ANNEX I PORT TARIFF SURVEY QUESTIONNAIRE

- Please provide the "Port Tariff" currently applied.
- Please fill out the table for the following two hypothetical container ships in local currency in 1999.
  - If a port charge currently charged at the terminal is not included in the list provided in the table, please provide information of the port charge by filling out the type, charging party, paying party, rates and basis in local currency in 1999.

1. Hypothetical Ship (3,000 TEU class)

❑ Basic assumptions

- Containership: 40,000 G/T, 22,322 NT, 43,600 DWT, Length: 252m, 3,052 TEU, Draft 9.5m
- Throughput handled: 1,000 TEU (loading 500 TEU, unloading 500 TEU) for full containers
- FEU : TEU = 2 : 1 = 200 FEU : 100 TEU (based on the real practice in the region)
- Yard storage period: 7 days (including free time)
- Berthing time: 16 hours
- Ship's stay in port during daytime (no surcharge)
- For your reference in the (amount) column, the port charges in 1993 are given

❑ Note

- Conservancy: Utilization of general nautical facilities in the approaches to the port (i.e., outside the port area)

- Port dues: Utilization of general nautical facilities within the port including channels, vessel traffic service, emergency fire services, breakwaters, pollution control, marine security
- Pilotage: Provision of pilot includes all matters ancillary to the provision of the pilot, including labour, craft, shoreside facilities etc.
- Tug service: Provision of tugs
- Mooring/Unmooring: Securing a vessel and subsequent release
- (i) Berth hire (=time of ship alongside size of ship) (ii) Wharfage (=volume/weight/size of cargo)
    - Items (i) and (ii) cover the use of the berth and all associated fixtures, facilities and services including berth/anchorage, fendering, channel depth, workers facilities, rail facilities, roads, fencing, lighting, stacking area, pollution control
- Ancillary service: Provision of various services at berth, for example, cleaning, water, electricity, telephone, garbage, security
- Stevedorage: Handling of cargo from ship to wharf or from wharf to ship
- Wharf handling: Handling of cargo from wharf to road/rail or vice versa either directly or through a transit shed
- Extra movement: Handling, restacking, and sorting
- Special cargo handling: Handling of cargo requiring special attention by reefers, over-height etc.
- Storage: Storage of cargo beyond basic time period
- Packing/Unpacking: Packing or unpacking of containers or unit loads
- Equipment/Service/Facility hire: Use of equipment, facilities and services for various cargo operations described above not provided as standard. It also includes use of transit sheds, stacking areas and other facilities when they are not uniquely associated with an individual berth

Questionnaire

Service group	Type of service		Charging party	Paying party	Rate		Amount
					Basis	Unit	
Navigation	Conservancy						
	Port dues						
	Pilotage						
	Tug service						
	Mooring/Unmooring						
	Others						
Berth	Berth hire						
	Wharfage						
	Ancillary service						
	Others						
Cargo operation	Stevedorage						
	Wharf handling						
	Extra movement						
	Special cargo handling						
	Storage						
	Packing/Unpacking						
	Equipment/Service /Facility Hire						
	Others						
Other business	Real estate						
	Licensing						
	Management service and consultancy						
	Others						

2. Hypothetical Ship (1,100 TEU class)

- **Basic assumptions**

  - Containership: 9,800 G/T, 13,000 DWT, Overall length: 147m, Capacity: 1,100 TEU, Draught Max.: 8.3m, Depth Moulded: 11.2m, Breadth: 22.7m
  - Throughput handled: 600 TEUs (loading 300 TEU, unloading 300 TEU) for full containers
  - FEU : TEU = 1 : 2 = 75 FEU : 150 TEU (based on the real practice in the region)
  - Yard storage period: 7 days (including free time)
  - Berthing time: 10 hours
  - Ship's stay in port during daytime (no surcharge)

▫ Questionnaire

Service group	Type of service		Charging party	Paying party	Rate		Amount
					Basis	Unit	
Navigation	Conservancy						
	Port dues						
	Pilotage						
	Tug service						
	Mooring/Unmooring						
	Others						
Berth	Berth hire						
	Wharfage						
	Ancillary service						
	Others						
Cargo operation	Stevedorage						
	Wharf handling						
	Extra movement						
	Special cargo handling						
	Storage						
	Packing/Unpacking						
	Equipment/Service /Facility Hire						
	Others						
Other business	Real estate						
	Licensing						
	Management service and consultancy						
	Others						

ANNEX II LITERATURE ON PORT PRICING

1. "Charging for Port Facilities" by I. G. Heggie

Elasticity of port demand differs greatly according to the type of cargo, type of vessel, characteristics of the port, hinterland conditions etc. For example, oil and iron ore are cargoes that are required in industrial areas located near the port. Therefore, these cargoes have to use a specific port and thus can be categorized as fixed cargo. On the other hand, other cargoes can be handled at ports that contribute to lowering the total cost, which includes inland transportation cost, ocean-borne transport cost, port cost etc. Therefore, these cargoes are categorized as variable cargo.

Port pricing based on marginal cost theory is recommended for variable cargo, whereas average cost pricing is desirable for fixed cargo because demand is not price elastic. Therefore, this article suggests that port pricing be based on cost factors.

Port costs can be divided into two sectors: capital costs and operation costs:

- Capital costs, which are required in constructing port facilities, generally cover depreciation costs and interest costs. The interest cost factor should be included in port costs as a fixed cost;

- Operation costs, which accrue in maintaining and operating the port facilities, consist of dredging costs, maintenance costs, labour costs for operation, and are characterized by both fixed and variable costs.

Amortization payments of capital costs are dependent upon the annual amortization payments based on marginal costs. Basic information for the economic life of assets and assets valuation should be given in advance.

The article suggests that designated replacement costs should be used as a base of assets valuation at present, and that wharfage be based on the amortization payments of a newly built wharf. It can be proved by a mathematical formula that it is simpler to find the service unit for which actual net replacement costs accrued annually than amortization costs based on a ship's size.

The article suggests that the economic life of assets be based on the expected physical life span, and that marginal social opportunity costs for all the resources mobilized in constructing port facilities be reflected in port tariffs.

A port pricing formula taking into account the annual replacement costs can be described as follows:

$$d = \frac{R_o}{V_o}\left[\frac{1-(1+r)/(1+R)}{1-(1+r)/(1+R)^t}\right]\cdot\frac{1}{(1+r)(1+R)}$$

Where d = the due;

R_o = the real replacement cost of the asset in year o;

V_o = the volume of traffic serviced in year o (measured in nrt or freight tons etc.);

r = the rate of growth of the service provided by the asset;

R = the discount rate;

t = the physical life of the asset.

One of the critical considerations is how to allocate the replacement costs of assets in port pricing, that is to say, how to reconcile the cost centre and revenue centre. For example, berth costs should be distributed between the berth hire and wharfage. But berth hire generally depends upon the ship's GRT, NRT or length overall, whereas wharfage depends upon cargo tons. Therefore, berth costs should be allocated based on reasonable criteria.

2. Port Pricing and Investment Policy by E. Bennathan and A. A. Walters

One of the conclusions in this publication is that port pricing should be based on short marginal cost for the port facilities that are used in supplying one unit of port service. This theory is applicable under the free economy system. It is somewhat of an abstract concept, but is necessary for the efficient management of port facilities.

The authors assert that it is most important to find a criterion for facilities tariffs such as berth hire and port dues. They suggest that it should be ship's length

Limitations of the theory

The port pricing method suggested in this publication is purely theory oriented, and has rarely been applied to real pricing cases.

It is impossible to estimate the marginal costs. As they rely on a competitive market, they cannot be applied freely to the public facilities, such as port facilities.

The publication indicates that government subsidy policies are likely to have negative effects rather than positive effects.

3. "The Economics of Port Pricing" by K. J. Button

Ports possess a public utility element and thus marginal cost pricing theory can be applied in determining the cost to be paid by the users.

In fact, the users of a public utility should be charged the marginal social opportunity cost (MSOC) of the resources that they use. This approach is a price mechanism which gives priority to those who are prepared to pay the full costs, including all external costs, of using the services provided by a port.

If port charges are above MSOC, total port capacity will be sub optimally utilized. It will encourage ships to divert to other, possibly less efficient, ports that are cheaper.

It is assumed that a port exists which offers a range of identical berths to vessels, each berth being equally attractive to potential users. The actual marginal financial costs to the port authority of handling each ship is considered identical and charges are assumed to reflect these direct short-term costs incurred by the port authority in operating a berth.

In any time period, there will be a sufficient number of potential users. Thus, a demand curve reflecting their desire to use the port facilities at different levels of price can be drawn. This demand curve will be negatively sloped to reflect the fact that some ships will be willing to pay more to use a berth than others.

Factors such as the availability of similar alternative facilities at adjacent ports and the future commitments of ships will influence the slope of this curve.

If the number of berths available and the demand for them match, then there will not be problems in berth allocation. In most cases, however, the actual supply of berths is limited relative to the demand for them. Therefore, where the supply of facilities is limited, excess demand occurs, resulting in ship congestion.

In such circumstances, some vessels, if a berth is assured at a definite charge, will either divert to other ports or reorganize sailings. In such cases, the probability demand curve which reflects the influence of the probability of not being able to dock immediately and adjustment of charges is located below the demand curve.

To alleviate port congestion, a higher charge must be levied. When the optimum congestion charge is levied, there is no excess demand and the probability demand curve becomes identical to the actual demand curve, reaching a balance.

The revenue collected by the port authority in excess of short-run marginal costs incurred in handling ships can be used for future port investment. When capacity is increased to that level where no congestion supplement needs to be added into MSOC, the port is of optimum size.

However, it will not be so easy for the port authority to devise the ideal MSOC pricing policy owing to fluctuating demands, inadequate information, administrative problems etc. Although it is very difficult to find, within a short-term period, a demand curve and a probable demand curve which are in line with the financial objectives of the port authority, this theory suggests that the probable demand curve is inside the actual demand curve. Therefore, where excess demand occurs, it is more advantageous to apply the MSOC pricing policy than the conventional analysis method.

4. "Port Charging Practices" by B. J. Thomas

This paper provides an analysis of the merits and demerits of various theories on port stevedoring charges.

(a) Commodity rate method

Commodity classification is based on the cargo-handling characteristics of the commodity in question. A cost analysis is conducted on the cargo by applying the average stevedoring cost in the stevedoring tariff. This practice has resulted in some complex tariff structures because cargo types, stevedoring methods and input elements are diverse.

According to this method, the commodity rate is calculated on the basis of costs. A fixed rate is levied per work unit of each commodity. Therefore after a certain period, the rates have to be adjusted to reflect the market situation.

In such cases, even if productivity increases and cost reduces, it acts as an incentive to improve productivity for the stevedoring companies because a fixed rate is applied. However, from the dockworker's viewpoint, it is not a good method to enhance productivity because even if they improve productivity, they still receive a fixed wage. To sum up, this method has a complex tariff structure and is not a sufficient incentive for enhancing productivity.

(b) Cost-plus method

The cost-plus method is widely used. The charges applied guarantee the direct cost from stevedoring and overhead costs. Cost is reduced with improved productivity and a certain level of bonus is paid to labour.

However, if productivity improves, direct cost decreases and profit automatically is reduced. In addition, the investment in equipment is not compensated and thus provides no incentive for productivity improvement.

(c) Sliding scales method

This method considers the average stevedore's costs and fixed profit, and compares them with a predetermined productivity to arrive at the initial rate. Productivity fluctuation is reviewed on a regular basis during the contract period, and it is linked to the rate.

It contributes to improving productivity because the shipowner and stevedore jointly assumes responsibility for production fluctuation by sharing the burden of cost reduction resulting from productivity improvement.

However, there is the difficulty of predetermining in-depth the cost and productivity.

(d) Consolidated system

A consolidated rate for each commodity is predetermined that incorporates numerous costs associated with various stages of stevedoring. This is then quoted as a single rate per stevedoring unit.

If the rate is determined wrongly, the stevedore may incur losses, so strict pre-investigation is required for rate determination. This method allows for a simple and easy application of the rate.

5. Usage Pricing for Public Marine Terminal Facilities by MARAD (U.S. Department of Transportation Maritime Administration)

This publication provides the formula for calculating port charges under the concept that port charges have to be determined so as to recover costs.

First, depreciation, maintenance cost, taxes and insurance fees, terminal operating cost, general administration cost etc. were calculated in order to determine the port operation cost. Second, the imputed cost for the port is estimated and calculated.

Third, costs apart from the costs mentioned above are estimated and calculated. Fourth, total revenues can be calculated by adding the above three costings.

Revenues from port facilities charges, except for wharfage should be calculated first. This requires the calculation of berth hire, wharf preferential charges, storage and other port charges.

In order to estimate wharfage, sums of all the port revenues except for wharfage should be deducted from the target revenue and this value should be divided by total cargo throughput volume of the port. This produces wharfage per unit cargo.

The publication is a useful guide in port pricing. However, it has two defects. It does not take into account the full cost of private sector terminal leases, which constitute a substantial part of port charges, and it does not deal with port charges for the water facilities.

ANNEX IV TRIGGERMODEL FOR TARIFF REVISION

When the cost analysis is finished, one might suppose that relating the cost data to tariffs would be the next logical step. But if the port charges of nearby ports are not so high rather lower than those of one's own port, then the cost data will not work satisfactorily as tariff guidelines. This is particularly true nowadays as the services provided by the ports are under severe competition.

It has, so far, been assumed that cost retrieval is a natural process. The increase in port charges in proportion to price increases is a critical process. A remarkable example of a tariff increase is found in the United States of America, where the port authorities were forced after 1970 to increase the port price. Ports in the United States did not change their berth hire and wharfage between 1948 and 1966. But port authorities increased their port charges shortly after 1970, supporting the rationale that the tariff level should be kept in line with the price increase. One advantage of this solution may be that it has sometimes been found very effective in detering the sharp increases in the port tariff.

Apart from these basic propositions, the following factors should be considered in adjusting and revising port tariff levels:

(a) Port tariffs, with reference to fluctuating price levels, should be increased at regular intervals;

(b) The rate of port price increase should be kept as low as possible at short time intervals;

(c) The port authorities need to gain full understanding for the increase from the users, and are consequently under an obligation to give rational and righteous reasoning for the increase.

1. Introduction

If a port tariff model is set suitably for a port and a port tariff level decided, then the port tariff level should be amended based on the change of economic situation each year.

Generally, the price index reflects normal economic fluctuations. Port authorities, as service providers, can maintain real port price per cargo or ship by making port tariff levels respond to the price index.

It goes, however, without saying that, if current charges are already kept too low, or if the port policy is to gain some commercial profit in the long run, there is a need to increase the real price strategically and gradually. In this case, the increase in real GDP should be considered as the maximum increase rate for port prices. For example, a stevedoring company can expect to increase their own port charge (stevedorage) taking into account the rate of increase of real GDP.

But a port charge item may consist of more than one service. For example, on-board stevedorage is made up of T/S charge, shifting charge and cargo handling charge. If the cargo composition rate of the stevedoring company is changed for a particular year, the real income of the company may not be maintained in spite of applying the price index.

It would be reasonable to introduce the port tariff change model so that the real income of the service provider (whether it be public or private sector) is maintained instead of applying the price level by charge item.

2. Model

The port tariff change model can be set as follows.

The average income of a port during fiscal year t is given by:

$$UP_t = \frac{R_t}{T_t}$$

UP_t: unit income earned by all related service providers for all services during the fiscal year t

R_t: total income earned by all related service providers during the fiscal year t

T_t: estimated traffic volume for the related service during the fiscal year t

The maximum unit price of all the normal services provided by a specific service provider is therefore:

$$MUP_t = CPI_t * \sum_{s=1}^{n} \left[UP_{s,b} * \frac{T_{s,t}}{T_t} \right]$$

MUP_t: the maximum unit price provided by the service provider of related charges during the fiscal year t

CPI_t: consumer price index in fiscal year t

b : base year

$UP_{s,b}$: unit income by service provider related to the service category p during the beginning year. In other words, the following must hold true: the UP in $/GT) that all regulated entities derive from regulated prices charged for the provision of, or in connection with, regulated services provided by that regular service provider in connection with channel service category p during the base year calculated in accordance with the following formula:

$$UP_{s,b} = \frac{R_{s,b}}{T_{s,b}}$$

$R_{s,b}$: The total revenue that all regulated entities derive from regulated prices charged for the provision of, or in connection with, regulated services provided by that regulated service provider in connection with service category s during the base year

$T_{s,b}$: the expected traffic volume of related service category S during fiscal year t. $T_{s,t}$ > fiscal year t. $T_{s,b}$ ->base year

T_t : the traffic demand during fiscal year t such as stevedoring quantity, tonnage of ship arrivals)

$\sum_{s=1}^{n}$: the sum of all service categories

If the real income of the service provider is allowed to be increased, then the final model in the system is given by

$$MUP_t = CPI_t * \sum_{s=1}^{n}\left[UP_{s,b} * \frac{T_{s,t}}{T_t}\right] * IRGDP_t$$

It is important $IRGDP_t$: increase in real GDP during the base year to note that the ultimate decision to allow real GDP increases is the responsibility of the port authorities.

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