V - Potential capacity

Assessments having been made of the probable future traffic load on the railways, the next main step was the study of the routes which can best be developed so that, when intensively loaded, they will provide the capacity required.

As a prelude, this section is devoted to a general discussion of the main factors which were taken into account in considering future capacity. It should be emphasised, however, that individual routes differ in important respects. For that reason the capacity estimates presented in this section give no more than a general indication of order of difference between the capacity of double and quadruple track routes under present conditions, and the capacity which they are expected to have under future conditions. In the actual process of route selection, however, route capacities were considered individually.

It is obvious that the capacity of a route in terms of payload carried depends upon:—

- (i) the closeness with which trains can be spaced along the route;
- (ii) the average speed at which trains move over the route;
- (iii) the capacity of the trains;
- (iv) the loading of the trains achievable with the type of traffic carried over the route.

The closeness with which trains can be spaced along a route and the average speed at which they move depend upon:—

- (a) the type of signalling provided;
- (b) the performance of tractive units;
- (c) the design of rolling stock—with particular regard to running speeds and braking characteristics;
- (d) the permanent way—in so far as it affects permitted speeds and the time required for track maintenance;
- (e) the mix of train speeds, and the effect of train stops;
- (f) the terminal capacity.

The type of signalling provided is of major importance. Most of the existing routes shown on Map i are mechanically signalled and are con-trolled manually from a large number of signal boxes. These boxes have been sited, in the past, in proximity to stations or level crossings. In con-sequence they are unevenly spaced and the effect on line capacity has been determined by a ruling section, i.e. the longest time taken to run between controlling signals.

The aim of modern signalling is to sub-divide a route into portions in such a way that the time taken to pass through each portion is about the same. In this way, the problem of a ruling section which stems from the historic allocation of signal boxes and governs so much of our present line capacity can be eliminated. Moreover, to realise the full advance in route capacity which can be gained from improved traction and braking, the spacing of the signals must be adjusted to the speed and braking characteristics of the trains which the route carries. Thus, if signalling and rolling stock are modernised in harmony, the effect on route capacity is very substantial. Even so, the potential capacity can only be realised if the train speeds are either high and uniform, or, at next best, if the operating pattern is such that trains in a limited number of speed bands can be grouped into 'flights'.

A random mixing of trains of different speeds creates a situation in which large gaps must be left between fast and slow trains, with a consequent loss in line use. Thus, for example, the number of trains which can pass over a simple up and down line will be less if alternate trains run at 80 and 40miles per hour than if all of them run at 40 miles per hour. A rationalization of the speed bands of trains can, therefore, be expected to contribute substantially to the realisation of route potential.

The present and planned future distribution of trains in speed bands are indicated by Tables 8 and 9.

TABLE 8

Average Speed of Trains of Various Types

	Average Speed	
	1964	1984
Passenger services on trunk routes.	30-60	50 or 70
General Merchandise.	20-40	50
Oil	20-30	50
Coal	J5-30	35
Iron and Steel — Raw Materials	20-30	35

TABLE 9

Distribution of Total Trains over Speed Bands for Trunk Routes in General			
I964		1984	
Average Speed	% of Total Trains	Average Speed	% of Total Trains
60	8	70	15
5«	19		
40	29	50	70
30	33		
20 or less	11	35	15

It would be wrong to imagine that the average mix of speeds is one which applies on all routes or even that the mix will remain constant over the whole of the day and night on one route. On certain routes, train frequency is likely to be increased during the night hours by the fact that the line will be used only by liner services and sleeping car trains running at similar speeds, or, conversely, the frequency may be reduced as a result of peak demands to run trains of unequal speeds at given times. On some routes it is envisaged that freight only will be moved—and then all at one speed—a feature which means a big increase in potential line capacity above the average.

In practice, too, the working capacity of particular routes is affected by joining or splitting of routes, the nature of the allowances which have to be made for contingencies arising from failure and delay, and the provisions which have to be made for maintenance of the track and signalling, any of which may be peculiar to the route. The scheduling of trains to achieve the best pattern of operation is therefore complex. So much so that plans are well advanced for using computers for this purpose, and this also will contribute towards the greater realisation of potential capacity.

As shown in Table 3, the present average loading of two track trunk routes is only some 2.5 million passenger/ton miles per annum, which, with present levels of train loading, represents about 40 trains per day in each direction—only one train every 36 minutes—whereas the capacity of such routes today lies between 70 and 100 trains per day on each track.

The workable capacity of a modernised two track route, with the pattern of traffic and operation envisaged for the future, is calculated to range from140 trains per day in each direction up to 200 in favourable circumstances. On four track routes, higher frequencies per track are more easily attainable because additional running lines facilitate the segregation of trains in different speed bands, and one pair of tracks at least can be used for a single speed band. On four track routes, therefore, the operation of 350 or more trains per day in each direction can safely be allowed for.

Apart from train spacing and the average speed of the whole group of trains using a route, the other factor influencing effective route capacity is train loading.

At present, most train sizes and payloads are small. This is attributable to a multiplicity of causes, most of which are historical but which need not affect the railway of the future.

Tractive power will not be a serious limiting factor, and track improvement and modern rolling stock will permit the operation of much larger trains over the trunk routes. Indeed, a few trains very much larger than the average are operating already.

Apart from the physical ability to run large trains, changes in the future traffic pattern and in the concentration upon services catering for the bulk flows of both freight and passenger traffic will also facilitate better loading of larger trains.

Table 10 shows in terms of passengers (p) and tons (t) the present and expected future loading of trains of various types:—

TABLE 10

	Payload	
Type of Service	1964	1984
Inter-city passenger	150 p	250 p
Stopping services on trunk routes.	60 p	—
General Merchandise.	100 t	400 t
Coal	500 t	1,000 t
Iron & Steel — Raw Materials	600 t	1,000 t
Oil	450 t	1,000 t

All the foregoing general considerations affecting capacity were taken into account in making a selection of individual routes, and account was taken of the particular characteristics of each of them.