All drawings appearing in this Recommendation have been done in Autocad.

Recommendation E.541

OVERALL GRADE OF SERVICE FOR INTERNATIONAL CONNECTIONS (SUBSCRIBER—TO—SUBSCRIBER)

1 Introduction

1.1 The overall grade of service (subscriber—to—subscriber) on international connections — relating only to the phenomena of congestion in the entire network as a result of the traffic flow — depends on a number of different factors, such as the routing arrangements in the national and international parts of the connection, congestion allowed per switching stage, the methods used to measure traffic and compute the traffic base, and the time differences between the busy hours of the various links involved in the connection.

1.2 The most satisfactory way in which this grade of service could be described would be to give its distribution. The design average grade of service during the busy hour of the complete connection would be the most useful single parameter. However, until such time as continuous traffic measurements are carried out during the busy season in all parts of the network on a routine basis, it is not possible to compute this average grade of service. Therefore, at this stage it cannot be used as a criterion for the dimensioning of the network.

1.3 The only practical way of ensuring an acceptable overall grade of service on international calls is to specify an upper limit on the design loss probability per connecting link in the national network as is done for the links in the international network (see Recommendation E.540).

2 General considerations

2.1 Since the success of the international automatic service is highly dependent on the grade of service of all links involved in the connection from subscriber—to—subscriber, it is desirable that the originating and terminating national network involved in the connection has grade of service standards comparable with those of the international network.

2.2 It is especially important that the links in the country of destination should have a good grade of service for handling the traffic, since high congestion in the terminating national network could have serious effects on the international network. High congestion in the network of the country of destination causes added retrials with consequent increased loading on common switching devices as well as increased occupation of the routes with ineffective calls.

3 Design objectives

3.1 It is recommended that the links in the national network should be designed for a loss probability[1)] not exceeding 1 per cent per link in the final choice route during its applicable busy hour. It is recognized, however, that in some countries additional congestion is permitted for the internal switching stages of the transit exchanges. It is also recognized that, where this recommended grade of service is not provided for the national service, it may not be economically feasible to provide it for international relations.

3.2 The maximum number of links in tandem used by an international connection is defined by Recommendation E.171 [1].

3.3 Although the worst overall grade of service would be approximated by the sum of loss probabilities for individual links connected in tandem, on most calls the overall grade of service will be significantly better.

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1) The loss probability mentioned refers to busy hour traffic values as defined in Recommendation E.500.

4 Maximum traffic loading

4.1 An acceptable automatic service on a final circuit group is difficult to maintain if the traffic loading on the group exceeds a level corresponding to a calculated Erlang grade of service of 10 per cent. Beyond this traffic loading, service on the route may rapidly deteriorate. This condition will be accentuated under the cumulative effect of repeat attempt calls if these should occur.

4.2 The curves of Figure 1/E.541 indicate the proportionate reduction in circuits that may be tolerated for a short period, 15 minutes for example, under normal busy—hour conditions, on a full—availability circuit group dimensioned for 1 per cent Erlang loss, in accordance with the above traffic overload criterion. Table 1/E.541 gives the figures used to plot the curves.

Figure 1/E.541 - CCITT 48110

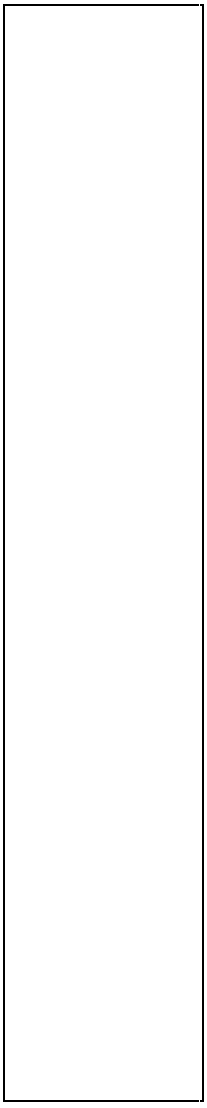

TABLE 1/E.541

Percentage reduction in the number of circuits if the calculated Erlang grade of service is not to exceed 10 %

Number of circuits	If originally operating at 1 % congestion, % reduction in circuits allowed to yield 10 % congestion	
	Random traffic (peakedness factor = 1.0)	Peakedness factor = 2.5
5	37.7	—
10	32.3	40.2
20	27.2	33.3
30	24.8	30.1
50	21.7	26.5
100	18.3	22.4
150	16.7	19.7

4.3 The curves of Figure 1/E.541 are intended merely as a guide. If the breakdown occurs during an exceptionally busy hour, the permissible proportionate reduction will be less. Conversely, if the breakdown occurs during an hour of light traffic, a higher proportionate reduction in circuits could be tolerated. A higher reduction might also be acceptable after an appropriate oral announcement has been introduced. In the general case, a knowledge of the circuit occupancy will enable an estimate to be made of the prevailing Erlang loss figure with the reduced number of circuits.

The permissible reduction in the case of large groups should not be exceeded; otherwise very serious congestion can result from repeated attempts.

5 General notes

Note 1 — Teletraffic implications for international switching and operational procedures under failure of a transmission facility are discussed in Supplement No. 5 of this fascicle.

Note 2 — Alternative routing in the national and in the international networks provides on average a grade of service that is better than that provided in the theoretical final route.

Note 3 — Non—coincidence of traffic peaks in the national and international networks will provide reduction in the overall grade of service compared with the sum of the design grade of service values per link.

Note 4 — Time differences will also improve the resulting grade of service.

Note 5 — The methods of measuring and calculating the traffic base for provisioning purposes in the national networks may be different in various countries and differ from the methods for the international network given in Recommendation E.500. This means that the national traffic values are not always comparable among themselves or with the values of the international network. Each Administration must estimate how its design traffic level compares with that recommended for the international network.

Note 6 — The design grade of service value of each link will only apply if the traffic at each switching stage is equal to the forecast. In practice, such a situation will seldom occur. Furthermore, the planning procedure normally is such that the specified grade of service should not be exceeded until the end of the planning period. In a growing network, this means that the circuit groups during almost the whole planning period give a better service than the specified critical standard.

In conclusion, the overall grade of service depends on the accuracy of forecasts made and the planning procedure used, i.e. it depends on the interval between plant additions and on the specific traffic value in future to which the grade of service is related.

Reference

[1] CCITT Recommendation *International routing plan*, Rec. E.171.