Welcome to a Lecture on

OPERATING

STATISTICS

by :

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Views expressed in this lecture are that of the speaker and may not necessarily reflect the official views of either Northern Railway or of the Railway Board.

Outline of the Lecture

- Operating Statistics.

Operating Statistics

- Railway Statistics are essential for planning, prioritizing and monitoring of activities connected with train operations.
- These are based on four factors :
  - Quantity,
  - Distance,
  - Duration and
  - Service.

Operating Statistics

- Primary Units :
  - (a) Quantity – Expressed as
    - Tonnes,
    - Number of passenger carried, and
    - Earnings derived.

Operating Statistics

- Primary Units :
  - (a) Quantity – Expressed as
    - Tonnes,
    - Number of passenger carried, and
    - Earnings derived.
  - (b) Distance – Expressed in kms.
  - (c) Duration – Expressed in days, hours & minutes.
  - (d) Service performed – Expressed in terms of
    - Trains,
    - Vehicles,
    - Wagons,
    - Engines.

Operating Statistics

- Fundamental Units :
- Relationship between primary units, expressed in composite terms is called ‘Fundamental units’.
- Fundamental units express two primary units in their relationship to one another, such as :
  - Tonne – kms.,
  - Passenger – kms.,
  - Train – kms.,
  - Wagon – kms.,
  - Engine – hours,
  - Wagon – days etc.

Operating Statistics

- Derived Units :
- Expresses the relationship that exists between two sets of primary or fundamental units.
- The results thus arrived at is termed ‘Derived Units’.
- The process by which this relationship is ascertained is illustrated in the following examples :

$$\text{Earning/Passenger} = \frac{\text{Passenger earning (P)}}{\text{Passenger carried (P)}}$$

Operating Statistics

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- The process by which this relationship is ascertained is illustrated in the following examples :

$$\text{Earning/Passenger} = \frac{\text{Passenger earning (P)}}{\text{Passenger carried (P)}}$$

$$\text{Earning/Passenger – Km.} = \frac{\text{Passenger earning (P)}}{\text{Passenger Kms. (F)}}$$

Operating Statistics

- Derived Units :
- Expresses the relationship that exists between two sets of primary or fundamental units.

$$\text{Lead of Passenger Traffic} = \frac{\text{Passenger Kms. (F)}}{\text{No. of Passenger (P)}}$$

Operating Statistics

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- Expresses the relationship that exists between two sets of primary or fundamental units.

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$$\text{Wagon Kms./Wagon day} = \frac{\text{Wagon Kms. (F)}}{\text{Wagons days (F)}}$$

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$$\text{Wagon Kms./Wagon day} = \frac{\text{Wagon Kms. (F)}}{\text{Wagons days (F)}}$$

- These Derived Units highlight special features of transportation output and are useful in evolving suitable management strategies.

Operating Statistics

- Operating statistics are broadly be divided into 3 categories :
  - Traffic.
  - Power.
  - Rolling Stock.

Operating Statistics

- Traffic statistics include :
  - wagons loaded,
  - wagon mobility,
  - wagon usage,
  - train loads,
  - train mobility,
  - productive and unproductive services,
  - wagon detention,
  - marshalling yard,
  - terminal goods station, and
  - punctuality.

Operating Statistics

- Power statistics include :
  - engine usage,
  - fuel and energy consumption, and
  - engine failure statistics etc.

Operating Statistics

- Power statistics include :
  - engine usage,
  - fuel and energy consumption, and
  - engine failure statistics etc.
- Rolling stock statistics include :
  - rolling stock holding & availability,
  - repairs & maintenance %.

Operating Statistics

- Operating Statistics for IR are issued in the form of pamphlets published periodically by Railway Board.
- Detailed Statistics relating to each division and gauge are contained in various parts of the 'Domestic' statistics issued quarterly (Parts, I, II and IIB & C).
- Some of the important statistics include Operating ratio.
  - The ratio of workings expense (excluding suspense but including appropriation to Depreciation Reserve Fund and Pension Fund) to Gross Earnings.
  - (Expenditure incurred in connection with Administration, Operation, Maintenance and repairs of open line traffic).

Operating Statistics

- Passenger Train Performance :
- Punctuality is the main criterion for judging passenger train performance.

$$\text{Punctuality} = \frac{\text{RT}}{\text{Total no. of Mail/ Express trains}} \text{ X } 100$$

Operating Statistics

- Passenger Train Performance :
- Vehicle Kms. per Vehicles Day :
- This figure indicates by the vehicle days which are the product of average number of coaching vehicles on line/in use and the number of days in the period under reference.
- This figure indicates the extent to which coaching vehicles are kept ‘on the move’.
- The main factors affecting its value are :
  - Average speed of trains.
  - Average length of train run (average lead).
  - The idle periods provided for in rake links.

Operating Statistics

- Passenger Train Performance :
- Vehicle Kms. per Vehicles Day :
- Since in the short run, train composition is not susceptible to change,
  - it is only by increasing speeds of trains and
  - tightening up rake links that an improved performance can be achieved.

Operating Statistics

- Passenger Train Performance :
- Vehicle Kms. per Vehicles Day :
- Since in the short run, train composition is not susceptible to change,
  - it is only by increasing speeds of trains and
  - tightening up rake links that an improved performance can be achieved.
- This result is calculated by dividing the coaching vehicles kms. by vehicles days.
- Vehicle days is the product of average number of coaching vehicles on line and the number of days in the period under reference.

Operating Statistics

- Passenger Train Performance :
- Vehicle Kms. per Vehicles Day:

$$\text{Vehicle Kms./Vehicle day} = \frac{\text{Coaching vehicle kms.}}{\text{Vehicle days}}$$

Operating Statistics

- Wagon Usage :
- Average Speed of Goods Trains :
- This figure is a measure of wagon mobility.
- Result is calculated separately for ‘through goods trains’ and all goods trains.*
- Detentions to through goods trains at roadside stations has the effect of bringing down average speeds.

Operating Statistics

- Wagon Usage :
- Average Speed of Goods Trains :
- Factors on which average speed of goods trains depend :
  - Line capacity utilization.
  - Hauling power of engines used.
  - Loads of trains.
  - Condition of rolling stock, particularly brake power.
  - Standards of signalling and interlocking.
  - Shorter block sections.
  - Gradients, curves, permanent restrictions.*

Operating Statistics

- Wagon Usage :
- Average Speed of Goods Trains :
- Factors on which average speed of goods trains depend* :
  - Temporary engineering restrictions.
  - Pre – departure detentions in yards.
  - Detentions at crew changing points.
  - Drivers' performance.*
  - Performance of line staff.
  - Performance of control staff.*

Operating Statistics

- Wagon Usage :
- Average Speed of Goods Trains :
- This result is arrived at by dividing the total train kms. by total train engine hrs. of the concerned service.*

$$\text{Average speed of Goods Trains} = \frac{\text{Train kms.}}{\text{Train Engine hrs.}}$$

Operating Statistics

- Wagon Usage :
- Wagon kms./wagon day :
- This figure is a measure of wagon mobility.
- It indicates the average number of kms. moved by a wagon, per day, both loaded and empty.

Operating Statistics

- Wagon Usage :
- Wagon kms./wagon day :
- Factors responsible for poor mobility :
  - delays in marshalling yards,
  - delays at stations for loading or unloading,
  - delays in clearance from roadside stations,
  - decrease in average speed of goods trains,
  - increase in number of wagons awaiting repairs, and
  - shorter loads of trains.

Operating Statistics

- Wagon Usage :
- Wagon kms./wagon day :
- This result is obtained by dividing wagon kms. by wagon days which is the product of daily average number of wagons on line and number of days in period.

$$\text{Wagon Kms./Wagon day} = \frac{\text{Wagon kms.}}{\text{Wagon days}}$$

Operating Statistics

- Wagon Usage :
- Net Tonne kms./wagon day :
- This unit is a measure of the revenue earning work done by wagons and reflects both mobility and loading.
- Factors responsible for decrease in this figure may *inter – alia* be due to
  - any of the causes which effect figure of wagon kms./ wagon day.
  - decrease in the proportion of loaded to total wagon kms.

Operating Statistics

- Wagon Usage :
- Net Tonne kms./wagon day :

$$\text{Net Tonne Kms./Wagon day} = \frac{\text{Net Tonne kms.}}{\text{Wagon days}}$$

Operating Statistics

- Wagon Usage :
- Wagon Turn Round :
- This figure expresses the average period between two successive loading of a wagon.

$$\text{Wagon Turn Round} = \frac{\text{No. of effective wagon holding}}{\text{Loaded wagons + loaded receipts}}$$

Operating Statistics

- Wagon Usage* :
- Average Detention/Wagon :
- All wagons.
- Through loaded wagons.
- Detention suffered by stock in a yard depends, *inter – alia*, on the layout of the yard and
  - on the number of trains that can be despatched in various directions per day.

Operating Statistics

- Wagon Usage* :
- Average Detention/Wagon :
- All wagons.
- Through loaded wagons.
- Detention suffered by stock in a yard depends, *inter – alia*, on the layout of the yard and
  - on the number of trains that can be despatched in various directions per day.
- Target figures have been laid down for each yard for detentions to all wagons and through loaded wagons.
- Such targets take into consideration the condition of work and facilities available in the yard concerned.

Operating Statistics

- Wagon Usage* :
- Average Detention/Wagon :
- Detentions in excess of this figure indicate inefficient yard work.
- Result is calculated separately for 'through goods trains' and all goods trains.*
- Detentions to through goods trains at roadside stations has the effect of bringing down average speeds.

$$\text{Average detention/wagon} = \frac{\text{Total detention hrs.}}{\text{No. of wagons despatched}}$$

Operating Statistics

- Wagon Usage** :
- Average Starting Wagon Load :
  - This statistic gave an indication of the extent to which wagon space was utilized by stations from which traffic originates.*
  - Tonnes loaded/No. of wagons loaded.

Operating Statistics

- Wagon Usage** :
- Average Wagon Load during Run :
  - This unit was a good index of wagon utilization as it referred to the average load of all loaded wagons carried.
  - It does not reflect the performance of the division or the railway to which it referred.
  - Net Tonne Kms./Loaded wagon kms.

Operating Statistics

- Wagon Usage* :
- Average Net Train Load (in Tonnes) :
  - This figure refers to the average freight load carried in tonnes,
    - to that portion of load which earns revenue for the railway.

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  - Net Tonne Kms./Train kms.

Operating Statistics

- Wagon Usage* :
- Average Gross Train Load (in Tonnes) :
  - This figure refers to the average overall load of goods train,
    - Freight load + the weight of rolling stock.

Operating Statistics

- Wagon Usage* :
- Average Gross Train Load (in Tonnes) :
  - This figure refers to the average overall load of goods train,
  - Freight load + the weight of rolling stock.
  - Gross Tonne Kms./Train kms.

Operating Statistics

- Wagon Usage :
- Average Train Load (in terms of 8 wheelers) :
  - This figure refers to the average load of goods trains run on a division.
  - BOXN rake – 59 wagons.
  - BCN rake – 42 wagons.
  - BCNHL – 58 wagons.
  - BTPN rake – 49 wagons.
  - BRNs – 42 wagons.

Operating Statistics

- Locomotive Performance :
- Engine kms./day/engine in use :
- This figure is compiled separately for passenger, mixed and goods train services; as also for all service combined.
- This statistic is affected by such factors as :
  - Average run of trains.
  - Average speed of trains.
  - Engine links.
  - The location of engine shed with respects to stations which they serve.

Operating Statistics

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$$\text{Engine kms./day/engine in use} = \frac{\text{Engine kms.}}{\text{Engine days in use}}$$

Operating Statistics

- Locomotive Performance :
- Engine kms./day/engine on line :
- This figure is compiled separately for passenger, mixed and goods train services; as also for all service combined.
- The proportion that this figure bears to the corresponding figure of 'engine kms./day/engine on line' indicates the proportion of available engines 'on line' that were put to effective use during the period in question.

$$\text{Engine kms./day/engine on line} = \frac{\text{Engine kms.}}{\text{Engine days on line}}$$

Operating Statistics

- Locomotive Performance :
- Net Tonne Kms./Engine hr. :
- The figure of net tonne kms./engine hour is a very useful index of the efficiency of freight working on a division.
- Net tonne kms. indicate the amount of revenue earning work done while
  - engine hour measure the cost of if doing it.

Operating Statistics

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  - engine hour measure the cost of if doing it.

$$\text{Net Tonne Kms./Engine hr.} = \frac{\text{Net Train kms.}}{\text{Engine hrs.}}$$

Operating Statistics

- Locomotive Performance :
- Net Tonne Kms./Engine hr. :
- A decrease in net tonne kms./engine hour may be due to factors such as :
  - Shunting engine hrs. not reduced in proportion to decrease in traffic.
  - Increase in departmental, assistance required, assisting not required and light engine running.
  - Decreasing in the average train load.
  - Decrease in average speed of goods train.
  - Increase in the proportion of unbalanced traffic.

Operating Statistics

- Locomotive Performance :
- Quantity of fuel consumed/Engine kms. by service :
- This figure indicates the fuel consumption in relation to engine kms. only.
- It does not reflect the tonnes hauled.

$$\text{Quantity of fuel consumed/ Engine kms. by service} = \frac{\text{Quantity of fuel consumed}}{\text{Engine kms.}}$$

Operating Statistics

- Locomotive Performance :
- Quantity of fuel consumed/1000 GTKm. by service :
- This figure indicates the fuel consumption in relation to the work done.
- It is, therefore, a better index of fuel consumption than the quantity of fuel consumed per engine kms. figure.
- The main factor that influences this result is the gross load of the train.
- It is derived by the formula given below :

$$= \frac{\text{Quantity of fuel consumed}}{\text{1000 GTKm.}}$$

Operating Statistics

- Locomotive Performance* :
- Shunting Engine Kms./100 Train Kms. :
  - This figure indicates the amount of non – revenue earning work done per 100 train kms.
  - Its value is affected mainly by the load of goods trains, and
    - the amount of terminal work involved.

Operating Statistics

- Locomotive Performance* :
- Shunting Engine Kms./100 Train Kms :
  - This figure indicates the amount of non – revenue earning work done per 100 train kms.
  - Its value is affected mainly by the load of goods trains, and
    - the amount of terminal work involved.
  - (Shunting kms. x 100)/Train kms.
- However, for the same division or railway, the pattern of traffic remaining the same, rise in this figure is indicative of wasteful shunting.

Operating Statistics

- Locomotive Performance* :
- No. of wagons dealt with/shunting engine hr. :
- The number of wagons that a given yard can deal with per shunting hour depends, *inter – alia*, on its layout.
- Accordingly a target figure has been prescribed for each yard to enable the efficiency of yard work to be gauged.
- As shunting involves cost, the higher this result, greater the efficiency of the yard.*

$$\text{No. of wagons dealt with/shunting engine hr.} = \frac{\text{No. of wagons dealt with}}{\text{Shunting engine hrs.}}$$

Operating Statistics

Units	Loco Utilisation	Loading	Terminal Detention	Full Load
Average Speed of Goods Trains	Y		Y	
Wagon kms./ wagon day	Y		Y	
Net tonne kms./ wagon day	Y	Y	Y	
Wagon Turn Round	Y	Y	Y	

Operating Statistics

Units	Loco Utilisation	Loading	Terminal Detention	Full Load
Average detention/wagon			Y	
Average Net Train Load				Y
Average Gross Train Load				Y
Full Train Load Running				Y

Operating Statistics

Units	Loco Utilisation	Loading	Terminal Detention	Full Load
Average Speed of Goods Trains	Y		Y	
Wagon kms./ wagon day	Y		Y	
Net tonne kms./ wagon day	Y	Y	Y	
Wagon Turn Round	Y	Y	Y	

Operating Statistics

Units	Loco Utilisation	Loading	Terminal Detention	Full Load
Engine kms./ engine day in use	Y			
Engine kms./ eng. day on line	Y			
Net tonne kms./ engine hr.	Y			Y
No. of wagon/ shtg. eng. hr.			Y	

Review

- Operating Statistics.

Operating Statistics

Any questions please ?

Thank You

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