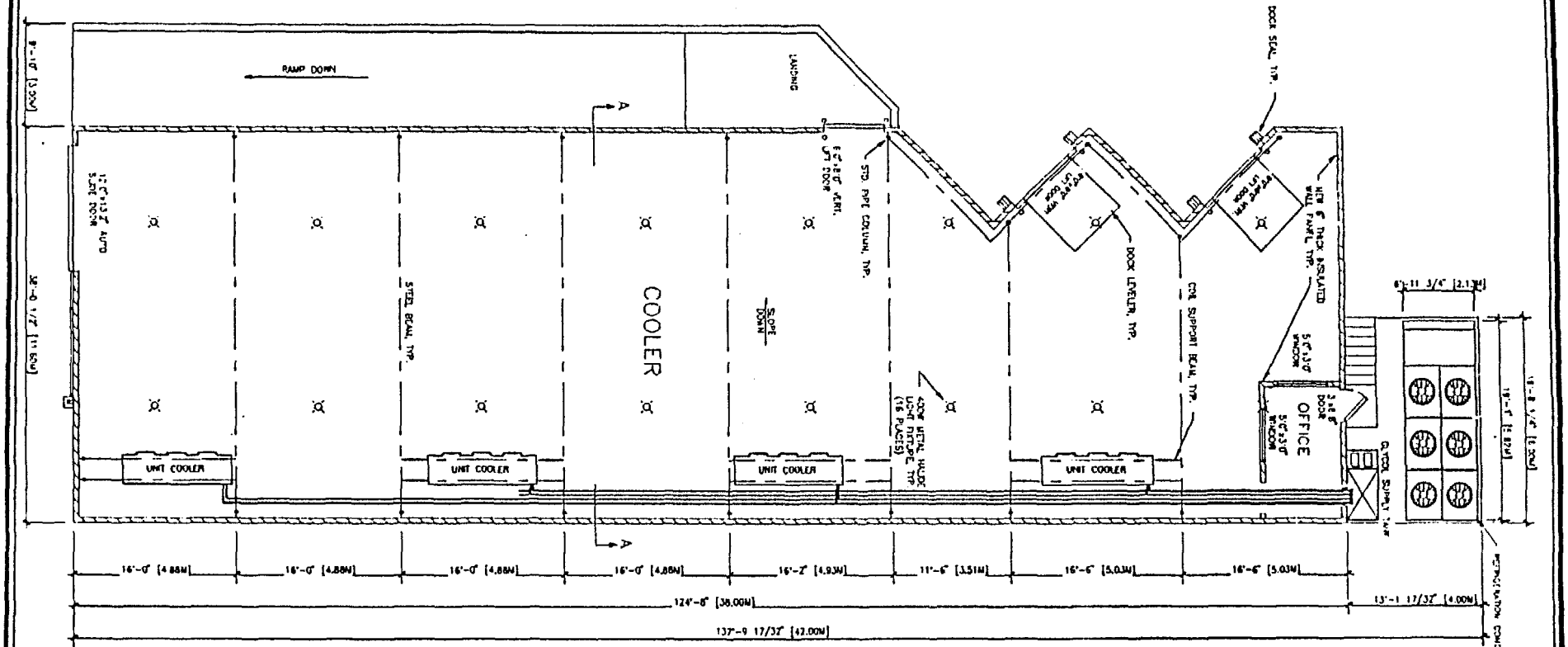
(2) FOOTING @ DOOR



(3) FOOTING @ COLUMN

FIGURE #10

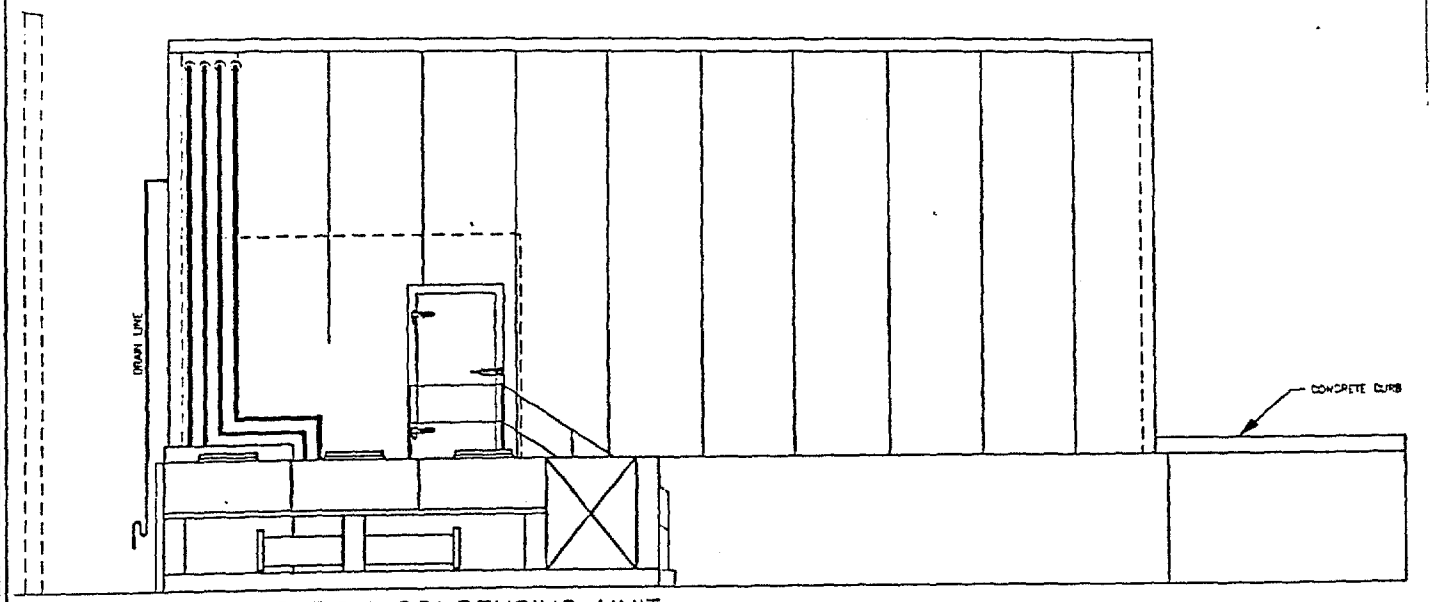
FOOTING DETAILS



REFRIGERATION FLOOR PLAN

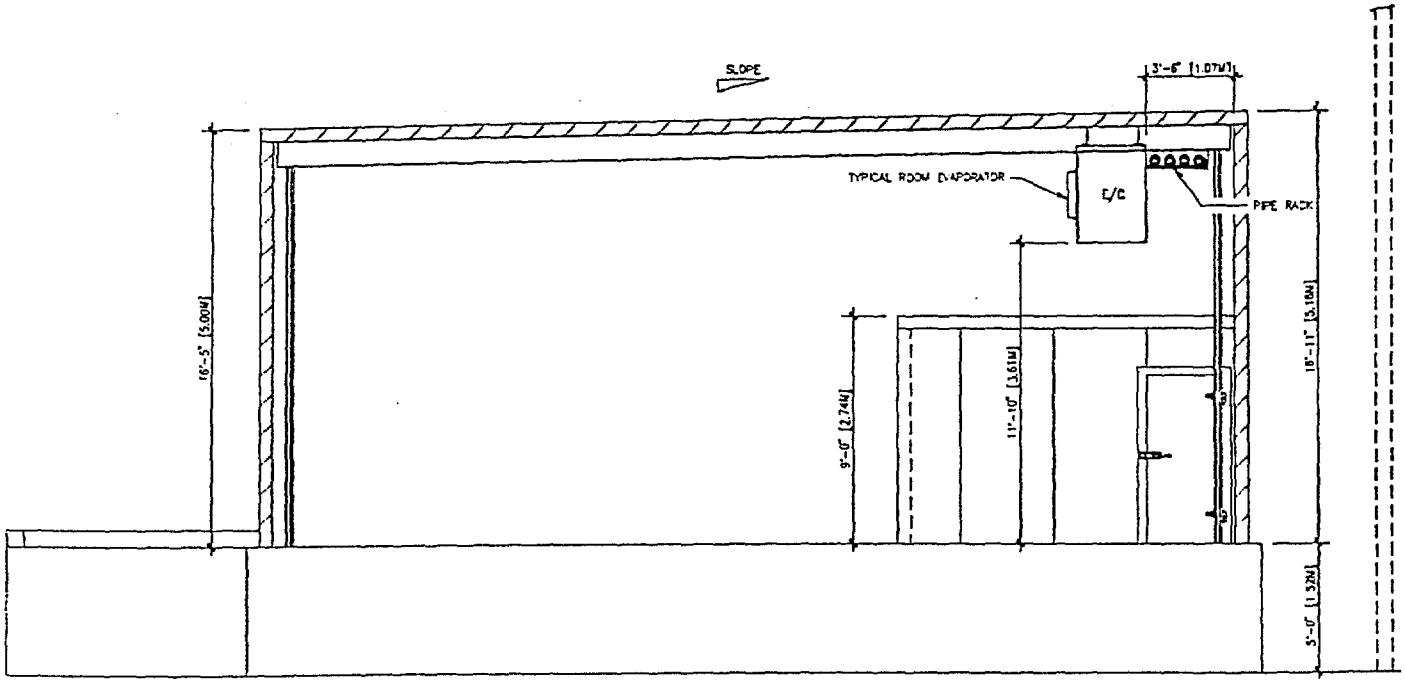
Figure 11

Refrigeration System Floor Plan



L.S. ELEVATION

SCALE: 1/4" = 1'-0"



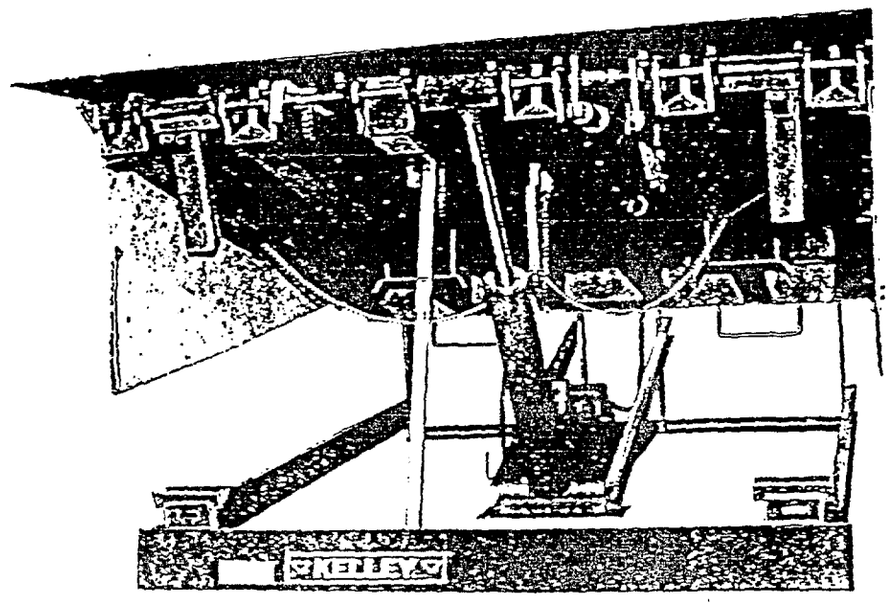
SECTION AA

SCALE: 1/4" = 1'-0"

Figure 12

Reifrigeration System Elevations

Hydraulic Dockleveler



DOCK PRODUCTS

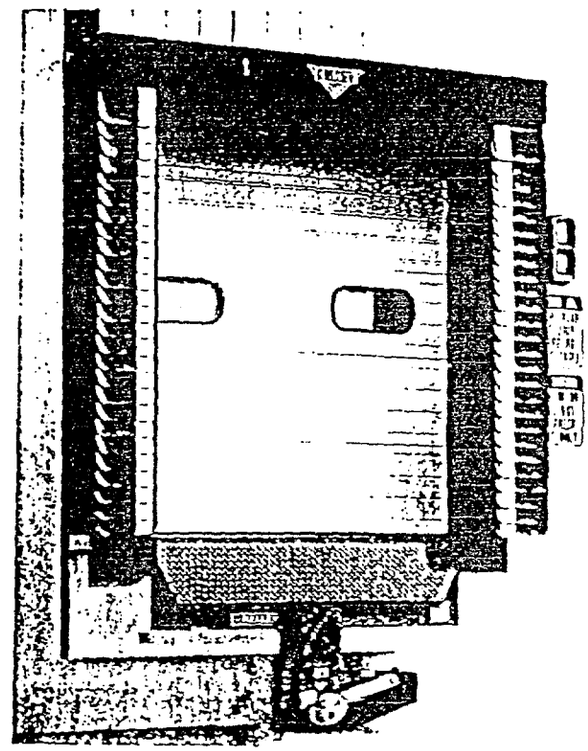


Figure 13

Dock Levelers and Dock Seals

Appendix A

Refrigeration System Specifications

ADVANCED REFRIGERATION CONCEPTS
Fax: (408) 663-6922 • (408) 758-3700

ROYAL JORDANIAN AIRLINES
CARGO COLD STORAGE FACILITY
AMMAN, JORDAN

REFRIGERATION SPECIFICATIONS

REVISED "OUTSIDE" COLD STORAGE ROOM

REVISION DATE FEBRUARY 10, 1994

Based on the general specifications provided by Cayton Associates for the new "outside" cold room, the following refrigeration specification is proposed for this project.

PREVIOUS ROOM DIMENSIONS	NEW ROOM DIMENSIONS
ROOM LENGTH = 34 Meters (111.5 FT)	**38.0 METERS (124.7 FT)**
ROOM WIDTH = 7.8 Meters (25.6 FT)	**12.0 METERS (39.4) FT)**
ROOM HEIGHT = 5 Meters (16.4 FT)	**5.0 METERS (16.4 FT)**
ROOM AREA = 265 SQ Meters	**456 SQ METERS (4900 SQ FT)**

Because of the possibility of handing a wide range of refrigerated commodities through this facility at different times of the year, the refrigeration design and equipment selected will be able to accommodate a wide range of operating room temperatures. The cold room temperature will be able to operated between 0° Celsius (+32°F) and +10.0° Celsius (+50°F). The equipment design for the cold storage room will be based on maintaining an average room temperature of between +1°C (+34°F) and +4.4°C (40°F), while maintaining a minimum relative humidity of 85% RH, or above. The refrigeration design will be based on the room size of 456 square meters (4900 SQ. FT.) at an average design room

17595 Vierra Canyon Road, Suite 303 • Salinas, California 93907

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temperature of +1°C (34°F). The design refrigeration load is calculated only to maintain design room temperatures based on room losses and service loads only. The refrigeration calculations do not include any commodity cooling loads. It will be assumed that all incoming commodities will be pre-cooled before arriving at the facility within 3°C of the operating room temperature.

Based on the possibilities of wide operating temperature and room loads within the facility, the refrigeration design will be based on a Cascade Freon R-22/glycol refrigeration system. This system design offers some significant advantages over a conventional direct expansion R-22 cold room refrigeration system.

One major advantage of using a glycol chiller package for a facility of this type, is that all the piping located inside the cold storage room is glycol / water piping. All the piping can be installed, repaired and maintained by general plumbing maintenance personnel. The refrigeration package will be located outside and will be fabricated using high quality refrigeration components which will ensure long operating, low cost operation. The chiller package will be fully piped, wired, tested before shipment to the project site. A minimum amount of on-site installation will be required to install the entire refrigeration system. Two to three pipe welders and fitters should be able to install all the equipment in a two to three week period.

With the high cost of Freon R-22 refrigerant and the potential harmful effects on the environment due to leaks, a packaged self-contained chiller unit offers the least risk of system losses. The entire refrigerated charge will be contained within the chiller skid package located outside the facility.

Another advantage of using a central chiller unit is the response of the equipment to varying refrigeration loads which will occur in a facility of this type. During operating periods when heavy product loading into and out of the facility is occurring, the refrigeration load can be very close to, or even exceed the design load. However, during periods of little activity in or out of the cold storage room, the refrigeration load may be only 10% - 25% of the design load. The use of direct expansion (DX) feed valves on evaporator coils do not perform very well under this wide range of operating conditions. Using a sensible heat glycol coiling coil will handle varying load conditions very well. The system will be furnished with two (2) room temperature controllers which will vary the room temperature within the design parameters by simply entering the new desired set point. The set temperature range is between 0°C (+32°F) to +10.0°C (+50°F).

Because of the location of this equipment and the strong need for low maintenance and high system reliability, we have specified only the highest quality refrigeration components. This specification is based on specific US manufactures which have an excellent record of supplying the highest quality equipment throughout the world at competitive pricing.

REFRIGERATION EQUIPMENT SPECIFICATIONS

The refrigeration system design proposed for the Royal Jordanian Cargo cold storage facility shall be a cascade type refrigeration system using a 35% glycol/water brine as the primary refrigerant which will be circulated directly through the cooling coils located in the cold storage room. Freon (R-22) will be the secondary refrigeration and shall be furnished as a completely assembled and tested chiller package, based on the following design specifications:

1.	NOMINAL DESIGN REFRIGERATION LOAD	=	33.0 TONS
2.	NOMINAL DESIGN ROOM TEMPERATURE	=	+1°C (+34°F)
3.	MINIMUM ROOM RELATIVE HUMIDITY	=	85% RH
4.	MINIMUM ROOM OPERATING TEMPERATURE	=	0°C (+32°F)
5.	MAXIMUM ROOM OPERATING TEMPERATURE	=	+10.0°C (+50°F)
6.	NOMINAL GLYCOL CHILLER DESIGN	=	35 TONS
7.	NOMINAL GLYCOL CHILLER OPERATE TEMP	=	-7.8°C TO -6.7°C (+18°F TO +20°F)
8.	NOMINAL LEAVING GLYCOL TEMPERATURE	=	-3.3°C TO -2.2°C (+26°F TO +28°F)
9.	NOMINAL RETURNING GLYCOL TEMP	=	-1.1°C TO +0.6°C (+30°F TO +33°F)
10.	DESIGN AMBIENT WET BULB TEMPERATURE	=	72° WET BULB
11.	DESIGN AMBIENT DRY BULB TEMPERATURE	=	97° DRY BULB
12.	ELECTRICAL DESIGN	=	350 V/3 PH/50 HZ

DIMENSIONS

MODEL		FIGURE	DIMENSIONS						SHIP WEIGHT
ELT6 or HLT6	ELT4 or HLT4		A	B	C	D	E	H	
85	80	A	34	24¾		2⅜	6⅞	23	90
106	100	A	34	24¾		2⅜	6⅞	23	100
125	116	A	46	36¾		2⅜	6⅞	23	125
180	165	A	64	54¾		2⅜	6⅞	23	170
225	210	A	64	54¾		2⅜	6⅞	23	185
260	241	A	82	72¾	36⅜	2⅜	6⅞	23	225
310	290	A	82	72¾	36⅜	2⅜	6⅞	28	245
390	365	A	82	72¾	36⅜	2⅜	6⅞	28	255
	446	B	92*	72	36	10	10	39	640
	569	B	92*	72	36	10	10	39	702
	669	B	128**	108	36	10	10	39	825
	746	B	128**	108	36	10	10	45	923
	853	B	128**	108	36	10	10	39	1,020
	985	B	128**	108	36	10	10	45	1,043
	1117	B	128**	108	36	10	10	51	1,268

*HLT drain pan dimension = 97¾.
**HLT drain pan dimensions = 133¾.

FIGURE A

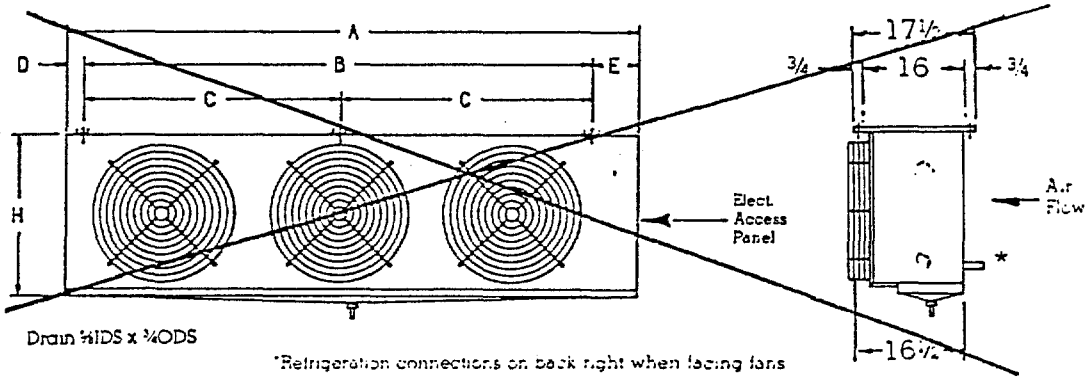
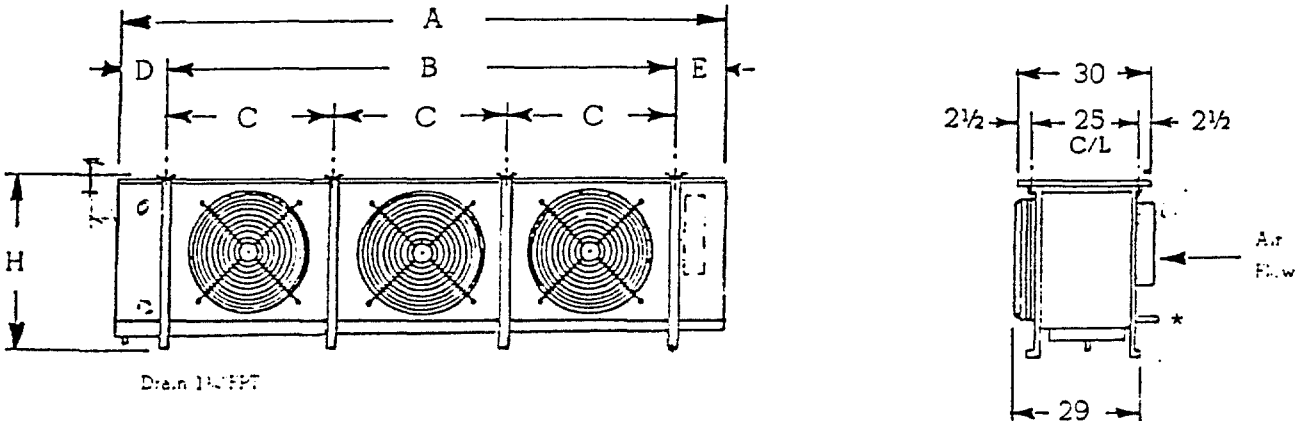


FIGURE B



Appendix B

"Inside" Cold Storage Room

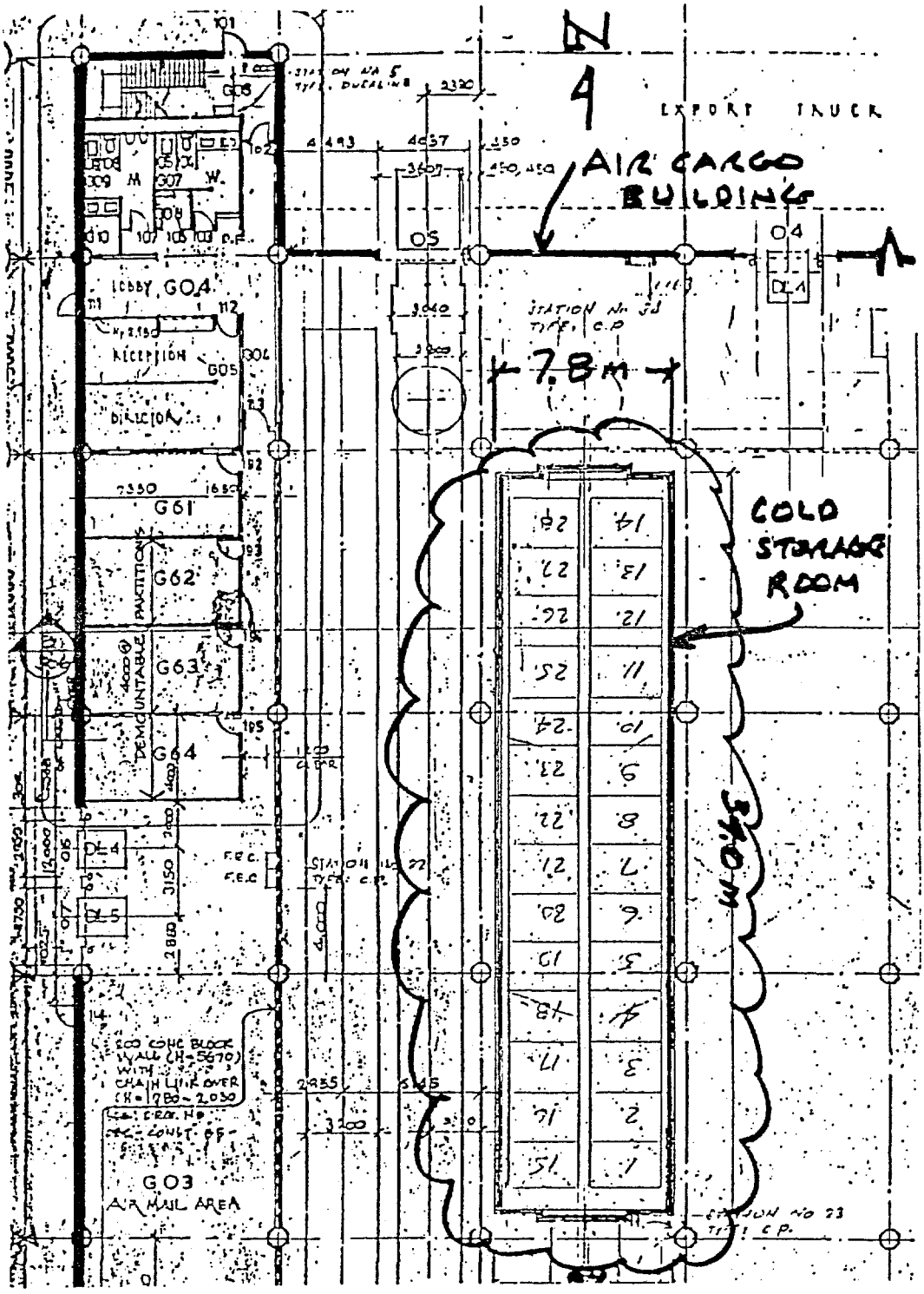


Figure 14
"Inside" Cold Storage Room

Appendix C

Mobil Container/Trailer Cold Storage System

CAYTON ASSOCIATES

DAVID W. CAYTON

408/455-1533 Fax 408/455-0376

December 12, 1993

Mr. Richard J. Peters
Sigma One Corporation
P.O. Box 9145
Amman, Jordan

011-962-6-689-192
011-962-6-689-194 Fax

Re: **Mobil Cold Storage Facility - Trailers/Ocean Containers**
Queen Alia Airport

Dear Richard,

Enclosed are copies of sketches which illustrate a system for cold storage which utilizes refrigerated trailers or refrigerated containers equipped with temporary "rolling floors" to accommodate air-cargo pallets.

The advantages of this system include:

* High product quality, minimal break in the cold chain
* Containers are availabe on relatively short notice
* Very low investment, rent the containers with refrigeration only during months required, rolling floor is a minor cost
* Flexibility, greater or lesser number of containers as demand changes
* No disruption to existing non-refrigerated air-cargo
* Containers can be used for hauling and/or storage

Please call me if you have any questions.

Thank you.

Sincerely,

David W. Cayton

DWC/cjc

Enclosures

14166 RESERVATION RD. SALINAS, CA 93908

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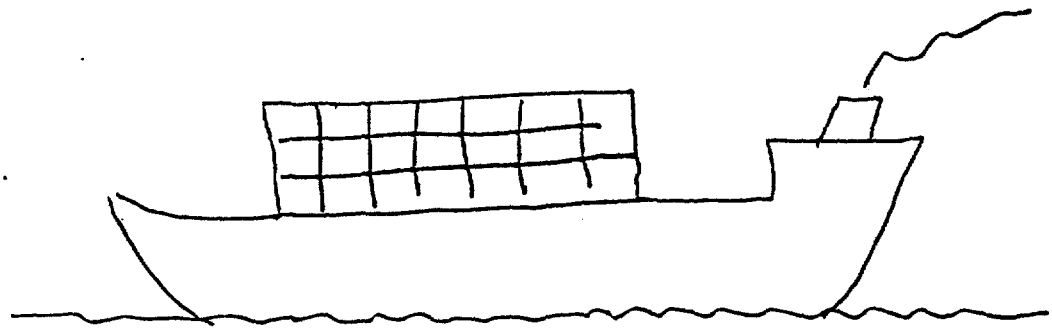

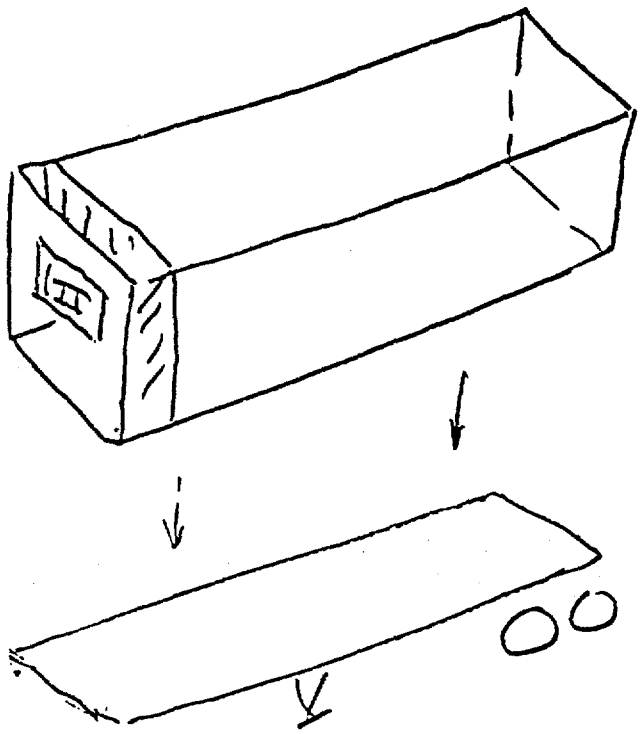

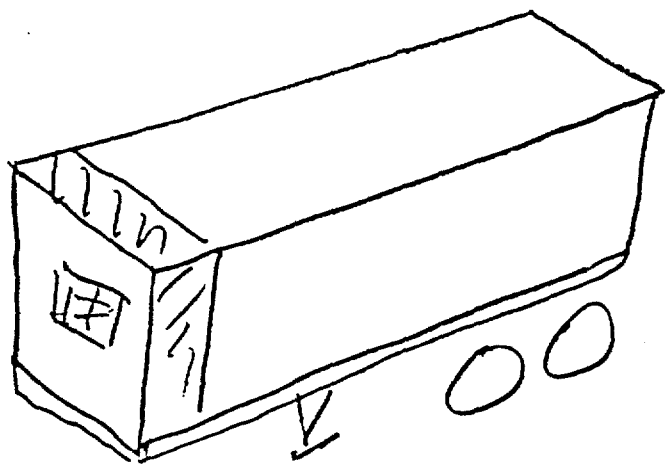

REFRIGERATED CONTAINER

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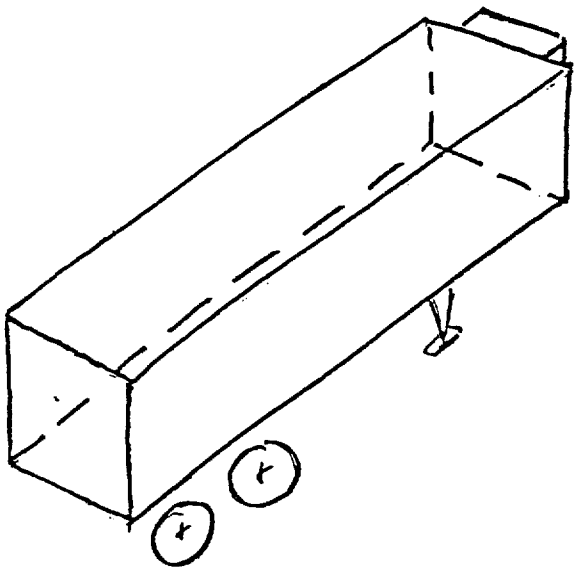

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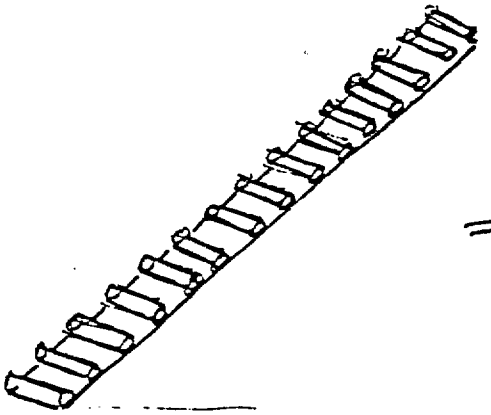

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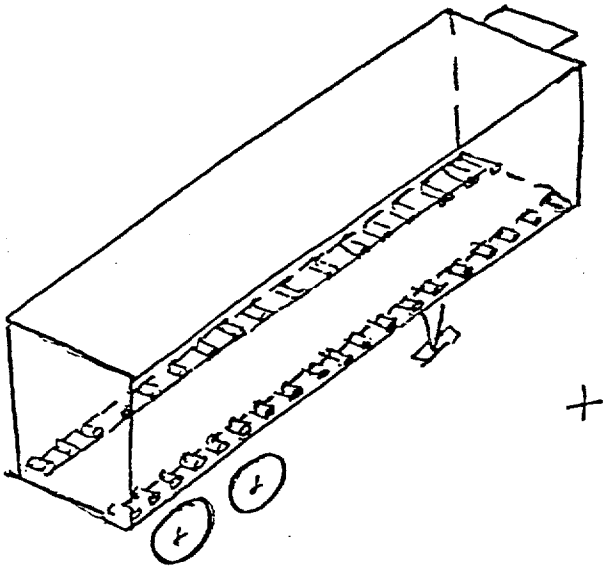

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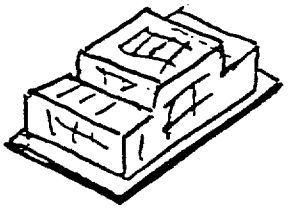

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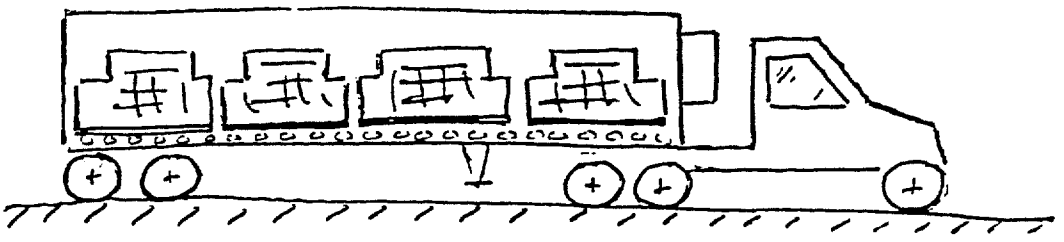

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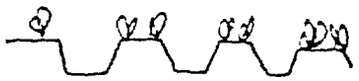
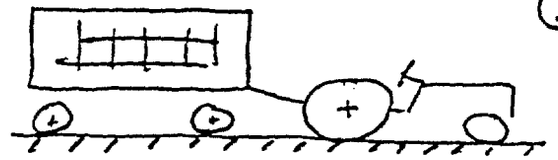


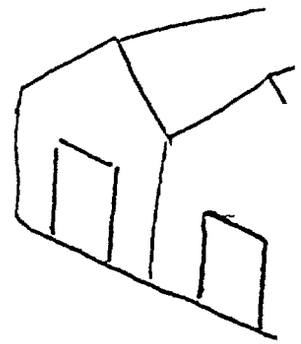
FIELD

2.



FIELD TRANSPORT

3.



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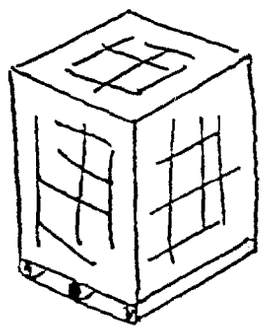
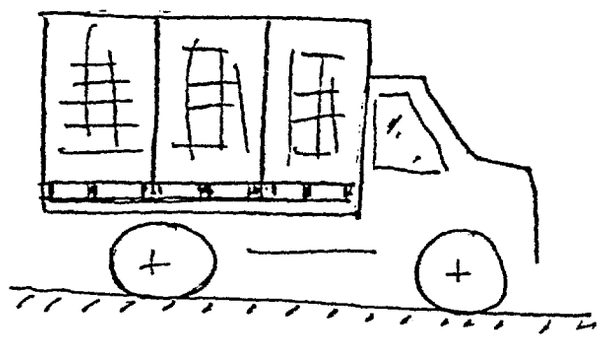


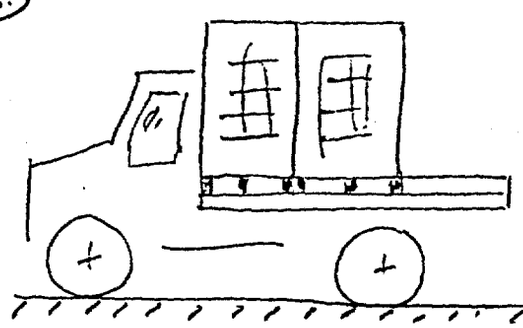
EUROPALLETIZED

5.



FARM TRANSPORT

6.



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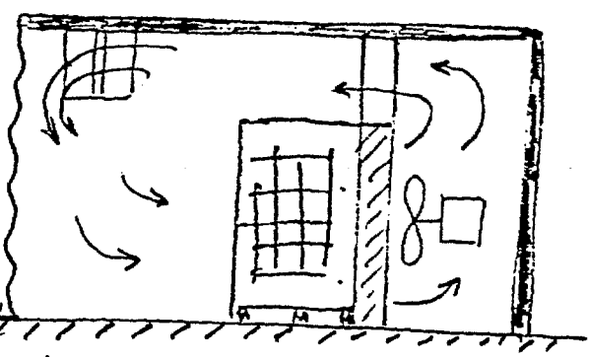
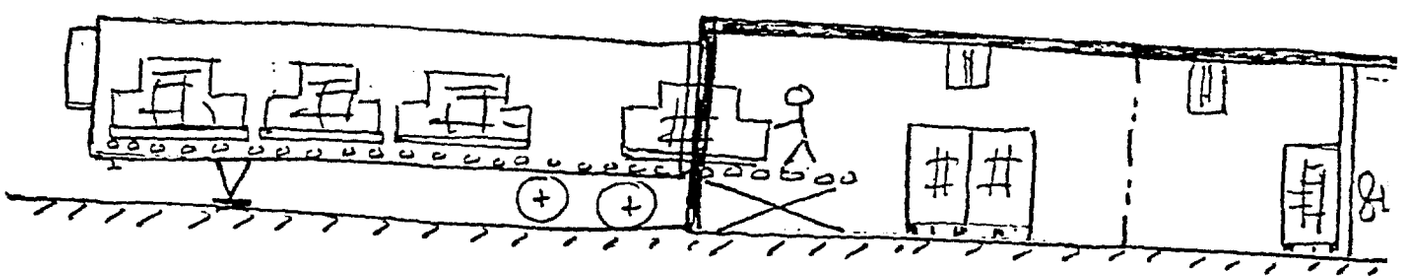


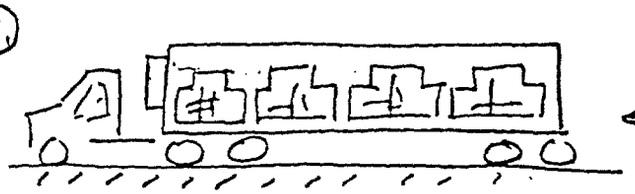
UNLOAD / PRE-COOL

8.



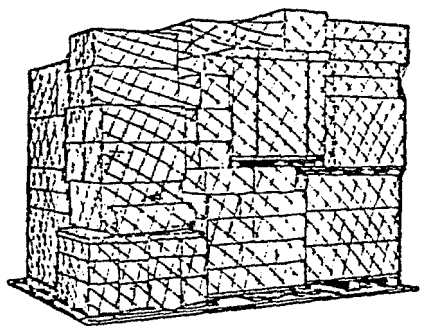
AIR-CARGO PALLETIZE / LOAD TO REFRIGERATED TRAILER

9.



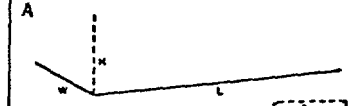
← AIRPORT.

125 x 88-inch maindeck pallet



aircraft	compart-ment	kgs.	lbs.
B747	Fwdhold	–	–
B 747	Afthold	–	–
B747D	maindeck	6,033	13,300
DC10	Fwdhold	–	–
DC10	Afthold	–	–
A310	Fwdhold	–	–
A310	Afthold	–	–
737 2k2c	maindeck	–	–
tare weight (net incl.)		120	264
max. gross weight		6,033	13,300

A



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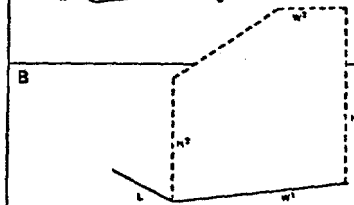


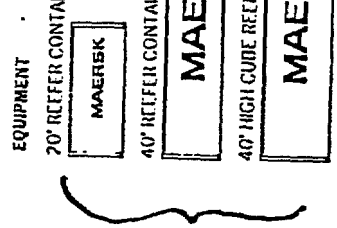
centimeters	inches
A 88 318 Lx224 Wx224 H	125 Lx88 Wx88 H
A 96 318 Lx224 Wx244 H	125 Lx88 Wx96 H
A 118 318 Lx224 Wx300 H	125 Lx88 Wx118 H

IATA Code	PAG		
IATA Classification Technical Rating	A 88 2 AA	A 96 2 A	A 118 2 C
USA Rating	M 1		
Usable Volume	A 88 A 96 A 118	13.3 cu.m. 16 cu.m. 19.6 cu.m.	468 cu.ft. 564 cu.ft. 694 cu.ft.
Pivot Weight	see page 28		

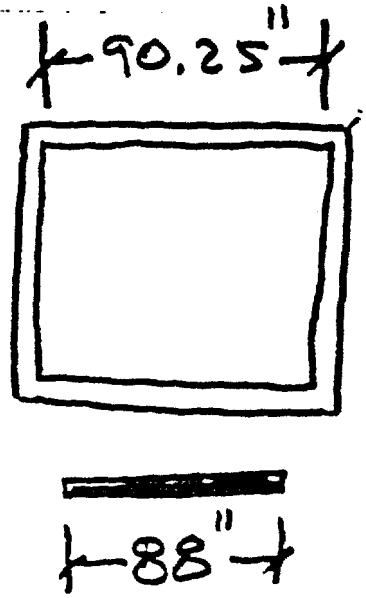
12

CONTAINER DETAILS

EQUIPMENT	INTERIOR DIMENSIONS	DOOR OPENING	TOP OPENING	TARE WEIGHT	CUBIC CAPACITY	PAYLOAD
20' REEFER CONTAINER	L: 17'9 1/2" W: 7'5 1/4" H: 7'4 1/4"	W: 7'6" H: 7'2"		6,482 lbs. 2,940 kg.	971 cu.ft. 27.5 cbm.	53,043 lbs. 24,060 kg.
40' REEFER CONTAINER	L: 36'9" W: 7'4" H: 7'2"	W: 7'3" H: 6'11 1/2"		10,670 lbs. 4,840 kg.	1,939 cu.ft. 54.9 cbm.	56,326 lbs. 25,640 kg.
40' HIGH CUBE REEFER CONTAINER	L: 38'1 3/4" W: 7'6 1/4" H: 8'2 3/4"	W: 7'6" H: 8'3 3/4"		9,766 lbs. 4,430 kg.	2,363 cu.ft. 66.9 cbm.	61,883 lbs. 28,070 kg.



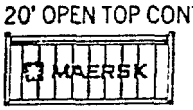
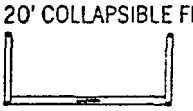
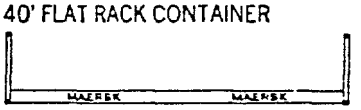
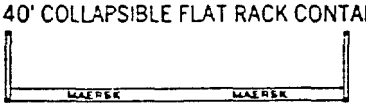
D.16.



90.25
- 88.00
2.25" CLEARANCE

12 DEC. 9:

CONTAINER DETAILS

EQUIPMENT	INTERIOR DIMENSIONS	DOOR OPENING	TOP OPENING	TARE WEIGHT	CUBIC CAPACIT
20' DRY FREIGHT CONTAINER 	L: 19'5" W: 7'8" H: 7'9 1/2"	W: 7'6" H: 7'5 1/2"		4,189 lbs. 1,900 kg.	1,165 cu. 33.0 cbr
40' DRY FREIGHT CONTAINER 	L: 39'6 1/4" W: 7'7" H: 7'9 1/2"	W: 7'6" H: 7'5 1/2"		6,799 lbs. 3,084 kg.	2,377 cu. 67.3 cbr
40' HIGH CUBE DRY CONTAINER 	L: 39'6 1/2" W: 7'8 1/4" H: 8'9 1/2"	W: 7'8" H: 8'5 3/4"		6,393 lbs. 2,900 kg.	2,684 cu. 76.0 cbr
45' HIGH CUBE DRY CONTAINER 	L: 44'6 1/2" W: 7'8 1/4" H: 8'10"	W: 7'8" H: 8'5 3/4"		8,598 lbs. 3,900 kg.	3,026 cu. 85.7 cbr
20' REEFER CONTAINER 	L: 17'9 1/2" W: 7'5 1/4" H. 7'4 1/4"	W: 7'6" H: 7'2"		6,482 lbs. 2,940 kg.	971 cu. 27.5 cbr
40' REEFER CONTAINER 	L: 36'9" W: 7'4" H: 7'2"	W: 7'3" H: 6'11 1/2"		10,670 lbs. 4,840 kg.	1,939 cu. 54.9 cbr
40' HIGH CUBE REEFER CONTAINER 	L: 38'1 3/4" W: 7'6 1/4" H: 8'2 3/4"	W: 7'6" H: 8'3 3/4"		9,766 lbs. 4,430 kg.	2,363 cu. 66.9 cbr
45' HIGH CUBE REEFER CONTAINER 	L: 43' W: 7'6 1/4" H: 8'2 3/4"	W: 7'6" H: 8'3 3/4"		11,464 lbs. 5,200 kg.	2,663 cu. 75.4 cbr
20' OPEN TOP CONTAINER 	L: 19'5" W: 7'8" H: 7'6"	W: 7'6" H: 7'4 1/2"	L: 17'9 1/2" W: 7'3 1/2"	4,793 lbs. 2,174 kg.	1,116 cu. 31.6 cbr
40' OPEN TOP CONTAINER 	L: 39'6" W: 7'8" H: 7'5 1/4"	W: 7'5 1/2" H: 7'5 3/4"	L: 38' W: 7'1"	9,480 lbs. 4,300 kg.	2,260 cu. 64.0 cbr
20' FLAT RACK CONTAINER 	L: 18'7" W: 8' H: 7'7 1/2"			5,578 lbs. 2,530 kg.	
20' COLLAPSIBLE FLAT RACK CONTAINER 	L: 19'6" W: 6'11 1/2" H: 7'4"			6,393 lbs. 2,900 kg.	
40' FLAT RACK CONTAINER 	L: 39'7 1/2" W: 8' H: 6'10 3/4"			12,081 lbs. 5,480 kg.	
40' COLLAPSIBLE FLAT RACK CONTAINER 	L: 39'7 1/2" W: 6'11 1/2" H: 6'8 1/4"			12,787 lbs. 5,800 kg.	
20' OPEN SIDE/OPEN TOP CONTAINER 	L: 19'5" W: 7'7 1/4" H: 7'5"	W: 7'4" H: 7'5 1/2"	L: 17'6 1/2" W: 6'11 1/4"	6,118 lbs. 2,775 kg.	1,095 cu. 31.0 cb:
40' ARTIFICIAL TWEENDECK	L: 39'7"			11,90? lb:	

O.K.

HOT AVAIL

Appendix D

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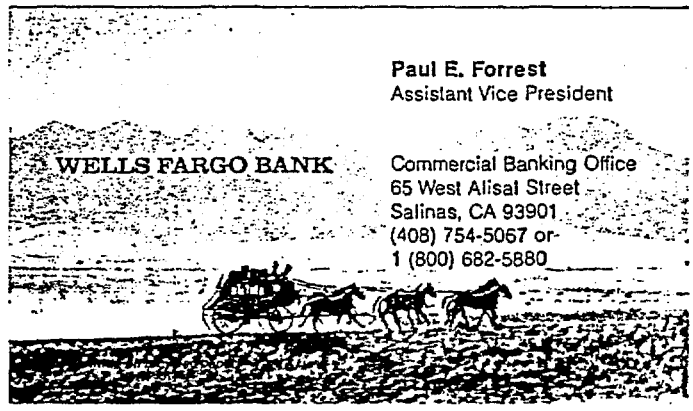

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