electricity consumption in traction area and is used to decide on Maximum Demand projections to Electricity Boards, which is critical in keeping power costs under control.

Passenger KM includes the distance to which a passenger has travelled. Passenger-kilometers are measured as travel distance between origin and destination stations multiplied by the number of passengers traveled between them. Passenger KM when compared with Coach KM gives an indication about the occupancy ratio.

Throughput of a section is the total quantum of traffic which is transported over the section in a period of 24 hours.

a. The passenger throughput could be measured in terms of number of passengers or passenger kms.
b. The goods throughput may be expressed in terms of
    i. Number of wagons or trains
    ii. GTKM or NTKM.

In Railways, generally throughput refers to 'goods throughput'. Improving throughput can be achieved by either operational means like increased train length, increased trailing load etc. It can also be enhanced by improvements in infrastructure like track strength, improved axle load of wagons, increased carrying capacity of coaches and wagons etc. It can also be increased by implementing some of the freight incentive schemes like concessional fare in traditional empty flow direction.

Operating Tools

Divisional Wagon Balance (DWB) is the total number of wagons held by the division, including the ineffective and departmental. It indicates the status of freight train operations in a division. When there is a congestion or unusual change in demand for loading, the wagon balance of the division increases above the usual average or the railway board target. The wagon holding of a division is divided into effective and ineffective based on its fitness and availability for handling traffic. Effective wagon holding consists of Inwards (Terminal units) that need to be unloaded in the terminals of the division; Empties that need to be supplied for loading or handed over to adjoining divisions; Outwards (Foreign Loads) which need to be handed over to the division as per their destination routes.

Interchange is the number of wagons or trains handed over / taken over between two units like divisions or zones. This is forecasted and exchanged between divisions and zones to their adjoining units on a daily basis. Such forecasts help in controlling the traffic pattern and ensure the requirement of assets in a division for maintaining efficient train operations. Efficiency of train operations can be assessed through

fulfillment of the interchange commitments by a division / zone as planned in its forecast. An increase in interchange indicates improvement in freight train operations.

Terminal detention is measured in hours. Wagons get detained in terminals for loading, unloading and examination activities. These detentions are closely monitored to keep them under minimum and ensure that wagons are on run as quickly as possible.

Average speed is measured in Kmph. Coaching trains are timetabled and hence their average speed is determined during timetabling. Mail Express trains are faster than passenger trains. Superfast trains have a higher average speed of >= 55 kmph. Freight trains receive the last priority in train running normally and hence their average speeds are lesser. Any regulation, under powering, speed restrictions affect the speed of trains. This statistics is a good indicator of the efficiency at which goods trains are run. To achieve maximum throughput and to make use of the existing section capacity all trains should run at the maximum permissible speed.
The average speed of goods train is calculated from the time it leaves the dispatching yard to the time it reaches the destination at the other end of the section. This includes detentions enroute on account of crossing, precedence, shunting etc. The total distance covered during the journey divided by the total time taken will be the average speed of a particular train.

Punctuality is the measure of adherence to time table timings by a coaching train. A coaching train based on the time it reached its destination is classified as 'before time (BT)'; 'right time (RT)'; 'not lost time (NLT)'; 'lost time (LT)'. Punctuality is measured in terms of percentage of such trains on a daily basis.

$$\text{Punctuality \%} = \frac{\text{Number of (BT + RT + NLT) x 100}}{\text{Total number of coaching trains}}$$

Outage of an asset is the number of such assets made available for traffic use in a day (24 hours). Wagon and Loco outages are calculated on a daily basis. When worked out for all locomotives owned by a shed irrespective of their physical location, it is termed as 'shed outage'. When worked out for locomotives in a territory of an unit like a division, it is called as 'territorial outage'.

If an engine is maintained in shed for 6 hours and provided for operations the rest of the day i.e. 18 hours, the outage is calculated as 18/24 = 0.75.

Whenever loco outage is disproportionate to wagon outage, the division/zone is asked to balance out the locos to the needy units adjacent.

Fortnightly Crew Working Hours – Crew utilization is a critical aspect in train operations in terms of safety as well as efficiency. Crew must be used optimally within the HOER (Hours of Employment and period of Rest Rules). This is being monitored through Crew Management System so that all crew are utilized fully and no crew is overworked.

Line Capacity – Path is measured in terms of line capacity. Line capacity is the number of trains which can be run in the line in 24 hours. It can be worked out block section wise, but usually it is worked out for a section. The sectional line capacity is limited by the line capacity of the critical block section.

a. Maximum line capacity is the maximum number of trains that can be run without giving any margins for other allowances and maintenance schedules.
b. Practical line capacity is the number of trains that can be run making allowance for maintenance and traffic fluctuations. If number of trains is more than this, it leads to congestion and reduction in block availability.
c. Economic line capacity is the optimum number of trains which can be run on the section economically. This is generally worked out by commercial/private railways which focus on keeping costs of train running and maintenance lower than returns.

   There are many ways to calculate the section capacity. One way is to draw the various paths available on a master chart. This is called Charted line capacity. The other ways depend on various formulae. One commonly used formula is Scott's formula.

$$C = 1440 / (T + t) * E$$

   Where
   'C' = Line Capacity.
   'T' = Running time of the slowest train over a critical Block section.
   't' = Block Operation time.
   'E' = Efficiency Factor.

(i) Critical block section is one which takes longest running time to clear. It is usually the lengthiest block section or one with unfavorable geographical and other conditions.
(ii) The formula will give total number of trains including both directions for a single line section.
(iii) On Double line sections this will give number of trains separately for Up & Down directions. These can be different if the running time of critical block section in Up line and Down line are different.
(iv) Any factor that reduces the running time in critical block section will improve the line capacity. It can be higher tractive power, easing out gradient, splitting up of block section through IBS or automatic block signaling etc.