REVIEW OF INDIAN RAILWAY COACHING COST DATA FOR FIXING TRACK ACCESS CHARGES FOR PRIVATE OPERATORS

A dissertation submitted to the Indian Institute of Public Administration (IIPA), New Delhi for the Degree of Master's Diploma in Public Administration (MDPA) in partial fulfillment of the requirement for the 45th advanced Professional Programme in Public Administration (APPPA)

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CERTIFICATE

I have the pleasure to certify that the dissertation titled "Review of Indian Railway Coaching cost data for fixing Track Access Charges for Private Operators" is a bonafide research work carried out by Shri Neeraj Kumar Mouriya under my guidance and supervision. The dissertation is a result of his own research and to the best of my knowledge no part of it has earlier comprised in other monograph, dissertation or book.

This is being submitted to the Panjab University, Chandigarh for the award of Master's Diploma in Public Administration in partial fulfillment of the requirement for Advanced Professional Programme in Public Administration (APPPA) of Indian Institute of Public Administration (IIPA), New Delhi.

I recommend that the dissertation of Mr. Neeraj Kumar Mouriya is worthy of the award of Master's Diploma in Public Administration.

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DISCLAIMER

The findings, interpretations, views, recommendations and conclusions in the dissertation are those of the author, and should not be attributed in any manner to any authority, organization or individual.

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List of Abbreviations

ADC	Administrative and Distribution cost
AOLS	Asset Operation Liability System
ARAIC	Aircraft and Railway Accident Investigation Committee
ATC	Automatic Train Control
ATS	Automatic Train Stop
BNetzA	Federal Network Agency – Bundesnetzgentur
BTP	British Transport Police
CER	Community of European Railway
COIS	Coaching Operation Information System
COMTRAC	Computer Aided Traffic Control
COSMOS	Computerized safety maintenance and operation system
CP	Control Period
CRC	China Rail Corporation
CRC	Chins state Railway group
Dakks	National Accredition Body
DB	Deutsche Bahn
DBAG	Deutsche Bahn AG - National Rail Company
DCTO	Direct Cost of Train Operation
DRF	Depreciation Reserve Fund
EBA	Eisenbahn Bundesamt - Federal Rail Authority
ECM	Entity in Charge of Maintenance
ETCS	European Train Control System
EU	European Union
EUAC	Electrification Usage Asset Charges
EUB	Federal Railway Accident Investigation Office - Germany
FAS	Federal Antimonoply Services
FC	Full Cost
FOC	Freight Operating Companies
FOIS	Freight Operation Information System
FTS	Federal Tariff Services
GAAP	Generally Accepted Accounting Principles
GASAB	Government Accounting Standards Advisory Board
GTKM	Gross Tonne Kilometer
HS1	High Speed 1
HSE	Health and Safety Executive
HSR	High Speed Railway
ICM	Infrastructure Cost Model

IGC	Inter Governmental Commission
IM	Infrastructure Manager
IMMIS	Integrated Material Management Information System
IOH	Intermediate Overhaul
IPAS	Integrated Payroll and Accounting system
IR	Indian Railway
IRCTC	Indian Railway Tourism and Catering Corporation
IRFC	Indian Railway Finance Corporation
IRG	Independent Regulators Group
JR	Japan Railway
JRTT	Japan Railway Construction, Transport and Technology agency
JTSB	Japan Transport Safety Board
MLIT	Ministry of Land Infrastructure Transport and Tourism
MLTRP	Medium Term and Long Term Railway Plan
MOT	Ministry of Transport
NDRC	National Development and Reform Commission
NOI	Non Operating Income
NPC	National People's Congress
OHE	Overhead Equipment
OOI	Other Operating Income
ORR	Office of Rail Regulator
POH	Periodic Overhaul
PR	Periodic Review
PRS	Passenger Reservation System
RAB	Regulatory Asset Base
RAIB	Rail Accident Investigation Branch
RIHSAC	Railway Industry Health and Safety Advisory Committee
ROB	Road Over Bridge
ROGS	Railway and Other Guided Transport Systems regulations
ROSCO	Rolling Stock Companies
RRA	Regional Rail Authorities
RSAC	Rail safety Advisory Council
RSSB	Rail Safety and Standards Board
RTRI	Railway Technical Research Institute
RU	Railway Undertaking
RUB	Road Under Bridge
RZD	Rossiyskie Zeleznye Dorogi - Russian Railway
SGV	Rail Freight Transport Service
SMS	Safety Management system

SNRP	Statement of National Regulatory Provision
SPFV	Long distance passenger rail service
SPNV	Local passenger rail service
SRA	State Railways administration
TAC	Track Access Charges
TKM	Train Kilometer
TOC	Train Operating Countries
TPU	Train Path Portal Network
UK	United Kingdom

1.0 Introduction

1.1 Introduction

Indian Railways is one of the major rail networks among the developed and developing countries. Since its beginning in 1853 from Bombay to Thane covering a distance of 21 kilometres it has come a long way and today it extends to all corners of the country. The Indian Railway network consists of a 94,735 kilometre long track (all gauges- Broad Gauge, Meter Gauge and Narrow Gauge) and runs around 11,000 trains per day out of which 7,000 are passenger carrying trains[1].

Rail operation can be broadly sub divided into two separate functions i.e (a) Infrastructure development & maintenance and (b) Train operations. Railways across the world are organized in three different ways – (a) Vertically integrated : If the two functions- Infrastructure development & Maintenance and Train Operations are undertaken by one legal entity (b) Separated model, which is mostly followed in Europe, Infrastructure development & maintenance and Train operations are undertaken by two separate legal entities. Network rail in UK follows the separation model (c) In the integrated model, the ownership arrangement can be on the holding model pattern where the network is owned by one legal entity and infrastructure maintenance and train operations are handled by a number of holding companies. Germany follows the holding company model(Vilius Nikitinasa, Stasys Dailydkab 2015).

Indian Railways is a vertically integrated Railway and all functions are undertaken by one entity. Even the regulatory and safety regulation are

[1] Indian Railway website. Available at http://www.indianrailways.gov.in/railwayboard/view_section_new.jsp?lang=0&id=0,1 Accessed 06.09.2019

done by the same entity. US railroads are another example of completely vertically integrated networks. Most of the European countries follow the separated model and Sweden and England are pioneers in this regard.

Separation of Rail network started in 1999s in Europe and it was done to achieve following objectives:-

a. To increase competition : Infrastructure company provides network access to multiple train operators. Access to infrastructure is provided on a non- discriminatory basis and train operators compete with each other in providing services to passengers and freight companies.
b. To increase efficiency and reduced cost : Since the cost of accessing infrastructure is same for all train operators, they strive to reduce cost and achieve operational efficiencies to increase their profits. The safety regulator ensures that train operators and infrastructure maintainers do not cut corners to endanger safety.
c. To improve quality of service : Passengers and freight companies have multiple choices and if the quality of one operator declines, passengers and freight operators can immediately switch to other operators. This constant competition improves quality of services.
d. Environment protection by reducing traffic moving on road to rail by providing subsidies in a transparent manner. Network Rail in UK is providing specific subsidies to move road traffic to rail in cases where the social cost of moving traffic on road is quite substantial (Fowkes, A.S. and Nash, C.A. (2004)).

The result of separating Infrastructure maintenance and Train operation on cost of operations, efficiency, passenger satisfaction,

freight movement and social cost needs to assessed before Indian railway decides to move in that direction.

Indian Railways, although, vertically integrated, has taken few steps to introduce an element of competition in its freight operations. Indian Railways in 2006 allowed private train operators to operate container trains for domestic and EXIM traffic. Similarly, in automobile sector, a scheme to allow private operators has been started by Indian Railways.

The Government has recently decided to offer two passenger trains to private operators as part of its hundred day agenda. New Delhi – Lucknow and Ahmedabad – Mumbai routes have been selected for the operation. Indian Railway Catering and Tourism Corporation(IRCTC) has been selected as the operator and operations on both the routes has commenced. IRCTC provides the onboard services and undertakes the ticketing operations. Tariffs are set by IRCTC and train operation is done by Indian Railways.

Indian railway has identified a set of 100 origin and destination stations for operation of about 150 private trains. Finance ministry's Public Private Partnership Appraisal Committee (PPPAC) has approved the proposal in principle. RFQ and RFP documents have been uploaded on the Railway Board website for obtaining stake holders comments.

Draft terms and conditions on which private operators will be allowed to offer passenger service have been spelled out in the draft RFP and RFQ documents. Although the RFP and RFQ documents are still under finalization, the broad contours are clear to the stakeholders. With the announcement of handing over 150 trains for operation to private

players, the privatization of passenger operations in India has begun. Deciding the Track access charge for the private operator is going to be a challenge as Indian Railway is a vertically integrated entity and it has no prior experience in this area. Being an integrated operator, Railway accounts and costs as maintained at present are not likely to easily identify its direct and indirect cost of operation and maintenance, which are required for fixing Track access charges.

1.2 Research Objectives

This study aims

(i) to briefly study how track access charges have evolved in UK and select other European countries.

(ii) to review the Indian Railway Coaching cost data to find possible methods to fix the Track access charges for private operators.

(iii) to study how cost data is collected, published and used in Indian Railways and to identify the areas where the data should be collected and maintained differently for better calculation of Track access charges.

1.3 Research Gap

Indian Railways has allowed private operators to run trains on two routes and is planning for handing over another 100 – 150 trains to private operators. Till now the Indian Railway was functioning as an integrated operator and introduction of private operators means that IR will provide network access to the private players and function as Infrastructure Operator for private players. Correct estimation of Track access charges is critical for success of private operators in running passenger trains on Indian railway network. Indian Railway itself is going to be the biggest train operator in the foreseeable future and it

will continue to maintain the infrastructure. As and when the private operators are allowed to ply their trains, Track access charges have to balance between complex objectives to ensure equity between players:-

1. As an infrastructure manager, Track access charges should be sufficient to meet the expenses incurred in infrastructure maintenance. It is a difficult objective to meet as the Rail industry is a capital intensive industry with a long return periods say 20 to 30 years, whereas track access charges are fixed for short duration for 3 to 5 years.
2. The track access charges for Indian Railway and Private operators should be at par. Normally, world over, passenger operations are subsidized by the Government. In case of Indian railways, freight operations subsidize passenger business and if the actual expenses are not recovered by Indian railway through Track access charges, it will translate into freight operations subsidizing private train operators. However, if actual charges are recovered, it will imply that Indian Railway will stop passenger and freight cross subsidies.

Track Access Charge for private passenger train operators will be fixed for the first time in Indian Railways and therefore no literature is available on this subject.

1.4 Research Questions

a. What is the structure of Rail Industry across the word (focus on UK, Germany, Japan, Russia and China)

b. How Track access charges have evolved in select countries(UK and Germany)

c. How cost data is maintained by Indian Railways and what changes are required to fix track access charges for Indian Railways.

d. Recommendations for Indian Railways to fix Track Access Charges

1.5 Justification

Indian railway has started the process of allowing private operators in Passenger business segment. The issue of track access charge is central to success of private operator regime. It is the time when the issue of regulation and track access charge issue is discussed threadbare from academic and administrative point of view and presented before policy makers to take suitable decision for rapid growth of the sector.

1.6 Research Design

Research design for the study is exploratory. Secondary cost data available in the public domain has been used for the study.

1.7 Conclusion

This chapter has set out the basic outline of the approach taken for researching the topic of this paper. The aim of this paper is to study the existing railway structure and track access charges in select countries and apply the lessons learnt from these countries to find a method of fixing track access charges for Indian Railways.

2.0 Literature Review

2.1 Introduction

Indian Railways is a vertically integrated entity and due to issues such as huge labor force, providing connectivity to remote areas of country etc. idea of privatizing/ corporatizing Indian Railways has not been considered by Government of India. Although, as a government entity, the sector has remained underdeveloped due to lack of funds and until recently, Railway finances were separated from Government of India finances and Railway Budget was presented separately[2]. Separation of finances meant limited budgetary support from Government of India and Indian Railway relied almost entirely on its own resources to fund its network and service expansion. As a result, network has not grown in terms of coverage and quality of services as per expectations of passengers and freight operators. The situation has changed after the merger of budgets and Government is providing substantial support to expand the network and to improve its quality of services. A step towards multiple operator regime has been taken by Ministry of Railways by allotting two trains to IRCTC for on board services and ticketing. Since Indian Railways is vertically integrated and multiple operator regime is just beginning limited literature is available on this aspect.

Track access charges and separation of rail industry are interlinked as two sides of a coin. The main aim of separation is to promote efficiency and improve quality of service. A lot of studies has been conducted to ascertain if the separation has really improved the efficiency of rail industry. The aspect of fixing maintenance charges has also been extensively covered by different scholars. In next few sections, a brief overview of literature is presented.

[2] https://pib.gov.in/newsite/PrintRelease.aspx?relid=153672

2.2 Literature Review

Privatization and unbundling of Railways started in Europe from 1990s and the these rail systems have matured over the years. Looking at European experience, suggestions have been made to separate Infrastructure development & maintenance and Train operations and segment its business into passenger and freight and entrust these to separate legal entities (Gangwar and Raghuram 2016).

Effect of separation of Infrastructure development & maintenance and Train operations on efficiency, cost saving is not clear. For British Railways, Fowkes and Nash (2004) concluded that (i) there was limited competition despite privatization (ii) fixing track access found to be very complex, errors made in judging the cost of track wear, no fix formula and charges were negotiated for different operators.(iii) freight grants for shifting traffic from road to rail increased over the years (iv) very difficult to introduce competition in freight market, without subsidies loss making freight will be abandoned.

Abbott and Cohen(2017) provided a summary of the different studies that have been conducted by different authors to estimate the effect of rail industry separation. The paper concludes that impact of separation on efficiency will depend upon conditions such as range of service being provided and the level of inter modal competition existing in that country. (EJTIR Issue 17(2) 2017 pp 207-224)

Bowman (2015) found that profit making in the UK's privatised rail system was dependent on public subsidy and subsidies have been channeled in such a way that privatisation appears to be successful. In perhaps the most comprehensive study by Smith et al., (2014) found out that vertical separation

has no effect on costs and costs are reduced by 5% in holding company model but the impact can be due to increased transparency.

On the issue of certain important elements of Track Access Charge and how it is calculated in UK, Germany, France and Sweden Chris Nash et al(2018) did a Project Report for Centre of regulation in Europe . The report covers the aspects of how to measure and charge cost of wear and tear on infrastructure , how to charge for congestion and scarcity and how to charge necessary mark up. The report findings are summarized below : -

i. Wear & tear and scarcity costs are the most important elements of track access charge. Mark- ups also constitute a substantial portion of track access charge. Engineering methods estimates lower wear and tear costs compared to the econometric methods and academically, econometric methods are believed to be more reliable way to estimate the wear and tear costs. However, The data across the countries suggest that charges for wear and tear is kept lower than suggested by econometric estimates. Maintenance and renewals costs also vary with characteristics of the vehicle and of the track. Econometric methods are not able to differentiate cost for different vehicle and track combinations and engineering methods are better suited for this purpose. If the charges are not differentiated properly for vehicle and track characteristic will distort choice of rolling stock and route. Charging per gross tonne km with some differentiation according to axle load and track characteristics , as in Sweden appears desirable,.

ii. At high capacity utilization levels, there is a need to include congestion and scarcity charges in track access charge scheme. This will add to the revenue side and incentivize better use of the track capacity.

Congestion charges are appropriate to model the cost of unreliability as track capacity utilization reaches its peak

iii. Mark up for freight should pass the test of capacity to pay and demand elasticity should be used to judge the appropriate level of freight mark-up. Elasticity for different commodities is different and therefore the mark – up should change with commodity.

iv. Assumption regarding passing on mark up as higher price is not correct except for the cases where there is a strong competition. Without competition the operators will naturally tend to maximize their revenue and it may in some cases lead to decline in no. of services run. The mark up therefore should be sophisticated enough to differentiate between different routes and time of week or day.

v. Mark up for public services is governed mostly by political concerns but efforts must be made that track access charge should at least cover the avoidable cost or the cost may be covered by grant/subsidy from the Government.

vi. To promote efficiency in a government owned infrastructure entity, financial penalties are not a viable option as the penalties result into increase of burden for passengers. The recommendation is to establish bench marks for efficient costs and set up track charges on the basis of benchmarks.

vii. Performance regime should also include incentives based on full social cost of delay and interruption of network for maintenance activities.

viii. To make infrastructure manger and network operators work together for reduction in infrastructure cost the cost risk should be shared by two.

ix. Ramsey pricing used for determining marginal cost and mark up cost are optimal only if other modes i.e. road, airlines are appropriately charged. If other modes do not satisfy the criteria, Ramsey pricing will not impact transport system efficiency.

On the issue of fixing TAC, Marschnig(2016) in his paper "Innovative track access charges" has concluded that detailed differentiation is mandatory for a competitive offer of railway traffic services as average charges which are based on gross-tonne-kilometres do not estimate the charges correctly and the charges should be based on three levels. The first level is the line section as the cost of track depends on profile i.e curves, gradient etc. The second aspect relates to the fact that allocating cost by cause in not proper as the standards of the track maintenance depend on the most stringent requirement among the group of users .The third aspect is the quality of rolling stock as the track damage depends upon the rail wheel contact and therefore it is equally dependent upon the quality of rolling stock.

Andersson (2006, 2007a, 2007b) estimates the marginal cost of wear and tear in Sweden using pooled ordinary least squares , fixed effects and survival analysis. The models used by Andersson utilize traffic and infrastructure variables, they exclude dynamic aspects on the cost structure. Andersson (2007) extended his earlier work by introducing lags and leads of dependent and independent variables as an explanation for railway infrastructure costs in Sweden. Both static and dynamic panel data models were used for exploring potential dynamic effects.

Estimating direct costs is complex and a crucial aspect of the Track Access charge setup. EU has issued several guidelines on this aspect. Independent Regulators's Group – Rail has issued four position papers during 2012 and 2014 on the direct cost before the EU issued its directive in 2015. IRG supported the view that the direct cost should be interpreted as short term marginal cost. IRG- Rail (2016) in its paper after issue of EU directive has concluded following :- (a) Engineering methodologies for direct cost estimation are based on domain knowledge and techniques. The engineering methods combine bottom-up methods to assess impact of operation of train services and wear and tear of the infrastructure and top-down cost allocation methods to estimate future maintenance and renewal costs to allocate cost to different categories and reference objects. Operating costs other than maintenance may also be included in the calculation of direct costs provided that the infrastructure manager can measure and demonstrate that these costs are directly incurred by the operation of the train service. (b) Econometrics relies solely on data to calculate the marginal cost of traffic. This methodology requires extensive data on operational, maintenance and renewal costs, on traffic and on other characteristics at a sufficiently disaggregated level to allow proper estimations. The econometric methodology can be used to estimate the impact of traffic on costs and using the estimated impact of traffic on costs, it is then possible to estimate the marginal costs of traffic.

Smith, Iwnicki et. Al(2017) proposed a two-stage process to estimate the relative marginal cost of different types of coaching and freight stock. The two stages are (1) engineering methods that estimate the track damage caused by the rail vehicles; and (2) econometric methods that estimate the relationship between the actual maintenance costs and the different damage mechanisms. This two-stage approach fills an important gap in the literature, given the limitations of the existing engineering or econometric approaches.

2.3 Conclusion

A lot of studies have been conducted on different rail system to assess the impact of separation on efficiency improvements and the conclusion drawn is that there is no evidence to suggest that separation has improved system efficiency. On the issue of operation and maintenance charges in track access charges both econometric and engineering models have been employed. European Union has issued directives to its member countries for fixing Track access charges and conducted different studies of aspects of track access charges. The European experience has been well documented and available in public domain. The information can be used as a reference point for fixing Track access charges for Indian Railways.

3.0 Structure of Railways in Select Countries

3.1 Introduction

Rail Industry is one of the oldest industry and it has evolved over the years. Different structures have evolved over the period of time in different countries. The trend over the period of time has been towards privatization. Railway being a strategic asset was government owned and integrated in most of the country in the beginning. The industry in many countries could not meet the public expectations in terms of quality and coverage of service. This coupled with economic efficiency parameters created a trigger for privatization. UK and Sweden were one of the earliest to adopt the privatization. Many combinations of rail Industry structures have evolved and this chapter attempts to categorize the possible structures and UK, Germany, China, Japan and Russia have been taken as case studies to provide more detail of structure in these countries.

3.2 Overview of market types

The rail market can be structured in different ways in different countries depending upon a range of factors and policy objectives. The main issues of consideration for market structure are:-

a. The ownership – Public of Private
b. Level of competition desired by the government

The rail market can be structured in a variety of ways based upon combinations of the factors listed above. Many markets are limited to one large integrated operator e.g. India and in some countries many integrated operators function e.g. USA. However, in many countries the operations are unbundled horizontally to introduce competition.

There has been extensive debate and research over the level of vertical and horizontal separation between the Infrastructure Manager or IM passenger or freight service market the Railway Undertaking or RU required to create a fair playing field between the incumbent and potential new entrants and the potential effects of such separation. There are three main approaches to market structure, which are associated with increasing levels of competition:

i. **Vertically integrated Railway** – IM and RU functions are undertaken by single organisation without any significant separation between the two. This model is generally synonymous with a state run railway such as India. However USA and Australia have some privately run vertically integrated railways. In such railways competition is very limited as the monopoly operator has no incentive to promote competition.

ii. **Internal separated Railway** – In such railways there is an accounting separation between IM and RU. The services are chargeable between IM and RU. This structure is created through the holding company model with separate profit and loss accounts for different elements of the market. In some countries there is an independent organisation for allocating capacity between the RUs. This model provides for better transparency over costs and revenues and is more suitable to introduce competition – but conflicts of interest will remain because of the financial interactions between IMs and RUs. This market structure is required by European directives for rail transport.

iii. **Vertically separated railway** – In this model there is full separation between IM and RU. This model is considered to be most suitable model for the facilitation of competition. In this model there is no financial connection between the entities that can create conflicts of interest and provides a level playing field for all RUs as they have equal opportunity to access the rail infrastructure. In this model the incumbent RU is a normally

a private entity and broken into several units on geographical basis. The IMs may remain under the ownership of Government.

Table 1 : Possible Rail market structures and there pros and cons

Structure	Advantages	Disadvantages
Vertically integrated	• Permits integrated planning of operations • Facilities long term investment planning • Internalises (and reduces) transaction costs	• Lack of responsiveness to market demands when publically owned • Lack of pressure to improve productive and allocative efficiency when publically owned • Tendency to poor financial performance • Incumbent organisation is a substantial barrier to introduction of competition
Internal market	• Promotes greater transparency of costs and subsidies • Provides greater commercial incentives • Facilities integration of services as they are still part of one organisation • Reduces number of inter-agency relationships as compared to vertically separated structure	• Difficult to allocate common costs between sectors – creates potential for disputes • Lack of competition in operations • Size of incumbent RU will often create a market barrier for potential competitors
Vertically separated	• Promotion of competition between a variety of operators (either on track or for franchises) • Clarity of intra-industry relationships • Stronger incentives for RU efficiency and innovation through competition • Specialisation of RU and IM	• Greater potential for complication of timetabling and slot allocation between RUs • Difficulties in planning investments due to existence of different entities • Lack of integration of prices and services • Competitive process introduces transaction costs

Source: Adapted from OECD (1997)

Each of these market structures can in turn have different structures of ownership varying from state run agencies to corporatized state owned enterprises to part or fully privatised companies providing services under the supervision of a regulator or through a licence or contract. Ownership structures can also differ between the IM and RU. The structure of ownership can have significant effects on the incentives and efficiency of the sector, its sensitivity to passenger demands and conversely responsiveness to government policy objectives and initiatives and its ability to attract private finance.

Where competition is desired, the form of competition can also differ with the main distinction being competition 'in the market' – implying multiple operators competing in the same market at the same time, and competition 'for the market' – whereby operators bid against one another for the right to serve the market in a franchise system. Rail also faces competition from other modes of transport which can impose a constraint even where there is limited market competition.

Competition in the market provides stronger incentives for efficiency and innovation, but can also have adverse side effects – such as reducing economies of scale and scope, reducing levels of co-ordination and increasing complexity for passengers. This means that passenger markets will generally be better served through franchise competition.[3] Freight markets do not suffer from the same sensitivities and so competition in the market is often deemed more appropriate.

Another objective for market restructuring is to raise private finance for investment. This may be desirable because public funding is limited, or constrained in ways which makes advanced planning difficult to achieve efficiently (electoral cycles and changes in government for example). There may

[3] For example the UK has a franchise market system, but also has some limited scope for Open Access competition where new services can be identified by new operators. Such services are highly regulated to avoid conflicts with the franchise system.

also be a belief that the introduction of private finance may generally improve project design, management and operation. On the other hand private finance tends to be more expensive than public funding.

Vertically separated market structures are more attractive to private finance because they are more effective at segmenting risks and defining clear revenue streams. Private finance is also likely to be wary of market structures in which their commercial interests are at odds with the interests of a state-owned monopolist or large competitor. For these reasons vertical separation is generally regarded as the most effective market structure for raising private finance as it provides a clearer separation between private and public investment and revenues, reducing risk for the private investor.

There has been extensive research in to the relative costs and benefits of different industry market structures, but the academic literature Drew, J. and Nash, C.A. (2011) has no clear conclusion on the relative merits or demerits of these models. Introduction of competition is expected to create better incentives for efficiency and innovation – but this may come at the cost of loss of economies of scale created through vertical integration and the additional burden of transaction costs which can potentially offset the gains obtained due to separation.

Empirical analysis of these factors suggest that competition between RUs improves efficiency, but vertical separation may result in increasing costs which offset this saving. There is no clear conclusion except to highlight that several factors are important for considering the overall benefits and costs. For example – an article by Nash et al (2014) comparing the costs of railways in Germany, the UK and Sweden concludes that contrary to expectations the vertically integrated German systems seems to operate at the lowest subsidies and fare levels, but notes that this may be caused by a range of other factors

such as the size, design and level of historic investment in the network, its usage and other factors that influence efficiency.

Despite this absence of clear outcomes, many countries and organisations such as the World Bank, European Commission and OECD have sought to promote competition in the rail sector. This policy objective is result of widespread problems faced in the rail market under the integrated market structure, including:

i. Limited of no Competition
ii. Decline of rail share relative to road transport.
iii. Lack of efficiency.
iv. Lack of interoperability among the European countries.
v. Financial problems
vi. Lack of Investments to create additional capacity.

In view of the issues listed above European commission has sought to introduce competition in the European rail system by separating them into IM and RUs for complete separation or at least create a holding company structure. The effort has not been completely successful. The reasons behind this is that Governments are not certain about the benefits of separation. Another reason is that there are important practical issues associated with public ownership of domestic entities which mean that governments are reluctant to open services up to competition – from other countries for example.

The table below provides a summary of the structure and ownership of the rail industry across the world.

Table 2 : Structure of railway industry in selected countries

Structure	**Ownership**	
	Private	**Public**
Fully separated	UK, private operators and infrastructure company, limited by guarantee, not	Bulgaria, Denmark, Norway, Netherlands, Portugal, Romania, Spain, Slovakia,

	equity	Sweden, Australia
Holding company structure with separation of capacity allocation		France, Czech Republic, Finland, Slovenia
Holding company structure		Germany, Austria, Poland, Italy
Fully integrated	US, Canada, most of Latin America, Japan, Estonia	China and India

Source: CER (Community of European Railway) (2005)

UK experience tells us that Government will remain a significant player even after horizontal separation. The intervention is required to correct the failure of market mechanism. In any case the passenger train operations are subsidized since the IMs do no not charge full cost of infrastructure upkeep and development and the gap in finances is bridged by Government. Case for full separation and privatisation is further undermined due to this fact. In UK, privatisation of Railtrack had to be reversed following the Hatfield rail accident and it necessitated significant investment in repair and maintenance work which created additional financial burden. Similarly Eurotunnel was forced to be brought into government fold as the ridership was not as projected and consequent financial issues.

With this background, different countries have made different choices regarding the rail structure based on following factors : -

i. Policy objectives

ii. To promote competition in the rail market

iii. To improve efficiency within the rail market.

iv. To improve quality of infrastructure and services and need to bring fresh investments

v. Type of network and its usage – passenger of freight.

vi. Need and ability to fund the railways through public subsidy and private sources of finance

vii. Competition from other transport modes such as road and aviation.

viii. Political and other issues such as labour unions, protection of domestic companies from foreign competition.

To understand market structure further, UK, Germany, China, Russia and Japan have been selected and case studies have been made to give a high level overview of these Railway systems.

3.3 CASE STUDY I : United Kingdom(UK)

3.3.1 Introduction

The UK rail market is one of the most liberalised in Europe. Opening up of the rail sector started with the privatization (Kopcki R., Thompson L.,1995). UK market is open to investors at different levels and the railroad market in UK has developed in line with UK's general approach to the liberalisation and privatisation of other sectors(UN Report, 2018).

Network Rail compared to other UK infrastructure is different in the sense that it is the only entity to receive significant government subsidy rather than relying on customers to pay directly for all its costs and services. The rail sector in UK is regulated by the Office of Rail Regulation (ORR), but the Government is a stakeholder with involvement in setting overall detailed policy and strategic direction. The Government itself specifies and funds a lot of investments in the rail infrastructure. It also has a role in determining the assessment criteria for the franchise competition process.

The market composition of the rail sector is complex and involves a number of public and private entities. There are four key elements to the UK rail sector:

i. The public transport authorities (Department for Transport, Transport Scotland and some metropolitan authorities such as Transport for London), which specify, let and manage operating contracts and provide a significant proportion of the funding for infrastructure maintenance and enhancement to Network Rail.

ii. Privately owned and operated Train Operating Companies (TOCs) and Freight Operating Companies (FOCs). TOCs operate under

Franchise or Concession Agreements. The concessions are typically competitively tendered every 7 to 15 years. Service levels are determined during the franchising competitions and around half of fares are regulated by the Government. FOCs are wholly commercial with competition in the rail market and with other modes.

iii. Privately-owned and financed Rolling-Stock Companies (ROSCOs), which lease rolling stock to the TOCs.

iv. Network Rail - regulated rail infrastructure, owned and operated by a government body. Network rail was originally created as a company limited by a guarantee following restructuring of its private sector predecessor, Railtrack, in 2002. Most of the stations on UKs national rail network are owned by Network Rail but operated by Train Operation Companies. However, the major London terminals and some other major stations are both owned and operated by Network Rail and a limited number of other stations are both owned and operated by TOCs.

v. In addition to the national rail infrastructure, there are also High Speed and international rail infrastructures, i.e. the High Speed 1 (HS1) rail infrastructure and the Channel Tunnel infrastructure connecting Britain to the European continent. A second high speed line between London and Birmingham (and beyond) is also currently being developed and is scheduled to be completed by 2026. However, BBC has reported[4] that some delay is expected and the line may be completed by 2028 .

[4] www.bbc.com/news/uk-16473296

3.3.2 Structure of the market

UK rail industry is a vertically separated structure divided between infrastructure and train operation. Network Rail, with few exceptions, is the owner and operator of Great Britain heavy rail infrastructure, i.e. track and signaling and some large stations. Earlier Network rail was a Private Company but from 1 September 2014, is a central government body in the public sector, with all of its debt consolidated in the UK's national public sector debt.

UK Government is interested in developing opportunities for greater private investment in the rail sector. This objective has been achieved recently for HS1, which is privately operated under a 30-year concession agreement which began in 2010, and HS2 may also involve private funding in the future.

Privately held Train Operating Companies (TOCs) and Freight Operations Company (FOCs) are running passenger and freight services. TOCs are normally leasing rolling stock from privately owned rolling stock leasing companies (ROSCOs).

Economic regulation

Railways Act 1993, the key legislation governing the GB rail sector, provided the powers under which the network was initially privatized and regulated. Network rail operates under a Network License, granted by the Office of Rail Regulation (ORR). The license outlines duties, obligations, rights and restrictions to which Network Rail is subjected to. Train Operating companies are also subject to a licensing regime. However, TOCs are not subject to full economic regulation like Network Rail.

Network infrastructure:

Network Rail is subject to regulation by the ORR under a Regulatory Asset Base (RAB) structure, similar to other regulated infrastructure sectors, on a five-year cycle. Each regulatory five year cycle involves the ORR determining NR's regulated income for the coming period (referred to as a "Control Period" (CP)), based on a range of factors, including high level outputs and funding specified by the Department of Transport and Transport Scotland as appropriate.

Train Operating Companies:

UK rail franchising market is competitive and TOCs compete in the open market to win franchises awarded. Franchises are normally granted for duration between seven and fifteen years. Although TOCs are not subject to full economic regulation akin to Network Rail and are insured from changes in charges, they are often directly affected by the ORR's regulatory decisions. They operate under contractual terms specified in their franchise or concession agreement, and they require a licence to operate services which is issued and enforced by the ORR.

Freight Operating Companies:

FOCs are completely private companies and unlike TOCs are exposed to the financial consequences of five-yearly track access charge reviews. They require a licence to operate, like TOCs, which is issued and monitored by the ORR. Only a limited subsidy in respect of certain types of freight is paid by Government.

Network Rail

Network rail operates and own most of Britain's Railway assets which includes 30,000 bridges, viaducts and 20000 miles of track. It also operates 20 large stations. It is a public sector not for dividend company and any

profit it makes are reinvested in the company. The company is answerable to Department of Transport and Transport Scotland. Majority of its funding comes from Government. The office of Rail and Road regulator(ORR) is the independent safety and economic regulator for Network Rail. Its income is a mix of grant and borrowing from UK and Scottish government, charges received from passenger and freight train operators. Network rail is funded by government in five year periods called control period. Its sixth control period started from April 2019. For every control period ORR assesses the efficient level of expenditure that it believes Network rail needs to run its business and to deliver the outputs regulated by ORR. ORR determines the revenue it needs taking into account the other income network rail receives and then it determines how much network rail is allowed to charge train operators for use of network. The train operations are therefore, hugely subsidised as more than 35% of Network rail's revenue comes from Government grants(source : UK Rail Industry Financial information 2017-18).

High Speed 1 (HS1) Ltd

With a 30 year concession HS1 Ltd has a mandate to operate and manage the railway between St Pancras and the Channel Tunnel. ORR, as the economic and safety regulator for HS1 Ltd, oversees the company's performance and efficiency. ORR approves all new framework agreements as well as revisions to existing framework agreements (i.e. track access contracts, covering the reservation of capacity for more than one timetable period of six months). ORR also ensures that HS1 Ltd is provided with incentives to reduce the cost of allowing access to the network through periodic charge reviews. The first of such reviews has been completed and

covers the period from 1 April 2015 to 31 March 2020 (Control Period 2 or CP2).

Channel Tunnel

The UK-France Channel Tunnel is operated under a 99-year concession agreement and run by Eurotunnel. The concession will expire in 2086. A bi-national body, the Channel Tunnel Intergovernmental Commission (IGC) regulates the infrastructure for aspects such as safety and efficiency. The commission includes members from both the UK and France. From April 2015, responsibility for regulating efficiency transferred to the national regulators jointly.

Train Operators

Passenger rail services in the UK can be operated by Private companies through two methods i.e. by winning a franchise or concession to run passenger services or by becoming an open access operator that applies to run new services directly. TOCs are normally owned by privately owned transport groups or by non-UK state-owned transport groups that have entered the GB market. TOCs bid for the right to operate passenger services on certain routes and the concerned public authority directs the specific requirements for each concession or franchise. Conditions may include minimum service levels on particular routes and franchise tenure. However, as mentioned above the infrastructure such as Track, signalling and station infrastructure remains under the ownership, operation and maintenance of Network Rail.

Except for the large 20 stations in major cities operated by Network rail, rest of the stations are operated by TOCs. TOCs obtain track access rights from the regulator in return for fixed and variable track access payments to Network Rail. It is the responsibility of Department of Transport to specify and let contracts to TOCs for running of franchised passenger services in

England and Wales along with long-distance services that also serve Scottish cities. Services within Scotland (ScotRail) and sleeper services between London and Scotland are responsibility of Scottish Government. It is the responsibility of ORR to work with TOCs to ensure that Network Rail operates the infrastructure and plans the future development of the network.

TOCs do not require large capital expenses as they do not own infrastructure or rolling stock and their incomes comes from passenger fares and related commercial activities. Except for the certain fares that are regulated by the Government, TOCs are allowed to set other fares on a commercial basis.

The franchising policy is designed in such a way that TOC's exposure to revenue risk is limited. TOCs operate in a relatively safe environment as the Operating costs tend to be relatively stable and TOCs are usually safeguarded by Department of Transport against any variations in Track Access Charges determined by the regulator. For non-commercial franchise services i.e. cases where the revenues do not cover the cost, TOCs receive subsidy payments from Department of Transport. In cases where revenues exceed costs, TOCs pay Franchise Premiums to Department of transport. The arrangement between TOCs and NR also includes mechanisms to protect TOCs from the revenue and cost impacts of network change and disruption.

Freight operating companies

In the fully competitive rail freight industry a handful of FOCs operate and these companies are not subject to economic regulation by the ORR. FOCs operate under certain licence conditions as determined by the regulator, and they are also subject to regulated Track Access Charges set in the periodic review of Network Rail. FOCs, by design, operate outside of a

formal franchise regime and are therefore, unlike TOCs, exposed to changes in charging, and risks associated with capital investments.

ROSCOs

ROSCOs have been established after the privatisation of the UK rail sector to finance, maintain and renew rolling stock under long-term lease arrangements with TOCs. They are not subject to economic regulation, but rolling stock is licenced by the regulator for technical and safety purposes. As leases are not necessarily aligned with TOC franchise terms, the Department of Transport provides certain guarantees to ROSCOs to limit risks from franchise change.

3.3.3 Licensing & Safety in UK

Office of Rail and Road - ORR acts as the independent economic and safety regulator in UK. It's function is to regulate different aspects such as capacity allocation, track access charges, revenue requirement, licensing and safety for the railway operators and the infrastructure managers. ORR is the regulator for Network Rail, and as regulator is holds Network rail accountable for delivering expected level of service. It also holds Network responsible for providing good value for money – for passengers, the freight industry and taxpayers.

ORR operates as per framework set by the UK and EU legislation for discharging it's role as regulator and according to the UK legislation is accountable to the Parliament. The economic and safety functions and duties of the ORR are also as defined by different UK acts and legislations. As per EU law, ORR is the national rail safety authority for Britain. The key acts in this regard are (i) Railways Act 2005, (ii) Railways Infrastructure (Access and Management) Regulations 2005, (iii) Railway (Licensing of Railway Undertakings) Regulations 2005, and (iv) the Railway and Transport Safety Act 2003.

The process of licensing train operators is briefly explained below:-

Licenses for Train operators (Passenger and Freight)

According to The *Railway (Licensing of Railway Undertakings) Regulations 2005* passenger and freight train operators are required to carry appropriate European license. The license is issued by ORR following a statutory consultation process. ORR is delegated to issues the two type of European licenses in Europe as per following details:-

European passenger license: to run passenger trains

European freight license: to run freight trains

Licensing process:

Licensing process ensures that operators are technically and financially fit to run a railway – a license applicant therefore must satisfy criteria such as professional and safety competence, financial fitness and insurance cover for civil liabilities. The process an applicant has to follow for obtaining a relevant license can be broadly described as below:

Table 3 : Licensing process in UK

Step I : Applying for license	• Applicants can select the required license form from ORRs website • SNRP application are also available on ORRs website • ORR infroms DfT for all the aplications it receives
Step II : Licence application Consultation	• ORR checks the applicant for the information provided • ORR publishes a notice on it's website that it proposes to grant license to the applicant and allows 28 days for any objections to be made • The notice is also sent to bodies like DfT, Network Rail, Railway Safety & Standards Board, British Transport Police, Railway Delivery Group among others
Step III: Grant of license	• After a positive response or resolution, ORR Grants licences and SNRPs to the applicant. • Licences, licence exemptions and SNRPs usually do not have a built-in expiry date and remain valid until revoked by ORR

Source: Licensing Guidance, ORR, 2014

Authorizing criteria

License applications are analyzed by ORR for following parameters:-

a. Good Repute – to check for bankruptcy, pending legal proceedings, legal prosecutions or enforcement orders made by ORR.
b. Financial eligibility
c. Professional and Safety competence - to check for health and safety law requirement Third Party Liability Insurance (covering liabilities in the event of accidents and the insurance must be approved by ORR)

ORR also has the powers to revoke a license in following conditions : -

i. The licence holder has not started the licensed activities within six months
ii. The licence holder stops conducting licensed activity for a period of six months or more continulusly
iii. Convicted of an offence
iv. A person not approved by ORR obtains control of the licence holder

Safety

Although ORR is the safety regulator in UK, responsibility of ensuring safety is ensured by multiple agencies. There are many stakeholders involved at different stages in different roles of safety planning, implementation or investigation.

Health and Safety Executive (HSE)

HSE was created by *Health and Safety at Work Act, 1974*. HSE is required to give advice to Government on health and safety matters on all issues

including Railways. In 2006, responsibility for regulating health and safety on the railway from the Health and Safety Executive (HSE) was shifted to ORR.

Office of Road and Rail (ORR)

Other than economic regulator function, ORR also became the safety regulator for railways in UK in 2005. The action was taken as per *EU Railway Safety Directive, 2004 which* mandated that all EU member state should create a national safety authority.

As a safety regulator, ORR's responsibilities are : -

a. To discharge the responsibility of Safety regulator of the railways sector in UK
b. Setting safety related standards and requirements as per recommendations of Railway Industry Health and Safety Advisory Committee Rail Safety and Standards Board and monitoring the standards implementation.
c. To issue relevant licenses
d. To frame safety targets for Network Rail for the Control Period

The Railway Safety Levy Regulations 2006 gives ORR the authority to raise a levy from all railway service providers to fund railway safety functions and this levy is used to fund the ORR's safety related functions.

Railway Industry Health and Safety Advisory Committee (RIHSAC)

RIHSAC was established in 1978. The committee meets thrice every year and it advices ORR on Railway Health and Safety. It also provides its input on the new regulation and works undertaken to promote health and safety issues.

Rail Safety and Standards Board (RSSB)

The RSSB is a non-profit-making and independent body that is run on the principle of 'By the industry & For the industry'. Board function is to bring together infrastructure managers, train operators, rolling stock leasers and suppliers. Board is responsible for following areas : -

a. Act as Technical experts
b. Create Railway industry standards which are managed by the industry itself
c. To provide support for shared decisions, products and services with the aim to lower cost, improve performance and develop long term strategy.

Rail Accident Investigation Branch (RAIB)

RAIB is a government agency established in 2005 as mandated by *EU Railway Safety Directive 2004* that every member state should establish a National Investigating Body. RAIB's function is to independently investigate railway accidents and incidents on the UK's railways to improve safety and not to establish blame. It is mandated by law to compulsorily investigate accidents causing death, serious injuries or extensive damage. RAIB also has authority to investigate incidents that could have resulted to accidents.

British Transport Police (BTP)

The British Transport Police are the national police force in UK for the railways sector and provide police services to rail operators, rail operators' staff and the passengers throughout UK. It is responsible for investigating serious criminal offences

ORR works along with the British Transport Police and the Rail Accident and Investigation Branch to investigate causes of any incidents. In cases where the

BTP does not have any precedence, RAIB leads the investigation into the cause of the accident/incident.

Railways and Other Guided Transport Systems (Safety) Regulations (ROGS)

The *Railways and Other Guided Transport Systems Regulations 2006* were promulgated to implement the *European Railway Safety Directive (2004/49/EC)*. Regulations aim for establishment of a common approach to rail safety and support the development of a single market for rail transport services in Europe.

To ensure safety in operations, ROGS mandates railway operators to:

1. **Safety Management System**: Maintain a Safety Management System (SMS), which is a formal arrangement for a safer working environment. A Safety Management System includes:

    i. A Safety policy statement
    ii. Procedures for meeting standards and responding to accidents or near-misses
    iii. Safety targets for maintaining and improving safety
    iv. Emergency planning
    v. Change management processes

2. **Safety Certificate or Authorization:** Railway operators must hold a Safety Certificate or Authorization that proves that SMS has been accepted by ORR. To obtain the safety certificate applicants need to show how their safety management system will allow them to safely run their transport systems. Certificate is required for entities operating transport. Authorization is required for those that operate the infrastructure (signals, track, bridges, etc.)

3. **Risk Assessment and Safety Verification:** Carry risk assessments and establish measures identified as necessary to make sure the transport system runs safely. If risks are new or have significantly increased, a Safety Verification Process has to be adopted e.g. the arrangements must describe the process to control risks arising from the introduction of new/altered vehicles/infrastructure. Here, the duty-holder must appoint an independent competent person to help devise a written scheme of Verification of the duty-holder's project. Though ORR does not need to be informed of the Safety Verification Process, the duty-holder must keep all the relevant documents in possession till the lifetime of the certificate

   Following entities are required to comply with ROGS:

   i. Infrastructure managers

   ii. Transport operator

   iii. An 'entity in charge of maintenance' (ECM) - This includes any person or organization that is responsible for maintenance of a vehicle and is registered in the national vehicle register as an ECM. This may include organizations such as infrastructure managers, owner of the rail vehicle or a maintenance organization

3.4 CASE STUDY II : Germany

3.4.1 Introduction

After the re-unification of Germany, in January 1994, the two state owned railways - Deutsche Bundesbahn DB (West Germany) and Deutsche Reichsbahn DR (East Germany) were merged to form the Deutsche Bahn AG (DBAG). DBAG works as a joint stock company and Federal Republic of Germany is its single shareholder. In 1999, as part of the Railway sector reform, five new sub-divisions - rolling stock, track and other assets were created under DBAG as the holding company.

Rail regulation in Germany is in place since 1994 and it has evolved with the changing EU legislation and German rail reforms program. The EU directives require development of a national safety authority and a regulator supervising access to infrastructure.

From 1994 to 2005, the Federal Rail Authority (Eisenbahn Bundesamt, EBA) was responsible for overseeing both safety regulation and access to infrastructure. During the period between 1994 and 2002, the Federal Rail Authority (EBA) had ex-post regulatory powers and could conduct investigations of infrastructure managers upon complaint of the respective entities entitled to access. The scope of the Federal Rail Authority's regulation was enhanced between 2002 and 2005 when it gained additional regulatory powers to review the infrastructure managers.

However in January 2006, the economic regulatory powers were shifted to Federal Network Agency (Bundesnetzagentur, (BNetzA)). BNetzA is responsible for the regulation of Telecom, Energy (electricity, gas), Post and Railway infrastructure markets. Thus, BNetzA controls and regulates a non-discriminatory access of railway operators in Germany.

There are two separate regulators for the Railway sector in Germany - a safety regulator and an economic regulator. In order to achieve a fair and non-

discriminatory regime in setting access charges the economic regulator, BNetzA, performs both active and passive regulation of the market.

The railway market in Germany has a nominal vertical separation of the railway infrastructure and the train operations through a holding company structure which enables the separation of revenues and costs. Thus, the DB group exhibits the characteristics of a vertically integrated railway entity as well as separation of railway infrastructure and train operations. Unlike UK, Germany did not go for a complete vertical separation of its railway system but created separate accounts within the same holding company.

3.4.2 Market Structure

The German railway sector is dominated by the existence of one large incumbent company – the national rail company DBAG - with a network of 34,100 km and a number of smaller operating companies that operate at a regional level with a network of 7,200 km (Link H. and Merkert R. 2010). Germany, like many other countries in the EU, has mixed-use railways but passenger services are offered through separate subsidiaries of a common holding company.

Some of the key facts (IRG Annual Report 2014) about the German rail market are:

i. The German market is the biggest market in the EU in terms of freight kilometres with Poland and France the next largest.

ii. Freight trains in Germany had 24% share of total train kilometres.

iii. During 2013, 113 billion freight tonne kilometres were transported in Germany - the highest in the EU.

iv. The national rail company – DBAG – had 67% of the market share of all freight railway undertakings (operators) based on net tonne kilometre during 2013.

v. The Federal Network Agency (BNetzA) is responsible for regulating all major network industries (including railways) in Germany.

Key stakeholders

Deutsche Bahn AG is the national rail holding company in Germany. The company is composed of various sub-divisions. Details of few of the sub-divisions is as follows:-

a. **DB Netz Track:** DB Netz Track is responsible for rail infrastructure and providing safe and reliable rail operations. It owns and manages almost 34,000 km of the network route in Germany i.e. almost 85% of the total network route. Some of its main function are:
    i. Setting the track access charges which are regulated by the Federal Network Agency i.e. BNetzA.
    ii. Providing non-discriminatory access to its infrastructure
    iii. Preparing time tables with customers
    iv. Managing operations
    v. Providing track maintenance services
    vi. Managing construction and creating additional capacity (with the additional capital funding coming from the Federal Government)
b. **DB Netz Energy:** DB Netz Energy procures and supplies energy required for rail transport and owns and operates the necessary energy infrastructure required. DB Netz Energy is the only supplier of electricity for traction in Germany. A non-discriminatory grid fee has to be paid for using this electricity by the various operators to DB Netz Energy. This fees is subject to the supervision of BNetzA.

    The main responsibilities of DB Netz Energy are:

    i. Providing a reliable supply of power to meet the energy requirements of train operating companies for traction energy and stationary energy.
    ii. Procurement of energy

c. **DB Schenker Rail:** DB Schenker Rail is the national freight train operator possessing more than 3,000 locomotives and 92,000 wagons and freight cars. Its main responsibilities are to:

   i. To transport of single wagons or wagons groups

   ii. Procure rolling stock required for operation

d. **DB Services:** The main responsibilities of DB Services are:

   i. Inspection and maintenance works of trains including conversion and modernization

   ii. Reconditioning of rail components like brakes, wheel sets

   iii. Inspection and maintenance works of buildings related to rail infrastructure

e. **Federal Network Agency (BnetzA)**

The Federal Network Agency for electricity, gas, telecommunications, post and railway or BnetzA is an independent, cross-sector regulatory authority and reports to the Federal Ministry for the Economy and Technology. For the Railways sector, BNetzA is responsible for monitoring rail competition and ensuring non-discriminatory access to railway infrastructure.

f. **Federal Railway Authority/EBA**

The Federal Railway Authority (EBA) is the Safety regulator and licensing authority in Germany for railways. EBA is subject to supervision by Federal Ministry of Transport and performs the following main functions:

   i. Provides licence to the infrastructure owners and train operators

   ii. Provides technical supervision and authorisation of rolling stock and railway infrastructure for Safety regulations

g. Federal Cartel Office (Bundeskartellamt)

The Bundeskartellamt (Federal Cartel Office of Germany) is an independent competition authority, under the supervision of Federal Ministry of Economy and Technology, tasked with the responsibility of protection of competition in Germany. As a federal entity, the Bundeskartellamt looks at price-fixing agreements and other anti-competitive agreements between companies. It also has the mandate to prosecute and impose substantial fine on entities violating the German competition regulations. The Federal Cartel Office has, in the past, initiated proceedings against the DBAG on suspicion of restricting competition in ticket sales for passenger railways.

Economic regulation

The economic regulatory function performed by EBA was shifted to The Federal Network Agency, BNetzA in 2006.

BNetzA has evolved to its present day role as a cross-industries economic regulator for railways, telecom, energy and post over many years. It was initially established in 1998 as the Regulatory Authority for Telecommunications and Post as these sectors were privatized much earlier.

As the economic regulator, it is the responsibility of BNetzA to ensure non-discrimination for all train operators or railway undertakings through the regulation of - track access charges, principles used for setting track access charges, facility access charges and capacity allocation. Entities that perceive discrimination can appeal to BNetzA for resolution and every planned new version or revision of fees for the use of train path or service facilities is first submitted to BNetzA for review BNetzA may at any time conduct a review, on its own initiative, of the applicable rates and charges to check for compliance

The two acts which ensure the non-discriminatory access to railway infrastructure in Germany are the *General Railways Act* and the *Ordinance Governing the Use of railway Infrastructure.*

3.4.3 Safety and Licensing in German railways

Licensing

Any railway undertaking that wishes to operate train services in Germany has to at first obtain a license as per the General Railways Act of Germany. The Federal Railway Authority (EBA) is the German national authority that acts as the independent safety & licensing regulator and is responsible for issuing such licenses. The EBA also performs the following processes:

- Issues safety certificates and licenses for railway undertakings
- Issues safety authorizations for infrastructure managers
- Authorizes Rolling Stocks, Sub-systems etc.
- Maintains a national vehicle register and a rolling stock register

Licensing process:

The process for obtaining a railway license by RUs in Germany is as follows:

1. An applicant who wishes to obtain the license has to prepare and submit the application available on EBA's website.
2. On receipt of this application, the EBA first checks whether the applicant has a Safety Certificate (which is mandatory in order to apply for a license)
3. If the valid Safety Certificate is present, EBA checks the Authorizing criteria for the applicant. For the purpose of granting licenses, the EBA evaluates the following parameters as the authorizing criteria:

a. The applicant and the persons in charge of the management of the undertaking must be of good repute,
b. the applicant must be financially fit,
c. the applicant or the persons in charge of the management of the undertaking must have the required professional competence

4. In case, the valid Safety Certificate is not present, EBA shall return the application on the basis of the non-availability of a valid safety certificate. The applicant can apply for a Safety Certificate to be issued

A license issued by the EBA has a validity of maximum 15 years. The license is issued for the provision of rail services for the carriage of passengers and/or freight. The license may include requirements or conditions depending upon the assessment done by EBA.

Safety

The Federal Railway Authority (EBA) is the national regulator for rail safety in Germany. In addition to the EBA, the other entities / agencies involved in rail safety in Germany include the DAkkS, EUB and the RSAC. These have been described below:

Federal Railway Authority (EBA)

The Federal Railway Authority (EBA) is the German national Safety authority and performs the main safety related function of monitoring and developing the safety regulatory framework.

National Accreditation Body (DAkkS)

DAkkS is the sole provider of accreditations related to railways in Germany. It is an independent non-profit body. It is subject to the Federal governments' technical, legal and financial supervision and is entrusted by the government to carry

accreditation tasks. Its main responsibility is to determine the technical competence and independence of the:

i. Inspection Bodies
ii. Certification Bodies
iii. Verification Bodies
iv. Laboratories
v. Providers of proficiency tests

Federal Railway Accident Investigation Office (EUB)

The Federal Railway Accident Investigation Office (EUB) is the independent investigating body responsible for the following:

1. Investigation of accidents on the railways infrastructure. These investigation carried out by the EUB are independent of criminal claims and are not intended to determine blame
2. To understand the reasons and provide proposals on both corrective and preventive measures to improve safety (based on the investigations)

Railway Safety Advisory Council (RSAC)

The Railway Safety Advisory Council advises the Federal Railway Authority in the performance of its duties as a safety authority.

Supervisions conducted by Federal Railway Authority (EBA)

In order to ensure and implement safety, Federal Railway Authority (EBA) conducts the following supervisions:

Supervision of railway undertaking and infrastructure managers

For ensuring safety regulations are met by the railway undertaking and infrastructure managers, the Federal Railway Authority (EBA) performs the

supervision of permanent way and structural installations by conducting audits and sampling checks. The monitoring done can be classified into the following:

1. Monitoring of undertakings: Assessment of the operator's maintenance organization by evaluating the organizations responsible for the installations. This audit is conducted every 2 years.
2. Monitoring of installations: Assessment of the condition of the installation to be made on site as well as the monitoring of the staff involved in maintenance. It is carried out by observing the inspections of the installation carried out by the operator
3. Special monitoring: The EBA can conduct special inspections after exceptional incidents

Supervision of signaling, telecommunication and electrical installations

This supervision is based on a statistical methodology which uses a risk and fault-based approach for the inspection of installations. The frequency of faults and the importance of the installation in terms of safety is also taken into account and there are clearly defined test guidelines along with checklists for each technology. Thus, it identifies on a statistical basis, which of these installations are at a higher risk.

Inspection of railway vehicles

The Federal Railway Authority (EBA) carries out inspection of rolling stock wherein the EBA:

a. Checks the systems for vehicle types and the design
b. Checks specific installations on the rolling stock

Safety Certificate

In order to obtain a license and start rail operations, the RU is required to possess a Safety Certificate from the EBA. For this purpose, an application for a safety certificate is to be submitted by the applicant RU to the Federal Railway Authority. The Authority then decides on the application within 4 months after it has received all the documents necessary for it to take a decision. To operate public rail services, railway undertakings require a safety certificate. This rule has its origins in the European Safety Directive (Directive 2004/49/EC), which was put into force by the (then) 5th Act amending Railway Regulations at the end of April 2007.

3.5 CASE STUDY III : JAPAN

3.5.1 Introduction

First Japanese railway line was opened in 1872 between Tokyo and Yokahama first private rail company was opened in 1881. Ministry of railways was established in 1920, Japanese national railway was started in 1949. First high speed train was started in 1964 between Tokyo – Osaka. JR group of companies was established in 1987 as a result of JNR reform. In 2006, 3 JR companies in mainland Japan were privatized.

From its establishment in 1872, Japan has created a Railway infrastructure which is one of the best in terms of quality of service and safety record. The rail network in metro cities and bullet trains known as shinkansen are extensively developed and form an integral part of Japanese society. Major Railway stations also duplicate as shopping centers and part of day to day life of Japanese citizens.

3.5.2 Network

Table 4 : Rail Network in Japan

Total length (2014)	Approx. 25,000 km
Shinkansen high-speed tracks (March 2016)	2,764 km
Operators (2015)	211
Railway gauges	Conventional: Narrow gauge (1067 mm) Shinkansen: Standard gauge (1435)
Electrification	JR: 1500V DC, 20KV AC (conventional) 25KV AC (Shinkansen) Private: 600V DC, 750V DC, 1500V DC Frequencies: 50Hz (Eastern Japan), 60 Hz (Western Japan)
Signaling systems (ATP)	ATS (Automatic Train Stop) ATC (Automatic Train Control)

	Shinkansen: DS-ATC, RS-ATC, KS-ATC, ATC-NS (European Train Control System (ETCS) equivalent)
Dispatch Centers	COMTRAC (Computer-aided Traffic Control) by JR Central COSMOS (Computerized Safety, Maintenance and Operation Systems of Shinkansen by JR East.

Source : MLIT; Transport Analysis, Railway in Sweden and Japan – a comparative study (November 2014); Japan Railways in figures 2015 edition (Institution for Transport Policy Studies, October 2015) p. 22

Shinkansen – The bullet train network in Japan was 2764 kilometers in 2016 and this network is under continuous expansion due to encouragement by state governments in Japan. Shinkansen is operated by four JR group companies i.e. JR East, West, Central and JR Kyushu.

3.5.3 Structure

As on 2015, 211 companies and railway entities were registered with Ministry of Land, Infrastructure, Transport and Tourism. The break up is as follows: -

Table 5: Rail companies operating in Japan

Operator	**Number of companies/entities**
Former Japan National Railways (JR) companies	6
Large private operators	16
Second tier	5
Public (Municipal) operators	11
Small and medium sized operators	128
Cargo railways	12
Monorail operators	9
New Transportation Systems	9
Cable car operators	14
Trackless trains	1
Total	**211**

These companies are not only involved in Railway transportation but engaged in other transport activities also.

JR Group of Companies

JR group of companies are the result of privatization exercise undertaken in Japan in 1987. The state owned company Japan National Railway (JNR) was divided into six region wise companies and one nationwide entity JR freight. The six regional JR companies are JR Hokkaido, JR East, JR Central, JR west, JR Kyushu and JR Shikoku.

The three JR group of companies have been completely privatizes. The process started in 1993 when 62.5% stake in JR East was sold and in 2002, entire stake was sold to private hands. This was followed by privatization of JR west in 2004 and JR central in 2006. Remaining three companies although owned by State work for profit like any other private company, However, their revenues are not enough and State support is provided to these entities.

Unlike the separation model adopted by most of the European countries where Railways have been separated into Infrastructure Managers and Train Operators, Japanese countries are integrated entities – they own the rolling stock , locomotives, maintain the below rail infrastructure and operate trains. The difference lies in the fact that Japanese rail companies are operating in different geographical areas. Shinkansen system slightly deviates from this in that shinkansen infrastructure was developed by state and then leased to JR group of companies.

Long distance trains are run by signing agreements between the concerned rail companies and rolling stock is shared for this purpose amongst the passengers so that inconvenience of changing trains is avoided.

Freight and passenger trains are organized separately and Japanese train market is dominated by passenger traffic. As per 2012 estimate, freight share in terms of

tonne – km was only 5%. Smaller freight companies own their infrastructure in some instances but JR Freight operates throughout Japan across network owned by different companies.

Institutional framework and Agencies in Rail Transport

Ministry of Land, Infrastructure, Transport and Tourism(MLIT)

MLIT is the apex body working under the supervision of Japanese parliament and is responsible for framing and implementing transport policy. The Ministry is divided into several wings and Rail Bureau is entrusted with Railway issues.

Japan Railway Construction, Transport and Technology Agency (JRTT)

JRTT was established in 2003 after merging Japan Railway Construction Public Corporation (JRCC) and Corporation for Advanced Transport and Technology(CATT). JRTT has been formed to promote system of mass transport. JRTT is engaged in construction activates and providing subsidies to rail and marine transport companies. Rail related construction activity involves development of new rail network and shinkansen lines. It also works on projects for improving the existing lines.

JR Group

Six JR passenger companies and JR Freight are important actors in Japanese railway ecosystem.

RTRI

Railway technical Research Institute was set up in 1986 and is involved in R&D activities in Railway technology. The Institute is involved in following activities[5]:-

a. R&D of Railway technologies

[5] RTRI Website https://www.rtri.or.jp/eng/rtri/

b. Investigation of railway technologies and science
c. Railway technology standards
d. Release of railway-related documents, materials and Statistics
e. Publications to promote railway technologies and science
f. Drafting of original plans and proposals for standardization
g. Commissioned testing and research projects in addition to the above

Accident Investigation Organization

Japan Transport Safety Board(JTSB) was established in 2008 to investigate railway accident as well as marine and aircraft accidents. Its predecessor, Aircraft and Railway accident Investigation committee(ARAIC) was set up in 1974, was for aircraft and train accident investigation which was subsequently subsumed in JTSB.

3.6 CASE STUDY IV : Russia

3.6.1 Introduction

The Russian rail system is of significant strategic importance for the country as it has a modal share of 85% for freight traffic , (excluding pipelines), and 27 % for Passenger traffic(РЖД 2014). The Russian railway system is the:

- Highest in terms of average lead of freight movement (1,700 km)
- 3rd largest network in the world (85,200 route-km(World Bank 2014) of which half is electrified) after USA and China
- 4th in terms of passenger kilometers (128,820 million passenger-km(http://data.worldbank.org/indicator/IS.RRS.PASG.KM 2014) after China, India and Japan)

3.6.2 Rail market structure in Russia

Historically, Rossiyskie Zeleznye Dorogi (RZD – the Russian Railways) (wholly owned by Russian Federation) was an absolute monopoly. A reforms program of the Russian railway system began in 2001. This reform program set out a clear direction for the future of railways in Russia and the following were the objectives of these reforms:

i. Introduce competition in railway transport;
ii. Facilitate private investment in rolling stock to renew the fleet;
iii. Improve sustainability, safety, access, and the quality of railway system; and
iv. Reduce the economic costs of freight and passenger transport.

The main idea of the reform was to separate the areas of RZD where competition would be possible and thus attract private investment and private initiatives into such competitive segments. The reforms were also aimed at increasing flexibility in setting operating tariffs, increasing investment opportunities for the industry and improving transparency in the overall railroad business in Russia.

As a result of the reforms, about 80% of freight turnover is transported by freight wagons owned by private wagon operators. There are companies that have between 20,000 and 50,000 wagons each and can operate on a countrywide basis. These private wagon operators mainly focus on higher margin cargo by providing premium services and optimizing empty runs.

However, only RZD is allowed to operate locomotives. RZD owns nearly all the mainline locomotives in Russia and is the sole locomotive operating company in Russia. There are a few smaller companies that own locomotives but these companies rent out their locomotives to RZD.

RZD is still not commercially viable and relies on government subsidies for capital investment and the costs of money-losing passenger services. The Russian government plans more reforms in the period up to 2030 to address the remaining issues on the reform agenda

Economic regulation

In Russia, there are two main economic regulators. They are Federal Tariff Services (FTS) and Federal Antimonopoly Services (FAS). As mentioned earlier, the main and only infrastructure owner is the Russian Railways (RZD). FTS sets rail tariffs after discussions with the Ministry of Transport and the Ministry of the Economy. In reaching such decisions on tariffs, FTS considers the macroeconomic situation and the funding needed to cover RZD's operating expenditures and to repay borrowings. Tariffs are subject to annual indexation. These tariffs are applied by RZD towards operators who pays to RZD for infrastructure usage and, in some scenarios, for wagons rent as well (in case if operators do not own wagons).

The FAS ensures non-discrimination for all train operators or railway undertakings with respect to track access charges, facility access charges, capacity allocation, safety certificates and authorizations and operating licenses.

This compliance to non-discriminatory access is ensured by the economic regulators in the following manner:

- Entities that perceive any discrimination can appeal to FAS for resolution
- Every planned new version or revision of fee for the use of train path or service facilities is first submitted to FAS for review
- FAS may at any time conduct a review, on its own initiative, of the applicable rates and charges to check for compliance

Freight Tariff

There are two tariff books in the Russian Federation for freight:

I. Domestic Traffic: Tariff List 10-01 (Preiskurant 101) which is established in 1989 is used for domestic, export, and import traffic. These tariffs are regulated by FTS.

II. International transit traffic: The second book is based on 1993 Tariff Policy of CIS Railways.

Tariff List 10-01 covers rail track access charges, charges for locomotive hire, charges for wagon hire etc. The freight tariff is broadly divided into two parts. The first part is a charge for the infrastructure and locomotive services. This is approximately 85% of the tariff and is regulated by FTS. The second part is a charge for the wagons. This is regulated by FTS if wagons belonging to RZD are used and market driven if wagons are provided by private sector.

Commodities are divided into three classes. Class I broadly consists of raw materials such as coal, iron ore etc. Class II consists of intermediate good such as fertilizer, grain etc. Class III consists of finished goods such as paper, steel etc. Within each class

the tariffs differ as per the commodity. The tariffs for Class I are the lowest and for Class III they are the highest. Most private wagon operators in Russian railway system carry Class II and Class III commodities.

3.6.3 Licensing & safety

In Russia, the legislation specifies conditions for the licensing of entities engaged in activities relating to railway transport. The licensing of railway transport operators is regulated by the Federal Law on the Licensing of Certain Activities. These licenses are granted for a period of 5 years by the Federal Service on Transport Supervision and Control which is part of the Ministry of Transport. Any licensee wishing to extend its license after expiration is required to apply to the Federal Service and pay a state tax. The Russian legislation permits simplified licensing rules if the licensee has civil liability insurance or internationally recognized certification to carry out the activities mentioned in its application seeking license. Also, as part of the simplified procedure, the licensing body waives the preliminary inspection and further scheduled inspections of the licensee’s activities.

3.7 CASE STUDY V: China

3.7.1 Introduction

As compared to other large countries, rail development started late in China. In 1949, China rail network was only 22,000 km long and damaged due to war. Since then, the network has increased many folds and the growth during last two decades is astounding and it has increased by more than five times in terms of route kilometers . The expansion of High speed rail network is equally rapid and has no parallel in the World. The current high speed network in China now is equal to all the other countries combined.

3.7.2 Structure of Rail Industry

Chinese rail industry has undergone several rounds of reform and most extensive reforms were carried out in 2013. However, the reforms are unique in the sense that ownership and control of state has remained intact through reforms .

Rail sector in China is governed by Railway law enacted in 1991. The law deals with following five subjects/ areas : -

1. Commercial aspects of freight and passenger business
    a. Commercial aspects of freight and passenger business such as who will fix tariffs, how claims will be settled, military transport etc. are dealt in these sections
2. Planning, construction standards and opening of new lines
    Planning, construction, guage, technical standards, land acquisition etc. is dealt in this portion
3. Sector Administration
    Provisions of administration of different units are in this section

4. Safety

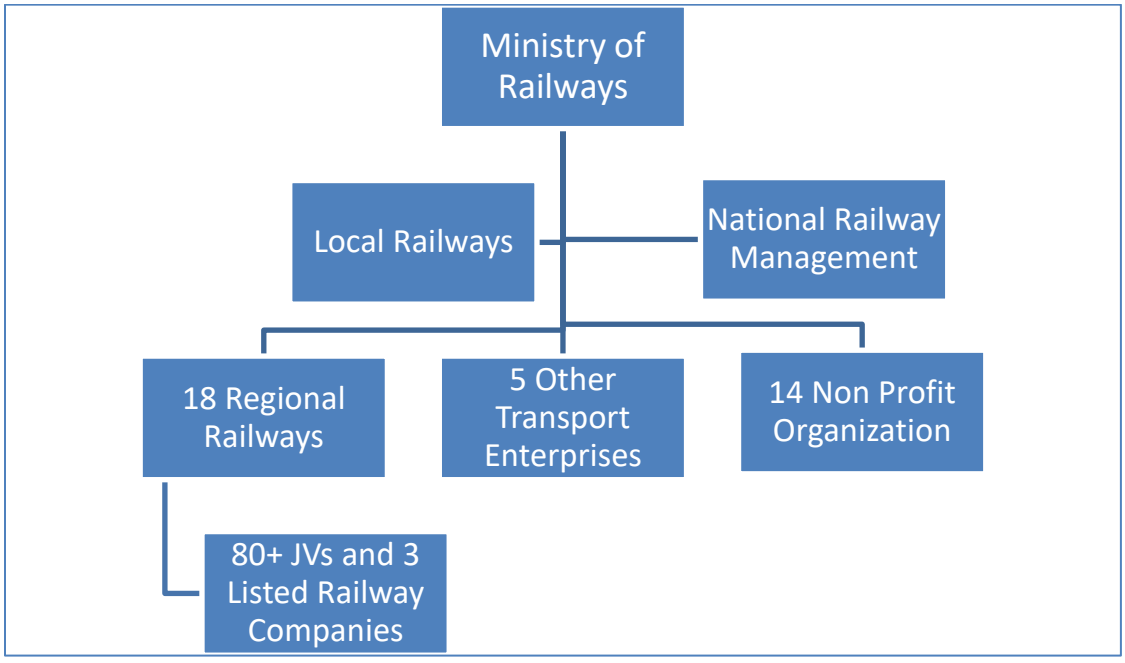
   Level crossing gate, carriage of dangerous goods, construction of bridges are dealt in this section.

5. Legal matters

   Legal aspects of the Act such as action to be taken in case of violation of act, formulation of regulations under the act are dealt in this section.

Before 2013, Ministry of Railways (MOR) was the apex body in control of Railway industry. Ministry was responsible for supervising the entire sector, frame policy for the sector, lay down technical standards, planning and investment, finance, rolling stock management and regulatory functions. Rail network infrastructure and services were operated by 18 Regional Rail Authorities (RRAs). While MOR had overall control RRAs were responsible for daily management of railway infrastructure and delivery of rail transport services.

Figure 1:PRE 2013 Chinese Railway Structure



Source:https://ppiaf.org/sites/ppiaf.org/files/documents/toolkits/railways_toolkit/PDFs/RR%20Toolkit%20EN%20New%202017%2012%2027%20CASE4%20CHINA.pdf

A very unique incentive/ disincentive program was launched in China in 1999. Program known as Asset Operation Liability System (AOLS) made RRAs' managers accountable for return on capital, output, profitability, and safety. Managers were made responsible for managing and increasing assets assigned to them. All member of management even stationmasters were asked to make incentive deposit proportionate to their rank and they forfeited the deposit if targets and commitments are not met. If targets were met, they got their deposit back along with bonus which could be p to double the value of the deposit. AOLS implementation improved RRAs' financial performance and safety improved significantly and accidents declined.

Before 2005, RRAs were divided into about five sub-administrations, each with a structure similar to RRAs. This sub administration was abolished in 2005 and RRAs become directly involved in management.

National Development and Reform Commission (NDRC) which was set up before 2013 gave following recommendations for Rail reform: -

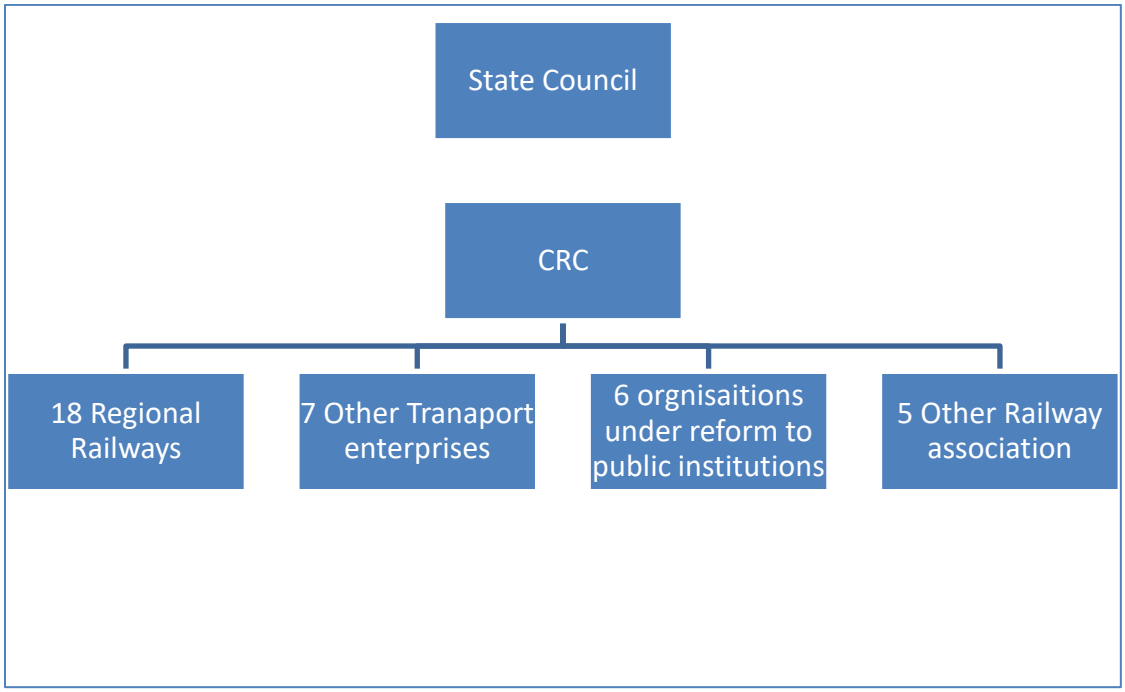
a. Separate government administration from enterprise management;
b. Introduce competition where suitable; and
c. Regulate industry more effectively.

In 2013, Chinese Government undertook steps to restructure Rail Industry and Ministry of Railway was dissolved and Government functions and Rail Operations were separated. Regulatory and administrative responsibilities from commercial operations were completely separated , however, railway assets remained centralized . National People's Congress (NPC) passed a restructuring plan in March 2013 and following three entities were created :-

a. The Ministry of Transportation (MOT), responsible for overall planning and policy;

b. The State Railways Administration (SRA), a new body under the MOT for setting technical standards, setting and monitoring safety standards, and supervising the quality of transport service and construction;
c. China Railway Corporation (CRC), a newly-established state-owned body for Railway Operation.

Figure 2 : Post 2013 Chinese Rail Industry Structure



Source:https://ppiaf.org/sites/ppiaf.org/files/documents/toolkits/railways_toolkit/PDFs/RR%20Toolkit%20EN%20New%202017%2012%2027%20CASE4%20CHINA.pdf

CRC monitors the 18 RRAs and RRAs have no board of control. RRAs head are responsible to CRC. CRC is financed by Ministry of Finance as Ministry of Rail is now defunct. CRC reports to the State Council.

As per newspaper reports emerging from China, in June 2019, China Railway Corporation (CRC) has been renamed as China State Railway Group (CR) and is now a state-owned enterprise with registered capital of 1.7 trillion yuan ($245.46 billion).

The company will now have a corporate structure with a board of directors and the Ministry of Finance would perform investor duties at the company.

According to China State Rail Group statement on its website "This initiative is aimed at deepening the reform of the railway system and to establishing a modern enterprise system, and promoting market-oriented operations,"

Debt of CRC increased to 300 billion yuan in 2019, from 240 billion yuan in 2018 and the restructuring is expected to ease the financial pressure and to meet government expansion targets.

3.7.3 High Speed Rail in China

Development of High speed rail network in China is one of the most remarkable stories in Rail development (Lawrence, Martha, Richard Bullock, and Ziming Liu. 2019); China started its HSR constructions in 2008 and in ten years period it has operationalized 25,000 km of rail network – more than all other HSR network in rest of the world put together. The first line was opened in 2008 between Beijing and Tianjin coinciding with the 2008 Olympic games and since then the network has grown to 25, 162 kilometer by 2017 end. China has many large cities situated at a distance of 200 to 500 kilometers suitable for HSR connectivity and it is running about 2600 trains per day on its HSR network.

HSR development in China is guided by Medium- and Long-Term Railway Plan (MLTRP). MLTRP – a plan for fifteen year - was approved in 2004 and revised in 2008 and 2016. Initial plan was for development of an HSR network of 12,000 km by 2020. The 2016 revision in the plan has revised the targets and now the plan aims for a network of 30,000 km by 2020, 38,000 km by 2025, and 45,000 km by 2030.

HSR lines have been constructed through special-purpose asset construction and management companies. These companies are normally joint ventures between the central and provincial governments. Most HSR lines have at least an hourly service between 7:00 a.m. and midnight translating into annual passenger demand of 4 million to 6 million passengers to be operated efficiently. Network speed is selected based on factors such as line's role in the network, market demand, and engineering conditions and investment cost. Fares are comparable with bus and airfares and low fares have made HSR travel affordable to passengers from all income group. HSR in China is able to capture up to half of the conventional rail traffic, almost all the intercity bus traffic and a majority share in air traffic up to 800 km. HSR has also created new market which may not have been possible in absence of HSR.

China has adopted some very innovate methods in constructing new HSR lines and as a result a very high quality infrastructure was built at an average cost of of $17 million to $21 million per km. This is about two third of what is possible in other countries despite the fact that many Chinese lines have a high proportion of their route on viaducts or in tunnels. Low labour cost is a factor in achieving this cost economy but the key reason for achieving cost economy lies in the standardization of designs and procedures. Scale of construction has also led to the creation of a capable, competitive supply industry.

Some concerns have been raised on safety of HSR operations in China. The record so far in this has been unblemished. China is managing safety by adopting project lifecycle approach. In this approach right from design phase, during construction, and operation & Maintenance phase safety is built in the system. Asset condition data is collected through physical inspection and dynamic testing and this data is used to ascertain maintenance requirement. A four-hour window is provided every night for maintenance.

Financial aspect of the HSR line differs from line to line. Lines with 350 kmph speed with average traffic densities of more than 40 million passengers per year and adequate average passenger revenue are able to generate enough revenue to pay for train operations, maintenance, and debt service. However, many lines in China with traffic density of 10 million to 15 million passengers per year, especially 250 kph lines without adequate passenger revenue are not able to cover train operations and maintenance, and are unable to contribute toward their debt service costs.

The economic impact of the HSR services can provide many valuable lessons for India. HSR in China has provided major benefits in terms of reduced travel time, better service. Benefits has also accrued for the transport sector as whole as users of higher-cost modes such as automobile and air transfer to HSR. Mode shift has also reduced externalities (such as accidents, highway congestion, and greenhouse gases. Regional connectivity has improved and it has helped in balancing growth across the regions and in poverty reduction.

3.8 Conclusion

The Rail Industry structure in the five countries we have studied is different. Each country has adopted an institutional set up according to their understanding of Industry and local requirements. All five countries run mixed services i.e. both freight and passenger services are run. Except China, private players are operating services in one form or another. In case of China only the state owner ship is maintained and private players are not allowed and the remarkable fact is that rail network has grown fastest in China particularly the High speed network. The requirement of India for network expansion are similar to China and Chinese model of financing the network and service expansion may hold important lessons for India.

4.0 Development of Track Access Charges in UK and Germany

4.1 Introduction

During the last 35 years Railway Industry has seen radical changes in terms of structure. Vertically integrated , state ownership pattern of Railway Industry has changed and it has been replaced by a model where infrastructure and operations have been separated. USA, China, India and Canada are the major exception to the separation model but Europe and Australia are the front runners in the model where infrastructure and operations have been separated.

In Europe, Sweden was the first country to implement the separation model followed by UK (UN Report, 2018). EU also issued a directive in 1991 namely 91/440. The directive did not mandate complete separation of Infrastructure and Operations, however, a number of countries in Europe have adopted the separation model. Some countries like Germany have followed a slightly different holding company model. The key element in the separation model is "Track Access Charge''. Track access charges are the charges levied by Infrastructure Manager on Operation Management company for providing access to the track for Operation management company to run the train.

Track Access charges have evolved over the period of time in every county where the separation model has been implemented. UK and Germany have been selected for study of development of track access charges over the years. Before discussing the development of track access charges in UK and Germany a brief discussion on the components of track access charges is presented below :-

4.2 Track Access Charge

Components of Track Access charge (TAC) depend upon the objective of the Institutional set up. For example, if the Infrastructure Manager(IM) and Rail User(RU) both are private entity and IM does not get any financial support from Government or other wise, the objective of the TAC regime will be full cost recovery. The TAC regime may also be required to balance multiple competing objectives. The objectives will vary according to local circumstance but they could include:

i. **Cost recovery** – to provide a mechanism for the IM to recover the (efficient) costs it incurs.

ii. **Promoting competition** – to provide conditions in which competition between RUs

iii. **Short term efficient utilisation** – to provide mechanisms which promote efficient utilisation of the infrastructure in the short term, reflecting the short-run marginal social costs of operation.

iv. **Long term investment incentives** – to provide incentives for the IM and RUs to make efficient use of the infrastructure over the long term. For example by encouraging the use of efficient, clean and safe rolling stock and encouraging the IM to invest in additional capacity.

v. **Equity** – to provide a means to allocate costs to users in a way that takes account of ability to pay for example.

vi. **Practicality and simplicity** – to be easily computable and to make it easy for everyone to understand.

Each objective has its own merits and demerits and it is for the Government concerned to fix the objective for TAC regime according to what it thinks is best in its interest.

4.3 Charging approaches

There are two main approaches for setting TACs:

i. Full cost (FC) recovery, whereby TACs recover the total long terms costs of the infrastructure.

ii. Partial cost recovery, whereby TACs recover only part of the long term costs of the network, with the rest covered by government subsidy or some other source of income.

The choice between the two approaches is driven by government policy and the availability of government subsidy. The government policy in turn depends upon two factors - market structure and the use of the rail network by passengers and freight. In passenger dominated markets, Governments are more likely to provide subsidy support to reduce passenger fares.

The choice between these two approaches also depends on market demand elasticity, or the price that the market can bear. Even for full cost recovery, price still needs to reflect market conditions and in certain scenarios the market may not be able to bear full cost recovery.

Social reasons like to provide connectivity or to integrate a remote part of country or positive externalities such as environment or overall impact on economy associated with rail usage may also prompt the Governments to provide subsidy.

Most governments provide some level of subsidy.

4.4 Charging methods

For the two approaches of setting TAC, there are following five main methods for setting TACs:-

i. Marginal costs

TACs are based on the marginal costs that rail users (RUs) impose on the IM and other stakeholders through their activities i.e. the wear and tear costs of rolling stock, use of infrastructure, congestion and other externalities.

The charge should be set to reflect costs directly incurred as result of operating the train network..

ii. Marginal costs plus a mark-up

TACs are primarily based on the marginal costs that are imposed on the IM (and stakeholders) from the activity of a train operator but with an additional 'mark-up' or secondary charge to cover some or all of the residual costs (i.e. total costs less marginal costs less government subsidy).

iii. Average costs

The average cost approach is generally the simplest method and it is also easily understandable for operators, and very transparent making it both practical and simple. This method is based on dividing the revenue requirement by a volume measure which is then used to set an average price.

The most common volume measure used by IMs are gross tonne-km (GTkm) and train-km (TKM).

iv. Two- part tariff

Under a two part tariff regime, TACs are set separately in two parts using a fixed and variable charge. In principle the variable charge is set to align with marginal costs, with the fixed charge set to recover the residual costs (often through the application of Ramsey pricing principles). The method is similar to the marginal cost plus mark-up method, with the distinction that the fixed charge (equivalent to the mark-up) has no direct relationship with the use of the network.

v. Negotiated charges

In North America, Australia and some parts of other jurisdictions, TACs are negotiated between the IM and RU, often with regulatory oversight to prevent the abuse of market power. This is often achieved by setting a price floor and ceiling based on marginal and full costs. It is only appropriate when the IM has limited market power over the RU and negotiations can be undertaken meaningfully.

4.5 Tariff structure, charging units and segmentation

Once the method of the charge has been selected two more things i.e. tariff structure (i.e. what is being charged) and charging units (i.e. how it is being charged) need to be decided to finalize the TAC regime. Tariff structure

Some of the aspects of the tariff structure in practice in different countries is listed below

i. **Access charge** – Charge for ability to access the network or a specific feature of the network such as a terminal or station. The rationale for this charging concept is that some costs are invariable with the level of usage of the infrastructure.

ii. **Variable use charge** – Charge related to usage of the track based on the level or number of train movements (e.g. tonne km or train km). This is the most widely used tariff concept for rail networks across jurisdictions as it can be used to provide a link with wear and tear. Most TAC regimes include a charge based on train movement in some form.

iii. **Traction charge** – Charge for access and consumption of energy/electricity required. This is an important element of marginal costs and should vary between operators based on usage.

iv. **Safety/Security** – Charge related to ensuring a safe and secure network. This charge concept is normally not applied in practice as safety and security is often treated integral part of fixed cost. Or maintenance cost.

v. **Capacity reservation** – Charge for the booking, reservation (or cancelation) of capacity.

vi. **Congestion** – Charge to take account of the opportunity and delay cost caused to others by an operator when the track is congested. This is important if the network is capacity constrained, so that users with the highest value are able to use the track.

vii. **Environment** – Charges based on the environmental or social impacts of train operations. The rationale for this charge concept is to mitigate negative externalities caused by train operators on society through pollution or accidents. Environmental costs are difficult to measure.

4.6 Charging units

An important component of the TAC framework is the choice of specific units used to set charges. The tariff structures outlined above can be implemented with different charging units and the choice of charging unit will have an impact on service choices of RU. For example in a freight rail scenario, if charging is based on train – kilometre, it will encourage operator to run longer trains. Some of the possible charging units are Flat fee , Train-km , Tonne-km, Fee per minute, Node fee, Axle km, and Axel load.

4.7 Track Access Charges in Europe : EU Directives

The EU Directive - 2012/34/ lays down the legal basis for establishing the rail charging systems in Europe. 2012directive is the latest directive in this regard. Rail Industry is following EU directives since 1991 when directive 91/440 was issued. The 2012 directive mandates its member states to establish charging framework that is compliant with principle of management independence initially laid down in Directive 91/440/EC. It also prescribes accounting principals, legal organisation and

separation between railway companies and the state, and between Infrastructure Managers (IMs) and Railway Undertakings(RUs). EU directive also lays down that a should be made responsible to guarantee fairness and transparency. This body should be legally distinct and independent from any other public and private entity and independent from the IM.

The charging system specified by EU has several key objectives and cost recovery is central to it. The mechanism can be used to incentivise the optimal use and provision of the infrastructure.

According to Directive 2012/34/EU, the charges specified in the network statements should cover the items included in the minimum access package which are:

i. Handling of requests for infrastructure capacity;
ii. Right to utilize capacity which is granted;
iii. Use of running track points and junctions;
iv. Train control including signaling regulation, dispatching and the communication and provision of information;
v. Use of electrical supply equipment for traction current, where available;
vi. All other information required to implement or operate the service for which capacity has been granted.

Charging principles laid down in Directive 2012/34/EU provide that:

1. Charges for the use of rail infrastructure must be paid to the IM and be used to finance its activities (article 31(1) of Directive 2012/34/EU);
2. In the definition of charges, direct costs should be identified. Article 31(3) of the Directive 2012/34/EU states that the charges for the minimum access package and for access to infrastructure connecting service facilities shall be set at the cost that is directly incurred as a result of operating the train service

The methodology for the calculation of the cost that is directly incurred is given by the European Commission Regulation 2015/909 of June 2015.

3. **Direct costs according to article 31(3) of Directive 2012/34/EU** : The charges for the minimum access package and for access to infrastructure connecting service facilities shall be set at the cost that is directly incurred as a result of running that particular train service.;
4. **Mark-ups - article 32(1) of Directive 2012/34/EU** : For full cost recovery through TAC, IM can charge a mark up over and above the direct cost. The mark should be levied on the basis of non discriminatory principle and it should be fixed at a level so that market can bear it .
5. **Long term cost** - **article 32(3) of Directive 2012/34/EU:** for specific investment projects that have been completed after 1988, IM can set TAC at a higher level on the basis of long term cost of the project. The project should be such that it should increase or cost effectiveness.
6. **Discounts - article 33(3) of Directive 2012/34/EU :** IMs can grant time limited discounts which should be available to all users for development of new rail services or to encourage use of underutilized lines.

7. **Impact of public service operation contract - article 12 of Directive 2012/34/EU:** Member states can impose a levy on RUs for providing passenger services for the operation of routes between stations lying in jurisdiction of member station.

8. **Incentives - articles 30.1 of Directive 2012/34/EU:** IMs may be provided incentives to reduce the cost of infrastructure provision. However, it has be ensured that safety and quality of infrastructure is maintained.
9. **Scarcity and congestion** - **Article 31(4) of Directive 2012/34/EU**: IMs can levy a charge for scarcity and congestion of network.

10. **Environmental charges Article 31(5)** IMs can charge for environmental effects caused by train operation and such charge should be differentiated according to the magnitude of the effect caused.
11. **Performance scheme Article 35(1) states** that charging scheme should encourage IMs and RUs to minimize network down time through performance incentive and penalties.
12. **Reservation charge - Article 36** states that a mandatory charge may be levied on IMs if they do not use the network capacity allocated to them. The criteria to levy such charge should be published in the network statement. The criteria should be controlled by the regulatory body.

4.8 Track Access Charges in UK :

In UK, infrastructure and operations were first separated in 1994. TAC at that stage consisted of (i) a variable usage charge to compensate for wear and tear of track, (ii) a fixed charge to allocate the remaining fixed cost (iii) Electricity cost (iv) Electrification asset usage charge and (v) Station cost.

In 2001, Infrastructure manager was given a direct grant from Government and the fixed charge element of the track access charge was removed.

For freight trains a mark up on the basis of negotiations was applied, however, it was removed in 2001 and replaced by a mark up on the basis of ability to pay.

A capacity charge was also levied but it is now set to be replaced by mark up for passenger and freight on the basis of ability to pay.

Except for 20 large stations operated by Network rail, balance stations are leased to single operator and other operators pay to the holding operator as per their usage of station.

Major stake holders of Rail Industry in UK

Before 1993, Britain's integrated railway was operated and maintained by British Rail. British Rail was responsible for both the planning and delivery of passenger operations. The 1993 Railways Act privatized Rail Industry in Britain and in doing so, it split responsibility for delivery of passenger rail services from the management and maintenance of infrastructure.

British Rail's passenger rail operations were reorganized into 25 separate, publicly owned franchises. The newly created Office of Passenger Rail Franchising was then given the responsibility for selling these franchises to privately owned Train Operating Companies (TOCs). Although the bidding process and contract specificity have changed over the years, this model remains broadly the same today.

Rolling stock of British Rail was sold to three Rolling Stock Operating Companies (ROSCOs). TOCs lease the coaches from ROSCOs, who are typically also responsible for heavy maintenance. Franchises generally have short tenures and it makes investment in rolling stock assets unattractive to train operators.

The responsibility for allocating franchises was given to newly created Strategic Rail Authority and 2001 and in 2006 it was shifted again to the Department of Transport Passenger franchises are awarded to TOCs through a competitive tendering process. Franchise durations are typically allotted for period up to seven years, although ther are discussions to award longer franchise contracts, up to 15 years. Franchises are automatically extended if TOC meets certain performance targets.

TOCs typically are thinly-capitalized companies with few assets and relatively little ability to bear downside risk (the risk involved in higher than expected costs or lower than expected revenues). To address the issue of weak risk bearing capacity revenue risk-sharing mechanisms were introduced into franchise contracts. A standard model for risk sharing mechanism commonly used is known as "cap and collar" mechanism,

which typically activates four years into the life of a franchise. The main features of a typical cap and collar are :-

(a) 50 per cent of any fares revenues in excess of 102 per cent of the TOC's original forecast go to the Department of Transport;

(b) Department of Transport makes a contribution equivalent to 50 per cent of any revenue shortfall below 98 per cent of the TOC's original forecast; and

(c) For any shortfall below 96 per cent, the Department of Transport's contribution increases to 80 per cent.

There are 21 TOCs currently working in UK as listed on Office of Rail Regulator website. The TOCs are c2c, Caledonian Sleeper, Chiltern Railways, Cross Country Trains, East Midlands Trains, Govia Thameslink Railway, Grand Central, Great Western Railway, Greater Anglia, London North Eastern Railway (Virgin Trains East Coast), London Overground**,** Merseyrail**,** Northern, ScotRail, South Western Railway, Southeastern, TfL Rail, TfW Rail (Arriva Trains Wales), TransPennine Express, Virgin Trains West Coast, and West Midlands Trains.

At present, Rolling stock leasing companies (ROSCOs) own most of the coaches, locomotives and freight wagons that run on the rails, which they lease to different operators. ROSCOs have replaced many of the older trains that were being used at privatization with modern vehicles. They are often responsible for the heavy maintenance and overhauling of the vehicles they lease to train operators.

According to Office of Rail Regulator website, following ROSCOs are at present working in UK : -

- Angel Trains Ltd
- Beacon Rail

- Caledonian Rail Leasing
- Eversholt Rail Group
- GE
- Halifax Asset Finance
- Macquarie European Rail
- Lombard North Central
- Porterbrook Leasing Company Ltd

Cost coverage by TAC

Perhaps the most significant aspect of the TAC regime in UK is the extent of cost coverage by TAC vis a vis the total cost incurred by the IM. For illustration refer to the 2016 -17 data published by Network Rail :-

Table 6 : Rail Infrastructure cost coverage – In million pounds – year 2016-17

Costs		**Revenue from Track Access Charges**	
Operations	554	Variable usage charges	224.2
Maintenance	1319	Capacity Charges	428.2
Renewals	2771	Fixed Charges	410.8
		Use of Electrification assets	16.1
		Stations and Depots	353.0
Total	4644	Total	1432.2

Source : Track access charges: reconciling conflicting objectives Case Study – Great Britain, Prof. Andrew Smith, University of Leeds Prof. Chris Nash, CERRE & University of Leeds 9 May 2018, Centre on Regulation in Europe

It can be seen that only 31% of the expenses are recovered by the IM i.e. Network Rail. The rest of the expenses are met through loans and grant from UK government. UK rail is passenger dominated and the Government has financially supported the operations of network rail to facilitate passengers. Another point to take note of is

that ORR – Office of Rail Regulator is tasked with the responsibility that only efficient costs incurred by Network Rail is taken as its revenue requirement. This setup serves several objectives as listed below:-

1. Network rail, the sole IM, owned by State can not be complacent about its functioning as ORR oversees and evaluates is functioning and only efficient costs are to be considered for its revenue requirement.
2. Rail undertakings (RUs) are getting subsidized access to infrastructure but they are in competition with other RUs to provide rail services and can not afford to be slack on quality and efficiency factors as it will affect their market share and revenues.
3. Government is spending a lot of money on providing subsidy to the sector but the subsidies are transparent and perhaps the least possible as institutional setup propels both IM and RUs to function efficiently.

Variable track access charges in UK from 2001 to 2009

In 1994 the UK rail was privatized under the rule of conservative government and the track, signaling infrastructure was handed over to a private company group - Railtrack. Due to financial difficulties, poor track record in infrastructure maintenance and accidents, assets of Rail track were transferred to a not for profit entity Network Rail in 2001. At that point of time expectation from Rail industry was that at best it will remain static or decline further. The track access charges were thus fixed in such a manner that it had a large fixed component and comparatively smaller portion was to come from wear, tear costs and electricity. However, contrary to the assumptions, the passenger numbers and train services grew and a revision was required in the TAC structure.(source: https://www.nao.org.uk/wp-content/uploads/2000/04/9900397.pdf)

Consequently, the charging method was changed and a new method was introduced to compute the variable charges. The variable charges are to compute the short run variations in operations, maintenance and renewal costs that are variable with the traffic. A two step process was adopted for variable charges calculation. In step one based on engineering judgment, overall variability of cost with respect to traffic was estimated and in step 2 the cost so determined was allocated to vehicles based on engineering models.

To illustrate the cost variability determined through this method, the proportions determined by ORR during Periodic review 2000 and Periodic review 2008 are quoted below:-

Table 7 : Variability proportion in Maintenance activities

Activity/Asset Class	Variability proportion PR 2000	Variability proportion PR 2008
Track Maintenance	30%	29%
Track Renewal for line	36%	23%
Track Renewal – switches and joints	25%	17%
Signaling – maintenance	5%	5%
Civil – Metallic under bridge	10%	8%
Civil – embankments	10%	5%

Source: *Track access charges: reconciling conflicting objectives Case Study – Great Britain : Prof. Andrew Smith, Prof. Chris Nash, 9 May 2018 (Original Source ORR 2008)*

Other than the costs listed above, other costs are assumed to not vary with traffic. The electrification asset charges are also not listed above. At PR 2000 Electrification

asset cost were charged as mark up and based on electricity amount used and not on the volume of traffic. The policy was changed in PR 2008.

Once the variability of charges is determined, these charges are allocated to different coaching vehicles and freight wagons based on their engineering characteristic. The process adopted in Periodic Review 2000 was to use EGTM – Equivalent gross Tonne Miles. It has been argued that EGTM is more sophisticated compared to GTM - Gross Tonne Miles as it captures wear and tear damages better than GTM.

EGTM calculations are as follows:-

EGTM = K * Ct * $A^{0.49}$ * $S^{0.64}$ * $USM^{0.19}$ * GTM (for track)

and **EGTM = L *Ct* $A^{3.83}$ *$S^{1.52}$ *GTM** (for structures)

where: **K, L** is a constant

Ct is 0.89 for loco hauled passenger stock and multiple units and 1 for all other vehicles
S is the operating speed [mph]
A is the axle load [tonnes]
USM is the unsprung mass [kg/axle]
GTM is gross tonne miles [Tonne-miles]

By adopting this approach after PR 2000, proportion of variable charges in TAC were increased. The strong point of this approach is its sophistication with respect to calculation of damage for different coaching and freight vehicles.

Variable Charges from 2009

After PR 2008 method to calculate wear and tear charges was changed. The two stage process was still used. However, for step one, a model was developed by Network Rail known as ICM – Infra structure cost model. This model was used to estimate the variable portion of different cost elements instead of the engineering judgment method used earlier. For stage two, new method was developed which also takes into account the lateral and longitudinal forces in allocating variable cost to different vehicles. Lateral and longitudinal forces on rail vehicles correspond to rail wear and rolling contact fatigue.

The net result of changes made in 2009 was that overall level of variable charges with traffic were reduced substantially as can be seen from Table No. 7.

In Europe including UK, the issue of proportion of charges which are variable with traffic is not settled from academic and Industry point of view. There are fundamentally two approaches to derive the variability proportions – one engineering modeling and two econometric approach. The separation model is in place in Europe now for approximately forty years and cost data for different countries is available to apply econometric approaches. The results derived from engineering model depend upon the choice of model and different countries have worked on different models and refined these models over the years. However, the result from all these approaches give different results on overall variability proportion and there are different views and there is no consensus amongst the stake holders. The regulators in UK have sided towards the approaches which give comparatively smaller variability proportions resulting into lower Track access charges.

Capacity Charges

The capacity charges in UK are based on congestion costs and not on scarcity cost. Congestion cost refer to delays which occur when capacity utilization increases nears its full potential. Scarcity cost occur when the network is fully utilized and to accommodate a new train, another train has to be pushed out. Regression analysis is used calculate congestion related costs. Although a very sophisticated differentiation of congestion charges can be done through regression analysis for a variety of location and time combination, the charging structure adopted by Network rail has been kept simple.

Mark Ups

Till recently Network rail applied a mark up on freight traffic access charge to recover avoidable fixed costs. These costs were further subject to the ability to pay test and as a result were applied for three commodities only i.e. coal, iron ore and nuclear waste. For these commodities increased TAC will not cause the traffic to shift to other modes.

For passenger traffic mark up potential is estimated be ORR as the difference between revenue and cost of running a train. Approach used for freight to take into account market elasticity is not used due to market structure. The passenger market is characterized by following : -

a. There is limited or nil on track competition between train operators
b. Passenger services are mostly run by franchises awarded through competitive bidding.
c. Only in some sectors fares are regulated otherwise train operators are free to fix fares to maximize there profit.

It is felt in UK markets that higher access charges under these circumstances may result into decrease in number of services and therefore, mark ups are not applied in passenger segment.

Electricity for Traction Charges

According to the ORR's Network Rails conclusions on variable charges and station charges in Control Period 6 (CP6) dated 14 May 2018, the steps used in method for calculating Electrification Asset Usage Charges (EUAC) for CP 5 are as follows : -

1. *Take the forecast annual average cost of maintaining and renewing AC and DC electrification assets over 35 years, respectively;*
2. *Network Rail quantified the proportion of maintenance and renewal costs that are variable and used these values to calculate average annual variable costs for AC and DC assets, respectively;*
3. *AC and DC variable costs were allocated to passenger and freight operators according to their share of AC and DC vehicle miles in 2011/12, respectively;*
4. *Calculate the forecast annual average electrified vehicle miles for passenger operators and annual average electrified thousand gross tonne miles for freight operators over 35 years, split into AC and DC;*
5. *AC/DC EAUC rates for passenger operators calculated by dividing the forecast annual average AC/DC variable costs allocated to passenger services by the forecast annual average passenger AC/DC vehicle miles; and*
6. *AC/DC EAUC rates for freight operators calculated by dividing the forecast annual average AC/DC variable costs allocated to freight services by the forecast annual average AC/DC electrified thousand gross tonne miles.*

This scheme has been slightly modified for the CP 6 and will be applicable for the years 2019-24.

4.9 Track Access Charges in Germany

Introduction

Germany has been one of the first countries which has opened up its rail market for third party access. DB track is the holding company managing the infrastructure and since 1994 both the passenger and freight companies have open access to tracks of DB Tracks. BNetzA is the economic regulator in Germany. Since 1994, four different track access charging system has been introduced in Germany. All four schemes have worked on full cost recovery and as a result track access charges are one of the highest in Europe. The charging schemes implemented in Germany were –

1. One part pricing scheme – 1994 to 1997
2. Two part scheme – 1998 to 2000
3. One part scheme – 2001 to 2017
4. Ramsey based charging scheme – since 2018

DB netz is the largest player providing the rail infrastructure in Germany. Other than DB Netz, 4000 km rail track is owned by other rail companies. However, the open access rule are applicable to all players.

Track Access Charges from 2018

Track access charging scheme of DB Netz, which was implemented in 2018 is as per requirements of EU Directive 2012/34 and Railway law enacted by Germany. Track access charges introduced from 2018 consist of three elements : -

1. The direct (or marginal) cost
2. Mark-ups for full cost recovery
3. Reductions and surcharges

Reduction and surcharges are to take into account for example noise costs, time flexibility and priority requests etc.

German law also stipulates that mark ups for passenger and freight transport should cover their respective costs and it must not preclude any market segment from track usage which is capable to recover at least its direct costs;

Charging Principles – Network statement 2020

DB NetZ publishes its network statement every year. Network statement contains terms and conditions of access to and usage of its rail network. It also provides its customers with extensive information. The statement contains rules, time limits/ dead lines, procedures, charging principles and terms and conditions of business. Network statement 2020 has been published by DB Netz AG and is applicable from 15.12.2019. A summary of charging principles employed by DB Netz is as follows : -

Charging principles for minimum access package

For the given train route, charge for the minimum access package is calculated using the train-path kilometres in the relevant predefined section multiplied by the relevant charge for the minimum access package for that section. Mathematically the charge will be as follows : -

Train-path charge = $\sum$ Charge for minimum access package$_i$*train-path kilometres$_i$

Minimum access package for a market segment comprises the direct costs of train operation and a surcharge to cover the full costs (full-cost surcharge). A viability test is applied to the full cost surcharge and other possible additional charges.

Principles for market segmentation

Market segments are identified by DB Netz AG on the basis of rail transport services. The decisive factor for market-segment allocation is the target timetable.

Differentiation of transport services

Each application for allocation of train path must state whether the train path relates to long-distance passenger services, local passenger services or freight services.

Rail freight transport services (SGV)

For the purposes of this Network Statement, freight rail services are all services that exclusively transport freight nationally and/or internationally. A mixed service carrying both freight and passengers together is treated as a passenger rail service. However, Military trains fall under freight rail services when conveying passengers

Passenger rail services

Passenger rail services are all services that, at a minimum, also transport passengers nationally and/or internationally or fulfill a preliminary function therefor.

Passenger rail services are subdivided into long-distance passenger and local passenger rail services. The two sub categories differ in terms of costs of providing the transport services, their market prices for end customers and their requirements in terms of quality of service.

Local passenger rail services (SPNV)

Local passenger rail services predominantly carry passengers on urban, suburban or regional services.

Services connecting two metropolitan stations with an average speed of at least 130 kph are not providing urban, suburban or regional services.

In cases of doubt, transport on all other stopping sections is providing an urban, suburban or regional service if a train is mainly conveying passengers whose journey distance does not exceed 50km or whose journey time does not exceed an hour.

Long-distance passenger rail services (SPFV)

Long-distance passenger rail services include train paths used for the conveyance of passengers and which are not local passenger rail services.

In addition, all train paths in the Charter/Nostalgia market segment are allocated to long-distance passenger rail services, regardless of their length.

Allocation

The underlying principle is that train paths must be allocated to either long-distance passenger rail services or local passenger rail services in their entirety. If a train path consists of different segments and in one segment the service is long distance and in another segment it is local passenger then the train path is allocated to the service that constitutes the main part in terms of train path kilometres.

If the segments of the two services i.e. long-distance passenger and local passenger rail services are equal in length, then the train path is allocated to local passenger rail services.

The market segments are derived on the basis of the following criteria: -

Table 8 : Segmentation criteria of rail market in Germany

Rail Freight Transport	Local Passenger rail service	Long distance passenger rail service
• Nature of transport(train weight, dangerous goods, train rakes and train path lengths) • Flexibility • Prioritization	• Federal State	• Relation • Service Time • Average speed • Prioritization • Temporal flexibility • Connections/network connection • Frequency
• Preliminary Service	• Preliminary service	• Nature of transport(e.g operating concept, hist. traction unit classes, status of a non-profit association) • Preliminary service

Source : Network statement 2020 DB Netz AG

Principles of calculating direct costs of train operation

To calculate the costs incurred as a direct result of train operation, there is an investigation into whether a change in the volume of traffic results in a change in the service to be rendered by DB Netz AG and thus in the costs. Thereafter, an analysis is carried out as to the extent to which changing the service to be rendered by DB Netz AG causes a change in the costs.

It is possible to determine a correlation between traffic volumes and costs incurred by DB Netz AG for the following cost pools:

- Timetable cost pool,
- Operation cost pool,
- Track Maintenance cost pool,
- Track Depreciation cost pool.

Annex 6.1 of the network statement contains the principles used for determination of direct cost. The principles used are as follows : -

Definition of direct cost

The following definition of the direct cost of train operation is used by DB netz:-

> *"Direct cost of train operation (DCTO) is the cost which is arises as an additional cost in the existing rail network by virtue of a tangible change in quantity.*
>
> *A tangible change in quantity can be understood both negatively as a reduction and positively as an increase. For the sake of simplification, all additional commentary will refer solely to changes in quantity."*

First step for determining direct cost is to determine the cost of standard services. For this purpose certain cost elements are straight away eliminated. The elements considered for this purpose are : -

- imputed interest,
- imputed Group charges,
- other operating income (OOI),
- the non-operating income factored in (NOI),
- administrative and distribution costs (ADC) and
- costs not directly booked to the RKOST lines.

As per EU regulations 2015/909, group charges, administrative and distribution costs cannot be included when calculating the direct costs. Other operating income and non-operating income reduce costs when calculating the CSS and, therefore, are included for determining the starting point for the direct cost of train operation.

Based on EU regulations and German regulator and Government's interpretation of EU regulations, Cost pools for identification of Direct costs are finalized. As of now, the timetable, operations, line maintenance and line DfD cost pools are e determined as DCTO relevant.

Assignment of the DCTO to the market segments

The actual calculation of the DCTO occurs separately for every cost pool relevant to the DCTO. There are two models for calculation of DCTO, first - DCTO can be determined by means of an econometric model like a regression analysis and second the engineering method can be used for DCTO calculation by distributing the costs of the individual areas on the basis of engineering findings. For the engineering method, one possible option is to carry out expert discussions.

The advantage of econometric model is that it provides repeatable results as it is based on provable data and predefined algorithms. The down side is that the model requires high-quality data to provide meaningful results.

Expert discussions approach identifies the driver that contributes to the occurrence of DCTO and the extent of influence of these drivers on the DCTO is analyzed in the expert model. The advantage of expert model is that it is easier to understand than a cost function calculated on a purely mathematical basis.

DB Netz AG has considered the methods of other European railway undertakings for determination of DCTO and in particular, the approaches taken by the French and Swiss railways were considered. The French railways takes a complex econometric approach and Swiss Railways uses engineering-based modeling.

DB Netz AG employs a combined approach consisting of expert discussions and an econometric model for determining the DCTO for its own track network.

Expert discussion is used for costs related to line sections for the timetable, operations and line cost pools in the operating nodes.

Econometric model is used for the DfD cost pool with the regression analysis. As the problem is complex and there is sufficient high quality data available in this cost pool, an econometric model is assessed as being better than the expert model.
Regulation (EU) 2015/909 states that depreciation that is not determined on the basis of wear and tear due to train service operation may not form part of the DCTO. Therefore, DfD values taken from balance sheet cannot be entirely recognized as DCTO.

Differentiation of the DCTO according to transport services or market segments

For each cost pool , the assignment of the calculated DCTO occurs on the basis of one or more parameters that should be regarded as cost drivers. DB Netz AG also uses additional drivers for each cost pools.

For time tabling cost pool an increase in the quantity of train path kilometres generally leads to increased costs in the timetable cost pool, since more train paths have to be constructed and thus more services are to be run. Therefore, those train path applications that exist separately on the Train Path Portal Network (TPU) under working timetable and ad-hoc timetable can be identified as drivers.

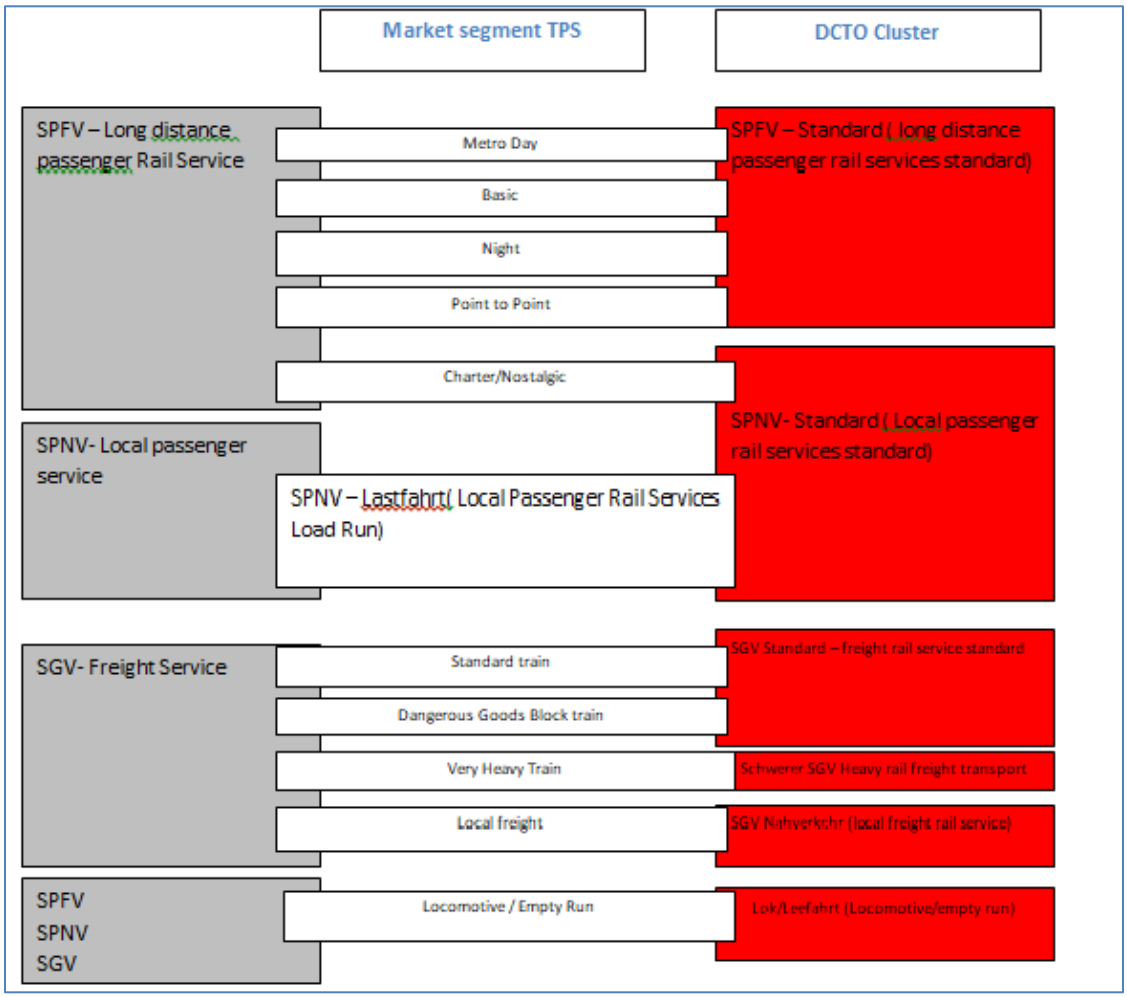
For operations cost pool, additional traffic results in increase in operational expenditure since more work related to train control needs to be done. The level of activity by train running staff , for instance, goes up when the train path kilometres increases and train path kilometers can be used as driver for this cost pool.
For maintenance cost pool the increased quantity results in line facilities experiencing higher levels of wear. Therefore, there are increases expenses for the maintenance of the facilities. The speed and the weight of the trains are internationally recognised cost drivers that result in wear to the railway infrastructure. In isolated cases, the number of trains can also be regarded as a driver of maintenance costs.

Range of weighting parameters

German Law (ERegG) requires that remuneration is to at least be differentiated according to the three transport services of rail freight transport, publicly ordered rail passenger transport and other rail passenger transport. DB Netz AG provides for a finer differentiation of remuneration whereby transport services are further subdivided into market segments determined on the market side.

The remuneration differentiation requires that DCTO should be calculated for each market segment. As it is not possible to properly differentiate between certain market segments with regards cost drivers, several segments are aggregated into clusters for the calculation of the DCTO. Chart depicting the broad cluster scheme is as follows : -

Figure 3 : Cluster scheme for calculation of direct cost of operation - Germany



(Source : Annex 6.1 Network statement)

Analysis of cost pools

Cost pool Timetable

The following functions of time table making have been classified in the experts' discussions as quantity linked and, therefore, relevant to the DCTO.

Central timetable:

- Framework agreements
- Time interval planning
- Coordination working timetable
- Coordination ad-hoc services
- Internal timetable documents
- Coordination "Operating and Engineering"

Regional timetable:

- Devising the working timetable
- Devising framework agreements
- Devising ad-hoc services
- Internal timetable documents
- Coordination worksite traffic timetable
- Devising the worksite traffic timetable

All accounts of the Timetable cost elements are analyzed in expert discussions as to their (predominant) relevance to the DCTO. Items that are deemed relevant to the DCTO respond to a change in quantity (train path applications in this case). A cost responsiveness of 100% in each case is assumed with regard to the functions depending on quantity. This is to say that an assumed quantity change of 10% results in a change in costs of 10%. In order to determine the DCTO of the timetable for each transport service, reference was made to each transport service's share of train path applications in the total of train path applications.

Cost pool Operation

Identification of cost elements attributed to the Operation division is the first step. In second step these elements are analyzed if these elements are quantity dependent.

In expert discussions, it was found that the functions relevant to the DCTO are to be identified in the regional areas. The areas where a change in quantity has a direct impact are:

- Operating control of signal boxes
- Operating control of level crossing gates
- Operation management of control centers

The operative staff involved in these functions is attributed as the relevant cost element for Operation. The fact that these cost elements are relevant to the DCTO becomes clear from the load profiles of individual signal boxes of DB Netz AG. Signal boxes are staffed as per the number of train movements. The major driver for the costs of all relevant cost centers are trains and shunting movements, which are measurable on the basis of the indicator “train path kilometers”. The more train path kilometers a train runs, the more points and signals are to be set, i.e. the more activities of relevant staff are required. All cost elements are analyzed in expert discussions as to their relevance to the DCTO. Items are declared relevant to the DCTO if they respond to a change in quantity (train path kilometers). This is true for staff costs and costs incurred for the creation of jobs.

According to EU regulation 2015/909 fixed costs for the provision of a line section must not be claimed as DCTO. Accordingly, minimum operative staff required to man the signal boxes is regarded as not quantity-responsive. The minimum staffing is ascertained in accordance with the following formula:

$$Stw * \frac{Söz}{Waz} * (1 + Vb)$$

Where,

Stw: Number of signal boxes to be staffed

Söz: average line operating hours [h/week]

Waz: weekly working time (39 h/week/full-time employee)

Vb: Need for substitutes for absences [%]

Cost pool Track maintenance

In the current DB Netz system, costs incurred for maintenance are recorded in the commercial systems and shown as a separate cost type in the master cost centers. Due to this, information about the nature and subject-matter of the maintenance measures carried out is not connected and is therefore lost. In a separate maintenance database, however, maintenance costs can be shown for each master cost center and operating center broken down to the order components of such maintenance.

Furthermore, maintenance expenses are incurred in the following cost pools relevant to the DCTO:

- Operations
- Line in operating nodes

Below, the general approach for the analysis of line maintenance costs within the scope of the expert model is described. The examination is based on the IDs on which bookings are made. An ID represents a given maintenance activity. In order to reduce complexity, the individual IDs are combined to clusters. The IDs combined in a cluster principally are homogeneous with regard to the damage to be repaired and the cause

of such damage. In a second step, object groups form the collective designation for similar classes of assets. Out of 26 object groups on which bookings are made in the line maintenance cost pool, only four are relevant to the DCTO.

i. Level-crossing systems
ii. Tracks
iii. Conductor rail systems
iv. Points and crossings

For other object groups, the maintenance experts do not assume any relevance to the DCTO, as a change in quantity does not result in load variation. These are primarily the object groups of signaling and telecommunications systems, which are not subject to wear and tear due to train operation.

According to the experts' opinion, there are three drivers due to train movements for the generation of maintenance expenses relevant to the DCTO:

i. Number of trains (train path km)
ii. Load ton kilometers (train path km * average weight)
iii. Speed (train path km * average maximum speed)

The experts determine the impact those drivers have on the generation of quantity-induced costs (0 to 100%).

Cost pool Operation maintenance

The Operation maintenance cost pool contains maintenance measures regarding facilities that are not directly attributed to the line, but to the upstream RKOST of the Operation cost pool. The determination of the DCTO for maintenance in the Operation cost pool principally follows the approach in the cost pool Line maintenance.

Cost pool Depreciation

In the DfD line cost pool, the DCTO was determined via regression analysis. It determines by way of estimation the impact of rail traffic (train path km) on the amount of depreciation of the line sections.

The rail network of DB Netz AG is divided into more than 2,300 line sections for the purpose of cost accounting. Regression is based on cross-sectional data regarding the number of trains and the amount of depreciation in each of those line sections. On the basis of these data, the cost function

*Depreciation Section = Fixed cost*Train path km Section + DCTO*Train path kmSection*

is statistically estimated.

In this context, the train path km are used as an independent variable, while depreciation is the dependent variable. The subject-matter of the estimation are the two parameters “fixed cost” (per train path km) and “DCTO” (per train path km).

Other cost Elements

In the experts’ discussions, the cost elements attributed to the Other cost pool were not regarded as relevant to the DCTO, as it cannot be seen that a quantity change would entail a change in costs of these RKOST. Furthermore, the 11 cost elements with the highest load on tracks were once again considered separately. In that analysis, too, no dependence on quantity could be identified.

Principles for the full-cost mark-up with viability of the market segment

Minimum access package also contains a mark-up per market segment to accommodate the costs incurred as a direct result of train operation. This mark-up is for covering the total fixed costs incurred in providing the minimum access package.

Mark ups are allocated between the market segments on the basis of relative viability. Annex 6.1 of the Network Statement contains an extensive description of the calculation of the full-cost mark-ups.

Principles of the additional charge components

New service discount

There is a provision for time-limited discounts for new services.

Noise-related charge component

EU Regulation 2015/429 of 13 March 2015 sets out the basis of modalities to be followed for charging for the cost of noise effect. The train-path charge includes a charge for noise-related effects for all market segments falling under freight rail services with the exception of the market segment Lokfahrt. This excludes wagons for which no composite brake blocks are available that are equivalent to TSI freight wagons and that can be directly installed on the wagons without further modification to the brake system.

Consequently, this restriction applies to all wagons that satisfy at least one of the following criteria:

- Wagons with a maximum speed >120kph,
- Maximum axle load >22.5t,
- Wheels with a nominal diameter of <920mm or >1000mm,
- Brake pads of a type other than Bg (split) or Bgu (split, segmented),
- Dynamic force per brake pad for Bg <6 oder >30kN, for Bgu von <6 or >50kN,
- Brake weight [t] >15.25t per wheel set,
- Wagons with tyred wheels,
- Wagons with a maximum speed of 120 kph (marked “ss”).

Loud freight trains of the aforementioned market segments must pay a surcharge on the train-path price. A train is deemed to be loud where more than 10 percent of it consists of loud wagons. A wagon is deemed to be loud if it does not satisfy the limits listed in the TSI related to noise (Regulation 1304/2014/EU of 26 November 2014).

The revenues and interest generated from this charge are used entirely to incentivize railway companies with a bonus to deploy upgraded freight wagons.

Movements outside line operating hours

For movements outside of line operating hours, the charge is calculated according to the expense incurred by DB Netz AG as a result of these movements.

a. Cancellation charges
b. Penalties for train delays

DB Netz has originally intended to charge for delays of more than 6 minutes in passenger transport and more than 31 minutes in freight transport an amount of 10 Cents per minute, to be paid by TOCs and DB Netz depending on causation of delays. The regulator has refused the whole scheme for several reasons, amongst them the fact that the S-Bahn systems in Berlin and Hamburg were exempted, and because there were no differentiation between time table transports and ad-hoc transports (which have more delays). The most important reason, however, was that the penalty of 10

Cents per minute was too low to give an incentive to avoid delays, given that it is cheaper to pay the penalty than to settle the causes for delays. DB Netz is currently in the process of elaborating a new penalty scheme.

Return of Capital for state owned company

German regulations prescribe market-based rate of return on capital as part of the eligible costs. The Regulator and DB Netz have used the WACC (weighted average cost of capital) method to estimate the capital cost chargeable for TAC framework. However, it was debated if Return of capital should be applicable for a 100% publicly owned company and privatization of DB Netz is not permitted. Another point of discussion centered around the appropriateness of interest rates, risk premiums, tax rates etc. used by DB Netz. The regulator has approved a WACC of 5.9% for the regulation period 2019-2023.

Surcharges for priority requests and flexibility

Surcharges are also applied for priority requests and flexibility. For example, long-distance passenger trains with high priority i.e. Express trains have to pay a surcharge of €2 /train-km and for "Fast" a surcharge of €0.50 /train-km is levied. Similar provisions are also there for freight trains. If the operator chooses time and route flexibility he can avail charge reduction of €0.10 /train-km for temporal flexibility (120 min) as well as for geographical flexibility.

4.10 Conclusion

Track access charging system in UK and Germany have evolved over the time and models, charging systems, market assessment has become more complex and sophisticated. The systems are different, the charging levels are different and both countries follow the EU directives. The lesson for Indian Railways from both the cases is that liberalization of the sector requires an Institutional set up for economic and safety regulation, accident investigation and a robust accounting system to generate data for TAC calculations.

5.0 : Review of coaching Cost Data for Indian Railways

5.1 Introduction

Indian railway collects, compiles and publishes a host of data related to its activities. The data is collected and maintained by different agencies. Expenses related data is maintained by finance department according to the Indian Railway finance code. Revenue related information is available through Passenger Reservation System(PRS), unreserved ticketing system and modules of Freight Operation information system(FOIS) . Traffic related data is captured through FOIS and Coaching Operation information system(COIS). This chapter intends to review the cost data published by Indian Railway for its suitability to fix Track Access Charge.

5.2 Indian Railway Cost data

The current railway cost data is available at Indian railway website[6]Statistics and Economics directorate is the nodal directorate and following statements containing Indian Railway cost data along with many other statements are prepared and published by it . Some of the sources are :-

A. Indian Railway Year book

Year book contains following information :-

a. Key statistics of Indian Railways

Rail network, Details of plants and equipment, passenger and freight volume data, employment and wages, financial results

b. Financial ratios

Operating ratio for goods and coaching, rate of return on capital, passenger yield, freight yield, asset utilization

c. Overview of passenger business

[6] http://www.indianrailways.gov.in/railwayboard/view_section.jsp?lang=0&id=0,1,304,366,554

Year wise passenger volume and revenue data passenger service improvement, ticketless travel, passenger reservation system, innovations in passenger segment, catering services.

d. Freight operation

Commodity wise freight carried , revenue, Other freight statistics, Steps taken by IR for freight marketing

e. Asset utilization

Engine kilometer, GTKM, Coach utilization, Average freight load and train speed, Wagon utilization, Wagon turnaround

f. Safety

Train accident, causalities and compensation Measures to improve safety

g. Track and bridges

Details of existing track. New lines, Gauge Conversion, Doubling, Track renewal and maintenance, Track up gradation, Land management

h. Electrification

Summary of Railway electrification, Progress of electrification

i. Signal & Telecom

Advances in signaling, complete track circuiting, Block proving axle counter, Interlocking of level crossing gates telecommunication

j. Rolling stock

Details of locomotives coach upkeep, Wagons, Repairs and maintenance.

k. Traction

Details of electric and diesel traction and locomotives and innovation in these areas.

l. Material Management.

Expenditure on purchases, modernization in procurement, agency of procurement, Inventory

B. Annual Reports and Accounts

Annual report contains following details:-

i. Organization structure, Apex Management

Details of IR organization and its units along with apex management

iii. Finance

Financial results of previous Financial year, revenue, working expense, Balance sheet, reserve fund balance, cash flow, IRFC investment

iv. Freight Operation

Commodity wise freight volumes, revenue, Freight marketing initiatives,

v. Passenger business

Passenger volume, revenue, lead fare structure, Punctuality, unit revenue, catering services tourism, luxury trains, unreserved ticketing system

vi. Planning

Asset acquisition, new works completed,

vii. Engineering

Details of gauge conversion, doubling, new lines, track renewal during last financial year, track modernization, track machines, bridges, level crossing, Road over bridge and under bridge, land management

viii. Railway Electrification

Summary and progress of railway electrification,

ix. Signal & Telecom

Developments in signaling, track circuits, block proving axle counter, Centralized traffic control, train management system, interlocking of level crossing gates., progress of Railtel.

x. Safety

Accidents statistics, causes of accident, compensation, damage to rail property, measures to improve safety

xi. Rolling stock

Induction of new rolling stock, manufacturing of rolling stock, Energy efficiency measures, maintenance of rolling stock, modernization of workshops, turnkey projects,

xii. Material Management

Expenditure of purchases, procurement, modernization, agency of procurement, vendor development, inventories

xiii. R&D

Highlights of initiatives under taken by RDSO.

xiv. Personnel

Industrial relations, Number of personnel, Wage bill, Training staff welfare,

xv. Financial statement

Consolidated profit and losses, statements supplementary to profit and loss account, gross traffic receipts, ordinary working expense, contribution to reserve funds, dividend and other payments to general revenues, balance sheet, value of railway asset, railway's contribution to the plan, capital at charge, subsidy from general revenue, loans for development fund and capital fund,

xvi. Operating statistics

Assets, Operation, traffic and earnings. Utilisation of rolling stock,

C. Indian Railway Annual Statistical Statement.

Indian Railway annual statistical statement contains following details: -

i. Financial Results (capital at charge and capital outlay to end of the year of branch line worked)

ii. Total investment from different sources

iii. Working expenses by head of demands for grants

iv. Earning and working expense of each Railway system

v. Kilometrage statement

vi. Rolling stock in service,

vii. Passenger and Goods revenue statistics

viii. Average lead, average rate charged and earnings by principal commodities

ix. Results of working of Coaching and Goods service

x. Tonne – kilometer of Steam. Diesel and electric locomotives

xi. Speed of goods train

xii. Density of traffic

xiii. Efficiency statistics

xiv. Analysis of Operating Expenses.

These documents / publication are not exclusive for cost data and they contain details of many heads related to performance of Indian Railway and Zonal Railway. The most relevant document from cost data perspective is Indian Railway Annual Statistical Statement. Following information which is relevant from TAC point of view is contained in this publication : -

1. Capital at charge
2. Working expense
3. Capital at charge , expenses and revenue for all the zonal railways

4. Kilometrage statement
5. Rolling stock in service
6. Passenger revenue statistics
7. Locomotive kilometers
8. Density of traffic
9. Analysis of Operating Expenses
10. Material Purchase

For fixing track access charges , the data available in public domain is clearly insufficient or not in the form that can be used readily. However, the data available in public domain is based on data collected as per Indian Railway Finance code. Indian Railway Finance code volume II has been designed to capture expenses of each activity by an accounts head. The code provides for a set demand heads and each head is further subdivided into subheads. A list of Indian Railway demand heads and subheads related to expenses can be seen at **Appendix 1**. Subheads are linked with different broad head of activities. The data captured through at the unit level as per finance code can be used to assess costs of different activities. The data is collected and processed through different IT products used by Zonal railways. Employee salary is processed by Integrated Payroll and accounting system – IPAS. Bills related to work done through contractors for different activities and other expenses are also processed by IPAS. The system is also used for financial adjustment among different zonal railways. Material management in IR is done through IMMIS system and it is also integrated with IPAS. IPAS database is the central database for all expenditure related items.

The Divisions are entrusted for Maintenance of track, rolling stock , OHE , signaling gear and other assets is done at Division level and the accounting system captures expenses of these details. Expenses are summarized at the end of month and year. Zonal Railways are responsible for creation of new assets, capital expenditure, Rolling stock major repair, bridges and track machines. Payments for IRFC lease charges, IT

infrastructure annual maintenance, appropriation to DRF and Pension Fund are responsibility of Accounts branch in Zonal Headquarter. Workshops are engaged in POH/IOH of rolling stock related costs are accounted for in respective units. Zonal account is prepared by taken into account the expenses done at divisional, zonal and workshop level. Yearly accounts are prepared by consolidating the monthly data.

Under the present system, the consolidated zonal data contains account head and subhead wise expense information. As mentioned earlier, the Zonal data is prepared by consolidating expenses done at divisional level, zonal level and in the Workshops located in the Zone. From this database, direct costs for services and overheads are identified. However, the average figure so arrived do provide an indication of expense level but are not sophisticated enough to be used for fixing Track Access Charges. The averaging of costs for the year, incurred at different units without taking into the efficiency factors of different units distorts the data inherently. In any case, in a Zone there will be certain sections which will have heavy passenger or freight traffic and there will be branch lines where the traffic will be minimal. The quality of infrastructure provided or the maintenance intensity of a busy section and a branch line is not captured by the average costs so arrived at.

For Indian Railway, fixing TAC will require complete cost data. The principles of fixing TAC are not yet decided but it can be reasonable assumed that it will at least recover the direct costs and there will be some mark up to recover a portion of the fixed cost. For this we need to know the direct cost incurred and the fixed cost for the partial, average or full recovery. The present accounting and cost system needs to be modified to ascertain these costs.

5.3 Changes Required

For the changes required the discussion will be limited to passenger services. The principles for ascertaining direct and indirect cost for freight will be same but the

allocation of costs to different freight services will be different from allocation of costs to different passenger services.

For calculation of direct cost the first step will be to know the joint cost pools, the second step will be to bifurcate these costs into direct and indirect costs and the third step will be allocation of direct and indirect cost to different services.

An indicative cost list will be : -

1. Operation Cost and Maintenance cost of Track, Bridges, OHE and Signaling gear (Man, material and Overhead).
2. Replacement cost of Track, Bridges, OHE and Signaling gear.
3. Capacity Expansion costs
4. Electricity/ Diesel Consumption
5. Station charges
6. Return on Equity and Cost of borrowed funds.

Rolling stock component of costs has been kept out from the list with the assumption that the responsibility of Rolling stock maintenance and purchase/ replacement will be with the train operator. The assumption is made on basis of two facts: -

1. In many markets the Infrastructure Manager is publicly owned (UK and Germany) and on top of that there are public or private train operators. In addition there are rolling stock companies, these companies own rolling stock and this stock is leased out to train operators. The existence of Rolling stock companies facilitates in reducing the capital requirement of Train Operating companies, lowering the entry barriers for train operating companies and facilitates greater competition amongst train operators.

2. The concept paper floated by NITI Ayog and Railway Board for Operation of 100 trains to private operators has the provision that the rolling stock will be owned and maintained by Private Operators.

Computation of cost of Electricity or Diesel is perhaps one of the simplest element of TAC. It is a direct cost and can be easily measured (Diesel Consumption) or metered (Electricity consumption). It can also be set on the basis of average Gross Tonne Kilometer (GTKM).

The present accounting system captures the cost data at Division, Zone and Workshop level and aggregates this for a Zone. The system needs to be changed to add unit or section specific information to enable generation of section and service specific data activity costing.

For the passenger business there are a variety of services offered by Indian Railway. The passenger services run by Indian railway can be divided into following categories:-

a. Premium Services – Rajdhani, Shatabdi, Tejas etc.
b. Mail/ Express services
c. Passenger service
d. MEMU and DMU services
e. Suburban services

The cost data requirement for fixing TAC can be illustrated by taking a theoretical section and a cost head and the data requirement to apportion this cost. If we take the example of track maintenance and for example Lucknow -Delhi train, the data requirement will be as follows :-

1. There are two main possible routes between Lucknow and Delhi i.e Route One - Delhi – Ghaziabad – Moradabad – Bareilly – Lucknow or Route 2 Delhi – Aligarh – Etawah – Kanpur – Lucknow. The track maintenance will off course depend upon the choice of route. Route 2 is faster and busier compared to Route One.
2. According to the route selected, the division wise – section wise bifurcation for the entire route. The section should be the basic unit for data capturing. In

Railway parlance section is area between two adjacent stations on which the train has to traverse.

3. Each section will lie under the jurisdiction of different Permanent way Inspectors (PWI). Each PWI unit will have its cost data available in Division accounts under following heads : -

Table 9 :Track maintenance head and subheads for account maintenance

Major Heads	Minor subheads
5002 Capital Outlay on Indian Railways – Commercial lines (01) 01- Capital bearing Dividend Liability	103 Track Renewals
3002 – Indian Railway commercial line working expense (17) B. Repair &Maintenance of Permanent way and works	100 Establishment in Offices 200 Maintenance of Permanent way

The date of expense and kind or work is being captured in the system. The material cost break up is also available. However, the present system needs to be modified to capture following additional details for getting the cost data for TAC purposes : -

a. The section wise expense and material used instead of division wise data aggregation is required. Even if PWI unit wise data will not work and it has to be section specific data. This can be achieved through addition of data fields by modifying the existing software. Since the exercise will begin from zero, initially there will be base available and system will attain maturity after few years only.
b. Data should be accessible through MIS systems on real time basis.

The exercise listed above will give section wise information for the chosen route.

Why Section wise data is required and averages over the zone or divisions will not work? A brief explanation for this specific requirement is in order. Cost of track maintenance differ greatly depending upon the profile of the section. For example the cost of maintaining curved and mountainous section with gradients can be two to three times more than the cost of maintaining a track on flat terrain. Using average cost across the zones will be therefore incorrect. The second reason is that the cost of track maintenance depends on the speed potential. For running high speed trains the track geometry requirements are more stringent and require intensive inputs compared to what is needed for a less speed potential section. In case of IR, averaging out the cost will be more unfair as the demand for private trains will be more focused on trunk routes which have higher speed potential.

On charging differently for different sections based on their characteristics instead of using the network average costs according to the regulation 2015/909 (European Commission (2015)), it is up to the infrastructure manager (or member states authority) to define the unit the costs are referred to. From a net-wide average cost allocation to train-kilometer, gross-tonne- kilometre or vehicle - kilometre, it is allowed to modulate charges taking into account different aspects.

Each section will have a different business wise traffic profile. The information regarding coaching trains run on each section and freight trains past data is available through two MIS systems presently under use by Railways i.e. Coaching Operation Information system (COIS) and Freight Operation Information system (FOIS) .

Next step involved will be determination of direct element in the track maintenance and renewal expense. As we have seen in case of Europe, it can be done on the basis of engineering modeling or on the basis of econometric models. However in case of IR, the data will not be available in the initial years for econometric models and engineering models have to be adopted. It has been observed in case of Europe that

the proportion of the direct cost also depends on the choice of model and in case of UK, ORR has favoured models which give lower direct cost proportions.

Similar exercise needs to be carried out for all the cost heads linked with TAC calculations.

A preliminary analysis of Indian Railway Finance Code heads and subheads indicate that the present heads and subheads do not capture the required details and some additions to this list are required. Few possible examples of such modifications have been identified by ICWAI Management Accounting research foundation for their report on cost accounting for Indian railway. Some of the changes identified in the report are as follows :-

Table 10 : Suggested changes in Finance code head and subheads

Minor Head	**Activity**	**Subhead**	**Detailed head**	**Remarks**
Demand No. 04 Repair & Maintenance. of Permanent way & works	*Maintenance of Bridge work and Tunnels including ROB/RUB - 04-300*	*ROB/RUB including foot over bridges 04-340*	*04-340*	*This head is being operated for both coaching and goods services, it is observed that Foot Over Bridge is being used for passengers only, hence separate detailed heads may be opened to book the expenditure for repair & maintenance of Foot Over Bridge.*
	Maintenance of Service	*Stations, Goods Sheds*	*Stations, Goods Sheds*	*It is observed that Stations are being used to operate all types*

	Buildings (other than staff quarters and welfare buildings) – 04-400	*04-420*	*04-420*	*of train operations (Coaching & Goods) whereas, Goods sheds are being used exclusively for Goods Services. Therefore, it is suggested that distinctive detailed heads separately for stations and goods sheds may be opened for booking of expenditure under this head for PCS purpose. Slots at Detailed head level under this sub-head are vacant.*
	Water supply, sanitation and Roads (other than colonies, staff quarters and welfare buildings)04-500	*Water Supply 04-510*	*Water supply 04-510*	*Separate detailed head are required for arrangement on water supply to Service Buildings and stations (i.e PF, washing line etc.) for costing purpose. Vacant slots at Detailed head level are available for opening new detailed heads.*
		Sanitation 04-520	*Service Road & Others 04-530*	*Separate detailed head are required for booking of expenditure of maintenance of Roads for Stations, Goods Sheds*

				and Service Buildings for costing purpose. Vacant slots at *Detailed head level are available for opening new detailed heads.*

This exercise with focus on track access charge needs to be done for addition/modification of data heads subheads in the existing system.

5.4 Accounting reforms in IR

Indian Railways as a department of Government of India, maintains its Finance Accounts under cash based government accounting. The format of the account is as required by CGA and C&AG. The system used by IR for accounting has served its purpose in the past but starting from 2000 the IR requirements have changed substantially. The era after 2000 is characterized by a need for expansion of rail network, technological up-gradation of operating and infrastructure systems. There has been a demand to enhance operating speeds of the trains and it has changed the safety requirement . The requirement of finances has therefore also gone up. Different committees which were formed for railway reform have pointed the requirement of improved financial reporting (operational results and financial position of Indian Railways) as per Generally Accepted Accounting Principles (GAAP) for various stakeholders.

In August 2002, Government Accounting Standards Advisory Board (GASAB) was formed by Central government to formulate Accounting Standards for both Cash Accounting and Accrual Accounting in Government Departments. An accounting Reforms Directorate was also formed in the Railway Board. In 2004, Accounting reform project was sanctioned by Ministry of Railways.

A consortium of consultants appointed in 2006 to study the existing railway Accounting System and make recommendations for such an Accounting System which not only meets the requirements of GASAB for Cash based Government Accounting but also contains aspects of Accrual based Commercial Accounting. Terms of Reference (ToR) were for (a) an improved Cost Accounting systems for train, section, route costing, profitability analysis for managerial decision support and (b) Accounting separation of various Line of railway business i.e. Passenger, Freight and suburban in such a manner that separate accounts are maintained for each line of business. AR Consultants submitted their report in 2010.

In 2014, Institute of Chartered Accountants of India was hired by Railway board for a pilot study with following objective : - a) To review and validate the Accounting Reforms Report of AR Consultants. b) Pilot Study for introduction of Accrual Accounting at Ajmer Division and Workshops of Ajmer. Institute was also required to prepare Accrual Accounting Manual for implementation of Accrual based Commercial Accounting in other Zonal Railways and Production Units.

It was expected that Introduction of Accrual Accounting will result into identification of outstanding liability under various works and stores procurement contracts. It shall also involve reconstruction of Asset Register in the requisite formats by all the field activity units.

In Feb 2015, the Railway Minister, in his Budget speech 2015-16, articulated the overall vision of the AR project and Minister of Railway included Performance Costing and Outcome Budgeting as Module 2 and Module 3 of the AR reform project besides developing financial accounts on accrual basis. Minister in his 2016-17 budget speech further announced that the project will be implemented in a “mission mode” and “Mission Beyond book-keeping” was instituted. In April 2016, the MOR (Ministry of Railways) also decided to implement a similar pilot in a Production Unit for

creating financial statements based on accrual accounts. RCF Kapurthala was identified for this.

Module 2 of the AR reform project i.e. performance costing is critical for TAC regime and if implemented keeping in view the requirements of TAC determination, it can serve as the backbone of TAC as all the data required can be culled out from this module. A report in this regard has been recently submitted by ICWAI Management accounting Research Foundation and the report is available on Railway Board website.

6.0 : Track Access charges for Indian Railways : A way forward

6.1 Introduction

In preceding chapters we have looked at the structure of the rail industry in select countries, how track access charges have evolved in UK and Germany and how cost data is maintained by Indian railway and its suitability for fixing track access charges. This chapter intends to look into the trend of passenger business of IR, its revenues and the background against which the decision to allow private operators has been taken by Government and suggest a possible way forward for fixing track access charges for the private players.

6.2 Passenger Business of Indian Railway

For last many decades, Indian Railways is the preferred mode of travel for the country as the roads were underdeveloped and airline were too expensive for the most of the citizens. As per Indian Railway year book 2018-19 during 2017-18, Indian Railway carried 8,286 million passengers as against 8,116 million in 2016-17 and Passenger kilometers was 1,178 billion as against 1,150 billion in the previous year.

The trend of passenger traffic since 1950-51 is shown below:

Table 11 : Indian Railway Passenger traffic trend Originating passenger in millions

	Suburban (All classes)	**Upper class**	**Mail Express**	**Ordinary**	**Total non suburban**	**Grand total**
1950-51	412	25	52	795	872	1,284
1960-61	680	15	96	803	914	1,594
1970-71	1,219	16	155	1,041	1,212	2,431
1980-81	2,000	11	260	1,342	1,613	3,613
1990-91	2,259	19	357	1,223	1,599	3,858
2000-01	2,861	40	472	1,460	1,972	4,833
2010-11	4,061	100	1,046	2,444	3,590	7,651
2015-16	4,459	145	1,321	2,182	3,648	8,107
2016-17	4,566	150	1,322	2,078	3,550	8,116
2017-18	**4,665**	**159**	**1,390**	**2,072**	**3,621**	**8,286**
2018-19	**4,784**	**179**	**1,499**	**1,977**	**3,655**	**8,439**

Source : Indian Railway year book 2018-19

Table 12 : Indian Railway passenger traffic trend- Total passenger km – in millions

	Suburban (All classes)	Upper class	Mail Express	Ordinary	Total non suburban	Grand total
1950-51	6,551	3,790	12,537	43,639	59,966	66,517
1960-61	11,770	3,454	22,251	40,190	65,895	77,665
1970-71	22,984	4,394	37,856	52,886	95,136	118,120
1980-81	41,086	5,140	86,712	75,620	167,472	208,558
1990-91	59,578	8,712	138,054	89,300	236,066	295,644
2000-01	88,872	26,315	222,568	119,267	368,150	457,022
2010-11	137,127	62,203	500,631	278,547	841,381	978,508
2015-16	145253	105315	634604	257867	997786	1143039
2016-17	145417	110355	634039	260024	1004418	1149835
2017-18	149465	114248	645462	268524	1028234	1177699
2018-19	146678	126641	664503	219352	1010496	1157174

Source : Indian Railway year book 2018-19

The passenger traffic along with freight has seen substantial growth since 1950 and the pace of growth has been more rapid during last two decades.

Number of passenger trains run daily

Table 13 : No. of train services run

Type of trains	Broad Gauge		Metre Gauge		Total (incl.NG)	
	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18
EMU	5,875	5,507	0	-	5,881	5,507
Mail/Express	3,695	3,581	0	-	3,695	3,581
Ordinary Passenger Trains and Mixed Trains	3,779	4,287	77	77	3,947	4,364
Total	13,349	13,375	77	77	13,523	13,452

Source : Indian Railway year book 2017-18

Table 14 : Overall average train speed including halts (Kms. /hr.)

Type of trains	Broad Gauge	
	2018-19	**2017-18**
EMU	37.5	37.5
Mail/Express	50.3	60.3
Ordinary Passenger Trains (incl. mixed)	33.8	33.8

Source : Indian Railway year book 2017-18

The speed of the trains is as per time table. The speeds are slow compared to other nations such as China. There is no high speed network in India and Mumbai – Ahmedabad high speed will take another couple of years to complete. The passenger sector is marred due to network capacity constraints and asset reliability issues. The system is also not geared to handle certain weather anomalies such as fog.

Passenger earnings in 2017-18 were 48,643.14 crore. This was 2,362.68 crore (5.11 %) higher than the earnings in 2016-17. Suburban traffic contributed 5.76 % to the total earnings. The remaining 94.24 % came from non-suburban passengers. Earnings from Second and Sleeper Class Mail/Express passengers comprised 49.99 % of the total passenger earnings.

Class wise Passenger revenue and passenger kilometer for 2018-19 was as under:

Table 15 : Passenger revenue and Passenger kilometer

Segment	No of passenger		Passenger kms		Revenue	
	Million	**Percentage**	**Million**	**Percentage**	**In crore rupees**	**Percentage**
Non Suburban						
Upper Class	179	2.12	126641	10.94	17702.52	34.66
Second class Mail/express	1499	17.76	664503	57.43	25885.25	50.69
Second Class Ordinary	1977	23.43	219352	18.96	4666.13	9.14
Total	3655	43.31	1010496	87.33	48,253.90	94.49
Suburban All Class	4784	56.69	146678	12.67	2812.75	5.51
Grand Total	8439	100	1157174	100	51066.65	100

Source : Indian Railway year book 2018-19

The passenger segment is characterized by the fact that revenues are not as per in proportion to the passenger segment. For example, for 2018-19, the passenger-kilometer (PKM) of suburban sector was 12.67% of the total whereas revenue was only 5.51% of the total. The upper class share in PKM was only 10.94 % but revenues were 34.66%.

Another limitation in the sector comes from the cross subsidy element between freight and passenger business. For railways the Operating Ratio is defined as operating expenses as a percentage of revenue. This financial ratio is most commonly used for industries which require a large percentage of revenues to maintain operations and railways is one such industry. Details of freight and passenger earnings for 2016-17 and 2017-18 was as follows : -

Table 16 : Passenger and Freight Revenues

Passenger Traffic (Suburban + Non-Suburban)				
			2018-19	2017-18
1	Passenger Originating	Millions	8,439	**8,286**
2	Passenger Kilometers	Millions	11,57,174	**11,77,699**
3	Average Lead	Kms.	137.1	**142.20**
4	Passenger Earnings	` in crores	51,067	**48,643**
Freight Traffic (Revenue)				
1	Tonnes originating	Millions	1,,221.48	**1,159.55**
2	Lead (originating)	Kms.	605	**598**
3	Freight Earnings excl. Demurrarge/Wharfage	` in crores	1,22,580.31	**1,13,523.53**

Source : Indian Railway year book 2018-19

Operating ratio for IR as a whole and for passenger and freight business separately during 2018-19 and 2017-18 was as follows : -

Table 17 : Operating ratio for Passenger and Freight Services

		2018-19	**2017-18**
Operating ratio	%age	97.29	98.44
Rate of return on Capital	%age	1.08	.51
Working ratio of IR	%age	91.9	92.5

Operating ratio with subsidy (Cost recovery)	%age	77.4	80.0
Operating ratio for Coaching (passenger) and Goods (Freight)			
Goods	%age	58.72	58.83
Coaching	%age	192.49	181.20

Source : Indian Railway year book 2018-19

The coaching operations is loss making for Indian Railways but it's losses are subsidizing by overcharging the freight segment. The cross subsidy has far reaching effects. High freight rates over IR are one of the reasons behind the fact that in India logistics cost for Industry are higher than world standards. The higher logistics cost in turn affects the competitiveness of manufacturing sector as a whole and it has stunted the growth of manufacturing in the country. The slow manufacturing growth has resulted higher level of unemployment in the country and higher dependence of agriculture as a source of livelihood.

6.3 Introduction of Private passenger trains on Indian Railways

Although the IR network and the passenger trains run have grown over the years and served the public, it has not entirely met the public expectations. Network capacity issues have affected the punctuality performance. Lack of desired investment in the line has resulted into limiting the top speed of network to 130 kmph. Improved LHB stock was introduced in the year 2000 to replace ICF stock to improve the safety and comfort of passengers. The conversion is still going on and is yet to be completed due to lack of resources. Due to concerted efforts of government, the conversion process has accelerated off late.

In the year 2018-19, the reserved passenger volume was 16% (0.59 billion) of the total originating non-suburban passengers (3.65 billion). Almost 8.85 crore of waitlisted passengers could not be accommodated. The major trunk routes are saturated and operate at near full capacity. However, with likely commissioning of Dedicated Freight Corridors in 2021 and other infrastructural works, it is expected

that additional capacity will be available for operation of additional passenger services on some routes. To improve its services and to attract investment from private sector, Indian Railway has announced that it will allow private operators to run trains on its network. As a first step, Tejas trains are being run on New Delhi – Lucknow and Ahmedabad – Mumbai route by Indian Railway Catering and Tourism Corporation(IRCTC) which provides the onboard services and undertakes the ticketing operations. Tariffs are set by IRCTC and train operation is done by Indian Railways. Railways and NITI Aayog, Government of India are spearheading participation of private entities in operation of 150 passenger trains on 100 route which will allow introduction of next generation technology and provision of higher service quality, ensuring use of improved coach technology and reduced journey time.

At present the draft proposal has been put up in public domain for comments of the relevant stakeholders. The proposed conditions in the draft document for discussion are as follows : -

> ***Operational routes:*** *100 origin destination pairs have been divided into a number of clusters such that each cluster would require operation of a minimum of 12 (twelve) rakes.*
>
> ***Duration of journey on each Path:*** *The time taken by a train to complete a path shall be comparable to the fastest train of IR operating on that path. IR shall provide a non-discriminatory treatment for the trains operated by the Concessionaire. No similar scheduled regular train will depart in the same origin destination route within 15 minutes of the Scheduled Operation of the Concessionaires Train.*
>
> ***Length of Train:*** *Each train shall have a minimum of 16 coaches and a maximum not exceeding the longest passenger train operating on the respective path.*

Configuration of trains: *to be determined by the Concessionaire based on the demand.*

Operation and Maintenance: *Operation and maintenance of the passenger trains would be governed by standards to be laid down by RDSO. The maintenance of the trains shall be the responsibility of private entity. IR will provide berth/ space to private entity in the existing maintenance depots/ washing lines or a space in proximate area on as is where basis for up-gradation and use of the same by the Concessionaire. The concessionaire to bring its manpower, tools and plants as required for undertaking the maintenance obligations. The Monthly schedule of the trains shall not be before 31 days of the previous scheduled maintenance or a travel of 40,000 kms after such scheduled maintenance. Further, IR shall provide washing lines in its existing coaching depots for washing and inspection of the Trains as per the maintenance schedule. IR shall also provide stabling lines for placing of trains when idle. Further, the trains in a cluster may have to be maintained in more than one maintenance depot.*

Crew and Guard: *Concessionaire would be responsible for providing Crew and Guard. However, it would have the option to take Crew and Guard from IR on secondment.*

Safety Certification: *The Safety certification of the rakes before each commercial service shall be done by IR based on the safety parameters indicated by IR and travel worthiness certified by the Concessionaire; however, the same will not relieve or absolve the Concessionaires of the obligation and liabilities as specified in the Agreement. Detailed terms and conditions will be specified in the Concession Agreement.*

Concession Period: *Concession Period will be for a period of 35 years commencing from the Appointed Date.*

Maximum Permissible Speed: *The passenger trains to be operated by the private entity shall be designed for a maximum permissible speed of 160kmph.*

Determination of Fare: *The Private Entity shall have the freedom to decide on the fare to be charged from its passengers.*

Design of the Rolling Stock: *Private Entity shall be free to procure trains and locomotives from a source of its choice, provided such trains and locomotives are compatible with specification and standards specified in the Concession Agreement. The trains could be either loco hauled or distributed power.*

Validation of Rolling Stock: *For introduction of new rolling stock, validation will be done by Accredited Independent Safety Assessor (ISA) on IR track. This process will be resorted to till such time RDSO adopts testing norms defined in UIC 518 or other internationally accepted norms.*

Role of Private Entity: *The private entity shall be responsible for financing, procuring, operation and maintenance of the trains. The Private Entity shall pay to IR pre-determined charges for haulage and any other payments as specified in the Agreement.*

Penalties for non-performance*: Pre-specified penalties shall be recovered from the Concessionaire for failure to meet the prescribed performance standards and outcomes. Similarly, penalties will be pre-specified in the Concession Agreement for the failure on the part of the Railways.*

Technology for the Trains

Proposed technology for the trains may inter alia include following:

a) Low maintenance requirements, especially pit maintenance, through use of modern design bogies, stainless steel/aluminum exteriors, brake system etc.;

b)Improved safety features with fire retardant interiors, modern couplers with anticlimbing features, wider gangway design for safe inter rail car movement etc.;

c)Improved passenger comfort, through use of bogies with superior ride index, efficient air conditioning with automatic temperature and humidity control, superior interiors and toilets etc.;

d) Under-Slung/roof-mounted IGBT propulsion system to release passenger space.

e)Friendly access to physically challenged passengers;

f)Folding step for physically challenged passengers;

g) GPS enabled passenger announcement system for on-board announcements for station arrivals, time to next station/destination, safety announcements etc;

h) Air-conditioning/Fresh air ventilation;

i) Vandal-proof interiors.

j) Energy efficient rolling stock with regenerative braking mechanism

The condition stipulated by IR has certain implications. The concession period of thirty five years means a long term commitment from the private player. The thirty five year concession term along with the condition with the condition that rolling stock will be provided by the private player means that substantial capital has to be invested upfront by the private player. To make this endeavor successful it requires certain assurances to be provided by IR other wise the private players will not risk their money. Some of the assurances required can be

a. The track access charge should be fixed on the basis of some predefined method. Frequency of its revision shall be part of tender document. An independent agency other than IR should determine Track Access Charges and its revision.
b. Since IR will be an operator competing with the private train operators, the condition that "*No similar scheduled regular train will depart in the same origin destination route within 15 minutes of the Scheduled Operation of the Concessionaires Train."* does not address the competition issue entirely. A similar train can be run by IR with a gap of 30 minutes with much cheaper tariff on any day during the 35 year concession period. For example even now IR is running two

Rajdhani trains between New Delhi and Mumbai with a gap of 25 minutes.

c. The maintenance of rolling stock as per RDSO standards – An independent safety watch dog is required to ensure this. IR being an operator itself should not be entrusted with this job.
d. Certification of new Rolling stock for Operation on IR: It should be done with a prescribed time limit. IR experience is that this process takes too much time even for the stock owned by IR.

There are two important issues which needs to be addressed by the IR internally for operation of private trains. The first issue is how the model will be scaled up and he second issue is the matter of subsidy and government support for passenger transport. At present the plan is to award only 150 trains to the private operators. IR is running more than 13000 train per day currently and 150 trains is only a small fraction of that number. The first requirement of the scaling up will be to set up the required institutional frame work. Since IR will continue to operate the trains, Ministry and IR needs to be separated. Ministry function will be limited to policy making and oversight. IR will be required to maintain infrastructure and operate trains. Ideally these two functions should be separated and one entity should maintain infrastructure and one entity should run trains as government operator. The separation will strengthen two aspects – first the access to network can be provided on non –discriminatory basis and second the element of subsidy to passenger segment can be provided in a more transparent manner. In all likelihood IR has to continue to work as an operator as the private sector will be interested to operate on the trunk and busy routes which are financially attractive. There will be many sections where the private operators will not be forthcoming and to maintain connectivity government has to step in.

To allow operation of trains by private requires three independent setups

a. Independent economic regulator – to fix the tariff between the train operator and infrastructure manager
b. Independent safety regulator- To ensure that private operators are following the required maintenance and other activities to ensure safety
c. Independent accident investigation body – To determine the cause of accident and suggest remedial action. In case of damages during accident, the regulators findings will determine the extent of damage compensation.

The issue of subsidy to be provided to the passenger segment is one of the crucial aspects of privatization. At present passenger business is being subsidized from freight revenue. However, the cross subsidization is not desirable as it causes greater negative externalities. Once private operators are allowed, to provide a level playing field they also need to be provided access to the network at a price less than the cost of providing such access. The question that needs to be addressed are two – what will be the basis of charging of providing access? and how the gap will be funded. The simplest way of funding the gap is to let the present system of cross subsidization continue. Better alternative will be fix the principles of access charging – both for private operators and IR. An independent regulator will look at the accounts and cost data of IR and decide the access charges. Suitable funding arrangement may be devised to fund the gap both for IR and private operators and freight sector may be charged without any distortion.

On the cross subsidy issue, Kamboj, Puneet; Tongia, Rahul have done a study on coal transport in India for Brookings India. The findings of the report are relevant and are quoted here briefly : -

- *Coal and railways in India are heavily interdependent. In the Financial Year (FY) 2017, out of 574 MT of coal (inclusive of imports) consumed for grid electricity generation (Central Electricity Authority, 2017), 341*

MT, or 60 per cent, was transported through railways (Railway Board, March 2017).

- *Coal is 44 per cent of IR's freight revenues and has an even higher share in its profits.*
- *IR's average distance of coal transported has fallen 30 per cent in the past five years due to coal linkage rationalisation*
- *to maintain total revenue, IR coal freight charges have grown more than four times the wholesale inflation rate during FY 2012 to FY 2017.*
- *Despite higher passenger volumes on a shared network, India has the lowest fare to- freight ratio—the ratio of passenger fares and freight charges—of 0.24, compared with several other countries including Japan (1.9), Germany (1.5) and China (1.2).*
- *Railways today explicitly over-prices coal freight by about 31 per cent to offset its "social obligation" or coaching losses. In FY 2017, this "overcharge" from coal to TPPs (Rs. 10,800 crores) increases the cost of power, on an average, by about 10 paisa per kWh on the basis of all electricity generated in India.*
- *Projections and modeling for the future suggest that to keep railways solvent based entirely on the cross-subsidy model would result in a freight rise that would make coal (and thus thermal electricity) uncompetitive.*

The cross subsidization issues and problems as mentioned above for coal hold good for other major commodities(Cement, steel, foodgrains, Petroleum products) carried by Railway are same for other major commodities

6.4 TAC for Indian Railway - Principles

Given the conditions outlined by Ministry of Railways for private operators, the charging principles are to be decided in such a way that the operation of trains by private operators may become a successful venture. The proposal put up in the public domain clearly stipulates that the private operator will bring its rolling stock and will

be responsible for its maintenance and therefore, the rolling stock and its maintenance will not be part of TAC. Another major element – traction energy charges will be pass through and may not be made part of track access charges. This leaves with following items for consideration :-

1. Operation cost
2. Maintenance cost
3. Terminal cost
4. Cost of capital/ cost of debt and depreciation
5. Overheads

Between the two approaches – the full cost recovery and partial cost recovery, it can be assumed that approach adopted by IR will be partial cost recovery and some part of the access cost will be in the form of subsidy. The best case will be that TAC should be based on short term marginal social costs which represent the structure and level of charge consistent with the efficient utilization of the infrastructure. The remaining fixed costs must then be covered through a government subsidy. This is generally regarded as the economically optimal approach for a TAC regime but may not be possible for financial and practical reasons.

The track access charge must make differentiation on the basis of section on which train is being run and the kind of stock it is using. An average charge on the basis of Passenger – kilometer and gross tonne – kilometer will be the simplest to implement.

Another aspect of the TAC calculation is the variability proportion of the Operation and maintenance charges. A short note on how this issue is handled in European countries is at **Appendix 2**.

A short discussion on possible ways to handle the each cost head for TAC calculation is presented in the following section : -

1. **Operation cost** : Operation cost will consist mainly of the staff cost plus overheads in maintaining the relevant office. The staff cost will consist of following main elements – station staff, train staff i.e. crew and guard, control staff and division and zonal headquarters and the operation staff other that control staff posted at divisional, zonal and board level. Cost of each category of staff is available in IPAS database. Station staff cost can be directly attributed to the concerned section and the total of this cost has to be apportioned for the goods and passenger trains. On the basis of historical data average train kilometers can be calculated and the per train kilometer charge can be arrived at. Similar exercise can be done for control staff and operation staff at division and zonal level by calculating the train kilomters for the trains handled by each group. Average crew cost per train kilometer can be estimated for the concerned divisions and can be used for estimating per train charge. The overheads and office expenses be stations, division, zonal and control office can also be calculated on train kilometer basis based on historical data.
2. **Maintenance cost**: Among all the cost elements, maintenance cost element is most challenging from apportionment point of view. The cost will come from two sources – man and material. Like Operation, maintenance staff is deployed at field level, division level, Head quarter level and aggregate cost at different level for the section concerned can be calculated through IPAS.

   Material cost per section may not be available as it is not captured by the IT system at present but the system can be modified to capture these details.

   To begin with , the aggregate cost needs to be apportioned between passenger and freight. A better system will be to apportion cost into further sub systems e.g. freight can be subdivided container, open, covered and flat wagons. The passenger system should be atleast divided into three segments i.e. long distance, passenger and suburban. However, these subdivisions can

be made for cost apportionment when the system matures and may not be possible at this stage.

Maintenance cost can not be apportioned on the basis of train kilometers as has been suggested for the operation cost. Track and bridge wear and tear for freight and passenger trains are very different and vary greatly on the basis of section curve and gradient. The tolerances of track maintenance are based on the train which is running at highest speed in that section which is normally a passenger train. Therefore the track and bridge maintenance cost has to be apportioned to some volume measure. Engineering models can be used to apportion this cost per train based on the weight and speed profile of the train.

Signaling and communication installations life does not depend on the no. of train runs or on their weight. It can be apportioned on the basis of no. of trains expected to be run during its shelf life it that particular section.

OHE installation wear depends on the no. of trains and the weight of trains as heavier trains will draw more current from the system. Here again, like track and bridge an engineering model should be more appropriate.

Between the engineering model and econometric model the most suitable choice will be apportioning the maintenance cost on the basis of engineering models. The other choice, the econometric models can not be used at this stage as the quality data required for econometric models is not available.

3. **Terminal cost** : Terminal cost will consist of following elements (a) staff cost (b) shunting charges (c) material costs (d) overheads

   Cost of the terminal can be captured through IPAS and apportionment between goods and freight can be done on the basis of no. of trains handled. In fact, Indian Railway is already calculating Terminal cost for container trains run by Private train Operators.

4. **Cost of Equity/ Cost of Debt and Depreciation:** Indian railway finance code volume II and section II Major and Minor heads of railway capital captures

details of the capital invested in IR for activities such as rolling stock, track renewal, Bridge works, Electrification projects, Machinery and Plants, Signaling and Telecommunication. It also captures whether a capital expenditure has dividend liability or not. By adding suitable location flag in the IPAS, it is possible to capture the section wise detail also. With this information the total cost of equity/ cost of debt and depreciation attributable to a section can be calculated. It can be apportioned to each train on the basis of train kilometers. Apportionment on the basis will not differentiate between a goods and passenger trains or within these categories and will give a result which will overcharge the passenger segment and undercharge the freight segment. However, perhaps this is the segment where the subsidy element for passenger trains can be brought into. The three elements listed above i.e. Operation cost, Maintenance cost and Terminal cost can be identified as direct cost for a particular train service and cost of equity/ cost of debt and depreciation can be treated as contribution over and above the direct cost on which the test of "ability to pay" can be applied to determine to fix the level of this charge and balance of this can be funded through subsidy.

5. **Overheads** There are certain cost which are not covered in the heads listed above. Training cost, cost of research institute RDSO and cost incurred at Railway board level are some of the major elements of this head. These costs can be apportioned on the basis of train kilometers.

6.5 Conclusion

Principles for deciding track access charges for Indian Railways has been presented in the preceding sections. The principles have been suggested on the basis of international practices and the feasibility from the data point of view. The data for calculating track access charges will be available from the existing IT systems of railways only after certain modification as has been suggested in chapter 5.

7.0 : Limitation of the Study and Future Scope

7.1 Introduction

An attempt has been made in the preceding chapters to present a scheme for fixing track access charges for Indian Railways. The subject is complex and only an outline of the Track access charge scheme has been presented. An account of limitation of the study and future course of work is attempted in this chapter.

7.2 Limitation of Study

Entry of private players for passenger service has just begun in India. The policy in this regard is yet to take shape and it is expected that policy in this sector will gradually evolve on the basis of conditions and the experience gained. The regulatory structure is also not in place and will evolve as per policy formulated. The track access charges will depend upon the roles and responsibility assigned to the private operator. Since the concession period proposed now is of 35 years, midway policy changes can alter the risk and financial burden on the private player. This risk can only be neutralized by the presence of a strong regulatory body of economic regulation and independent safety and accident investigation bodies. Contours of these regulatory bodies are not clear at present. All these factors impose a limitation on the scope of study in the sense that only a general outline of track access charge scheme can be suggested.

The subsidy element for passenger operation is another limiting factor. The extent of subsidy offered will depend upon the policy of government.

Actual calculation of track access charge is a very complex exercise. Even the determination of principles, choice of engineering model or econometric method is a very complex and time consuming exercise. This study is limited in scope due to paucity of time and can not go beyond suggesting a general outline.

7.3 Future Scope of the Study

Scope of future study is very wide as the subject is just taking root at present. Some of the possible areas are listed below: -

a. Institutional set up required for Indian rail industry
b. Changes required in IT systems employed by IR to capture the data required for track access charges calculation
c. Engineering models for calculation of track wear and tear
d. Analysis of Econometric methods for track access charge calculation and changes required in the IT systems to generate the data required for econometric models.
e. Assessment of variability proportion in Operation and maintenance cost
f. Timetabling and analysis of timetabling cost
g. Scarcity and congestion charge estimation

References

1	Andrew Bowman (2015), An illusion of success: The consequences of British rail privatization
2	Drew, J. and Nash, C.A. (2011). Vertical separation of railway infrastructure - does it always make sense? Institute for Transport Studies, University of Leeds, Working Paper 594
3	Kamboj, Puneet; Tongia, Rahul."Indian Railways and Coal: An unsustainable interdependency, Brookings India report, July 2018
4	List of TOCs retrieved from (https://orr.gov.uk/about-orr/who-we-work-with/industry-organisations/train-operating-companies)
5	Vilius Nikitinasa, Stasys Dailydkab (2015). The Models of Management of Railway Companies in the European Union: Holding, the German Experience. 9th International Scientific Conference Transbaltica 2015 pp 80-88
6	Andersson, M. (2006) Marginal Cost Pricing of Railway Infrastructure Operation, Maintenance and Renewal in Sweden: From Policy to Practice Through Existing Data. Transportation Research Record: Journal of the Transportation Research Board, vol. 1943, pp. 1-11.
7	Andersson, M. (2007a): Fixed Effects Estimation of Marginal Railway Infrastructure Costs in Sweden. Chapter 3 in Andersson, M. (2007) Empirical Essays on Railway Infrastructure Costs in Sweden. Ph.D. Thesis. ISBN: 91-85539-18-X. Division of Transport and Location Analysis, Department of Transport and Economics, Royal Institute of Technology, Stockholm, Sweden.
8	Andersson, M. (2007b): Marginal Railway Renewal Costs - A Survival Data Approach. Chapter 4 in Andersson, M. (2007) Empirical Essays on Railway Infrastructure Costs in Sweden. Ph.D. Thesis. ISBN: 91-85539-18-X. Division of Transport and Location Analysis, Department of Transport and Economics, Royal Institute of Technology, Stockholm, Sweden.
9	Andersson, Mats. (2007). Marginal Railway Infrastructure Costs in a Dynamic Context. Swedish National Road & Transport Research Institute (VTI), Working Papers. 8. 10.18757/ejtir.2008.8.4.3357.
10	Andrew Smith, Simon Iwnicki, Aniruddha Kaushal, Kristofer Odolinski, Phill Wheat(2017), Estimating the relative cost of track damage mechanism : combining economic and engineering approaches.
11	Fowkes, A.S. and Nash, C.A. (2004), Rail privatisation in Britain - lessons for the rail freight industry. European Integration of Rail Freight Transport URL : http://eprints.whiterose.ac.uk/2473/
12	Heike Link, DIW and Rico Merkert, Cranfield University 2010, "Success Factors and Problems of Rail Franchising: A Fresh Assessment of the German Case".

13	Independent Regulators Group – Rail (2016) : An introduction to the calculation of direct costs in respect of implementing regulation 2015/909.
14	Independent Regulators' Group – Rail : Annual Market Monitoring Report, 2014
15	Kopcki R. Thompson L.,1995, Best methods of Railway restructuring and Privitization, CFS discussion paper series Number 111
16	Lawrence, Martha, Richard Bullock, and Ziming Liu. 2019. China's High-Speed Rail Development. International Development in Focus. Washington, DC:World Bank. doi:10.1596/978-1-4648-1425-9
17	List of ROSCO retrieved from https://orr.gov.uk/about-orr/who-we-work-with/industry-organisations/rolling-stock-companies
18	Mizutani, F, Smith, ASJ, Nash, CA et al. (1 more author) (2014), Comparing the costs of vertical separation, integration, and intermediate organisational structures in European and East Asian railways. Journal of Transport Economics and Policy, 2014
19	Rachna Gangwar, G Raghuram (2016), Implications of vertical unbundling on Indian Railways: Lessons from German railway reform
20	Railway Reform in the ECE region, UN report , 2018, pp 29, , eISBN: 978-92-1-363117-1
21	Railway Reform in the ECE region, UN report , 2018, pp 32, , eISBN: 978-92-1-363117-1
22	Stefan Marschnig(2016) Innovative track access charges, 6th Transport research arena, April 18-21, 2016
23	Vertical integration, separation in the rail industry: A survey of empirical studies on efficiencies, Malcolm Abbott, Bruce Cohen(2017), EJTIR Issue 17(2), 2017 pp 207-224

Appendix 1 : Indian Railway Finance Code : Expenditure Heads and subheads

Major Heads	Minor Heads
3001	
Indian Railway Policy Formulation, Direction, Research and Other Misc. Organisation	Railway Board(8) , Survey (9& 10), Research Designs and Standards Organization (8), Misc. Establishment (8 & 11), Statutory Audit including Pensionary Charges (12 & 10), Payment to worked lines (13) , Subsidised companies (14) , Misc. Charges (10 & 15), Suspense – misc. advances, Deduct – amount met from railway pension fund (10)
3002 Indian Railway commercial lines – working expense	
A. General Superintendence & Services	100. General Management including General Management Services, 200. Financial Management 300 Personnel Management, 400 Materials Management, 500 Way & Works Management 600 Rolling Stock Management, 700 Electrical Management, 800 Signal & Telecommunications Management, 900 Traffic Management
B. Repairs & Maintenance Permanent Way & Works	100 Establishment in offices, 200 Maintenance of permanent way, 300 Maintenance of Bridge work and Tunnels including Road over/under bridges,400 Maintenance of Service buildings(other than staff quarters and welfare buildings), 500 Water supply, sanitation and roads(other than colonies staff quarter and welfare buildings), 600 Other repairs and maintenance 700 Special repairs pertaining to breaches , 800 Accidents etc. including special revenue works 900 credit and recoveries
C. Repairs and Maintenance of Motive Power	100 Establishment in offices, 200 Steam locomotives, 300 Diesel Locomotives, 400 Electric Locomotives, 500 Rail cars, ferry steamers and other maintenance expenses, 900 credit and recoveries,
D. Repair and maintenance of carriage and wagons	100 Establishment of offices, 200 Carriages, 300 Wagons, 400 Electric Multiple Units, 500 Electrical General Service Train Lighting, fans and air conditioning, 600 Misc. Repairs & Maintenance expenses, 700 DMU Coaches, 900 Credit and recoveries

E. Repair and Maintenance of Plants and equipment's	100 Establishment in offices, 200 Plant & Equipment Way and works, 300 Plant & Equipment – Mechanical 400 Plant & Equipment – Electrical, 500 Plant & Equipment – Signalling, 600 Plant & Equipment – Telecommunications, 700 Rental to P & T for Signalling & Tekecommunication, 800 Other Plant & Equipment – General and Traffic Departments, 900 Credit and recoveries
F. Operating Expenses – Rolling Stock and Equipment	100 Steam Locomotive, 200 Diesel Locomotives, 300 Electrical Locomotive, 400 EMU Coaches, 500 Carriages and Wagons, 600 Traction (Other than Rolling stock) & general electric service 700 Signallling & Telecommunications , 800 Ferry Services and Rail Cars, 900 Credits or Recoveries
G. Operating Expenses – Traffic	100 Establishment in offices , , 200 Station Operations, , 300 yard Operation, 400 Transshipment and Repacking Operations, 500 Trains Operations , 600 Safety, , 700 Other Misc Expenses , 800 Credit or Recoveries
H. Operating Expenses – Fuel	100 Steam Locomotives, , 200 Diesel Locomotives, 300 Electrical Locomotive, 900 Credit or Recoveries
J. Staff Welfare & Amenities	100 Educational Faculties, 200 Medical Services, 300 Health and Welfare Services, 400 Canteen & Other Staff Amenities, 500 Residential and welfare Buildings Repairs and maintenance, 600 Miscellaneous Expenses , 900 Credits or Recoveries
K. Miscellaneous Working expenses	100 Securit, 200 Compensation Claims, 300 Workmen's and other compensations claims, 400 catering 500 Cost of training staff, 600 Other expenses, 700 Hospitality & Entertainment expenses 900 Credits and recoveries
L. Provident Fund Pension and other retirement benefits	100 Superannuation and retiring Pension, 200 Commuted Pernsion, 300 Ex – gratia Pension, 400 Family Pernsion, 500 Death cum retirement Gratuity, 600 Other allowances other pensions and other expenses, 700 Leave encashment benefits, 800 contribution to provident fund and contribution to provident fund , 900 Credits and recoveries
M. Appropriation to funds (19)	100 Appropriation to depreciation reserve funds, 200 Appropriation to Pension funds,
N. Suspense	100 Miscellaneous Advance Demands Payble, 200 Credit Recoveries,
3003 Indian Railway Strategic Lines – Working Expenses (	Same as for "Working Expenses"under Major Heads 3002

17)	
3004 Indian Railway – Open Line Works (Revenue) (20) A- Commercial Lines B- Strategic Lines	Transfer amount from major head 5002 Transfer amount from major head 5003
3005 Payments to General Revenues	Dividend to General Revenues (i) Payment from Revenues (ii) Payment by withdrawals from revenue reserve fund contribution to general revenues for grants to lien of passenger fare tax contributions to general Revenues for Grants to States for financing safety works
3007 Repayment of Loans taken from General Revenue	Repayment of Loans (22) Interest on loans (22) Payment of deferred dividend liability in respect to the period prior to 1978-79 Deduct – amount met from Railway Development Fund
3025 Payment towards Amortization of Overcapitalisation	Payment towards Amortization of over – capitalization
2016 Audit	Railway Audit Offices

Appendix 2 : Proportions of direct cost in TAC

Several econometric studies have been conducted across the Europe to assess the variable charges for member countries[7]. These studies have concluded for Britain, France and Sweden maintenance elasticity was between 20% to 35% . It was also found that elasticity depended upon traffic density i.e. tonne kilometer per track kilometer. Andersson et. al. (2012) and Odolinski and Nilsson, 2017 studied the Swedish rail data and concluded that elasticities for track renewals was fifty five percent and for other renewals it was 50%.

Smith and Wheat 2017 found that upper range of variability of maintenance and renewal was 45% and lower bound was 25%. The conclusion was based on data from multiple countries and similar methodology was applied to the data set.

Smith et. al. 2016 did a study on SNCF Reseau and arrived at following elasticities for maintenance activities[8] : -

Preferred Models in Model selection					Regulator Choice
	Box Tidwell model	Box – Cox Model	Interacted Box cox model	Average	Trans log
Track	51%	41%	69%	54%	29%
Switches and Crossings	33%	49%	48%	48%	23%
Signalling	43%	42%	41%	41%	33%
Catenary	15%	20%	20%	20%	22%

[7] a. Cost Allocation of Transport Infrastructure cost Rail Cost Allocation for Europe, Wheat, P., Smith, A. and C. Nash, 2009,
b. FP7 SUSTRAIL project
c. Horizon 2020 NeTIRail-INFRA
d. SNCF Réseau study

[8] Track access charges: reconciling conflicting objectives Case Study – Great Britain, Prof. Andrew Smith, University of Leeds Prof. Chris Nash, CERRE & University of Leeds 9 May 2018,

As can be clearly seen that the results depend upon the choice of model. For the other assets, the results do not change with the change of method.

The model chosen by regulator i.e. Translog the costs were normally less than other models. Regulator chose this model as this was simpler compared to other , transparent and results could be replicated.

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