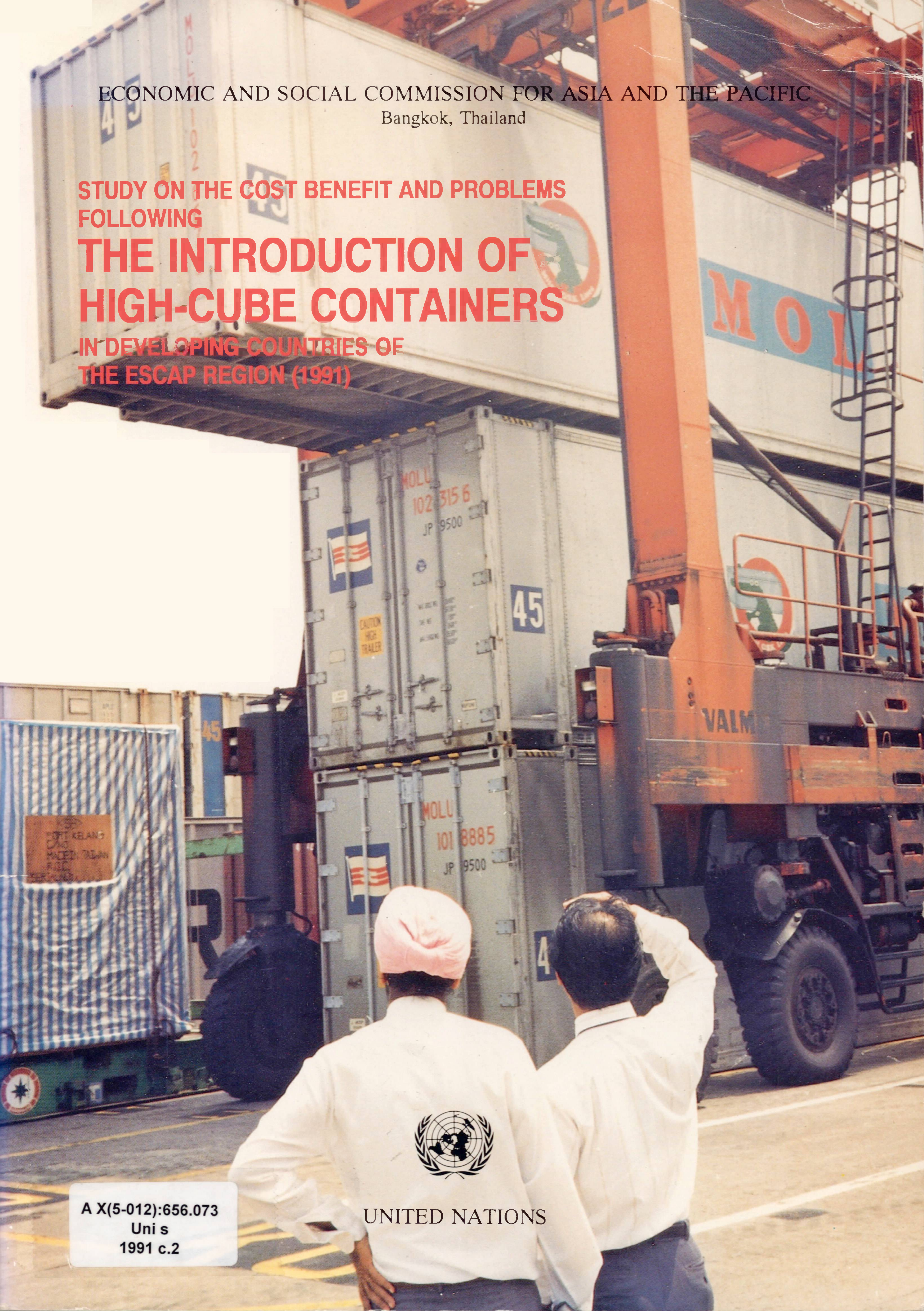
ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC
Bangkok, Thailand

STUDY ON THE COST BENEFIT AND PROBLEMS FOLLOWING THE INTRODUCTION OF HIGH-CUBE CONTAINERS IN DEVELOPING COUNTRIES OF THE ESCAP REGION (1991)



UNITED NATIONS

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

ANNEXES

I. INTRODUCTION

At the Twelfth Session of the Committee on Shipping, Transport, Communications and Tourism, concern was expressed that the introduction of non-ISO (International Organization for Standardization) standard containers might pose particular problems for the developing countries in the ESCAP region because their infrastructures are designed to handle only ISO standard containers. The ESCAP secretariat was requested to undertake a study into this matter, with the United Nations Conference on Trade and Development (UNCTAD).

The overall objective of the study was to assist developing countries of the ESCAP region in the formulation of appropriate policies for the inland movement of non-ISO standard containers. The immediate objectives were to:

(a) Estimate present and future demand for inland movement of containers, particularly those of non-ISO standards such as high cube[1] and oversize containers;

(b) Identify constraints on such movements in ports, railways, roads and inland waterway trunk routes;

(c) Recommend means of alleviating these constraints; and

(d) Provide broad estimates of the costs and benefits of implementing the recommendations.

II. METHODOLOGY

The study included both research and field studies to investigate the problems encountered in the movements of these containers between the ports and their hinterland. The ports visited included:

(a) Bangkok (Thailand);
(b) Tanjung Priok (Indonesia);
(c) Bombay (India); and
(d) Manila (the Philippines).

In addition, inland container depots in Bandung, Indonesia and New Delhi, India were visited.

III. CONTAINERIZATION AND ISO STANDARDS

In 1956, when containerization was introduced on a world scale, various sizes of containers existed. It was recognized immediately, that the issues of interchangeability, compatibility and intermodality would have to be dealt with if this system of mechanization of cargo handling and physical distribution was to develop properly. This would require ensuring that containers correspond to certain broadly accepted standards regarding:

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1 Containers having a height of 9 ft or more are called HIGH CUBE. Most of them are 9 ft 6 in high and 40 ft long. Their width is 8 ft (i.e., the same as that of ISO).

Containers 9 ft 6 in high and having a width of 8 ft 6 in and lengths of 45 ft, 48 ft and 53 ft are known in the industry as "SUPER HIGH CUBE" or "WIDE BODIED" containers.

(a) Dimensions;
(b) Ratings;
(c) Specifications;
(d) Testing;
(e) Corner fittings;
(f) Coding identification and marking; and
(g) Handling and securing.

The leading role in obtaining such standardization was assumed by ISO and by its Technical Committee 104 (TC 104).

In developing the concept of international standardization of containers, ISO took the following criteria into account:

(a) The dimensional configuration of the containers to be transported should be compatible with the cargo to be handled and its capacity should be attractive to the shipper and the carrier;

(b) The container design should be readily acceptable to the rail, ocean and road carrier groups and facilitate their ability to handle, secure and transport the unit in an efficient and economical manner;

(c) The container should be designed to conform to the safety rules and regulations of each of the transport modes to which it was exposed and yet be simple enough to accomplish its assigned purpose without imposing unnecessary cost or causing operational disadvantages;

(d) The dimensional and load limits of the standard container should permit maximum penetration of the hinterlands of the continent within which it would circulate and therefore would have to take into account the restrictive limits existing in terms of the capabilities of one or a combination of carrier modes;

(e) The container standards should provide for a series of modularly related sizes and capacities to accommodate a variety of transport and distribution operations in the movement of goods to and from the major trading nations as well as in countries with limited facilities and domestic transport possibilities;

(f) The standard container should be capable of providing a common-denominator between economically independent transport systems in different countries so as to ensure minimum disruption to established distribution patterns; and

(g) The standard container should be strong enough to support five other fully loaded containers of the same type and rating under the conditions encountered in a ship's cell structure.

The work of TC 104 led to the publication of ISO 668 standard (see table 1) which, although not ideal, took into account the requirements of rail, marine and road transport modes and the main national transport regulations that existed at the time. This standard gave guidance to planners in the development of the necessary infrastructure.

Table 1. Series I containers (ISO 668 standard)

Designation	Year introduced	Length	Width	Height	Rating
1AA	1969	40 ft	8 ft	8 ft 6 in	30,480 kg
1A	1964	40 ft	8 ft	8 ft	30,480 kg
1AX	1979	40 ft	8 ft	>8 ft	30,480 kg
1BB	1974	30 ft	8 ft	8 ft 6 in	25,400 kg
1B	1964	30 ft	8 ft	8 ft	25,400 kg
1BX	1979	30 ft	8 ft	>8 ft	25,400 kg
ICC	1974	20 ft	8 ft	8 ft 6 in	24,000 kg (from 1985)
IC	1964	20 ft	8 ft	8 ft	24,000 kg (from 1985)
ICX	1979	20 ft	8 ft	>8 ft	24,000 kg (from 1985)
ID	1964	10 ft	8 ft	8 ft	10,160 kg
IDX	1979	10 ft	8 ft	>8 ft	10,160 kg

This standard has changed little since its introduction in 1964 and has acted as a catalyst in fostering the growth of containerization and multimodal transport. The only significant changes incorporated into the standard were the introduction of 8 ft 6 in high containers and the increase of a maximum gross mass of 24 tons for 20 ft containers.

IV. DEVELOPMENT OF NON-ISO STANDARD CONTAINERS

It is imperative that the differences between ISO standard and non-ISO standard containers be clearly understood at the outset. ISO standard containers comply with ISO standards and dimensions, particularly those setting width at 8 ft (2.44 m). Non-ISO standard containers do not comply with ISO standards and dimensions. Their width often exceeds 8 ft, such as 8 ft 2½ in (2.5 m) or 8 ft 6 in (2.6 m) or are too long or too tall.

The shippers and carriers that serve the huge markets of North America, Europe and the Far East, put forward the view that the old container sizes were not responsive to their emerging needs. It was argued that ISO container sizes should not be based on the most confining design parameters presently in place in every country. They recommended that a new generation of containers be introduced that would stretch to the limit (and perhaps exceed) the physical capabilities of existing transport infrastructures. Referred to as high cube containers, they would offer more volume for the transport of low density freight. For instance, the rate of utilization of a container was measured by the load space density (i.e., ton per cubic metre). The closer the average density of the cargo to be transported is to the load space density, the better will be the rate of utilization. Recent surveys revealed that the average density of packaged general cargo is approximately 0.21 ton/m^3. Table 2 shows the load space density of various types of containers.

Table 2. Container load space density

Container Type	Load Space Density (t/m³)
20 ft x 8 ft x 8 ft 6 in	0.66
40 ft x 8 ft x 8 ft 6 in	0.41
40 ft x 8 ft x 9 ft 6 in	0.35
48 ft x 8 ft x 9 ft 6 in	0.27

The table shows the improvement in utilization rates as the size of the container increases and explains partially, why the larger containers were introduced.

Several different industrialized countries and developing countries, however, do not share this view. They are quite content to utilize the available volume in the Series 1 containers.[2]

The call for the establishment of a second series of containers was prompted by the following developments:

(a) The move away from 45 ft "piggy-back" trailers in the United States of America to the use of 45 ft and longer containers and "stack" trains for domestic cargo;

(b) Changes in the road regulations in some states of the United States of America permitting the carriage of longer containers and trailer vans;

(c) The introduction of post-Panamax vessels onto the Pacific services on which containers up to 48 ft long could be carried;

(d) The agreement (acquiescence) by India, Republic of Korea, Taiwan Province of China and other economies to allow 45 ft containers on their roads; and

(e) The move by European short sea operators to wider containers to accommodate two "Europallets" side by side.

The deregulation of road transport, together with the desire to build larger capacity containers to match the maximum carrying capacity of the landside transport operators as permitted by changes in road or other regulations, led to the introduction of high cube and super high cube containers firstly in domestic service in United States and later in the trans-Pacific and the trans-Atlantic trade. Indications are that this activity is expanding. For instance, while the census of 1978, 1980 and 1985 showed the share of 9 ft and 9 ft 6 in high containers at about 1.8 per cent of the world's container population, the 1986 census showed that their share had increased to 3.1 per cent.

Taking into account recent orders by some major operators, as well as new additions to the world's container population in general, it is expected that the next census will show an even greater proportion of high cube containers. For example, about 10 per cent of the 1988 container production in Taiwan Province of China and in the Republic of Korea was high cube containers. This amounted to about 7 per cent or 370,000 TEUs of the world's container population. At the same time, the number of 45 ft containers reached some 30,000 and some container vessels have had their cells adapted to carry them, signifying a greater, albeit reluctant, acceptance of this non-

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2 At its meeting in London in June 1989, TC 104 approved a new container height of 2.9 m (9 ft 6 in) for Series 1 length A (40 ft) and B (30 ft) containers.

ISO length. The proliferation of high cube, super high cube and wide bodied containers gives rise to the concern referred to in the introduction.

Due to the lack of data within the developing member and associate member countries of the region, it is not possible to make a meaningful estimate of the present and future demand for inland movement of containers, particularly those of a non-ISO standard such as high cube and super high cube containers. This lack of data has been brought to the attention of the concerned government organizations and agencies at various international meetings.

V. THE PROBLEMS

Containerization is a logistic system that provides door-to-door service, makes both the ship and land transport operators integral parts of the system and allows fast, regular inland and international service. In this context, the operators are required both to invest in and have daily operational responsibility for the ships and vehicles. In most cases, this represents an extensive fleet of containers and other equipment, all of which are linked to and dependent upon extensive management and technical services. For these reasons, the economic and financial impact of introducing new and bigger load units must be examined.

The problems and constraints include, *inter alia*, the following:

A. Ship operations

Due to the success of the ISO standard containers[3] container vessels were designed to carry ISO standard containers.

The proposed adoption of an additional 9 ft 6 in height limit for 40 ft and 30 ft containers would create problems with vessels, because ships built to carry 8 ft 6 in high units would suffer a reduction in the number of 9 ft 6 in high units that could be carried under deck. Thus 9 ft 6 in high containers would have to be restricted for stowage on deck.

Similarly, cell guides in cellular container vessels were designed for the carriage of ISO standard (length and width) containers. Super high cube and wide bodied containers could not be carried below deck without extensive modifications to existing ships. For this reason, 9 ft 6 in high and non-ISO standard length containers are restricted for stowage on deck. This restriction would, in some cases, constrain the types of commodities that could be carried in such containers or it might attract a higher insurance premium. The constraints on under deck stowage could be overcome when replacement vessels were ordered through, for example, the adoption of movable cell guides and hatchless vessels. Such innovations are currently being adopted on some new ships.

But noting the current size and age of the present container vessel fleet, it is likely that the constraints mentioned above will remain for some time.

B. Port operations

The principal function of ports is to provide an interface between sea and land transport. As a result, problems and constraints relating to the introduction of non-ISO standard containers therefore arise in four main areas.

3 In 1969, an additional height limit of 8 ft 6 in (2.6 m) was approved for 40 ft containers. The same addition was adopted for 20 ft units in 1976. Currently over 90 per cent of containers in international trade are 8 ft 6 in high units.

1. Quay cranes (gantry)

Quay cranes were designed to handle ISO standard containers. The principal characteristics of the most common types of these are tabulated in table 3.

Table 3. Principal characteristics of quay cranes

Principal Characteristics	Type	
	A	B
Rated capacity	30.5/35.6 tons	35.00 tons
Outreach	35.0 metres	35.00 metres
Span	16.0 metres	30.48 metres
Backreach	16.0 metres	7.50 metres
Lift above rail	25.0 metres	28.00 metres
Wheel base	18.0 metres	16.75 metres
Inside clearance	16.0 metres	15.17 metres

Since the maximum permissible gross weight of 30,480 kg has not been changed, it can be seen from table 3 that the rated capacities of the more common types of gantry crane are adequate for handling the larger load units. Inside clearance is also sufficient to handle 45-ft containers but this is done, to some extent, at the expense of the built-in safety margin. It might be unsafe or even impossible for a number of present day cranes to handle containers in excess of 48 ft.

This problem may be overcome by installing a rotating spreader. Such a solution, however, would require additional investment, maintenance costs and technical skills. The weight of the turntable also reduces the lifting capacity of the crane under the spreader.

High cube containers could create a clearance problem between the height of the containers stowed on deck and that of the crane boom in the lowered position. For example, if all the containers stowed on deck are 9 ft 6 in high, the clearance between the top of the stow and that of the crane boom when lowered may be reduced to such an extent that the crane cannot operate. In at least one port in the United States of America, the height of the crane boom had to be raised at great expense by cutting all four crane legs and inserting an additional section in each of them.

Moreover, the handling of over-length containers could create a productivity problem. It is possible to handle a 45-ft container with a 40-ft spreader because the corner castings of the 45-ft container, are also fitted at the 40-ft positions. However, the use of corner flippers to position the spreader is impossible. This make the positioning of the spreader more difficult and loss of productivity could result. As long as the over-length containers are placed on deck only, the distance between the crane driver and the container allows a good view and it may not create too much of an operational problem. But if such containers are stowed in the cells, the positioning of the spreader would become more difficult. This problem may be overcome by adjusting the flippers so that they no longer fit around the corner but rather along the side of the container.

It would be useful to bear these operational problems in mind when considering replacement of equipment.

2. Straddle carriers

Some makes of straddle carriers do not allow the stacking of over-height containers (9 ft or 9 ft 6 in) to the same stacking height (three high) of 8 ft 6 in containers, because the distance from the ground to the spreader, at its highest elevation, was designed for use with ISO standard containers. The newer versions of straddle carriers are capable of stacking over-height containers to three high. This fact should be borne in mind when considering replacement of equipment.

3. Transfer cranes (transtainers) and the trailer system

These are generally framed by a bridge-type beam and fitted with properly spanned travelling legs. They are also fitted with wheels or tyres for running on rails or pavement. They generally have a rated lifting capacity of 30.5 tons and are capable of high density stacking in the container yard. Most rail mounted transfer cranes are of special designs which aim at meeting the operational requirements of individual terminals.

As far as crane operations are concerned, little problem is envisaged. This handling system, however, requires tractor-trailer sets for linkage between the marshalling yard and the shipside. In this respect, the handling of containers longer than the present maximum ISO standard of 40-ft could create serious problem, particularly if the trailer is fitted with corner guides at all four corners at the 40-ft positions.

The use of flat bed trailers with no corner guides may be a solution. Flat bed trailers may also be used to handle over-width containers. This solution, however, would result in reduced productivity because positioning would be more difficult. Operational safety would also be reduced because the container would no longer be properly secured.

Special trailers or modified existing trailers are necessary for handling such containers. Some simple and inexpensive modifications may be made to existing trailers to enable them to handle over-size containers and a number of terminals within the region are effecting these modifications in-house.

4. Yard storage

Container yard layouts, both in sea terminals and inland depots, are designed for the modular sizes of ISO standard containers. Such arrangement facilitates the use of automated systems for yard management since the two area dimensions (X and Y) allow the introduction of a modular grid system. The introduction of over-length and over-width containers departs from this system and requires another more flexible and more complicated system of yard addresses. This creates yard planning and ship operation problems. In a number of terminals, these containers are stacked in separate areas.

C. Road transport

The introduction of non-ISO containers affects road transport in two main areas.

1. Legislative problems

The length and width of road vehicles are governed by road legislation or regulations. These may have to be amended before over-length and over-width containers can be brought onto the national road network. In some countries this may be accomplished relatively easily, but in others this may be a very long and laborious process.

2. Physical problems

The length and width of vehicles are also constrained by the physical width of the roads and the width of the lanes as well as the curvature of the national road network. In addition, low bridges, underpasses, viaducts and low overhead wires may also restrict the height of vehicles. Another danger of over-width containers is that motorists may be unaware of the extra width of the load unit, particularly during hours of darkness.

Physical alteration of the national road network may be necessary before non-ISO standard containers can be accommodated. Alternatively, the movement of such containers may be restricted to suitable roads that are used less than others. Movement could also be restricted to when traffic is lightest.

It should also be noted that when over-length containers are transported, it may be impossible to use the twist locks, certainly not at the rear end of conventional trailers. Containers may also surpass the trailer deck by several feet. Thus, securing the container to the trailer in an adequate and appropriate manner is no longer possible and drivers may have to resort to the use of ropes and chains as in the past. This practice, which was quite common in many developing countries at the beginning of containerization, led to many security problems and serious accidents owing to containers sliding off the trailers.

Special road-trailers are needed to carry these containers on the road safely. There are special trailers on the market which are designed to handle specific over-length containers (e.g., 45-ft). There are also telescopic trailers that can be used to handle containers between 20 and 45-ft. This latter type of trailer, however, also has major disadvantages for developing countries such as the high investment involved and the vulnerability of the trailer when used on bumpy roads.

D. Railways

Similar to road transport, the transport of non-ISO standard containers by rail is constrained by the type of wagon used. If dedicated container railcars are used (i.e., flatcars with collapsible twist locks), it is likely that container lengths of 45, 48 and 53 ft may be accommodated and properly secured.

However, the length of the flat cars themselves may create a problem. For example, if the flat car is designed to handle a 40-ft container only, the carriage of a container the length of which does not confirm to ISO standard length may overhang both ends of the car by some 2.5 ft. This means that if two subsequent cars are loaded with such containers, the clearance between them might be reduced so much that the train would be unable to negotiate sharp bends in the track.

The Malaysian railway system, for example, faces such a problem. Containers of 45-ft length can only be transported on that railway if each 45-ft container is placed between two 40-ft or a combination of two 20-ft containers.

In several railway systems, wagons of 3-TEU capacity are used. Over-length containers may be transported comfortably on such cars but not in combination with a standard 20-ft container thus resulting in a reduction of railway carrying capacity.

The height of high cube containers may represent the most serious problem for the transport of such containers by rail. The transport of 9 ft or 9 ft 6 in high containers is impossible in many countries because the wagon/container combination is too high to pass under bridges or through tunnels.

A number of solutions are available for resolving this problem of insufficient clearance, including:

(a) Lowering the flat cars by some 30 cm by using newly developed, high-performance, small diameter wheeled freight bogies where it is technically feasible to do so;

(b) Lowering the rail track under bridges, viaducts or tunnels; and

(c) Jacking up bridges or viaducts or cutting out the ceiling of tunnels.

All these solutions require substantial investment.

The view has been also expressed that containers higher than 9 ft 6 in might create stability problems when transported by train and that containers higher than 9 ft 6 in should be prohibited.

E. Barges

The problem with transport non-ISO containers by barge is relatively small. But, similar to the ships, most of these barges, though not of cellular type such as those self-propelled and push container barges used in Europe and elsewhere, were designed with hold dimensions determined on the basis of the modular size of ISO standard containers.

Therefore, if containers with lengths other than 20 or 40 ft are carried, loss of space results unless the sizes are such that modular blocks could again be created. For example, four containers of 45 ft are as long as nine containers of 20 ft or three containers of 40 ft plus three containers of 20 ft. However, such exact combinations seldom occur. In addition, the positions of foot-lashing for the containers on both sides of the barge above the hatch coamings, may also be inadequate. This needs to be resolved.

If the barge is of the pontoon type, it may not be able to carry oversize containers in the bottom tier because the positioning of corner hooks, container rests and/or fixed or detachable twist locks are fitted along ISO standard modular parameters. Oversize containers may be stowed on the second tier but some loss of space may occur as well as problems with lashing as mentioned above.

The stacking height of high cubes on a barge may obstruct visibility from the wheelhouse of self-propelled barges. This may require the loading of a lesser number of boxes than the carrying capacity of the barge would allow. Additionally, the excess air draught may prevent the barge from passing under low bridges.

Overly wide containers may also create a problem. For instance, on the inland waterways of Germany the overall breadth of a barge is restricted to 10 m because of the size of the locks. Therefore, such barges would not be able to accommodate four rows of containers if their width exceeded 8 ft (2.438 m). In such a case, the barge could cease to be economical. A similar situation may occur elsewhere as well.

VI. COST BENEFIT ANALYSIS OF USING NON-ISO CONTAINERS

As stated in chapter four, the introduction of non-ISO standard containers was prompted by the requirements of the users, in this case the shippers of volume goods. This argument is evaluated in the following paragraphs.

The advantages of using non-ISO standard containers may include, *inter alia*, the following:

(a) The number of boxes to be handled is reduced;

(b) Under certain tariff conditions, the port handling charges per unit of product may be reduced;

(c) The number of container movements within the port area may be reduced, thus leading to energy savings and reduced pollution;

(d) Road congestions in the vicinity of the port may be reduced;

(e) The use of non-ISO standard (40-ft and/or oversize high cube boxes) in place of ISO standard 20 ft and/or 40 ft containers will reduce documentation and administration costs; and

(f) The transport of "volume goods" by high cube and super high cube containers may lead to a reduction in the total transport costs and therefore a lower market price.

Information relating to the costs and benefits of using non-ISO standard containers was collected in the course of this study and is presented here in the form of case studies.

A. Case 1: Trans-Pacific

A major shipping line sailing between Asia and the United States provided confidential data. The data related to freight charges for containers filled with plastic products from Hong Kong being shipped to the West and East coasts of the United States.

The freight costs included:

(a) Ocean freight from Hong Kong to the United States based on the commodity box rate;

(b) Bunker surcharges;

(c) Destination delivery charges; and

(d) Stuffing charges at Hong Kong.

Charges were quoted for a 20 ft, a 40 ft and a 45 ft container, but did not distinguish between a standard (8 ft 6 in high) and a high cube (9 ft 6 in high) 40 ft container. Therefore, an assumption was made that the rates related to a standard (8 ft 6 in high) 40 ft container.

On the basis of the internal volumes of the three types of containers and assuming that all containers can be filled completely but do not exceed the maximum payload, the data received were analyzed and expressed in relative currency units in the following tables:

Table 4. Hong Kong to West coast of the United States of America

Container Length	Container Height	Relative Freight Charge per cubic metre
20 ft	8 ft 6 in	100
40 ft	8 ft 6 in	71
45 ft	9 ft 6 in	64

Table 5. Hong Kong to East coast of the United States of America

Container Length	Container Height	Relative Freight Charge per m^3 Product
20 ft	8 ft 6 in	100
40 ft	8 ft 6 in	72
45 ft	9 ft 6 in	64

The tables show, that on the basis of these data, shipping costs are reduced about 10 per cent if shippers use 45 ft high cubes instead of 40 ft standard height containers. Shipping costs are reduced about 35 per cent if they use 45 ft high cubes instead of the standard height 20 ft containers.

Moreover, the freight charges mentioned above do not include documentation and handling charges. If these are included, even lower costs per m^3 of product may be achieved.

B. Case 2: Trans-Atlantic

Another major shipping line, also active in transporting, containers between Asia and the United States provided the following information which it published in a commercial brochure. Although the brochure gives an example of figures for the trans-Atlantic westbound trade, a spokesman for the company said that the same principles could be applied to the Pacific trade.

Table 6. Trans-Atlantic

	20 ft standard	40 ft standard	45 ft high cube
Average stowage in m^3	27	54	68
Number of containers required	149	74	59
Freight rate all-in from container yard to container yard	2,070	3,120	3,605
Inland transportation charges	450	500	500
Documentation/handling charges	200	200	200
Total freight costs	308,430	230,880	212,695
Total inland transportation costs	67,050	37,000	29,500
Total documentation/ handling costs	29,800	14,800	11,800
Total costs for 4,000 m^3 of product	405,280	282,680	253,995
TOTAL COSTS PER M^3 OF PRODUCT	101.32	70.67	63.50

The figures are based on statistical data and give an example of a shipper who ships 4,000 m^3 of furniture on a yearly basis. They compare the rates when using 20 ft or 40 ft standard height containers or 45 ft high cube containers for this traffic.

The last line of the table indicates, that in this example the shipper reduces shipping costs by about 35 per cent when using 45 ft high cube containers instead of standard height 20 ft boxes, and about 10 per cent when using 45 ft high cubes instead of the standard height 40 ft boxes.

This is similar to the conclusion of the earlier case study on the Hong Kong-United States route.

C. Case 3: Inland transport

The Port of Seattle provided interesting data regarding inland transport rates for containers being shipped from the Port of Seattle to various inland destinations in the United States by train as well as by road.

To protect business interests, the rates were made relative by giving the lowest rate on container-on-flatcar (COFC 20 ft) a value of 100 and calculating the other rates relative to that.

The processed information is as follows:

1. Rail rates

Table 7. Rail rates

From Seattle to:	20 ft COFC	40/45 ft COFC	20/40/45 ft TOFC
Denver, CO	100	105	126
Chicago, IL	100	119	191
Detroit, IL	100	121	179
Minneapolis, MN	100	105	144
Kansas City, KS	100	126	146
Memphis, TN	100	126	148
Dallas, TX	100	120	144
Kearney, NJ	100	106	136
Atlanta, GA	100	112	144

Note:

- Container-on-flatcar (COFC): This refers to an ocean container loaded flush on a railroad flatcar.
- Trailer-on-flatcar (TOFC): This refers to railroad-owned trailers or ocean containers mounted on chassis which are then loaded on railroad flatcars. Simply described, this equipment moves with highway wheels attached.
- All rates are inclusive of truck drayage from the marine terminal to the rail ramp in Seattle and final delivery to the rail ramp in the city of destination.

2. Truck rates

Rates for truck services are normally quoted on a milage basis (i.e., a number of dollars per mile multiplied by the distance in miles). It is uncommon to move containers by truck from the West Coast to any of the destinations listed in table 7. When this does occur, the container is usually loaded onto a flatbed truck trailer. It is more common to tranship the freight into a truck trailer (48 ft or 53 ft) or to move the container by rail.

Therefore, on a cubic meter basis, 45-ft COFC containers are normally the lowest priced option. Truck trailers are more expensive but the service - particularly to the East Coast - is generally three to five days faster.

Using super high cube containers is advantageous for shippers as well as making the goods more competitive. The advantages provide a margin within which fees and charges may be raised to recover the additional investments necessary for accommodating these containers.

VII. CONCLUSIONS

It can be concluded that:

(a) The introduction of non-ISO standard containers was brought about by users' requirements;

(b) Definitive and quantifiable advantages are accruable to the shippers and to some extent, the competiveness of the goods. The advantages create a margin within which fees and charges may be raised to recover additional investments that would have to be made in order to accommodate non-ISO containers;

(c) The size and age of the present container vessel fleet, together with the current size of the ISO standard container population, indicate that non-ISO containers will continue to be carried on deck in the near future. Therefore the number of such containers arriving in ports will increase gradually and will not reach an unmanageable level in the next few years;

(d) Nevertheless, appropriate planning actions would have to be taken now in order to be prepared for the eventual increase in traffic. This may include legislative and procedural amendments as well as promoting awareness of the eventual increase among all concerned, such as national road planning and traffic management agencies and railway authorities; and

(e) Some investment in modifying existing equipment and infrastructure is also envisaged. It would be appropriate to review equipment replacement and amortization policies at this time in order that expenditures may be phased in gradually. In this respect, the types of replacement equipment to be acquired and the annual charges must be carefully assessed.

VIII. POLICY OPTIONS

On the basis of this study and the information received from various quarters, including the results of the field studies and comments from the United Nations Conference on Trade and Development (UNCTAD) the following policy options are presented.

A. The zero option

This is not a laissez-faire approach but rather represents a decision to prohibit the entry of high cube, super high cube and wide bodied containers into a country at all.

Such a decision requires careful consideration of all the factors involved because the country concerned may be depriving itself of the advantages mentioned in this study.

B. Modified multimodal transport option

Basically, this policy means a downgrading of the multimodal transport concept. This option means that high cube, super high cube and/or wide bodied containers will be stripped and stuffed within the port area, because it would be physically impossible or economically unviable to transport them to and from the hinterland.

This maybe a viable option when the traffic in high cube, super high cube and/or wide bodied containers is light. However, such an option eliminates the advantages of the door-to-door concept and may lead to an increase in transport costs for a percentage of import and export cargo.

The extra costs are illustrated in figure 1. The slope of the graph will vary from port to port and from country to country depending on local conditions, such as labour costs and the length of the route.

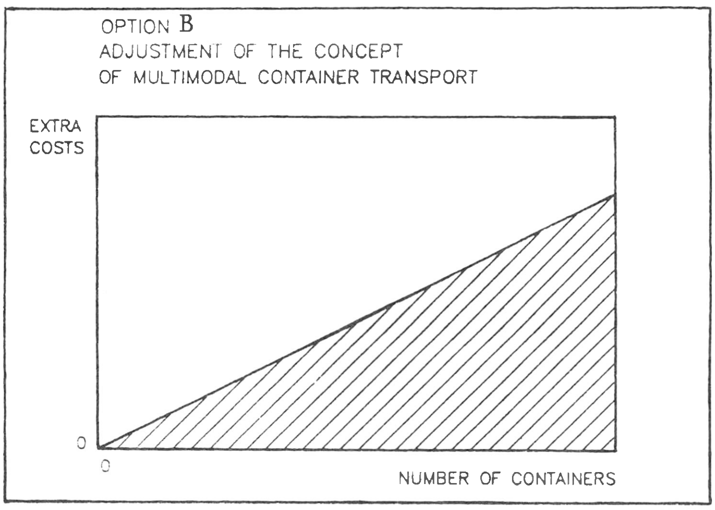

Figure 1.

C. Changing routes and/or modes of transport option

This option aims at avoiding the major problems caused by the acceptance of high cube and/or super high cube containers by changing the routes or the mode(s) of transport. It assumes the condition that, if a road connection cannot be used, then a barge or a railway may provide the solution.

This option may also lead to an increase in transport costs in respect of each container. Figure 2 illustrate the situation.

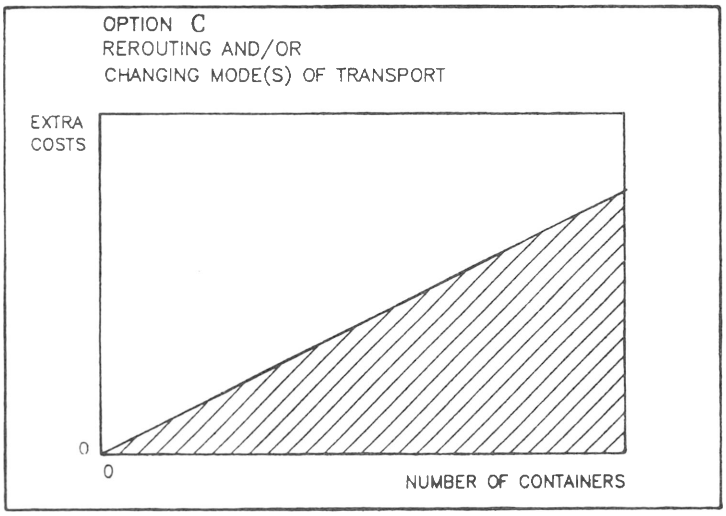

Figure 2.

In principle, this is the same type of graph as in option B above. The slope of the graph will also vary from port to port or from country to country according to local conditions.

D. <u>Modify or purchase appropriate equipment option</u>

In some cases it might be possible to modify equipment already in use to meet the requirements of the dimensions of high cube, super high cube and/or wide bodied containers. However, because almost all the ports in the ESCAP region are experiencing an increase in container throughput, it is likely that many ports will have to purchase additional equipment in the near future. This option, basically, recommends that the specifications of new equipment and the annual replacement charges be reviewed so that the appropriate equipment may be phased in gradually according to the circumstances.

It is likely that such equipment will be more expensive in terms of investment and use. In this respect, suitable adjustments in fees and charges may have to be considered. The cost implications are illustrated Figure 3.

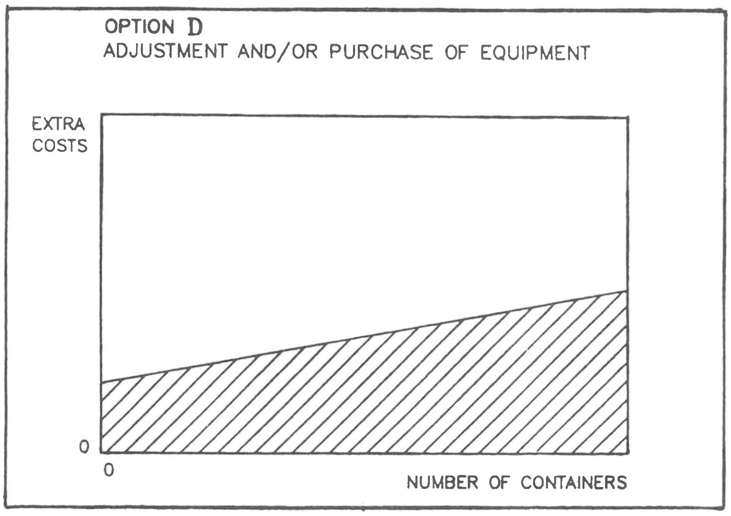

Figure 3.

E. <u>Modification to the infrastructure option</u>

The major characteristic of this option is the high cost involved. However, various field visits revealed that these costs may differ from one country to another, depending on local conditions.

Adjustment of the infrastructure will lead to additional investments which will lead to extra costs as indicated in Figure 4. This effect may be minimized, to some extent, if all concerned are made aware of the problem at an early date and, where possible, appropriate adjustments to infrastructure planning are made (e.g., when building replacement bridges or under-passes due to increase in normal vehicular traffic).

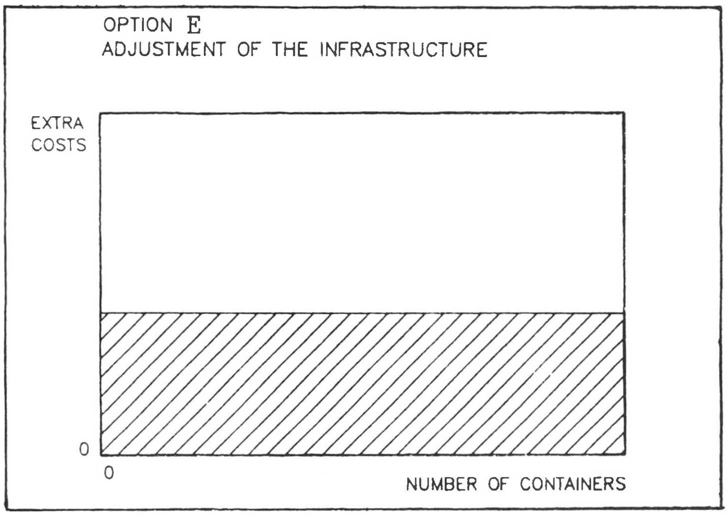

Figure 4.

Figure 5 shows all options combined in one single figure representing the general conditions of a model port and hinterland situation. Options B and C are interchangeable. Depending on the local circumstances, option B or option C is relevant. The figure illustrates that the option to be chosen depends largely on the present and future level of traffic in high cube, super high cube and/or wide bodied containers.

If the throughput of these types or combinations of containers is high, it is likely that the policy to be followed is either to adapt the infrastructure or the equipment, whereby a certain combination of these two options might be the most feasible solution. If throughput is, and will remain, limited to small numbers, the best policy will be to re-route, change the mode of transport, stuff and strip the containers inside the port area, or even prohibit these containers from entering the country at all.

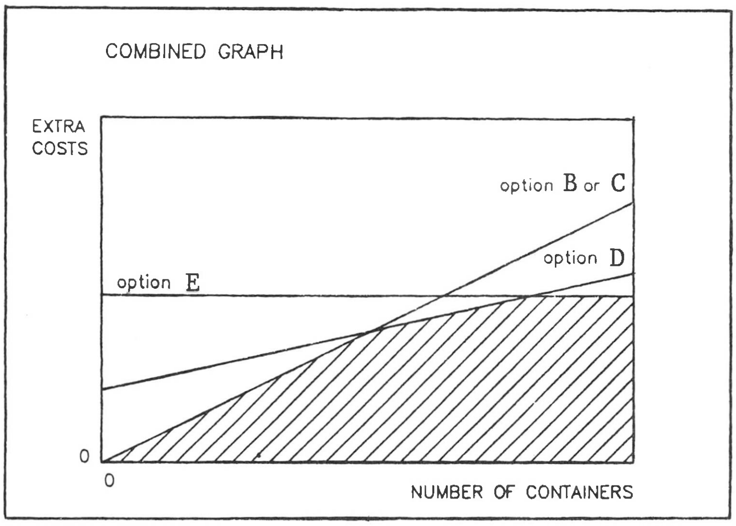

Figure 5.

IX. THE COMPUTER MODEL

To assist developing member countries of the ESCAP region in the decision-making process, with regard to the choice of policy options and in investment choices for the inland transport of high cube and/or super high cube containers, a computer Model was made for use with IBM-compatible personal computers.

For ease of operation, the model was set up in a spreadsheet format and with help menus so personnel with little or no training in computers can run the programme. All relevant parameters can be entered into and tested by the model.

On the basis of the data inputs, the model calculates:

(a) The charge margin when a high cube container is used;

(b) Comparison of the cost of conventional and container transport for inland movement;

(c) Cost benefit analysis of investments in equipment;

(d) Cost benefit analysis of investment in railway infrastructure; and

(e) The break even point (i.e., the number of high cube and/or super high cube containers that must be transported annually to make the investment viable).

The basic data for the calculation is the PRESENT CHARGE for the inland transport of a 40 ft long and 8 ft 6 in high container by any of the three modes, namely: road, rail or inland waterway (if applicable) on a specific route in a given country. Additional costs arising from any investment necessary to accommodate non-ISO standard containers are then calculated and compared with the basic data.

The starting point of the computer model is that a shipper or consignee can transport more (volume) cargo by each single move, such as:

(a) 13 per cent more in the case of a 40 ft high cube (9 ft 6 in); and

(b) 28 per cent more in the case of a 45 ft high cube (9 ft 6 in) container,

when compared with an ISO standard 40 ft long and 8 ft 6 in high container. These percentages are based on the average cubic capacity of each of the three types of container. That is to say, when the shipper/consignee chooses to use a 40 ft or a 45 ft high cube container, the transport charges per container could be readjusted upwards by 13 per cent or 28 per cent, respectively (i.e., the charge margin), notwithstanding the other advantages the shipper/consignee may accrue, such as:

(a) Fewer containers to be transported;
(b) Lower documentation costs;
(c) Lower port handling costs; and
(d) Lower administrative costs.

On the basis of this **charge margin**, the model compares the differences between transporting cargo in 40 ft and/or 45 ft high cube containers and transporting the same cargo by conventional means to and from the port, where it is then stuffed into or unstuffed from such a container (including certain expenses for handling and storage of the cargo in the shed or warehouse).

Next, the model calculates the financial consequences of investments in equipment and/or infrastructure and compares these with the margin. It calculates the consequences of the investments as follows:

A. <u>Equipment</u>

#1	-	Investment in one piece of standard equipment
#2	-	Investment in one piece of super high cube equipment
#3	-	Difference in costs between the two investments (#2-#1)
#4	-	Expected economic life span of the equipment
#5	-	Expected interest rate of the investment
#6	-	Amortisation factor
#7	-	Costs of the investment per year (#3*#6)
#8	-	Number of operating days of the respective service (company) per year
#9	-	Average duration of a round trip of the equipment (days)
#10	-	Utilization factor
#11	-	Number of runs per year (#8/#9)/#10
#12	-	Extra costs per run (#7/#11)
#13	-	Comparison of the additional costs with the charge margin

If #12 is less than the margin, the investment is feasible and it is left to the transport operator to decide to what level the charges are to be adjusted in order to recover the additional investment.

B. Infrastructure

@1	-	Costs of the investment
@2	-	Expected lifetime of the investment
@3	-	Interest rate
@4	-	Amortisation factor
@5	-	Annual charge of Investment (@4*@1)
@6	-	Number of return trips of high cube containers to reach the break-even point of the investment (including the investment in super high cube containers).

This computer model has been validated at two country-level seminars held at Kuala Lumpur and at Seoul in June 1991. A separate manual, which describes the computer model in detail, has been prepared to facilitate a better understanding of the model. It also provides step-by-step direction for running the model.

A sample printout of one of the test runs of the model made during the seminar held at Seoul is attached. It should be noted that, although the data are those put forward by the seminar, participants, they do not necessarily represent an actual situation but serve only as an example.

COBEMODEL
VERSION 2 910701

****

ESCAP CONTAINER STUDY
COST/BENEFIT ANALYSIS POLICY OPTIONS

****

		INPUT	AUTOMATIC
	COUNTRY:	REPUBLIC OF KOREA	
	ROUTE:	PUSAN-SEOUL-PUSAN	

****

		INPUT	AUTOMATIC
	BASIC CHARGES (ROUNDTRIP) FOR 40 FT STANDARD HEIGHT CONTAINER (8'6")		
A1	ROAD	545	
A2	RAIL	545	
A3	BARGE	NA	
	CUBIC VOLUMES (M3):		
A4	40 FT STANDARD HEIGHT		67
A5	40 FT HIGH CUBE		76
A6	45 FT HIGH CUBE		86
	SPACE FACTORS		
B1	40 FT HIGH CUBE ((A5-A4)/A4)		13.4%
B2	45 FT HIGH CUBE ((A6-A4)/A4)		28.4%

****

CHARGE MARGIN PER HIGH CUBE CONTAINER

****

C1	ROAD 40 FT HIGH CUBE (A1*B1)	73.21
C2	ROAD 45 FT HIGH CUBE (A1*B2)	154.55
C3	RAIL 40 FT HIGH CUBE (A2*B1)	73.21
C4	RAIL 45 FT HIGH CUBE (A2*B2)	154.55
C5	BARGE 40 FT HIGH CUBE (A3*B1)	NA
C6	BARGE 45 FT HIGH CUBE (A3*B2)	NA

****

COMPARISON OF CONVENTIONAL WAY OF TRANSPORT INCLUDING STUFFING, STORAGE AND HANDLING WITH INLAND MOVEMENT OF CONTAINERS

****

AVERAGE LOAD (TONS) OF:

D1	40 FT HIGH CUBE	11
D2	45 FT HIGH CUBE	14

ROAD:

E1	MAXIMUM VOLUME PER TRANSPORT UNIT (M3)	25
E2	MAXIMUM TONNAGE PER TRANSPORT UNIT (TONS)	12

RAIL:

E3	MAXIMUM VOLUME PER TRANSPORT UNIT (M3)	100
E4	MAXIMUM TONNAGE PER TRANSPORT UNIT (TONS)	80

BARGE:

E5	MAXIMUM VOLUME PER TRANSPORT UNIT (M3)	NA
E6	MAXIMUM TONNAGE PER TRANSPORT UNIT (TONS)	NA

NUMBER OF TRANSPORT UNITS REQUIRED:

ROAD:

IN TERMS OF VOLUME

E7	40 FT HIGH CUBE (A5/E1)	3.04
E8	45 FT HIGH CUBE (A6/E1)	3.44

IN TERMS OF TONNAGE

E9	40 FT HIGH CUBE (D1/E2)	0.92
E10	45 FT HIGH CUBE (D2/E2)	1.17

REQUIRED NUMBER OF TRANSPORT UNITS

E11	40 FT HIGH CUBE (MAXIMUM OF E7 AND E9)	4.00
E12	45 FT HIGH CUBE (MAXIMUM OF E8 AND E10)	4.00

RAIL:

IN TERMS OF VOLUME

E13	40 FT HIGH CUBE (A5/E3)	0.76
E14	45 FT HIGH CUBE (A6/E3)	0.86

IN TERMS OF TONNAGE

E15	40 FT HIGH CUBE (D1/E4)	0.14
E16	45 FT HIGH CUBE (D2/E4)	0.18

REQUIRED NUMBER OF TRANSPORT UNITS

E17	40 FT HIGH CUBE (MAXIMUM OF E13 AND E15)	1.00
E18	45 FT HIGH CUBE (MAXIMUM OF E14 AND E16)	1.00

BARGE:

IN TERMS OF VOLUME

E19	40 FT HIGH CUBE (A5/E5)		NA
E20	45 FT HIGH CUBE (A6/E5)		NA

IN TERMS OF TONNAGE

E21	40 FT HIGH CUBE (D1/E6)		NA
E22	45 FT HIGH CUBE (D2/E6)		NA

REQUIRED NUMBER OF TRANSPORT UNITS

E23	40 FT HIGH CUBE (MAXIMUM OF E19 AND E21)		NA
E24	45 FT HIGH CUBE (MAXIMUM OF E20 AND E22)		NA

MINIMUM CHARGES PER MOVEMENT AND
PER TRANSPORT UNIT

E25	ROAD	250	
E26	RAIL	500	
E27	BARGE	NA	

TRANSPORT COST

ROAD:

E28	40 FT HIGH CUBE (E11*E25)		1000
E29	45 FT HIGH CUBE (E12*E25)		1000

RAIL:

E30	40 FT HIGH CUBE (E13*E26)		500
E31	45 FT HIGH CUBE (E14*E26)		500

BARGE:

E32	40 FT HIGH CUBE (E15*E27)		NA
E33	45 FT HIGH CUBE (E16*E27)		NA

COST OF STUFFING, HANDLING AND STORAGE:

F1	40 FT HIGH CUBE	456	
F2	45 FT HIGH CUBE	516	

****
TOTAL COST PER CONTAINER
****

ROAD

G1	40 FT HIGH CUBE (E28+F1)	1456
G2	45 FT HIGH CUBE (E29+F2)	1516

RAIL

G3	40 FT HIGH CUBE (E30+F1)	956
G4	45 FT HIGH CUBE (E31+F2)	1016

BARGE

G5	40 FT HIGH CUBE (E32+F1)	NA
G6	45 FT HIGH CUBE (E33+F2)	NA

****
MARGIN CONTAINER TRANSPORT

COMPARES THE TRANSPORT COSTS OF A 40 FT STANDARD (8'6") CONTAINER, INCLUDING THE CHARGE MARGIN, WITH THE CONVENTIONAL WAY OF TRANSPORT

(COMPARES AX + CX WITH GX)
****

ROAD

40 FT HIGH CUBE (G1-(A1+C1))	838
45 FT HIGH CUBE (G2-(A1+C2))	816

RAIL

40 FT HIGH CUBE (G3-(A2+C3))	338
45 FT HIGH CUBE (G4-(A2+C4))	316

BARGE

40 FT HIGH CUBE (G5-(A3+C5))	NA
45 FT HIGH CUBE (G6-(A3+C6))	NA

****

COST/BENEFIT ANALYSIS OF INVESTMENT IN EQUIPMENT

****

ROAD

H1	INVESTMENT COSTS OF 40 FT TRAILER	8000	
H2	INVESTMENT COSTS OF 45 FT TRAILER	8800	
H3	DIFFERENCE IN INVESTMENT COSTS (H2-H1)		800
	EXPECTED LIFETIME (YEARS)	5	
	INTEREST RATE	12.0%	
H4	COST PER YEAR: (AMORTISATION FACTOR * DIFFERENCE IN INVESTMENT COSTS (H3))		222
H5	AVERAGE DURATION OF ROUNDTRIP (DAYS)	2.00	
H6	NUMBER OF OPERATIONAL DAYS PER YEAR	330	
H7	UTILISATION RATE	5%	
H8	NUMBER OF ROUNDTRIPS PER YEAR ((H6/H5)*H7)		8
H9	ADDITIONAL COSTS PER ROUNDTRIP (H4/H8)		26.90
H10	COMPARISON OF ADDITIONAL COSTS WITH THE CHARGE MARGIN OF THE TRANSPORT OF A 45 FT CONTAINER (COMPARE H9 AND C2)		-127.65

IF H10 SHOWS A NEGATIVE NUMBER, THE INVESTMENT IN OVERSIZE EQUIPMENT IN TERMS OF CHARGES IS FEASIBLE

RAIL

I1	INVESTMENT COST OF 40 FT RAILCAR	20000	
I2	INVESTMENT COST OF 45 FT RAILCAR	25000	
I3	DIFFERENCE IN INVESTMENT COSTS (I2-I1)		5000
	EXPECTED LIFETIME (YEARS)	30	
	INTEREST RATE	12.0%	
I4	COST PER YEAR (AMORTISATION FACTOR * THE DIFFERENCE IN INVESTMENT COSTS (I3))		621
I5	AVERAGE DURATION OF ROUNDTRIP (DAYS)	3.00	
I6	NUMBER OF OPERATIONAL DAYS PER YEAR	365	
I7	UTILISATION RATE	15%	
I8	NUMBER OF ROUNDTRIPS PER YEAR ((I6/I5)*I7)		18.25
I9	ADDITIONAL COSTS PER ROUNDTRIP (I4/I8)		34.01
I10	COMPARISON OF ADDITIONAL COSTS WITH THE CHARGE MARGIN OF THE TRANSPORT OF A 45 FT CONTAINER (COMPARE I9 AND C4)		-120.54

IF I10 SHOWS A NEGATIVE NUMBER, THE INVESTMENT IN OVERSIZE EQUIPMENT IN TERMS OF CHARGES IS FEASIBLE

****

BREAK-EVEN ANALYSIS OF INVESTMENT IN RAIL INFRASTRUCTURE

****

J1	INVESTMENT COSTS	3500000	
J2	EXPECTED LIFETIME (YEARS)	50	
J3	INTEREST RATE	12.0%	
J4	COST PER YEAR (AMORTISATION FACTOR * INVESTMENT COST (J3))		421458

BREAK-EVEN ANALYSIS

NUMBER OF CONTAINER ROUNDTRIPS REQUIRED

J5	FOR 40 FT HIGH CUBES (J4/C3)	5757
J6	FOR 45 FT HIGH CUBES (J4/(C4-I9))	3496

NOTE: AS FAR AS THE BREAK-EVEN POINT FOR 45 FT CONTAINERS IS CONCERNED, THE EXTRA COSTS OF OF INVESTMENT IN OVERSIZE RAILWAY CARS (I9) IS INCLUDED

****

Annex I

Research Findings

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1 STATISTICAL INFORMATION

1.1 WORLD CONTAINER STATISTICS

During the research phase of this study, considerable statistical information on the world's container population was gathered. This is included in the tables and graphs of this annex. At that time, the most up-to-date information available was that of the World Container Survey of 1987, carried out by the technical periodical "Containerization International". However, at the beginning of 1991, and prior to publication of this study, Cargoware International published its World Container Census of 1990. The census provided statistical data of the world container population as of mid-1990, which was useful for comparison with earlier published material. In that census, however, only the number of TEUs (twenty-foot equivalent units) was published, not actual container units.

The following excerpts from the 1990 survey were of particular relevance to this study:

- The global fleet of in-service containers was, as of mid-1990, recorded to be 5,874,084 TEUs. (In mid-1986 this figure was approximately 4,800,000 TEUs.)

- The 1990 TEU figures can be converted into about 4,360,000 container units.

  (In mid-1986 the total number of boxes was 3,620,000 units)

- A little over 85 per cent, or 5,021,265 TEUs, comprised standard dry freight boxes of ISO 20 ft and 40 ft length.

- "Specialist" type containers, including non-dry freight containers and those featuring non-ISO lengths or widths, numbered 852,819 TEUs, or 14.5 per cent.

- High Cube 9 ft 6 in containers of all types numbered 419,011,TEUs, comprising 7.1 per cent of the total TEU population. (The percentage of high cubes (both 9 ft and 9 ft 6 in high) in TEUs in the world's container population in the 1986 Survey was only 3.1 per cent).

  Considering that most high cubes are 40, 45 or 48 ft long, this implies that the number of high cubes expressed in actual units was about 180,000. This figure was considerably less than that estimated by the Shipping Division of the United Nations Conference on Trade and Development (UNCTAD) which, in a paper supplied to the International Cargo Handling Co-ordination Association (ICHCA) International Secretariat, forecast that the number of containers with a height of 9 ft 6 in would reach about 300,000 in 1990.

- Wide bodied (Europallet width) containers numbered about 19,485 TEUs.

- Standard end-door containers featuring non-ISO lengths (10 ft, 24 ft, 30 ft, 45 ft and 48 ft) amounted to 81,298 TEUs.

These data notwithstanding, it remained quite difficult to obtain accurate and up-to-date statistics (expressed in actual units) on the numbers of high cube, super high cube and wide bodied containers.

A survey of container manufacturers carried out by UNCTAD provided indications but no accurate data owing to the less than satisfactory response to the questionnaire sent out. The results of that survey, which were published in the UNCTAD report TD/B/C.4/329 of January 1990, revealed that of a throughput of approximately 75,000 boxes:

- 0.1 per cent were 8 ft high,
- 90.4 per cent were 8 ft 6 in high,
- 0.4 per cent were 9 ft high,
- 6.0 per cent were 9 ft 6 in high, and
- 3.1 per cent were of other heights.

The same sample, when categorized into lengths, indicated that:

- 59.9 per cent of the boxes were 20 ft long,
- 32.9 per cent of the boxes were 40 ft long,
- 4.0 per cent of the boxes were 45 ft long, and
- 3.1 per cent of the boxes were of other lengths.

A conference paper, presented at a recent Intermodal Conference organized by Cargo Systems, provided some insight into the share of high cube containers. Based on a very conservative forecast following an extensive survey among many container carriers, the paper contained the information found in Table 1.1.

Table 1.1 Percentage of high cube containers

	Year		
	1990	1995	2000
Of 40 ft fleet	11	15	17
Of total TEUs	3	4	5

To obtain more data, available information from the Containerization Yearbooks published by Containerization International were also studied and analysed in the research phase of this study. Unfortunately, while these yearbooks list all the container shipping companies and their container fleets, it did not provide data for shipping companies such as MAERSK and NEDLLOYD Lines which certainly own and/or lease a considerable number of high cube and/or super high cube containers.

The following tables were derived from an analysis of the 1989 and 1990 yearbooks.

Table 1.2 Number of non-ISO standard containers owned and/or leased by major shipping companies in 1988 and 1989

Shipping company	Number of oversize containers owned and/or leased		Difference (%)
	1988	1989	
Kawasaki Kisen Kaisha (K-line)	1,000	1,000	-
Lykes Lines	623	623	-
American President Lines	15,990	17,932	12 %
Navieras de Puerto Rico	-	990	n.a.
Nippon Yusen Kaisha (NYK)	210	1,445	683 %
Sea-Land Services	5,936	5,936	-
Totals	23,759	27,926	18 %

Table 1.3 Number of high cube containers owned and/or leased by major shipping companies in 1988 and 1989

Shipping company	Number of high cube containers owned and/or leased		Difference (%)
	1988	1989	
American President Lines	37,238	39,132	5 %
Evergreen Line	12,100	13,000	7 %
Hanjin Container Lines	3,096	7,228	133 %
Hyundai Merchant Marine Co.	1,400	3,906	179 %
Jugolinija	2,112	2,554	21 %
Kawasaki Kisen Kaisha (K-Line)	6,475	6,970	8 %
Mitsui-OSK Line (MOL)	6,870	8,020	17 %
Navieras de Puerto Rico	686	2,928	327 %
Nippon Lines	3,278	3,623	11 %
Nippon Yusen Kaisha (NYK)	3,968	8,983	126 %
Orient Overseas Cont. Lines	5,926	6,594	11 %
Sea-Land Services	21,891	21,891	-
Yangming Marine Transport Corp.	2,300	2,530	10 %
Zim Israel Navigation Co.	2,500	3,553	42 %
Lykes Lines	623	623	-
Hapag Lloyd	952	931	-2 %
Totals	111,415	132,466	19 %

The result of this survey, despite its limitations, showed the same order of magnitude as that of the data presented earlier. The following tables were derived from the World Container survey statistics.

Table 1.4 World container population in 1970 - 1990

Year	(million TEUs)
1970	0.5
1976	1.5
1980	3.1
1987	5.0
1988	5.4
1990	5.9

Table 1.5 World container transport

Year	(million TEU)
1979	33
1981	41
1983	47
1985	56
1986	60
1987	64
1988	74
1989	78
2000	111

Table 1.6 World container population (in TEUs) by length (1990)

Type	Container length							
	20 ft		40 ft		Other		Total	
	Number	%	Number	%	Number	%	Number	%
General cargo	2,454,227	41.8	2,567,038	43.7	81,298	1.4	5,102,563	86.9
Other types	391,800	6.7	354,018	6.0	25,703	0.4	771,521	13.1
Total	2,846,027	48.5	2,921,056	49.7	107,001	1.8	5,874,084	100.0

Table 1.7 World container population (in TEUs) by height (1990)

Height	Type of container					
	General cargo		Other types		Total	
	Number	%	Number	%	Number	%
8 ft	102,674	1.7	60,081	1.0	162,755	2.7
8 ft 6 in	4,618,698	78.6	623,433	10.6	5,242,131	89.2
9 ft 6 in	380,231	6.5	38,780	0.7	419,011	7.2
Other	960	0.1	49,227	0.8	50,187	0.9
Total	5,102,563	86.9	771,511	13.1	5,874,084	100.0

Table 1.8 World container population (in TEUs) by type (1990)

Type	Number (TEUs)	%
Standard	5,102,563	86.9
Open top	155,958	2.7
Integral reefer	277,465	4.7
Insulated	69,480	1.2
Folding flatrack	58,581	1.0
Fixed flatrack	39,344	0.7
Platform	38,728	0.6
Europallet width	19,485	0.3
Ventilated	46,302	0.8
Bulk	21,951	0.3
Tank	44,227	0.8
Total	5,874,084	100.0

1.2 CONTAINER DIMENSIONS AND THE ROLE OF THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

When combining the data contained in the research phase of the study with data collected more recently, the experts arrived at the following table, containing all the presently applied and/or container dimensions possibly or likely to be used in the future.

Table 1.9 Container dimensions that will possibly be used in the future

Length		Height		Width	
Feet/inches	Meters	Feet/inches	Meters	Feet/inches	Meters
10/00	03.05	08/00	02.44	08/00	02.44
20/00	06.10	08/06	02.59	08/025	02.50
24/00	07.32	09/00	02.74	08/06	02.59
24/06	07.44	09/06	02.89		
30/00	09.14				
35/00	10.67				
40/00	12.19				
45/00	13.72				
48/00	14.63				
49/00	14.93				
52/00	15.85				
53/00	16.15				

At Bombay, India, in 1982 the Technical Committee 104 (TC 104) of the ISO discussed for the first time the possibility of accepting higher containers than the standard heights of 8 ft and 8 ft 6 in as an additional standard. At a meeting of TC 104 in 1985, it was decided also to study the introduction of the 9 ft 6 in high container. In 1987, TC 104 decided to proceed with a new series of ISO containers. At that occasion, it was proposed to accept the width of 8 ft 6 in and heights up to 9 ft 6 in. No standard was selected for the length of containers. In 1989, the following dimensions, referred to as ISO 2A, met the design criteria for submission to ISO for adoption.

- LENGTHS : 49 ft or 14.93 m and the half module length of 24 ft 6 in or 7.44 m

- WIDTH : 8 ft 6 in or 2.59 m

- HEIGHT : 9 ft 6 in or 2.90 m

The dimensions of this container, as far as length and width were concerned, were mainly based on the dimensions of pallets used in Europe in combination with optimum use of the floor space inside the container.

In June 1989, a plenary session of TC 104 (Freight Containers) was held in London. According to a report in the Maritime Press:

> "The meeting devoted much time on the debate on future container dimensions. After contributions by almost all 24 delegations present, there was a general consensus that further economic studies were needed to determine the overall impact and feasibility of introducing containers larger in size than the present ISO Standard.
>
> The meeting decided that, while Working Group 4 should continue to look into the technical details of any new series of freight containers, other groups, particularly the United Nations Economic and Social Commissions, should be urged to study in depth the full economic implications of such containers.
>
> Before the plenary, there were fears that some delegations would try to stop discussion of the future container sizes issue, but this did not materialise. Instead, after full debate, the question was put on hold as far as the ISO was concerned, pending the completion of the 'economic studies'. The importance of having precise technical data inputs into these studies was realised, however, and so the mandate of Working Group 4 to continue to review this area was renewed.
>
> While decisions on a new series of containers were deferred, possibly until well into the 1990s, the plenary did adopt 9 ft 6 in (2.9 m) as a standard height for 40 ft containers within Series 1, although not for the 20 ft module.
>
> Designated 1AAA, the 9 ft 6 in height will now be introduced into various ISO standards. The Coding and Marking Subcommittee (SC 4) was to design and develop a distinctive marking to be placed on the side of 9 ft 6 in high containers."

The most recent ISO TC 104 plenary was held at Seoul, Republic of Korea, in June 1991.

1.3 CONTAINER THROUGHPUTS IN THE ESCAP REGION

According to the 1990 and 1991 yearbooks of Containerization International, container throughputs in the major ports of the ESCAP region (i.e., those which reported) were as shown in Tables 1.11 and 1.12.

Table 1.10 Throughputs of major ports in the ESCAP region

PORT	COUNTRY OR AREA	THROUGHPUT 1989 (TEUs)	THROUGHPUT 1988 (TEUs)	DIFFERENCE (%)
ADELAIDE	AUSTRALIA	38,700	29,800	30
BRISBANE	AUSTRALIA	144,964	139,000	4
BURNIE	AUSTRALIA	86,393	80,256	8
DARWIN	AUSTRALIA	2,910	2,789	4
DEVONPORT	AUSTRALIA	20,600	13,920	48
FREMANTLE	AUSTRALIA	128,200	120,496	6
GEELONG	AUSTRALIA	6,000	232	2.486
HOBART	AUSTRALIA	195,000	20,011	-3
LAUCESTON	AUSTRALIA	39,861	41,404	-4
MELBOURNE	AUSTRALIA	665,933	615,467	8
SYDNEY	AUSTRALIA	214,650	214,265	0
TOWNSVILLE	AUSTRALIA	10,770	10,539	2
CHITTAGONG	BANGLADESH	112,977	79,437	42
DALIAN	CHINA	100,000	74,945	33
GUANGZOU	CHINA	78,472	84,448	-7
QINGDAO	CHINA	116,600	86,290	35
SHANGHAI	CHINA	353,836	312,917	13
TIANJIN	CHINA	265,500	214,000	24
XIAMEN	CHINA	27,458	21,106	30
HONG KONG	HONG KONG	4,467,097	4,033,427	11
BOMBAY	INDIA	309,898	277,358	12
CALCUTTA	INDIA	129,075	102,367	26
JAWAH. NEHRU	INDIA	120,000	33,880	254
KANDLA	INDIA	49,360	35,933	37
MADRAS	INDIA	95,773	90,652	6
TUTICORIN	INDIA	14,115	8,782	61
BELAWAN	INDONESIA	59,414	38,524	54
TANJUNG EMAS	INDONESIA	22,277	23,672	-6
TANJUNG PERAK	INDONESIA	143,225	110,111	30
TANJUNG PRIOK	INDONESIA	559,617	415,960	35
KITAKYUSHU	JAPAN	247,195	218,056	13
KOBE	JAPAN	2,458,964	2,263,214	9
NAGOYA	JAPAN	815,351	665,621	22
NAHA	JAPAN	60,118	53,469	12
NIIGATA	JAPAN	11,064	4,224	162
OSAKA	JAPAN	513,658	515,924	-0
SHIMIZU	JAPAN	141,177	137,525	3
TOKYO	JAPAN	1,438,521	1,396,026	3
TOMAKOMAI	JAPAN	146,000	127,564	14
YOKKAICHI	JAPAN	14,290	12,976	10
YOKOHAMA	JAPAN	1,506,338	1,452,857	4
JOHOR	MALAYSIA	58,735	31,502	86
KUCHING	MALAYSIA	25,732	23,400	10
PENANG	MALAYSIA	189,734	155,120	22
PORT KELANG	MALAYSIA	399,348	325,661	23
SIBU	MALAYSIA	12,125	10,137	20
AUCKLAND	NEW ZEALAND	213,610	189,731	13
BLUFF HARBOUR	NEW ZEALAND	2,940	2,798	5
LYTTELTON	NEW ZEALAND	54,400	45,700	19
NAPIER	NEW ZEALAND	12,217	11,775	4
NEW PLYMOUTH	NEW ZEALAND	9,182	6,379	44
ONEHUNGA	NEW ZEALAND	8,445	8,669	-3
OTAGO	NEW ZEALAND	49,476	53,071	-7
TAURANGA	NEW ZEALAND	32,658	35,767	-9
TIMARU	NEW ZEALAND	9,722	11,598	-16
WELLINGTON	NEW ZEALAND	78,627	77,258	2
KARACHI	PAKISTAN	342,946	339,807	1
ALOTAU	PAPUA NEW GUINEA	1,792	1,732	3

Table 1.10 (continued)

PORT	COUNTRY OR AREA	THROUGHPUT 1989 (TEU)	THROUGHPUT 1988 (TEU)	DIFFERENCE (%)
KIETA	PAPUA NEW GUINEA	3,997	3,940	1
KIMBE	PAPUA NEW GUINEA	1,462	1,123	30
LAE	PAPUA NEW GUINEA	42,129	38,715	9
MADANG	PAPUA NEW GUINEA	3,043	3,246	-6
PORT MORESBY	PAPUA NEW GUINEA	29,218	27,812	5
RABAUL	PAPUA NEW GUINEA	6,947	5,833	19
WEWAK	PAPUA NEW GUINEA	2,329	1,660	40
CAGAYAN D.O.	PHILIPPINES	35,912	38,129	-6
CEBU	PHILIPPINES	165,208	146,233	13
DADIANGAS	PHILIPPINES	13,781	13,873	-1
ILOILO	PHILIPPINES	87,447	57,481	52
MANILA	PHILIPPINES	857,350	767,499	12
BUSAN	REP. OF KOREA	2,158,828	2,065,462	5
BINTULU	SABAH	2,818	1,537	83
KOTA KINABALU	SABAH	28,363	24,686	15
SANDAKAN	SABAH	8,404	7,371	14
TAWAU	SABAH	13,478	9,040	49
APIA	SAMOA	10,022	13,277	-25
SINGAPORE	SINGAPORE	4,364,400	3,375,100	29
COLOMBO	SRI LANKA	544,197	620,940	-12
PAPEETE	TAHITI	31,630	29,772	6
KAOHSHIUNG	TAIWAN)Province	3,382,512	3,082,838	10
KEELUNG	TAIWAN)of	1,787,067	1,709,763	5
TAICHUNG	TAIWAN)China	108,564	96,490	13
BANGKOK	THAILAND	924,040	791,584	17
SATTAHIP	THAILAND	15,000	3,717	304
TOTALS (TEUs)		31,882,298	28 446 670	12

Table 1.11 Throughputs of countries and areas in the ESCAP region

COUNTRY OR AREA	THROUGHPUT 1988 (TEU)	THROUGHPUT 1987 (TEU)	DIFFERENCE (%)
AUSTRALIA	1,379,023	1,288,884	7
BANGALDESH	112,977	79,437	42
CHINA	941,866	793,706	19
HONG KONG	4,463,709	4,033,427	11
INDIA	718,221	549,972	31
INDONESIA	784,533	588,267	33
JAPAN	7,353,216	6,909,050	6
MALAYSIA	739,615	589,128	26
NEW ZEALAND	471,277	406,979	16
PAKISTAN	342,946	339,807	1
PHILIPPINES	1,159,698	1,096,743	6
REP. OF KOREA	2,158,828	2,065,462	5
SINGAPORE	4,364,400	3,375,100	29
SRI LANKA	544,197	620,940	-12
TAIWAN PROVINCE OF CHINA	5,278,143	4,889,091	8
THAILAND	939,040	795,301	18
TOTALS	31,751,689	28,421,294	12
WORLD TOTALS	78,470,653	73,810,483	
ESCAP SHARE OF TOTAL	40%	39%	

2 CONTAINER SURVEY OF THE INTERNATIONAL ASSOCIATION OF PORTS AND HARBORS

In 1989, the Committee on Cargo Handling Operations (CHO) of International Association of Ports and Harbors (IAPH) conducted a survey on container dimensions and ratings. The final report was prepared by the IAPH Head Office in Tokyo, Japan and contains valuable and interesting information. The questionnaire, which was drafted by CHO, was sent to 227 regular members of IAPH. In total, 98 (44 per cent completed questionnaires were returned. The questions and answers (expressed in number of replies), in so far as they corresponded with the scope of this study, are summarized below:

	YES	NO	NO REPLY
1. Do you have equipment to handle:			
- Oversize boxes	49	38	4
- High cubes	69	19	3
- Overwidth boxes	24	62	5
2. Do you expect oversize boxes to create problems with:			
- Gantry crane width	56	29	6
- Stacking areas or yard layout	53	30	8
- Inland transport	72	11	8
3. Do you expect high cube boxes to create problems with:			
- Gantry crane clearance aboard ship	37	47	7
- Stacking areas	35	52	4
- Inland transport	67	15	10
4. Do you expect overwidth boxes to create problems with:			
- Container handling equipment	76	10	5
- Stacking areas	61	25	5
- Inland transport	77	9	5
5. Do you expect increased container gross weight to create problems in:			
- Gantry crane ratings	56	25	10
- Equipment ratings	64	23	4
- Inland axle loads	76	08	7
- Quay and stack loading	41	46	4

The results show clearly that the findings of the ESCAP study corresponded well with the outcome of the IAPH/CHO survey. A general analysis of the survey concluded that there was considerable concern regarding the introduction of the new dimensions of containers in the ports of developing countries.

3 UNCTAD PUBLICATION

It would be useful to include in this study, views of the UNCTAD secretariat as expressed in the UNCTAD report TD/B/C.4/329, published in January 1990. The findings of the first phase (research phase) of this ESCAP study were incorporated in that report.

The summary and conclusions of the research phase of this study were as follows:

(a) Although non-ISO standard containers have existed since the beginning of containerization and some of these continue to circulate worldwide, others move only in selected trades. For this reason, standardization of equipment, especially the equipment and ratings of containers, has been the major element in the development of multimodal transport.

The essential parameters of the ISO 668 standard have not changed since its introduction in 1964. This has provided conditions favouring the remarkable growth of containerization and multimodal transport.

The use of containers of relatively few sizes and with fixed dimensions has allowed the construction and economic use of expensive equipment, such as fully cellular container ships and transtainers as well as dedicated container trains and road vehicles. It has made investors confident that their investments would be subject only to the uncertainties of international trade and not to the poliferation of different container sizes.

(b) The censuses of the world container fleet, carried out periodically by an industry magazine have given a fairly distinct picture of the distribution of the container population by dimensional parameters, cladding material, ownership and other features.

In the UNCTAD report, the evolution of the container population was analysed on the basis of the censuses made since 1978. The main conclusion of this analysis was that a high degree of homogenity of the world dry cargo container population had been achieved and had increased from one census to another. The wide voluntary acceptance of the ISO 668 standard reflected the compromise between the differing technical, safety, operational and economic requirements of marine, rail and road transport interests, which was achieved by the standard's elaboration and adoption.

(c) The evolution of shippers' requirements, changes in regulations restricting the dimensions of transport means, technical progress, and the use by transport operators of economies of scale have introduced containers with dimensions beyond present ISO standards.

The newly introduced non-ISO dimension containers are being used primarily on specific trade routes but their area of circulation appears to be spreading.

(d) At present, however, a considerable number of countries cannot handle these new (larger) sizes of containers. The movement of high cube, super high cube and wide bodied containers by inland transport systems in Europe is, in most cases, considered as "exceptional transport" with all the commercial consequences connected therewith (conditions, tariffs, etc.).

In many developing economies, current container handling equipment is designed to handle ISO standards and the new sizes cannot automatically be handled.

(e) Due to operational and economic constraints in both developed and developing economies, and taking into account these new (larger) containers'modest share of the world container population, it would seem premature to incorporate them into the ISO standards.

(f) Monitoring the development of the situation in respect of new additions to the world container fleet and trends in this area is important. Data on the distribution of containers entering the industry in respect of their dimensional characteristics would permit evaluation of the rate of proliferation of each dimensional category of containers and might be used to solve the question of the desirability of introducing changes in existing container standards.

In this respect, sample surveys similar to that conducted by the UNCTAD Secretariat would be useful in providing the industry with an indication of the rate of increase of containers with different dimensional parameters and trends in this area.

Although, response to the IAPH/CHO questionnaire was rather poor, the analysis of those returned was published in the UNCTAD report. Significant trends are shown in table 2.1.

Table 2.1 Containers (in actual units) manufactured in 1985

	Length					
Height	20 ft	40 ft	45 ft	Others	Total	Percentag e of total
8 ft				100	100	0.1%
8 ft 6 in	43,90	22,30			66,20	90.4%
9 ft	0	0			0	0.4%
9 ft 6 in		300	2,95		300	6.0%
Others		1,400	0	2,183	4,350	3.1%
		100			2,283	
Totals	43,90 0	24,10 0	2,95 0	2,283	73,23 3	100%
Percentag e of total	59.9%	32.9 %	4.0%	3.1%	100%	

Although the data shown above is not representative of the entire container population, it is useful to compare this data with the results of the surveys carried out by Containerization International in 1987 and by Cargoware International in 1990, which provided information on the world container population.

Table 2.2

Year of survey taken	Length			
	20 ft	40 ft	Others	Total
1987	66.9%	31%	2.1%	100%
1988	59.9%	32.9%	7.2%	100%
1990	48.5%	49.7%	1.8%	100%

The paper supplied to the ICHCA International Secretariat by the Shipping Division of UNCTAD contained some significant statements. Excerpts of the paper are given below.

> Nobody believed, that completely new empirical container dimensions, based on pallet modules, would ever materialize.
>
> It was widely recognized, that in order to safeguard heavy investment in equipment and transport infrastructure when introducing containerization, a high degree of stability of the internationally agreed container standards would be required.
>
> In assessing the ISO's work on container standards, the UNCTAD Group of Experts on Container Standards for International Multimodal Transport noted many positive results of the work of ISO in this area, the most important of which had been the establishment of a restricted number of container dimensions. This established worldwide compatibility in transport and handling equipment with a reasonable compromise between the needs of the sea, road and rail transport.
>
> A recent UNCTAD report showed that there was a high degree of homogenity among the world's dry freight container fleet in regard to dimensions which reflected wide voluntary acceptance of the current ISO standard (e.g., 1976 saw 70 per cent of containers being 20 ft or 40 ft in length and 8 ft 6 in in height. In 1986 this figure rose to about 90 per cent). As a result, cranes, chassis, rail wagons and other shore equipment were designed to handle this fleet of containers.
>
> Both UNCTAD and ESCAP reported that there was no general acceptance of the new container sizes, especially by developing economies. The use of larger than ISO standard containers was limited to certain trades, primarily involving the United States. The share of these containers in the total world container population was insignificant (much less than 1 per cent) so there was little reason to speak of their noticeable proliferation.
>
> The exception to this was the high cube container, with a height of 9 ft 6 in, which numbered about 300,000 units. These boxes were mainly transported inland in Europe and Japan. They were still considered as exceptional and regarded as special in inventories.
>
> The use of Europallets had also increased pressure to increase container dimensions. However, these pallets, 800 mm to 1,200 mm in size, were being gradually superseded by 1,000 mm to 1,200 mm pallets. There was therefore no need to build a global future transport system based on a module having only regional application.
>
> It should be stressed that all previous developments in international standards on container dimensions were of an evolutionary character.
>
> What was proposed in TC 104 represented a departure from accepted international container standards and meant the introduction of a new series of containers with a base geometry different from that of the existing international standard container. Such new geometry would be incompatible with existing transport infrastructures and superstructures.
>
> Non-ISO containers had always existed. The newly introduced containers might be required in some regions and might be properly utilized for special trades.

4 EVALUATION OF ESCAP QUESTIONNAIRES

Specially designed questionnaires were sent to 44 ports in the following economies in the Asian and Pacific region:

AUSTRALIA
BANGLADESH
CHINA
FIJI
HONG KONG
INDIA
INDONESIA
JAPAN
MALAYSIA
NEW CALEDONIA
NEW ZEALAND
PAKISTAN
PAPUA NEW GUINEA
PHILIPPINES
SINGAPORE
SRI LANKA
TAHITI
THAILAND

Forty questionnaires were returned.

Analysis of the returns reveals that:

(a) Some returned forms were incompletely filled in.

(b) In 1988, the responders handled a total of 9,077,178 boxes or 12,333,909 TEUs.

(c) The BOXES/TEU ratio shows that the average 20/40 ratio is 64/36, a value which corresponds with the world container population statistics for 1986.

(d) Only nine ports reported handling 45 ft boxes.

(e) A total of 35,503 boxes of 45 ft length were handled or 0.4 per cent of the total box throughput of all respondents. This is far less than the share of 45 ft containers indicated in the 1986 World Container Census.

(f) Ports reported to have handled 45 ft boxes in 1988 were:

Bangkok	3,281 units	(estimate)
Cebu	109 units	
Colombo	1,307 units	
Hong Kong (MTL)	6,749 units	
Hong Kong (SL)	4,247 units	
Manila	2,499 units	
Penang	300 units	
Singapore	1,645 units	
Yokohoma	15,366 units	

(g) Number of 45 ft boxes handled by the ports increased as indicated below:

Port	Years		
	1986	1987	1988
Bangkok	338	734	3,281
Cebu	23	46	109
Colombo	-	-	1,307
Hong Kong (MT)	-	-	6,749
Hong Kong (SL)	-	-	4,247
Manila	-	1,043	2,499
Penang	-	-	300
Singapore	-	-	1,645
Yokohama	12,481	14,019	15,366
Total	12,482	15,142	35,503

(h) The data above indicates that, in 1988 at least, non-ISO standard containers were only handled at mainports and terminals. These boxes did not spread to regional feeder ports, except Bangkok and Cebu.

(i) Of the 40 ports that responded, only 15 (37.5 per cent) kept records on container heights.

(j) The responses concerning heights might be inaccurate because many ports reported all their container throughput to be 8 ft high; a figure which did not correspond with the 1986 World Container Census.

(k) Some ports, however, did provide seemingly correct data. On the basis of an analysis, the following average distribution was deduced:

Dimension	Percentage
8 ft	6.0
8 ft 6 in	89.9
9 ft	0.1
9 ft 6 in	3.0

This result corresponded well with the 1986 World Container Census.

(l) On average, of the total number of boxes handled, 24 per cent were empty. The range, however, was spread widely. The returns indicated that most ports with Export Processing Zones (exporting volume cargo) such as Bandang, Bangkok, Belawan, Calcutta, Cebu, Cochin, Kelang, Lampun, Panjang and Wellington tended to have an inflow of many empty boxes but an out flow of few empties. The major pivotal ports handled an appreciable number of empty boxes for servicing the feeder ports.

(m) The overall average weight of loaded boxes was 17.2 tons, which corresponded with data obtained in other studies.

(n) Eleven ports provided no detailed information on the modes of hinterland transport (road, rail or inland waterway).

(o) Of the 29 returns which provided information on inland transport, only Bangkok, Chittagong and Palembang ports reported the use of barge transport.

(p) Seventeen of same 29 responsdents stated that they had the possibility of rail transport. All 29 ports had the possibility of road transport.

(q) Regarding road transport, 28 ports provided complete or partial data on the maximum allowable width, length, height, total weight and axle load.

(r) In 12 of the countries the maximum, legally allowed width of road vehicles was 2.5 m. Only India (3.1 m), Thailand (3.0 m) and the Philippines (3.6 m) allowed greater widths.

(s) The maximum allowable length of road vehicles varied widely from country to country and depended on the type of truck or trailer combination.

(t) The maximum allowed height ranged from 3.4 m (Bangladesh) to 4.8 m (Malaysia). In general terms, the following standards applied:

Australia	4.30 m
Bangladesh	3.40 m
Hong Kong	4.60 m
India	4.60 m
Indonesia	3.50 m
Japan	3.80 m
Malaysia	4.80 m
New Caledonia	no data
New Zealand	4.25 m
Papua New Guinea	4.30 m
Philippines	no data
Singapore	4.50 m
Sri Lanka	3.80 m
Tahiti	4.00 m
Thailand	3.80 m

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Annex II

Field Survey Reports

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1 REPORTS ON THE VISITS TO MALAYSIA AND SINGAPORE IN MAY 1990

1.1 MALAYSIA

Malaysia was visited in May 1990. In Kuala Lumpur, the Ministry of Transport (MOT) arranged a meeting with representatives of all parties concerned with container transport. Those attending included:

(a) Mr. Kalwat Singh, Officer in Charge (MOT);

(b) Ms. Huzaimak Mohd. Yusoff, Principal Assistant Secretary (Ports, MOT);

(c) Mrs. Ng Tian Soo (MOT);

(d) Mrs. Lin (MOT);

(e) Mr. Azhar Ismail, Regional Manager, Konsortium Perkapalan;

(f) Mr. Johari Hj. Arbain, Terminal Manager, Shapadu;

(g) Mr. Akmad Bin Ishak, Assistant General Manager, Shapadu;

(h) Mr. Mohd. Nor Jadi, Assistant Chief Executive, Kelang Container Terminal;

(i) Mr. Wong Pun Yoke, Kelang Port Authority;

(j) Mr. S. Poopalasingann, Assistant Traffic Manager, Kelang Port Authority;

(k) Mr. Sarmin Hussein, Senior Assistant Director of Customs;

(l) Mr. Tawil B. Hj. Adnan, Project Engineer, Malayan Railways; and

(m) Mr. Abdul Hanis B. Zakasia, Marketing Manager (Container), Malayan Railways.

In addition, field visits were made to the Ipoh Cargo Terminal (ICT, an inland container rail depot) as well as to the highway linking Kuala Lumpur and Ipoh.

In Ipoh discussions were held with:

(a) Mr. Khoo Ong Chuan, ICT Manager
(b) Mr. V. Satchithanathan
(c) Mr. Abu Bakar Othman

The points discussed and the conclusions reached are contained below:

1.1.1. KUALA LUMPUR

1.1.1.1 General

Malaysia, in principle, was against the introduction of high cube, super high cube and wide bodied containers. The authorities, however, recognize that a decision to prohibit these containers from entering Malaysia might affect detrimentally the competitiveness of her exports (particularly volume cargo) to markets such as the United States.

The problem for Malaysia, as was the case for most developing countries, was to determine when and what adjustments in container handling and transport infrastructure would be needed. The ports in Malaysia were already handling a limited number of high cube and non-ISO standard containers. The exact number of such containers handled would soon be established because the Ministry of Transport had recently established a committee consisting of all parties concerned, including ports and inland transporters, to study the problem.

One of the activities of this committee was to collate quarterly reports from every port in Malaysia regarding the handling of high cube, and non-ISO standard containers. The committee could be a focal point for liaison between Malaysia and international organizations such as ESCAP regarding this matter.

Malaysia also requested ESCAP to study the trunk routes of Port Kelang-Kuala Lumpur-Port Kelang, Port Kelang-Ipoh-Port Kelang, and Penang-Ipoh-Penang.

The Kelang Container Terminal (KCT) had already invested in a new crane which would allow the handling of cellular container vessels carrying high cubes deck cargo. However, it was also experiencing stacking space allocation problems relating to the storage of non-ISO standard containers.

1.1.1.2 Road Transport

The inland transport of high cubes by road encountered problems caused by overhanging cables, branches of trees, viaducts and traffic lights. The free profile under bridges and viaducts was increased from 4.8 m to 5.2 m but a new problem arose. Road repairs were usually done by adding a new layer of asphalt but that would eventually decrease the free profile. The view was expressed that the improvement of bridges and viaducts to accommodate the new standards would cost an estimated $M143 million.

The length of high cubes created a problem at junctions and when manoeuvering around sharp bends. The major problem in road transport of containers was in the remote areas where industries had been set up. Difficulties in reaching these places had been experienced mainly because of the low maximum permissible axle loads, narrow lanes and limited overhead clearance. Axle load regulations were a problem due to new government regulations aimed at reducing highway wear and tear.

1.1.1.3 Rail Transport

The major problem of rail container transport in Malaysia laid with one of the three railway tunnels between Penang and Ipoh, which prevented the transport of high cubes owing to insufficient clearance, even when low bed wagons (900 mm) were used. It might be possible to lower the rail bed in the tunnels, but a technical investigation as to its feasibility had yet to be undertaken.

Also, on the Ipoh-Kuala Lumpur track, the train has to pass under some viaducts. At these places a speed of 55 km/h left only a margin of 3 to 4 in between the top of the high cube containers and the viaduct.

The container railway car capacity of Malayan Railways at the time of the visit was 298 wagons of one TEU capacity and 598 wagons of two TEU capacity. It was possible to transport 45 ft boxes (with an overhang of 2.5 ft at each end of the car) on a two TEU capacity wagon, provided that at both ends of this car only 40 ft boxes were loaded in order to allow the train to negotiate sharp bends. The maximum train load for a 1,000 tons capacity locomotive was 60 TEUs, between Port Kelang and Ipoh and only 40 TEUs (due to the slope of railway line) between Ipoh and Port Penang.

The construction of railway cars with wheels of a smaller diameter (28 in) was possible but would cost $M250,000 to $M300,000 per car. The problems with smaller wheels were increased wear and tear, increased maintenance, decreased train stability, etc.

In addition to the height problem, Malayan Railways was also facing the difficulty of selecting the appropriate length of the replacement wagons to be purchased. One alternative for solving the height clearance problems was to lower the bed by using swan-neck type low bed cars. The problem associated with such a solution was the increased train length which, in turn, created problems at the sidings of a number of stations. Malayan Railways would soon have to decide whether to buy new container wagons that were 45, 48, 49, 52 or even 53 ft long. Another problem to be studied by Malaysia Railway system was the use of telescopic cars.

1.1.2. IPOH CARGO TERMINAL

Ipoh is located about 220 km North of Kuala Lumpur on Highway Number Nine between Kuala Lumpur and Penang. The Ipoh Cargo Terminal (ICT) is located in the vicinity of the marshalling yard of the Ipoh Railway Station. ICT started to operate in November 1989 and at the time of the visit in May 1990, had handled about 4,000 boxes.

ICT isa so-called 'dry port', an inland port which provided all the logistic services required by importers and exporters. At present, the terminal has an area of nine ha, with another four ha being kept in reserve for future expansion.

The container yard has a 3.2 ha hard standing area and two ha area for empty boxes. Other facilities include one 1,100 m^2 import shed, one 1,400 m^2 export shed and equipment such as container trailers and one heavy fork-lift truck.

Subject to further government decisions, Malayan Railways and the Port Kelang Authority jointly operate ICT, or rather, supervise and market it. The actual operations are carried out by a contractor. Containers come from and go to Port Kelang in the South and Port Penang in the North.

Rail transport is financially very competitive with road transport as evidenced by the following data:

Road:	Transport of one TEU from Ipoh to Port Kelang:	$M819
	Transport of two TEUs or one FEU (forty-foot equivalent units) on same road:	$M1,638
Rail:	Transport of one TEU from Ipoh to Port Kelang, including 15 km road haulage in the vicinity of Ipoh:	$M680
	Same for one FEU:	$M1,130
	Same for containers delivered at ICT:	one TEU $M540 one FEU $M950

Tranporting containers by road is faster. A complete roundtrip can be made in 12 hours and trains run overnight. If enough containers are available, a special container train is assembled. If this is not the case, container wagons have to be fitted into normal cargo trains.

The intention was to run one container block train to Port Kelang and one to Port Penang each day, in addition to the daily running of three freight trains to both destinations. However, the problems were that traffic level was low and the track was single line all the way, so the use of sidings at stations was required which limited the length of the train.

1.1.2.1 Highway between Kuala Lumpur and Ipoh

For 10 km out of Kuala Lumpur the highway provides two lanes each way. From there northward, it is single lane each way, passing through sloping landscape, towns and villages. The speed limit is 90 km/h, except in the urban areas where the limit is 50 km/h.

From the city centre of Kuala Lumpur to Ipoh, some six viaducts cross the highway. The clearance is at least 4.2 m but this clearance is not always indicated. The 4.2 m clearance shows signs of severe collision damage. The surface of the highway is perfect but traffic is heavy.

1.2 SINGAPORE

On 15 May 1990, the Tanjung Pagar Container Terminal (TPT) in Singapore was visited. Discussions took place with:

(a) Mr. Ho Yap Kuan, Traffic Superintendent, TPT; and

(b) Mr. Peter Teo, Manager (Port Services), Container Warehousing and Transport Pty. Ltd. The items discussed and the conclusions reached are contained below.

Singapore is handling an increasing number of 45 ft containers as well as many high cubes, although no statistics were yet available. It is believed that in 1989, about 15,000 45 ft containers were handled. They were usually kept in specially designated areas so they would not interfere with the normal container stacking system. High cubes had not yet created handling problems with the present equipment, such as the yard stacking cranes and even the 45 ft boxes had not created major ship-to-shore handling problems.

Since these boxes were usually placed on deck, the visibility was such that the crane operator could handle these boxes without using the flippers of the spreader. Some spreaders were to be telescoped to 45 ft.

Since the sealegs of some gantry cranes were only 50 ft apart, the occasional handling of 48 ft containers left little clearance and operations had to be carried out slowly.

All terminal chassis (some 130) were capable of transporting 45 ft boxes. This had been achieved either by lengthening the existing chassis to 45 ft at a cost between $S 3,000 to $S 5,000 apiece or by purchasing many new 45 ft chassis at a cost of about $S 20,000 apiece. Only at the rear end of the chassis have guide plates been welded to the longitudional direction of the chassis at both sides. All chassis are double axled. When carrying a 45 ft box the spring pins at the 40 ft location are automatically depressed.

Road transport of 45 ft trailers is allowed, provided the trailer has three axles but they sometimes experience turning problems in remote areas.

The approximate purchase costs of road trailers at the time of the visit were:

- Double axle	20 ft	$S 12,000
- Double axle	40 ft	$S 18,000
- Triple axle	45 ft	$S 21,000

The 4.4 m high overhead safeguard at the terminal exit gate prevented excessively high containers from entering the city except when a special permit has been obtained from the Police Traffic Department for designated routes.

To avoid over-investment, the various road haulage companies jointly formed a new company with only 45 ft trailers. It is therefore the only company to transport them.

Singapore has not handled any 8 ft 6 in wide containers.

2 REPORT ON THE VISIT TO HONG KONG IN FEBRUARY 1991

In February 1991, during a mission to China and Hong Kong, the two major container terminals in Hong Kong, Modern Terminals Limited (MTL) and Hong Kong International Terminal (HIT) were visited. Special attention was paid to their handling of non-ISO standard containers. HIT provided some useful data, which has been summarized below.

In 1989, HIT handled 1,068,700 containers, distributed as follows:

20 ft boxes: 556,900 or 52 per cent;
40 ft boxes: 490,600 or 46 per cent; and
45 ft boxes: 21,200 or 2 per cent.

No WIDE BODIED containers were handled. HIGH CUBEs of 9 ft and 9 ft 6 in high) were handled but records of the actual numbers were not kept. The number of 9 ft high boxes was said to be limited, whereas the number of 9 ft 6 in high boxes was significant and estimated to be about 7 to 8 per cent of all the boxes handled.

Of the quay side container cranes, nine units were able to handle containers up to 53 ft long (portal width being 55 ft), and another 16 units were able to handle boxes up to 49 ft long (portal width being 50 ft). All yard gantry cranes could handle containers of all lengths. Chassis were available on the terminal to handle up to 53 ft long containers.

It was reported that any container length over 45 ft would create technical design and weight problems for the telescopic spreaders. It was also recognised that technical difficulties existed in designing a truly universal spreader to fit all container sizes that might be fitted with different corner castings.

The problem of further changes in container dimensions was viewed as a serious problem, because it could lead to large investments and/or adjustments in operational procedures and equipment. For example, of the 76 yard gantry cranes, 20 were fitted with fixed side spreader guides. These would have to be adjusted if the number of non-ISO standard containers increase significantly.

Although trailers were available to carry containers of any length, these were available in limited numbers. When the number of non-ISO standard containers increases, additional equipment will be required.

It was reported, that the existing fork-lift trucks were unsuitable for containers longer than 45 ft. Moreover, the spreaders were limited to containers 8 ft wide.

Increased and more varied container dimensions might lead to segregated stowage on board ships which would have an impact on operational productivity and reduce the effective terminal throughput capability. It might also lead to difficulties in ship planning and to a higher risk of accidents.

Regarding the stacking of containers, more varied dimensions would require heavy investments in ground stacking pads. There would be an increased need to segregate sizes, which would lead to loss of storage capacity and throughput capacity. Modifications in computer control would also be required.

HIT expected, that more than 75 per cent of all non-ISO standard containers would be stripped and stuffed within the port area.

Some 99 per cent of inland transport of containers was done by road. The remaining 1 per cent was transported by barge.

Traffic regulations in Hong Kong were unlikely to be altered to accept truck lengths in excess of 45 ft. Widths up to 8 ft 6 in might be possible. Presently, 45 ft long containers can be transported by truck legally by modifying the truck. This is done by shifting the "king pin" forward to keep the total truck length within legal limits.

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