INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Series D

Supplement 2
(11/1988)

SERIES D: GENERAL TARIFF PRINCIPLES

Charging and accounting in international telecommunications services

Method for carrying out a cost price study by regional tariff groups

ITU-T D-series Recommendations – Supplement 2

Originally published in Blue Book (1988) – Fascicle II.1

NOTES

1 Supplement 2 to the D-series Recommendations was approved in Melbourne (1988) and published in Fascicle II.1 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2 In this Supplement, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Supplement 2 to ITU-T D-series Recommendations

METHOD FOR CARRYING OUT A COST PRICE STUDY BY REGIONAL TARIFF GROUPS[1]

1 Introduction

Tariffs for telecommunication services are normally established on the basis of cost incurred by the Administrations for providing the services, and of certain other factors which can be summarized as the value of service rendered or the market price. These factors are explained in Recommendation D.5.

For international services a clear distinction is made - especially since 1968 - between the accounting rate and the collection charge. Definitions and explanations of these terms and of international accounting procedures are given in Recommendation D.150. Accounting rates are regarded as a matter to be settled between Administrations, each Administration being reimbursed according to the cost of the equipment it makes available. On the other hand, the determination of collection charges is, within limits, a national matter. While accounting rates are, or should be, based essentially on costs, collection charges depend on costs as well as on the value of service rendered and other factors.

The main tasks which the regional Tariff Groups have to perform are undoubtedly an analysis of the costs of the different telecommunication services provided, and the determination of accounting rates proposed for application by the Administrations of a region. For this purpose, each Tariff Group had to develop a suitable working method to be followed in its region. A description of such methods, especially of an analytical method, is given in Supplement No. 1 to the Series D Recommendations.

2 Methods used for establishing tariffs

Two basic methods can be used for international tariff studies, namely:

1) *The synthetic method*

   This is a simple, purely pragmatic method which consists in comparing existing tariffs applied within a region and agreeing on generally applicable standards for international accounting This method leads to satisfactory results if the tariffs applied by the different Administrations reflect the actual costs of providing the services;

2) *The analytical method*

   As the term implies, it is a procedure for analysing in a more or less detailed manner the cost involved in making specific equipment available to other Administrations or providing a traffic unit in a given telecommunication service. Analysis of the cost situation, the operating conditions and the available statistical data is the only way to obtain realistic standards for determining the accounting rates and, finally, the collection charges.

   The analytical method has been used particularly by the regional Tariff Group for Europe and the Mediterranean Basin, the TEUREM Group. Since 1969, this Group has consistently pursued its studies and refined its working method.

3 Implementation of an analytical cost price study

3.1 *Difficulties to be overcome and problems to be solved before undertaking a cost price study*

The Administrations belonging to a Tariff Group have to be convinced that it is in their own interest to undertake cost price studies and apply recommended standard rates, as such standards lead to harmonized tariff structures for the different telecommunication services and guarantee the most equitable remuneration of the various facilities made available by the Administrations. Each Administration should know where the costs arise, in what direction these costs are developing and also what the situation is in other, comparable countries.

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[1] Text of a lecture delivered at a seminar held in Tokyo in May 1984.

In order to conduct an international cost price study successfully, Administrations have to be assured that all data provided by them will be treated confidentially and that all problems can be discussed openly. Genuine collaboration by all parties is required in working towards the common goal.

Therefore it is essential that:

– only representatives of Administrations and recognized private operating agencies take part in the meetings of the Tariff Group;

– the meetings be conducted in an absolutely neutral and objective manner;

– the data provided and the detailed results be made available only to the parties directly concerned.

3.2 *Methodology to be adopted for conducting a cost price study*

To accomplish a cost price study, at least two meetings of the Tariff Group are necessary, and the delegates will have to carry out considerable preparation and investigation work within their Administrations.

3.3 *Preparation of questionnaires*

It is of great importance that the Group asks precisely all the questions to which it needs answers from the Administrations, giving the necessary details and explanations. This task, considered as the *first step* of the study, is normally completed during the first meeting of the Tariff Group within a study period. An example of such a questionnaire is shown in Annex A to Supplement No. 1 to the Series D Recommendations. It may also be helpful for the Administrations to obtain the numerical data collected and agreed to in a former study.

A detailed questionnaire is normally prepared for each service, namely:

– the telephone service;

– the telex service;

– the public telegram service;

– sound-programme and television transmissions;

– circuits routed via satellites, etc.

For services with similar features and conditions, such as telephone and telex, a single questionnaire may be established.

Each questionnaire should be subdivided, according to needs, into several parts and chapters dealing with:

– general information;

– cost information;

– statistical data.

Practice has shown that it is convenient to consider the telephone as the basic service, from which a great number of data can be derived and used for the studies of other services, such as telex, sound-programme transmissions, etc. *The different questionnaires should ask only for data which the Tariff Group is not able to derive itself from the basic study*.

3.4 *Replying to questionnaires*

The *second step* to be undertaken in the study is the preparation of replies by the Administrations of the region. It is a delicate and difficult task, as the data are in most cases not immediately available in the required form or presentation. Each service has to be analysed, and a great deal of research, calculations and estimates are necessary. An *analytical cost accounting system can provide only general data* for a given service, for instance the annual charges per centre or service, but it cannot provide details for the facilities made available. Specialists from the different services will have to calculate these detailed data using the general accounting system, statistics, and their own documents. In order to assure consistency between the different parts of a study, and from one study to the next, an expert representing his Administration in the Tariff Group must act as coordinator at home and explain to his colleagues how the questions have to be interpreted. *Preparing the answers to the questionnaire means team-work by generalists and specialists*, since all-rounders are rare in today's complex telecommunications environment.

As a rule, the Administrations need several months to prepare their replies.

3.5 *Analysis of the replies and completion of the study*

This is the *third step* which the Tariff Group has to undertake, usually during a meeting lasting several days. Its success depends mainly on the *preparation work* done by the CCITT Secretariat and the Group Chairman.

The CCITT Secretariat analyses the replies provided by the Administrations and presents the numerical data anonymously in the form of tables. Examples of such tables are given in Annex B to Supplement No. 1 to the Series D Recommendations.

It is useful for the Chairman to draw up beforehand a complete calculation model in order to determine the path to follow in order to lead the study to the best possible result. The Chairman should know in advance the likely outcome of the study. He should be able to provide the delegates with background information on each item. During the meeting, the Chairman should serve the Group as moderator, adviser and decider. It is important that everybody should be able to speak openly and that an atmosphere of confidence should reign throughout the meeting.

An international cost price study is not just a matter of calculation. It is much more a joint effort which should lead to a coherent, harmonious and durable tariff structure for the full range of the telecommunication services offered, and should reflect the actual cost and operating situation of a region. Tariffs should evolve in small steps according to the development of technology, operating procedures and economic situation. This goal can best be achieved if a study method, once adopted, is maintained and gradually improved from one study period to another.

The agenda of the meeting is drawn up with a view to guiding the study to its final goal in the most efficient possible way: draft Recommendations for the determination of accounting rate shares and collection charges. It starts with the study for the basic service in the following order:

1) A standard reply is calculated and agreed for each item of the questionnaire, based on the individual replies given by the Administrations.

2) From the data thus obtained, a whole series of detailed calculations are made in order to derive the average cost price of each equipment made available (annual cost and unit cost) for the year to which the data refer (reference year). These figures are then updated to the year when the standard rates shall become effective.

3) Generally acceptable standard rate shares are then determined which will apply during the next study period.

4) Recommendations containing these standard rates and the rules for applying them are drafted.

4 Considerations relating to an analytical cost price study

4.1 *Analysis to be made*

4.1.1 *Analysis of basic elements for the provision of a service*

Since an international telecommunication service provided to users involves both the international network and the national networks of the terminal countries, we have to distinguish between the three following basic elements:

– the line (transmission) part of the international network, which includes the various transmission systems used and is normally a function of the distance;

– the international exchanges, i.e. the switching parts of the international circuit, plus the terminal transmission equipments located in the terminal countries and, where appropriate, in the transit countries;

– the national extensions, which denote the part of the national network of each terminal country involved in completing the connection.

4.1.2 *Analysis of the cost structure*

When calculating the total cost of a given service, we have to analyse for each element the nature of the costs and their components. The following distinctions are made:

– investment costs and annual costs;

– financial charges, maintenance costs, building costs and operating costs;

– total annual charges and traffic-unit costs;

– fixed costs and variable costs;

– directly allocated costs and overhead costs.

4.1.2.1 *Investment costs*

The investment costs relating to the reference year are first calculated per given equipment (circuit) installed, and next per equipment in service. They are then updated to the year when the tariffs shall become effective. To obtain these results, coefficients are applied which take account of:

– standbys (installed apparatus/apparatus in service);

– price increases (annual rates of change);

– composition of the standard network (relative importance of coaxial cables, radio-relay links, etc.);

– the ratio: "actual length/crowflight distance" of transmission facilities.

4.1.2.2 *Annual costs*

The basis for completing the cost price study is the total annual charges per piece of equipment in service. These charges are compounded by adding the amounts obtained for the "transmission" part and the "switching and operations" part under the headings:

– financial charges;

– maintenance costs;

– building costs;

– operating costs.

4.1.2.2.1 *Financial charges*

The average investment costs are used to calculate the annual financial charges on the basis of the weighted average life assumed for the equipment and the interest rate assumed for return on invested capital. For this purpose the "Table giving amortization coefficients as a function of amortization period and interest rate" is used.

4.1.2.2.2 *Maintenance costs*

The average annual maintenance costs are calculated per given equipment. They correspond in many cases to an agreed percentage applied to the investment costs.

4.1.2.2.3 *Building costs*

These costs are usually calculated in the form of an annual rental for the space occupied by an equipment.

4.1.2.2.4 *Operating costs*

These costs refer only to costs of staff responsible for operating a service (setting up of calls, etc.)

4.1.2.3 *Traffic unit costs*

To calculate the traffic unit costs (minute of telephone or telex call, etc.) the total annual charges for an international circuit are divided by the average number of traffic units for this circuit per year. The average number of traffic units is extracted from the statistical data provided by the Administrations in their replies to the questionnaire.

4.2 *Methods used for calculating average costs*

According to the nature of the service provided, it is recommended that one of the following methods be used to calculate the average costs for a region.

4.2.1 *Analytical cost comparison*

Where the individual equipments made available for providing a service and the structure of the network are similar in the different countries, it is customary to compare the detailed numerical data provided by the Administrations and to calculate the costs for each element, step by step, according to the classical analytical method. This method is generally used for determining the average cost of the *international part* of a service.

4.2.2 *Direct comparison of national costs*

Where the equipment made available and the structure of the network differ considerably from one country to another, a simplified method is normally applied. This method is used especially for determining the average cost of the national extension.

In this case, the costs calculated by the Administrations for their respective countries are compared directly per traffic unit (minute) for one of the following elements or services:

- local or trunk exchange;
- a terminal transmission equipment;
- 100 km (crowflight) of national circuit;
- billing of subscribers, international accounting, management of internaitonal services (administrative costs).

To calculate the average total cost of the national extension per traffic unit, the Administrations should also provide statistical and financial data enabling the Tariff Group to make a genuine comparison.

It is pointed out that this method is not identical with the "Synthetic method", as *cost elements* and not *existing tariffs* are compared.

5 Examples of cost price studies

5.1 *Cost price study for the international telephone service*

5.1.1 *Determination of mean values and rules for the calculation*

Preliminary remarks

- All amounts are expressed in gold francs.
- The data have been chosen as examples and relate to the year 1980, called the *reference year*.
- The *target year* adopted is 1986, i.e. the standard rates determined would correspond to the cost situation at the beginning of 1986.
- The rate of return on capital investment provides not only for the remuneration of capital but also for a reasonable financial return.
- The annual rate of change represents the expected change in costs due to inflationary cost increases on the one hand, and cost savings due to technological developments on the other hand.

5.1.1.1 *Financial data*

Rate of return on capital investment	15%
Annual rate of change:	
– for capital investment	+4%
– for staff costs	+5%

5.1.1.2 *Costs for the line (transmission) part (simplified example)*

5.1.1.2.1 *Investment*

a) *Supergroups (installed) in a:*

– coaxial land cable: (terminal equipment)	A	20 000
(100 km real length)	B	200 000
– radio-relay link	A	(same as for a coaxial cable)
	B	150 000
– coaxial submarine cable:	B	300 000

b) *Groups:*

	A	10 000
	B	(1/5 of supergroup)

c) *Carrier telephone circuits:*

	A	5 000
	B	(1/60 of supergroup)

5.1.1.2.2 *Annual costs*

a) *amortization costs*

average useful lives:

– element A: 12 years

– element B: coaxial cables: 25 years
radio-relay links: 15 years

b) *maintenance costs*

percentage of investment costs:

– element A: 2%

– element B: coaxial cables: 1%
radio-relay links: 5%

c) *annual charges for buildings* (for element A only)

supergroup	80
group	30
carrier telephone circuit	11

5.1.1.3 *Costs for the switching part (simplified example)*

5.1.1.3.1 *Investment*

costs per carrier telephone circuit

– automatic outgoing:	22 000
– automatic or semi-automatic incoming:	20 000

5.1.1.3.2 *Annual costs*

a) *amortization costs*

average useful life: 15 years

b) *maintenance costs*

percentage of investment costs: 5%

c) *annual costs for buildings per circuit*

– automatic outgoing:	150
– automatic or semi-automatic incoming:	100

d) *annual operating costs per circuit in use*

– automatic outgoing	3 000

5.1.1.3.3 *Statistical information*

Number of chargeable minutes per circuit in use per year:

– semi-automatic and automatic: 65 000 minutes

5.1.1.4 *Costs for the "national extension" (simplified example)*

5.1.1.4.1 *Statistical information*

– number of national exchanges used for international calls (weighted average): 3

– number of terminal transmission equipments used (weighted average of A elements): 2

– crowflight length of national circuit used (weighted average): 150 km

5.1.1.4.2 *Financial information*

– cost for use of a national exchange per minute: 0.06

– cost for use of a terminal transmission equipment (element A) per minute: 0.02

– cost for use of 100 km of national circuit per minute: 0.05

– administrative cost per minute: outgoing: 0.10
incoming: 0.05

5.1.2 *Example for calculating costs in reply to the questionnaire*

5.1.2.1 *Average investment costs per 100 km of route of a supergroup (60 channels) actually installed in a coaxial cable*

Basis:

Coaxial cable containing *4 systems at 12 MHz* + 1 spare system.

Maximum capacity: 4 × 2700 circuits = 10 800 circuits or *180 supergroups*

Actually installed (2/3 of capacity) = 7200 circuits or *120 supergroups*

Translation equipments: 0.5 equipment per 100 km (supermastergroup + supergroup = two A elements + 1 filter)

The amounts include *30% for overheads*.

Calculation:

– *cost of the cable* per 100 km of real length: 16.4 million gold francs
intermediate repeaters 4.12 million gold francs
20.52 million gold francs

– *cost per supergroup actually installed:*

  – *cable* 20.52 million gold francs: 120 supergroup 171 000 gold francs

  – *translation equipments:*

    supermastergroup

    two A elements at 78 000 = 156 000
    1 filter = 33 000
    189 000 × 0.5 = 94 500

    per supergroup (1/15) 6 300 gold francs

    supergroup

    two A elements at 20 800 = 41 600
    1 filter = 8 000
    49 600 × 0.5 = 24 800 gold francs

Total cost for a supergroup 202 100 gold francs

5.1.2.2 *Average investment cost for a terminal equipment (element A) of a carrier telephone circuit actually installed*

The amounts include *30% for overheads*

Calculation:

– element A for a supergroup: 20 800 gold francs

– element A for a group:
1/5 of supergroup = 4160 + group 5940 = 10 100 gold francs

Element A for a carrier telephone circuit

1/12 of group = 842 + carrier circuit 3958 = 4 800 gold francs.

5.1.2.3 *Annual charges for buildings per terminal equipment (element A) of a carrier telephone circuit actually installed*

Basis:

Annual rental per m^2 = 260 gold francs (analytical cost accounting)

Calculation:

– surface occupied per rack (about 1 m^2) × coefficient "occupied surface/accessory surface" (= 4) = 4 m^2

– annual rental per rack = 4 × 260 gold francs = 1 040 gold francs

– surface per group: 0.117 m^2 = 30 gold francs

Surface per carrier telephone circuit
(average per rack, new and old equipment, 121 circuits)

0.033 m^2 + 1/12 of group (= 0.010) = 0.043 m^2 × 260 gold francs = 11 gold francs

5.1.3 *Calculation of mean costs*

Example for calculating the transmission costs per carrier telephone circuit

5.1.3.1 *Investments*

	Element A	*Element B*
investment 1980:	5000	3333 (1/60 of 200 000)[2]
coefficient of increase for spares:	1.35	1.50
total costs 1980:	6750	5000
cost increase: annual:	2%	4%
coefficient 5 years:	1.104	1.216
investment 1985:	7452	6080
Weighting coefficient of typical network	–	coax. cables 0.50
	–	radio-relay 0.40
	–	submarine cable 0.10
Investment 1985 (typical network):	7452	5000 (approx.)
real length/crowflight distance ratio:	–	1.3
Overall results 1985:	7452	6500

[2] Investment for a supergroup installed in a coaxial land cable.

5.1.3.2 *Annual costs*

	Element A	*Element B*
Capital costs		
investments 1985:	7452	6500
useful life (years)	12	20
amortization coefficient (i = 15%)	0.1845	0.1598
annual amortization	1375	1039
Maintenance costs		
percentage of investment cost 1980	2% (of 5000)	2.5% (of 4000 approx.)
amount per circuit installed 1980:	100	100
per circuit in use 1985:	250 (approx.)	250 (approx.)
Charges for buildings		
per circuit installed in 1980:	11	–
per circuit in use in 1985:	ca. 25	–
Total annual costs per circuit in use 1985		
capital costs	1375	1039
maintenance	250	250
buildings	25	–
Total:	1650	1289

5.1.4 *Cost per minute of an international telephone call (automatic service)*

5.1.4.1 *Transmission part*

Element B

Cost per 100 km of circuit per minute:
1289 gold francs : 65 000 minutes = 1.98 gold centimes

Element A

Cost per minute:
1650 gold francs : 65 000 minutes = 2.54 gold centimes

5.1.4.2 *Switching part*

Switching equipment

– *outgoing:*

Example: per year 7000 gold francs : 65 000 minutes = 10.77 gold centimes

– *incoming:*

Example: per year 6000 gold francs : 65 000 minutes = 9.23 gold centimes

Operation (outgoing only)

Example: per year 4000 gold francs : 65 000 minutes = 6.15 gold centimes

5.1.4.3 *National extension*

Assumption: annual rate of change = 0, i.e. cost 1980 = cost 1985.

– national exchanges (3 × 0.06 gold francs)		18.0 gold centimes
– terminal transmission equipments (Element A) (2 × 0.02 gold francs)		4.0 gold centimes
– national circuits: (average 150 km) (1.5 × 0.05 gold francs)		7.5 gold centimes
– administrative cost:	outgoing:	10.0 gold centimes
	incoming:	5.0 gold centimes
Total cost per minute	outgoing:	39.5 gold centimes
	incoming:	34.5 gold centimes

5.1.4.4 *Total cost per minute of an international telephone call*

	outgoing	*incoming*
Transmission part (Element B)		
example 500 km (5 × 1.98 gold centimes) =	9.9 gold centimes	9.9 gold centimes
Switching part (1 exchange)		
element A (transmission)	2.54 gold centimes	2.54 gold centimes
switching equipment	10.77 gold centimes	9.23 gold centimes
operation	6.15 gold centimes	– gold centimes
National extension	39.5 gold centimes	34.5 gold centimes
Total cost per minute:	68.86 gold centimes	56.17 gold centimes

5.2 *Cost price study of telephone-type circuits set up via satellite (INTELSAT)*

5.2.1 *Preliminary remarks*

An earth station is defined as the total equipment installed on a site and consisting of one or several antennas.

For the calculation of mean costs, it is impossible to compare the detailed cost components provided by the Administrations. Two methods can be used:

1) calculate, for each Administration which has supplied data, the annual cost price of a telephone circuit by dividing the overall annual cost of the earth station by the number of telephone circuits set up via the station, and then take the average of the separate cost prices calculated in this way;

2) add up the total annual costs of the telephone service indicated by each Administration and divide the total figure thus obtained by the total number of circuits set up over the various earth stations for which replies have been submitted.

The data concerning the extension circuit between the earth station and the gateway (Element B + 1 Element A at the gateway) are taken from the study for the international telephone service.

5.2.2 *Investments for telephone-type circuits*

Example for an earth station with 2 antennas

	Investments 1980 gold francs	*Useful life* years
Construction and installation costs of an earth station:		
– land	4 000 000	–
– building	39 000 000	40
– power supply system	16 000 000	15
– auxiliary equipment	1 200 000	20
– antennas:		
mechanical part	23 000 000	10
electronic part	40 500 000	10
– terminal equipment (2 A elements at the station)	9 500 000	15
	133 200 000	

Overheads of 46% are included in these costs.

5.2.3 *Annual costs (financial charges)*

	Costs 1980 gold francs
– land (interest only)	232 400
– building (amortization)	2 383 600
(maintenance)	235 200
– power supply system	1 680 000
– auxiliary equipments (air conditioning, etc.)	103 200
– antennas:	
mechanical part	3 110 000
electronic part	5 388 000
– terminal equipment	930 000
Total annual financial charges:	14 062 400

5.2.4 *Operating costs*

	Costs 1980 gold francs
– operational staff (including 50% for overheads)	2 535 200
– power	345 100
– consumable goods	511 300
– maintenance (staff costs are included in operational staff costs; maintenance under this item refers therefore to third party costs including 50% of overhead costs)	625 400
– other costs (motor cars and material)	7 100
Total operating costs	4 024 100

5.2.5 *Total annual costs*

– financial charges	14 062 400
– operating costs	4 024 100
Total annual costs:	18 086 500

5.2.6 *Traffic elements*

– average number of telephone-type circuits during 1980: 350 circuits

5.2.7 *Statistical data*

– 1980: number of antennas = 2
equipped for 407 circuits (in use on the average: 350 circuits)

– 1985: Number of antennas = 2
equipped for 1200 circuits (in use on the average: 1100 circuits)

– length (km) of the extension circuits to the gateway: 300 km

5.2.8 *Annual costs per telephone-type circuit*

– *1980 (reference year)*

– total annual costs of the earth station:	18 086 500 gold francs	
– costs per circuit (1/350)		51 675 gold francs
+ extension circuit to gateway (300 km at 1289)		3 867 gold francs
+ 1 Element A at gateway		1 650 gold francs
Total costs per circuit:		57 192 gold francs

– *1985 (target year)*

– total annual costs of the earth station:

1980:	18 086 500 gold francs
1985: cost increase in 5 years at 5% p.a. = coeff. 1.276	23 000 000 gold francs
+ additional equipments:	16 000 000 gold francs
Total	39 000 000 gold francs

Number of circuits in use: 1100

Costs per circuit (1/1100)	35 454 gold francs
+ extension circuit to gateway (300 km at 1289)	3 867 gold francs
+ 1 Element A at gateway	1 650 gold francs
Total costs per circuit:	40 971 gold francs

6 Conclusions

The description of the analytical cost study method contained in §§ 1 to 4, together with the examples of cost calculations in § 5, may help regional Tariff Groups to undertake their own studies for the full range of telecommunication services provided. Although the data used in the examples are hypothetical, they reflect an actual situation existing in the study period 1981 to 1984.

Geneva, 2004