भारत सरकार / Government of India
रेल मंत्रालय / Ministry of Railways
(रेलवे बोर्ड / Railway Board)

No. 2022/W-I/Genl/DPRproforma (E-off:3404238) New Delhi, Dt. 13 .12.2023

The General Managers,
All Indian Railways.

Sub: Proforma for submission of Detailed Project Report.

As per existing instructions, Detailed Project Reports (DPRs) containing Detailed Estimates are prepared for all works costing above Rs 50 Crore and are sent by Zonal Railways/PSUs to Railway Board for obtaining sanction of the competent authority as per the extent of delegation of powers. Instructions have been issued vide Board's letter No. 2021/W-I/Genl/Policy dated 12.05.2022 wherein Railways were advised to send details as per prescribed proformas in Executive Summary/covering letter of DPR/DE/RE of new/sanctioned projects before sending to Board.

On perusal of DPRs of the various projects, it has been observed that there is no uniformity in submission of DPRs due to which some important aspects do not get covered, resulting in difficulty in the appraisal of DPRs. Also, the projects are now planned as per PM Gatishakti framework and appraised by Network Planning Group (NPG). Therefore, in order to bring uniformity in DPR preparation and to effectively appraise the DPR, Standard Format has been prepared. The initial DPR submission to contain the following:-

(i) **Covering letter**: It should contain Brief details and justification of project, Pink Book reference (if included in Pink Book), FLS reference, Table showing Total cost and Dept wise cost, Basis of rates and certification about estimated cost at current price level, Completion period, Existing & Projected Freight and Passenger traffic, projected earnings, FIRR & EROR. Covering letter should also mention about finance concurrence and approval of GM. It should be signed by officer not below **SAG level officer**;

(ii) **DPR (Vol-I)**: The volume I of DPR should contain Executive summary and chapters on various components as per the Format attached as Annexure-I;

(iii) **DPR (Vol-II)**: The Volume-II of DPR should contain Detailed Estimate of the Project as per Engineering code.

A checklist on Cash Outflows (Construction cost, Working expenses) and Cash Inflows (Traffic earnings and residual value) is also required to be submitted.

Documents related to Internal correspondence and vetting of Associate finance of Zonal Railways are not required to be made part of DPR.

This supersedes instructions issued vide letter dated 02.09.2022

13/12/2023

(Rajesh Kumar Garg)
Executive Director/GS(Civil)-I
Railway Board.

DA:

i. Annexure I- Format of DPR Vol-I
ii. Annexure II- Salient Features of Project
iii. Annexure III- Summary of cost estimates
iv. Annexure IV-Electrical Estimate checklist
v. Annexure V- S&T estimate checklist
vi. Annexure VI- Rly Board letter dtd 14.09.2023 (Finanicla/Economic appraisal framework)
vii. Annexure VII- Rly Board letter dtd. 19.08.2022 (Economic appraiasal framework)
viii. Annexure VIII: Generic guidelines for preparation/updation of DPR

Copy to :-

1. **CAO(Con)s, All Indian Railways.**
2. **Director General, National Academy of Indian Railways, Lalbaug, Vadodara, Gujarat - 390004**
3. **The Director, Indian Railway Institute of Civil Engineering, Pune.**
4. **The Director. Indian Railway Institute of Mechanical and Electrical Engineering, Jamalpur.**
5. **The Director, Indian Railway Institute of Signal Engineering and Telecommunications. Secunderabad.**
6. **The Director, Indian Railway Institute of Electrical Engineering, Nasik.**
7. **The Executive Director, Indian Railways Centre for Advanced Maintenance Technology, Gwalior.**
8. **The Director, Indian Railway Institute of Transport Management, Lucknow.**

Annexure-I

DETAILED PROJECT REPORT: VOLUME I	
CHAPTER -1 : EXECUTIVE SUMMARY	
1.1	**Introduction**
1.2	**Project Overview, brief history (if any) and justification** The brief shall be supported with project map, location map and following details: State | District | No of existing lines | No of lines after project completion | Length (Km) | Land area (Ha) involved | Parliamentary Constituency/ Name of MP
1.3	**Salient Features of Project (in prescribed format as per Annexure- II)**
1.4	**Summary of Cost estimate (in prescribed format as per Annexure-III)**
1.5	**Technological improvement/Innovations, use of technology/software etc. if any**
1.6	**Time lines of survey/ study**
1.7	**Methodology of preparation of DPR / Feasibility Report**
1.8	**Traffic survey and Traffic forecast (including existing and projected line capacity utilization, anticipated additional Goods traffic etc.). Anticipated additional Goods traffic (both incoming & outgoing), expected passenger traffic. Names of Seaports, SEZ, Logistic Parks, and Industrial corridors, Airports, Tourists place & pilgrimage center to be connected.**
1.9	**Traffic projection and Earnings**
1.10	**Non Fare revenue**
1.11	**Criteria for alignment finalization for New Lines** (Traffic survey, obligatory points, **BISAG verification**, site constraints, techno economic factors, Protected monuments, wildlife sanctuaries, interaction with various stakeholders etc.)
1.12	**Alignment of proposed New Line / Doubling etc. and key plan** showing surrounding Railway Network also
1.13	**Alignment parameters** (Horizontal Curves, Vertical Curves, Ruling Gradient etc., turnouts etc.)
1.14	**Brief description about alignment and Terrain characteristics** (Length, states/districts covered giving brief reference to stations / tunnels (if any) / major rivers / canals / nallahs / important bridges / major bridges / crossing of National Highway / State Highway / major District Roads / Towns / ROBs / Power Crossings / Climate characteristics etc.) Maps should be included to show following on the project alignment: • Bridges & Tunnels • Rivers and water bodies • ROB/RUBs • Forest, Sanctuary & National Parks • Economic nodes, mines, ports • Tree Cutting • Utility shifting • L section including Land widths
1.14	**Topographical survey and soil investigation**
1.15	**Design standards** (speed potential / formation / track structure / tunnel cross section / bridge loading standard / interlocking standards / electrification / Telecom / building standards etc.)
1.16	**Land requirement** (brief details of Private, Government & Forest Land) and brief methodology for calculation of the same. Summary should be based on Land

	required/Land available/Land to be acquired/cost of acquisition for District wise/State wise and contribution of State Govt., if any. Average width of land considered at railway stations and mid section, total land to be acquired. Chainage wise land width proposed to be acquired to be included as an annexure.
1.17	**Permanent way** (Route length/total track length/No of loop lines/ length of longest loop line/ Turnout details/Ballasted deck/Ballast less track/LWR / Loop speed etc.)
1.18	**Major civil Engineering features** (Brief details of bridges, spans of Major & important bridges, Tunnels, RoBs, ROBs/LHS, Level crossings, RoRs, Per KM cost of Bridges/Tunnels etc.)
1.19	**Railway stations & yards** (list of stations and brief details of facilities being proposed in each station e.g. station building area, no & length of loop lines, Platforms, FoBs, COPs, etc.)
1.20	**Offices and Other service buildings** (Panel building, workshops, sheds etc.)
1.21	**Residential Buildings** (staff quarters, Rest houses, Running rooms etc.)
1.22	**Shifting of Utilities** (LT/HT lines, Telecom, Water pipe lines ,Sewers, cables etc.)
1.23	**Electrical (General)** (brief details being proposed in every station, buildings etc, source of Power supply, etc)
1.24	**Electrical (Traction)** (Type, source, TSS etc)
1.25	**Signaling** (Brief of Signaling system at each station, Type of Block working, Standards of Interlocking, Telecom facilities etc)
1.26	**Telecomm** (Control communication, PA system, coach guidance, display boards etc.)
1.27	**Statutory clearances required** (From NMA, wildlife , FCA etc.)
1.28	**Environment and Social Impact Assessment**
1.29	**Phasing and Construction timelines**
1.30	**Source of Funding, Financial Rate of Return and Economic Rate of Return**
1.31	**Annual Fund requirement**
1.32	**Conclusion & Recommendations**
CHAPTER-2 : Traffic Study	
2.1 Traffic Survey	Traffic Survey attempts to arrive at an assessment of the total traffic likely to be generated in the foreseeable future with special reference to the catchment area and the inter-modal allocation of total streams of traffic between rail and road. The traffic survey or forecast should be conducted considering scenario of with and without project. **DPR should be based on professional study carried out by an integrated team of traffic, engineering and financial experts of all fields**. The survey should identify project influence area and diverted traffic from other modes of transport for both freight and passengers. The traffic survey should consider following guidelines: A. **As is analysis** – The project team should provide the existing traffic handling on following parameters: Provide details of existing traffic handled on the existing route in parallel to project route. In case of new lines / gauge conversion the traffic handled by any alternate route to the project route to be provided.

Details of other railway projects planned / ongoing in that area and relevance of the proposed project route to be provided.

In case, there is any detention saving on account of proposed project, the details of trains which are currently detained should be provided.

B. **Existing Line Capacity Utilization –**

The existing line capacity should be properly evaluated. Based on projection of traffic, the gap in the availability of capacity and likely requirement should be identified and alternative solutions to create requisite capacity should be considered. For instance, capacity may be improved by ABS, additional crossing stations, patch doubling, introduction of CTC etc. Capacity utilization details for all relevant sections (adjacent, adjoining, spokes in all directions) with respect to project to be provided.

Table 2.1

Name of Section in Project area	**No of Coaching Trains.**	**No of Freight Trains.**	**Present Line Capacity (Year)**	**Line Capacity after Project line (Year)**
Project line section 1				
Project line section 2				

Table 2.2

Name of Sections in Contiguous section/other zonal railways	**No of Coaching Trains.**	**No of Freight Trains.**	**Present Line Capacity (Year)**	**Line Capacity after Project line (Year)**
Adjoining section 1				
Adjoining section 2				

It may be examined if adequate line capacity exists in contiguous section or adjoining zonal railways so that additional traffic on the project line can be carried out throughout its lead on the Indian Railway network in a smoother manner. DPR must be shared and discussed with the adjoining zonal railways.

C. In case of multitracking, gauge conversion, traffic facilities such as flyover projects, the Traffic survey should include the line capacity utilization of existing line with and without maintenance block. The capacity utilization should be assessed:

- at present,
- at the time of project implementation with & without project implementation and
- 6th Year and 11th Year.

- Details of Economic nodes/ Industries/ warehouses etc. in the catchment area

of the project should be collected based on detailed survey including upcoming economic nodes. Following details may be collected

Table 2.3

Name of Mine/ Plant/ Industries (Steel, Sugar, Power, Cement, etc.)/ Refinery/ Port/ MMLP	**Production Capacity/Reserve**		**Actual Production**	
	Present Annual Capacity	**Future Annual Capacity**	**Present Annual Production**	**Future Annual Production**

Table 2.4

Name of Mine/ Plant/ Industries (Steel, Sugar etc.)/ Refinery/ Port/ MMLP	**Incoming Commodity/Raw Material (By all modes of transport i.e road, Rail, coastal shipping, air cargo etc.)**		**Outgoing Commodity/Finished Material (By all modes of transport i.e road, Rail, coastal shipping, air cargo etc.)**	
	Commodity	**Volume**	**Commodity**	**Volume**
Industry 1	XYZ			
	ABC			
Industry 2	XYZ			
	ABC			

Assessment of Goods Traffic available for movement by Rail

Table 2.5

SN	Name of Economic Node	Distance from Rail Head (km)	Existing Capacity (MTPA)	Moved by Road (MTPA, %)	Moved by Rail (MTPA, %)	Likely shift to rail

D. **Improvements**:- The proposed project should take into consideration that the existing facility is optimally utilised pre and post implementation of the proposed project. Also, reduction in
- travel time
- Distance
- improvement in average speed of coaching & freight trains

if any for the project route should be specified.

E. **Traffic forecasting** – project feasibility should be assessed only on account of additional traffic. As per Para 307 of codal provisions, the traffic survey team should adopt the following methods, as appropriate to each component of traffic in making assessment of potential traffic prospects, capacity constraint analysis if applicable at both demand and supply side of the addressable market.

- The conventional method of actual census of particulars of goods and passengers using the existing means of communication.
- Statistical methods of forecasting based on regression analysis especially in respect of traffic relating to the major commodities in the area and its correlation with specific economic activities; and
- Building up models based on such observations and data and applying sensitivity tests to ensure that the models adopted give a reliable forecast
- Existing scenario
- Future scenario with and without project implementation
- Final Scenario
- Nos and reserve capacity of mines, projected production capacity of mines in the project span, rail and road share
- Existing and future expansion plans of Power houses, industrial plants, their traffic plan, sources for raw material, consumption location/market
- Requirement of goods sheds, sidings – private/assisted or under GCT policy

__ **Assessment of total Goods in the project area:**

F. **Origin and Destination Surveys -** are required for identification of O-D matrices. These surveys mainly capture the number of trips and freight volumes (by commodity) interchanged across projected route. The assessment of available market should be done considering Chapter 3 of Indian Railway Code for the Engineering Department. The details of existing and additional projected freight traffic needs to be projected as per following format:

Existing Freight traffic

Table 2.6

Commodity	Loading		On IR Network			On Project route			Originating/ terminating/ cross traffic
	MTPA	No. of rakes per	Origin from	Destination to	KM	From	To	KM	

Additional Traffic

Table 2.7

Project Year	Commodity	Loading		On IR Network			On Project route			Originating / terminating / cross traffic
		MTPA	No. of rakes per day	Origin from	Destination to	KM	From	To	KM	

G. Assessment of Passenger Traffic:

For estimating coaching earnings, assessment should first be made of the passenger traffic handled by the existing modes of traffic. This can be done by taking a sample count of the existing passenger traffic moving between different points on the section and on the contiguous existing rail sections. This count can be taken over two spells of 3 days each, as far as possible, one each during the peak and the slack season, should give a break-up of the number of passengers moving by various public transport like buses and taxis as also by private means.

Table 2.8

Total no. of Passengers		**Travelling by Roadways**		**Travelling by Railways**		**Travelling by other modes**	
Present	**Future**	**Present**	**Future**	**Present**	**Future**	**Present**	**Future**

Table 2.9

Type of train (Mail/ Exp/ MEMU/ Sub Urban etc.)	No. of rakes		On Project Route (Travellers)	
	Present	Future	Present	Future

The following statistics to the section should be obtained:

The population of the area (to be served by the new line) in the following details:

- Population of the market towns through which the line passes;
- Population of the area served by the section excluding the population of the market towns;
- The density per square kilometer of the population;
- The composition of the population by age groups;
- The growth rate of the population;
- Details of melas, fairs, festivals etc. regularly held and the number of people travelling to and attending these;
- Characteristics of movement of labor force inside the area as well as to and from outside the area.

Based on this data an assessment of the following should be made:

- The number of local journeys per head of market town population and the average earnings per each such journey;
- The number of local journeys per head of the rest of the population served and the average earnings per each such journeys;
- The number of journeys per head of market town population to and from stations outside the section (inter-changed traffic);
- The number of journeys per head of the rest of the population to and from the stations outside the section (the inter-changed traffic);

H. **Modal shift** – Traffic survey should evaluate the existing modes used by movement of passenger and freight in without project scenario, the estimated modal shift to the project route should be quantified and considered for assessment of project feasibility.

	RR. **Stakeholder Consultation Meeting** – The traffic survey should also consult the stakeholders to understand the prospective demand and modal shift to railway, the Minutes of meeting for such consultation meeting should be recorded and reflected in the traffic demand forecast. The project details should be shared with all zonal railway on which traffic is planned to traverse. DPR should also cover the impact on line capacity of such routes of affected zonal railways and mitigation/augmentation measures needed/planned. SS. **New line projects** – As per para 306 of chapter III of the Codal provision the traffic survey should emanate from the study of the economic base of the area surveyed from the following angles: Human resources; Agricultural resources; Mineral resources; Industries located and projected; The pattern of trade and commerce; Existing transport facilities; Tourism and tourist prospects; Banking facilities; National Income; and Planning for economic development of the area by the local Government or by the Central Government. Further, the assessment of goods traffic for new line projects should be done based on Codal provision stated between para 316 to para 326 of IR Engineering Code (All data sources and methodology to be followed in accordance with extant policy guidelines and codal provisions. Confirmation to same shall be part of traffic checklist).
2.2 **Traffic earning projections**	(i) Details of anticipated goods traffic (both incoming & outgoing) and goods earning The projected additional traffic data should be based on stakeholder consultations, DPRs, if available, of mines/plants/ports, Niti Aayog studies, field survey, demand/supply scenario, market study, Coal/Mines allotment/lease by Ministry of Coal/Mines, Power Purchase agreements of Ministry of Power, efforts needed to increase rail share etc.
	(ii) Details of passenger traffic projection and earnings This should be based on traffic study of existing traffic, population in project catchment area, public demands, capacity of existing/proposed network etc.
	(iii) Savings due to avoidance of detention of trains- The data should be substantiated with field survey, control traffic charts, model study and/or simulation analysis. The summary should be provided as per following format:-

	Route	Line capacity (%) before project completion	Direction (Up/ Dn)	No. of Passenger/ freight trains	Weighted average no. of trains per day	Total detention time (minutes)	Avg. detention time per train (minutes)	Avg. detention time per train after project completion (minutes)	Weighted average no. of trains per day after project completion	Line capacity (%) after project completion	Saving due to reduction in detention in crores
	The saving should be based on para 202 of IR Finance Code										
2.3 Non Fare Revenue	Various existing & anticipated sources of NFR, Details of projected non-fare earnings										
2.4 PM Gatishakti Framework	**A.** The proposed project should be verified on BISAG-N platform and examined on various GS principles:- Integrated Development Multi-modal Infrastructure Last Mile connectivity Expedited Land acquisition Minimized Clearances Reduced Ecological Impact Following aspects of GatiShakti National Master Plan shall be part of survey: **I. Bisag Map: Geographic location** (a) District (specify any special status such as Aspirational, Border, Tribal , Autonomous Counsils, etc.) (b) Loksabha constituency (c) Habitations (population and density) **II. Bisag Map: Existing railway infrastructure** (a) Contiguous railway networks (b) Major railway bridges (c) Stations (d) Goods Shed, Gati Shakti Cargo Terminal (e) Container terminals (PFT, ICD, DRYPORTS) (f) Major coaching terminals **III. Bisag Map : Multi-modality - Other transport infrastructure** (a) Expressway, National highway, State highways, Bridges (b) Airport, Seaport, Helipad, (c) Inland water ways and Terminals (d) NICDC Corridor, NICDC Nodes **IV. Bisag Map : Economics nodes** (a) Mines, Reserves (b) Factories, Plants (Cement, Steel, Power, Refineries, Fertilizers) (c) SEZ, Industrial parks, MMLP										

	(d) Textile parks/ MITRA park (e) Electronic manufacturing cluster, Pharma cluster (f) Warehouse, Cold storage (g) FCI Godowns (h) Agricultural Produce Market Centres (APMC Mandis) **V. Bisag Map : Existing social infrastructure** (a) Education(School, College) (b) Health care (Multi speciality hospitals, Health centres) (c) Anganwadi (d) Skill centres (ITI Centres) (e) Training institutes (f) Research institutes. (g) Stadium, playground, parks, sports training centre (h) Playground. **VI. Bisag Map : Tourist, Forest and other layers** (a) Tourist Locations (b) Cultural Fairs and Festivals (c) Mapping of Natural heritage and Man – made heritage. (d) Wild life park and sanctuaries open for tourist **VII. Bisag Map : Eco sensitive zones/ River bodies** (a) Co-sensitive zones-Protected or restricted areas such as National parks and Wildlife (b) Sanctuaries (c) Rivers, water bodies and wetland (d) Coastal/ Hill zone (e) Green & Forest cover Environmentally Sensitive areas DPRs for all works costing more than 500 crore shall be appraised by Network Planning Group (NPG) which is assisted by Technical Support Unit (TSU). The appraisal shall be examined for fulfillment of aforesaid principles on Area approach methodology and a short video film of 5-8 minutes about the projects needs to be prepared.
2.5 Rolling Stock	The requirement of additional rolling stock for movement of projected additional passengers and freight, but only on the project route, has to be worked out on 1st , 6th and 11th year and its implication on cost. Also, due to reduction in detention time on account of removal of bottlenecks, shorter routes, increase in average speed. Improved rolling stock etc. should be worked out. Based on which net requirement in rolling stock should be worked out. Also, the formation of rolling stock both for passenger & freight trains should be optimized so as to maximized revenue to the project.
2.6 Project Brief	The details on following items should be provided: • Pink Book reference, if included or sanctioned, abstract cost, year of inclusion

<table>
<tr><td></td><td>• Past surveys – PET/RETS/FLS and summary position. The decision taken in past.
• State Govt. references w.r.t. the project demand, any cost sharing etc.
• Benefit/Justification of the project
• In case the project not taken forward then what will be likely fallout.
Alternative options and cost implication.</td></tr>
<tr><td colspan="2">CHAPTER -3: Engineering Survey</td></tr>
<tr><td>3.1</td><td>Methodology of Topographical Survey (Survey of India Maps, DGPS Survey, permanent and temporary benchmarks, Arial Photogrammetry by Drones, LIDAR Survey, Total Stations etc.). List of benchmarks along with their coordinates.</td></tr>
<tr><td>3.2</td><td>(i) Alternative alignments and route selection. Techo-financial analysis of various alignments should be carried out based on which the optimum alignment, so chosen, should be elaborated in DPR.
(ii) Verification / validation of alignment in consultation with BISAG-N. The validation should be carried on various layers such as:-
• Mines
• Economic nodes
• Waterbodies
• Road network
• Railway network
• Forest, sanctuary & National Parks
• Distracts, Taluka, villages land boundary
• Transmission Towers
• Soil
• Population
• Tribal Villages
• Flood Lines
• Multi model Parks</td></tr>
<tr><td>3.3</td><td>Description of alignment. Station location and criteria for choosing them.</td></tr>
<tr><td>3.4</td><td>Geometric design of alignment (Chainage wise list of Horizontal Curves, Vertical Curves, Gradients). List of longitudinal section and plan of the alignment</td></tr>
<tr><td>3.5</td><td>Details of soil investigation and type of strata along the alignment</td></tr>
<tr><td colspan="2">Chapter-4: Land requirement</td></tr>
<tr><td>4.1</td><td>Criteria for requirement of land for track, stations, bridges etc.</td></tr>
<tr><td>4.2</td><td>Break up of land requirement state-wise and district wise for Private land, Government land and Forest land</td></tr>
<tr><td>4.3</td><td>Details of land requirement in the following format:
<table>
<tr><th rowspan="2">SN.</th><th colspan="2">Chainage (M)</th><th rowspan="2">Length (Cum)</th><th rowspan="2">Width of land (M)</th><th rowspan="2">Area of land (Sqm)</th><th rowspan="2">Private/ Govt/ Forest</th><th rowspan="2">Purpose for which land required</th></tr>
<tr><th>From</th><th>To</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
</table>

Chapter-5: Permanent Way

5.1	Details of total track length including loop line etc.
5.2	Design speed for Main line and Loop Line
5.3	Cant excess and deficiency
5.4	Track structure (Rail, Sleepers, Fittings, Ballast cushion etc.) for Main line and Loop Line
5.5	Turnouts, SEJs, Glued joint etc.

Chapter-6: Formation, Tunnels & Bridges

6.1 List of important, major and minor bridges incorporating liner waterway in meter, chainage of bridge, span arrangement, river name, type of bridge etc. in the following format:

SN.	Bridge Nos	Chainage (M))	Waterway (M)	Span arrangement	Type of Bridge	River name

6.2 Details and list of road crossing works such as ROBs, RUBs / LHS and Level Crossings.

ROB/RUBs shall be planned as per latest guidelines and minimize level crossings.

6.3 Details and List of Rail Over Rail Flyovers. Use of RE wall/retaining wall may be explored taking into account cost benefit analysis of RE/retaining wall vis-à-vis earthen banks.

6.4 Tunnel details and type of strata. Typical Cross Section of Tunnel. List of Tunnels in the following format:

SN.	Tunnel No	Length (M)	Chainage (From)	Chainage (To)	Cross section area of Tunnel (Sqm)	Maximum over burden over Tunnel (M)

6.5 Earth work in embankment and cutting.

List of embankment in the following format:

SN.	Length (M)	Height of embankment (M)	Chainage (From)	Chainage (To)	Quantity of earth work (Cum)

List of cutting in the following format:

SN.	Length	Depth of	Chainage	Chainage	Quantity of earth

		(M)	cutting (M)	(From)	(To)	work (Cum)
Chapter-7: Stations & Yards						
7.1	Stations and their Demographic details, MSL, Climate etc.					
7.2	Facilities proposed at each station (station building area, FOB details, platform details, platform shelter details, circulating area. Standard of construction for station buildings					
7.3	No. of loop lines and their length at each station, Turnout details at each station					
7.4	Conceptual Yard Plan of each station					
Chapter-8: Service buildings (including offices, workshops, shed etc.						
8.1	List of all service building station-wise along with plinth area and justification. All service/residential buildings, SSPs etc. should be planned preferably along railway land boundary so as to ensure future expansion of railway network as well as to reduce encroachments on railway land.					
8.2	Standard of construction for the service buildings					
Chapter-9: Residential buildings (staff quarters, running rooms, rest houses, RPF barracks etc.)						
9.1	Details of type wise and station wise residential quarters proposed and the basis of same. Only multi-storied buildings shall be planned. The scope and location of residential buildings shall be based on study involving the existing infrastructure, its usage/occupancy, availability of health/school amenities.					
9.2	Details of station wise running rooms / rest houses / RPF barracks etc. if proposed along with justification					
9.3	Standard of construction					
Chapter-10: Shifting of utilities and provision of ducts for utilities						
10.1	Transmission Line Modification payment to SEBs Voltage Level-wise (LT/11KV/33KV/110KV/220KV/400KV/765KV) including numbers, unit cost and total cost of each voltage level line requiring modification					
10.1	Details of Telecom Lines required to be shifted					
10.2	Details of civil utilities (sewer line / water pipeline / drains etc.) required to be shifted.					
10.3	In Urban area, integrated planning should be explored so that common utility duct					

	can be provided both for railway and other infrastructure deptts.

Chapter-11: Electrical Traction & General

11.1 Electrical Traction

a.	Standard Checklist and project appraisal Performa for Electrical Items
b.	Type of OHE system & design speed
c.	Pegging plan
d.	Traction power supply system (TSS,SP,SSP location & spacings)
e.	Modifications in existing OHE system
f.	Requirement of communication channel for SCADA
g.	Details of feasibility of EHV power supply at nearest GSS for feeding to proposed TSS. Alignment & expected ROW.
h.	Provision of fire suppression system in transformer

11.2Electric General

a)	Details of 11kv & 33 kv power supply points
b)	Details of electrification of Tunnels/service building etc.
c)	Ventilation of tunnels details

Chapter-12: Signal & Telecommunication

12.1	Details of Signaling Arrangement (type of signaling, block working, standard of interlocking etc)
12.2	Details of survey regarding type of soil for cable laying, cable route, track crossing, approach/location of S&T installations, infringements, RSSI etc
12.3	Requirements of S&T service building along with electrical requirements including power budget etc.
12.4	Utility/ cable shifting for S&T works.
12.5	Alterations in existing Signaling systems.
12.6	Specifications and testing procedure of S&T equipments.
12.7	Provision of EI, ABS, ATP, CTC, LTE etc as per extant guidelines
12.8	Details of Telecommunication arrangement for operations and passenger amenities.
12.9	Standard Checklist and project appraisal Performa for Signaling & Telecom items
12.10	Mandatory clearances required (ISA, WPC, RDSO approvals etc)
12.11	Testing and training required before commissioning.

CHAPTER-13: Environmental Assessment and Social Impact Assessment (as per requirement)

13.1	Introduction
13.2	Existing Scenario, water bodies, noise level, land environment, biological environment, socio economic survey, archaeological sites etc
13.3	Environmental Policy Framework

13.4	Detailed Environmental Impact assessment due to project location, design and construction including the impact of operation and maintenance facilities.
13.6	Environment Management Plan Mitigation measures needed if any.
13.7	Environmental Monitoring Plan including for Pre-Construction, construction phase, Operations Phase, Implementation of environmental Management Plan and setting up an Environment management System.
13.8	Social Impact Assessment including resettlement/rehabilitation alternatives, public consultation, resettlement assistance plan, cost monitoring and evaluation. Further, the project benefits expected to occur in terms of upliftment of local population, state economy etc.
13.9	Analysis of Alternatives
13.10	Summary of Costs
Chapter-14: Statutory clearances	
	Details of clearances required such as ASI/NMA, Wildlife, Forests, CRZ etc.
Chapter-15: Cost Estimates	
15.1	Basis of rates for working out, cost of land, civil engineering structures, P-way, Electrical, S&T, Utility shifting etc.
15.2	Summary of the cost estimates (detailed estimate to be attached as Vol-II of DPR) The estimate shall be based on latest USSOR and DSR. The basis of reference rates should be provided.
CHAPTER 16 : FINANCIAL ANALYSIS	
16.1	Estimation and Phasing of Investment for both project and rolling stock and Credit from Rail Released Material (CRRM) if any
16.2	Estimation of Working Expense The working expense related to goods and coaching are mainly related to repair & maintenance, terminal handling, traction and marshalling etc.. The working expense should also consider general overhead and central charges. These costs should be calculated based on the benchmark rates published by the statistic department of Railway Board as part of latest available Annual statistical statement (ASS) and the methodology as prescribed by Railway Board time to time in the form of FIRR/EIRR model.
16.3	Earning potential of the Project: Fare Revenue, Detention Saving as well as non-fare revenue **Fare Revenue** – The primary source of Indian railway revenue comes from fare. This revenue is determined over goods as well coach. In case of Goods revenue, the commodity wise traffic should be identified with origin and destination (OD) analysis. Thereafter the applicable tariff should be applied over tonnage KM based on commodity and distance travelled. Similarly, in case of Coaching Revenue, the additional passenger traffic should be analysed based on existing population, expected demand, OD analysis etc. The traffic so arrived should be used to arrive coaching revenue based on the prescribed rate. **Detention saving** – The detention of rolling stock is one of the key factors which impacts utilization of existing infrastructure as well as rolling stock. The detention may occur on various counts such as bottleneck over existing lines, requirement of engine reversal, level crossing, disproportion of demand and supply. Accordingly, detention saving plays key role to increase productivity of existing infrastructure. This has resulted into a need of various doubling, multitracking, flyover, bypass

	line like projects. In terms of note 2 of para 202 the detention saving should be calculated on following basis: *the financial justification should be worked out on the basis of increased locomotive or wagon, etc., utilization and consequent postponement of the purchase of new engines or wagons, etc., if such saving can be definitely secured, and not on the basis of the earning capacity of the stock saved.* The detention saving should be calculated considering the saving of detention time over number of trains as on the date of commissioning of the project. The saving should be calculated in terms of number of trains detained and detention time. The detention saving should be calculated as per the methodology as prescribed by Railway Board time to time in the form of FIRR/EIRR model. **Non-Fare revenue**- The Non-Fare Revenue can contribute fairly to the viability of the project. Accordingly, the Non Fare Revenue should be projected in terms of advertisement, F&B, Retails, Rental, Platform tickets, Car Park etc.. The methodology as prescribed by Railway Board time to time in the form of FIRR/EIRR model should be followed in this regard.
16.4	Terminal Value Estimation Terminal value should be estimated based on useful life only. In this regard the guidelines issued by Railway Board time to time in terms of FIRR/EIRR methodology should be followed.
16.5	**Calculation of Project IRR (as per the latest FIRR/EIRR model issued by the Railway Board) Details should be summarized as per Annexure-IV Excel sheet issued vide Rly Board letter no. 2023/GatiShakti/TF/02 dt. 14.09.2023**
16.6	Sensitivity Analysis with respect to Expected Traffic (range of +/- 20%), Cost Escalation (+/- 20%) and Time Overrun (+/-20%). In order to assess the project viability in different scenario it is important that the project financial parameters are assessed on various key drivers like traffic, capital cost etc. The sensitivity should be calculated as per the guidelines issued by the Railway Board in terms of FIRR/EIRR computation methodology.
16.7	Assumptions with respect to both cash inflows and outflows The assumptions with respect to financial assessment should be reflected and synced with DPR. The assumption should be detailed in the respective chapters as required.
16.8	Analysis and Results The outcome of the financial assessment in terms of FIRR and EIRR should be summarized along with recommendation for the project.
16.9	Verbatim comments of FA&CAO/CN regarding the project may be mentioned in the covering letter sent with DPR. However, covering letter is not to be binded with DPR
16.10	Copy of the FIRR vetted by Zonal Finance may be attached to the DPR
CHAPTER 17: ECONOMIC ANALYSIS	
17.1	Basic Approach of Economic Analysis should be done in accordance with the FIRR/EIRR determination methodology as prescribed by Railway Board time to time.
17.2	Demand Assessment Methodology (it should be similar to what is adopted in case of FIRR determination)
17.3	Quantification of Economic Costs and Economic Benefits.

17.4	Checklist for Economic Cash flows. (refer Annexure III of Railway Project Economic Appraisal Framework Note for checklist, circulated vide letter no.2022/ Gati Shakti/EU/49 dated19/08/2022.)
17.5	Cash flows of Economic Internal Rate of Return (EIRR)
17.6	Sensitivity Analysis for critical factors in the range of 5% to 20% on EIRR: a. Project Cost sensitivity due to delay or other factors b. Passenger traffic sensitivity
17.7	Details of Network effect alongwith map.
17.8	Model Input data used along with sources. (refer Annexure II of Railway Project Economic Appraisal Framework Note for list of data sources, circulated vide letter No.2023/ Gati Shakti/TF/02 dated 14.09.2023.)
CHAPTER 18 : RISK ANALYSIS	
18.1	Cost Risk Project Cost plays vital role in the viability of any project. Cost risk analysis should consider analyze key cost component such as labor, materials, equipment, administration, etc and focuses on the uncertainties and risks that may affect these costs.
18.2	Schedule Risk Project completion time has significant impact on project cost, In an infrastructure project the time delay has been identified as one of the major risk. It may also result into loosing competitive advantage the project can have on timely completion. Accordingly, this risk should be evaluated carefully, and any expected bottleneck should be identified, and mitigation plan should be prepared to address this risk. Land acquisition risk should be carefully analyzed in this segment. A CPM schedule and an estimate for the uncertainty in the activity durations of this project is to be worked out prior to execution to avoid this risk.
18.3	Operational Risk Operational risk generally identified in terms of expected challenge in terms of procurement of project resources, project implementation or logistics. Any expected risk in project implementation should be identified upfront and a mitigation plan should be in place to minimize impact.
18.4	Market Risk One of the key market risks in terms of railway project can be competition, demand and supply constraints, economic condition. The risk in terms of competition and demand and supply risk are controllable risk and should be factored in traffic assessment. The traffic assessment should consider the demand and supply constraints if any. For example in case a project is planned for a particular mining region than the traffic assessment should evaluate the capacity of such mines and alternate mode if any to evacuate that material, existing mode used, competition etc. These supply constraints can play key role in project planning.
18.5	Risk Mitigation Measures Risk Mitigation Measures is a strategy to lesson the impact of the identified risk. The project team should have mitigation plan for the risk identified above. Risk mitigation plan should include strategy in terms of risk allocation, risk monitoring, stakeholder consultation process and strong communication management.

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Detailed Project Report :Vol-II (Detailed Estimate of the Project)		
		Annexure- II
Salient Features of Project		
Name of Project (NL/DL/GC):		
SN	**Item**	**Details**
1	**Route length (Km)**	
(i)	State-wise and District wise breakup of route length	
2	**Current Estimated cost (In crores of Rs.)**	
2(i)	**Estimated Completion cost (In crores of Rs.) (taking into account 5% escalation every year)**	
3	**Completion period (years)**	
4	**RoR : (i) FIRR**	
	(ii) EIRR (As per guidelines issued by Board and including network effect)	
5	**Land requirement (Ha) (Statewise and Districtwise)**	
(i)	Private	
(ii)	Government	
(iii)	Forest	
6	**Total Track Km (incl loops/siding etc.) (Km)**	
7	**Maximum permissible speed (Kmph)**	
8	**Maximum Degree of Curvature**	
8(i)	Curve Track **(% of alignment)**	
8(ii)	Length of route in curves	
9	**Ruling Gradient**	
9(i)	**% length on Ruling Gradient**	
10	**No. of PSRs**	
10.1	**Min./Max. of PSR (in KMPH)**	
11	**Earthwork in embankment (Cum)**	
11(i)	Maximum Bank Height (m)	
12	**Earthwork in Cutting (Cum)**	
(i)	**Maximum Cutting Depth (m)**	
13	**Total no. Tunnels (nos.)**	
(i)	**Total Tunneling length (Km)**	
(ii)	**Tunnel route (% of alignment)**	
(iii)	**Longest Tunnel (m)**	

(iv)	Escape tunnel length	
(v)	Type of OHE in tunnel (ROCS/Normal)	
14	Total Adits/Shafts and their length	
15	Total Linear waterway (m)	
(i)	Important bridges (nos.)	
(ii)	Major bridges (nos.)	
(iii)	Minor bridges (nos.)	
(iv)	Bridges length (% of alignment)	
16	Loading standards	
17	Total stations (including Originating and Destination stations, junction stns, crossing staions, halts) (nos.) (statewise)	
(i)	Junction stations (nos.) (including Originating and Destination stations if they are junctions) (nos.) (statewise)	
(ii)	Crossing stations (nos.)(including junction stations, Originating and Destination stations if they are crossing stations)	
(iii)	Halts (nos.)	
18	Total loop lines (nos.)	
(i)	loop line length (CSR) (m)	
19	RoBs (nos.)	
(i)	RuBs/LHs (nos.)	
(ii)	Level crossings (nos.)	
20	Rail over Rail flyover (RoRs)	
21	Track structure (Both for Main lines and Loop lines separately)	
	Main Line	
	Loop Lines	
22	Track centre (m)	
	Reason for adopting other than 5.3 track center	
23	Signalling system (MACLS std. II/III etc.)	
	Basis for it's adoption	
24	Traction system	
25	Projected Passenger traffic (Lakh passengers/annum)	
25 (i)	Projected Coaching trains in case of NL (pairs of trains per day)	
26	Projected Freight traffic/Additional freight traffic (MTPA)	
26 (i)	Projected goods train/additional goods train per day	
27	Existing line capacity utilisation incase of Doubling etc. without maintenance Block and with maintenance Block at current year level	
28	Projected gross earning and net earning per annum (In Crs of rs)	
29	Clearances	

Item	Required	Available	Balance	Remarks
Land (Ha)				
Forest (Ha)				
Environment (Ha)				

	Wildlife (Ha)					
30	**Loading Standard**					
31	**Length of longest freight train on prohect section**					
32	**Maximum length of loop line**					
33	**Total length of loop lines**					
34	**Loop length (% of alignment)**					
35	**No of goods terminals/sheds**					
36	**Longest length of passenger trains**					
37	**Longest length of platform**					
38	**Maximum width of Platform**					

CPM/GS or CAO or CE/Construction

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Annexure-III

Summary of Main items of DPR/ Detailed Estimate for New Projects

Name of Project (NL/DL/GC):

SN	Item	Unit	Quantity	Unit cost (Rs in Crores/ lakhs)	Amount (Rs in crores)	Remarks
1	**Route length**	Km		Total estimated cost/ Route length		
(i)	Total Track Km (incl loops/siding etc)	Km		Total estimated cost/ Total track length		
	Civil Engg Items					
2	**Preliminary expenses**		---			
3	**Total Land requirement**	Ha				
(i)	Pvt land	Ha				
(ii)	Govt land	Ha				
(iii)	Forest land	Ha				
4	**Earthwork in Embankment**	Cum				
(i)	Upto 5 m high = KM	cum				
(ii)	5-10 m high= KM	cum				
(iii)	More than 10 m high = KM	cum				
(iv)	Maximum Bank height	m		-----	------	
4(a)	**Blanketing quantity**	**Cum**				
5	**Earthwork in cutting**	Cum				
(i)	Upto 5 m high = KM	cum				
(ii)	5-10 m high= KM	cum				
(iii)	More than 10 m high = KM	cum				
(iv)	Upto 5 m high = KM	cum				
6	**Main Tunnels(cross sectional area of tunnel= sqm)**	**nos**		----------		
(i)	Total Main Tunnel length	Km				
(ii)	Maximum length of Tunnel	Km				
(iii)	Tunnels more than 2 Km long	Nos				
7	**Adit/ shafts/cross passages length and cross sectional area of Adit/cross passage etc)**	Km				
8	**Walling length(____ avg. height in m)**	Km				
9	**Drain length(avg cross section= sqm)**	Km				

SN	Item	Unit	Quantity	Unit cost (Rs in Crores/ lakhs)	Amount (Rs in crores)	Remarks
10	**Rails and fastenings**	---	------	--------	-------	----------
10.1	**Main Line**	Km				
10.2	**Loop/sidings (SH)**	KM				
11	**Sleepers and fastenings**	Km				
12	**Ballast**	cum				
13	**Points and crossings**	Nos				
(i)	1 in 16	nos				
(ii)	1 in 12	Nos				
(iii)	1in 8.5	Nos				
(iii)	Others (DS etc.)	Nos				
14	**Ballastless Track (wherever required)**	**Km**				
15	**Fencing (stations/LC etc.)**	**m**				
16	**RoBs**	**Nos**				
17	**RUB/LHS (new/extension)**	**Nos**				
18	**Level crossings (new/extension)**	**Nos**				
19	**Rail over rail flyovers (RoRs)**	**Nos**				
20	**Linear waterway**	**m**				
(i)	Important bridge (Total span ____m)	Nos				
(ii)	Major bridge(Total span ____m)	Nos				
(iii)	Minor bridge(Total span ____m)	Nos				
(iv)	Bridge cost per KM of waterway		---------			
21	**Total no. of stations (incl originating and destination station)**	**Nos**		----------	----------	
(i)	No. of junction stations	Nos		----------	----------	
(ii)	No. of Crossing stations (excluding junction station)	Nos		----------	----------	
(iii)	No. of Halts	Nos		----------	----------	
22	**Total no. of loop lines/sidings**	**Nos**				
(i)	Total length of loop lines/sidings	Km		----------	----------	
23	**Station buildings**	**Sqm**				
24	Office buildings	Sqm				
25	Workshops and sheds	Sqm				
26	Other service buildings	Sqm				

SN	Item	Unit	Quantity	Unit cost (Rs in Crores/ lakhs)	Amount (Rs in crores)	Remarks
27	**Total H/L Platform length**	**m**				
(i)	H/L Platform area	Sqm				
28	**Cover over Platforms**	**Sqm**				
29	**Residential quarters**	**Nos**				
(i)	Type II= nos	Sqm				
(ii)	Type III= nos	Sqm				
(iii)	Type IV= nos	Sqm				
(iv)	Type V= nos	Sqm				
30	**FoBs**	**Nos**				
(i)	**FoBs length**	**m**				
31	**officers/Subordinate rest house**	**Sqm**				
32	**Plants & Equipment**					
33	**Misc. Items**					
34	**Departmental charges**					
35	**Total – Civil Engg**					
	Electrical					
36	**OHE**	**Km**				
37	**TSS**	**Nos**				
38	**SSP**	**Nos**				
39	**General Services**					
40	**Shifting/Modification of electrical crossings**	**nos**				
(i)	400 kv	**nos**				
(ii)	200 kv	**nos**				
(iii)	132 kv	**nos**				
(iv)	33 kv	**nos**				
(v)	11 kv	**nos**				
41	**D&G charges**					
42	Total - Electrical					
	Signalling & Telecom					
43	**Signalling System**					
(i)	No. of stations upto 100 routes	**nos**				
(ii)	100 to 200 routes	**nos**				
(iii)	200 to 500 routes	**nos**				
(iv)	More than 500 routes	**nos**				
(v)	Interlocked LC gates	**nos**				
44	**Telecom**					
45	**D&G charges**					
46	Total – S&T					

SN	Item	Unit	Quantity	Unit cost (Rs in Crores/ lakhs)	Amount (Rs in crores)	Remarks
	Mechanical					
47	**Mechanical cost**					
(i)	Maintenance facilities					
(ii)	Watering facilities					
(iii)	Disaster management facility					
(iv)	Wayside detection equipments					
48	**D&G charges**					
49	**Total – Mechanical**					
50	**Grand Total**					
51	**Grand Total – excluding D&G charges**					
52	**Environmental charges**					
53	**Sports charges**					
54	**Total Estimated Project cost**					
55	Project Completion Cost					

CPM/GS or CAO or CE/Construction

Annexure-III

Checklist for Detailed Financial Cash Flow in DPR for Estimating FIRR

SN	Name of Project (NL/DL/GC): Item	Railway : Description
1	Total capital cost (states's share to be excluded, if any)	
2	Total land to be acquired and cost	
3	Total capital cost of the project, with department wise (Civil, mechanical, electrical and S&T) phasing of costs for each year of construction	
4	Cost of rolling stock in year zero, and additional rolling stock cost in subsequent years, if applicable	

5	Renewal & replacement cost	
6	Gross coaching working expenses for 1st/6th/11th year of the project (Cr.)	
7	Gross coaching earnings for 1st/6th/11th year of the project (Cr.)	
8	Gross goods earning for 1st/6th//11th year of the project (Cr.)	
9	Gross goods working expenses for 1st/6th/11th year of the project (Cr.)	
10	(i) Have savings due to avoidance of detention to rolling stock (both, one time capital and recurring operational), wherever applicable, been duly accepted/vetted by the associated finance. (ii) Passenger and goods savings to be stated separately. In case of doubling, tripling, etc. project only goods savings to be taken into account.	
11	CRRM if accounted for gauge conversion/doubling etc., project to be indicated.	
12	Cash Flow Statement	

Years	Civil Engg.	Electrical	S&T	Mechanical	Total
2024-25					
2025-26					
...					
Total					

- **Cash flow** should match with cost/ timelines of land acquisition and project execution.

Deptt. wise cash flow should match with planning.

13	FIRR of the project (use excel formula).	
14	ERoR of the project	
	Encl. : FIRR/ERoR calculation sheet	
	Note: Excel Sheet to be shared by Zonal railway.	

Dy CPM/GS/Traffic or CTPM/PCOM, Zonal Railway

CHECKLIST

1. Cash Out Flows:

A. Construction Cost

1. Whether cost of land acquisition has been incorporated?
2. Whether state's share of project cost has been incorporated? In case, the land is provided free of cost fully or partially, such reduction in land cost has to be accounted. In case, the State or other users are sharing part of the project cost, no reduction in project cost should be made but cost sharing should be reflected as revenue/refund yearwise as per the projection given by State/user deptt.
3. Whether construction cost of each department has been incorporated?
4. Whether the cost of construction has been projected year-wise as per the schedule of Construction?
5. Whether CRRM is incorporated as per Para 233 of IRFC Vol 1?

B. Working Expenses:

6. Whether maintenance cost of each department has been incorporated as per extant maintenance schedules?
7. Whether the repair cost of each department has been considered?
8. Whether the cost of replacement of assets as per the latest available policy instructions has been factored in?
9. Whether it is verified that depreciation and interest has not been considered as per Para 215 of IRFC Vol 1?
10. Whether operational expense is considered based on the latest traffic costing/Statistical data?

2. Cash Inflows:

A. Traffic earnings:

11. Whether both outward and inward traffic data is considered?
12. Whether savings in engine days or wagon days or both is worked out as per Para 202 of IRFC Vol 1?
13. Whether reduction in revenue of other lines/ railways due to diversion has been considered?
14. Whether any non-fare revenue is considered?
15. Whether the latest available Statistical data has been used?

B. Residual value:

16. Whether Residual value of assets at the end of project period is considered as per Para 233 of IRFC Vol 1?
17. Whether Land has been factored in as per Book Value?
18. Whether Second hand value of assets has been calculated as per Para 241, IRFC Vol 1?

3. General:

19. Whether project involves any reserve forest/eco sensitive measure?
20. If yes, whether mitigation measures and its cost included in DPR?
21. Whether DPR is based on integrated teal of sector experts?
22. Whether estimate is based on latest USSOR/DSR?
23. Whether any station is part of any other DPR? If yes, what action has been planned to avoid any infructuous/repeated expenditure?
24. Whether deviation statement has been provided?

4. Generic guidelines for prepraration/updation of DPR : Generic guidelines as enclosed as Annexure-VIII may be used as guiding principles for preparation/updation of DPR.

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Annexure-IV

Annexure-I

SALIENT FEATURES OF ELECTRICAL ESTIMATE

Electrical TRD:

1. Name of Section:
2. RKM:
3. TKM:

SN	Name of item	Unit	Qty	Unit Rate	Cost
1	OHE	TKM			
2	TSS	Nos.			
3	PQCE/Shunt Capacitor	Nos.			
4	SP	Nos.			
5	SSP	Nos.			
6 (a)	SCADA RCC cost	Nos.			
6 (b)	SCADA RTU cost	Nos.			
7	Bay charges to SEBs				
8	Transmission line (SEB)	km			
9	Cables (Size)	km			
10	Construction of siding if any	km			
11	M&P	Nos.			
12	OHE depot	Nos.			
13	PSI depot	Nos.			
14	Contingencies	@1%			
15	D&G charges as per Bd's letter no. 2017/E&R/3(2)/2 dt 20.02.2019	@9.964%			

Electrical General:

SN	Name of item	Unit	Qty	Unit Rate	Cost
1	Modification in power line crossings payment to SEBs (LT/11KV/33KV/110KV/220KV/400KV/765KV)	Nos.			
2	Tunnels:,				
	a Cost of lighting (Wattage-wise and Nos. of lighting fixtures of each wattage)	No.			
	b Ventilation (Spec. of Fans & No.of each specification)	No.			
	c. Power supply (No. of transformers, panels, ckt breakers, isolators, size of cables & their qty)	No.			
	d. Fire fighting system (Major items)	No.			
	e. SCADA	No.			
3	Electrification of staff qtrs (Type wise)	No.			
4	Electrification of service buildings (Stn bldg, platform, offices etc separately)	No.			
11	Gysers (no. of each rating)	Nos.			
12	Air conditioners with spec. (window, split)	Nos.			
13	Air conditioner centralised with spec.	Tonnage			
14	DG set with spec.	Nos.			
15	Lifts/escalators	Nos.			
16	Contingencies				
17	D&G charges as per Bd's letter no. 2017/E&R/3(2)/2 dt 20.02.2019	@9.964%			

Annexure-II

Rly	Project	Date of DPR	RKM	TKM	TRD Cost (In Cr.)								Elec. (G) Cost (In Cr.)		Total Cost (In Cr.)	Cost/ TKM (TRD)
					OHE		Tr.Line			Cable			Utility shifting (PLCs)	Other Electric general works		
					PSI	Length of T.Line	Costing	Bay Charge	Length of Cable	Costing						

Annexure-V

Appraisal checklist

S. No	Item	Certified By Railway
1.	Technical checklist of Signaling & Telecom as applicable is duly filled and attached with proposal.	
2.	Estimate is based on Latest SOR (Mention year also) or Latest LARs & Allocation wise break up is shown.	
3.	Certification of quantities is based on field requirement of the work as per plan and drawings. CRRM, if any, is considered.	
4.	All the provisions in the estimate are as per Board's circulars issued from time to time.	
5.	Commissioning date of Stations / Gears proposed for replacement is duly mentioned.	
6.	Proper justification for proposal has been brought out in case, codal life is not over.	
7.	DPR is enclosed for projects costing more than 50 Crores in the format prescribed by Boards L No. 2021/SIG/Estimates/DPR (efile-3363771) dated 24.02.23. For composite works S&T chapter in DPR is in standard format as per Boards L No 2022/W-I/Genl/DPR Performa dated 02.09.22.	
8.	There is no duplicity in the scope of proposed work with any other sanctioned or proposed work.	
9.	There is no willful splitting of work in the proposal.	
10.	Cost of proposal is not breaching the limit of Sub-umbrella or Umbrella for the zone as applicable for the proposal.	
11.	RoR (Exceptions mentioned under Para 202 of IRFC Vol I) of the proposal covered under Capital head duly approved by finance is enclosed. Excel Sheet of Cash flow shall also be enclosed.	
12.	Duly vetted PDF copy of Estimate is enclosed along with the proposal.	
13.	System Map (In Colour) showing proposed works of ABS, CTC, KAVACH & Double Distant along with already sanctioned/functional work in the vicinity is enclosed.	
14.	Name of the stations is mentioned in full form with code in bracket.	
15.	For the works pertaining to Level crossing gates, Joint certificate of Engg. & S&T that LC gates covered under the proposal are not planned for closure in near future.	
16.	For ABS & other throughput enhancement works present line capacity & Line capacity after project completion is clearly mentioned.	
17.	Target date of completion (TDC) of proposed work is clearly mentioned.	

18.	Unit cost estimation and key elements have been taken in accordance with Board Letter 2023/GS/SIG./Typical Abstract Estimate dated 01.05.2023 & reason for variation if any.	
19.	The proposed work is in consonance with cannons of financial propriety.	

To be Signed By Concerned CSTE/C or CSTE/Project.

Technical Checklist for Signaling Sub-estimates submitted with DPRs & Proposals submitted on IRPSM for sanction of Board.

SN	Items	Policy/Guidelines	Yes/No
1	Provision of PI/EI/RRI	As per Railway Board's policy, provision of EI should be made in all estimates. Railway Board's letter No. 2003//Sig/G/5 dated 28.04.2016. Centralized/Distributed EI up to 100 routes based on physical layout of yard, complexity involved, maintainability aspect etc. (letter No. 2021/Sig/25-Conf/5/SSC dated 26.02.21 of Special SSC)	
2	Point Machine	Non-Trailable Electric Point Machines 143-mm throw with internal locking and non-trailable electric point machines 220 mm. (IRS - S 24-2002 or latest spec)	
3	LED Signal	Procurement of Main Signals and subsidiary signals should be as per RDSO specification i.e. RDSO/SPN/199/2010 Rev 1.0 and of RDSO/SPN/153/2011 ver. 4.1 respectively or as per latest Spec.	
4	Cable	Provision of cable as per extant policy	
		a. 6 core X 1.5 sq. mm. Copper conductor cable.	
		b. 12 core X 1.5 sq. mm. Copper conductor cable.	
		c. 24 core X 1.5 sq. mm. Copper conductor cable.	
		d. 2 core X 2.5 sq. mm. Copper conductor cable.	
		e. 2 core X 25 sq. mm. Aluminum conductor power cable.	
		f. 2 core X 70 sq mm power cable.	

		g. 6 Quad cable. h. OFC.	
5	Power Supply (IPS)	There should be provision of IPS or approved power supply arrangement.	
6	BPAC	Dual detection should be there. JPO issued by Board (ML & MT) vide letter No. 2015/Sig/PLN/Pt. dated 02.11.2005.	
7	DAC	Redundancy to be provided as per extant guideline.	
8	Provision of Automatic signaling.	To be provided as per policy issued vide L No ABS No 2021/Sig/WP/Action Plan dated 14.06.2022.	
10	Double line Block instrument	Double line Block instrument complete with block bell equipment, HMT set with induction coil & condenser, 3-position polarised relay, filter unit etc for working in RE area as per RDSO specification.	
11	Datalogger	To be provided as per latest RDSO spec.	
12	Double Distant	To be provided as per Boards L No 2017/Mobility/2/3 dated 12.06.18 .	
13	Fire alarm and smoke detector system	To protect from fire the panel interlocking equipment, indication cum operating panel, S&T equipments in Panel room, Relay room, power supply room, battery room, diagnostic panel room and OFC room shall be provided with Fire alarm and smoke detection system as per extant policy.	
14	Automatic Fire Detection & Suppression system	As per Rly Board's policy letter no. 2013/Sig/Specifications dated 22.06.2015, firefighting equipment shall be kept in the power supply equipment room. Automatic fire suppression system along with Automatic fire detection & alarm system may be provided at stations with more than 400 routes or as per requirement in accordance with extant guidelines.	
15	Interlocking of LC Gates	To be done as per guidelines. Provision of Emergency Sliding Boom should be made in the estimate.	
16	Standard of Interlocking	Standard of Interlocking shall be as per extant guidelines.	
17	Cost of Alteration	In sections where KAVACH/ABS/CTC is functional/sanctioned the cost of alteration in KAVACH/ABS/CTC has been included in estimate.	

18	Cable laying & Trunking	Laying of cable should be inside prefabricated/pre cast cable ducts as per Boards L No. 2022/GS/IR/Cable laying Policy dated 29.03.23.	
19	Dept. Charges	To be taken as per Rly Board's latest policy dated 28.12.2022 with Contingency @ 1%, Dept Charges @10.05% for S&T projects & any other charges as per latest guidelines.	

Existing Telecommunication checklist will be continued for telecommunication portion of estimate.

To be Signed By Concerned CSTE/C or CSTE/Project.

Checklist for Telecom Sub-estimates submitted with DPRs

SN	Items	Policy/Guidelines	Yes/No
1	IP-MPLS, IP-Exchange and Data Network for PRS, UTS, FOIS and SCADA	To be followed Railway Board's policy vide letter no. 2011/Tele/9(2)/1 dated 25.02.2020 as Telecom Circular no.4/2020 and Technical Advisory Note issued by RDSO vide letter No RDSO-TELE0LKO(TECH)/8/2020-Telecom Directorate/ RDSO dtd 16.12.2020	-
1a	Provision of IP-MPLS System at stations	All future works/replacement of SDH/PDH works, including works where tender is yet to be floated shall be with IP-MPLS standards.	
1b	Provision of IP Exchange	All future exchange works/replacement shall be done with IP exchanges. All exchanges can be integrated into one at the Divisional level, where feasible, with provision of suitable bandwidth and ring connectivity/protection. In addition to that, for IP-Exchange, telecom Circular 04/2022 should be followed.	
1c	Provision of Data network	The telecom backbone of all future works/ replacement of Data networks such as PRS/UTS/ FOIS/SCADA shall be with IP-MPLS equipment by providing separate VPN network, if required	
2	Provision of VOIP based TCCS at station	As Para 5.4 of Telecom manual, VoIP Based TCCS among the various control communication systems to be used in Indian Railways as per RDSO specification.	
3	LC gate communication	Phone communication to all manned level crossing gates controlled from the station preferably with voice logging facility.	
4	25 W VHF set and 5W VHF sets	25W VHF sets with proper standby power supply at each station and 5 W warlike-Talkie set as per requirement.	
5	Provision of LTE in section where Kavach is provided	Vide Board Letter No 2020/Tele Dev/Umbrella works dtd 21.10.2021, Provision of LTE in section where Kavach is provided/being provided.	

6	Cable	Usage of cable as per Telecom manual 6 Quad cable (Quad Cable 0.9 or 1.4 mm conductor dia. as per IRS specification No. IRS:TC 30/05. 1.4 mm conductor dia cable is used for longer block sections longer than 12 kms.) Multi pair (from 10 pairs to 200) Multi Dia (0.5mm/0.63mm/0.9mm) PIJF (Polythene insulated Jelly Filled) Cable as per IRS specification No.IRS:TC 41/97 used for exchange subscriber lines or branch cables branching off from the main Quad cable Twisted Pair Switch Board Cable of sizes 0.5 mm /0.6mm copper conductor dia. as per IRS/TEC specification used for indoor applications such as distribution to various telephone subscribers in a building, MDF to exchange wiring etc OFC (24/48 Fibres Optical Fibre Cable as per latest RDSO specification) to be laid in HDPE pipe.	
7	Power Supply (IPS)	All Telecom Equipments shall be provided with a reliable Power Supply	
8	IP based Video Surveillance System	**CCTV system at stations** - As per RDSO spec (Spec no RDSO/SPN/TC/65 /2021 Rev 6.0 issued by Tele Dte/RDSO or latest). **CCTV at non critical locations**- To be procured either RDSO spec or Rly's own specifications with approval of GM as per RB letter No 2017/Tele/3(8)/1 dtd 28.11.2017. **CCTV system in Divisional & Zonal Hospitals-** Type of system and its specifications to be decided by Zonal Rlys as per RB Letter No 2018/Trans Cell/Health/MR Review dtd 14.09.2018. **CCTV at Railway offices**- Type of system and its specifications to be decided by Zonal Rlys as per RB letter No 2018/Tele/6(4)/1 dtd 16.01.2020 **CCTV system in relay rooms**- an extension of the existing/proposed CCTV system at stations as RB Letter No 2017/Tele/3(8)/1 Pt-1 dtd 20.04.2020 **CCTV at RPF Thana/Posts**- an extension of the existing/proposed CCTV system at stations as RB Letter No 2020/Sec(CCB)/210/CCTV dtd 23.11.2021.	

9	Passenger Information System at station	Followed Comprehensive instructions for provision of Passenger Amenities and user facilities at Stations issued vide Lt.No.2018/LM(PA)/03/06 Dtd. 09.04.2018	
10	Fire Alarm system at Telecom Installations	As per Rly Board's policy letter no 2019/Tele Dev/ Fire Alarm dtd 27.07.2019, Automatic Fire Detection & Alarm System is to be provided as per RDSO specification No. RDSO/SPN/217/2018 ver 2.0 or latest at Telecom installations like major Exchanges, Test Room/Telecom Control Room, Data Centre locations, CCTV Control & Equipment Rooms, Main Switching Centre (MSC) & Base Station Controller (BSC) of MTRC, main QFC centres /Quad repeater stations, Satellite Hubs, etc	
11	Tunnel communication	In Section where Tunnel exist, Tunnel communication is to be provided as per RDSO spec (Spec no RDSO/SPN/TC/109 /2019 Rev 0.0 issued by Tele Dte/RDSO or latest).	
12	Utility shifting of Telecom assets	Like in doubling, Gauge conversion project, existing utility pertaining to telecom cables and other accessories have to be shifted, Hence, its shifting provisions should be ensured	
13	Remote diagnostic & predictive maintenance tool for Telecom assets.	To ensure uninterrupted communication services, 24x 7 working of Telecom assets has to be ensured. Hence, Provision of Remote diagnostic & predictive maintenance tool for Telecom assets should be ensured.	
14	D&G Charges	As per Rly. Board's latest policy dated 04.03.2020 16.33% for projects requiring Traffic Blocks. 12.19% for projects not requiring Traffic Blocks.	

Signature of SAG officer In-charge

Project Appraisal Format
(To be submitted along with checklist)

1. Name of Project & Plan head :
2. Total Cost of Project and allocation :
3. ROR (if allocation is Capital or EBR) :
4. Brief Scope of Signalling & Telecom Work:
5. Cost of Signaling Work:
6. Cost of Telecom Work:
7. Total cost of S&T Work:
8. No of stations :
9. No of Engg LC gates :
10. Length of Section :
11. Whether part of HDN/HUN/3000MT routes :
12. Details of Stations.

S. No.	Type	No of Stations	No of Running Lines	Architecture of EI	Cost of Signaling Work/Station	Rate reference	Total cost
a	Up to 100 Routes						
b	100 to 200 Routes						
c	200 to 500						

	routes						
d	More Than 500 Routes						
e	Alterations in existing stations						

13. Details of Stations/Section.

S. No.	Type	No of stations	Architecture of Telecom setup at station and in block section	Rate reference	Cost of Telecom Work/Station & per Km
a	Up to 100 Kms				
b	100 to 200 Kms				
c	200 to 500 Kms				
d	More Than 500 Kms				

14. Details of Interlocked LC Gates.

S. No.	Type	Nos.	Cost of Signaling Work/LC Gate	Cost of Telecom Work/LC Gate	Rate reference	Total cost
a	Traffic LC Gate					
b	Engg LC Gate					

15. Details of IBH :

S. No.	Nos.	Cost of Signaling Work per IBH	Rate reference	Total cost

16. Type of Block Working :

17. Track Circuiting in the Yard (DC Track/ MSDAC):

18. Detail of High Value Signaling items in the Estimate.

S No	Item	Qty.	Unit Cost	Rate reference	Total cost
a	Signaling Cable				
b	Power cable				
c	Quad cable				
d	EI				
e	Indoor relays				
f	Maint. Free earth				
g	BPAC S/L or D/L with UFSBI				
h	SSDAC/HASSDAC				
i	MSDAC (Per DP cost)				
j	IPS				
k	Datalogger				

19. Detail of High Value Telecom items in the Estimate

S No	Item	Qty.	Unit Cost	Rate reference	Total cost
a	Quad Cable (Tele)				
b	OFC (Tele)				
c	EPC, e-Node B and other items in LTE System				
d	LER and LSR in IP-MPLS System				
e	Communication server and other items in VOIP based TCCS				
f	Passenger Amenity item				
g	IP-Exchange				
h	others				

20 a) Provision of ABS (Yes/No):
b) Cost of ABS/Km:

21 a) Provision of Kavach (Yes/No):
b) Cost of Kavach/Km:

22 a) Provision of CTC (Yes/No):
b) Cost of CTC/Km:

23 a) Provision of IP-MPLS (Yes/No):
b) Cost of IP-MPLS System/Stn:

24. a) Provision of LTE (Yes/No):
b) Cost of LTE/Km:

(Signature of in charge SAG officer)

Station wise summarized position

S No	Name of Station (no of routes)	Total Cost of Signalling at Station	EI/EI modification		Sig. Cable		Quad Cable		MSDAC		Other high value items like BPAC, MF Earth, IPS		Total cost of high value item	Remark
			Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost		
1														Remarks to clearly mention reason for higher cost at given station.
2														
3 etc														
	Total													

S No	*Name of station/Section*	*Total telecomm Cost at station/Section*	*OFC with HDPE*		*Quad Cable(Tele)*		*IP-MPLS*		*MF Earth(Tele)*		*Passenger Amenity*		*Total cost of high value item*	*Remark*
			Qty	*Cost*	*Qty*	*Cost*	*Qty*	*Cost*	*Qty*	*Cost*	*Qty*	*Cost*		

(Signature of in charge SAG officer)

Annexure VI

GOVERNMENT OF INDIA (भारत सरकार)
MINISTRY OF RAILWAYS (रेल मंत्रालय)
RAILWAY BOARD (रेलवे बोर्ड)

No.2023/Gatishakti/TF/02 New Delhi, Date: 14th Sept'23

The General Managers
All Indian Railways/Pus, NF(Con), CORE
DG/RDSO/Lucknow, DG/NAIR/Vadodara

Subject : Updation, Improvement and Integration Financial and Economic Appraisal Framework for Evaluation of Railway Project
Reference : No.2022/Gatishakti/TF/01 dt 20th Mar'2023
: No.2022/Gatishakti/EU/49 dt 19th Aug'2022

In order to streamline and standardize calculation of EIRR and FIRR across Indian Railways, an approach paper on tandardized Economic appraisal framework was issued on 19-08-2022 and a tandardized Financial appraisal framework was issued vide letter 20.032023.

The various reference rates considered for the FIRR/EIRR model had to be updated on an annual basis as per latest available data or circulars. IR has issued Annual Statistical Statement 2021-22, End result Freight 2022 and End Result Coaching 2022 and accordingly the reference rates have been updated in the FIRR/EIRR model.

Along with updation of latest reference rates, improvements in calculation of FIRR/EIRR as well as integration of EIRR and FIRR calculation sheet has been made. No substantive change has been made to the approach paper or the calculation sheet. A brief update on key changes to the financial appraisal framework is attached herewith as Annexure-1.

The methodology in the approach paper should be adopted while calculating Financial Rate of Return (FIRR) for the projects at the time of preparation of the Detailed Project Reports for New Line, Doubling, Gauge Conversion and Traffic facilities (for Traffic Facilities –wherever necessary parameters required for calculation can be captured).

Associate Finance will ensure that the guidelines set out in this model are scrupulously followed and the concurrence note to the proposal should state as much.

Contd..2/-

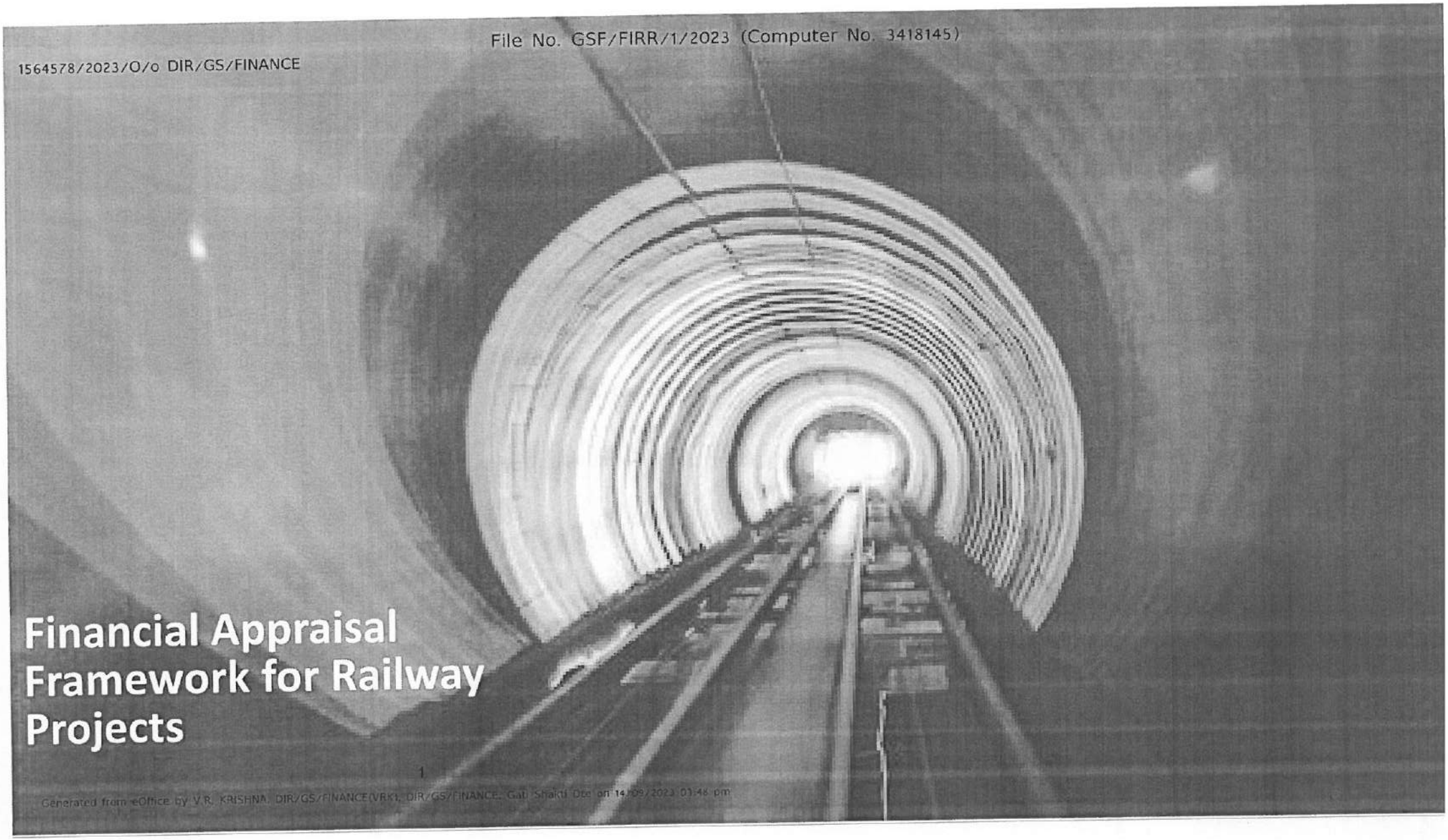
This has the concurrence of the Associate Finance of Gati Shakti Directorate. This issues with the approval of PED Gati Shakti. This will be applicable with immediate effect.

(Purushottam Kumar)
DD GS Traffic
Railway Board

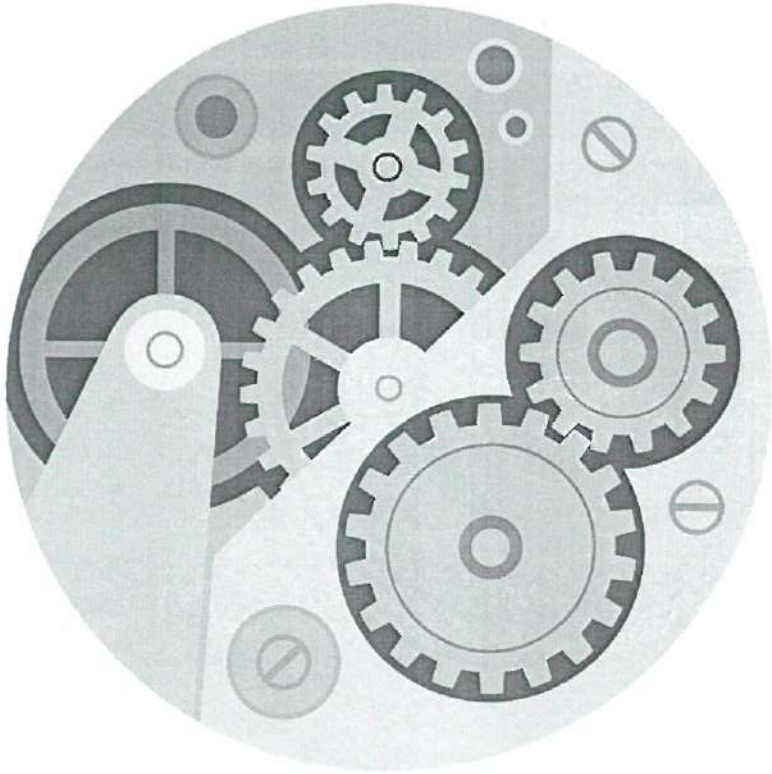
1. The PFAs, All Indian Railways & Production Units
2. Dy. Comptroller and Auditor General of India (Railways), Room No.224, Rail Bhavan, New Delhi.

Copy to:

1. Advisor to MR, EDPG to MR, OSD to MR, EDPG to MOS(D), EDPG to MOS(J)
2. Chief Administrative Officer/Construction of all Indian Railways.
3. CMD/RVNL, CMD/IRCON, CMD/IRCON, CMD/KRCL, CMD/RITES & CMD/DFCCIL.



Financial Appraisal Framework for Railway Projects

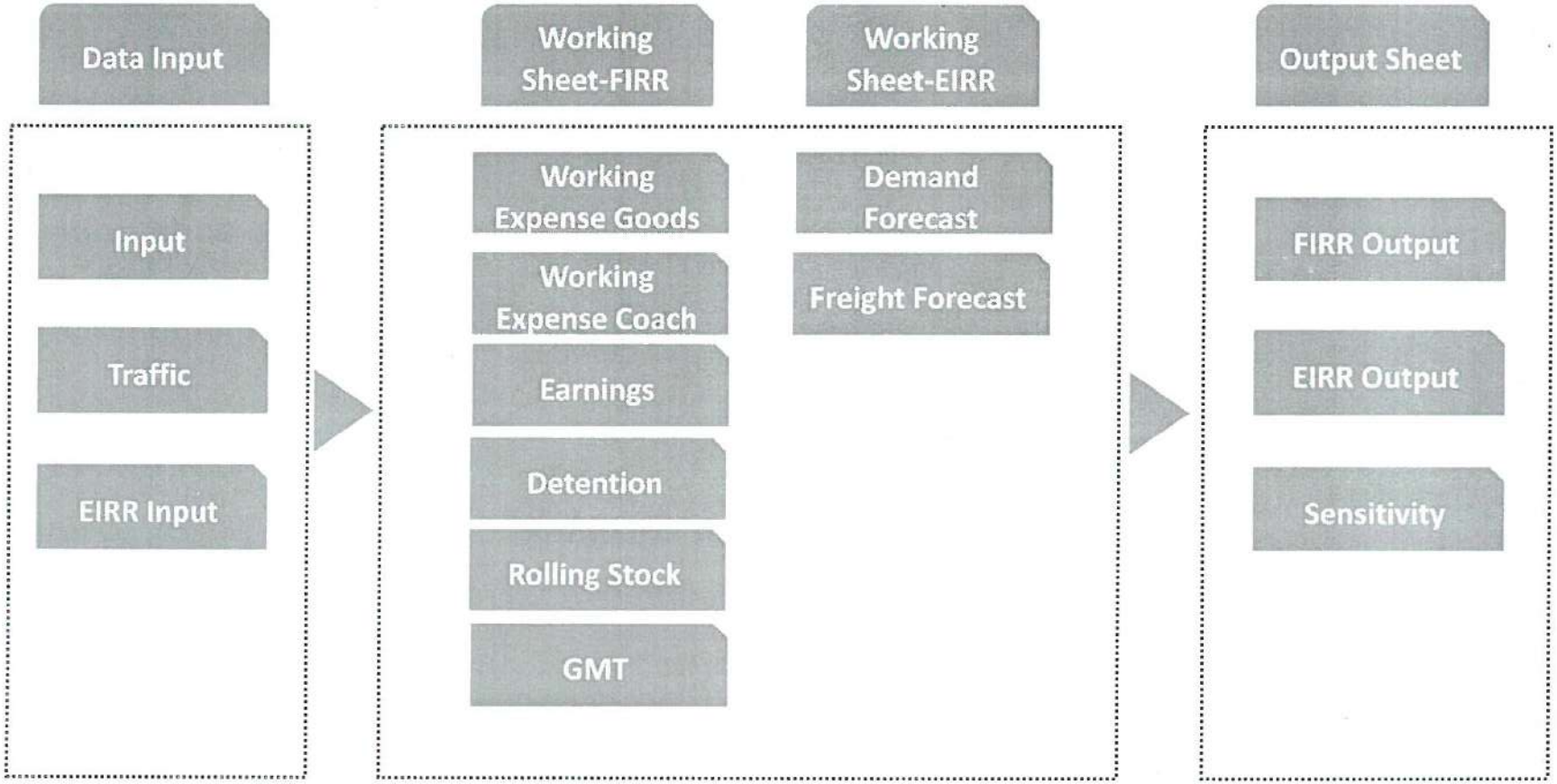


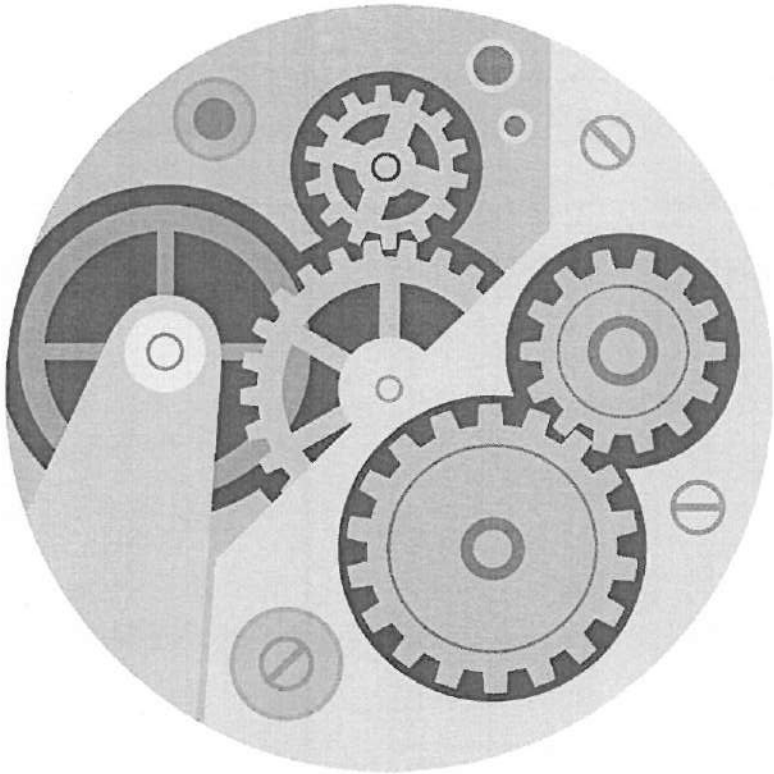
FIRR Model –
Financial Appraisal Framework – An Update

Key Areas which have been updated

- Adoption of reference rates based on latest available reference document for 2021-22
  - Annual Statistical Statement 2021-22
  - End result 21-22 Freight
  - End result 21-22 Coaching
- Integration of Rolling stock computation in the model
- Incorporation of Capex Schedule
- Consideration of rail/fastening replacement based on utilization instead of useful life.
- Further automation in excel model
- Integration of EIRR and FIRR Model
- Incorporation of a separate Traffic Sheet which will be used for both EIRR & FIRR calculations
- Incorporation of Sensitivity for both FIRR and EIRR

FIRR Model – Model Structure



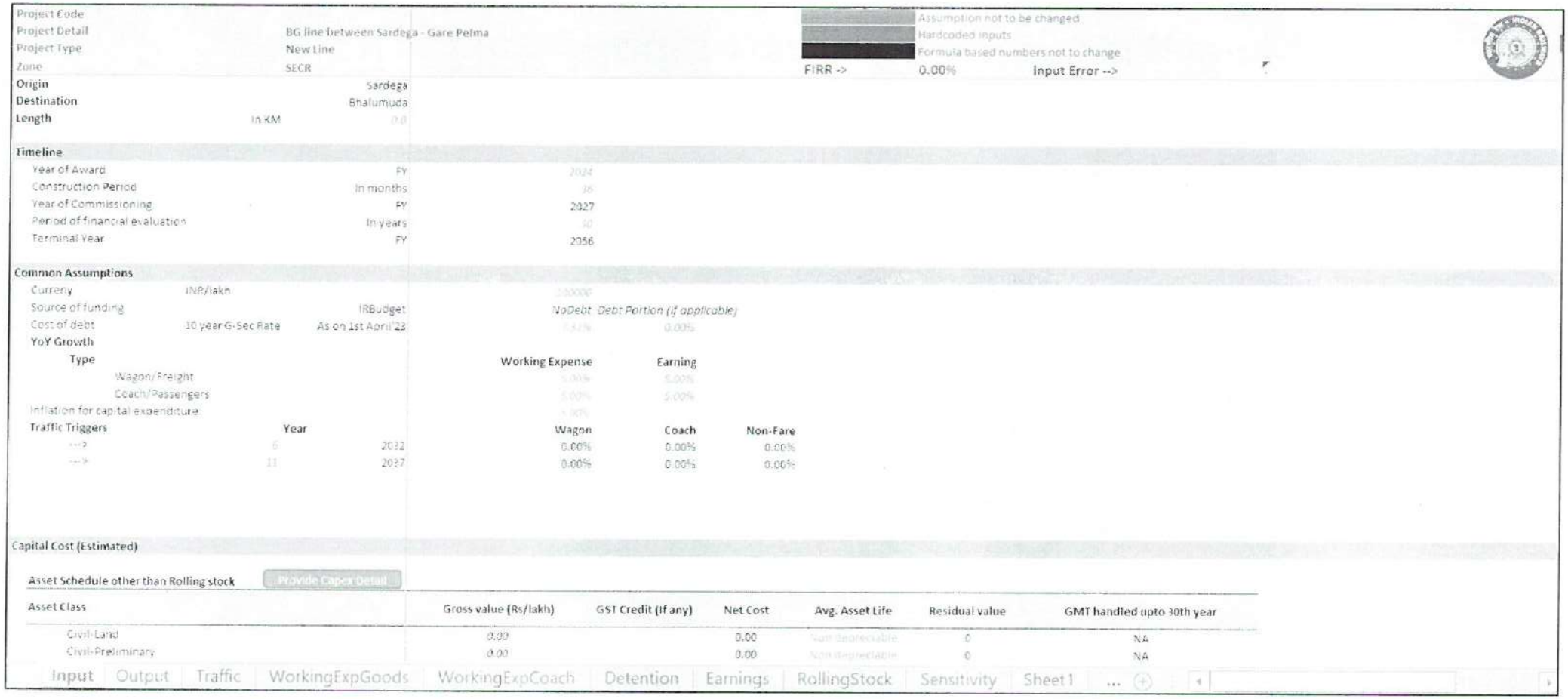


FIRR Model – Details on update

FIRR Model – Input Sheet

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

3418145/2023/GS/E-DIR/GS/FINANCE



Project Code					
Project Detail	BG line between Sardega - Gare Pelma			Assumption not to be changed	
Project Type	New Line			Hardcoded inputs	
Zone	SECR			Formula based numbers not to change	
			FIRR ->	0.00%	Input Error -->
Origin	Sardega				
Destination	Bhalumuda				
Length	In KM	0.0			
Timeline					
Year of Award	FY	2024			
Construction Period	In months	36			
Year of Commissioning	FY	2027			
Period of financial evaluation	In years	30			
Terminal Year	FY	2056			
Common Assumptions					
Currency	INR/lakh	1.00000			
Source of funding	IRBudget	NoDebt	Debt Portion (if applicable)		
Cost of debt	10 year G-Sec Rate	As on 1st April'23	7.41%	0.00%	
YoY Growth					
Type			Working Expense	Earning	
Wagon/Freight			5.00%	5.00%	
Coach/Passengers			5.00%	5.00%	
Inflation for capital expenditure			5.00%		
Traffic Triggers	Year		Wagon	Coach	Non-Fare
--->	6	2032	0.00%	0.00%	0.00%
--->	11	2037	0.00%	0.00%	0.00%

Capital Cost (Estimated)

Asset Schedule other than Rolling stock — Provide Capex Detail

Asset Class	Gross value (Rs/lakh)	GST Credit (If any)	Net Cost	Avg. Asset Life	Residual value	GMT handled upto 30th year
Civil-Land	0.00		0.00	Non Depreciable	0	NA
Civil-Preliminary	0.00		0.00	Non Depreciable	0	NA

Input | Output | Traffic | WorkingExpGoods | WorkingExpCoach | Detention | Earnings | RollingStock | Sensitivity | Sheet 1 | ... ⊕

FIRR Model – Input Sheet

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

5645x8/2023/GS/0 DIR/GS/FINANCE

Project Code		Assumption not to be changed	
Project Detail	BG line between Sardega - Gare Pelma	Hardcoded inputs	
Project Type	New Line	Formula based numbers not to change	
Zone	SECR	FIRR -> 0.00%	Input Error -->

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Capital Cost Details

Capex Details

Please Click here for Summary

S.No.	Item	Unit	Quantity	Unit Cost in INR Lakh	Amount in INR/Lakh	Category
1	**Route Length**	**KM**	0.00	0.00	0.00	
(i)	Total Track Km. (incl. loop/siding etc.)	KM	0.00	0.00	0.00	
A	**CIVIL Engineering**					
2	**Preliminary expenses**	Rs.	0.00	0.00	0.00	Civil-Preliminary
3	**Total Land requirement**	Ha	0.00	0.00	0.00	Civil-Land
(i)	Pvt. land	Ha	0.00	0.00	0.00	
(ii)	Govt. land	Ha	0.00	0.00	0.00	
(iii)	Forest land	Ha	0.00	0.00	0.00	
4	**Earthwork in embankment**	Cum	0.00	0.00	0.00	Civil-Formation
(i)	Upto 5 m high =	Km	0.00	0.00	0.00	
(ii)	5-10 m high	Km	0.00	0.00	0.00	
(iii)	More than 10 m high	Km	0.00	0.00	0.00	
(iv)	Maximum Bank height	m	0.00	--	--	
4(a)	**Blanketing quantity (40 cm)**	Cum	0.00	0.00	0.00	Civil-Formation
5	**Earthwork in Cutting**	Cum	0.00	0.00	0.00	Civil-Formation
(i)	Upto 5 m depth	Km	0.00	0.00	0.00	
(ii)	5-10 m depth	Km	0.00	0.00	0.00	
(iii)	More than 10 m depth	Km	0.00	0.00	0.00	
(iv)	Maximum Cutting depth	M	0.00	0.00	0.00	
6	Main Tunnels (Cross sectional area of tunnel)	Nos.	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.
(i)	Total Main Tunnel Length	KM	0.00	0.00	0.00	
(ii)	Maximum Length of Tunnel	KM	0.00	0.00	0.00	
(iii)	Tunnel more than 2 Km. long	Nos.	0.00	0.00	0.00	
7	Adit/Shaft/Cross passage Length	KM	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.
8	Walling Length	KM	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.
9	Drain Length	KM	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.
10	Rails and Fastening	KM	0.00	0.00	0.00	Civil - Rail, Fastening, Point & Crossing
11	Sleepers and fastening	KM	0.00	0.00	0.00	Civil - Rail, Fastening, Point & Crossing

Input | Output | Traffic | WorkingExpGoods | WorkingExpCoach | Detention | Earnings | RollingStock | Sensitivity | Sheet1 | ...

FIRR Model – Input Sheet

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

15045 18/2023/GS/0 DIR/GS/FINANCE

Project Code						Assumption not to be changed	
Project Detail	BG line between Sardega - Gare Pelma					Hardcoded inputs	
Project Type	New Line					Formula based numbers not to change	
Zone	SECR				FIRR ->	0.00%	Input Error -->
11	Sleepers and fastening	KM	0.00	0.00	0.00	Civil - Rail, Fastening, Point & Crossing	
12	Ballast	KM	0.00	0.00	0.00	Civil - Pway & others	
13	Points and Crossings	Nos.	0.00	0.00	0.00	Civil - Rail, Fastening, Point & Crossing	
(i)	1 in 16	Nos.	0.00	0.00	0.00		
(ii)	1 in 12	Nos.	0.00	0.00	0.00		
(iii)	1 in 8½	Nos.	0.00	0.00	0.00		
(iv)	Others (DS ets.)	Nos.	0.00	0.00	0.00		
14	g	KM	0.00	0.00	0.00	Civil - Pway & others	
15	Fencing (Station/LC etc.)	m	0.00	0.00	0.00	Civil - Pway & others	
16	ROBs	Nos.	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.	
17	RUB/LHS (new/extension)	Nos.	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.	
18	Level Crossings (new/extension)	Nos.	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.	
19	Rail over Rail Flyovers (RoRs)	Nos.	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.	
20	Linear Water-way	m	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.	
(i)	Important Bridge	Nos.	0.00	0.00	0.00		
(ii)	Major Bridge	Nos.	0.00	0.00	0.00		
(iii)	Minor Bridge	Nos.	0.00	0.00	0.00		
21	Total no. of stations (incld. Originati	Nos.	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.	
(i)	No. of junction stations	Nos	0.00	0.00	0.00		
(ii)	No. of crossing stations (exclud	Nos	0.00	0.00	0.00		
(iii)	No. of Halts	Nos	0.00	0.00	0.00		
(iv)	No. of IBS stations	Nos	0.00	0.00	0.00		
22	Total No. of Loop lines/Sidings	Nos.					
(i)	Total length of Loop lines/Sidings	KM	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.	
23	Station Building	Sqm.	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.	
24	Office Buildings	Sqm.	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.	
25	Workshop and Sheds	Sqm.	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.	
26	Other Service Buildings	Sqm.	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.	
27	Total H/L Platform Length	m					
(i)	H/L Platform area	Sqm.	0.00	0.00	0.00	Civil - Pway & others	
28	Cover over Platform	Sqm.	0.00	0.00	0.00	Civil - Pway & others	
29	Residential Quarters	Nos.	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.	
(i)	Type-II	Nos.	0.00	0.00	0.00		
(ii)	Type-III	Nos.	0.00	0.00	0.00		

Input | Output | Traffic | WorkingExpGoods | WorkingExpCoach | Detention | Earnings | RollingStock | Sensitivity | Sheet1 | ...

FIRR Model – Input Sheet

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

Project Code							
Project Detail	BG line between Sardega - Gare Pelma				Assumption not to be changed		
Project Type	New Line				Hardcoded inputs		
Zone	SECR				Formula based numbers not to change		
					FIRR ->	0.00%	Input Error -->
	(ii) Type-III	Nos.	0.00	0.00	0.00		
	(iii) Type-IV	Nos.	0.00	0.00	0.00		
	(iv) Type IV Spl.	Nos	0.00	0.00	0.00		
30	FOBs	Nos.					
(i)	FOBs Length	m	0.00	0.00	0.00	Civil - Pway & others	
31	Officers/Sub-ordinate Rest House	Sqm.	0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.	
32	Plants & Equipments		0.00	0.00	0.00	Civil - Bridges, Buildings, walls etc.	
B	**Electrical**		**Quantity**	**Unit Cost in INR Lakh**	**Amount in INR/Lakh**		
33	OHE	KM	0.00	0.00	0.00	Electrical	
34	TSS	Nos.	0.00	0.00	0.00	Electrical	
35	SSP	Nos.	0.00	0.00	0.00	Electrical	
35(i)	SP	Nos	0.00	0.00	0.00	Electrical	
36	General Services	Rs.	0.00	0.00	0.00	Electrical	
37	Shifting/Modification of electrical e	Nos					
(i)	400 kv	Nos	0.00	0.00	0.00	Electrical	
(ii)	220 kv	Nos	0.00	0.00	0.00	Electrical	
(iii)	132 kv	Nos	0.00	0.00	0.00	Electrical	
(iv)	66 kv	Nos	0.00	0.00	0.00	Electrical	
(v)	33 kv	Nos	0.00	0.00	0.00	Electrical	
(vi)	11 KV	Nos	0.00	0.00	0.00	Electrical	
						Electrical	
						Electrical	
						Electrical	

FIRR Model – Input Sheet

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

15445x/2023/G/0 DIR/GS/FINANCE

Project Code
Project Detail: BG line between Sardega - Gare Pelma
Project Type: New Line
Zone: SECR

Assumption not to be changed
Hardcoded inputs
Formula based numbers not to change

FIRR -> 0.00% Input Error -->

Indian Railways
Lifeline to the nation

							Electrical
C		**Signaling & Telecom**					
38		Signaling System					
	(i)	No of stations upto 100 routes		0.00	0.00	0.00	S&T
	a	4 lines station	Nos	0.00	0.00	0.00	S&T
	b	5 lines station		0.00	0.00	0.00	S&T
		Alteration in Existing El					
	a	4 lines station		0.00	0.00	0.00	S&T
	b	5 lines station		0.00	0.00	0.00	S&T
	(ii)	100 to 200 routes		0.00	0.00	0.00	S&T
		Alteration in Existing El					
	(iii)	200 to 500 routes		0.00	0.00	0.00	S&T
	(iv)	More than 500 routes		0.00	0.00	0.00	S&T
	(v)	Interlocked LC gates		0.00	0.00	0.00	S&T
39		Telecom		0.00	0.00	0.00	S&T
D		**Mechanical**					
40		Mechanical Cost					
	(i)	Maintenance Facilities		0.00	0.00	0.00	Mechanical other than Rolling stock
	(ii)	Watering Facilities		0.00	0.00	0.00	Mechanical other than Rolling stock
	(iii)	Disaster Management Facility		0.00	0.00	0.00	Mechanical other than Rolling stock
	(iv)	Wayside detection equipment		0.00	0.00	0.00	Mechanical other than Rolling stock
E		**Other Charges**					
	(i)	Environmental Charges		0.00	0.00	0.00	Departmental Charges
	(ii)	D&G Charges		0.00	0.00	0.00	Departmental Charges
	(iii)	Sports Charges		0.00	0.00	0.00	Departmental Charges

Input | Outout | Traffic | WorkingExpGoods | WorkingExpCoach | Detention | Earnings | RollingStock | Sensitivity | Sheet1 | ...

10

FIRR Model – Input Sheet

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

Project Code			Assumption not to be changed	
Project Detail	BG line between Sardega - Gare Pelma		Hardcoded inputs	
Project Type	New Line		Formula based numbers not to change	
Zone	SECR	FIRR ->	0.00%	Input Error -->

Indian Railways
Lifeline to the nation...

Capital Cost (Estimated)

Asset Schedule other than Rolling stock — Provide Capex Detail

Asset Class	Gross value (Rs/lakh)	GST Credit (If any)	Net Cost	Avg. Asset Life	Residual value	GMT handled upto 30th year
Civil-Land	0.00		0.00	Non depreciable	0	NA
Civil-Preliminary	0.00		0.00	Non depreciable	0	NA
Civil-Formation	0.00		0.00	Non depreciable	0	NA
Civil - Bridges, Buildings, walls etc.	0.00		0.00	60	0	NA
Civil - Rail, Fastening, Point & Crossing	0.00		0.00	GMT800	0	GMT
Civil - Pway & others	0.00		0.00	35	0	NA
S&T	0.00		0.00	20	0	NA
Electrical	0.00		0.00	30	0	NA
Departmental Charges	0.00		0.00	30	0	NA
Mechanical other than Rolling stock	0.00		0.00	30	0	NA
Total Cost	0.00	0.00	0.00		0	

Replacement of Asset

	Rep. Year	Asset	Year of Replacement	Useful life	Amount	Year utilised	Residual value	Remarks
1	0	Civil - Rail, Sleepers, Point & Crossing-	0	GMT800	0.00	GMT	-	Replacement due
2	NA	Civil - Rail, Sleepers, Point & Crossing-II	NA	GMT800	0.00	GMT	-	Replacement not due
3	NA	Civil - Rail, Sleepers, Point & Crossing-III	NA	GMT800	0.00	GMT	-	Replacement not due
4	NA	Civil - Rail, Sleepers, Point & Crossing-IV	NA	GMT800	0.00	GMT	-	Replacement not due
5	NA	Civil - Rail, Sleepers, Point & Crossing-V	NA	GMT800	0.00	GMT	-	Replacement not due
	20	S&T	2046	20	0.00	10.00	-	Replacement due
					-		-	

Input | Output | Traffic | WorkingExpGoods | WorkingExpCoach | Detention | Earnings | RollingStock | Sensitivity | Sheet1 | ...

FIRR Model – Input Sheet

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

1564578/2023/O/o DIR/GS/FINANCE

Project Code
Project Detail: BG line between Sardega - Gare Pelma
Project Type: New Line
Zone: SECR

Assumption not to be changed
Hardcoded inputs
Formula based numbers not to change

FIRR -> 0.00% Input Error -->

Indian Railways
Lifeline to the nation

Construction Year		Project Progress	Capitalised	CWIP	CWIP with Inflation	Capitalised	Closing CWIP	Average CWIP	Interest	Project cash outgo
Year 1	2024	0.00%	0%	-	-	-	-	-	-	-
Year 2	2025	0.00%	0%	-	-	-	-	-	-	-
Year 3	2026	0.00%	0%	-	-	-	-	-	-	-
Year 4	2027	0.00%	0%	-	-	-	-	-	-	-
Year 5	2028	0.00%	0%	-	-	-	-	-	-	-
Year 6	2029	0.00%	0%	-	-	-	-	-	-	-
Year 7	2030	0.00%	0%	-	-	-	-	-	-	-
Year 8	2031	0.00%	0%	-	-	-	-	-	-	-
		0.00%			-	-			-	-
									-	

CRRM with respect to initial period

Timeline	Year	Value
Yr	2027	0
Yr	2028	0
Yr	2029	0

CRRM with respect to replacement asset	Year	Value
Year of realisation	2047	0
Year of realisation	2047	0
Year of realisation	2047	0

Rolling Stock (Rs/lakh)

Category	Type	Useful life	No. of Stock	Year->	0	Year->	6	Year->	11	Residual Value
			Unit	Rate	Amount	Unit	Amount	Unit	Amount	Amount
NA	NIL	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
NA	NIL	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
NA	NIL	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
NA	NIL	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
NA	NIL	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
NA	NIL	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
NA	NIL	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
NA	NIL	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
NA	NIL	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
NA	NIL	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
NA	NIL	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
NA	NIL	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
Total					0.00		0.00		0.00	0.00

Capacity per Loco | Wagon per rack | Coach per rack

Input | Output | Traffic | WorkingExpGoods | WorkingExpCoach | Detention | Earnings | RollingStock | Sensitivity | Sheet1

12

FIRR Model – Input Sheet

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

1564578/2023/O/o DIR/GS/FINANCE

Capacity per Loco	Wagon per rack	Coach per rack
	58	22

Earnings

A	Detention saving		Document Ref.	Sub-Ref.		Goods	Coach
	No. of trains detained per day	Up	(As on the date of commissioning)			0	0
		Down	(As on the date of commissioning)			0	0
	Avg. detention time in Minutes	Up				0	0
		Down				0	0
	Avg. load per train in terms of wagons					0	0
	Repair & Maintenace Hours Wagon/Coach		ASS 2021-22/Stmnt 26A/Pg.293	Column 56&58 fr Wagon	Pg. 291/Column 28 for Coach	3.13%	5.68%
	Repair & Maintenace Hours Loco-Diesel Electric		ASS 2021-22/Stmnt 26A/Pg.290	Column 4+ Column 6		9.79%	9.79%
	Cost of Wagon					-	-
	R&M Charges Wagon		ASS 2021-22/Stmnt 26B/305	Column 13 for wagon	Column 7 For coach	117550	514962
	R&M Charges Loco		AIEHC letter dtd. 30/6/22			16215	16215
	Depreciation index		3.75% index table for 30 years			0.0186	0.0186

B	Passenger Earning		
	Passenger capacity		
	Earning per passenger/KM in Rs.	*As per All class average as per Statement 12/ASS-2021-22 pg.117/Col.*	0.664
	Passenger weight - Static value	In tonnes	0.071

13

FIRR Model – Input Sheet

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

1564578/2023/O/o DIR/GS/FINANCE

Project Code	
Project Detail	BG line between Sardega - Gare Pelma
Project Type	New Line
Zone	SECR

Assumption not to be changed
Hardcoded inputs
Formula based numbers not to change

FIRR -> 0.00% Input Error ->

Indian Railways

Working Expense

Assumptions and inputs for working expenses

Goods

Particular	Standard Document	Sub-Ref	Page	Volume/Rate
Avg. Wagon KM per wagon day	ASS 2021-22	Col 16	281	
Maintenace cost per wagon	End result 21-22 Freight	Table 6	13	
Line haul maintenance cost per (000) GTKM				
Electric Traction	End result 21-22 Freight	Table 8	14	
Train passing staff	End result 21-22 Freight	Table 10	15	
Track	End result 21-22 Freight	Table 12	16	
Signalling	End result 21-22 Freight	Table 14	17	
Other Terminal Charges per Wagon	End result 21-22 Freight	Table 3	11	
Marshalling Charges per wagon/yard	End result 21-22 Freight	Table 5	12	
Documentation charges per 10 wagon	End result 21-22 Freight	Table 1	10	
Indirect Expense	End result 21-22 Freight	Table 15	18	
Central Charges	End result 21-22 Freight	Table 16	18	
Coach				
Vehicle KM per vehicle day in use	ASS 21-22	Col 9	280	
Maintenance cost per vehicle day	End result 21-22 Coaching-Ordir	Table 18	56(a)	
Traction cost per day per 1000 GTKM	End result 21-22 Coaching-Ordir	Table 13	51	
Prov. & Maint. Of track per 1000 GTKM	End result 21-22 Coaching-Ordir	Table 16	54	
Signalling cost per engine KMs	End result 21-22 Coaching-Ordir	Table 17	55	
General Overhead	End result 21-22 Coaching-Ordir	Table 47	71	
Central Charges	End result 21-22 Coaching-Ordir	Table 48	71	

Funding

State Grant

FIRR Model – Input Sheet

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

1584578/2023/O/O DIR/GS/FINANCE

Net Earning Prior to CoD (if applicable)

Year	Rolling stock	Earning	Working Expense	Net Earning (INR/lakh)
2024	0	0.0	0.0	0.0
2025	0	0.0	0.0	0.0
2026	0	0.0	0.0	0.0
2027	0	0.0	0.0	0.0
2028	0	0.0	0.0	0.0
2029	0	0.0	0.0	0.0

Earning and Working expense details

GOODS --	S.NO.	ype of Wago	Type of Engine	Commodity	From	To	Existing Route KM	Project Route KM	Additional Projected traffic (Tonnes) D	Class	Rate/Tonne	Additional Traffic 6th Year	Additional Traffic	PCC	Tare Weight
	1	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	2	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	3	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	4	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	5	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	6	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	7	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	8	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	9	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	10	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	11	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	12	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	13	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	14	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	15	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	16	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	17	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	18	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	19	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	20	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	21	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	22	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	23	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	24	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	25	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	26	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	27	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	28	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	29	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA
	30	NIL	NIL	Nil	0	0	0	0	0	-	0	0	0	NA	NA

FIRR Model – Input Sheet

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

15845758/2023/O/O-DIR/GS/FINANCE

Net Earning Prior to CoD (if applicable)

Year	Rolling stock	Earning	Working Expense	Net Earning (INR/lakh)
2024	0	0.0	0.0	0.0
2025	0	0.0	0.0	0.0
2026	0	0.0	0.0	0.0
2027	0	0.0	0.0	0.0
2028	0	0.0	0.0	0.0
2029	0	0.0	0.0	0.0

Earning and Working expense details

GOODS	S NO.	ype of Wago	Type of Engine	Commodity	From	To	Existing Route KM	Project Route KM	Additional Projected traffic (Tonnes) D	Class	Rate/Tonne	Additional Traffic 6th Year	Additional Traffic	PCC	Tare Weight
	1	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	2	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	3	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	4	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	5	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	6	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	7	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	8	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	9	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	10	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	11	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	12	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	13	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	14	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	15	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	16	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	17	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	18	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	19	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	20	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	21	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	22	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	23	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	24	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	25	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	26	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	27	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	28	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	29	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA
	30	NIL	NIL	Nil	0	0	0	0	0		0	0	0	NA	NA

16

FIRR Model – Input Sheet

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

15045F8/2023/O/O-DIR/GS/FINANCE

Project Code	
Project Detail	BG line between Sardega - Gare Pelma
Project Type	New Line
Zone	SECR

Assumption not to be changed
Hardcoded inputs
Formula based numbers not to change

FIRR -> 0.00% Input Error -->

Indian Railways

Coaching-

S.No.	Type of Coach	Type of Engine	From	To	Operation day	No. Of Coaches	Capacity	Tare Weight of one Coach	No. of Engine	Additional Traffic 6th Year	Additional Traffic 11th Year
1	NIL	NIL	0	0	0	0	NA	NA	0	0	0
2	NIL	NIL	0	0	0	0	NA	NA	0	0	0
3	NIL	NIL	0	0	0	0	NA	NA	0	0	0
4	NIL	NIL	0	0	0	0	NA	NA	0	0	0
5	NIL	NIL	0	0	0	0	NA	NA	0	0	0
6	NIL	NIL	0	0	0	0	NA	NA	0	0	0
7	NIL	NIL	0	0	0	0	NA	NA	0	0	0
8	NIL	NIL	0	0	0	0	NA	NA	0	0	0
9	NIL	NIL	0	0	0	0	NA	NA	0	0	0
10	NIL	NIL	0	0	0	0	NA	NA	0	0	0
11	NIL	NIL	0	0	0	0	NA	NA	0	0	0
12	NIL	NIL	0	0	0	0	NA	NA	0	0	0
13	NIL	NIL	0	0	0	0	NA	NA	0	0	0
14	NIL	NIL	0	0	0	0	NA	NA	0	0	0
15	NIL	NIL	0	0	0	0	NA	NA	0	0	0

Non Fare

S.No.	Category	1st Year-Total	6th Year-Additional	11th Year Additional
1	Advertisement	0	0	0
2	F&B			
3	Retails			
4	Rentals			
5	Platform Tickets			
6	Car Park			
7	Others			

FIRR Model – Traffic Sheet

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

[redacted]

Project Code
Project Detail BG line between Sardega - Gare Pelma
Project Type New Line
Zone SECR

Hardcoded inputs
Formula based numbers not to change

Indian Railways

Traffic

Freight In Tonnes

No. of Year-->				1	2	3	4	5	6	7	8	9	10	11
S.NO.	Commodity	From	To	FY2027	FY2028	FY2029	FY2030	FY2031	FY2032	FY2033	FY2034	FY2035	FY2036	FY2037
1	Nil			0	0	0	0	0	0	0	0	0	0	0
2	Nil			0	0	0	0	0	0	0	0	0	0	0
3	Nil			0	0	0	0	0	0	0	0	0	0	0
4	Nil			0	0	0	0	0	0	0	0	0	0	0
5	Nil			0	0	0	0	0	0	0	0	0	0	0
6	Nil			0	0	0	0	0	0	0	0	0	0	0
7	Nil			0	0	0	0	0	0	0	0	0	0	0
8	Nil			0	0	0	0	0	0	0	0	0	0	0
9	Nil			0	0	0	0	0	0	0	0	0	0	0
10	Acids and Alcohols			0	0	0	0	0	0	0	0	0	0	0
11	Alloys and Metals			0	0	0	0	0	0	0	0	0	0	0
12	Bricks and Stones			0	0	0	0	0	0	0	0	0	0	0
13	Caustic Potash and Soda			0	0	0	0	0	0	0	0	0	0	0
14	Cement			0	0	0	0	0	0	0	0	0	0	0
15	Chemical Manures			0	0	0	0	0	0	0	0	0	0	0
16	Clay and Sand			0	0	0	0	0	0	0	0	0	0	0
17	Nil			0	0	0	0	0	0	0	0	0	0	0
18	Nil			0	0	0	0	0	0	0	0	0	0	0
19	Nil			0	0	0	0	0	0	0	0	0	0	0
20	Nil			0	0	0	0	0	0	0	0	0	0	0
21	Nil			0	0	0	0	0	0	0	0	0	0	0
22	Nil			0	0	0	0	0	0	0	0	0	0	0
23	Nil			0	0	0	0	0	0	0	0	0	0	0
24	Nil			0	0	0	0	0	0	0	0	0	0	0
25	Nil			0	0	0	0	0	0	0	0	0	0	0
26	Nil			0	0	0	0	0	0	0	0	0	0	0
27	Nil			0	0	0	0	0	0	0	0	0	0	0
28	Nil			0	0	0	0	0	0	0	0	0	0	0
29	Nil			0	0	0	0	0	0	0	0	0	0	0
30	Nil			0	0	0	0	0	0	0	0	0	0	0
Total				0	0	0	0	0	0	0	0	0	0	0

FIRR Model – Traffic Sheet

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

1546X8/2023/O/O DIR/GS/FINANCE

Traffi Coaching- Passenger in Nos.

							1	2	3	4	5	6	7	8	9	10	11
S.NO.	Type of Coach	From	To	Year 1 - Operation days	Year 1 - No. of Coaches	Capacity	FY2027	FY2028	FY2029	FY2030	FY2031	FY2032	FY2033	FY2034	FY2035	FY2036	FY2037
1	NIL					NA	0	0	0	0	0	0	0	0	0	0	0
2	NIL					NA	0	0	0	0	0	0	0	0	0	0	0
3	NIL					NA	0	0	0	0	0	0	0	0	0	0	0
4	NIL					NA	0	0	0	0	0	0	0	0	0	0	0
5	NIL					NA	0	0	0	0	0	0	0	0	0	0	0
6	NIL					NA	0	0	0	0	0	0	0	0	0	0	0
7	AC EMU/MC					NA	0	0	0	0	0	0	0	0	0	0	0
8	AC EMU/TC-C					NA	0	0	0	0	0	0	0	0	0	0	0
9	GS					NA	0	0	0	0	0	0	0	0	0	0	0
10	LFC/WAC					NA	0	0	0	0	0	0	0	0	0	0	0
11	LSL/RD					NA	0	0	0	0	0	0	0	0	0	0	0
12	L/WACC/N					NA	0	0	0	0	0	0	0	0	0	0	0
13	L/WACC/NE					NA	0	0	0	0	0	0	0	0	0	0	0
14	NIL					NA	0	0	0	0	0	0	0	0	0	0	0
15	NIL					NA	0	0	0	0	0	0	0	0	0	0	0
Total							0	0	0	0	0	0	0	0	0	0	0

FIRR Model – Rolling Stock

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

15/09/2023/O/O DIR/GS/FINANCE

								1st Year			6th Year			11th Year		
Category	Type	Commodity	INR/Lakh	Useful Life	PCC	Tare Weight	Type of Engine	No. of Wagon	No. of Coach	No. of Locos	No. of Wagon	No. of Coach	No. of Locos	No. of Wagon	No. of Coach	No. of Locos
Coach	AC EMU/MC	AC Conventional	782.33	25.00	362.00	59.00	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	AC EMU/TC-C	AC Conventional	179.14	25.00	591.00	36.00	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Wagon	BCNAHSM1	Packed items	31.93	40.00	66.00	24.30	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Wagon	BCNHL	Packed items	13.80	35.00	70.00	20.80	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Wagon	BFNS	Steel	15.00	35.00	63.00	26.71	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Wagon	BOBRNHSM2	Coal	36.35	35.00	63.00	25.61	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Wagon	BOXNHL	Coal, Ore Etc.	38.05	30.00	70.00	20.60	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Wagon	BOXNS	Coal, Ore Etc.	11.07	30.00	70.00	23.20	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Wagon	BTPN	Petroleum Product	85.00	40.00	54.80	27.00	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	GS	Non-AC Conventional	202.49	20.00	90.00	37.14	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	LFCWAC	LHB AC 1st Class-II Tier	245.33	35.00	38.00	43.60	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	LSLRD	LHB Non AC Coaches	229.83	35.00	37.00	41.20	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	LWACCN	LHB AC Coaches	246.93	35.00	72.00	45.60	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	LWACCNE	LHB AC -Garib Rath	265.29	35.00	83.00	48.50	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	LWACCW	LHB AC-2 Tier	241.21	35.00	52.00	44.50	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	LWCBAC	LHB AC -Pantry Car	257.56	35.00	18.00	40.80	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	LWCTZAC	LHB AC Coaches	377.84	35.00	44.00	45.10	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	LWFAC	LHB AC 1st Class	254.68	35.00	24.00	43.30	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	LWLRRM	LHB AC -Power Car	351.13	35.00	NA	53.00	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	LWSCN	LHB Non AC III Tier	215.05	35.00	80.00	39.60	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	LWSCZ	LHB Non AC Chair Car	198.44	35.00	106.00	40.50	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	LWSCZAC	LHB AC Chair Car	238.10	35.00	78.00	40.40	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	MEMU/MC	Non-AC Conventional	467.46	25.00	69.00	47.00	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	MEMU/TC	Non-AC Conventional	154.80	25.00	80.00	32.95	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
NA	NIL	NIL	0.00	0.00	NA	NA	NIL	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Coach	VPH/VPHX	Non AC Conventional- Pa	157.07	20.00	NA	29.79	NA	0.00	0.00	NA	0.00	0.00	NA	0.00	0.00	NA
Loco	WAG-9	Loco	1024.33	35.00	NA	132.00	NIL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loco	WAP-5	Loco	1227.29	35.00	NA	78.00	NIL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loco	WAP-7	Loco	1094.38	35.00	NA	123.00	NIL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FIRR Model – Sensitivity

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

Project Code	-		
Project Detail	BG line between Sardega - Gare Pelma		
Project Type	New Line		
Zone	SECR		
Sensitivity			
Parameter			
Traffic	% of Proposal	Project FIRR	0.00%
Capex	% of Proposal	Project EIRR	0.00%

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FIRR Sensitivity

Capex \ Traffic	80%	90%	100%	110%	120%
80%	0.00%	0.00%	0.00%	0.00%	0.00%
90%	0.00%	0.00%	0.00%	0.00%	0.00%
100%	0.00%	0.00%	0.00%	0.00%	0.00%
110%	0.00%	0.00%	0.00%	0.00%	0.00%
120%	0.00%	0.00%	0.00%	0.00%	0.00%

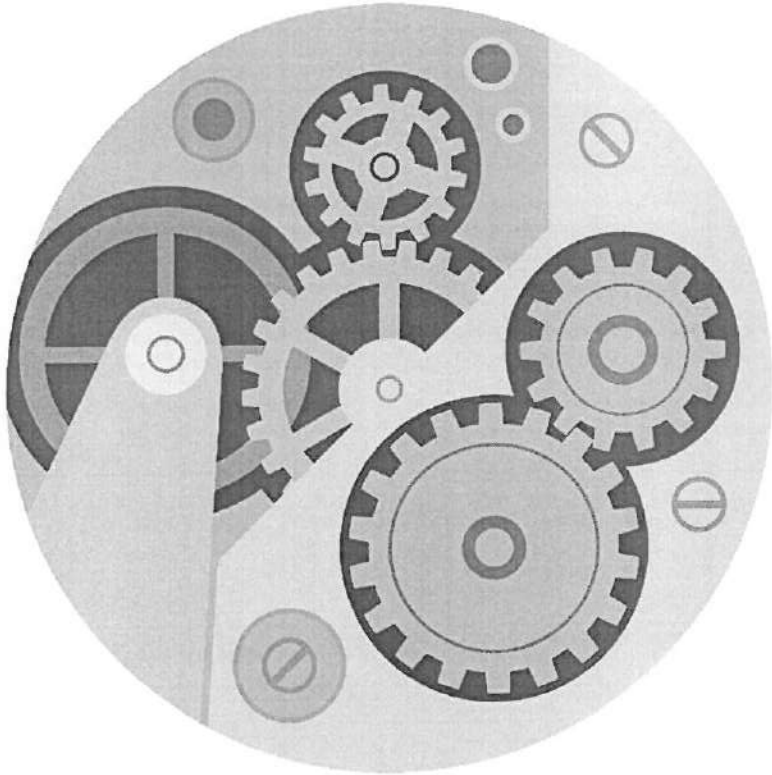
EIRR Sensitivity

Capex \ Traffic	80%	90%	100%	110%	120%
80%	0.00%	0.00%	0.00%	0.00%	0.00%
90%	0.00%	0.00%	0.00%	0.00%	0.00%
100%	0.00%	0.00%	0.00%	0.00%	0.00%
110%	0.00%	0.00%	0.00%	0.00%	0.00%
120%	0.00%	0.00%	0.00%	0.00%	0.00%

FIRR Model – GMT

S.No.	Year	Goods in Tonnes	Cumm. Goods in Mn Tonnes	GMT Coaching	Cumm. Coaching in mn Tonnes	Tare Weight (Goods)	Tare Weight (Coaching)	Overall Volume	Year having more than 800 GMT	Tare Weight (Goods)	Tare Weight (Coaching)
1	2024	0	0	0	0.00	-	-	0	0	-	-
2	2025	0	0	0	0.00	-	-	0	0	-	-
3	2026	0	0	0	0.00	-	-	0	0	-	-
4	2027	0	0	0	0.00	-	-	0	0	-	-
5	2028	0	0	0	0.00	-	-	0	0	-	-
6	2029	0	0	0	0.00	-	-	0	0	-	-
7	2030	0	0	0	0.00	-	-	0	0	-	-
8	2031	0	0	0	0.00	-	-	0	0	-	-
9	2032	0	0	0	0.00	-	-	0	0	-	-
10	2033	0	0	0	0.00	-	-	0	0	-	-
11	2034	0	0	0	0.00	-	-	0	0	-	-
12	2035	0	0	0	0.00	-	-	0	0	-	-
13	2036	0	0	0	0.00	-	-	0	0	-	-
14	2037	0	0	0	0.00	-	-	0	0	-	-
15	2038	0	0	0	0.00	-	-	0	0	-	-
16	2039	0	0	0	0.00	-	-	0	0	-	-
17	2040	0	0	0	0.00	-	-	0	0	-	-
18	2041	0	0	0	0.00	-	-	0	0	-	-
19	2042	0	0	0	0.00	-	-	0	0	-	-
20	2043	0	0	0	0.00	-	-	0	0	-	-
21	2044	0	0	0	0.00	-	-	0	0	-	-
22	2045	0	0	0	0.00	-	-	0	0	-	-
23	2046	0	0	0	0.00	-	-	0	0	-	-
24	2047	0	0	0	0.00	-	-	0	0	-	-
25	2048	0	0	0	0.00	-	-	0	0	-	-
26	2049	0	0	0	0.00	-	-	0	0	-	-
27	2050	0	0	0	0.00	-	-	0	0	-	-
28	2051	0	0	0	0.00	-	-	0	0	-	-
29	2052	0	0	0	0.00	-	-	0	0	-	-
30	2053	0	0	0	0.00	-	-	0	0	-	-
31	2054	0	0	0	0.00	-	-	0	0	-	-
32	2055	0	0	0	0.00	-	-	0	0	-	-
33	2056	0	0	0	0.00	-	-	0	0	-	-
34	End	0	0	0	0.00	-	-	0	0	-	-
35	End	0	0	0	0.00	-	-	0	0	-	-
36	End	0	0	0	0.00	-	-	0	0	-	-
37	End	0	0	0	0.00	-	-	0	0	-	-
38	End	0	0	0	0.00	-	-	0	0	-	-

*GMT=Gross Million Tonne



EIRR Model – Integration with FIRR Model

FIRR Model – EIRR Input

15646X8/2023/GSF/DIR/GS/FINANCE

Project Code	
Project Detail	ABC
Project Type	New Line
Zone	ABC

Hardcoded inputs
Formula based numbers not to change

Indian Railways

Assumptions

EIRR 0.00%

Journey Assumptions	Nos.
Journey per head	
Local	0.50
Interchange	0.49

Mode	Distance	Avg Speed (Km per hr)	Avg Occ	Total Time (In Minutes)	Difference in Min.	Avg. Lead Time
Train	0.0	40	1125	0.0		
Bus	40.0	50.0	45.0	48.0	48.0	125.0
Four wheeler	40.0	60.0	3.6	40.0	40.0	52.0
Two wheeler	40.0	60.0	1.6	40.0	40.0	35.0
Truck	40.0	40.0	16.0	60.0	60.0	110.0

Mode	Modal share (%)
Train	
Bus	75%
Four wheeler	5%
Two wheeler	20%

Annual escalation	%
Annual Escalation - VOC	4%
Annual Escalation	5%
Annual Escalation - Time value of Money	
First 10 year	5%
Next 10 years	2%
Next 10 years	1%

Coach Earning assumptions	INR

... RollingStock | Sensitivity | Sheet1 | GMT | >>EIRR>> | EIRRInput | DemandForecast | FreightForecast | EIRROutput

FIRR Model – EIRR Input

Project Code	
Project Detail	ABC
Project Type	New Line
Zone	ABC

Hardcoded inputs
Formula based numbers not to change

Indian Railways
Lifeline to the nation...

EIRR 0.00%

Assumptions

Coach Earning assumptions	INR
Second Class earning rate	
Local	
Interchange	
Other coaching earnings	
Project line earnings share (%)	
Local	100.0%
Interchange (originating)	11.37%
Other coaching earnings	11.37%

ASSUMPTIONS FOR VEHICLE OPERATING COST & Economy

Mode	VOC/Km.*(INR)	Fuel Economy (Km/ltr)
Metro	-	
Bus	52.39	7.4
Car	18.17	20.0
2 Wheeler	8.54	35.0
Trucks	19.8	12.2

Source :Economic Evaluation of Highway Projects in India ,IRC:SP:30-2019

Particular	
Fuel cost	100
YoY Growth	0.50%

COST OF ACCIDENTS

Type of accidents	(2004 prices)*	(2022 prices)**
Cost of fatal accident	437,342	1,052,516
Cost of major accident	64,256	154,640
Cost of damage to Two wheelers	2,286	5,502
Cost of damage to Car	9,763	23,496
Cost of damage to buses in road accidents	32,818	78,980

*Source: *Appraisal guidelines for Metro Rail Project Proposals MoHUA, GOI 2017**derived using escalation factor of 5%*

Particular	Unit	Non-Fatal Accident	Fatal Accident
Accident rate	/Per Cr Vehicle Km	0.2	0.02
Accident cost	INR Per Accident	154639.73	1052515.67
Accident share as total accidents	%	91%	9%

... | RollingStock | Sensitivity | Sheet1 | GMT | >>EIRR>> | EIRRInput | DemandForecast | FreightForecast | EIRROutput | ⊕

FIRR Model – EIRR Input

Project Code			
Project Detail	ABC	Hardcoded inputs	Indian Railways
Project Type	New Line	Formula based numbers not to change	
Zone	ABC		
Assumptions			EIRR 0.00%

MODE WISE EMISSION FACTORS (Gram/Km)

Vehicle Type/ Pollutant	CO	HC	NOX	PM	CO2
2-wheeler	1.4	0.7	0.3	0.05	28.58
Auto	2.45	0.75	0.12	0.08	77.89
Cars (incl. cabs)	1.39	0.15	0.12	0.02	139.52
Bus (incl. BRT)	3.72	0.16	6.53	0.24	787.72
Trucks			4		695
Treatment Cost (Rs. /ton)	200,000	200,000	200,000	200,000	20,000

Source: Appraisal guidelines for Metro Rail Project Proposals MoHUA, GOI 2017

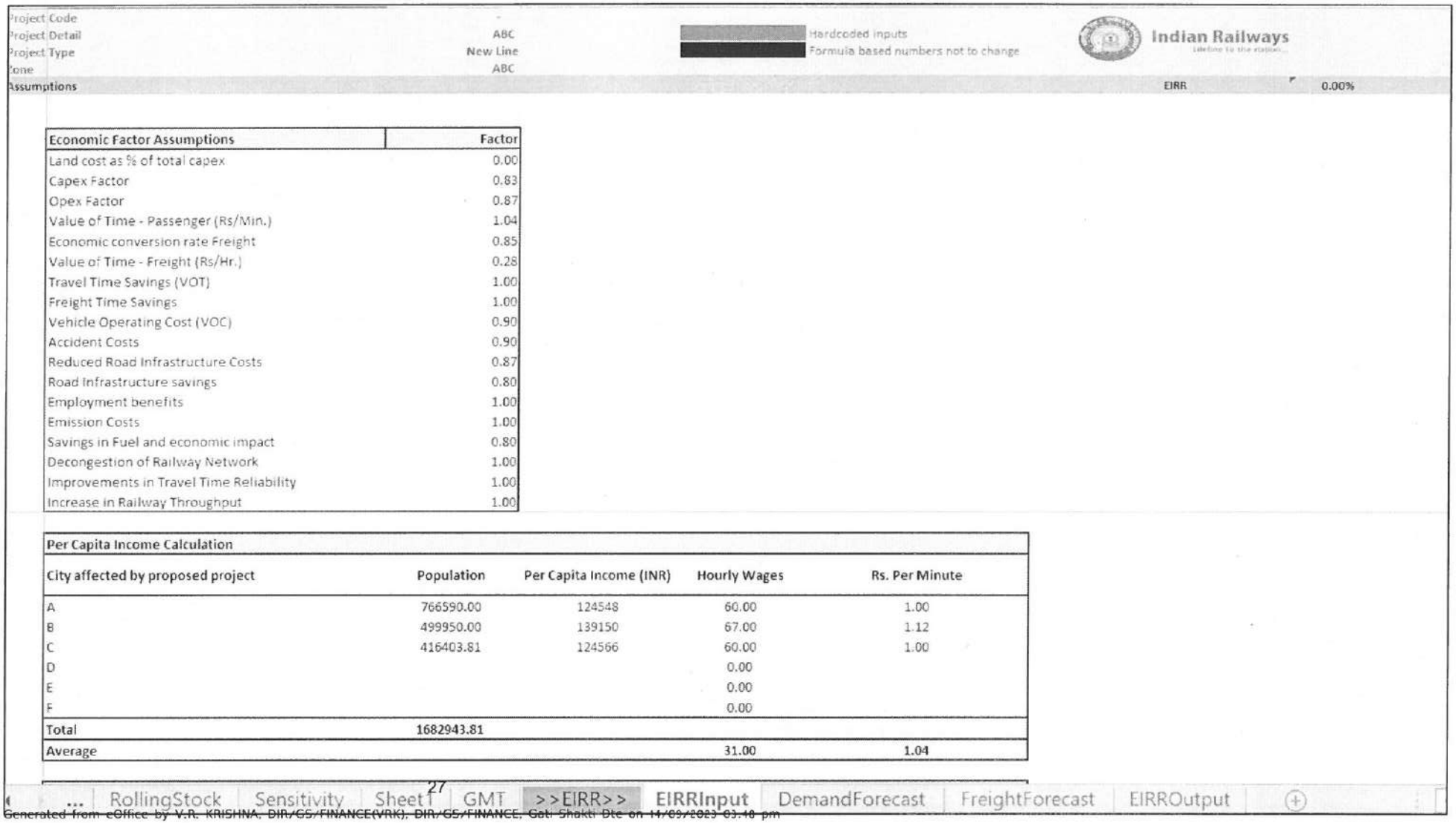
Infrastructure Benefit Factors			
Road Infrastructure Maintenance Cost	INR/Vehicle KM		1.7
New Road Infra Required in lieu of proposed project	Year	Start of Const^	2037
	Construction Period	In Years	2
	Project KM		40.0
	Current cost	INR Cr Per km	9.7
	Estimated Cost	INR Crore	-

Employment Benefit		
Personnel Cost	2%	% of Project Cost
Skilled Employment Cost	20%	% of Employment Cost
Unskilled Employment Cost	80%	% of Employment Cost
Direct Employment of Skilled Workers	0.75	Factor
Direct Employment of Unskilled Workers	1	Factor
Indirect Employment Generation	1.5	Factor
Direct Employment benefits-Operations	40%	% of Opex

... | RollingStock | Sensitivity | Sheet1 | GMT | >>EIRR>> | EIRRInput | DemandForecast | FreightForecast | EIRROutput

FIRR Model – EIRR Input

File No. GSF/FIRR/1/2023 (Computer No. 3418145)



Project Code
Project Detail ABC
Project Type New Line
Zone ABC

Hardcoded inputs
Formula based numbers not to change

Indian Railways

Assumptions EIRR 0.00%

Economic Factor Assumptions	Factor
Land cost as % of total capex	0.00
Capex Factor	0.83
Opex Factor	0.87
Value of Time - Passenger (Rs/Min.)	1.04
Economic conversion rate Freight	0.85
Value of Time - Freight (Rs/Hr.)	0.28
Travel Time Savings (VOT)	1.00
Freight Time Savings	1.00
Vehicle Operating Cost (VOC)	0.90
Accident Costs	0.90
Reduced Road Infrastructure Costs	0.87
Road Infrastructure savings	0.80
Employment benefits	1.00
Emission Costs	1.00
Savings in Fuel and economic impact	0.80
Decongestion of Railway Network	1.00
Improvements in Travel Time Reliability	1.00
Increase in Railway Throughput	1.00

Per Capita Income Calculation				
City affected by proposed project	Population	Per Capita Income (INR)	Hourly Wages	Rs. Per Minute
A	766590.00	124548	60.00	1.00
B	499950.00	139150	67.00	1.12
C	416403.81	124566	60.00	1.00
D			0.00	
E			0.00	
F			0.00	
Total	1682943.81			
Average			31.00	1.04

... RollingStock Sensitivity Sheet1 GMT >>EIRR>> EIRRInput DemandForecast FreightForecast EIRROutput

FIRR Model – EIRR Input

Project Code			
Project Detail	ABC	Hardcoded inputs	Indian Railways
Project Type	New Line	Formula based numbers not to change	
Zone	ABC		
Assumptions			EIRR 0.00%

Other Factors-Passenger related		
Increase in average speed on the section	25.00	KM/Hr
Increase in throughput passenger	1.00	lakh
YoY Growth Factor	2.00%	
Value of Travel time	0.90	INR per minute
Reduction in buffer time	20.00	Minutes
Reliability ratio	0.80	Factor
Average Revenue per passenger	35.90	INR per passenger
Increase in passenger throughput	0.10%	

Freight Rate calcuations					
Commodity	Rate per Tonne	Tonnes 1st Year	Share		
A	35000.00	200000	20.00%	Weighted Avg. Commodity Price	38694.3
B	67231.00	300000	30.00%	MIBOR Rate	7.38%
C	23050.00	500000	50.00%		
D	6000.00		0.00%		
E	5600.00		0.00%		
F	5360.00		0.00%		
		1000000	100.00%		

Freight Forecast		
Tonnage per truck	In Tonne	16
Freight throughout on Network	Mn ton	0.05
Value of freight time	INR per min	0.052827913
Average Revenue per tonne	INR per tonne	940
Increase in Freight throughout		1.19%

RollingStock | Sensitivity | Sheet1 | GMT | >>FIRR<< | FIRRInput | DemandForecast | FreightForecast | EIRROutput

FIRR Model – Demand Forecast

Project Code
Project Detail ABC
Project Type New Line
Zone ABC

Hardcoded inputs
Formula based numbers not to change

Indian Railways

Passenger Forecast

Year		Project Traffic	Local	Interchange (originati	Interchange (terminati	Non-Fare Penetration	Total Addressable	Passenger traffic to Mode: Bus	Four wheeler	Two wheeler	Trips by each mode: Bus	Four wheeler	Two wheeler	Vehicle KM: Bus	Four wheeler	Two wheeler	No. of Hours: Bus	Four wheeler	Two wheeler
1	2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	2026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	2027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	2029	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	2031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	2032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	2033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	2034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	2036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	2037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	2038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	2039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	2041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	2042	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	2043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	2044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	2045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	2046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	2047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	2048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	2049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	2050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	2051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	2052	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	2053	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	2054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	2055	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	2056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	End	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

RollingStock | Sensitivity | Sheet1 | GMT | >>EIRR>> | EIRRInput | DemandForecast | FreightForecast

FIRR Model – Freight Forecast

Project Code
Project Detail ABC
Project Type New Line
Zone ABC

Indian Railways

Passenger Forecast

	Year	Tonnage	No.of Trucks/Trips	Veh KM	Avg. Lead (KM)	Weighted Avg. Commodity price	MIBOR rate per annum
1	2024	0	0	0	0	0	0.00%
2	2025	0	0	0	0	0	0.00%
3	2026	0	0	0	0	0	0.00%
4	2027	0	0	0	0	0	7.38%
5	2028	0	0	0	0	0	7.38%
6	2029	0	0	0	0	0	7.38%
7	2030	0	0	0	0	0	7.38%
8	2031	0	0	0	0	0	7.38%
9	2032	0	0	0	0	0	7.38%
10	2033	0	0	0	0	0	7.38%
11	2034	0	0	0	0	0	7.38%
12	2035	0	0	0	0	0	7.38%
13	2036	0	0	0	0	0	7.38%
14	2037	0	0	0	0	0	7.38%
15	2038	0	0	0	0	0	7.38%
16	2039	0	0	0	0	0	7.38%
17	2040	0	0	0	0	0	7.38%
18	2041	0	0	0	0	0	7.38%
19	2042	0	0	0	0	0	7.38%
20	2043	0	0	0	0	0	7.38%
21	2044	0	0	0	0	0	7.38%
22	2045	0	0	0	0	0	7.38%
23	2046	0	0	0	0	0	7.38%
24	2047	0	0	0	0	0	7.38%
25	2048	0	0	0	0	0	7.38%
26	2049	0	0	0	0	0	7.38%
27	2050	0	0	0	0	0	7.38%
28	2051	0	0	0	0	0	7.38%
29	2052	0	0	0	0	0	7.38%
30	2053	0	0	0	0	0	7.38%
31	2054	0	0	0	0	0	7.38%
32	2055	0	0	0	0	0	7.38%
33	2056	0	0	0	0	0	7.38%
34	End	0	0	0	0	0	0.00%
35	End	0	0	0	0	0	0.00%
36	End	0	0	0	0	0	0.00%
37	End	0	0	0	0	0	0.00%
38	End	0	0	0	0	0	0.00%
39	End	0	0	0	0	0	0.00%
0	0	0	0	0	0	0	0.00%

..30 RollingStock | Sensitivity | Sheet1 | GMT | >>EIRR>>

FIRR Model – EIRR Output

File No. GSF/FIRR/1/2023 (Computer No. 3418145)

1564678/2023/DG/O DIR/GS/FINANCE

Project Code -
Project Detail BG line between Sardega - Gare Pelma
Project Type New Line
Zone SECR

Hardcoded inputs
Formula based numbers not to change

Indian Railways

0.00%

Passenger Forecast

(INR/Lakh)

	Year	OpFactor	Economic Capex	Economic Opex	Travel Time Saving (VoT)	Freight Time Saving	Vehicle Operating Cost	Accident Cost	Reduction in Road Infra cost	Road Infra Saving	Employment Benefit-Construction	Employment Benefit-Operation	Emission Cost- CO2	Emission Cost-Others	Saving in Fuel and Economic impact	Deconges tions	Travel time reliability	Increase in railway throughput	Total Benefit
1	2024	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	2025	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2026	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	2027	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	2028	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	2029	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	2030	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	2031	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	2032	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	2033	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	2034	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	2035	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	2036	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	2037	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	2038	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	2039	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	2040	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	2041	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	2042	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	2043	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	2044	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	2045	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	2046	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	2047	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	2048	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	2049	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	2050	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	2051	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	2052	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	2053	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	2054	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
32	2055	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
33	2056	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34	End	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	End	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
36	End	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00


Thank You
Gati Shakti Dte on 14/09/2023 03:48 pm

आज़ादी का अमृत महोत्सव

भारत सरकार/ Government of India
रेल मंत्रालय/ Ministry of Railways
(रेलवे बोर्ड/ Railway Board)

Azadi Ka Amrit Mahotsav

No. 2022/Gatishakti/EU/49 New Delhi, dated: 19.08.2022

The General Managers
All Indian Railways/PUs, NF(Con), CORE
DG/RDSO/Lucknow, DG/NAIR/Vadodara

Sub: Economic Appraisal framework for evaluation of Railway Project.

Ref: AM's Multi- disciplinary Committee Report dated 31.05.2022 on comprehensive project appraisal system for sanctioning new projects by factoring in "Network Effect".

Vide reference above, AM's Committee had suggested that the Economic Appraisal Framework being used by Indian Railways needs to be modified to factor in network effect. Additionally, it was felt that as per the extant evaluation, the Economic IRR do not fully capture the socio-economic impact of railway project as envisaged in Finance Code.

2.0 Accordingly, with the approval of Board (M/Infra, M/O&BD, MF and CRB & CEO), framework has been finalized detailing the methodology to be followed for calculating the Economic IRR giving due weightage to the network effect and other determinants that enable calculating economic cost and benefits (copy enclosed).

3.0 Zonal Railways are advised to undertake pilot for evaluation of EIRR of one project of New line/Doubling/Multi-Tracking/GC as per the guidelines enclosed and submit the same to Board within one month. Also, this revised framework of EIRR may be followed till issuance of any further directions/guidelines in this regard.

(Kusum Mishra)
Economic Advisor
Railway Board

No. 2022/Gatishakti/EU/49 New Delhi, dated: 19.08.2022

1. The PFAs, All Indian Railways & Production Units.
2. Dy. Comptroller and Auditor General of India (Railways), Room No.224, Rail Bhavan, New Delhi.

KRISHNA V R

(For Member Finance)

Copy to:

1. Advisor to MR, EDPG to MR, OSD to MR, EDPG to MOS(D), EDPG to MOS(J)
2. Chief Administrative Officer/Construction of all Indian Railways.
3. CMD/RVNL, CMD/IRCON, CMD/IRCON, CMD/KRCL, CMD/RITES & CMD/DFCCIL.

Railway Project Economic Appraisal Framework Note

Ministry of Railways

1. Comprehensive Economic IRR approach factoring Network effect

Project economic analysis aims at ensuring efficient allocation of scarce resources and raising the welfare of its citizens, so that it benefits the country as a whole. All resource investments have an opportunity cost because, if the resource is not allocated to the project, it will create value elsewhere in the economy.

The Philosophy of economic valuation of railway investments is indicated in the Annexure "F" of Chapter II, Indian Railway Financial Code (Vol-1). Some of the fundamental principles on which economic evaluation of Railway investments should be carried out are as follows:

- Economic benefits attributable to a particular investment can, for a number of reasons, exceed the revenues directly accruing to the Railways in the form of fare and freight receipts.
- Rail transportation can make a substantial indirect contribution as well to general wellbeing by facilitating economic expansion. A new line, in a backward region not well endowed with alternative modes of transportation, stimulates the growth of output and employment by widening the market for local products as well as by creating a market for some hitherto unexploited natural resource. The quantification of such indirect benefits can at best be approximative.
- Great care should be taken in estimating social benefits for the purpose of economic appraisal of railway investments. Such benefits should, to the extent possible, be quantified with a reasonable degree of accuracy. Thorough investigations at the traffic survey stage would help in identifying the "developmental effects" and in estimating broadly the magnitude the complementary investments that may be required.
- The expenditure flows associated with Railway projects can, to varying extents, diverge from the cost to the economy of acquiring resources needed for their implementation and operation. The prices at which certain inputs and resources are made available to the Railways, for instance, may understate or exaggerate their real cost to the economy.

It is, however, noticed that different methods are being used for the economic valuation of railway investments. With a view to standardise the procedure, and bring clarity, a comprehensive approach for economic IRR analysis of Indian Railway Line Projects is indicated below.

It is pertinent to highlight that as prescribed in above code viz. "*Thorough investigations at the traffic survey stage would help in identifying the "developmental effects"*, it is critical that traffic studies are based on required primary and secondary data. A brief guidance on traffic demand assessment based on various primary and secondary data is appended as Annexure IV of this note.

It is clarified that this note is applicable only for mainline projects viz. new line or multi-tracking projects.

1.1. Basis adopted for EIRR Analysis

For the appraisal of a Railway project proposal, the economic IRR analysis should be done based on various parameters such as the project's economic benefits, economic costs, and sensitivity analysis (against variation in key project parameters) to assess economic rationale and economic viability on the basis of project life cycle costs. The approach, prescribed herein, takes into account a number of direct and indirect benefits to be accounted for in the economic cost benefit analysis, in line with national and global relevant best practices (MoUHA, MoRTH and ADB). The proposed approach also considers the recommendations from the report

prepared by Multi- disciplinary Committee of Additional Members on Comprehensive Project Appraisal System for sanctioning new projects by factoring in the "Network Effect". The framework takes certain assumptions from the MoUHA guidelines, and these guidelines are taken as a base as it is updated from time to time and accepted across national infrastructure projects. This note aims at providing a comprehensive approach to analyse economic IRR of Indian Railway Line Projects.

1.2. Proposed Economic IRR analysis framework

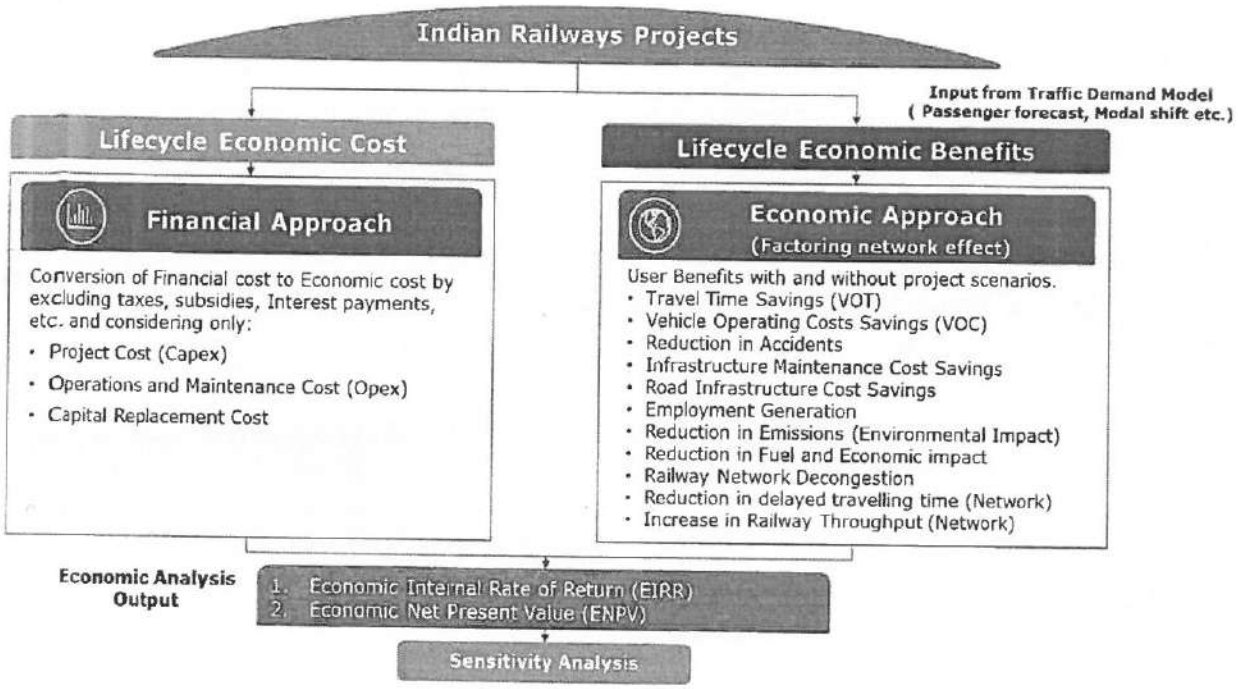


Figure 1 Proposed Economic IRR analysis framework

Railway projects provide larger economic and social benefits to the society in terms of reduction in cost and time of travel, a substantial reduction in emissions reducing chronic diseases, reduction in road accidents, etc. A railway project improves mobility of people and efficiency of commodity flow by providing seamless connectivity with the rest of network. In addition, new railway projects can also influence the existing rail network and create benefits outside the local area of the project depending upon the scale and size of the project. This can be referred to as "Network effects".

The proposed economic IRR analysis framework incorporates Direct and Indirect benefits of the project, factoring network effects. The methodology and source list for the proposed economic analysis framework is summarized and attached as Annexure-I and Annexure- II.

Annexure I

Steps for Calculating Economic IRR factoring Network effect

The steps in economic analysis are as described below:

Step 1: Define Project Horizon

The project horizon comprises of construction and operation period of the Railway project. During the project horizon, the cost and benefits associated with the project should be estimated. The horizon period for the purpose of economic analysis may be taken as 30 years in line with codal life of track assets as per para 219, Chapter 2, Volume 1 of Indian Railway Finance Code.

Step 2: Develop Alternative Scenarios

This step involves development of alternative project scenarios to which a comparison with the project case that is undertaken is to be made. For example, economic cost and benefits of undertaking a Railway project ("With Project") are to be compared with the base case i.e. "Without Project" or "Do Nothing" scenario or any other alternative project in order to arrive at incremental costs and benefits.

Step 3: Determine Economic Cost of the Project

The steps involved in determining the Economic Cost of the project are specified below:

Table 1 Steps for estimating Economic Cost of Project

Steps	Methodology
Project Cost[1,2]	The Project cost covers both the implementation period of major investments and operating years, known as the project operating life. Costs are measured in constant prices of a base year. The Project Cost includes: 1. Capital Cost 2. Operations and Maintenance Cost
Project Economic Cost	The economic costs of the capital works and annual operation and maintenance costs are calculated from the financial cost estimates using economic conversion factors given in table 1 to exclude the impact of: 1. Price contingencies/price escalations 2. Import duties and taxes 3. Sunk costs 4. Interest payment, principal payment and interest during the construction period.

Source: MoHUA Appraisal Guidelines for Metro Rail Project Proposals

Step 4: Estimation of Economic Benefits of the Project

Year wise project benefits should be estimated during the project operation period. The "With project" scenario should be compared with the option of "Without project" scenario to determine the incremental economic benefits. The economic benefits of the projects should capture the economic and social network impact on any railway project.

---

[1] Capital replacement cost has not been assumed in the project cost during the Economic IRR calculation. In case it is assumed, the project horizon period needs to be extended accordingly to account for benefits over replaced asset's life horizon. Accordingly, it is recommended that the project horizon should be equal to the prescribed life of asset as per the applicable IR code.

[2] Rolling stock cost is not assumed in the project cost during the Economic IRR calculation, given that the rolling stock is not dedicated to the project.

The following quantifiable benefits are accrued to the society owing to implementation of the Railway project.

Direct and Indirect Benefits	Network Benefits
Travel Time Savings (VOT)	Reduction in Emissions (Environmental impact)
Vehicle Operating Costs Savings (VOC)	Reduction in Fuel and Economic impact
Reduction in Accidents	Railway Network Decongestion
Infrastructure Maintenance Cost Savings	Reduction in delayed travelling time (Network)
Road Infrastructure Cost Savings	Increase in Railway Throughput (Network)
Employment Generation	

a) Direct and Indirect benefits

The railway investments provide substantial direct and indirect benefits to the economy. The components and steps involved in determining the direct and indirect economic benefits are:

i) Travel Time Savings (VOT)

Railway projects significantly contribute to modal shift owing to higher speeds and comfort to passengers. This leads to travel time savings for passengers travelling on rail system over the existing transport modes because of faster speed of Railway.

The formula for calculation of travel time savings is presented below.

Travel Time Savings (VOT)	=	Passenger Time Savings (Hour)	X	Value of Passenger time (INR per Hour)
Source		(Traffic demand studies/surveys)		(Estimate based on per capita income of the region on new railway line corridor; concerned State Economic Survey documents, take weighted average based on OD patterns of traffic and passenger profile (basis traffic surveys) in case of multiple states involved)

The formula for calculation of Freight time savings is presented below.

Freight Time Savings	=	Difference in the freight time savings between rail and the next dominant mode (hour)	X	Volume of Freight that derives benefit over next predominant mode (ton)[3]	X	Value of Freight time (INR per ton hour)[4]
Source		(Estimate based on freight demand studies/surveys)		(Freight demand studies/surveys)		$\frac{(\textit{Weighted}\ \text{Average commodity price}^5 \times \text{MIBOR Rate per annum}^6 \times \text{Economic price Conversion factor (0.85)})}{365\times24}$

ii) Vehicle Operating Cost Savings (VOC)

[3] In case the next pre-dominant mode is Railway itself, for eg.in case of coal lines, then entire projected freight on new line shall benefit from improved speed and hence included. In case road is the pre-dominant mode for a commodity, then only the incremental traffic shifted from road to rail shall benefit and accordingly taken as much.

[4] Inputs in different currency shall be converted in INR.

[5] Weighted Average Commodity Price: Σ(share of commodity in total volumes (%)×Average value of commodity per ton) For eg. If total traffic volumes is 10 tonn comprising Coal (20%, average value INR 4000 per ton), Steel (70%, average value INR 35000 per ton) and Cement (10%, average value INR 7000 per ton), then weighted average commodity price is = (0.2×4000)+ (0.7×35000)+0.1×7000 = INR 26000

[6] Average 3 month Mibor Rate or short term interest rate for the year, sourced from Financial Benchmarks of India Ltd sourced from https://www.fimmda.org/modules/securitiesApproval/securitiesApproval.aspx?op=mibor

Vehicle operating costs (VOCs) are the cost to the owner of operating a motor vehicle. Savings in vehicle operating costs of different modes arise due to a decrease in the number of vehicle trips on the roads. The VOC cost varies based on vehicle type (2-wheelers, 3-wheelers, cars, buses or any other prevalent mode) and is calculated using the equations and guidelines given in the "Manual on Economic Evaluation of Highway Projects in India, 2019" by the Indian Road Congress (IRC).

The formula for calculation of travel time savings is presented below.

Vehicle Operating Cost (VOC) =	No of trips (Difference between with & without scenario)	X	Average Lead (Km)	X	Vehicle Operating Cost (INR per Km)
Source	(Traffic demand studies/surveys)		(Estimate based on Traffic demand studies/surveys)		Manual on Economic Evaluation of Highway Projects in India, 2019[7]

iii) Reduction in Accidents

The reduction in traffic volumes on roads due to the modal shift to rail is expected to reduce road accidents on the project corridor. Reduction in accidents will lead to saving of lives, reduction in damages to vehicles and savings towards medical, insurance expenses, administrative expenses on police and the intangible psychosomatic cost of pain to people involved in the accidents and their families.

The economic benefits due to the reduction in accidents are calculated as follows:

Accident Costs =	Vehicle Km (Difference between with & without scenario)	X	Accident rate (per vehicle Km)	X	Accident Cost (INR)
Source	(Traffic demand studies/surveys)		Collection of past accident data along the project corridor; MoRTH report on Road accidents in India[8]		Toolkit on Finance and Financial Analysis, 2013 by MoUHA[9]

iv) Infrastructure Maintenance Cost Savings

Infrastructure Maintenance Cost Savings will arise due to reduced need for maintenance of the existing road infrastructure owing to reduced traffic on account of modal shift. The benefits can be calculated using the reduction in vehicle kilometres due to modal shift and the road infrastructure maintenance cost per km.

Infrastructure Maintenance Cost Savings =	Reduction in vehicle km due to modal transfer (km)	X	Infrastructure maintenance cost (INR/Vehicle km)
Source	(Estimate based on traffic demand studies/surveys)		(MoRTH Annual Report[10]; Estimate based on published values on annual expenditure on roads and traffic and annual vehicle km)

v) Road Infrastructure Cost Savings

Additional road infrastructure or upgrading the existing road infrastructure will be required to solve the congestion problem and accommodate growth in traffic in case the railway line is not

[7] https://www.scribd.com/document/522057946/IRC-SP-30-2019-Manual-on-Economic-Evaluation-of-Highways-in-India
[8] https://morth.nic.in/sites/default/files/RA_2020.pdf
[9] https://smartnet.niua.org/sites/default/files/resources/finance_and_financial_assessment_toolkit.pdf
[10] https://morth.nic.in/annual-report

introduced. The new railway line will bring savings in investment in road infrastructure due to shifting of passengers to Rail and withdrawal of vehicles in the project corridor.

The road infrastructure savings will be calculated using the below formula.

Road Infrastructure savings	=	Additional express highway lanes required in without Project situation (km)	X	Cost of road construction (INR per km)
Source		(Estimate based on traffic demand (Number of PCU trips saved /road PCU capacity, ideally 1600 Passenger Car Unit (PCU) per hour))		(Normative Cost Norms for the National Highways by MoRTH)

vi) Employment Generation

During the period of construction, manpower will be needed for various project activities. In post-construction phase, manpower will be employed for the operation and maintenance of the system. Thus, the project would provide substantial direct employment. In addition to these, more people would be indirectly employed in allied activities.

Employment benefits	=	Capex (INR)	X	Employment cost as a % of Project Cost (INR)	X	Share of Skilled vs Unskilled employment	X	Direct/Indirect employment multiplier
Source		(Project DPR Cost chapter)		(Project DPR Cost chapter)		(20:80 ratio assumption; To be adjusted based on project requirement)		ADB guidelines for the economic analysis of projects[11]

b) Network Benefits

Railway investments can influence the entire railway network and generates Network benefits in terms of reduction in environmental impact due to a decrease in emissions, reduction in railway network congestion and improvement in travel time reliability etc. The components and steps involved in determining the economic benefits factoring network effects are:

i) Reduction in Emissions

Railway projects significantly contribute to pollution reduction, and these should be considered in economic analysis. The significant environmental savings come from decrease in air pollution associated with existing non-railway traffic due to the modal shift from the existing modes of transport to rail.

The reduction in emissions will be calculated based on the decrease in vehicle kilometres, volume of pollutants emitted from different modes and the cost of treatment per ton.

Emission Costs	=	Vehicle Km (Difference between with & without scenario)	X	Volume of Pollutant released per Km (grams per km)	X	Treatment cost/ton (INR)
Source		(Traffic demand studies/surveys)		(Source Profiling for vehicular Emissions Report by CPCB[12])		(MoHUA Appraisal Guidelines for Metro Rail Project Proposals[13])

ii) Reduction in Fuel and economic impact

[11] https://www.adb.org/sites/default/files/institutional-document/32256/economic-analysis-projects.pdf
[12] https://cpcb.nic.in/displaypdf.php?id=U291cmNlX1Byb2ZpbGVfVmVoaWNsZXMucGRm
[13] https://mohua.gov.in/upload/whatsnew/59c21852a4874Appraisal%20Framework%20Sept%202017.pdf

Reduction in the number of vehicles on the roads and decongestion effect with the construction of new railway line gives benefits to the economy in terms of reduction in fuel consumption. A decrease in fuel consumption will result in a reduction in the import of crude oil.

Fuel and economic savings impact	=	Vehicle Km (Difference between with & without scenario)	X	Fuel economy (Average mileage of each mode)	X	Avg fuel cost (INR per liter)
Source		(Traffic demand studies/surveys)		Bureau of Energy Efficiency[14]		Petroleum Planning & Analysis Cell[15]

iii) Railway Network Decongestion

Construction of a new railway line will reduce congestion on the existing line or section of the rail network and will help in improving line capacity of the section. This will also reduce the lead time of trains moving via new railway line instead of moving via existing rail route. The savings due to the railway network decongestion can be calculated using the below formula.

Railway Network Decongestion	=	Increase in average speed on the section or adjacent network	X	Average Lead on network (Km)	X	Value of Passenger Time	-	Value of Time Travel Savings estimated in #i)
Source		(To be estimated by Project Team using Rail network data)		(To be estimated by Project Team)		(Estimate based on per capita income on railway network)		Travel Time Savings on proposed rail corridor

iv) Reduction in delayed travelling time (Travel Time Reliability)

Travel time reliability refers to reaching the destination in a consistent journey time. Construction of a new railway line will result in an improvement in travel time reliability due to the reduction in rail congestion and predictability of travel time. The value of travel time reliability is estimated from the reduced travel time variability and associated buffer time that passengers have allowed before making trips. The savings due to the travel time reliability or reduction in delayed travel time will be calculated using the below formula.

Improvements in Travel Time Reliability	=	No of Trips (Difference between with & without scenario)	X	Reduction in Buffer time per trip	X	Reliability Ratio	X	Value of Passenger time (INR per Hour)
Source		(Traffic demand studies/surveys)		(Traffic demand studies/surveys)		(80%; Project team assumptions)		Estimate based on per capita income on railway network)

v) Increase in Railway Throughput

Construction of a new railway line will result in additional passenger traffic on the rail network due to a reduction in travel time and an increase in the number of choices for a passenger. The economic benefit due to the increase in the railway throughout can be calculated using increase in passenger traffic and average revenue generated per passenger.

Increase in Railway Throughput	=	Increase in passenger and Freight traffic due to modal shift	X	Average revenue per passenger and Freight Ton km (INR)
Source		(Traffic demand		Indian Railways Annual Report

[14] https://beeindia.gov.in/content/fuel-efficiency
[15] https://www.ppac.gov.in/content/149_1_PricesPetroleum.aspx

studies/surveys)

Step 5: Economic conversion factors

The financial cost and benefits of the railway project are converted to economic cost and benefits using economic conversion factor. Economic conversion factors are used to adjust for taxes, subsidies, inefficient land or wage markets, and other transfer payments, before performing the economic analysis. The conversion factors for different categories are given in Table 1.

Table 2 Economic Conversion Factor

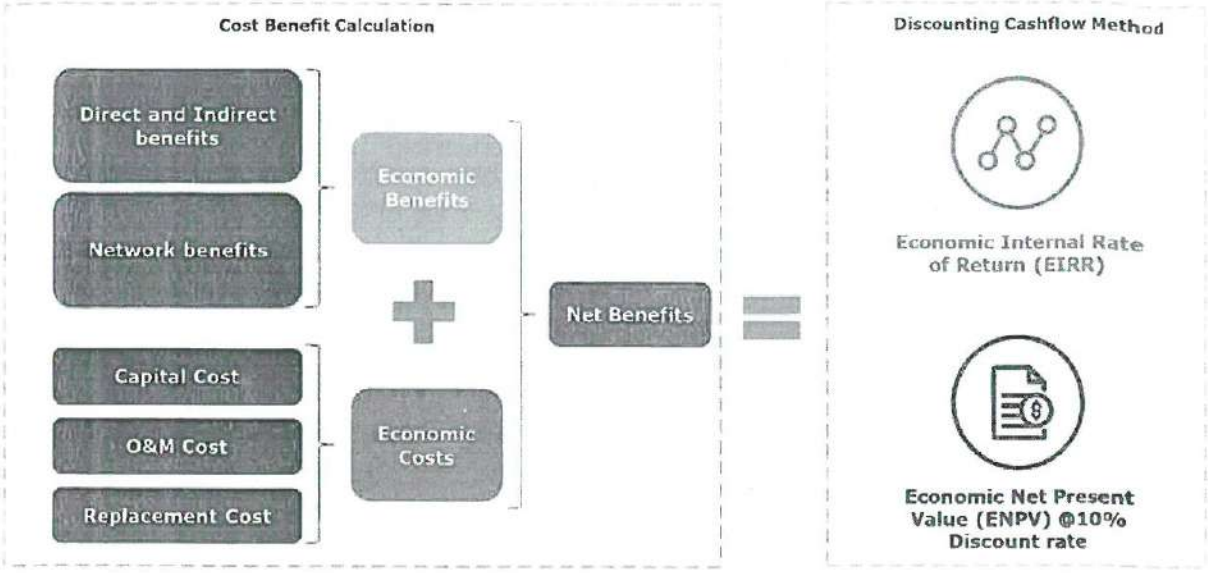
Type	Components	Economic factor
Economic Cost	Capital Cost	0.83
	Operations and Maintenance Cost	0.87
	Capital Replacement Costs	0.87
Economic Benefits (factoring network effect)	Travel Time Savings (VOT)	1.00
	Economic Price conversion coefficient	0.85
	Vehicle Operating Costs Savings (VOC)	0.90
	Accident Costs	0.90
	Infrastructure Maintenance Cost Savings	0.87
	Road Infrastructure Cost Savings	0.80
	Employment Generation	1.00
	Emission Costs	1.00
	Reduction in Fuel and Economic impact	0.80
	Railway Network Decongestion	1.00
	Reduction in delayed travelling time (Travel Time Reliability)	1.00
	Increase in Railway Throughput	1.00

Source: MoHUA Appraisal Guidelines for Metro Rail Project Proposals

Step 6: Economic Analysis Output

The outputs of economic analysis are calculated using two parameters.

1. Economic Net Present Value (ENPV)- ENPV is the sum of differences between the discounted benefits and cost flows.
2. Economic Internal Rate of Return (EIRR)- EIRR is the discount rate at which the ENPV becomes zero.



Step 7: Sensitivity Analysis

The range of sensitivity can be carried out to see the impact of change in critical parameters in the range of 5% to 20% on EIRR. The critical factors such as

1. Cost overruns due to delay or other factors
2. Increase in Operations and Maintenance Cost
3. Reduction in passenger traffic
4. Reduction in economic benefits
5. Combination of reduction in benefits and increase in cost.

Annexure II

List of Data sources

Parameter	Items	Source
Economic Costs		
Capital Cost		Project DPR
Operations and Maintenance Costs		Project DPR
Capital Replacement Costs		Project DPR
Economic Benefits		
Travel Time Savings (VOT)	Passenger Time Savings	Traffic demand studies/surveys
	Value of Passenger time	To be estimated based on per capita income on new railway line corridor; State Economic Survey document. Weighted average based on OD patterns of traffic and passenger profile (basis traffic surveys) to be adopted in case of multiple states involved
Freight Time Savings	Difference in the freight time between rail and the next fastest mode (hour)	To be estimated by Project Team based on freight demand studies/surveys
	Volume of Freight (ton)	Freight demand studies/surveys
	Value of Freight time (INR per ton hour)	$= \frac{(Weighted\ Average\ commodity\ price\ (basis\ stakeholder\ consultation\ and\ traffic\ study) \times MIBOR\ Rate\ per\ annum \times Economic\ price\ Conversion\ factor\ (0.85))}{365 \times 24}$ • Weighted Average Commodity Price: **Σ(share of commodity in total volumes (%) × Average value of commodity per ton)** • For eg. If total traffic volumes is 10 tonn comprising Coal (20%, average value INR 4000 per ton), Steel (70%, average value INR 35000 per ton) and Cement (10%, average value INR 7000 per ton), then weighted average commodity price is = (0.2×4000)+ (0.7×35000)+0.1×7000 = INR 26000 • Average 3 month Mibor Rate or short term interest rate for the year, sourced from Financial Benchmarks of India Ltd[16]
Vehicle Operating Cost (VOC)	No of trips	Traffic demand studies/surveys
	Average Lead (Km)	Traffic demand studies/surveys

[16] https://www.fimmda.org/modules/securitiesApproval/securitiesApproval.aspx?op=mibor

	Vehicle Operating Cost	Manual on Economic Evaluation of Highway Project[17]
Reduction in Accidents	Vehicle Km	Traffic demand studies/surveys
	Accident rate	Road Accidents in India, MoRTH[18]; Collection of past accident data along the project corridor
	Accident Cost	Toolkit on Finance and Financial Analysis, 2013 by MoHUA[19]
Infrastructure Maintenance Cost Savings	Vehicle Km	Traffic demand studies/surveys
	Infrastructure maintenance cost	Ministry of Road Transport and Highways[20]
Road Infrastructure Cost savings	Length of Road	To be estimated based on Demand estimation (Number of PCU trips saved /road PCU capacity, ideally 1600 PCU per hour)
	Road construction cost	Ministry of Road Transport and Highways[21]
Employment benefits	Capex	Project DPR (Cost Chapter)
	Employment cost as a % of Project Cost	Project DPR (Cost Chapter)
	Share of Skilled vs Unskilled employment	20:80
	Direct employment multiplier	ADB guidelines[22]
Reduction in Emissions	Vehicle Km	Traffic demand studies/surveys
	Volume of Pollutant	CPCB Source Profiling for vehicular Emissions Report[23]
	Treatment cost/ton	MoHUA Appraisal Guidelines for Metro Rail Project Proposals[24]
Fuel and economic Savings impact	Vehicle Km	Traffic demand studies/surveys
	Fuel economy	Bureau of Energy Efficiency[25]
	Fuel Price	Petroleum Planning & Analysis Cell[26]
Decongestion of Railway Network	Increase in average speed on the section or adjacent network	To be estimated by Project Team using Rail network data
	Average Lead (Km)	To be estimated by Project Team using Rail network data
	Passenger throughout on Network	To be estimated based on per capita income on railway network

[17] https://www.scribd.com/document/522057946/IRC-SP-30-2019-Manual-on-Economic-Evaluation-of-Highways-in-India
[18] https://morth.nic.in/sites/default/files/RA_2020.pdf
[19] https://smartnet.niua.org/sites/default/files/resources/finance_and_financial_assessment_toolkit.pdf
[20] https://morth.nic.in/annual-report
[21] https://morth.nic.in/sites/default/files/circulars_document/Revision_of_Normative_Cost_Norms_for_National_Highways.pdf
[22] https://www.adb.org/sites/default/files/institutional-document/32256/economic-analysis-projects.pdf
[23] https://cpcb.nic.in/displaypdf.php?id=U291cmNlX1Byb2ZpbGVfVmVoaWNsZXMucGRm
[24] https://mohua.gov.in/upload/whatsnew/59c21852a4874Appraisal%20Framework%20Sept%202017.pdf
[25] https://beeindia.gov.in/content/fuel-efficiency
[26] https://www.ppac.gov.in/content/149_1_PricesPetroleum.aspx

	Value of Passenger time	Traffic demand studies/surveys
Improvements in Reduction in delayed travelling time (Travel Time Reliability)	No of trips	Traffic demand studies/surveys
	Buffer time	80%;
	Reliability Ratio	To be estimated based on per capita income on rail network
	Value of Trave time	Traffic demand studies/surveys
Increase in Railway Throughput	Passenger traffic	To be estimated by Project Team using Rail network data
	Average revenue per passenger	Indian Railways Annual Report and Accounts[27]
	Freight Traffic	Traffic demand studies/surveys
	Average revenue per Freight ton	Indian Railways Freight Tariff schedule X length of line
Economic conversion factors		MoHUA Appraisal Guidelines[28]; Assumptions

[27] https://indianrailways.gov.in/railwayboard/uploads/directorate/stat_econ/Annual-Reports-2020-2021/Annual-Report-English.pdf
[28] https://mohua.gov.in/upload/whatsnew/59c21852a4874Appraisal%20Framework%20Sept%202017.pdf

Annexure III - Data to be filled by Project team to calculate Financial and Economic IRR of Railway Projects

DATA FOR FIRR, EIRR, NETWORK EFFECT & COMMON USER FACILITY					
Name of Project (NL/DL/GC):					
SN	**Item**		**Description**		
1	**FIRR:**				
a	Data for calculation of FIRR and FIRR values				
	As per existing Financial Code				
b	FIRR of the project				
2	**EIRR:**				
a	Field data for calculation of EIRR, including network effect				
Sr No	**Parameter**	**Items**	**Description***		
			Passenger	**Freight**	**Whether filled or not#**
1	Travel Time Savings (VOT)	Passenger Time Savings by each mode			
		Value of Passenger time			
		Value of freight time savings			
2	Freight Time Savings	Difference in the freight time between rail and the next fastest mode (hour)			
		Volume of Freight (ton)			
		Value of Freight time (INR per ton hour)			
3	Vehicle Operating Cost (VOC)	No of trips (Difference between with & without scenario) by each mode			
		Average Lead (Km)			
		Vehicle Operating Cost by each mode			
4	Reduction in Accidents	Vehicle Km (Difference between with & without scenario)			
		Road accident rate			
		Accident Cost (Fatal vs non-fatal accident)			
5	Infrastructure Maintenance Cost Savings	Vehicle Km (Difference between with & without scenario)			
		Infrastructure maintenance cost per km			
6	Road Infrastructure Cost savings	Additional express highway lanes required in without Project situation			
		Road construction cost per km			

7	Employment benefits	Project Capex			
		Employment cost as a % of Project Cost			
		Share of Skilled vs Unskilled employment			
8	Reduction in Emissions	Vehicle Km (Difference between with & without scenario)			
		Volume of Pollutant-CO2 by each mode			
		Volume of Pollutant Others by each mode			
		Treatment cost/ton - CO2			
		Treatment cost/ton- Others			
9	Fuel and economic Savings impact	Vehicle Km (Difference between with & without scenario)			
		Fuel economy by each mode			
		Fuel Price			
10	Decongestion of Railway Network	No of trips			
		Average Lead (Km)			
		Value of Passenger time			
11	Improvements in Reduction in delayed travelling time (Travel Time Reliability)	No of Trips (Difference between with & without scenario)			
		Reduction in Buffer time (Difference between with & without scenario) per trip			
		Reliability Ratio			
		Value of Passenger time			
12	Increase in Railway Throughput	Increase in passenger and Freight traffic (Difference between with & without scenario)			
		Average revenue per passenger and per Ton-km for freight			
3	**Network effect of the Project (paragraph)**				
4	**The work is a common user facility essentially required to improve mobility movement of passengers and goods for improving loading to achieve mission 3,000 MT**				

Dy.COM/GS or CTPM or PCOM

 # If the data is not filled, please provide the appropriate explanation and approval from designated authority.
**Inputs in different currency shall be converted in INR assuming the exchange rate on the day of analysis.*

Annexure IV

Demand assessment methodology

Demand assessment for Railway traffic requires a combination of activities such as hinterland demarcation, extensive field surveys, primary interactions with the stakeholders and other required research towards developing a base year demand matrix and undertaking demand projections. The methodology for the demand assessment is given below:

Task 1: Delineation of project influence area/ hinterland

The first task would be to identify influence areas/hinterland for the planned railway line, as well as accompanying port and industrial clusters. The influence zone within all states through which the proposed corridor would pass needs to be evaluated for the purpose of identifying the hinterland.

Based on extensive review of assessing passenger and freight movement on rail corridors, the hinterland/catchment area of rail corridors can typically be categorized into:

a) Primary hinterland: which includes end to end network of the proposed corridor including originating point, terminating point, all key regions falling along the corridor, or within a 150 km range from the corridor

b) Secondary hinterland: which includes regions from which cargo is either originating or terminating on the corridor, and

c) Tertiary hinterland: which includes region from which cargo is neither originating nor terminating on the proposed corridor but passing through the significant part of the corridor. It may be noted that only such regions will be considered under tertiary hinterland, wherein significant amount of cargo is currently moving from/to.

While identifying the hinterland, the study team should also consider main feeder lines connecting to the proposed corridor alignment. Further, in case, proposed corridor is expected to connect to ports, hinterland of identified ports should also be considered.

Task 2: Assessment of Base year demand

The next task would be to assess the base year traffic in the project hinterland. For this, traffic moving across different modes (road, railways and IWT) needs to be assessed. A robust data collection strategy combining primary and secondary surveys should by used to carve out the base year demand.

Traffic Surveys

a) Primary surveys

Name of Survey	Purpose	Method/ location	Duration of survey
Road Side Origin and Destination (OD) survey (sample survey)	To capture key flow attributes including: • vehicle origin, destination, • commodity (for freight), number of passengers (for passenger vehicles) • trip distance, • Travel time, and cost • frequency, • vehicle type (car, bus container, axles etc.)	Interview with drivers/ passengers at survey points on NHs and SHs. Toll locations are preferable.	At least 3 days (2 weekdays and 1 weekend) 16-24 hrs

Classified Volume count survey for roads #	To expand the Road O-D volumes for arriving at 24-hour traffic volume.	Traffic counts at the OD locations.	At least 7 days. 24 hrs.
Passenger Survey at Intercity Bus Terminal	To assess the demand for long distance passenger demand in the catchment. The following data should be captured during the survey: • Passenger boarding and alighting • Passenger OD • Frequency of travel • Fare • Travel time	Interview with passengers at the bus terminal and Ticket data from the operator (if available).	8-16 hours (depending upon the timetables)
Operator/industry survey (for freight)	To capture the time/ cost in each segment of supply chain. To understand various issues that an operator faces during transport movement.	Interview with Vehicle operators, Drivers, transport agencies.	
Stated preference survey for passengers and major cargo players	To capture the potential shift of passenger, cargo from other modes to Railways based on: • time and cost savings across ODs • Special value added services etc.	Interview with shippers, industries etc.	

 # This survey is undertaken by NHAI and same can be sourced from the regional offices of NHAI wherever available.

b) Secondary data collection:

Data points	Purpose	Source
Railway ODs for passenger and freight	To capture the existing railway traffic (if any) in the primary, secondary and tertiary catchment.	Indian Railways FOIS data and PRS data
Petrol sales data	To assess the periodicity of road transport demand. Also, the data is a key input in expanding daily traffic to average annual daily traffic (AADT).	Petrol Pump operators
Reports/ studies/ guidelines published by IWAI, NHAI and any other government and multilateral agencies for assessing financial and economic costs.		

Transport demand projections

Demand for transport is a derived demand, and therefore, it depends on how the transport-requiring industry grows over time. A top-down assessment needs to be undertaken for projecting transport demand. It will start with a compilation of existing transport demand, which will be informed by section 1.2. The transport demand must be projected based on appropriate macroeconomic indicators, past trends and econometric models to arrive at projected transport demand for a period upto 20-30 years from the baseline year. Along with this there needs to be

a holistic review of industry plans, upcoming SEZs and other proposed traffic intensive activities in the catchment. All such inputs must factor in during transport projections.

Rail transport demand is a subset of the transport demand projections. Hence, rail modal share for future years can be estimated based on mode choice models (based on time and cost analysis) and outputs from stated preference surveys in section 1.2.1.

Annexure-VIII

Generic guidelines for preparation/updation of DPR

CIVIL ENGINEERING:-

Sr No	Description	Proposed
1	Route Standard	As per classification
2	Gauge	1676 mm (B.G.)
3	Traction	Electric traction 2X25 KV AC traction
4	Loading standard	25 T Loading- 2008
5	Maximum permissible design speed	160 KMPH.
6	Maximum degree of curvature.	The geometry of track i.e., degree of curvature & transition length should be according to the speed potential of 160 kmph. Due to constraints ,max degree of curvature 3 degrees fully transition curve can be adopted duly bringing out the economic considerations. Curves should be avoided on major bridges and tunnel and yards as far as possible and if unavoidable ,personal approval of Chief Engineer to be obtained .
7	Ruling gradient	**PLAIN AREA:** 1 in 150 (Compensated). In case of any serious difficulty and constraint in providing ruling gradient of 1 in 150 (Compensated), to elaborate the constraints, and indicate the comparative costs for achieving the gradient of 1 in 150 vis any other steeper gradient proposed. Cost to include that of additional facilities required to haul the freight trains/passenger trains due to steeper gradient. **GHAT SECTION:** 1 in 100 (Compensated) **TUNNELS:** Flatter gradient up to 75 % of ruling gradient is desirable as per RDSO guidelines RDSO/2012/GE: G-0017. Ballast - less track in Tunnel. **BRIDGES:** Level on all important and Major Bridges. Skew and curves are to be avoided on major bridges /ROB's.
8	Maximum grade on approach to main river	As far as possible consistent with site conditions and not steeper than 1 in 150 compensated.
9	Permissible Maximum length of gradient in one stretch.	Preferably not more than 4.0 km in a continuous stretch for 1 in 100.
10	Gradient in yards	Not steeper than 1 in 1200 or consistent with prevailing gradient in existing yards. If any constraint due to site conditions than up to 1 in 400 may be adopted.
11	Station Layouts	Preferably in straight alignment, Avoid major bridge, ROB within station limits for main/loop lines. Perspective planning for future expansion.
12	Width of formation.	**BANK / CUTTING :** **Bank :** Single line (7.85 m) , Double line (13.16 m)

<table>
<tr><td></td><td></td><td>Cutting: Single line (7.85 m) , Double line (13.16 m)
Width of bank and cutting may be increased suitably based on extra clearances required on curves.</td></tr>
<tr><td>13</td><td>Side slopes.</td><td>H:V
i) Hard Rock : ¼ : 1
ii) Soft Rock : ¼ : 1
iii) Murum: 1 : 1
iv) Ordinary Soil : 2 : 1</td></tr>
<tr><td>14</td><td>Track structure</td><td>i) Rails: -60 kg First class
ii) Sleepers: -MBC sleepers 1660 No. per Km.
iii) Ballast Cushion: - 350 mm
iv) Welding of rails: -To convert in to CWR/LWR/SWRs as far as possible
v) Points & crossing: -
Only 60 Kg - 1:12 turnouts with thick web switch for passenger trains negotiating and 1 in 8 ½ turnouts with thick web switch for other lines. CMS crossings
vi) Girder Bridges: -
Same track Structure with H - beam sleeper and standard set of PSC sleepers on approaches under guard rails.
vii) Ballast less track in Tunnel.</td></tr>
<tr><td>15</td><td>Loop/sidings</td><td>Minimum clear length of one siding at any station where it is intended to cross trains:-
1. Shall be the length of longest train permitted in the section plus 35 m.
2. Although it may not be necessary till traffic develops to provide sidings for the largest possible train loads, land should be acquired for them and no building, level crossings or other obstructions should be permitted that will interfere with the crossing siding being lengthened to the following conditions.
<table>
<tr><td>On sections of the Railways where the ruling gradient is</td><td>Minimum clear available length of one siding for new work or alterations to existing works.</td></tr>
<tr><td>1 in 100 or flatter</td><td>750 m</td></tr>
<tr><td>Steeper than 1 in 100</td><td>Length of the longest train permitted in the section plus 35 m.</td></tr>
</table></td></tr>
<tr><td>16</td><td>Track centers.</td><td>5.3 m for doubling, 7.8 m for 3rd line
5.3 m for 4th line from 3rd line.
6.10 m (min) for loop lines & sidings in yards.
Track center near existing Bridges and tunnel etc. to be fixed with consideration of safety of existing structure as per SOD.</td></tr>
<tr><td>17</td><td>Level Crossings</td><td>(i) No level x-ing in new lines.
(ii) All existing L-xings to be eliminated in Doubling/Multiple lines.</td></tr>
<tr><td>18</td><td>Bridges</td><td>Design Loading:
25 T- 2008 loading standards
Super structure:</td></tr>
</table>

		Standard spans to be used as per master list of Drawing (BS-28) issued by RDSO. **SUB structure:** CC piers and abutments as per Master list (BS-28) as far as possible. Non-standard RCC piers / Abutments can be considered in special circumstances. **Foundations:** Open foundations shall be preferred as far as possible. **Minor Bridges:** PSC slab to be used as far as possible. RCC box may be used in exceptional case, Avoid twin RCC box. **FOB:** Existing approved span of FOB's.
19	No. of stations to be opened initially	All proposed stations.
20	Railway electrification	All section will be constructed as electrified section
21	Obligatory points	To connect all important towns, existing stations.
22	Traffic facilities	Proposed traffic facilities, junction arrangements & yard plans shall be as proposed in traffic chapter & concept yard plans.
23	Track machine siding	Provision of track machine siding of 300 m length @ 30-50 km interval facility as per Annexure 8.11 of IRTMM - 2019 with one track machine hut (6x4m) near track machine siding.
24	Ballast siding	Ballast siding of 500 m length @ 100-150 km interval.
25	Stations	High level platforms. Major station up gradation done with ballast less track.
26	Tools and equipment	As per JPO of PCE and CAO/C dated 01/06/2022
27	Service Building	Service Buildings for various offices/departments with sufficient open space, sheds for store & equipment including that of RPF post.
28	Quarters	Requirement of sufficient quarter for officers, supervisor and staff at various stations.
29	Security	Security of newly created infrastructures, assets, buildings and equipment of all departments.
30	Vehicles	Provision of vehicles for inspection, maintenance and breakdown/failure restoration in the section.
31	Water Supply	Planning and design of water supply system to various service building, quarters, stations etc.

Additional Special Technical issues for consideration.

A. Technical issues

1. Tunnel design for Double line section should preferably be Double Bore single Track with suitable interconnection and fire/ventilation . For single line tunnel , arrangement of escape tunnel in case of longer tunnel beyond threshold length.
2. Method of execution - by conventional or TBM
3. Adequate trespass control measures may be adopted –
   a. Pedestrian/Light vehicular traffic of size (2.5x2.5 m) subways may be planned at about 1000 m interval for cross passages in new lines..
   b. For provision of cross passages. Minimum height of embankment may be suitably kept.

4. Ballast less track may be provided at tunnels and major station/terminals in accordance with Railway Board instructions.
5. Provision of transition system for bridges and tunnels at change of Track stiffness may be provided

II) **S & T**

I. SIGNALING

S. No	Description	Provision
1	Type of Signaling	MACLS, Std.-II Interlocking.
3	Type of Interlocking	Electronic Interlocking (EI).
4	Power Supply	IPS as per Standard drawing with VRLA Battery sets at stations.
5	DG Sets	DG sets to be provided at all major junctions and major EI's as per policy in vogue.
6	Points	Motorized operation with independent detection and operation circuit and cable.
7	Track Circuits	DC Track circuits with dual detection & having 10 mm center post Glued joints and QTA type relays with QSP repeater relays. MSDAC for dual detection at vulnerable location.
8	Block Working	Absolute Block System with Token less block instruments and BPAC shall have both Quad cable & OFC media with dual detection system.
9	Interlocked Level crossing gates	Power operated lifting barrier with Sliding boom. Road signals with hooter. No. Of LC Gates if any to be specified. AT supply
10	Use of type of cables - Signaling	Following type of cables have been standardized by Central Railway vide letter CON.129.N.16 (Sys.Imprv.) /2 dtd. 09-04-2012. 12 core 6 core of 1.5 sq. mm
11	Use of type of cables - Telecom	Axle Counter – 6 quad cable jelly filled as per latest RDSO specifications with associated equipment Required for OFC & dual detection shall be included.
12	Data Logger	Networked Data logger to be provided at all stations including midsection interlocked LC gates. Data connectivity requirements and associated hardware, software, infrastructure and facilities. Minimum capacity of data logger is as under:- In EI – 1024 inputs In LC gates/IBH/ABS –RTU Hardware and software with infrastructure for divisional set up of data logger networking. All data loggers to be networked with divisional and Zonal HQ and integrated with MIS on E1 channel.
13	Cable laying & protection	Line wise and function wise cabling. As per cable laying practice prevailing in CR with GPS based cable route marker.
14	Aids and Alarms	Fire alarm system in relay room & equipment rooms. Earth leakage detector.

		Fuse alarm system with automatic fuse changeover to be catered for. Remote Diagnostic & Predictive Maintenance system.
15	Furniture	For ASM/Operating staff. For maintenance staff.
16	Tools for Maintenance	Tool kit. VHF communication. Test and measuring instruments.

II. TELECOM

1	Central, EMC & LC gate communication	Various telecom facilities at stations & LC Gates and their interconnectivity with the backbone telecom network including STM-1 OFC equipment at all stations and Emergency communication (EMC sockets, VHF etc.).
2	Administrative Telecom facilities	Administrative telecom facilities required for operations and maintenance activities including their connectivity with backbone telecom network of divisions and zones, and associated housing and infrastructure.
3	Exchanges	As per requirement.
4	Passenger Amenities	RDSO type C. G. System & Train information system as per norms. PA system at all stations. GPS clocks at all stations.

III. GENERAL

1	Data Connectivity	Data connectivity requirements and associated hardware, software, infrastructure and facilities.
2	Soil investigation	Soil investigation report along the complete section of uniform interval (say 50 mtrs to 100 mtrs) to be carried out for assessing the cable trenching requirement.
3	Layout of stations	Provision of isolation and station working to maintain uniformity as far as possible in station layouts so that ESP, SIP, other design documents and station working in the section is standardized.
4	Junction stations	Signaling and Telecom requirements at Junction and Junction arrangements. Alternation / replacement of signaling gears at Junction station based on requirement.
5	Accommodation	S&T service building for accommodating signaling and telecom equipment's at stations as per prevailing practice on CR. S&T staff duty room at station.

III) ELECTRIC TRACTION

1. Carry out survey, prepare pegging plan, lay out plan for design of 2 x 25 KV AC Traction System for Railway Electrification.
2. Provision/modification of 2 X 25 KV Tractions sub - stations, SP, SSP, & its building.
3. Provision of tower wagon siding with shed.
4. To study the scope of SCADA/ Augmentation, if any.
5. To Study the power supply arrangement and grid connectivity, to avail EHV 3 phase power to feed the 2 X 25 KV Tractions sub – stations and Augmentation, if required.
6. Requirement of OHE maintenance major/minor depots including Tower Wagon shed.

7. To Study the alteration /modification/shifting of infringing OHE in existing station yards, if any.
8. Requirement of Electric Loco Trip and maintenance shed.
9. Requirement of staff and Staff quarters for maintenance of electrical assets created.
10. Requirement/Augmentation of LT power supply arrangements to feed signaling system, Railway yards & other Engineering structures.
11. Electrification of platforms, station buildings, staff quarters, cover over platform, circulating areas, approach road and other Engineering structures.
12. Provision of Passenger Amenities items.
13. Provision of Electrical Maintenance facilities including maintenance depots at important stations/shop/shed etc.
14. Provision of utilization for renewable energy sources also for stations service building and level crossing gates etc.
15. Requirement of General Service sub-stations at all block stations, and major maintenance depot. Also study SEB Power supply arrangements at LC gates & Halt stations.
16. Requirement of Modification, if any , for existing LT, HT, EHT power line crossings with details as under:-

SN	Chainage/ Kilometer	Voltage	Height of lowest conductor from proposed rail level	Height of pole/tower	Distance of both ends poles/towers from centered of proposed new track		Owner of power transmission line
					LH Side	RH Side	

17. Study requirement of tunnel lighting and ventilation if any.
18. Provision of ROCS (Rigid Overhead Conductor system) of OHE in Tunnel.
19. Requirement of accommodation for office supervisors and staff.
20. Requirement/augmentation of maintenance facilities for train lighting.
21. Requirement/augmentation of maintenance facilities for AC coaches.
22. To study requirement, if any, on the basis of receipt of Traffic, Signaling, Mechanical and Engineering chapters.
23. Any other aspect which has not been covered and would be necessary as per traffic chapter/requirement.

III) MECHANICAL

1) Terminal examination and facilities for rolling stock.
2) Round trip/ Enroute / other end attention facilities for rolling stock.
3) Rolling stock maintenance facilities at Depot and sick - line /Shade.
4) Way side monitoring and attention facilities for rolling stock.
5) Offices service buildings and staff amenities.
6) Machineries and plant for rolling stock maintenance
7) Maintenance and fuelling facilities for Diesel locomotive in case of diesel traction is proposed and their locations.
8) Environment and housekeeping management (EnHM) works and facilities.
9) Residential quarters for rolling stock maintenance and disaster management staff.
10) Any other aspect which has not been covered and would become necessary as per Traffic chapter/ Traffic required to be handled in the location to the section.

IV) OPERATING:

1	To conduct the traffic field survey and prepare the Traffic portion of the DPR as per guidelines issued by Railway Board vide (Annexed with the instructions)

2	To calculate the Financial Rate of return and Economic Rate of return as per the guidelines and parameters issued by Railway Board vide letter Ndtd. 14.09.23 and 19/08/2022
3	The integration of 3^{rd} & 4^{th} or $3^{rd}/4^{th}$ line should be at a distance of 30 kms. Or so or after 3-4 stations.3^{rd} & 4^{th} line will have normal signaling. Switching over facility from $3^{rd}/4^{th}$ line to double line shall be available after 3-4 block stations only. Each and every section where 3^{rd} & 4^{th} line is being proposed or are sanctioned may have peculiarities like sidings taking off from road side stations. At such locations operational wisdom should be applied by Zonal & Divisional authorities for the integration of 3^{rd} & 4^{th} or $3^{rd}/4^{th}$ line with the main existing network.
4	To decide upon the zone of influence, study the travel habits/trends of the people and planned road transport facilities and traffic pattern. Present movement of passenger by road (Buses, 4 wheelers, 2 wheelers, private transport operators etc.). Project the population and its growth pattern on the proposed alignment Make estimates of passenger traffic, including traffic diverted from other rail routes that will be generated on the alignment.
5	To identify the agricultural and industrial products of the influence zone. To assess the quantum of freight traffic, including diverted traffic from rail route. Present pattern of truck movement, into and out of the influence zone. Traffic projections for future years, commodity wise.
6	To identify the location of stations and scale of facilities required according to the traffic and development of the area
7	To propose the System of working, Standard of Interlocking, Type of traction, Signaling and Telecommunication facilities, line capacity, rolling stock and manpower required with reference to the traffic and working on the adjoining sections.
8	To study the suitability of junction arrangement for handling of diverted streams of traffic, both passenger and freight. Economics of various options of junction arrangement, with or without surface crossing. Propose the appropriate junction arrangement
9	To study the traffic which can be diverted on the proposed line and by which the line capacity on the adjoining sections can be eased out.
10	To examine the socio-economic benefit on the construction of the new line.
11	To study and recommend the strategic utility of the line as an alternative line.
12	Speed potential of 160 kmph of the line viz maximum permissible speed for the passenger and freight trains with initial imposition of speed restrictions on commissioning by CRS and later on, after removal of initial speed restrictions.
13	To analyse the operational constraints over the adjoining sections with regard to decongestion of yards, space/speed constraints and other factors affecting mobility. To study the pattern of traffic from western railway towards Central Railway and vice-versa.
14	To identify the savings in detention to rolling stock, avoidance of engine reversal, saving of crew etc. over the existing rail routes due to the construction of the new line.
15	To adjudge the operational suitability and compatibility of the proposed New line to take diverted traffic from the existing saturated routes.
16	To identify the line capacity this could thus be released /off loaded from the existing saturated routes.
17	Assessment of Traffic projections, Savings, Earnings and Working expenses and Calculation of FIRR and EIRR. All data sources and methodology to be followed in accordance with extant policy guidelines and codal provisions.
18	Four way sidings
19	To provide for ruling gradient not steeper than 1 in 150 over the proposed alignment. In case of any serious difficulty and constraint in providing this gradient, to elaborate the constraints, and indicate the comparative costs for achieving the gradient of 1 in 150 vis a vis any steeper gradient proposed. Costs to include that of additional locomotives required to haul the Freight trains/passenger trains due to steeper gradient.
20	To plan and provide for an alignment involving minimum permanent speed restrictions on account of curvatures etc.