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TELEPHONE NETWORK AND ISDN

QUALITY OF SERVICE, NETWORK MANAGEMENT AND TRAFFIC ENGINEERING

NUMBER OF CIRCUITS TO BE PROVIDED IN AUTOMATIC AND/OR SEMIAUTOMATIC OPERATION, WITHOUT OVERFLOW FACILITIES

ITU-T Recommendation E.520

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation E.520 was published in Fascicle II.3 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 Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Recommendation E.520

NUMBER OF CIRCUITS TO BE PROVIDED IN AUTOMATIC AND/OR SEMIAUTOMATIC OPERATION, WITHOUT OVERFLOW FACILITIES

This Recommendation refers to groups of circuits used:

- in automatic operation;
- in semiautomatic operation;
- in both automatic and semiautomatic operations on the same group of circuits.

1 General method

1.1 The CCITT recommends that the number of circuits needed for a group should be read from tables or curves based on the classical Erlang B formula (see Supplements Nos. 1 and 2 at the end of this fascicle which refers to full availability groups). Recommended methods for traffic determination are indicated in Recommendation E.500.

For *semi-automatic operation* the loss probability *p* should be based on 3% during the mean busy hour.

For *automatic operation* the loss probability *p* should be based on 1% during the mean busy hour.

Semiautomatic traffic using the same circuits as automatic traffic is to be added to the automatic traffic and the same parameter value of $p = 1\%$ should be used for the total traffic.

The values of 3% and 1% quoted above refer to the Erlang B formula and derived tables and curves. The 3% value should not be considered as determining a grade of service because with semiautomatic operation there will be some smoothing of the traffic peaks; it is quoted here only to determine the value of the parameter *p* (loss probability) to use in the Erlang B tables and curves.

1.2 In order to provide a satisfactory grade of service both for the mean busy-hour traffic and for the traffic on exceptionally busy days, it is recommended that the proposed number of circuits should, if necessary, be increased to ensure that the loss probability shall not exceed 7% during the mean busy hour for the average traffic estimated for *the five busiest days* as specified in Recommendation E.500.

1.3 For *small groups of long intercontinental* circuits with automatic operation some relaxation could be made in respect to loss probability. It is envisaged that such circuits would be operated on a both-way basis and that a reasonable minimum for automatic service would be a group of six circuits. A table providing relaxation in Annex A is based on a loss probability of 3% for six circuits, with a smooth progression to 1% for 20 circuits. The general provision for exceptional days remains unchanged.

For exceptional circumstances in which very small groups (less than six intercontinental circuits) are used for automatic operation, dimensioning of the group should be based on the loss probability of 3%.

2 Time differences

Time differences at the two terminations of intercontinental circuits are likely to be much more pronounced than those on continental circuits. In order to allow for differences on groups containing both-way circuits it will be desirable to acquire information in respect to traffic flow both during the mean busy hour for both directions and during the mean busy hour for each direction.

It is possible that in some cases overflow traffic can be accepted without any necessity to increase the number of circuits, in spite of the fact that this overflow traffic is of a peaky nature. Such circumstances may arise if there is no traffic overflowing from high-usage groups during the mean busy hour of the final group.

3 Both-way circuits

3.1 With the use of both-way circuits there is a danger of simultaneous seizure at both ends; this is particularly the case on circuits with a long propagation time. It is advisable to arrange the sequence of selection at the two ends so that such double seizure can only occur when a single circuit remains free.

When all the circuits of a group are operated on a both-way basis, time differences in the directional mean busy hours may result in a total mean busy-hour traffic flow for the group which is not the sum of the mean busy-hour traffic loads in each direction. Furthermore, such differences in directional mean busy hour may vary with seasons of the year. However, the available methods of traffic measurement can determine the traffic flow during mean busy hour for this total traffic.

3.2 Some intercontinental groups may include one-way as well as both-way operated circuits. It is recommended that in all cases the one-way circuits should be used, when free, in preference to the both-way circuits. The number of circuits to be provided will depend upon the one-way and total traffic.

The total traffic will need to be determined for:

a) each direction of traffic;

b) both-way traffic.

This determination is to be made for the busy hour or the busy hours corresponding to the two cases a) and b) above.

In the cases where the number of one-way circuits is approximately equal for each direction, no special procedure is necessary, and the calculation can be treated as for a simple two-group grading [1].

If the number of one-way circuits is quite different for the two directions, some correction may be needed for the difference in randomness of the flow of calls from the two one-way circuit groups to the both-way circuit group. The general techniques for handling cases of this type are quoted in Recommendation E.521.

ANNEX A

(to Recommendation E.520)

Table A-1/E.520 may be applied to small groups of long intercontinental circuits. The values in column 2 are suitable for a random offered traffic with full availability access.

The table is based on 1% loss probability for 20 circuits and increases progressively to a loss probability of 2% at 9 circuits and 3% at 6 circuits (loss probabilities for these three values being based on the Erlang loss formula: see Supplement No. 1). The traffic flow values obtained from a smoothing curve coincide very nearly with those determined by equal marginal utility theory, i.e. an improvement factor of 0.05 Erlang for an additional circuit.

For groups requiring more than 20 circuits the table for loss probability of 1%, mentioned in Supplement No. 1, should be used.

TABLE A-1/E.520

Number of circuits	Traffic flow (in erlangs)		
	Offered	Carried	Encountering congestion
(1)	(2)	(3)	(4)
6	2.54	2.47	0.08
7	3.13	3.05	0.09
8	3.73	3.65	0.09
9	4.35	4.26	0.09
10	4.99	4.90	0.09
11	5.64	5.55	0.10
12	6.31	6.21	0.10
13	6.99	6.88	0.10
14	7.67	7.57	0.10
15	8.37	8.27	0.11
16	9.08	8.96	0.11
17	9.81	9.69	0.11
18	10.54	10.42	0.11
19	11.28	11.16	0.12
20	12.03	11.91	0.12

Reference

[1] TÅNGE (I.): Optimal use of both-way circuits in cases of unlimited availability, *TELE*, English Edition. No. 1, 1956.