Bangladesh SASEC Railway Connectivity Investment Programme Project

Final Report on Updating Railway Master Plan

Prepared for:

ADB/Bangladesh Railways

Prepared by:

CPCS Transcom Limited

In association with

e.Gen Consultants Ltd.

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Quality Assurance

Bangladesh Railway Connectivity Investment Programme Project
Final Report – Railway Master Plan

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October 21, 2017 CPCS Ref: 15328

Mr. Tsuneyuki Sakai
Transport Specialist
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Asian Development Bank
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Dear Sakai-san;

Re: Final Report – TA 8597 BAN: SASEC Railway Connectivity Investment Program

We are pleased to submit our Final Report on Updating Railway Master Plan (v2.1) for the captioned project. As this is a final report, we request your approval of this document.

We have prepared this report in accordance with the TORs for this project or, where deviation from the TOR was advisable, discussed the deviation with you and with Bangladesh Railway.

Yours very truly,

CPCS Transcom Limited

Seán McDonnell
CPCS Team Leader

cc: Engr. A. Hoque, Bangladesh Railways

Acknowledgements

CPCS would like to acknowledge the kind assistance granted to them by the staff and management of Bangladesh Railway. In addition we wish to thank all stakeholders who gave so generously of their time and shared with us their insights into the future development of the railway. Any errors of fact or interpretation are ours.

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Acronyms/Abbreviations

AACGR	Accumulated Annual Compound Growth Rate
AC	Air Conditioned
ADB	Asian Development Bank
AIIB	Asian Infrastructure Investment Bank
BBS	Bangladesh Bureau of Statistics
BCIC	Bangladesh Chemical Industries Corporation
BCIM	Bangladesh–China–India–Myanmar Forum for Regional Cooperation
BDT	Bangladesh Taka
BG	Broad Gauge
BIMSTEC	Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
BPC	Bangladesh Petroleum Corporation
BR	Bangladesh Railway
BRSIP	Bangladesh Railway Sector Improvement Project
BRT	Bus Rapid Transit
BRTC	Bangladesh Road Transport Corporation
CAD	Computer Aided Drafting
CAPEX	Capital Expenditures
CBI	Computer Based Interlocking
CCBL	Container Company of Bangladesh Limited
CGPY	Chittagong Port Yard
CIDA	Canadian International Development Agency
CLS	Colour Light Signalling
CPCS	CPCS Transcom Limited
CTC	Centralized Traffic Control
D&S	Development and Standardization
DEMU	Diesel Electric Multiple Unit
DFID	Department for International Development (UK)
DG	Dual Gauge
DHUTS	Dhaka Urban Transport Network Development Study 2010
DMTC	Dhaka Mass Transit Company Limited
DSP	Deep Sea Port
DTCA	Dhaka Transport Coordination Authority
DTCB	Dhaka Transport Coordination Authority Board
EDFC	Eastern Dedicated Freight Corridor
EEZ	Exclusive Economic Zone
EIRR	Economic Internal Rate of Return
EMI	Electro-Magnetic Interference
EMU	Electric Multiple Unit
EPZ	Export Processing Zone
ERTMS	European Rail Traffic Management System

ETSI	European Telecommunications Standards Institute
FO	Fuel Oil
GDP	Gross Domestic Product
GM	General Manager
GOB	Government of Bangladesh
GOH	General Overhaul
GRV	Geometry Recording Vehicle
GSM	Global System for Mobile Connections
GSM	Global System for Mobile Connections
GSM-R	Global System for Mobile Connections - Rail
GTKM	Gross Tonne-Kilometres
HOD	Head of Department
HSD	High-Speed Diesel
ICD	Inland Container Depot
INR	Indian Rupee
IR	Indian Railways
IT	Information Technology
IWT	Inland Water Transport
JICA	Japan International Cooperation Agency
km	Kilometres
LPG	Liquid Petroleum Gas
LVCD	Low Voltage Differential Signalling
ME	Mail and Express
MG	Metre Gauge
MRT	Mass Rapid Transit
MTM	Mechanized Track Maintenance
MTMU	Mechanized Track Maintenance Unit
NIMTP	National Integrated Multi Modal Transport Policy
NLTP	National Land Transport Policy
NPV	Net Present Value
ODA	Overseas Development Assistance
OFC	Optical Fibre Cable
OR	Operating Ratio
p.a.	Per annum
PCS	Pre-Stressed Concrete Sleepers
POL	Petroleum Oil Products
PPP	Public Private Partnership
PPTA	Project Preparatory Technical Assistance
RCIP	Regional Cooperation and Integration Project
RCR	Rail Cum Road
RFD	Rail Flaw Detection
RHD	Roads and Highways Department
RMG	Ready-Made Garment; Rail Mounted Gantry
RRI	Route Relay Interlocking
SAARC	South Asian Association for Regional Cooperation
SASEC	South Asia Sub-regional Economic Cooperation Program

SEZ	Special Economic Zone
SG	Standard Gauge
TAR	Trans-Asian Railway
TBD	To Be Determined
TEU	Twenty-Foot Equivalent Unit
TKM	Tonne-km
TOR	Terms of Reference
TSP	Triple Super Phosphate (fertilizer)
UN	United Nations
USAID	United States Agency for International Development
USD	United States Dollar
WACC	Weighted Annual Cost of Capital

Executive Summary

Railway transport is one of the two main land-based transport modes in Bangladesh; the other is road transport. Railways are inherently more environmentally efficient than road transport - railways produce less greenhouse gas, require less fuel and less land per unit of operation. Even with these greater efficiencies, railway operations employ more people than roads, adding to the economic impact of transport activities and providing sustenance for more families. Unless they are very small, countries see railways as a vital backbones of their transport systems. Bangladesh is no different in this regard - the Bangladesh Railway (BR) was instrumental in development of the country and continues to provide important social services to the nation as it grows. This Master Plan details ways and means by which those social services can be increased, leading to further economic growth for the country.

The current Bangladesh Railway Master Plan (the 2010-30 Master Plan) was researched and written in 2006/2007, based on 2005 and earlier data. This plan was meant to cover the period from 2010 to 2030 and was adopted in June 2013. The Master Plan contained descriptions of 235 separate projects organized into four five-year phases from 2010 to 2030. This constituted an extensive program of works designed to increase capacity in both freight and passenger transport. Many projects have been completed or are being implemented. However, much remains to be done.

The fact that the existing Master Plan was prepared in 2007, based on 2005/2006 data, means that the assumptions and situation on which it was founded are now over ten years old. Bangladesh Railway's market has changed due to increasing competition from the road sector. As a result, BR's share of both the freight and passenger market in Bangladesh has shrunk over time.

Provision of enhanced maintenance facilities, procurement of new rolling stock and expansion of BR's network will enable BR to increase its share of the transport market. The Government of Bangladesh (GOB) is giving more priority to the Railway and will be allocating more funds for infrastructure development and rolling stock procurement. Loan financing from IFIs such as the ADB is also available to enhance BR's assets.

Bangladesh signed the Trans-Asian Railway (TAR) agreement in 2007. This agreement includes a requirement for the conversion of track gauge on international trade corridors to broad gauge (BG). The gauge conversion is essential for establishing regional connectivity with neighbouring countries under TAR and a number of other regional transport agreements. Further to this, the Bangladesh government recently committed to convert not only its international trade corridors, but all of the existing national rail network to BG to achieve the inherent transport efficiencies that a BG railway offers.

BR has access to sources of capital to upgrade its operations. A revised Master Plan will allow BR to efficiently exploit those resources. This Master Plan also includes a discussion on financial performance and the need for BR to increase the productivity of its assets (both human and infrastructural) in order to obtain better returns to investment.

Policy Environment

Like all national railways, BR operates within both the transport policies of its country and its international agreements. BR is guided by several documents with transport implications, including the National Land Transport Policy (NLTP) Seventh Five Year Plan, Vision 2021, the National Integrated Multi-modal Transport Policy (NIMTP) and its own Bangladesh Railways Vision Statement. International agreements include the Intergovernmental Agreement on the Trans-Asian Railway Network and the SASEC policy guidelines. These documents give both general and project-specific goals as well as objectives for the railway.

This Master Plan is designed around those policy statements. Initiatives include enhancing the operational capacity, obtaining a greater share of the freight market, more efficient management of Railway assets and improved financial efficiency (all NLTP goals). The Plan responds to Vision 2021 by rehabilitation and improvement of rolling stock and infrastructure, increasing line capacity, increasing the modal share of rail over road transport and expansion of the BR network to areas currently not served. Initiatives related to the Seventh Five Year Plan include (among others) construction of new rail lines, double-tracking of existing lines, improvement of level crossing gates, purchase of new rolling stock (RS), purchase of modern maintenance equipment and upgrading of rail signalling. NIMTP-related initiatives include increasing container movements, construction of inland container depots and improving inter-city service quality, timetabling and capacity.

The Master Plan also uses these policy goals and objectives as the basis of its project ranking methodology. By this method, projects which score highly in the ranking are already assessed as satisfying more of these goals and objectives than other projects.

Physical Environment

Bangladesh Railway had a total of 2,877.10 route-km across two zones at the end of year 2014-2015. The railway is split into two zones (east and west) by the Jamuna River. The country shares around 94% of its land border with India (4096 km) and remaining with Myanmar (265 km). BR has a rail connection with India and onwards to Pakistan through the western border and will soon have a connection through India's northeastern states to Nepal. No railway connectivity currently exists with Myanmar. Lack of a compatible gauge has restricted seamless integration with Indian Railway's broad gauge network and onwards; thus gauge unification and regional connectivity are current GoB and BR objectives. No operational railway link exists with Myanmar or India on the eastern side. That is why this Master Plan includes a project to provide the Bangladesh portion of a rail link between Akhaura and Agartala (in India's Tripura State) in the next few years.

Projects either underway or contained in this Master Plan will change the economic geography of Bangladesh in several noteworthy ways:

- The Padma Bridge Project and Padma Bridge Rail Link Project will enable much better rail connection from Dhaka and Eastern Bangladesh to Southwest Bangladesh. These projects also make possible an efficient rail link between Dhaka and the new Payra Port.
- The Bangabandhu Railway Bridge will remove a significant constraint to freight rail traffic between the East and West zones, enabling higher levels of freight transfer to support economic development.

- Gauge conversion from MG to BG will allow higher train capacities and higher train speeds, effectively bringing all parts of Bangladesh closer together. Conversion to Broad Gauge (BG) will also remove a constraint to trade with other regional countries. Gauge conversion will provide seamless railway connectivity across Bangladesh and with its neighbours.

- Construction of a Dhaka-Chittagong via Comilla-Laksam high-speed railway will assist in bringing Bangladesh's two main economic generators (Dhaka and Chittagong) closer together by reducing travel times and increasing rail capacity.

Environmental Performance and Social Safeguards

Internationally, trains outperform passenger vehicles in greenhouse gas (GHG) efficiency. While numbers vary by source, trains produce only 11%-27% of the CO_2 produced by cars per passenger-km[1]. The same holds true for freight transport: trains produce less than 40% of the CO_2 produced by trucks transporting the same tonnage of goods. In Europe, railways produce only 1.5% of transport sector GHG emissions although they enjoy 8.5% of total market share[2].

Rail also takes up a smaller footprint than road transport. This means less agriculturally productive land or expensive urban land must be used than if roads are built. Involuntary resettlement is reduced for the same reason.

Shifting modal share from road to rail transport is a highly effective way of reducing environmental damage and meeting national environmental goals. This Master Plan details the ways and means of achieving that modal share shift for both passenger and freight transport. The Plan incorporates the ability to increase BR passenger traffic by 5% per year over the plan period; this translates to almost 3.9 times more passenger-km than BR is currently delivering over the plan period. This modal shift from road to rail transport will provide a significant reduction in GHG emissions for Bangladesh.

However, railway network expansion often present a number of adverse risks to society such as:

- → Involuntary resettlement, migration, and urbanization
- → Unfair distribution of benefits, local conflicts of interest, and impacts on local economy
- → Impacts on vulnerable populations such as indigenous peoples and the poor, gender equality, and children's rights
- → Impacts on health and safety (including accidents)
- → Impacts on, or caused by, the labour environment (including occupational health and safety)
- → Impacts on social structures, social infrastructures, and social services
- → Impacts on cultural heritage

In this context, it becomes critical to identify and assess such potential risks during project design, their impacts and develop robust safeguards to mitigate or minimize such adverse impacts associated with the project.

[1] European Environmental Agency, "CO2 emissions from passenger transport"; UIC, "Rail Transport and Environment Facts and Figures"
[2] UIC, "Rail Transport and Environment Facts and Figures"

Most International Financing Institutions (IFIs) require the application of social safeguards to approve projects. These policies require borrowing governments to address certain environmental and social risks in order to receive Bank support for investment projects.

While social impact assessment is not yet a legally mandated requirement in Bangladesh, it is critical for Bangladesh Railway to comply with internationally accepted practices for ensuring robust social safeguards.

Social impact of the project and need for safeguards were criteria for evaluating various project options and developing a priority list in this plan. The plan also recommends a comprehensive environmental assessment of BR's operations with the overall objective of ensuring that BR remains an environmentally and socially sustainable organisation. Lastly, given that project impact assessment and development of safeguards are unique to every project, this plan envisages that these activities shall form a core part of the project feasibility study, detailed design, tender preparation and implementation. In this context, suitable budget has been allocated for these activities.

Freight Market

BR carried 2.55 million tonnes of freight in 2014-15, continuing a long-term decline since the early 1970s, when 4.8 million tonnes were carried (1969-70). The decline in modal share of freight transport is even greater – BR has lost much traffic to road transport. A large part of this decline can be attributed to the dramatic increase in the Bangladeshi road network over the interim period. Road transport provides door-to-door service and faster transport times; these factors assisted in the loss of BR's modal share.

BR's freight traffic has changed over the years. Where the railway once transported a variety of "break-bulk" goods, it now transports mainly containers and bulk commodities (solid and liquid). This change is in line with other railways around the world.

BR's current low market share means there is substantial room for expansion in the freight market. In order to exploit that market, BR's freight operations will have to both change and expand. More market focus and response to market needs is necessary. The recent initiative to set up the Container Company of Bangladesh will provide impetus to those changes. However, expansion of both infrastructure and rolling stock levels will be necessary as well.

BR has on-going efforts to add new railway capacity between Chittagong and Dhaka. These plus additional projects in this Plan mean it is possible that BR's freight traffic could increase from a mere 2 million tonnes to 18 million tonnes by 2045. BR could even exceed this forecast given the huge potential that exists for market capture. BR is also planning substantial increases in its freight RS fleet.

Container traffic growth in Bangladesh offers enormous potential. In order to convert the opportunities to actual business, BR needs a comprehensive approach including development of rail-based ICDs at both ends so that total transportation cost and time to the shippers are minimised. BR could even consider provision of door-to-door service. This would involve a change in BR's business model from a transporter between container terminals to a door-to-door logistics service provider.

There are only two ICDs in Bangladesh at present. One is at Kamlapur - this serves a tiny fraction of Bangladesh's container traffic. There is also one at Pangaon, on the Buriganga River, and linked to Chittagong by three small (120 TEU) containerships. Most container cargo travels by road between Dhaka and Chittagong, which is congested by thousands of mainly two-axle trucks.

A new ICD has been proposed to at Dhirasram, north of Tongi and just south of Joydebpur. Along with the Dhirasram facility, this Plan also includes ICDs proposed for Uttara Export Processing Zone and Benapole.

BR could increase its modal share of freight traffic by marketing to major users with specific service offers that enhance quality of service in terms of wagon availability, reliable schedule and pre-determined delivery time. The railway could enter into service contract agreements so that it could make investments based on guaranteed revenue. This could both minimize investment risks and guarantee efficient service delivery to major users.

Passenger Market

In 1975 the overall Bangladeshi long-distance passenger market was 17 billion passenger-kilometres (km). BR's share was 30% or 5.1 billion passenger-km. By 2006 the market had grown more than ten-fold to 178 billion passenger-km of which BR's share had fallen more than ten-fold, to 2.8%. It continues at around that level.

BR's share of the passenger market is limited by train capacity — in other words, train frequency and length. This makes future passenger traffic dependent firstly on rolling stock (RS) acquisition and secondly on BR's absorptive capacity to put that new RS into service and maintain it. It is felt that if BR's passenger capacity increases, that capacity will be utilized. Therefore, BR should aim to increase its passenger capacity by an average 5% per annum over the Plan period.

Increasing capacity at that rate implies increases of capacity in several areas of BR's operations. New rolling stock will have to be procured and availability of existing rolling stock will have to improve. In the short term, capacity can be increased by increasing passenger train length; over the longer term, additional train and therefore more locomotives will be required. Increased RS numbers will require enhanced maintenance capability; existing maintenance facilities will have to be rehabilitated and new facilities built. Maintenance of Permanent Way (PW) will also have to be enhanced to allow for the increased traffic. This Master Plan contains projects that deal with all of these requirements.

Finally, more staff will be required. BR does not have enough people to run its current operations, particularly in the area of RS maintenance. More trains require more people to run them. Enhanced maintenance of both RS and PW will require more trained personnel to perform and oversee that maintenance. This Master Plan includes some projects for enhancement of training facilities; however, long-term Human Resource planning for the Railway should include for increased staff numbers to support expanded operations.

Mega-Projects which could affect Bangladesh Railways

Outside of BR itself, there are several large infrastructure projects either ongoing or being planned. These projects will affect BR's business, either positively or adversely.

The Padma Bridge is scheduled for completion at the end of 2018. This bridge will have a four-lane upper deck for road traffic and a lower deck designed for a single-track railway. By eliminating ferries, the Padma Bridge will shorten the time taken for road traffic between Dhaka and the south-west of the country. BR will use this bridge to enhance its access to Bangladesh's southwest regions and improve the possibilities for international traffic between India and Bangladesh.

As at April 2017, the Dhaka-Chittagong Elevated Expressway Project will soon be in the feasibility analysis stage. The current configuration includes six traffic lanes. The Railway's ability to attract both passenger and freight traffic may be constrained by the dramatic increase in road capacity on that route.

Construction has started on the Payra port in the Patuakhali district of southwest Bangladesh; this seaport could be a large source of containers and other freight for BR. There is currently no rail service to Payra - this Master Plan includes a projects to provide that rail link.

Strategy to Achieve the Vision

In updating this Master Plan, it was realized that without a time-bound strategy for gauge conversion, it would be quite difficult to efficiently plan infrastructure projects. Having a time-bound gauge conversion plan will also reduce risk in future rolling stock procurement by providing more certainty as to what gauge RS to procure. Thus, the planning for gauge conversion was undertaken and is presented in Section 7.1.

In recent years, the railway system has been the beneficiary of extensive investment in fixed infrastructure, accompanied by the purchase of some rolling stock. Dhaka-Chittagong will soon be MG double track all the way but, to serve BG trains, conversion to DG is now in progress.

Numerous new rail line projects have been assessed in recent years as part of the Bangladesh Railway Sector Improvement Project (BRSIP) and the Regional Cooperation and Integration Project (RCIP), both funded by ADB. Of these, several are underway: the Padma Rail Link project, from south Dhaka to Jessore; the Jamuna Bridge project (rail-only bridge parallel to Bangabandhu Bridge); the new line from Dohazari to Cox's Bazar; and double-tracking of the Joydebpur-Ishurdi and Akhaura-Laksam lines. This Master Plan discusses several other projects currently under consideration, including the construction of a Dhaka-Chittagong via Comilla/ Laksam High Speed Railway, the Bogra-Jamtoil line, the Chittagong Bypass and an extension to Payra Port. While some of these projects have had detailed feasibility studies, not all have been analyzed yet.

Railways worldwide are optimizing existing rail infrastructure and increasing line capacity by introduction of modern signalling. In recent years, BR has been increasing line capacity by this method. This effort will continue into the future.

BR presently uses the Absolute Block System which permits one train only between two adjacent stations. Many of the stations are still non-interlocked, requiring a long time for route setting. Bangladesh Railways has improved operational flexibility by progressively introducing electronic interlocking at important stations. But there is need to utilize electronic interlocking for increasing line capacity on the block sections and doing remote control operation of way stations.

With introduction of Centralized Traffic Control (CTC) by Bangladesh Railway, on line monitoring and remote control of trains from the CTC Centre has already begun. As a next step in this direction, introduction of GSM-R radio systems will improve operation, provide security and will facilitate providing passenger information services to the travelling public on BR trains.

These and other measures will enable optimal utilization of track and rolling stock and will allow significant increases of line capacity at a lower cost than infrastructure solutions such as line doubling.

Maintenance and Rehabilitation of Infrastructure

As part of the overall process of updating the Master Plan, the consultants were tasked with an "Assessment for the establishment of a Mechanized Track Maintenance (MTM) Unit of BR and recommendations for the strategy, investments and organization." MTM can most economically and efficiently be introduced into a railway with modern infrastructure inspection and maintenance processes and technologies in other areas. As such, the consultants' analysis went beyond what normally constitutes a MTMU to include all elements of infrastructure maintenance, inspection and monitoring.

Recommended inspection technologies include Geometry Recording Vehicle (GRV) and Rail Flaw Detection (RFD). Both types of vehicles will be rail-cum road vehicles for maximum flexibility. Infrastructure maintenance would be undertaken by either local or mobile gangs. Local gangs will be located at section headquarters across the rail network and will be assigned territories for which they will be responsible for day-to-day maintenance of fixed infrastructure, including remedial action for defects and near-defects and emergency response to incidents.

The MTM study recommends a two-tiered maintenance organization with:

- System Engineering responsible for policy and strategy, infrastructure testing, and maintenance and sharing of track machinery and vehicles
- Zonal Engineering (Eastern and Western) responsible for the development of plans and execution of maintenance and renewal programs, visual inspections of infrastructure, and response to incidents and in-service failures

The proposed maintenance organization will require a re-organization of permanent way (track and civil) employees as well as changes in roles. Mechanization, technology and improved employee competency will produce productivity improvements. Personnel role changes will involve aggressive training and, likely, hiring programs for more specialized staff. The net difference in numbers of permanent way employees cannot be ascertained at this time as reductions in required staff due to mechanization will give opportunities for switching some staff to other roles such as weather and soil conditions monitoring, flood control, safety assurance and miscellaneous maintenance roles. BR would likely approach optimum personnel levels slowly as staff productivity improvements due to mechanization will take some time to achieve. However, in order for the investment to pay off over time, the political will must be in place to implement and sustain the necessary changes in organizational culture and structure.

Maintenance and Rehabilitation of Rolling Stock

Analysis identified the following major factors affecting rolling stock maintenance:

- Over age rolling stock – a very high percentage of BR rolling stock is over industry standard economic life. Their failure rate is high and they require frequent attention.
- Inadequate facilities for locomotive maintenance. All three workshops have very low loco berthing capacity, poor support shop facilities, inadequate space to attend components and sub-assemblies, etc.
- Human Resources shortages – at present, vacancies vary from 20% to 60% in different workshops and within the next five years this will go up to 44% to 75%.
- Inadequate shop floor staff skill levels. Training Units attached to workshops are very poorly equipped and have no facility for practical training.
- Inefficient materials, components and spare parts procurement – all workshops have a large number of materials, components and spare parts out of stock, affecting maintenance performance.
- Inefficient rolling stock condemnation – very large numbers of rolling stock continue on the books even though these assets have been taken off the rails and are no longer functional as rolling stock. Four-wheeler wagons are obsolete and are no longer used, but remain on the books. These wagons require immediate condemnation. They should be deleted from the books so that their depreciation cost is not reflected in the costing profile.
- Inadequate Maintenance Budget Allocation – Many workshops have to lower their out-turn level because of low budget allocations.

A number of projects are recommended both to enhance the capacity for maintenance of existing rolling stock and to provide for the proper maintenance of an increased fleet. These include upgrading of existing facilities and provision of additional shop equipment as well as construction of entirely new facilities.

RDS Unit

A component of this project involved the investigation of a potential research and development unit for Bangladesh Railway. The consensus opinion from consultations was that BR does not require primary research capability, but that applied research capability could be useful in development of local materials and development of standards. Primary research is being adequately done by other bodies and BR can access that research simply by forming liaisons with the appropriate industry organizations. To that end, it is proposed to create not an R&D Unit, but an RDS (Research, Development and Standardization) Unit.

The RDS Unit will be an independent modern technology based establishment complete with following facilities: chemical and metallurgical testing laboratory; petroleum products and rubber testing facilities; component inspection facility; digitised data storage system and Auto CAD facility; and a technical library auditorium.

One of the main functions of this unit will be import substitution - development of indigenous sources for rolling stock components, track items, signalling and telecommunication parts, etc.

The unit will also investigate repeated failure cases, find reasons for the failures and suggest design, material or manufacturing processes to overcome the problems. Capital cost for establishment of the unit is estimated at BDT 2.18 crore.

Rolling Stock (RS) Procurement

Railways require rolling stock (locomotives, passenger carriages, commuter cars and freight wagons of various types) to perform their business. Even with the best maintenance, these vehicles have a finite lifespan and must eventually be replaced. Increased trade requires increasing RS numbers. Changes in business (e.g. moving from breakbulk to bulk carriage) requires both procurement of new RS and disposal of vehicles no longer needed.

As part of this project, a thorough review of existing RS was made, including determination of condition, age and useful economic life. At the same time a forecast of required RS over the plan period was made, using the forecasts for increases in both passenger and freight carriage over the plan period. These were combined to develop a procurement plan for new rolling stock. In keeping with the objective of completing transition to BG operations over the plan period, the RS procurement plan incorporates aspects of the gauge conversion plan to reduce as far as possible the procurement of Metre Gauge RS.

A table showing the RS procurement requirements over the plan period can be seen below. All Phase 1 procurement has sources of funding at present. As a point of reference, the analysis is based on the BR rolling stock complement as of April 2017; any RS procured after that date should be assumed to be included in the numbers below.

RS Procurement Summary Table		Phase 1 2017-20	Phase 2 2021-25	Phase 3 2026-30	Phase 4 2031-35	Phase 5 2036-40	Phase 6 2041-45
Locomotives							
	Expansion						
	BG	31	0	48	63	75	64
	MG	37	0	0	0	0	0
	Replacement						
	BG	55	0	0	7	7	13
	MG	74	0	0	0	0	0
	Total	**197**	**0**	**48**	**70**	**82**	**77**
Coaches							
	Expansion						
	BG	216	103	831	775	858	965
	MG	65	171	0	0	0	0
	Replacement						
	BG	241	0	21	0	0	201
	MG	696	0	0	0	0	0
	Total	**1218**	**274**	**852**	**775**	**858**	**1166**
Wagons							
	Expansion						
	BG	1000	0	423	731	1165	1282
	MG	0	0	96	0	0	0
	Replacement						
	BG	140	482	33	0	0	0
	MG	580	0	507	0	0	0
	Total	**1720**	**482**	**1059**	**731**	**1165**	**1282**

Projects of the Railway Master Plan

The consultants have compiled a list of projects from a number of sources, including the previous Master Plan, their analyses of RS maintenance, MTM, the RDS Unit, gauge conversion, S&T upgrades and extensive consultation with BR. These have been included in a project database listing all salient information collected for over 200 projects. The database is sortable and filterable by a number of criteria. The database (including all projects, but not all fields) can be seen in Appendix 1.

The database serves as a platform for project ranking as well. In addition to the ranking criteria stipulated in the TOR, the consultants and BR have ranked projects by the manner in which those projects respond to the various Bangladeshi transport policy documents discussed in Chapter 2, as well as the BR Vision Statement and BR operational priorities. A selection of the highest-priority projects can be seen in Section 8.3.

In addition to project rankings, the Master Plan presents groupings of projects by theme and inter-relatedness. Groupings include gauge conversion projects; RS Maintenance projects (both for enhanced maintenance of existing RS as well as facilities required to maintain an expansion of the RS fleet); projects which together should increase the capacity for container transport between Dhaka and Chittagong; and projects which will improve east-west connectivity.

Finally, the Master Plan looks at the finance aspects of the projects and identifies which projects are best undertaken with GoB financing, ODA financing or undertaken as PPPs. The table below shows the disbursements in each of the Master Plan's 5-year phases if all projects were undertaken according to this allocation of funding source.

Phases	Period	Total no. of Projects	GOB	FA	FA/PPP or PPP	FA / GOB	Total Cost
Phase 1 projects	2016-2020	83	6,673	77,673	9,030	54,457	147,833
Phase 2 projects	2021-2025	67	11,412	72,812	3,439	32,017	119,680
Phase 3 projects	2026-2030	37	8,054	-	1,600	84,507	94,161
Phase 4 projects	2031-2035	23	726	-	-	96,159	96,885
Phase 5 projects	2036-2040	14	125	9,448	-	73,076	82,649
Phase 6 projects	2041-2045	6	125	1,534	-	10,795	12,454
Total for all Phases		**230**	**27,115**	**161,467**	**14,069**	**351,011**	**553,662**

All Cost in BDT crores

BR's average OR (Operating Ratio: operating expenses divided by revenue from operations) has averaged 210% over the past nine years. While an OR over 100% can be justified by the social obligation of providing passenger services (especially where tariffs are not set by the railway itself), a profitable railway will have an OR somewhere below 100%. It is clear by comparison to other railways that BR operating ratios can be improved. The projects set out in this Master Plan could assist in that improvement, but only if BR uses the resultant assets to their best advantage.

Inflation has badly affected BR's financial performance over the past decade. Costs have increased with inflation while tariffs (with the exception of one tariff adjustment in 2012) have not. This implies that not only should rail tariffs be brought up to (or at least close to) cost recovery levels, they should also be indexed to inflation to avoid further degradation of BR's ability to recover its costs.

Finally, this Master Plan was written to span between 2017 and 2045. Much can change over that time. In order to keep the Master Plan current, the projects and recommendations contained in this Master Plan should be revisited and updated every five years.

1 Introduction

Key Messages

- Bangladesh's previous Railway Master Plan was written in 2006/2007.
- A new Railway Master Plan is needed to focus on current markets and infrastructure needs.
- A rail master plan should be more than a set of time-phased projects. It needs to provide a vision of where development of the railway is heading.
- It is important to identify all aspects of the railway, which will contribute to the success of infrastructure projects. Human resources assets and training are covered.
- In this Master Plan, groups of interacting projects are identified, showing greater economic benefits than would be achieved without that grouping.

1.1 Background

In 2007, Bangladesh signed the Trans-Asian Railway (TAR) agreement. Under this agreement, Bangladesh agreed to convert its track gauge on international trade corridors from metre gauge to broad gauge. This would allow the efficient transport of goods across national borders in that it eliminates the need to transfer freight to different trains. Further, the Bangladesh government recently committed to progressively convert its existing national rail network of metre gauge (MG) to broad gauge (BG) to achieve the inherent transport efficiencies that a broad gauge railway offers due to its greater axle load and speed capabilities versus that of metre gauge. The gauge conversion is essential for seamless movement of passenger and goods trains within Bangladesh and for establishing regional connectivity with neighbouring countries under TAR, South Asian Association for Regional Cooperation (SAARC), Bangladesh–China–India–Myanmar Forum for Regional Cooperation (BCIM) and Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC). Gauge unification was also an important aspect of the previous Railway Master Plan.

Bangladesh was a founding member of the South Asia Sub-regional Economic Cooperation Program (SASEC) in 2001. ADB has assisted Bangladesh in many of its SASEC investment projects in the past, and that partnership will continue into the current Plan period. Many of the recommended projects in this plan will be taken up in accordance with SASEC policy guide lines.

Sustainable and effective organisational transformation endeavours will be required for BR to successfully meet its responsibilities and expand its market. BR needs a long-term strategy with a clear implementation blueprint and institutional strategy. Such a strategy must be outcome focussed – it must provide stable, sustainable and scalable capability to BR. Equally importantly, there is a need to align the financing plan with IFIs, funding entities and the Government of Bangladesh.

1.2 Need for Revised Master Plan

The current Bangladesh Railway Master Plan (the 2010-30 Master Plan) was researched and written in 2006/2007, based on 2005 and earlier data. The effort was completed by Bangladesh Railway (BR) in collaboration with the Transport Sector Coordination (TSC) wing in the Physical Infrastructure Division of the Planning Commission, with the assistance of local and international consultants.

This plan was meant to cover the period 2010 to 2030. It was adopted in June 2013. The 2010-30 Master Plan focused on the nine major rail corridors in the country which carried 90% of Bangladesh's rail traffic. The objective was to improve those corridors to enable meeting the future rail transport needs for the country. Traffic on those corridors was examined and future traffic was forecast. Major work needed on each corridor was described at a conceptual level. Ongoing and proposed projects were described for each corridor, and conceptual level cost estimates presented. The Master Plan contained descriptions of 235 separate projects organized into four 5-year phases from 2010 to 2030.

This constituted an ambitious program of works designed to increase capacity in both freight and passenger transport. Many projects have been completed or are being implemented. However, much remains to be done.

The fact that the existing Master Plan was prepared in 2007 based on 2005/2006 data means that the assumptions and situation on which it was founded are now over ten years old. BR's market has changed due to increasing competition from the road sector. BR's ability to respond to that competition has been compromised by under-funding of infrastructure and rolling stock maintenance. This has meant declining movement of passengers and freight since the 1960s in the face of a dramatically increased market for both passenger and freight transport. Bangladesh Railway's share of both the freight and passenger market in Bangladesh has shrunk over time.

BR has access to sources of capital to upgrade its operations. A revised Master Plan will allow BR to efficiently exploit those resources. It should allow for the long-term and sustainable development of the railway. It should also plan out the most efficient route to gauge conversion. Finally, it should restore BR as an efficient, attractive alternative to road transport for both freight and passengers.

1.3 Approach to the Master Plan

A rail master plan should be more than a set of time-phased projects. It needs to provide a vision of where development of the railway is heading. The Railway Connectivity Investment Project (RCIP), presently drawing to a close, provided a vision of a "core network" together with defined service levels such as operating speeds and axle loads. There was a demonstrable need for such a vision, since the benefits of individual RCIP sub-projects were dependent on whether and when other sub-projects were undertaken. Agreeing on a core network would place sub-projects and their implementation timing on a much firmer footing.

The current Master Plan is organised by key corridors, listed below:

- → Corridor 1: Dhaka – Chittagong –- Cox's Bazar – Deep sea port
- → Corridor 2: Chilahati – Ishurdi – Khulna – Mongla
- → Corridor 3: Dhaka – Bangabandhu Bridge – Darsana/Benapole
- → Corridor 4A: Dhaka – Bangabandhu Bridge – Rajshahi – Rohanpur
    - 4B: Dhaka – Bangabandhu Bridge – Ishurdi – Parbatipur-Chilahati/Birol
- → Corridor 5: Dhaka – Sylhet/Shahbazpur
- → Corridor 6: Dhaka – Bangabandhu Bridge– Sirajganj/Roypur(Jamtoil) – Burimari
- → Corridor 7A: Dhaka – Mawa – Bhanga – Jessore – Khulna – Mongla
    - 7B: Dhaka – Mawa – Bhanga – Jessore – Benapole
    - 7C: Dhaka – Mawa – Bhanga – Barisal
    - 7D: Dhaka – Mawa – Bhanga – Kashiani – Gopalganj – Tungipara
- → Corridor 8A: Dhaka – Mymensingh – Jamalpur – Tarakandi- Bangabandhu Bridge

- 8B: Dhaka – Bhairab Bazar – Mymensingh

→ Corridor 9A: Dhaka – Mawa – Jajira – Rajbari – Moukuri (Mizanpur) – Bara Durgapur (KhasChar) – Pabna – Ishurdi

- 9B: Dhaka – Paturia – Douladia - Moukuri (Mizanpur) – Bara Durgapur (Khas Char) – Pabna – Ishurdi

The railway network by corridor can be seen in Figure 1-1. These corridors were chosen by way of their higher passenger and freight loadings. It is 'track network centric' and underplays some of the inter-relationships that a master plan should illuminate.

While organization by corridor is one useful way of visualizing the network, there are several drawbacks:

- Organization by corridor cannot easily show projects that are not corridor-specific (such as rolling stock procurement projects or upgrading of maintenance manuals)
- The corridor method does not show the inter-connection between projects of different types, which may be required to be implemented as a group to maximize project returns (such as RS maintenance projects required to support new RS procurement)
- Listing projects by corridor does not permit easy understanding of the combination of projects which would be connected to any particular objective of the railway. Some projects are corridor specific (e.g. line enhancements) while others are corridor-independent (e.g. rolling stock procurements).

This revised Master Plan moves away from organization by corridor. First, the current state of BR projects was reviewed, including status and costs. Then projects were incorporated from other aspects of this study, including rolling stock (RS) maintenance enhancements, signalling and telecom (S&T) enhancements and projects related to the gauge conversion effort. A system-wide capacity model was developed to assess the effect of individual projects on railway operating capacity. Requirements for human resources were examined and the training and qualifications those resources would need was assessed. From this, existing projects were adapted and new projects developed to achieve desired goals. These projects were included in a comprehensive project database which can be filtered in a number of different ways to group like projects.

Figure 1-1: Bangladesh Railway Network by Corridor

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The advantage of this new master plan method is that it centers on the railway as an operating entity – an entity that provides transportation services to society. A railway is a combination of infrastructure, systems and people providing those transportation services. This Master Plan provides a comprehensive list of projects which will enable the railway's personnel to provide the services.

The Master Plan provides more than a list, though. Master Plan projects are interdependent. For example, there would be no point in building a rail track over the Padma Bridge if it connected only to Dhaka. The Padma Bridge will provide excellent access to Southwest Bangladesh, Mongla and Payra Ports as well as, through Benapole, access to India. For reference, however, the project database in Appendix 1 shows each project by corridor as well as a number of other descriptive criteria.

Finally, the 2013 Master Plan focused on physical investment requirements with no attention paid to actual financial performance. The new Master Plan includes a chapter on financial performance and the need to increase productivity of assets (both human and infrastructural) in order to increase both revenue and decrease Operating Ratio.

1.4 The Railway Connectivity Investment Programme

In order to accomplish the revision of the Railway Master Plan, the Asian Development Bank provided Project Preparatory Technical Assistance (PPTA) funding to prepare the SASEC Railway Connectivity Investment Programme (RCIP). In addition to a revision of the Master Plan, this project included examination and recommendations on rolling stock maintenance, the introduction of mechanized track maintenance and the inception of a BR Research & Development Unit.

1.5 Contents of this Report

This report contains the following chapters:

- Chapter 1: Introduction
- Chapter 2: Bangladesh Transport Policy
- Chapter 3: Railway Characteristics and Compatibility
- Chapter 4: Freight Traffic Projections
- Chapter 5: Opportunities for Bangladesh Railway
- Chapter 6: The Vision for Bangladesh Railway
- Chapter 7: The Strategy to Achieve the Vision
- Chapter 8: Projects of the Railway Master Plan
- Chapter 9: Financial Performance

Please note that this report refers to phases. In all cases, the phases and years in general correspond to BR's fiscal year, which extends from July 1st to June 30th. For instance: the fiscal year 2020 should be considered to extend from July 1st 2019 to June 30th 2020.

2 Bangladesh Transport Policy

Key Messages

- Bangladesh Railways operates within the transport policy environment of Bangladesh and is named specifically in several policy documents:
  - The National Land Transport Policy
  - Vision 2021
  - The Seventh Five Year Plan
  - The National Integrated Multi-modal Transport Policy

  This chapter discusses the implications of these policies to Bangladesh. Railways.

2.1 Bangladesh Transport Policy Framework

The institutional mandate for transport policy, planning and development in Bangladesh rests with a number of nodal agencies with varying jurisdiction, roles and responsibilities. The proposed Master Plan must be in harmony with the current transport development priorities of the government and provide a realistic roadmap for implementing the prevalent policies, summarized below.

2.1.1 National Land Transport Policy

The National Land Transport Policy (2004) lays down the following goals for railway transport in Bangladesh:

Figure 2-1: NLTP Goals

- → To encourage greater private sector participation in the provision of services
- → To enhance the operational capacity of railways
- → To obtain a greater share of the freight market
- → More efficient management of the railway's assets
- → Improved financial efficiency
- → More effective provision of services for social needs
- → Fostering inter-national rail links
- → To reduce involvement in non-rail activities
- → Improvement of railway safety
- → Improvement of institutional capability of Bangladesh Railway

The proposed Railway Master Plan complies with each of the above policy directives. The Master Plan presents an optimum roadmap for railways covering passenger services: rail network development; infrastructure enhancement; railway operations improvement; increased market share for freight traffic especially containers, passenger services, regaining lost market share and promoting modal shift; rural connectivity; and inter-regional rail links, etc. Phase-wise implementation of the projects, as proposed in this Master Plan, shall result in achieving the above listed goals by enhancing operational capacity of railways, increasing freight market share, providing effective services for social needs and obligations, fostering international rail links, improving railway safety and approaching financial sustainability.

2.1.2 National Perspective Plan 2010-2021, Vision 2021

The Vision 2021 and the associated Perspective Plan 2010-2021[3] has set ambitious development targets for Bangladesh by the end of 2021. The vision of the Perspective Plan, in context of railways, is *"to expand and improve the railway system to provide safer, better, a more environmentally friendly and cost effective transport facility to national and international traffic. BR will also foster international rail links to serve regional/sub-regional connectivity and Trans Asian Railway (TAR)."*

The perspective plan further advises the following strategies to achieve the above vision:

[3] Perspective Plan of Bangladesh 2010-2021, Planning Commission, Bangladesh.

Figure 2-2: Vision 2021 Strategies

Perspective Plan: Vision 2021

- → Rehabilitate, upgrade/improve and replace old-aged infrastructures and rolling stocks to reduce journey time, improve service quality and build the image of railway as a safe and reliable means of transport
- → Augment line capacity along selected corridors, acquiring modern locomotives, coaches and wagons
- → Increase market share in freight transport, in container transport between Dhaka-Chittagong Port and in passenger transport
- → Implement organizational reforms introducing a modern financial management system, an improved maintenance and operational system, and increased human resource development
- → Connect the capital city with Cox's Bazar, Mongla Port, Tungipara, Barisal, Chittagong Hill Tracts and other areas where rail network does not exist
- → Improve commuter train services to provide better urban transport facilities to daily passengers around Dhaka, Chittagong, Rangpur, Dinajpur, Parbatipur, Nilphamari, Sylhet, etc.

The perspective plan also reinforces the need for regional cooperation and advises *"Participation in the grand Asian Highway and Asian Railway Systems that generate win-win outcomes. This however calls for development common standards through establishment of institutions backed by adequate financing from participating governments."*

2.1.3 Seventh Five Year Plan

The Seventh Five Year Plan (2015) identifies modern transportation and communication as a key building block for the roadmap to achieve the target growth of 8% and calls for renewed focus on modernizing railways. The key element of the Seventh Five Year Plan, in context of railways, is *"to strengthen the use of river and rail transport to provide a low cost and more environment-friendly alternative to road transport; coordinate the roads, railway and inland water cargo linkages to strengthen the performance of Chittagong Port."*

The core objectives and targets prescribed to Bangladesh Railway in the plan are presented below:

Goals/Objectives	Actions	Specific Targets	Action
Expand and improve railway system to provide safer, efficient, environment friendly and less expensive transport facilities to national	Expansion of railway network to expand rail operations.	Undertake construction of 856 km of new rail track.	Projects underway plus Phase 1 projects total 817 km.
	Double tracking of important sections and gauge unification to overcome operational bottlenecks.	Undertake dual gauge double tracking of 1110 km.	Phase 1 projects total 650 km. Some projects already underway

Goals/Objectives	Actions	Specific Targets	Action
and international traffic, increasing its market share. Increase its market share from 4% to 15% in freight transport, 10% to 15% in container transport between Dhaka-Chittagong Port and 4% to 10% in passenger transport.	Rehabilitate/upgrade existing rails for improved speed and safety.	Undertake rehabilitation of 725 km of existing rail track.	
	Construction of railway bridges and other infrastructure for operational improvement.	Undertake construction of rail bridges, improvement of level crossing gates and improvement of other infrastructure.	
	Procure new locomotives to improve service quality.	Purchase 100 new locomotives, 1 locomotive simulator and 4 relief cranes.	
	Procure new coaches for passenger comfort.	Purchase 1218 new passenger coaches	
	Upgrade railway workshops and maintenance.	Procure modern maintenance equipment.	
	Improve rail speed and safety.	Upgrade rail signalling for 81 stations.	
	Improve rail efficiency.	Strengthen railway management.	
	Improve railway finances.	Eliminate operational deficit through price increases and operational efficiency gains.	

Source: Ministry of Railways, Bangladesh

The plan presents various strategic considerations, listed below, used while devising the above railway expansion Program:

Figure 2-3: Seventh Five Year Plan Strategies

- → *Shortening the Dhaka –Chittagong rail distance. Due to orientation problem, Dhaka has detoured connection with Chittagong and has only one gateway for trains from all directions and thereby causing undesirable bottleneck and operational problems. To solve these, priority will be given to construct Dhaka-Laksham elevated cord line via Fatullah in Narayanganj (new gateway). This strategic investment would also act as a catalyst in improving port operational efficiency as well as can cater Padma Bridge induced train movements and will establish a missing link for establishing transhipment/regional connectivity.*
- → *Address the biggest capacity constraint found on the single line sections in major railway corridors like Dhaka-Chittagong, Dhaka-Sylhet, Dhaka-Khulna, and Dhaka-Parbatipur. Bangladesh Railways needs to undertake double tracking of all major railway corridors by phases.*
- → *Developing a full access controlled right of way as well as capital intensive grade separated measure to make level crossing free allowing segregated rail corridor and thereby ensuring operation of commuter trains in urban areas, particularly for Dhaka city. Emphasis would be given to higher frequency and speed without affecting the roadway capacity.*
- → *Strengthening South Asia regional and Trans-Asian railway connectivity.*
- → *Taking into cognizance that the railway freight transportation cost in Bangladesh is one of the highest in the world and presently it takes about 18 days to bring a container to Dhaka from Chittagong Port mainly due to acute shortage of freight trains, and most importantly very low average travelling speed (15-20 kmph), besides augmenting rolling stock, development of dedicated high speed freight corridor capable of carrying double layer container is a must. Present ground* condition is not friendly for modernization of train (Electric Traction System). This is a matter of urgency because an important element in improving the efficiency of the Chittagong Port hinges on developing a balanced multimodal freight transport system, which is now overwhelmingly and unsustainably road biased, to move the containers to and from the hinterland more efficiently and thereby to make the railway profitable.
- → Priority would be given to connect large EPZ/SEZ mouth ICDs and thereby to develop market oriented container transport friendly new railway infrastructures.
- → In the long run for even distribution of traffic load, urban contribution of railway in terms of carrying commuter traffic (which is now less than 1 percent of the total daily trips of Dhaka city) needs to be increased by adopting two-tier railway system i.e. sub-urban and urban rail. Urban rail network need to be developed by including the circular rail and by integrating fully with the long distance sub-urban rail (may start from Tongi & Narayanganj) as well as STP (Strategic Transport Plan 2004-2024) and DHUTS (Dhaka Urban Transport Studies 2010-2050) recommended BRT and MRT based urban mass transit network systems.

Source: Seventh Five Year Plan (FY2016-FY2020)

The plan further reports that along with routine and regular activities/projects/programmes, the following major/remarkable projects are underway to be implemented during the Seventh Five Year Plan:

Project	Status as at April 2017
Construction of Single Line Dual Gauge Railway Track from Dohazari to Cox's Bazar via Ramu and Ramu to Gundhum near Myanmar Border	Construction tenders being assessed; project expected to be underway shortly.
Padma Bridge Rail Link Project (Dhaka-Mawa-Bhanga-Jessore)	Project underway – contract issued to China Railway Group Ltd in August 2016
Construction of Double Track Standard Gauge Railway Line from Dhaka to Chittagong via Comilla/Laksam (expressway)	Rail portion of expressway project removed from project.
Construction Modern Railway Workshop at Rajbari.	Project currently scheduled for 2021-2025
Construction of Double Line (Dual Gauge) Railway Track between Joydebpur-Iswardi sections	Project currently scheduled for 2017-2020
Construction of Bangabandhu Railway Bridge (2nd) over the River Jamuna	Project currently scheduled for 2017-2020
Construction of Railway line from Khulna to Mongla Port with feasibility study	Project underway
Construction of Dual Gauge Double Rail Line and Conversion of Existing Rail Line into Dual Gauge between Akhaura and Laksam	Project underway
Construction of Dhaka – Laksam/ Comilla Chord line	Project replaced by Dhaka-Laksam Comilla High Speed Railway. FS yet to be undertaken

BR also has taken up two other projects –construction of Khulna- Mongla and Chittagong-Cox's Bazar rail lines. Additionally, in view of growing coal import requirements, a new line will be constructed to carry coal from the new port at Matarbari to the required coal-fire based power stations. Lastly, steps are being taken to establish an Airport Railway Station to upgrade airport services and to improve terminal accessibility by establishing multi-modal transfer facilities. This is proposed to be achieved by integrating Hazrat Shahjalal International Airport with the nearby airport railway station, on-going three Bus Rapid Transit (BRT) and Dhaka elevated expressway projects.

2.1.4 National Integrated Multi-modal Transport Policy

The National Integrated Multi-modal Transport Policy (NIMTP, 2013) lays primary focus on the roles that rail and inland water transport must play in the development of the overall transport network. In this effort, it prescribes the following imperative measures for Bangladesh Railway:

Figure 2-4: NIMTP Measures

- → *Improved inter-city service quality, timetabling and capacity.*
- → *Increasing container movement efficiency and capacity;*
- → *Establishing more inland container depots;*
- → *Taking a lead in providing multi-modal door-to-door services in close co-operation with operators of other modes;*
- → *Developing multimodal corridors between major economic centers which give priority to freight and a high-speed network for passengers. The immediate priority will be the Dhaka Chittagong Economic Corridor;*
- → *Establishing technical harmonization and interoperability between various logistics and systems, including regional traffic, particularly for rail-based container movement;*
- → *Reorganising the organisation into lines –of-business with a focus on operations in the multimodal environment;*
- → *Ensuring better integration and interchange ;*
- → *Establishing regional links, including those of Trans-Asian Railway, to facilitate trade in goods and services;*
- → *Corporatising BR in order to bring in efficiency and modern business practices;*
- → *Encouraging BR to divest itself of non-operational land holdings;*
- → *Improving value for money for passengers from the Government subsidy; and*
- → *Bringing forward investment plans and projects to meet these objectives.*

Source: NIMTP

Constraints for Bangladesh Railway as identified by NIMTP:

"……Bangladesh's rail infrastructure is characterised by lack of maintenance with many speed restrictions and safety concerns. Locomotives and rolling stock are relatively aged, and do not offer modern levels of service to passengers. The railway operates on two gauges, which obviously hampers seamless travel. In order to ensure that rail plays its full role in a multi-modal system in the future, these special issues need to be addressed by policy."

In order to ensure that rail plays its envisaged role in a multi-modal ecosystem in the future, these special issues and constraints need to be resolved. The proposed master plan has been prepared accordingly and aims to attract current and future roads users to rail by proposing and adopting measures as stipulated by NIMTP viz (*improving inter-city service quality, timetabling and capacity; increasing container movement efficiency and capacity; establishing more inland container depots; and taking a lead in providing multi-modal door-to-door services in close co-operation with operators of other modes*).

The Master Plan, when implemented, shall enable achieving if not exceeding performance targets prescribed for Bangladesh Railway, as summarized in the table below:

NIMTP Target	Master Plan Actions
30% growth in intercity rail passengers across 5 years	→ The Master Plan implementation shall result in longer trains and new train services resulting in more than 5% year-on-year compounded increased in passenger capacity. → The proposed new lines and integrated gauge conversion plan shall result in an exponential rise in passenger capacity during various plan periods.
Share of container traffic to double over next 8 years	→ The Master Plan implementation shall result in achieving this target during the prescribed time frame. It is envisaged that rail shall be able to capture at least 15% market share in a realistic scenario compared to current market share of around 3%.

Railway safety is another focus area. The NIMTP recognizes the immediate need to improve maintenance and eliminate manned railway crossings. The current Master Plan and its associated projects already endeavour to ensure that all level crossings on national and regional highways will be fitted with some form of physical protection and road over-bridges are constructed at identified level crossings on national and regional highways in accordance with the Road Master Plan.

3 Railway Characteristics and Compatibility

Key Messages

- This chapter details the current physical and operational characteristics of Bangladesh Railways, including:
  - Network distribution and line type
  - Gauge characteristics
  - Line usage (freight and passenger)
  - Signalling and telecom characteristics
  - Compatibility with neighbouring countries

3.1 Physical Characteristics

Bangladesh Railway reported a total of 2,877.10 route-km across two zones at the end of year 2014- 2015. The network distribution and line type is illustrated in

Figure 3-1 below. Bangladesh Railway is bifurcated into two zones (east and west) by the Jamuna River. The East Zone was entirely meter gauge. The West Zone was broad gauge except for the Lalmonirhat division, which was meter gauge. The East Zone, headquartered at Chittagong, has 1308 km of track while the West Zone, headquartered at Rajshahi, has 1569 km of track.

A detailed gauge composition of tracks across two zones is presented in the table below.

Table 3-1: Route-km Gauge Composition (2015)

Zone	Headquarters	Meter Gauge (route-km)	Broad Gauge (route-km)	Dual Gauge (route-km)	All Gauges (route-km)
East	Chittagong	1113.57	0	194.70	1308.27
West	Rajshahi	534.67	659.33	374.83	1568.83
Total		**1648.24**	**659.33**	**569.53**	**2877.10**

Source: Bangladesh Railways

Banghabandhu Bridge was constructed as dual gauge track from Parbatipur to Ibrahimabad (East Station of Jamuna Multipurpose Bridge). The bridge opened to traffic in June, 1998. In August 2003, direct train connection between Dhaka (Joydebpur) and Rajshahi was established with the introduction of the first intercity passenger train. Dual gauge track on the bridge is constructed of 4 rails (instead of 3 elsewhere in Bangladesh) so as to keep the load central on the bridge deck.

A comparison of network size with other regional railways is presented in Table 3-1 below. It can be seen that Bangladesh has the most railway for land mass but the least railway per population. This is explained by the much higher population density in Bangladesh.

Table 3-1: Regional Network Comparison

Country	Year	Network Size (route- km)	Area (km^2) per route-km	Population per route-km
Thailand	2005	4,044	126.04	16.084
Viet Nam	2005	2,671	105.25	27,765
Bangladesh	2014	2,781	52.87	60,537
India	2005	63,465	49.96	18,390
Pakistan	2006	7,791	102.18	22,750

Source: World Bank Railway Database, 2007

Bangladesh's higher population density and short freight haul distances mean that passenger rail is more dominant than freight rail in Bangladesh as opposed to the comparison countries.

Figure 3-1: Bangladesh Railway Network as of November 2016

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Table 3-2: Regional Networks: Passenger vs. Freight Traffic

Country	Year	Passenger-km (000,000)	Freight Ton-km (000,000)	Ratio: Pass-km to Freight-km
Thailand	2004	9,332	4,085	2.28
Viet Nam	2005	4,558	2,928	1.56
Bangladesh	2005	4,164	817	5.10
India	2005	575,702	407,398	1.41
Pakistan	2005	24,237	5,013	4.83

Source: World Bank Railway Database, 2007

Traffic flows vary significantly across the Bangladesh rail network. Some lines are primarily used for passenger trains, others for goods trains and a few are heavily used for both. In addition, there are many that are very lightly used on a regular basis. The information on traffic flows for 2013-14 is further illustrated on GIS based maps, as follows:

- Tonnes of Traffic per Day - Figure 3-2
- Goods Wagons per Day - Figure 3-3
- Passenger and Mixed Trains per Day - Figure 3-4
- Freight Trains per Day in 2013-14 - Figure 3-5
- Coaching Vehicles per Day in 2013-14 - Figure 3-6

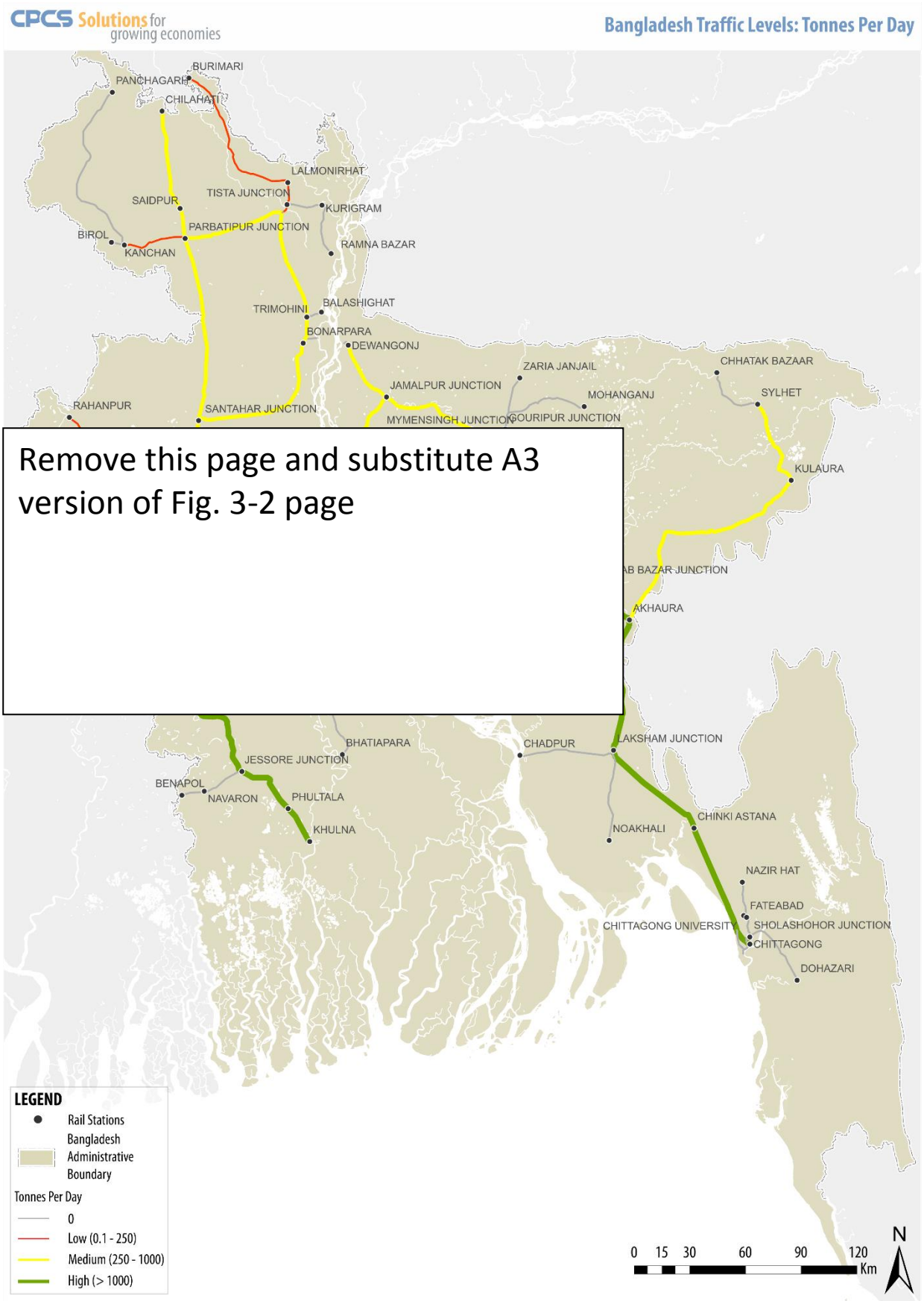
Most heavily used lines for passenger traffic are:

- Dhaka-Chittagong
- Akhaura-Sylhet
- Dhaka-Jamalpur Junction
- Dhaka- Narayanganj
- Abdulpur- Chapainowabgonj

Most heavily used lines for freight traffic are:

- Chittagong-Dhaka
- Ishardhi-Khulna

Figure 3-2: Tonnes of Traffic per Day in 2013-14



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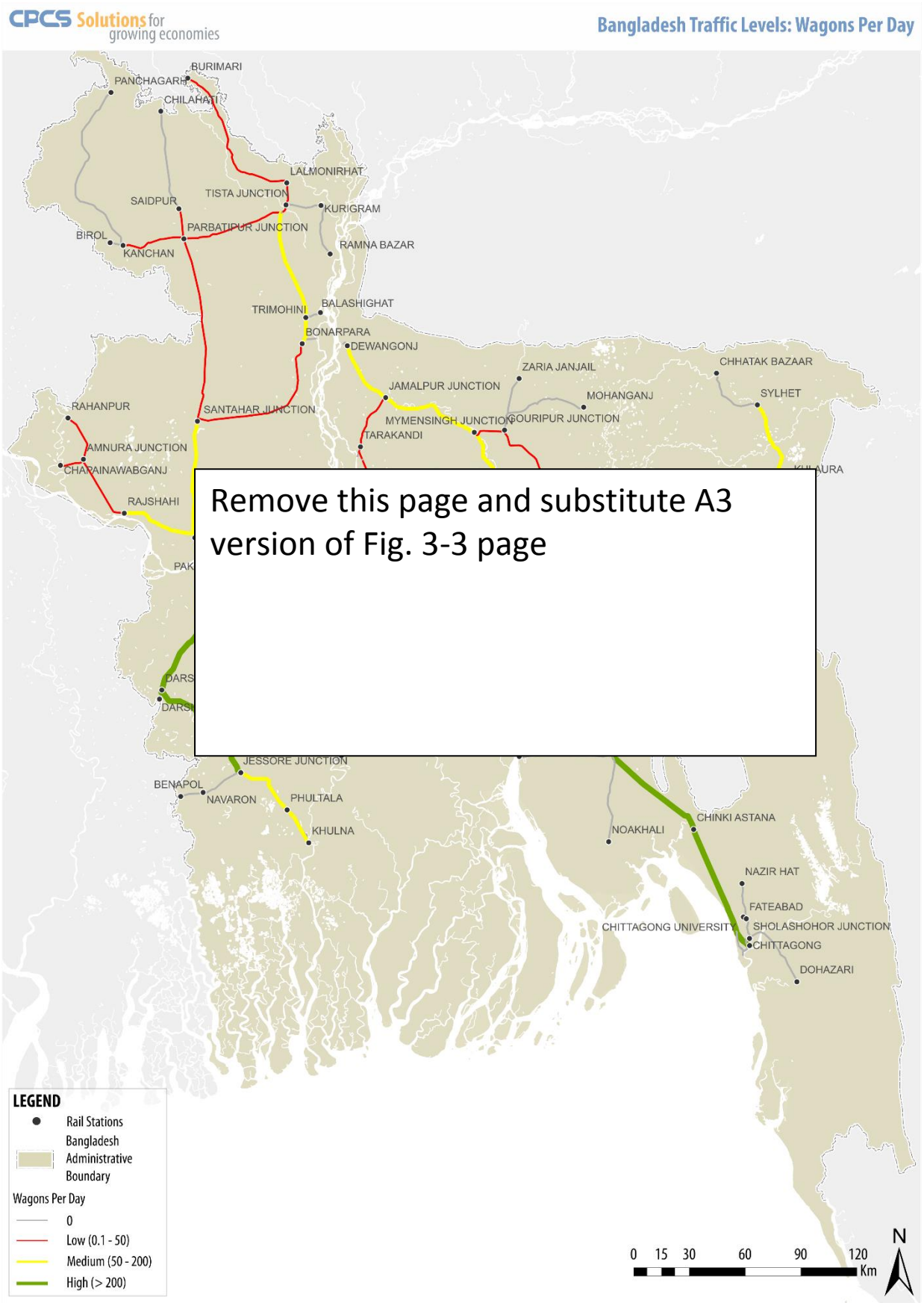
Source: Bangladesh Railway Information Book 2014 (Tables 60-1 and 60-2)

Figure 3-3: Goods Wagons per Day in 2013-2014



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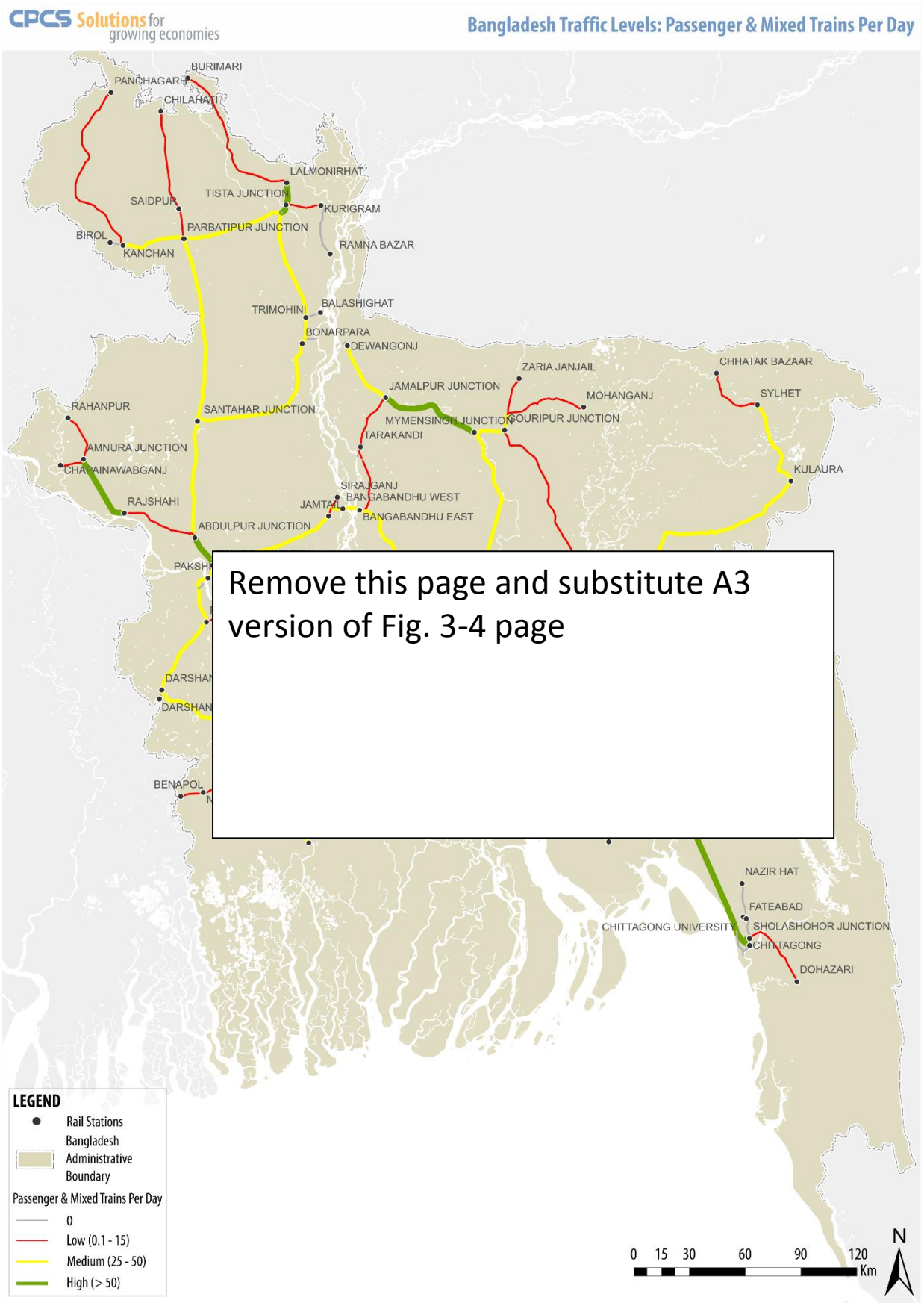
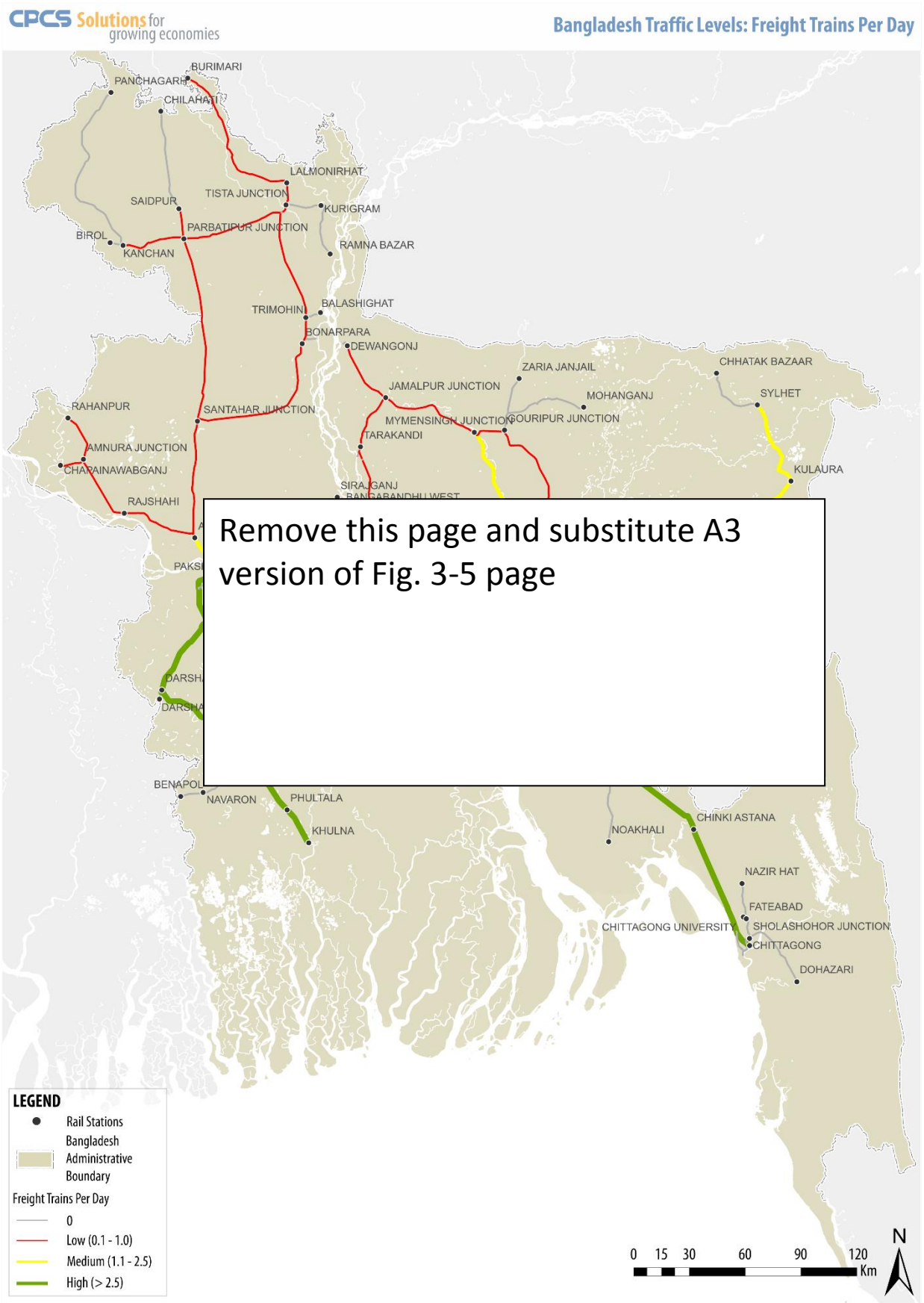
Source: Bangladesh Railway Information Book 2014 (Tables 60-1 and 60-2)

Figure 3-4: Passenger and Mixed Trains per Day in 2013-14



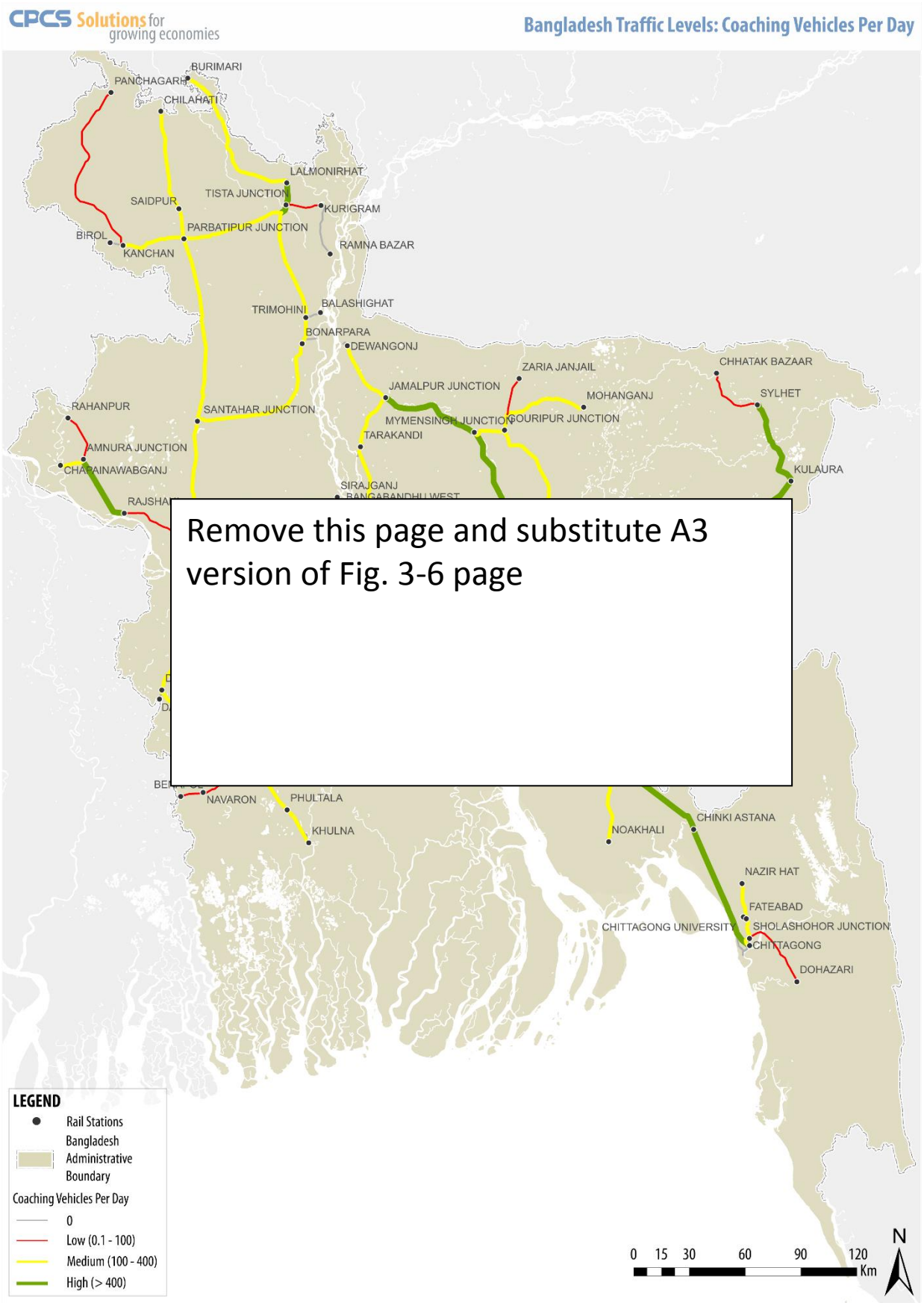
Source: Bangladesh Railway Information Book 2014 (Tables 60-1 and 60-2)

Figure 3-5: Freight Trains per Day in 2013-14



Source: Bangladesh Railway Information Book 2014 (Tables 60-1 and 60-2)

Figure 3-6: Coaching Vehicles per Day in 2013-14



Source: Bangladesh Railway Information Book 2014 (Tables 60-1 and 60-2)

3.1.1 Signalling and Communication

During the last decade, as a part of modernisation of Bangladesh Railways, the conventional mechanical signalling are being progressively replaced by colour light signalling. In recent years computer-based interlocking is being introduced on main routes of Bangladesh Railways. Further, Bangladesh Railways is moving ahead in its endeavour to modernize signalling on the Chittagong- Laksam section where a Centralised Traffic Control (CTC) system is under installation.

The following types of signalling are presently in use on Bangladesh Railways:

- Centralised Traffic Control
- Computer Based Interlocking (CBI)
- Route Relay Interlocking (RRI) with Colour Light Signalling
- Double Wire Upper Quadrant Mechanical Signalling
- Single Wire Mechanical Interlocking
- Non-Interlocked (NI) with Colour Light Signalling (CLS)
- Non-Interlocked (NI) Mechanical Signalling

The standards of signalling on Bangladesh Railways and the corresponding permissible maximum speed are:

- Standard III: Unrestricted Speed
- Standard II: Up to 72 kmph
- Standard I: Up to 48 kmph
- Non-interlocked: Up to 16 kmph

Examples of the present signalling system on some of the important sections of Bangladesh Railways are as given below:

S.No.	Type of Signalling	Sections
1.	Centralised Traffic Control (CTC)	Laksam-Chinkiastana (installed) Chinkiastana-Chittagong (in progress)
2.	Computer Based Interlocking (CBI)	Dhaka-Tongi Tongi-Bhairab Bazar Tongi-Joydevpur Joydevpur-Mirzapur Mirzapur-B.B, Bridge (E) B.B. Bridge (E)-Jamtail Jamtail-Muladuli-Majhgram Sylhet-Akhaura
3.	RRI with Colour Light Signalling	Akhaura-Laksam Jamalpur-Mymensingh Mymensing-Gouripur Mmensing Parbotipur-Santahar

S.No.	Type of Signalling	Sections
4.	D.W.U.Q. Mechanical Signalling	Gouripur Mmensing -Bhairab Bazar Bonarpara-Santahar Darshana-Benapol Benapol-Khulna
5.	Non Interlocked with Colour Light Signalling	Fatehabad-Sholahshahar Laksam-Noakhali Dhaka-Narayanganj Jamalpur-Jagannathganj Ghat Abdulpur-Rohanpur Lalmonirhat-Burimari

Figure 3-7: Signalling across BR Network

Source: Bangladesh Railway

3.2 Compatibility with Neighbouring Countries

Bangladesh shares around 94% of its land border with India (4096 km) and the remaining 6% with Myanmar (265 km). Bangladesh Railway has a legacy physical rail connection with India and onwards to Pakistan through the western border.). The Railway will soon have a connection through India's northeastern states to Nepal. No railway connectivity currently exists with Myanmar in the East. Also, lack of a uniform compatible gauge has restricted seamless integration with Indian Railway's broad gauge network and onwards with other neighbouring countries, including Pakistan and other participating Trans Asian Railway – southern corridor countries. No operational railway link exists with Myanmar or India on the eastern side.

Table 3-3: Prevalent gauges in neighbouring countries

Trans-Asian Railway- Southern Corridor participating countries	Primary Gauge
Turkey	SG
Iran	SG
Pakistan	BG
India	BG
Bangladesh	BG (West Zone) and MG (East Zone)
Myanmar	MG
China	SG
Thailand	MG
Cambodia	MG
Vietnam	MG

As stated above, BR's Western Zone comprises primarily of broad gauge, allowing railway connectivity with Indian Railway's broad gauge network. Starting 14th April, 2008, one daily intercity passenger train (the Moitry Express) was running between Dhaka and Kolkata via Darsana junction; the frequency has been reduced to four trains/week. Freight traffic from India enters Bangladesh (and vice versa) at 4 locations: Benapole, Darsana, Rohanpur and Birol, which are all located in the West Zone. There are currently no international rail connections in the East Zone between the BR network and Myanmar; nor any to the North-Eastern Indian states. However, BR and IR have agreed to rehabilitate the line to Shahbazpur where it will interchange traffic with IR. The line would be meter gauge with provisions for broad gauge conversion in the future. It is expected to be operational in 2019.

Bangladesh has the possibility of having a rail link with Myanmar on the eastern side, and Bangladesh Railway has already moved a step forward with the proposed 129 km rail track between Dohazari to Gundum via Cox's Bazaar, scheduled to be commissioned in 2022. An alternate possible rail link with Myanmar on the eastern side may also be possible, once the Indian Railway's 84 km link from Jiribum to Tupul (near Imphal) is completed and this link is further extended up to Tamu at the India/Myanmar border. However, there is a missing link for further rail connectivity between Kalay-Tamu (135 km) in Myanmar. The project has seen little progress since 2005 when a feasibility study was undertaken by RITES of India and still remains under consideration of the Government of Myanmar with no progress till recently.

The Southern corridor of the Trans- Asian Railway (TAR) from the East passes through Myanmar, India, Bangladesh and again India and then Pakistan, Iran and Turkey before it joins the

European Railway. As evident from the above table, three different gauges are involved in the corridor such as metre gauge (MG), standard gauge (SG) and broad gauge (BG). Within Bangladesh, this corridor is expected to traverse from Darshana-Ishurdi-Jamtoil-Joydevpur-Tongi (Dhaka)-Bhairab Bazar-Akhaura-Kulaura-Shahbazpur. The rail link to Tongi is already DG (dual gauge – broad and metre) currently and the link from Tongi to Akhaura shall be converted by 2020 with the remaining section (Akhaura-Shahbazpur) converted by 2025, under the proposed gauge conversion plan described in Section 7.1.

4 Freight Traffic Projections

Key Messages

- Bangladesh Railways freight traffic has been generally declining since 1969-70
- The railway, which once transported a variety of goods, has now become a "bulk" transporter
- BR capacity expansion in 2013-14 has resulted in higher market capture indicating clearly that BR traffic potential and market capture is "supply driven" rather than demand driven
- Bangladesh Railways should focus only on bulk commodities and containers

4.1 Introduction

The Interim Report identified principal commodities carried by BR and discussed past traffic in terms of volume by commodity and dynamics over time. The growth trend of these identified principal commodities was examined in relation to economic growth drivers. The methodology that was proposed in the Inception Report was further refined based on comments from BR and the same was presented in the Interim Report, which is adopted now for traffic projections.

4.2 Current Situation: 2014-15

The total traffic of BR in 2014-15 was 2.1 million tonnes, consisting of 78 % up-direction traffic and remaining 22% down-direction traffic. This means that there is considerable empty return haulage. This is especially true of liquid bulk traffic (38% up and 3% down). A similar imbalance in movement also prevails with regards to dry bulk (rice, wheat and sugar, which are imported cargoes). However, container movement between Dhaka and Chittagong port is balanced (although the data compiled based on BR's freight invoice shows imbalance).

Table 4-1: Principal Commodities carried by BR in 2014-15

Commodity Category and Principal Commodities	BR Traffic (Volume in Tonnes)			BR Traffic (Volume in % Share)		
	UP Stream	Down Stream	Total	UP Stream	Down Stream	Total
A. Liquid Bulk						
- Fuel Oil	715,734	21,773	737,507	34.9	1.1	35.9
- Kerosene	35,876	3,315	39,191	1.7	0.2	1.9
- Petrol	18,240	34,643	52,883	0.9	1.7	2.6
Sub-Total (A)	**769,850**	**59,731**	**829,581**	37.5	2.9	40.4
B. Dry Bulk						
- Fertilizer	43,329		43,329	2.1	-	2.1
- Wheat	208,532	41,878	250,410	10.2	2.0	12.2
- Rice		90,700	90,700	-	4.4	4.4
- Other Grain	47,893	3,850	51,743	2.3	0.2	2.5
- Sugar		1,463	1,463	-	0.1	0.1
Sub-Total (B)	**299,754**	**137,891**	**437,645**	14.6	6.7	21.3
C. General cargo						
- Soya Oil Cake	59		59	0.0	-	0.0
- Marble & Stones	3,037	15,934	18,971	0.1	0.8	0.9
- Others	197,431	18,277	215,708	9.6	0.9	10.5
Sub-Total (C)	**200,527**	**34,211**	**234,738**	9.8	1.7	11.4
D. Container (D)	**327,806**	**223,593**	**551,399**	16.0	10.9	26.9
Grand Total (A+B+C+D)	1,597,937	455,426	2,053,363	78.0	22.0	100.0

Source: Consultants' O-D Analysis based on Freight Invoice of BR

In terms of commodity composition, 89% is bulk commodities: 41% liquid bulk, 21% dry bulk and 27% container. The most important commodities are:

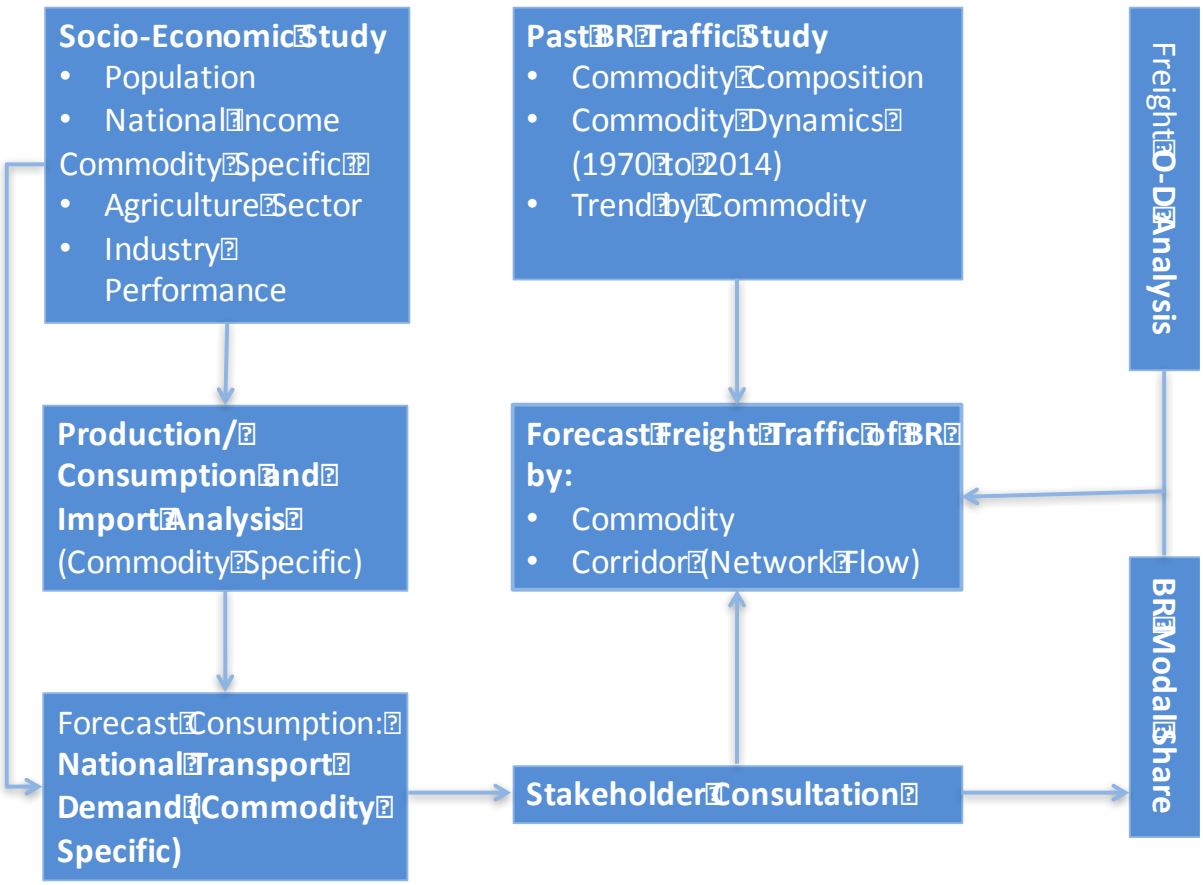
- Fuel Oil
- Kerosene
- Petrol
- Fertilizer
- Wheat
- Rice
- Container

Therefore, the forecast has been done for the above commodities.

4.3 Forecast of Potential Traffic

The methodology finally adopted to project the potential traffic of BR, which is almost the same as that of presented in the Interim Report, is depicted in Figure 4-1.

Figure 4-1: Methodology adopted to forecast potential traffic of BR

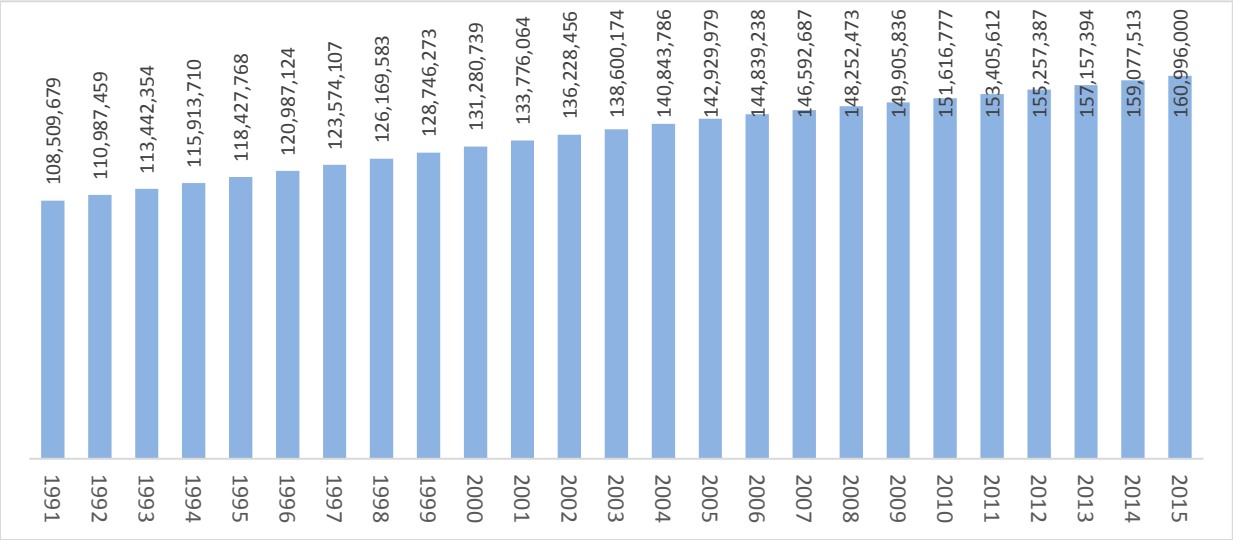


4.3.1 Population

The population of Bangladesh has increased from 108.5 million in 1991 to 133.8 million in 2001 and further to 153.4 million in 2011, as per the Population Census of Bangladesh. This equates

to a growth rate of 2.11% p.a. between 1991 and 2001, and 1.37% p.a. between 2001 and 2011 respectively. The estimated population in 2015 at 161 million provides an estimated growth rate of only 0.97% p.a. during 2011 to 2015 (see Figure 4-2). Thus, the growth rate has been on the decline.

Figure 4-2: Trend in Population Growth of Bangladesh (in Numbers)



Among many population forecasts available, two sources are found to be of interest to the study; one carried out by the Department of Economic and Social Affairs of the UN[4] and the other by the Bangladesh Bureau of Statistics (BBS)[5], Ministry of Planning, Government of Bangladesh. Their forecast for the study period is estimated as given below:

Table 4-2: Population Forecasts for Bangladesh (millions)

Year	United Nations	Bangladesh Bureau of Statistics		
		Scenario-1	Scenario-2	Scenario-3
2011	153.4	149.8	149.8	149.8
2015	160.9	158.1	158.1	158.1
2020	169.1	169.4	169.4	169.4
2025	177.6	181.1	179.7	179.7
2030	186.5	192.6	188.2	188.2
2035	190.3	203.0	195.8	193.7
2040	194.2	213.0	202.9	198.6
2045	198.2	222.4	208.8	202.5

Source: Estimated based on UN and GoB sources as given in the foot-note 1 and 2.

Among these various forecasts, the UN forecast is considered in this study for the following reasons:

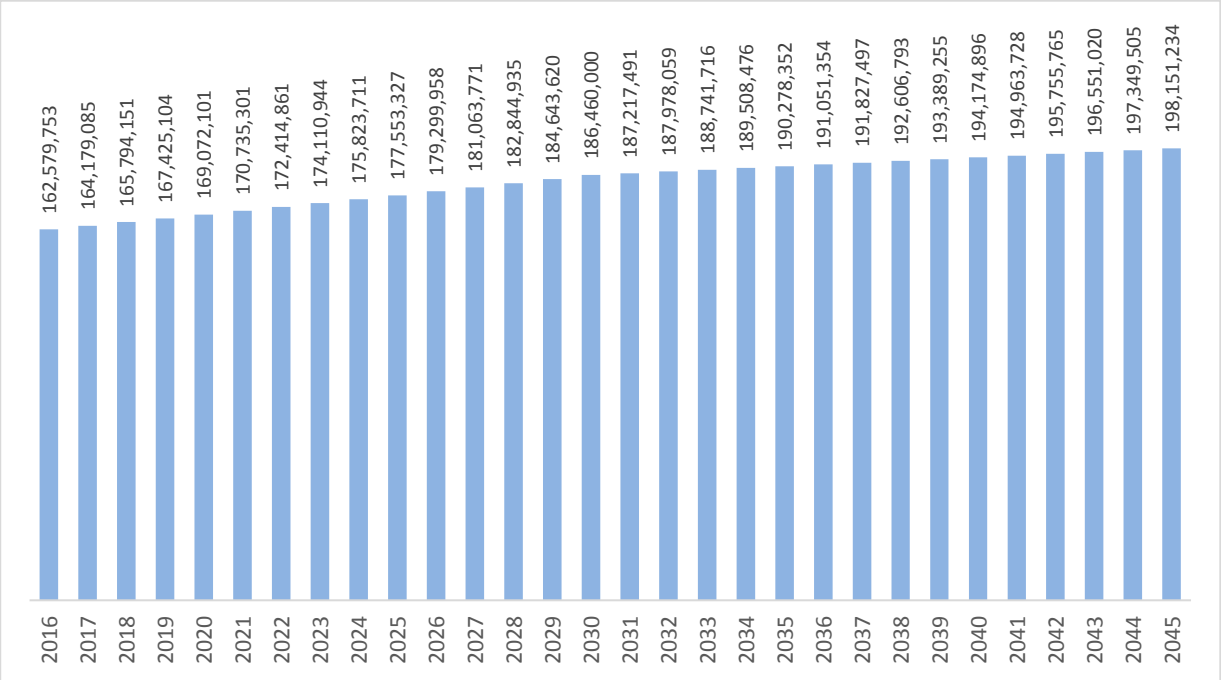
[4] Population Division, Department of Economic and Social Affairs (2015): World Population Forecasts-2015 Revision, Key Findings and Summary, UN, New York.

[5] Bangladesh Bureau of Statistics (2015): Population Projection of Bangladesh-Dynamics and Trend (2011-2061), Ministry of Planning, Government of Bangladesh.

- BBS forecast has carried out the forecast in 3 scenarios with varied assumptions of Total Fertility Rate (TFR), which is found to be difficult to assess their validity in the time available for this task
- The difference between UN and BBS forecast (Scenario-3) is marginal (4 million over a period of 30 years)

The forecast population of Bangladesh used in this study is illustrated in Figure 4-3.

Figure 4-3: Adopted Forecast Population of Bangladesh (in Numbers)



4.3.2 National Economy

The National Income, measured in terms of Gross Domestic Product (GDP) at current prices is estimated at BDT 1520 crore in 2015 and the same measured in GDP at constant price was BDT 820 crore. The real national economic growth (GDP, at constant prices) of Bangladesh witnessed in the last 15 years is set out in Table 4-3 and shown in Figure 4-4.

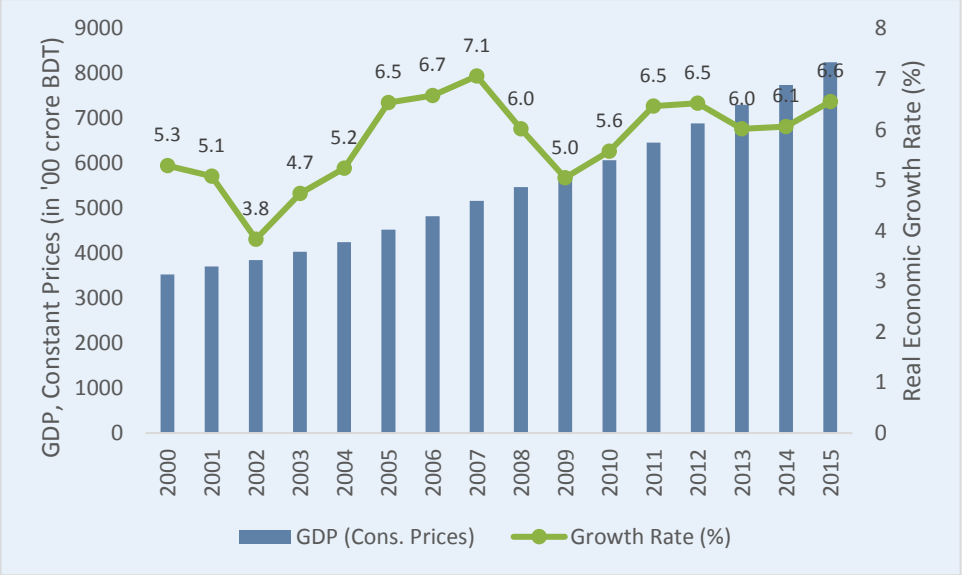
Table 4-3: Trend in National Economic Growth of Bangladesh

	GDP At Constant Prices (BDT crore)	GDP At Constant Prices (BDT crore)	Real Economic Growth Rate (%)
2000	2,68503	3,52914	5.29
2001	2,91337	3,70833	5.08
2002	3,14280	3,85047	3.83
2003	3,48320	4,03297	4.74
2004	3,83294	4,24428	5.24
2005	4,27074	4,52168	6.54
2006	4,82337	4,82336	6.67

	GDP At Constant Prices (BDT crore)	GDP At Constant Prices (BDT crore)	Real Economic Growth Rate (%)
2007	5,49800	5,16383	7.06
2008	6,28682	5,47437	6.01
2009	7,05072	5,75056	5.05
2010	7,97539	6,07097	5.57
2011	9,15829	6,46342	6.46
2012	10,55204	6,88493	6.52
2013	11,98923	7,29896	6.01
2014	13,43674	7,74136	6.06
2015	15,15802	8,24862	6.55

Source: World Development Indicators, WB, 2015

Figure 4-4: Trend in Bangladesh Economic Growth (2000 to 2015)



The major features observed of the national economic growth in Bangladesh are:

- The overall growth rate of Bangladesh, in real terms, between 2000 and 2015 was 5.8% p.a.
- The annual average compound growth rate has been increasing; 5.1% p.a. during 2000 to 2005, 6.1% p.a. during 2005 to 2010 and 6.2% p.a. between 2010 and 2015.

The above trend clearly shows that the growth rate will continue to increase in future. For the current Master Plan project, an increasing real economic growth rate is assumed as given below for the next 15 years, but a stagnant growth in the later period, which is slightly higher than what was observed in the last 15 years:

Year	% G.R
2020	6.3
2025	6.4

Year	% G.R
2030	6.5
2035	6.0
2040	6.0
2045	6.0

4.3.3 Petroleum Oil Products (POL)

POL consists of a) motor gasoline, b) jet fuel, c) kerosene, d) distillate fuel Oil (DFO) and e) others. The consumption of POL and other hydrocarbon products was analyzed, including liquid petroleum gas (LPG), for the past 26 years (1990 to 2015) based on data from the Energy Information Administration, which is supplemented with information from the Bangladesh Petroleum Corporation (BPC).

The consumption of POL in Bangladesh is given in Appendix 2. Important observations to note of the growth trend are:

- Overall consumption of hydrocarbon products increased at the rate of 4.4 % p.a.
- Kerosene consumption is declining by 1.9 % p.a. because of enhanced electrification of rural areas and an increase in LPG consumption in semi-urban and urban areas, which has increased over time at the rate of 2. % p.a. DFO and jet fuel have registered the highest growth rate of 5.5 % p.a., which reflects increased travel demand in Bangladesh, while both domestic and international motor gasoline also exhibited similar trend in growth at 4.5 % p.a.

In terms of composition, the last 26 years' average works out to be:

- Motor gasoline : 6.6%
- Jet fuel : 5.0%
- Kerosene : 14.3%
- DFO : 50.5%
- All others : 23.2%
- LPG : 0.5%

Having examined the past trend in consumption and composition, two methods were applied to forecast the national demand: a) Time trend, and b) Per Capita Consumption, based on 25 years' data (1991-2015). The details of time trend and per capita consumption are laid out in Appendix 2. The final results are summarized in Table 4-4.

Table 4-4: Forecast National Demand of POL in Bangladesh (million tonnes)

	Time Trend	AACGR (%)	P.C. Consumption	AACGR (%)
2015	5.1		5.3	
2020	6.1	4.0	6.6	4.4

	Time Trend	AACGR (%)	P.C. Consumption	AACGR (%)
2025	6.6	1.4	7.6	2.8
2030	6.9	0.9	8.6	2.7
2035	7.3	1.2	9.5	1.9
2040	7.6	0.8	10.4	1.8
2045	8.0	1.1	11.4	1.7
2015 to 2045		1.6		2.6

Source: Consultants Estimate, 2016

The result of time trend analysis shows that the consumption of POL will only be 1.6 times of today's consumption in 30 years from now, whereas the forecast based on per capita consumption shows a 2.2 times increase in the same period. It is ascertained that such a meagre increase in POL consumption based on time trend analysis is conservative and that of increase in POL consumption based on per capita consumption method is moderate. Therefore, the moderate result based on per capita consumption is considered further in assessing the potential traffic of BR.

The forecast national demand is split into different products based on past composition, but suitably amended to reflect the following phenomena:

Motor gasoline would marginally increase its share from 6.6% to 7.0% in future. With the increased travel demand and people's tendency to use more and more of high speed diesel (HSD) *would increase jet fuel share from 5.0% to 6.0% and DFO's share from 50.5% to 60%. However, the share of kerosene would come down from 14.3% to 5.5% with the increase in electrification and use of alternate energy such as solar/wind energy.*

In line with above considerations, the national demand of DFO, kerosene and MG, which are the candidate traffic of BR, will be as given in Appendix 3 and summarized in Table 4-5.

Table 4-5: Demand Forecast for Bulk Liquids (in '000 tonnes)

	Forecast POL	DFO	Kerosene	Motor Gasoline
2015	5.32	3.19	0.29	0.37
2020	6.60	3.96	0.36	0.46
2025	7.58	4.55	0.42	0.53
2030	8.64	5.19	0.48	0.61
2035	9.52	5.71	0.52	0.67
2040	10.42	6.25	0.57	0.73
2045	11.36	6.81	0.62	0.79

Source: Consultants Estimate, 2016

4.3.4 Distillate Fuel Oil

Having forecasted the national demand of DFO, the next step is to assess the modal share of railways, which will determine the traffic potential of BR. In this regard, market capture of BR will entirely depend on de-bottlenecking various supply constraints and easing out supply constraints. Therefore, scenarios are adopted to illustrate the range of "potential" traffic of BR:

- Scenario-1: present market capture (conservative)
- Scenario-2: improved market capture (realistic)
- Scenario-3: jump in market capture (optimistic)

BR has transported 715 thousand tonnes of FO in 2014-15, which accounts for 22% of the national FO consumption (3,193 thousand tonnes). Accordingly, the following market capture under the three scenarios, in terms of percentage to the national demand, are assumed:

Table 4-6: Forecast of DFO Market Share Carried by BR (%)

	2015-20	2020-25	2025-30	2030-35	2035-40	2040-45
Scenario-1	22%	22%	22%	22%	22%	22%
Scenario-2	25%	28%	32%	34%	37%	40%
Scenario-3	28%	30%	35%	40%	45%	50%

Source: Consultants Estimate, 2016

The resultant annual forecast is set out in Appendix 2 and summarized at 5-yearly intervals in Table 4-7.

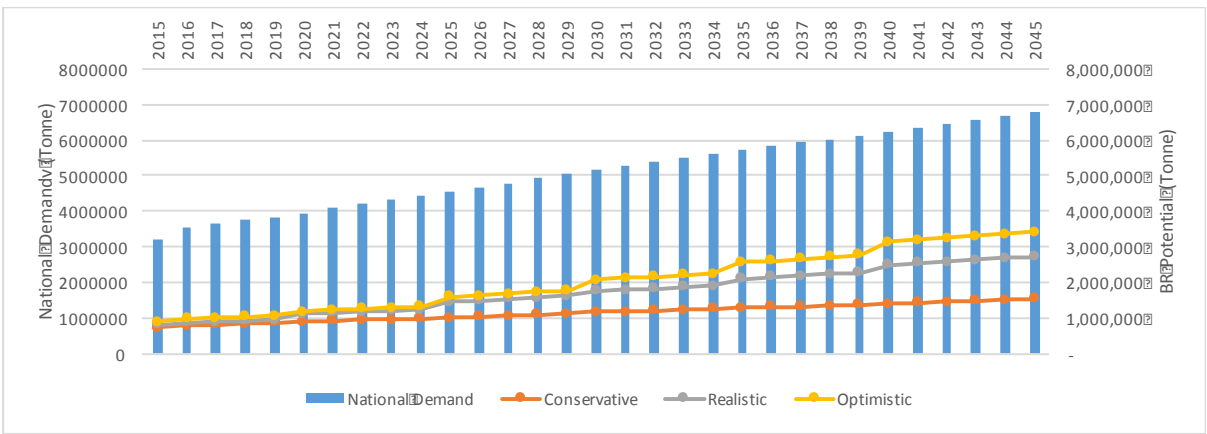
Table 4-7: Scenario Forecast of DFO Tonnages to be Carried by BR ('000 Tonnes)

	National Demand	Conservative	Realistic	Optimistic
2015	3,192.85	715.73	798.21	894.00
2020	3,962.58	888.28	1,109.52	1,188.77
2025	4,550.25	1,020.02	1,456.08	1,592.59
2030	5,186.91	1,162.74	1,763.55	2,074.76
2035	5,709.89	1,279.97	2,112.66	2,569.45
2040	6,252.12	1,401.52	2,500.85	3,126.06
2045	6,814.16	1,527.51	2,725.67	3,407.08

Source: Consultants Estimate, 2016

The annual forecast, in tonnage terms, is illustrated in Figure 4-5.

Figure 4-5: Scenario Forecast of DFO Tonnages to be Carried by BR (Tonnes)



Depending on how effectively supply constraints are addressed in future, the potential traffic ranges from 1.1 million tonnes to 1.6 million tonnes in 2030 and the same increases to 1.5 million tonnes to 3.4 million tonnes in 2045.

It should be noted that POL in general is one of the predominant commodities carried by BR already. Secondly, inland waterways are significantly used to transport imported liquid from Chittagong Port, up to Godnail and Bagabari. The demand for BR wagons is high during dry season as the depth available in the waterway is highly limited. Thirdly, there is a pipeline under construction (under Indo-Bangladesh Friendship Treaty) to transport POL from Nimaligarh Refinery in Assam, India to Parbatipur in Bangladesh, which is expected to be commissioned by 2017/18. In this case, the immediate need is to convert the present MG system to BG between Parbatipur and Rangpur, as BPC proposes to use Parbatipur Depot for distribution purposes with increased quantity. Furthermore, the expansion of crude refining capacity of East Coast Refinery from 1.5 million tonnes to 4.5 million tonnes is underway and is scheduled for completion by 2018/19. This will reduce the import quantity of POL through Chittagong port, but will demand increased quantum of crude import. As the refinery is located in Chittagong, the demand for POL transport upstream will continue to increase in future also. Unfortunately, there is limited detail available with regard to the transport distribution plan of POL cargo. As a result, the flow of traffic was estimated by using the 2014-15 O-D analysis.

In light of the above considerations, the future traffic flow of DFO is estimated by Section/Segment for the realistic scenario-2, as given in Table 4-8.

Table 4-8: Future DFO Traffic for BR (2020-2045)

Railway Section/ Segment	Loading Station	Unloading Station	Distance (km)	2014-15 Traffic (Tonne)	% Share to Total Traffic	2020	2025	2030	2035	2040	2045
Up Direction											
Ctg.-LKM-CDR	GPTK	CDR	180.72	6,501	0.9%	9,780	12,835	15,545	18,623	22,045	24,026
Ctg.-LKM-AKA-BCI-TGI-DA	GPTK	DACT	305.51	28,896	3.9%	43,472	57,050	69,097	82,775	97,985	106,793
Ctg.-SLHR-DHZ	GPTK	DHZ	47.04	31,902	4.3%	47,994	62,985	76,285	91,386	108,178	117,903
Ctg.-SLHR-HZI	GPTK	HZI	47.04	32,008	4.3%	48,154	63,194	76,538	91,690	108,537	118,295
Ctg.-LKM-AKA	GPTK	MAMT	149.73	18,393	2.5%	27,671	36,314	43,982	52,689	62,370	67,977
Ctg.-LKM-AKA-BCI-TGI-JY-ISD-AUP-STU-PBT-KNA	GPTK	RNP	724.49	21,566	2.9%	32,444	42,578	51,569	61,778	73,129	79,703
Ctg.-LKM-AKA-KRF	GPTK	SRG	288.58	48,598	6.6%	73,112	95,948	116,209	139,214	164,793	179,608
Ctg.-LKM-AKA-KRF-SYT	GPTK	SYT	377.56	55,822	8.9%	89,024	129,954	157,395	188,553	223,199	243,264
KLN-JS-DSN-PDB-RB-FDP	KLNJ	AIB	260.00	33,541	4.5%	50,460	66,222	80,205	96,083	113,737	123,962
KLN-JS-DSN-PDB-ISD-AUP-AUA	KLNJ	AUA	301.00	33,457	4.5%	50,333	66,055	80,003	95,841	113,451	123,650
KLN-JS-DSN-PDB-ISD	KLNJ	BYM	188.53	22,404	3.0%	33,705	44,233	53,573	64,178	75,971	82,800
KLN-JS-DSN-PDB-ISD-AUP-AUA	KLNJ	HRY	255.63	63,611	8.6%	95,698	125,589	152,108	182,220	215,702	235,092
KLN-JS-DSN-PDB-ISD-AUP-STU	KLNJ	NTE	238.98	60,564	8.2%	91,114	119,573	144,822	173,491	205,369	223,831
KLN-JS-DSN-PDB-ISD-AUP-STU-PBT	KLNJ	PBT	379.20	194,687	26.4%	292,891	384,376	465,541	557,700	660,173	719,521
KLN-JS-DSN-PDB-ISD-AUP-AUA	KLNJ	RJHI	263.20	13,108	1.8%	19,720	25,879	31,344	37,549	44,449	48,444
KLN-JS-DSN-PDB-ISD-AUP-STU-CLH	KLNJ	SDP	394.30	5,891	0.8%	8,862	11,630	14,086	16,875	19,975	21,771
KLN-JS-DSN-PDB-ISD-AUP-STU	KLNJ	STU	283.25	18,819	2.6%	28,312	37,155	45,001	53,909	63,814	69,551
PBT-KNA	PBT	RNP	89.57	5,799	0.8%	8,724	11,449	13,867	16,612	19,664	21,432
PBT-KCQ-PCGH	PBT	THRD	94.65	10,167	1.4%	15,295	20,073	24,312	29,124	34,476	37,575
Sub-Total: Up Direction			293.59	715,734	97.0%	1,076,766	1,413,092	1,711,484	2,050,289	2,427,017	2,645,197
Down											
PBT Siding	PBT	JOCL	85.00	1,723	0.2%	2,592	3,402	4,120	4,936	5,843	6,368
KRF-AKA-LKM-CTG	SRG	GPTK	288.58	20,050	2.7%	30,164	39,585	47,944	57,435	67,989	74,100
Sub-Total: Down Direction			272.47	21,773	3.0%	32,756	42,987	52,064	62,371	73,831	80,468
Total (Up and Down Direction)				737,507	100.0%	1,109,521	1,456,079	1,763,548	2,112,660	2,500,848	2,725,665

Source: Consultants Estimate, 2016

4.3.5 Kerosene

BR has transported 39,000 tonnes of kerosene in 2014-15, which accounts for 13% of the national demand. The market capture of BR under the 3 scenarios assumed are:

Table 4-9: BR's Market Capture Forecast for Kerosene (%)

	2015-20	2020-25	2025-30	2030-35	2035-40	2040-45
Scenario-1	13%	13%	13%	13%	13%	13%
Scenario-2	13%	15%	16%	17%	18%	19%
Scenario-3	13%	15%	17%	20%	23%	25%

Source: Consultants Estimate, 2016

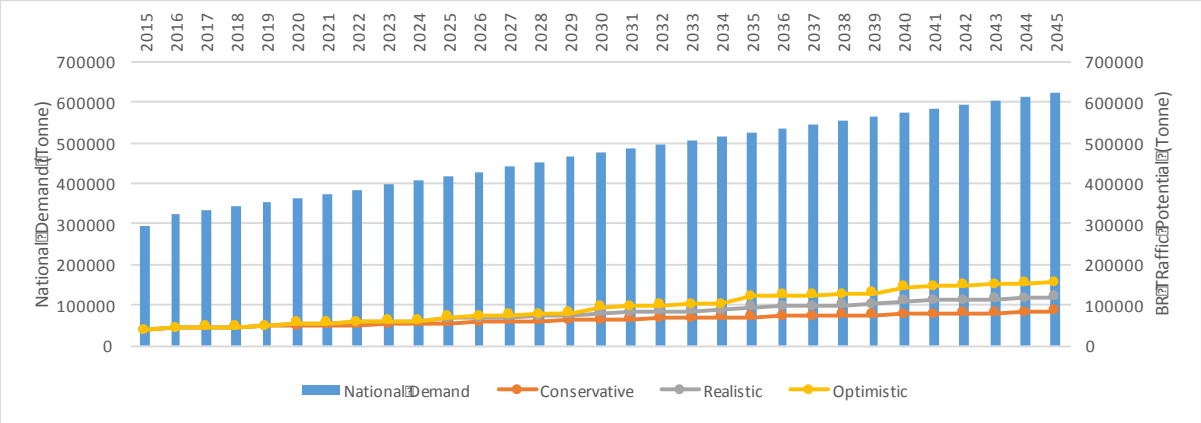
Based on the estimated national demand and considering the market capture as assumed above, the forecast potential traffic of kerosene is estimated as given in Table 4-10 and the same is illustrated in Figure 4-6.

Table 4-10: BR's Market Capture Forecast for Kerosene ('000 Tonnes)

	National Demand	Conservative	Realistic	Optimistic
2015	292.68	39.19	39.19	39.19
2020	363.24	48.64	54.49	54.49
2025	417.11	55.85	66.74	70.91
2030	475.47	63.67	80.83	95.09
2035	523.41	70.09	94.21	120.38
2040	573.11	76.74	108.89	143.28
2045	624.63	83.64	118.68	156.16

Source: Consultants Estimate, 2016

Figure 4-6: BR's Market Capture Forecast for Kerosene (Tonnes)



The forecast potential kerosene traffic of BR is likely to follow the O-D pattern as observed in 2014-15, which is presented in Table 4-11.

Table 4-11: Forecast Kerosene Traffic Flow of BR (in tonnes)

Railway Section/Segment	Loading Station	Unloading Station	Distance (km)	2014-15 Traffic (Tonne)	% Share to Total Traffic	2020	2025	2030	2035	2040	2045
UP											
KLN-JS-DSN-PDB-ISD-AUP-AUA	KLNJ	HRY	255.63	1,633	1.6%	1,880	1,077	1,305	1,521	1,758	1,916
KLN-JS-DSN-PDB-ISD-AUP-STU-PBT	KLNJ	PBT	379.20	34,378	87.7%	47,794	58,541	70,903	82,644	95,519	104,106
KLN-JS-DSN-PDB-ISD-AUP-AUA	KLNJ	RJHI	263.20	865	2.2%	1,203	1,473	1,784	2,079	2,403	2,619
Sub-Total: UP Direction			874.22	35,876	91.5%	49,877	61,092	73,992	86,244	99,680	108,641
Down											
SYT-KRF-AKA-LKM-CTG	MBJ	MPL/Ctg.	365.89	115	0.3%	160	196	237	276	320	348
SYT-KRF-AKA-LKM-CTG	SYT	GPTK	377.57	3,200	8.2%	4,449	5,449	6,600	7,693	8,891	9,690
Sub-Total: Down Direction			377.16	3,315	8.5%	4,609	5,645	6,837	7,969	9,211	10,039
Total (Up and Down Direction)				39,191	100.0%	54,485	66,737	80,829	94,213	108,891	118,680

Source: Consultants Estimate, 2016

4.3.6 Petrol

BR has transported 52,800 tonnes of petrol in 2014-15, which accounts for 14% of the national demand. The market capture of BR under the 3 scenarios assumed are:

Table 4-12: Assumed Market Capture Scenarios of Petrol Traffic of BR

	2015-20	2020-25	2025-30	2030-35	2035-40	2040-45
Scenario-1	14%	14%	14%	14%	14%	14%
Scenario-2	14%	15%	16%	17%	18%	19%
Scenario-3	14%	18%	20%	22%	24%	26%

Source: Consultants Estimate, 2016

Based on the estimated national demand and considering the market capture as assumed above, the forecast potential traffic of kerosene is estimated as given in Table 4-13.

Table 4-13: Forecast BR Potential Petrol Traffic Under Scenarios ('000 tonnes)

	National Demand	Conservative	Realistic	Optimistic
2015	372.50	52.28	52.28	52.28
2020	462.30	64.89	69.35	83.21
2025	530.86	74.51	84.94	106.17
2030	605.14	84.94	102.87	133.13
2035	666.15	93.50	119.91	159.88
2040	729.41	102.38	138.59	189.65
2045	794.99	111.58	151.05	206.70

Source: Consultants Estimate, 2016

The forecast potential kerosene traffic of BR is likely to follow the O-D pattern as observed in 2014-15, which is presented in Table 4-14.

Table 4-14: Forecast Petrol Traffic Flow of BR (in tonnes)

Railway Section/ Segment	Loading Station	Unloading Station	Distance (km)	2014-15 Traffic (Tonne)	% Share to Total Traffic	2020	2025	2030	2035	2040	2045
UP											
KLN-JS-DSN-PDB-ISD-AUP-STU-PBT	KLNJ	PBT	279.20	18,240	34.5%	23,918	29,296	35,482	41,358	47,801	52,098
Down											
SYT-KRF-AKA-LKM-CTG	MBJ	MPL/CTG	265.89	9,771	18.5%	12,813	15,694	19,008	22,155	25,607	27,908
SYT-KRF-AKA-LKM-CTG	SYT	GPTK	277.57	24,872	47.0%	32,614	39,948	48,384	56,395	65,181	71,041
Sub-Total: Down Direction			274.28	34,643	65.5%	45,427	55,642	67,391	78,550	90,788	98,949
Total (Up and Down Direction)				52,883	100.0%	69,345	84,938	102,874	119,908	138,589	151,047

Source: Consultants Estimate, 2016

4.3.7 Fertilizer

Forecasting of fertilizer is a complex task. It involves analysis of production, import and consumption by type of fertilizer. In Bangladesh, complexity increases further as the feed stock availability is very volatile. For instance, availability of natural gas determines the production level of fertilizer as the GOB allocates natural gas on a priority basis for power production. Furthermore, government-determined prices and the distribution system influence the level of import requirement. On top of that, monsoons play a vital role in affecting demand for fertilizers in Bangladesh. Similarly, consumption of fertilizer and its components (Nitrogen (N), Phosphorous (P) and Potassium (K)) vary depending up on the crop, season and increased use of inorganic manures. Nevertheless, a comprehensive attempt is made to estimate the future national fertilizer transport demand and further to forecast BR potential traffic.

Production

There are 6 fertilizer plants owned and operated by Bangladesh Chemical Industries Corporation, which produces only urea. In addition to these, private sector plants also exist, including KAFCO that is an export-oriented international joint venture. The plant capacity of these plants are listed in Table 4-15. It shows that the production capacity of urea is 2.3 million tonnes per annum with a potash complex of 220 thousand tonnes, which excludes KAFCO's 680 thousand tonne granular urea complex at Chittagong.

Table 4-15: Fertilizer Plant Capacity in Bangladesh

Fertilizer Plant	Location	Year of Installation	Annual Production Capacity (in tonnes)
Natural Gas Fertilizer Factory	Fenchuganj, Sylhet	1961	1,06,000 tonne urea, 12000 tonne Amm. sulphate
Urea Fertilizer Factory Ltd.	Ghorashal, Narsingdi	1970	4,70,000 tonne urea
Zia Fertilizer Co. Ltd.	Ashuganj, Sylhet	1981	5,28,000 tonne urea
Polash Urea Fertilizer Factory Ltd.	Polash, Narsingdi	1985	95,000 tonne urea
Chittagong Urea Fertilizer Co. Ltd.	Rangadia, Chittagong	1987	5,61,000 tonne urea
Jamuna Fertilizer Co. Ltd.	Sarishabari, Jamalpur	1994	5,61,000 Mtonne urea
Total annual production capacity			**23,21,000 tonne urea**

Fertilizer Plant	Location	Year of Installation	Annual Production Capacity (in tonnes)
TSP Complex Ltd.	Patenga, Chittagong	1976	1,00,000 tonne TSP, 1,20,000 tonne SSP
DAP Fertilizer Co. Ltd.	Rangadia, Chittagong	2006	800 tonne /day
Kharnaphuli Fertilizer Co. Ltd. (KAFCO)	Rangadia, Chittagong		6,80,000 tonne granular urea, 1,50,000 tonne anhydrous ammonia

Source: USAID (2010): Constraints of farmers' access to fertilizer for food production

Production of fertilizer in Bangladesh has been volatile; of late it is declining for the following reasons:

- Natural gas required for the fertilizer plants is inadequate due to supply controls (priority is given for power plants)
- Age: old plants are unable to operate under optimal efficiency level

The GoB, however, recognizes the importance of the agriculture sector and its need for fertilizer and a new plant is being commissioned with a 500,000 tonne capacity to produce urea.

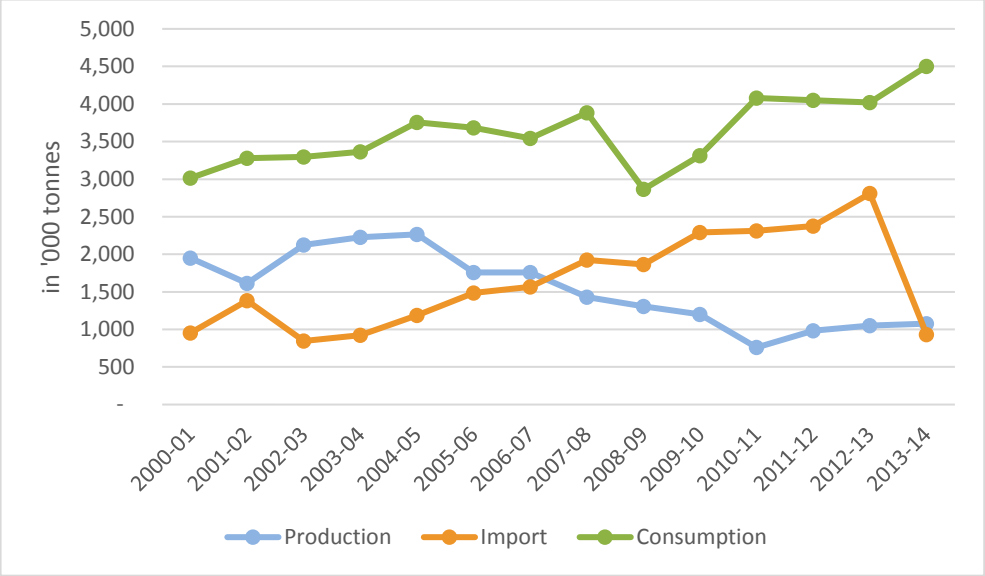
The past trend in production, consumption and import of fertilizer in Bangladesh is illustrated in Figure 4-7: and shown in Table 4-16.

Table 4-16: Bangladesh Fertilizer Usage Trends ('000 tonnes)

	Production	Import	Consumption
2000-01	1,951	954	3,017
2001-02	1,614	1,384	3,277
2002-03	2,123	846	3,298
2003-04	2,229	924	3,364
2004-05	2,265	1,189	3,755
2005-06	1,760	1,484	3,683
2006-07	1,760	1,566	3,545
2007-08	1,430	1,926	3,886
2008-09	1,305	1,863	2,865
2009-10	1,200	2,291	3,313
2010-11	760	2,313	4,081
2011-12	984	2,376	4,049
2012-13	1,050	2,809	4,023
2013-14	1,075	930	4,502

Source: Compiled based on statistics of Bangladesh Fertilizer Association and Bangladesh Bureau of Statistics

Figure 4-7: Bangladesh Fertilizer Usage Trends



Consumption

The general practice adopted is to estimate the consumption of various types of fertilizer based on area of cultivation under different types of crop and season. This disaggregated estimate is aggregated to arrive at the national consumption level. The approach adopted herein is similar to such Bangladeshi practice. About 80% of fertilizer is consumed for rice production. The Government of Bangladesh recommends and provides guidelines to farmers for the use of fertilizers, from time to time. It varies, however, in real practice for various reasons. The weighted average consumption of fertilizers for rice production, in terms of kg per Hectare, considered for the projection is as follows:

Table 4-17: Fertilizer Consumption for Rice Production (kg/ Ha)

	Recommended	Actual	Average
Urea	227	169	198
TSP	119	40.1	80
MoP	100	31.45	66

Based on the above averages, the consumption requirement of different fertilizers is estimated as given in Table 4-18.

Table 4-18: Bangladesh Consumption Forecast for Different Fertilizers ('000 tonnes)

	Rice Cultivation Area (Ac.)	Rice Cultivation Area (Ha.)	Urea	TSP	MP	Total	Total all Crops
2015	29,157	11,800	2,335	939	777	4,050	5,063
2016	29,282	11,850	2,345	943	780	4,068	5,085
2017	29,498	11,938	2,362	950	786	4,098	5,122
2018	29,713	12,025	2,379	957	792	4,128	5,159
2019	29,929	12,112	2,397	964	797	4,158	5,197
2020	30,144	12,199	2,414	970	803	4,187	5,234
2021	30,360	12,287	2,431	977	809	4,217	5,272
2022	30,576	12,374	2,448	984	815	4,247	5,309
2023	30,791	12,461	2,466	991	820	4,277	5,347
2024	31,007	12,548	2,483	998	826	4,307	5,384
2025	31,222	12,636	2,500	1,005	832	4,337	5,421
2026	31,438	12,723	2,518	1,012	837	4,367	5,459
2027	31,653	12,810	2,535	1,019	843	4,397	5,496
2028	31,869	12,897	2,552	1,026	849	4,427	5,534
2029	32,085	12,985	2,569	1,033	855	4,457	5,571
2030	32,300	13,072	2,587	1,040	860	4,487	5,609
2031	32,516	13,159	2,604	1,047	866	4,517	5,646
2032	32,731	13,246	2,621	1,054	872	4,547	5,684
2033	32,947	13,334	2,638	1,061	878	4,577	5,721
2034	33,162	13,421	2,656	1,068	883	4,607	5,758
2035	33,378	13,508	2,673	1,075	889	4,637	5,796
2036	33,594	13,595	2,690	1,082	895	4,667	5,833
2037	33,809	13,683	2,707	1,088	901	4,697	5,871
2038	34,025	13,770	2,725	1,095	906	4,726	5,908
2039	34,240	13,857	2,742	1,102	912	4,756	5,946
2040	34,456	13,944	2,759	1,109	918	4,786	5,983
2041	34,672	14,032	2,776	1,116	924	4,816	6,020
2042	34,887	14,119	2,794	1,123	929	4,846	6,058
2043	35,103	14,206	2,811	1,130	935	4,876	6,095
2044	35,318	14,293	2,828	1,137	941	4,906	6,133
2045	35,534	14,381	2,846	1,144	947	4,936	6,170

Source: Consultants' Estimate, 2016.

Considering the above forecast consumption, and further that production of fertilizer will improve in future resulting in increased availability by 100,000 tonne per annum from the present level, the following estimate as shown in Table 4-19 is arrived at for 2015 to 2045. It may be noted that there is always additional demand for fertilizer in order to maintain 10% of the consumption level in stock to meet for any unforeseen eventuality, which is taken in to account in the estimate.

Table 4-19: Estimated National Demand & Supply of Fertilizers in Bangladesh ('000 tonnes)

	Production	Consumption	Stock	Total Demand	Import
2015	878	4,815	482	5,297	4,419
2016	1000	5,085	508	5,593	4,593
2017	1100	5,122	512	5,634	4,534
2018	1200	5,159	516	5,675	4,475
2019	1300	5,197	520	5,717	4,417
2020	1400	5,234	523	5,758	4,358
2021	1500	5,272	527	5,799	4,299
2022	1600	5,309	531	5,840	4,240
2023	1700	5,347	535	5,881	4,181
2024	1800	5,384	538	5,922	4,122
2025	1900	5,421	542	5,964	4,064
2026	2000	5,459	546	6,005	4,005
2027	2100	5,496	550	6,046	3,946
2028	2200	5,534	553	6,087	3,887
2029	2300	5,571	557	6,128	3,828
2030	2400	5,609	561	6,170	3,770
2031	2500	5,646	565	6,211	3,711
2032	2600	5,684	568	6,252	3,652
2033	2700	5,721	572	6,293	3,593
2034	2800	5,758	576	6,334	3,534
2035	2900	5,796	580	6,375	3,475
2036	3000	5,833	583	6,417	3,417
2037	3100	5,871	587	6,458	3,358
2038	3200	5,908	591	6,499	3,299
2039	3300	5,946	595	6,540	3,240
2040	3400	5,983	598	6,581	3,181
2041	3500	6,020	602	6,622	3,122
2042	3600	6,058	606	6,664	3,064
2043	3700	6,095	610	6,705	3,005
2044	3800	6,133	613	6,746	2,946
2045	3900	6,170	617	6,787	2,887

Source: Consultants' Estimate, 2016

Forecast BR Potential

Based on the considerations as discussed above, the National Demand (production, consumption, import and stock) is summarized in Table 4-19. In order to work out the BR potential, the following scenarios are considered:

- Conservative (Scenario-1): 3%
- Realistic (Scenario-2): 5%

- Optimistic (Scenario-3): 10%

Accordingly, the forecast potential for BR ranges from 159,000 tonnes to 530,000 tonnes in 2015 to 204,000 tonnes to 679,000 tonnes in 2045 under conservative and optimistic scenarios. The result is presented in Table 4-20.

Table 4-20: Forecast BR Potential Traffic-Fertilizers Under Different Scenarios ('000 tonnes)

	Production	Consumption	Stock	Total Demand	Import	Conservative	Realistic	Optimistic
2015	878	4,815	482	5,297	4,419	159	265	530
2016	1000	5,085	508	5,593	4,593	168	280	559
2017	1100	5,122	512	5,634	4,534	169	282	563
2018	1200	5,159	516	5,675	4,475	170	284	568
2019	1300	5,197	520	5,717	4,417	171	286	572
2020	1400	5,234	523	5,758	4,358	173	288	576
2021	1500	5,272	527	5,799	4,299	174	290	580
2022	1600	5,309	531	5,840	4,240	175	292	584
2023	1700	5,347	535	5,881	4,181	176	294	588
2024	1800	5,384	538	5,922	4,122	178	296	592
2025	1900	5,421	542	5,964	4,064	179	298	596
2026	2000	5,459	546	6,005	4,005	180	300	600
2027	2100	5,496	550	6,046	3,946	181	302	605
2028	2200	5,534	553	6,087	3,887	183	304	609
2029	2300	5,571	557	6,128	3,828	184	306	613
2030	2400	5,609	561	6,170	3,770	185	308	617
2031	2500	5,646	565	6,211	3,711	186	311	621
2032	2600	5,684	568	6,252	3,652	188	313	625
2033	2700	5,721	572	6,293	3,593	189	315	629
2034	2800	5,758	576	6,334	3,534	190	317	633
2035	2900	5,796	580	6,375	3,475	191	319	638
2036	3000	5,833	583	6,417	3,417	192	321	642
2037	3100	5,871	587	6,458	3,358	194	323	646
2038	3200	5,908	591	6,499	3,299	195	325	650
2039	3300	5,946	595	6,540	3,240	196	327	654
2040	3400	5,983	598	6,581	3,181	197	329	658
2041	3500	6,020	602	6,622	3,122	199	331	662
2042	3600	6,058	606	6,664	3,064	200	333	666
2043	3700	6,095	610	6,705	3,005	201	335	670
2044	3800	6,133	613	6,746	2,946	202	337	675
2045	3900	6,170	617	6,787	2,887	204	339	679

Movement of Fertilizers

Inland Water Transport (IWT) transports most of imported urea from Chittagong/ Mongla port to North Bengal area where 14 out of 24 buffer warehouses are located. It should be noted, however, that the IWT vessels don't reach out to these warehouses - road transport by Bangladesh Road Transport Corporation (BRTC) moves the commodity. There are few important points that have emerged out of the discussion with BCIC:

- BCIC awards the transport contract to BRTC under Public Procurement Guidelines of the GoB.
- Bangladesh Agriculture Promotion Corporation is the owner of these 24 buffer warehouses, which have outlived their economic life.

- These warehouses are used as distribution points. They are not only old but also lack modern storing and handling systems, leading to considerable pilferage and wastage of material.

It is likely that the current situation could be changed to facilitate modal shift of fertilizer traffic from road to rail, if:

- Intermodal facilities for railway operation at the IWT terminal are developed
- Similar facilities are developed at the BCIC operated buffer warehouses
- BR is awarded the overall freight and distribution contract, on long term basis, with or without open tendering system

The above proposals merit serious consideration.

The discussion with BCIC further reveals that BR transports fertilizer from the port and from the factory to distribution warehouses located in the hinterland. Over the past years, fertilizer traffic has dwindled because of multiple handling and multiple agencies involved in such handling and transfer of cargo. Furthermore, and more importantly, availability of wagons and operating personnel of BR have become the major hurdles. Therefore, BCIC is not very optimistic about BR being able to provide the required services to the industry. It should, however, be clearly noted that fertilizer will come back to BR if the quality and reliability of BR services improve.

For the Master Plan assessment, 2014-15 O-D is analyzed to develop the future O-D, which is presented in Table 4-21.

Table 4-21: Likely BR Traffic Flow of Fertilizer Under Realistic Scenario (in tonnes)

Railway Section/Segment	Loading Station	Unloading Station	Distance (km)	2014-15 Traffic (Tonne)	% Share to Total Traffic	2020	2025	2030	2035	2040	2045
UP											
AKA-BCI, BCI-GRPM, GRPM-JJL	ASZ AFCCL	NRQ	225.40	57	0.1%	379	392	406	419	433	446
AKA-BCI, BCI-GRPM, GRPM-JJL	ASZ AFCCL	JJL	230.42	76	0.2%	505	523	541	559	577	595
KLN-JS-DSN-PDB-ISD-JOY-JY	KLN	JY	216.09	1,350	3.1%	8,970	9,290	9,611	9,932	10,253	10,573
KLN-JS-DSN-PDB-ISD-AUP-STU-PBT	KLN	PBT	279.20	2,610	6.0%	17,341	17,961	18,582	19,202	19,822	20,442
KLN-JS-DSN-PDB-ISD-AUP-STU-PBT	KLNJ	JY	216.09	1,350	3.1%	8,970	9,290	9,611	9,932	10,253	10,573
KLN-JS-DSN-PDB-ISD-AUP-STU-PBT	KLNJ	PBT	279.20	2,655	6.1%	17,640	18,271	18,902	19,533	20,164	20,794
KLN-JS-DSN-PDB-ISD-AUP-STU-PBT	NAP	JY	289.65	1,350	3.1%	8,970	9,290	9,611	9,932	10,253	10,573
KLN-JS-DSN-PDB-ISD-AUP-STU-PBT	NAP	PBT	349.76	7,605	17.6%	50,529	52,336	54,143	55,950	57,757	59,563
KLN-JS-DSN-PDB-ISD-AUP-STU	NAP	STU	253.81	3,780	8.7%	25,115	26,013	26,911	27,809	28,707	29,605
SRV (CTG)-FJT-LKM-CDR	SRV	HJJ	159.79	285	0.7%	1,894	1,961	2,029	2,097	2,164	2,232
Ctg.-LKM-AKA-BCI-GRPM-MYN-JLX-DWB	SRV	MLDB	415.45	3,832	8.8%	25,461	26,371	27,281	28,192	29,102	30,013
Ctg.-LKM-AKA-BCI-GRPM-NRQ	SRV	NRQ	355.55	3,079	7.1%	20,458	21,189	21,921	22,652	23,384	24,115
Ctg.-LKM-AKA-BCI-GRPM-MYN	SRV	SXJ	343.43	1,984	4.6%	13,182	13,653	14,125	14,596	15,068	15,539
Ctg.-LKM-AKA-BCI-GRPM-MYN-JLX-DWB	SRV, CTG	MLDB	415.45	2,874	6.6%	19,095	19,778	20,461	21,144	21,827	22,510
Ctg.-LKM-AKA-BCI-GRPM-NRQ	SRV, CTG	NRQ	355.55	2,909	6.7%	19,328	20,019	20,710	21,401	22,093	22,784
Ctg.-LKM-AKA-BCI-GRPM-MYN	SRV, CTG	SXJ	343.43	2,942	6.8%	19,547	20,246	20,945	21,644	22,343	23,042
JLX-BBE-JOI-ISD-AUP-STU-BNRP-KNA-KRM	TKND	KRM	280.00	856	2.0%	5,687	5,891	6,094	6,298	6,501	6,704
JLX-BBE-JOI-ISD-AUP-STU-BNRP	TKND	BNRP	280.36	343	0.8%	2,279	2,360	2,442	2,523	2,605	2,686
JLX-BBE-JOI-ISD-AUP-STU-BNRP-KNA	TKND	GBH	307.27	1,131	2.6%	7,515	7,783	8,052	8,321	8,589	8,858
JLX-BBE-JOI-ISD-AUP-STU-BNRP-KNA-KRM	TKND	KRM	280.00	240	0.6%	1,595	1,652	1,709	1,766	1,823	1,880
JLX-BBE-JOI-ISD-AUP-STU-PBT-KCQ-PCGH	TKND	PIX	274.54	754	1.7%	5,010	5,189	5,368	5,547	5,726	5,905
JLX-BBE-JOI-ISD-AUP-STU-PBT-KCQ-PCGH	TKND	THRD	296.44	1,267	2.9%	8,418	8,719	9,020	9,321	9,622	9,923
Sub-Total (UP)	0	0	349.99	43,329	100.0%	287,887	298,181	308,476	318,770	329,064	339,358
Down											
Nil											
Total (Up and Down Direction)	0	0		43,329	100.0%	287,887	298,181	308,476	318,770	329,064	339,358

4.3.8 Wheat

Wheat is the most important food grain consumed in Bangladesh, second only to rice. The GOB supports increase in wheat production in order to reduce import dependency as well as to control domestic price though a public distribution system. Despite such efforts, land area under wheat cultivation during 2004 to 2011 stagnated. In recent years, however, it has shown an increasing trend. A similar trend is observed for the yield rate also. The growth trend in wheat cultivation area, production and yield rate per acre is set out in Table 4-22 and shown in Figure 4-8. The compound growth rates observed during 1998-2016 are:

- Area under wheat cultivation: 3.4% p.a.
- Production of wheat: 6.0% p.a.
- Yield rate: 2.6% p.a.

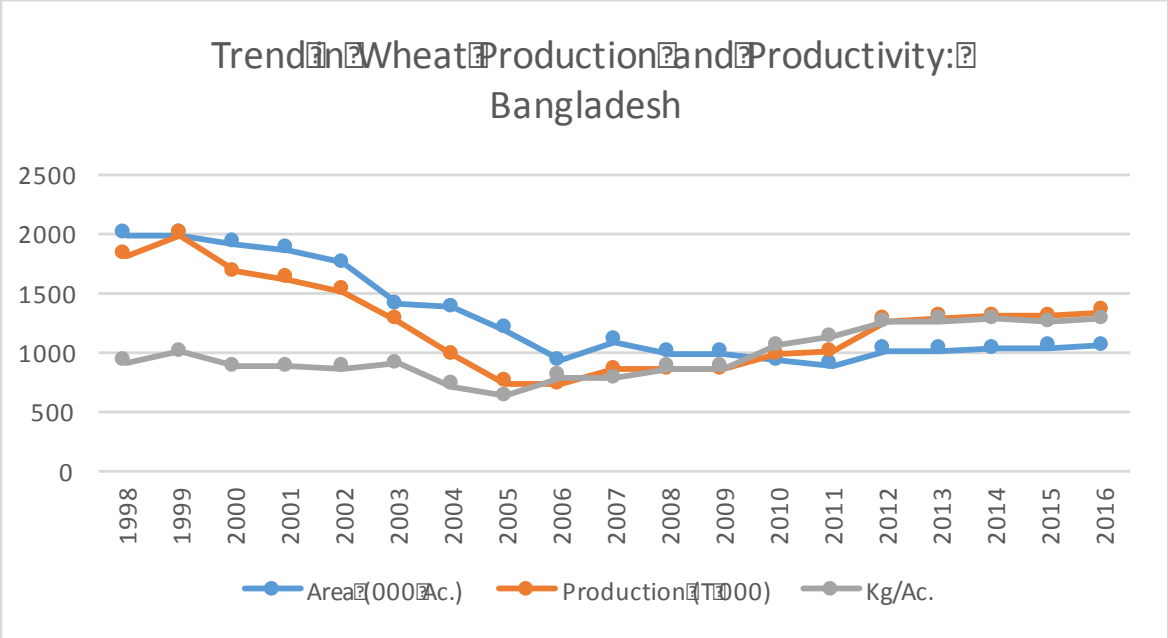
Table 4-22: Wheat Cultivation in Bangladesh (1998-2016)

	Area ('000 Ac.)	Production ('000 tonnes)	Yield Kg/Ac.
1998	1,989	1803	906.4
1999	1,989	1988	999.4
2000	1,910	1673	875.9
2001	1,853	1610	868.7
2002	1,747	1510	864.3
2003	1,401	1253	894.3
2004	1,374	976	710.4
2005	1,186	735	619.7
2006	919	725	788.7
2007	1,087	844	776.3
2008	988	849	859.0
2009	988	850	860.0
2010	924	972	1,051.8
2011	890	996	1,119.7
2012	1,013	1260	1,243.7
2013	1,013	1280	1,263.4
2014	1,025	1300	1,267.7
2015	1,038	1300	1,252.6
2016	1,050	1335	1,271.2
AACGR (%)	3.4	6.0	2.6

Source: Compiled based on:

1) http://www.indexmundi.com/agriculture/?country=bd&commodity=wheat&graph=production
2) United States Department of Agriculture
3) Bangladesh Bureau of Statistics, Economic Review

Figure 4-8: Trend in Wheat Production and Productivity in Bangladesh



The per capita consumption of wheat was analyzed for the period between 1998 and 2016 as set out in Table 4-23.

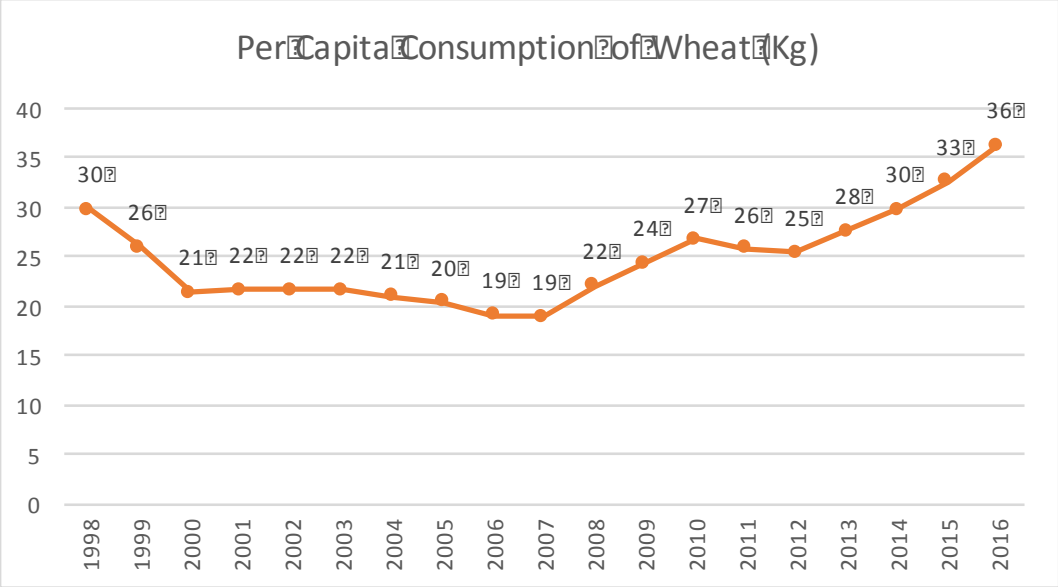
Table 4-23: Trend in Wheat Consumption of Bangladesh

	Consumption ('000 Tonnes)	Population (In Numbers)	Per Capita Consumption (Kgs)
1998	3,839	128,746,273	29.82
1999	3,412	131,280,739	25.99
2000	2,866	133,776,064	21.42
2001	2,950	136,228,456	21.65
2002	3,000	138,600,174	21.64
2003	3,050	140,843,786	21.66
2004	3,000	142,929,979	20.99
2005	2,950	144,839,238	20.37
2006	2,800	146,592,687	19.10
2007	2,800	148,252,473	18.89
2008	3,300	149,905,836	22.01
2009	3,700	151,616,777	24.40
2010	4,100	153,405,612	26.73
2011	4,000	155,257,387	25.76
2012	4,000	157,157,394	25.45
2013	4,400	159,077,513	27.66
2014	4,800	160,996,000	29.81
2015	5,300	162,579,753	32.60

	Consumption ('000 Tonnes)	Population (In Numbers)	Per Capita Consumption (Kgs)
2016	5,900	162,579,754	36.29
AACGR			1.1%

Source: Compiled based on:
1) http://www.indexmundi.com/agriculture/?country=bd&commodity=wheat&graph=production
2) United States Department of Agriculture
3) Bangladesh Bureau of Statistics, Economic Review

Figure 4-9: Trend in Per Capita Consumption of Wheat in Bangladesh



It shows that the per capita, consumption has increased marginally from 30 kg/person in 1998 to 36 kg/person in 2016, thus witnessing a compound growth rate of 1.1% p.a. during the study period. However, in recent years increase in per capita consumption of wheat is significant; it has increased at the rate of 7.5% p.a. between 2007 and 2016. Taking a long term perspective of growth, 3% p.a. growth rate is considered appropriate. Accordingly, the forecast national scenario with respect to consumption, production, import and total distribution quantity (transport demand) is estimated (including stocks) as shown in Table 4-24 and in Figure 4-10.

Figure 4-10: Forecast National Scenario of Consumption, Production and Import of Wheat in Bangladesh

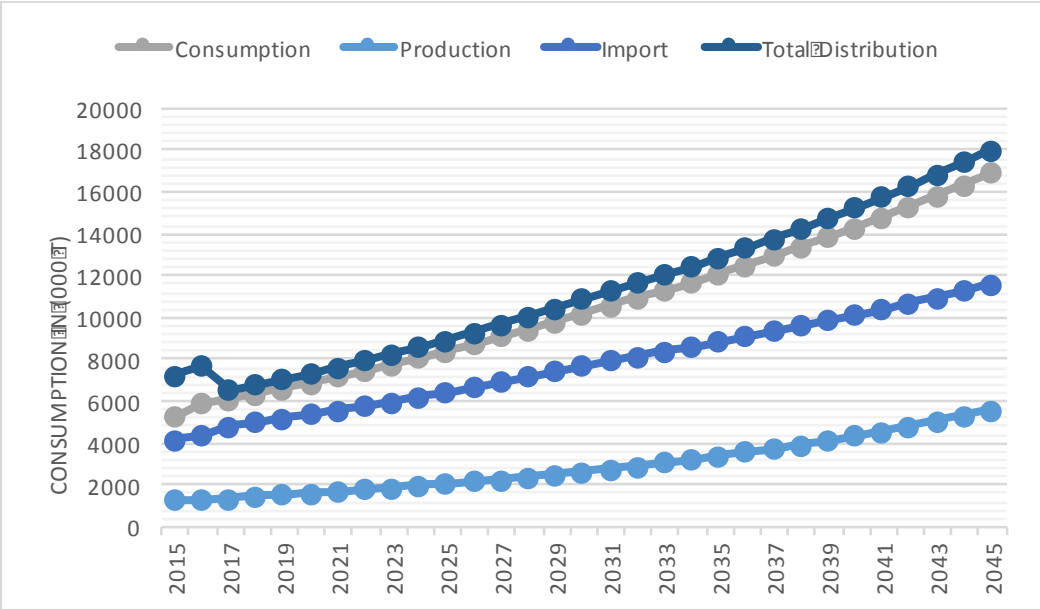


Table 4-24: Estimated Future National Production, Consumption and Import of Wheat in Bangladesh (Area in '000 Ac., Wheat in '000 Tonnes)

	Area	Yeild	Production	Consumption	Deficit	Opening Stock	Import	Total Distribution	Closing Stock
2015	1,038	1,253	1,300	5,300	4,000	1,753	4,200	7,253	1,953
2016	1,050	1,271	1,335	5,900	4,565	1,953	4,400	7,688	1,788
2017	1,082	1,297	1,403	6,137	4,734	307	4,829	6,538	402
2018	1,114	1,323	1,474	6,383	4,910	319	5,008	6,800	417
2019	1,148	1,349	1,548	6,639	5,091	332	5,193	7,073	434
2020	1,182	1,376	1,626	6,906	5,279	345	5,385	7,357	451
2021	1,217	1,404	1,709	7,183	5,474	359	5,584	7,651	469
2022	1,254	1,432	1,795	7,471	5,676	374	5,789	7,958	487
2023	1,292	1,460	1,886	7,771	5,885	389	6,003	8,277	506
2024	1,330	1,489	1,981	8,083	6,101	404	6,223	8,609	526
2025	1,370	1,519	2,082	8,407	6,325	420	6,452	8,954	547
2026	1,411	1,550	2,187	8,745	6,558	437	6,689	9,313	568
2027	1,454	1,581	2,298	9,096	6,798	455	6,934	9,686	591
2028	1,497	1,612	2,414	9,461	7,047	473	7,187	10,074	614
2029	1,542	1,644	2,536	9,840	7,304	492	7,450	10,478	638
2030	1,588	1,677	2,664	10,235	7,571	512	7,722	10,898	663
2031	1,636	1,711	2,799	10,585	7,786	529	7,941	11,270	685
2032	1,685	1,745	2,941	10,947	8,006	547	8,166	11,654	707
2033	1,736	1,780	3,090	11,321	8,231	566	8,396	12,052	731
2034	1,788	1,816	3,246	11,708	8,462	585	8,631	12,463	755
2035	1,841	1,852	3,410	12,108	8,698	605	8,872	12,888	779
2036	1,897	1,889	3,583	12,522	8,939	626	9,118	13,327	805
2037	1,954	1,927	3,764	12,950	9,186	648	9,370	13,781	831
2038	2,012	1,965	3,955	13,393	9,438	670	9,627	14,251	858
2039	2,073	2,005	4,155	13,851	9,696	693	9,890	14,737	886
2040	2,135	2,045	4,365	14,324	9,959	716	10,158	15,240	915
2041	2,199	2,086	4,586	14,814	10,228	741	10,433	15,759	945
2042	2,265	2,127	4,818	15,320	10,502	766	10,713	16,296	976
2043	2,333	2,170	5,062	15,844	10,782	792	10,998	16,852	1,008
2044	2,403	2,213	5,318	16,386	11,068	819	11,289	17,426	1,041
2045	2,475	2,257	5,587	16,946	11,359	847	11,586	18,020	1,074

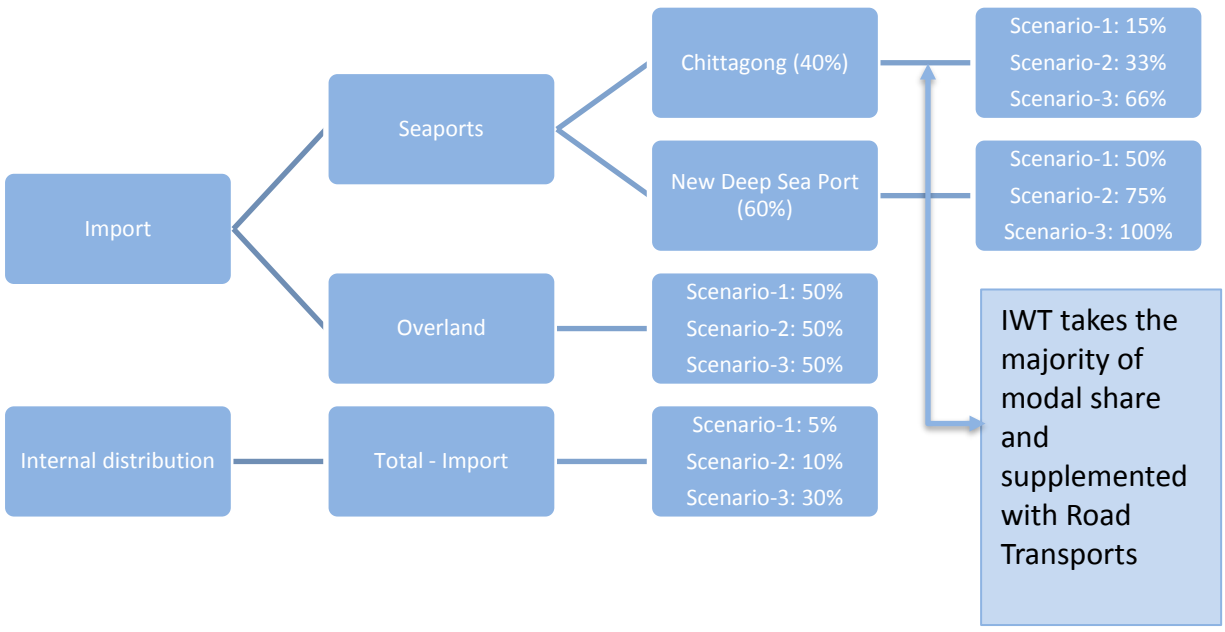
It is recognized that BR will have an opportunity to play a larger role in future for the following type of wheat movement:

- Import traffic of seaports
- Import traffic by overland transport, particularly from India
- Procurement and distribution traffic within hinterland

Under the first category, there are 2 existing seaports (Chittagong and Mongla) and a proposed new Deep Sea Port (DSP) at Payra or Sonadia. Mongla port will play limited role, but Chittagong and DSP will have larger role to play in catering to wheat import of Bangladesh. It is assumed that shippers will take advantage of deep draft at DSP and increase the size of dry bulk carrier to enjoy economies of scale. Secondly, India exports wheat to the larger Middle East countries. With the advent of the Eastern Dedicated Freight Corridor (EDFC) from Amritsar to Kolkata and further developing the India-Bangladesh-NE India States linkage, it is quite likely that Bangladesh will have better market accessibility to import wheat from Punjab/Haryana States, which fall within the hinterland of EDFC of Indian Railways. Thus, it is highly probable that Bangladesh will meet its future import requirement of wheat from sources such as India by sea and India by overland transport. This could open new opportunities for BR. Thirdly, for distribution purposes within Bangladesh BR will be in a position to capture additional market.

Based on the above possibilities, the future BR potential is assessed as illustrated in Figure 4-11.

Figure 4-11: Method Adopted to Forecast BR Potential Fertilizer Traffic



The summary forecast for potential traffic is given in Table 4-25 and details can be found in Table 4-26, with accompanying illustration in Figure 4-12.

Table 4-25: Summary of Forecast BR Potential Fertilizer Traffic Under Scenarions (in '000 tonnes)

	Conservative	Realistic	Optimistic
2015	816	1,513	3,122
2020	1,764	2,723	4,211
2025	2,120	3,276	5,087
2030	2,546	3,940	6,143
2035	2,944	4,563	7,167
2040	3,395	5,273	8,352
2045	3,904	6,078	9,717

Source: Consultants' Estimate, 2016

Figure 4-12: Forecast BR Fertilizer Traffic Potential in Scenarios (in '000 tonnes)

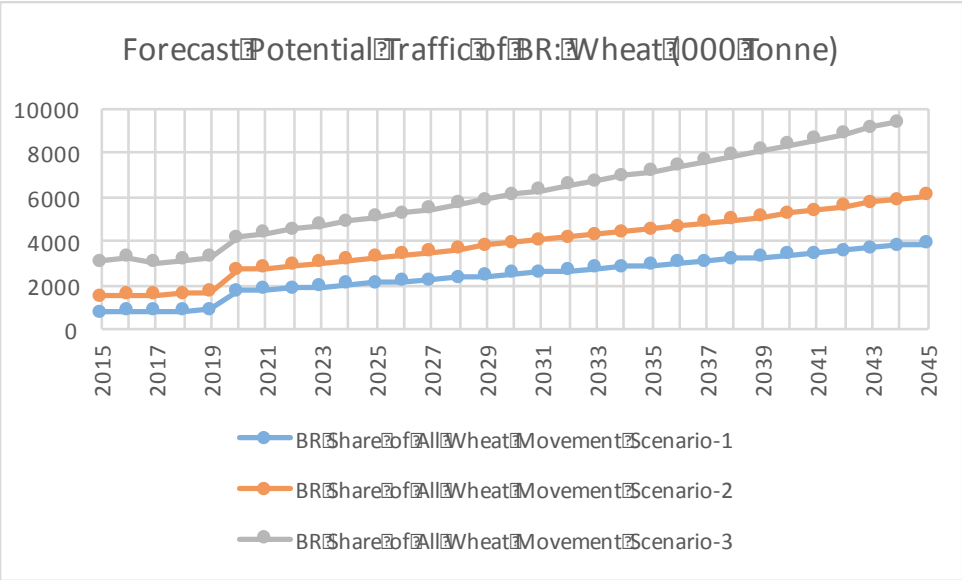


Table 4-26: Forecast Potential Traffic of BR-Fertlizer (in '000 tonnes)

	Total Distributio	Total Import	Import by Over Land	Import by Sea	Chitagong	New Deep Sea Port	Evacuation by IWT	Evacuation by Other	From Chittagong Port			From Deep Sea Port			Share of Overland Transport			Inland Movement			BR Share of All Wheat Movement		
									Scenario-1	Scenario-2	Scenario-	Scenario-	Scenario-2	Scenario-3	Scenario-1	Scenario-2	Scenario-	Scenario-	Scenario-	Scenario-	Scenario-	Scenario-	Scenario-
2015	7,253	4,200	420	3,780	3,780	0	756	3,024	454	998	1,996				210	210	210	153	305	916	816	1,513	3,122
2016	7,688	4,400	440	3,960	3,960	0	792	3,168	475	1,045	2,091				220	220	220	164	329	986	860	1,594	3,297
2017	6,538	4,829	483	4,346	4,346	0	869	3,477	522	1,147	2,295				241	241	241	85	171	513	848	1,560	3,049
2018	6,800	5,008	501	4,507	4,507	0	901	3,606	541	1,190	2,380				250	250	250	90	179	538	881	1,619	3,168
2019	7,073	5,193	519	4,674	4,674	0	935	3,739	561	1,234	2,468				260	260	260	94	188	564	914	1,682	3,291
2020	7,357	5,385	538	4,846	1,939	2,908	969	3,877	233	512	1,024	1,163	1,745	2,326	269	269	269	99	197	592	1,764	2,723	4,211
2021	7,651	5,584	558	5,025	2,010	3,015	1,005	4,020	241	531	1,061	1,206	1,809	2,412	279	279	279	103	207	620	1,830	2,826	4,373
2022	7,958	5,789	579	5,210	2,084	3,126	1,042	4,168	250	550	1,100	1,251	1,876	2,501	289	289	289	108	217	651	1,899	2,932	4,542
2023	8,277	6,003	600	5,402	2,161	3,241	1,080	4,322	259	570	1,141	1,297	1,945	2,593	300	300	300	114	227	682	1,970	3,043	4,717
2024	8,609	6,223	622	5,601	2,240	3,361	1,120	4,481	269	591	1,183	1,344	2,016	2,688	311	311	311	119	239	716	2,044	3,158	4,898
2025	8,954	6,452	645	5,807	2,323	3,484	1,161	4,645	279	613	1,226	1,394	2,090	2,787	323	323	323	125	250	751	2,120	3,276	5,087
2026	9,313	6,689	669	6,020	2,408	3,612	1,204	4,816	289	636	1,271	1,445	2,167	2,890	334	334	334	131	262	787	2,199	3,400	5,283
2027	9,686	6,934	693	6,240	2,496	3,744	1,248	4,992	300	659	1,318	1,498	2,247	2,995	347	347	347	138	275	826	2,282	3,527	5,486
2028	10,074	7,187	719	6,469	2,587	3,881	1,294	5,175	310	683	1,366	1,552	2,329	3,105	359	359	359	144	289	866	2,367	3,660	5,697
2029	10,478	7,450	745	6,705	2,682	4,023	1,341	5,364	322	708	1,416	1,609	2,414	3,218	373	373	373	151	303	908	2,455	3,797	5,916
2030	10,898	7,722	772	6,950	2,780	4,170	1,390	5,560	334	734	1,468	1,668	2,502	3,336	386	386	386	159	318	953	2,546	3,940	6,143
2031	11,270	7,941	794	7,147	2,859	4,288	1,429	5,718	343	755	1,510	1,715	2,573	3,431	397	397	397	166	333	999	2,622	4,058	6,336
2032	11,654	8,166	817	7,349	2,940	4,410	1,470	5,880	353	776	1,552	1,764	2,646	3,528	408	408	408	174	349	1,046	2,699	4,179	6,535
2033	12,052	8,396	840	7,556	3,023	4,534	1,511	6,045	363	798	1,596	1,814	2,720	3,627	420	420	420	183	366	1,097	2,779	4,304	6,739
2034	12,463	8,631	863	7,768	3,107	4,661	1,554	6,214	373	820	1,641	1,864	2,797	3,729	432	432	432	192	383	1,149	2,860	4,432	6,950
2035	12,888	8,872	887	7,985	3,194	4,791	1,597	6,388	383	843	1,686	1,916	2,875	3,833	444	444	444	201	402	1,205	2,944	4,563	7,167
2036	13,327	9,118	912	8,206	3,283	4,924	1,641	6,565	394	867	1,733	1,970	2,954	3,939	456	456	456	210	421	1,263	3,030	4,698	7,391
2037	13,781	9,370	937	8,433	3,373	5,060	1,687	6,746	405	891	1,781	2,024	3,036	4,048	468	468	468	221	441	1,323	3,118	4,836	7,621
2038	14,251	9,627	963	8,664	3,466	5,199	1,733	6,932	416	915	1,830	2,079	3,119	4,159	481	481	481	231	462	1,387	3,208	4,978	7,857
2039	14,737	9,890	989	8,901	3,560	5,341	1,780	7,121	427	940	1,880	2,136	3,204	4,272	494	494	494	242	485	1,454	3,300	5,124	8,101
2040	15,240	10,158	1,016	9,143	3,657	5,486	1,829	7,314	439	965	1,931	2,194	3,291	4,388	508	508	508	254	508	1,524	3,395	5,273	8,352
2041	15,759	10,433	1,043	9,389	3,756	5,634	1,878	7,512	451	992	1,983	2,253	3,380	4,507	522	522	522	266	533	1,598	3,492	5,426	8,610
2042	16,296	10,713	1,071	9,641	3,857	5,785	1,928	7,713	463	1,018	2,036	2,314	3,471	4,628	536	536	536	279	558	1,675	3,592	5,583	8,875
2043	16,852	10,998	1,100	9,898	3,959	5,939	1,980	7,919	475	1,045	2,091	2,376	3,563	4,751	550	550	550	293	585	1,756	3,693	5,744	9,148
2044	17,426	11,289	1,129	10,160	4,064	6,096	2,032	8,128	488	1,073	2,146	2,438	3,658	4,877	564	564	564	307	614	1,841	3,797	5,909	9,428
2045	18,020	11,586	1,159	10,428	4,171	6,257	2,086	8,342	501	1,101	2,202	2,503	3,754	5,005	579	579	579	322	643	1,930	3,904	6,078	9,717

Under the scenario of DSP not being materialized and/or there is no viable railway linkage to the proposed DSP, the traffic flow is assumed to follow the O-D as assessed based on 2014-15 traffic, which is presented in Table 4-27.

Table 4-27: Forecast Fertilizer Traffic Flow of BR

Railway Section/Segment	Loading Station	Unloading Station	Distance (km)	2014-15 Traffic (Tonne)	% Share to Total Traffic	2020	2025	2030	2035	2040	2045
UP											
Ctg.-LKM-AKA-BCI	Ctg Silo	ASZ	230.15	1,800	0.7%	19,573	23,552	28,319	32,799	37,902	43,688
Ctg.-LKM-AKA-BCI-TGI-JY-ISD-AUP-STU-BNRP	Ctg Silo	BGC	600.80	1,245	0.5%	13,538	16,290	19,587	22,686	26,216	30,218
Ctg.-LKM-AKA	Ctg Silo	CML	153.35	3,123	1.2%	33,959	40,862	49,133	56,906	65,761	75,799
Ctg.-LKM-AKA-BCI-TGI-JY-ISD-AUP-STU-PBT-KCQ	Ctg Silo	DGP	221.01	1,009	0.4%	10,966	13,196	15,866	18,376	21,236	24,478
Ctg.-LKM-AKA-BCI-TGI-JY-ISD-AUP-STU-BNRP-KN	Ctg Silo	GBH	554.95	1,059	0.4%	11,515	13,856	16,661	19,297	22,299	25,703
Ctg.-LKM-AKA-BCI-GRPM-MYN-JLX	Ctg Silo	JLX	401.57	2,017	0.8%	21,927	26,385	31,725	36,744	42,461	48,943
Ctg.-LKM-AKA-BCI-GRPM-MYN	Ctg Silo	MYN	349.46	5,342	2.1%	58,087	69,896	84,043	97,340	112,486	129,657
Ctg.-LKM-AKA-BCI-TGI-DAC	Ctg Silo	TJN	314.34	12,073	4.8%	131,278	157,967	189,939	219,989	254,220	293,028
Ctg.-LKM-AKA-BCI-TGI-JY-ISD-AUP-STU-PBT-KNA	Ctg Silo	RNP	694.39	690	0.3%	7,503	9,028	10,855	12,573	14,529	16,747
Ctg.-LKM-AKA-BCI-TGI-JY-ISD-AUP-STU-PBT-KCQ	Ctg Silo	STGJ	215.44	1,008	0.4%	10,961	13,189	15,858	18,367	21,225	24,465
DSN-PDB-ISD-SYJB	DSN	SJYB	158.34	51,116	20.4%	555,818	668,815	804,182	931,411	1,076,341	1,240,647
DSN-PDB-ISD-SYJB	DSN	ULP	134.82	19,666	7.9%	213,842	257,316	309,396	358,346	414,105	477,320
KLN-JS-DSN-PDB-ISD-AUP-STU-PBT-CLH	DT	SDP	386.84	5,241	2.1%	56,989	68,575	82,454	95,499	110,359	127,206
KLN-JS-DSN-PDB-ISD-SYJB	DT	SJYB	277.94	4,062	1.6%	44,169	53,148	63,906	74,016	85,533	98,590
KLN-JS-DSN-PDB-ISD-JOY-JY	KLN	JY	316.09	1,217	0.5%	13,233	15,924	19,147	22,176	25,626	29,538
KLN-JS-DSN-PDB-ISD-AUP-STU-PBT	KLN	PLB	361.06	1,262	0.5%	13,723	16,512	19,854	22,996	26,574	30,630
KLN-JS-DSN-PDB-ISD-AUP-STU-PBT-CLH	KLN	SDP	394.30	1,216	0.5%	13,222	15,911	19,131	22,157	25,605	29,514
KLN-JS-DSN-PDB-ISD-AUP-STU	KLN	STU	283.25	1,126	0.4%	12,244	14,733	17,715	20,518	23,710	27,329
KLN-JS-DSN-PDB-ISD-SYJB	KLN	SYJB	285.60	1,172	0.5%	12,744	15,335	18,439	21,356	24,679	28,446
RIP-AUA-ISD-JOI-SYJB	RIP	SJYB	202.16	5,289	2.1%	57,093	68,542	81,027	93,189	107,374	123,584,650
RIP-AUA-ISD-JOI	RIP	ULP	184.64	27,800	11.1%	302,289	363,744	437,365	506,560	585,382	674,742
Sub-Total (UP)			215.00	208,532	83.3%	2,267,512	2,728,494	3,280,739	3,799,781	4,391,035	5,061,340
Down											
DSN-JS-KLN	DSN	NAP	97.82	35,755	14.3%	388,789	467,829	562,518	651,513	752,890	867,821
RIP-AUA-CNBJ	RIP	CNBJ	37.38	4,354	1.7%	47,344	56,969	68,500	79,337	91,682	105,677
RIP-AUA-AUP-ISD-PDB-DSNJ-JS-KLN	RIP	NAP	296.72	1,769	0.7%	19,236	23,146	27,831	32,234	37,250	42,936
Sub-Total (Down)			99.94	41,878	16.7%	455,369	547,945	658,848	763,084	881,821	1,016,434
Total (Up and Down Direction)				250,410	100.0%	2,722,880	3,276,439	3,939,587	4,562,865	5,272,856	6,077,774

Source: Consultants' Estimate based on 2014-15 O-D Flow of traffic

4.3.9 Rice

Bangladesh is almost self-sufficient in rice production, although at times it imports to meet unforeseen eventualities. For instance, in 2005 and 2006, there was not enough stock and consequently it imported about 2 million tonnes in 2007. Thus, import is resorted to balance out deficits in production and consumption and more so for stocking purposes, as could be seen in Table 4-28.

Table 4-28: National Trend in Rice Status of Baangladesh (in '000 tonnes)

	Opening Stock	Production	Imports	Total Supply	Domestic Consumption	Ending Stock
1998	400	19,854	2,500	22,754	21,854	900
1999	900	23,066	400	24,366	23,766	600
2000	600	25,086	672	26,358	24,958	1,400
2001	1,400	24,310	243	25,953	25,553	400
2002	400	25,187	955	26,542	26,100	442
2003	442	26,152	850	27,444	26,700	744
2004	744	25,157	725	26,626	26,900	(274)
2005	169	26,553	514	27,236	29,000	(1,764)
2006	441	27,318	769	28,528	29,764	(1,236)
2007	446	31,976	2,047	34,469	30,747	3,722

	Opening Stock	Production	Imports	Total Supply	Domestic Consumption	Ending Stock
2008	546	32,612	732	33,890	31,200	2,690
2009	1,278	33,403	92	34,773	31,600	3,173
2010	770	33,541	1,308	35,619	32,400	3,219
2011	1,378	33,889	563	35,830	34,300	1,530
2012	1,341	33,823	35	35,199	34,500	699
2013	696	34,356	751	35,803	34,900	903
2014	937	34,710	1,248	36,895	35,100	1,795
2015	1,560	34,500	250	36,310	35,200	1,110
2016	1,106	34,550	400	36,056	35,300	756

Source: Compiled from:
1) http://www.indexmundi.com/agriculture/?country=bd&commodity=milled-rice&graph=production
2) United States Department of Agriculture
3) Bangladesh Bureau of Statistics, Economic Review

The yield rate per acre of rice cultivation was fairly high at 1,183 kg/Acre and the per capita consumption was 217 kg in 2015. It has grown at the compound rate of 2.2% p.a. and around 1.0% p.a. between 1998 and 2015. Any increase in rice production would be due to more efficient use of farming inputs and increase in area of cultivation. Bangladesh has already achieved intensive utilization of fertilizer inputs and the area under rice cultivation has exhibited only 1% p.a. growth during 1998 to 2015. Therefore, it is considered appropriate to forecast the increase in area under cultivation by using time trend analysis. A growth in yield rate of rice production and an increase in per capita consumption of rice at 1.0 % p.a. was assumed until 2045. Accordingly, the production and consumption of rice in Bangladesh is forecast. As the import of rice is limited to balance the requirement, 3% of consumption level is assumed for stock purposes.

Figure 4-13: Rice Cultivation Area of Bangladesh

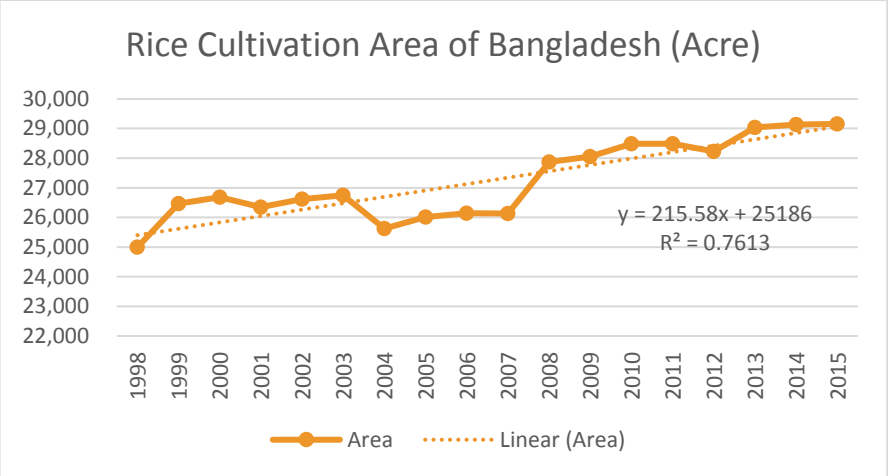
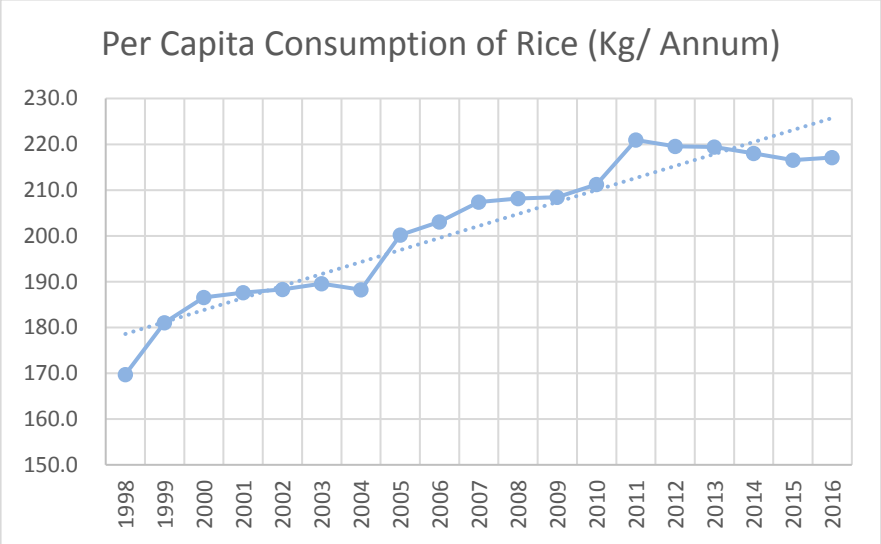


Figure 4-14: Per Capita Consumption of Rice



The forecast potential rice traffic of BR is based on the fact the market capture of BR was only 0.25% in 2014-15, when the actual traffic was 90,700 tonnes whilst the National Transport Demand was 36.3 million tonnes. While Scenario 1 (conservative) assumes that the present BR market capture observed in 2014-15 would continue in future, Scenario 2 assumes that this share would increase in line with BR's effort to improve its operational efficiency over time. Scenario 3 considers that the capacity (and actual transport) would be improved considerably due to operational efficiency improvement measures. Accordingly, the result of forecast potential rice traffic of BR is given in Table 4-29.

Table 4-29: BR Rice Traffic Forecast

	Population	PC Consumption	Estimated (000 Tonne)		Railway Share (%)			Estimated Potential (000 Tonne)		
			Consumption	Total Supply	Scenario-1	Scenario-2	Scenario-3	Scenario-1	Scenario-2	Scenario-3
2015	162,579,753	217	35,200	36,256	0.25	0.25	0.25	90.64	90.64	90.64
2016	162,579,754	219	35,300	36,359	0.25	0.25	0.50	90.90	90.90	181.80
2017	164,179,085	221	36,364	37,455	0.25	0.35	0.70	93.64	131.09	262.18
2018	165,794,151	224	37,089	38,201	0.25	0.40	0.80	95.50	152.81	305.61
2019	167,425,104	226	37,828	38,963	0.25	0.45	0.90	97.41	175.33	350.67
2020	169,072,101	228	38,582	39,740	0.25	0.50	1.00	99.35	198.70	397.40
2021	170,735,301	230	39,351	40,532	0.25	0.50	1.00	101.33	202.66	405.32
2022	172,414,861	233	40,136	41,340	0.25	0.50	1.00	103.35	206.70	413.40
2023	174,110,944	235	40,936	42,164	0.25	0.50	1.00	105.41	210.82	421.64
2024	175,823,711	237	41,752	43,005	0.25	0.50	1.00	107.51	215.02	430.05
2025	177,553,327	240	42,584	43,862	0.25	1.00	2.00	109.65	438.62	877.24
2026	179,299,958	242	43,433	44,736	0.25	1.00	2.00	111.84	447.36	894.73
2027	181,063,771	245	44,299	45,628	0.25	1.00	2.00	114.07	456.28	912.56
2028	182,844,935	247	45,182	46,538	0.25	1.00	2.00	116.34	465.38	930.76
2029	184,643,620	250	46,083	47,466	0.25	1.00	2.00	118.66	474.66	949.31
2030	186,460,000	252	47,002	48,412	0.25	1.25	3.00	121.03	605.15	1,452.36
2031	187,217,491	255	47,665	49,095	0.25	1.25	3.00	122.74	613.68	1,472.84
2032	187,978,059	257	48,337	49,787	0.25	1.25	3.00	124.47	622.34	1,493.61
2033	188,741,716	260	49,019	50,489	0.25	1.25	3.00	126.22	631.11	1,514.67
2034	189,508,476	262	49,710	51,201	0.25	1.25	3.00	128.00	640.02	1,536.04
2035	190,278,352	265	50,411	51,923	0.25	1.50	4.00	129.81	778.85	2,076.93
2036	191,051,354	268	51,122	52,656	0.25	1.50	4.00	131.64	789.83	2,106.22
2037	191,827,497	270	51,843	53,398	0.25	1.50	4.00	133.50	800.97	2,135.93
2038	192,606,793	273	52,574	54,151	0.25	1.50	4.00	135.38	812.27	2,166.05
2039	193,389,255	276	53,316	54,915	0.25	1.50	4.00	137.29	823.72	2,196.60
2040	194,174,896	278	54,067	55,689	0.25	1.75	5.00	139.22	974.57	2,784.47
2041	194,963,728	281	54,830	56,475	0.25	1.75	5.00	141.19	988.31	2,823.74
2042	195,755,765	284	55,603	57,271	0.25	1.75	5.00	143.18	1,002.25	2,863.57
2043	196,551,020	287	56,387	58,079	0.25	1.75	5.00	145.20	1,016.38	2,903.95
2044	197,349,505	290	57,183	58,898	0.25	1.75	5.00	147.25	1,030.72	2,944.91
2045	198,151,234	293	57,989	59,729	0.25	1.75	5.00	149.32	1,045.25	2,986.44

Source: Consultants' Estimate, 2016

Movement of rice by rail is in one direction: downstream only, as observed based on O-D analysis of 2014-15 information of BR. This indicates that BR moves rice from production to deficit areas for distribution purposes only. It is assumed that this will continue. Table 4-30 shows the resultant traffic flow, section-wise, for the Scenario 2 forecast as Scenario 1 and 3 are extreme cases.

Table 4-30: Forecast BR Rice Traffic Flow by Line

Railway Section/Segment	Loading Station	Unloading Station	Distance (km)	2014-15 Traffic (Tonne)	% Share to Total Traffic	2020	2025	2030	2035	2040	2045
UP											
NIL											
Down											
PBT-STU, STU-AUP, AUP-ISD, ISD-PDB, PDB-Jessore, JS-KLN	BARP	DT	358.31	5,412	6.0%	11,856	26,172	36,109	46,473	58,152	62,369
PBT-STU, STU-AUP, AUP-ISD, ISD-PDB, PDB-Jessore, JS-KLN	BARP	KLNJ	365.77	1,352	1.5%	2,962	6,538	9,021	11,610	14,527	15,581
PBT-STU, STU-AUP, AUP-ISD, ISD-JY, JY-TGI, TGI-DA	BARP	TJN	390.83	855	0.9%	1,873	4,135	5,705	7,342	9,187	9,853
PBT-STU, STU-AUP, AUP-ISD, ISD-DSN	BBP	DSN	243.14	5,240	5.8%	11,479	25,340	34,961	44,996	56,303	60,387
PBT-STU, STU-AUP, AUP-ISD, ISD-PDB, PDB-DSN	BBP	HS	207.59	2,631	2.9%	5,764	12,723	17,554	22,593	28,270	30,320
PBT-STU, STU-AUP, AUP-ISD	BBP	ISD	165.60	21,052	23.2%	46,119	101,806	140,458	180,776	226,202	242,609
PBT-STU, STU-AUP, AUP-ISD, ISD-PDB, PDB-RB	BBP	RB	268.81	2,632	2.9%	5,766	12,728	17,561	22,601	28,281	30,332
PBT-STU, STU-AUP, AUP-ISD	BBP	ISD	165.60	3,947	4.4%	8,647	19,087	26,334	33,893	42,410	45,486
KCQ-PBT-AUP-ISDB-JOI-JYR-TGI-BCI-AKA-CTG	DGP	CTG, D/Hat	721.01	890	1.0%	1,950	4,304	5,938	7,643	9,563	10,257
KCQ-PBT-AUP-ISDB-JOI-JYR-TGI-DA	DGP	TJN	443.95	855	0.9%	1,873	4,135	5,705	7,342	9,187	9,853
KNA-BNRP-STU-AUP-ISD-JOI-BBE-JYR-TGI-DA	GBH	TJN	400.85	924	1.0%	2,024	4,468	6,165	7,934	9,928	10,648
ISD-PDB-DSN-JS-KLN	ISD	DT	197.34	9,475	10.4%	20,757	45,821	63,217	81,363	101,808	109,193
ISD-PDB-DSN-JS-KLN	ISD	KLN	204.80	2,662	2.9%	5,832	12,873	17,761	22,859	28,603	30,678
JLX-MYN-JYR-TGI-BCI-AKA-LKM-CTG	JLX	CTG/D-Hat	401.57	1,024	1.1%	2,243	4,952	6,832	8,793	11,003	11,801
PBT-STU-AUP-ISD-PDB-DSNJ-JS-KLN	JY	DT	308.63	1,353	1.5%	2,964	6,543	9,027	11,618	14,538	15,592
KRM-KNA-BNRP-STU-AUP-ISD-JOI-BBE-JYR-TGI-DA	KRM	TJN	482.06	1,848	2.0%	4,048	8,937	12,330	15,869	19,857	21,297
JOI-ISD-PDB-DSN-JS-KLN	MODI	DT	216.70	5,235	5.8%	11,468	25,316	34,928	44,953	56,250	60,330
MYN-GRPM-BCI-AKA-LKM-CTG	MYN	CTG/D, Hat	333.96	1,971	2.2%	4,318	9,532	13,150	16,925	21,178	22,714
STU-AUP-ISD-PDB-DSNJ-JS-KLN	NTE	DT	231.52	1,592	1.8%	3,488	7,699	10,622	13,671	17,106	18,347
PBT-STU-AUP-ISD-PDB-DSNJ-JS-KLN	PIB	DT, M/Pasa	319.04	1,354	1.5%	2,966	6,548	9,034	11,627	14,549	15,604
PBT-STU-AUP-ISD-PDB-DSNJ-JS-KLN	PLB	DT	353.60	6,138	6.8%	13,447	29,683	40,953	52,708	65,952	70,736
PBT-STU-AUP-ISD-PDB-DSNJ-JS-KLN	PLB	DT, M/Pasa	353.60	361	0.4%	791	1,746	2,409	3,100	3,879	4,160
KNA-PBT-STU-AUP-ISD-JOI-BBE-JYR-TGI-DA	RNP	TJN	441.83	2,052	2.3%	4,495	9,923	13,691	17,621	22,049	23,648
CLH-PBT-AUP-ISD-PDB-DSNJ-JS-KLN	SDP	KLNJ	394.30	2,663	2.9%	5,834	12,878	17,767	22,867	28,614	30,689
KRF-AKA-LKM-CTG	STGJ	CTG/D/hat	544.79	890	1.0%	1,950	4,304	5,938	7,643	9,563	10,257
KRF-AKA-BCI-TGI-DA	STGJ	TJN	463.43	1,471	1.6%	3,223	7,114	9,814	12,632	15,806	16,952
STU-AUP-ISD-PDB-DSNJ-JS-KLN	STU	DT	275.79	2,614	2.9%	5,727	12,641	17,441	22,447	28,087	30,124
STU-AUP-ISD-PDB-DSNJ-JS-KLN	STU	KLN	283.25	1,352	1.5%	2,962	6,538	9,021	11,610	14,527	15,581
PCGH-KCQ-PBT-STU-AUP-ISDB-JOI-BBE-JYR-TGI-DA	THRD	TJN	498.91	855	0.9%	1,873	4,135	5,705	7,342	9,187	9,853
Sub-Total (Down)			270.19	90,700	100.0%	198,698	438,620	605,148	778,850	974,565	1,045,253
Total (Up and Down Direction)				90,700	100.0%	198,698	438,620	605,148	778,850	974,565	1,045,253

4.3.10 Other Commodities

Other commodities that are not individually forecast, but are candidate traffic are: other grains, sugar, soya oil cake, marble & stones and others. These commodities are not significant on its own but relevant overall. Therefore, it is assumed that these commodities would be:

- 10% of dry bulk traffic (wheat, rice and fertilizer) under Scenario-1
- 15% of dry bulk traffic (wheat, rice and fertilizer) under Scenario-2
- 20% of dry bulk traffic (wheat, rice and fertilizer) under Scenario-3

Also it is assumed further that traffic flow would follow the present movement pattern as observed based on O-D analysis of 2014-15 BR traffic.

4.3.11 Containers

Chittagong port handles almost the total container traffic (97%) of Bangladesh. There is another port at Mongla that handles the remaining 3% of container traffic, which is due to various physical restrictions and inadequate hinterland linkages. With the increase in container traffic, BR has set up an Inland Container Depot at Dhaka (Kamlapur), which is rail-based. It serves Chittagong port traffic. Currently there are proposals to develop additional port facilities at Chittagong port and at Sonadia, which is proposed to be a Deep Sea Port. Furthermore, Payra port (which is under development) is also planned to handle container vessels. The capacity for container handling at various terminals of Bangladesh is set out in Table 4-31 and the import and export container traffic handled at Chittagong Port is given in Table 4-32, and the analysis in Figure 4-15.

Table 4-31: Container Handling Capacity of Port Terminals in Bangladesh, 2014/15

Port Facility	Capacity (TEUs)
Chittagong Container Terminal (CCT)	550,000
New Mooring Container Terminal (NMCT), Chittagong Port	1,200,000
General Cargo Berth (GCB), Chittagong Port	200,000 TEU each berth / Total 400,000
KCT(Berths 10 – 13), Chittagong Port	600,000
Other than Chittagong Port	738,000 TEU
Mongla Port	Not Available
Sonadia Port (Planned)	3,500,000

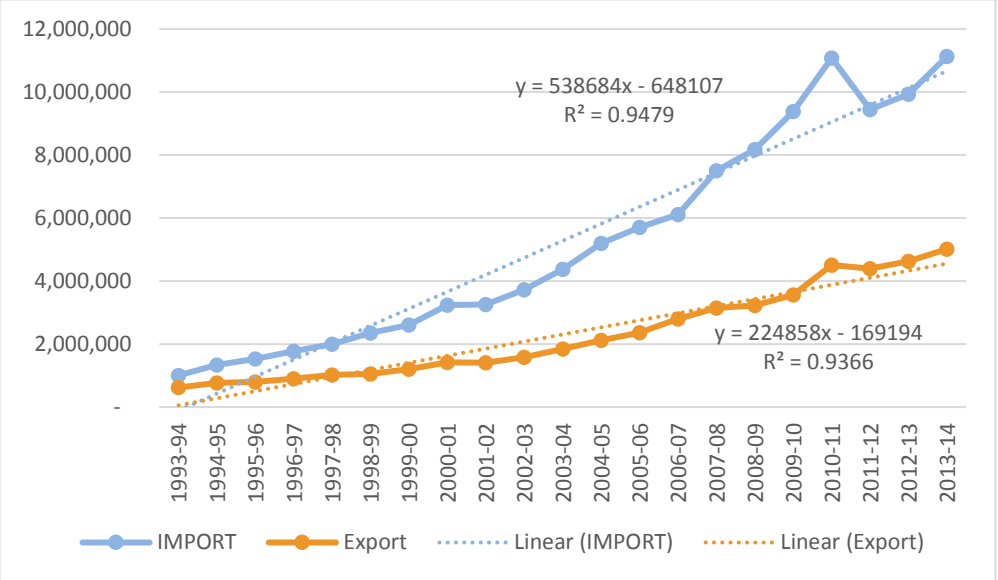
Source: Bangladesh: Trade and Transport Facilitation Programme, KCT Pre-Feasibility Study, World Bank, July 2014

Table 4-32: Trend in Container Traffic of Chittagong Port (in tonnes)

	IMPORT	Export
1993-94	1,005,073	621,461
1994-95	1,341,498	772,517
1995-96	1,534,370	801,145
1996-97	1,771,880	898,085
1997-98	1,996,238	1,021,560
1998-99	2,351,180	1,050,465
1999-00	2,609,220	1,207,553
2000-01	3,235,164	1,419,311
2001-02	3,254,668	1,408,565
2002-03	3,723,745	1,577,656
2003-04	4,370,324	1,841,724
2004-05	5,197,709	2,122,947
2005-06	5,708,489	2,366,799
2006-07	6,114,985	2,796,246
2007-08	7,498,904	3,144,310
2008-09	8,169,677	3,227,074
2009-10	9,377,271	3,562,978
2010-11	11,071,826	4,510,114
2011-12	9,439,987	4,398,684
2012-13	9,928,300	4,627,676
2013-14	11,125,348	5,012,347
AACGR (%)	12.8	11.0

Source: Chittagong Port Authority, 2015

Figure 4-15: Trend Analysis of Container Traffic Handled at Chittagong Port



Some important characteristics of container traffic:

- Import tonnage has grown at the rate of 12.8% p.a. during 1994 to 2014.
- Export tonnage registered a growth of 11.0% p.a. between 1994 and 2014.
- The average load per TEU for import has been 13.6 tonnes and for export has been 5.9 tonnes, as estimated based on 2006 to 2013 data.
- About 2% of import TEU consists of empty containers (MTs).
- Principal commodities of import containers are accessories for Ready Made Garment (RMG) manufacturing, equipment and machinery. With the advent of technology and use of alternate light weight material, it is likely that the average load per import TEU is likely to decline
- RMG and jute products will continue to be predominant commodities of export container traffic. There could be a marginal increase in average load of an export TEU due to improved packaging/stuffing.

The average elasticity of import container traffic (M) and export (X) has been estimated with respect to the Bangladesh economic growth rate as given in Table 4-33 and illustrated in Figure 4-16. It shows that:

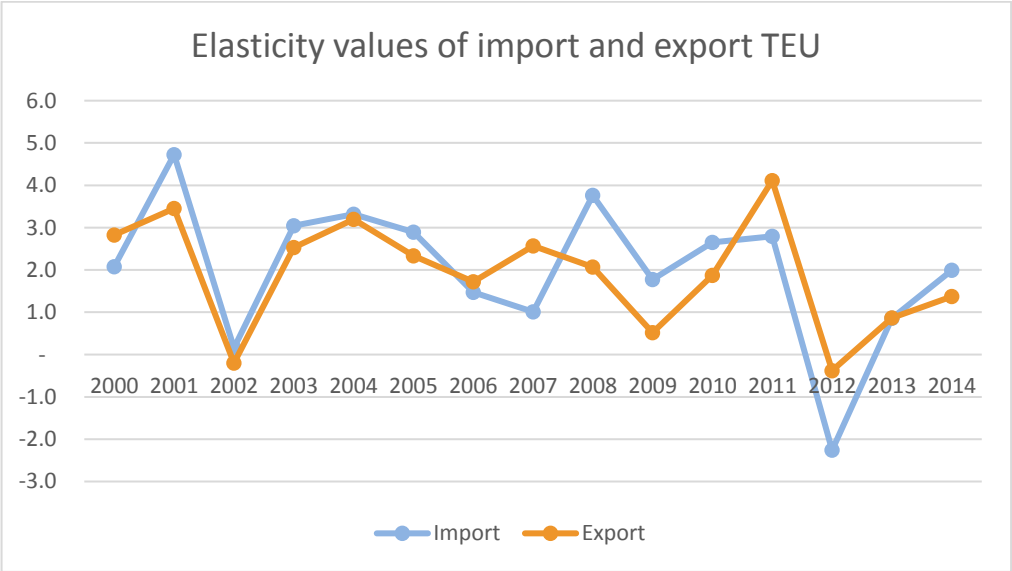
- The elasticity values of import and export container traffic have been volatile when analyzed on an annual basis between 2000 and 2014.
- 5-yearly average elasticity reveals a clear trend: i.e. declining trend but starting at a very high elasticity value, which is in line with the international trend.
- The average elasticity of import traffic has declined from 2.7 to 1.2 and export traffic decreased from 2.4 to 1.6. It means that export container traffic has more potential to grow than the import traffic, which is evident from the fact that RMG of Bangladesh will

continue to grow in future and that it has huge potential to spur the economic growth of Bangladesh.

Table 4-33: Estimated Average Elasticity of Container Traffic of Chittagong Port

	% Growth Rate of Import TEU	% Growth Rate of Export TEU	% Growth Rate of Economy	Elasticity M	Average-M	Elasticity-X	Average-X
2000	11.0	15.0	5.29	2.1		2.8	
2001	24.0	17.5	5.08	4.7		3.5	
2002	0.6	-0.8	3.83	0.2	2.7	-0.2	2.4
2003	14.4	12.0	4.74	3.0		2.5	
2004	17.4	16.7	5.24	3.3		3.2	
2005	18.9	15.3	6.54	2.9		2.3	
2006	9.8	11.5	6.67	1.5		1.7	
2007	7.1	18.1	7.06	1.0	2.2	2.6	1.8
2008	22.6	12.4	6.01	3.8		2.1	
2009	8.9	2.6	5.05	1.8		0.5	
2010	14.8	10.4	5.57	2.7		1.9	
2011	18.1	26.6	6.46	2.8		4.1	
2012	-14.7	-2.5	6.52	-2.3	1.2	-0.4	1.6
2013	5.2	5.2	6.01	0.9		0.9	
2014	12.1	8.3	6.06	2.0		1.4	

Figure 4-16: Trend in Elaticity Values of Chittagong Port's Container Traffic



In line with the observed trend and the conclusion arrived thereof, the elasticity values for import and export container traffic were assumed as given in Table 4-34.

Table 4-34: Assumed Elasticity Values of Chittagong Container Traffic for Forecasting

Period	Import containers	Export Containers	Economic Growth Rate (% p.a.)
2015-20	1.20	1.40	6.30
2021-25	1.15	1.30	6.40
2026-30	1.10	1.20	6.50
2031-35	1.00	1.10	6.00
2036-40	0.90	1.00	6.00
2041-45	0.90	0.90	6.00

Source: Consultants' Assessment, 2016

An average load per import TEU of 11 tonnes and 6 tonnes for export TEU was assumed. With these assumptions, the national container traffic demand is estimated and the result is presented in Table 4-35.

Table 4-35: Forecast Container Traffic of Bangladesh, Loaded and Empty by Import and Export

	Tonne		Loaded TEU			Empty TEU			Total TEU			GR (%)
	Import	Export	Import	Export	Total	Export	Import	Total	Import	Export	Total	
2015	11,966,424	5,328,125	1,087,857	888,021	1,975,878	199,836	3,997	203,833	1,091,853	1,087,857	2,179,710	
2016	12,871,086	5,798,065	1,170,099	966,344	2,136,443	203,754	4,075	207,830	1,174,174	1,170,099	2,344,273	
2017	13,844,140	6,309,455	1,258,558	1,051,576	2,310,134	206,982	4,140	211,122	1,262,698	1,258,558	2,521,256	
2018	14,890,757	6,865,949	1,353,705	1,144,325	2,498,030	209,380	4,188	213,568	1,357,893	1,353,705	2,711,598	7.5
2019	16,016,498	7,471,525	1,456,045	1,245,254	2,701,300	210,791	4,216	215,007	1,460,261	1,456,045	2,916,306	
2020	17,227,346	8,130,514	1,566,122	1,355,086	2,921,208	211,037	4,221	215,257	1,570,343	1,566,122	3,136,465	
2021	18,495,278	8,806,973	1,681,389	1,467,829	3,149,218	213,560	4,271	217,831	1,685,660	1,681,389	3,367,049	
2022	19,856,531	9,539,713	1,805,139	1,589,952	3,395,091	215,187	4,304	219,491	1,809,443	1,805,139	3,614,582	
2023	21,317,971	10,333,417	1,937,997	1,722,236	3,660,234	215,761	4,315	220,076	1,942,313	1,937,997	3,880,310	7.4
2024	22,886,974	11,193,157	2,080,634	1,865,526	3,946,160	215,108	4,302	219,410	2,084,936	2,080,634	4,165,570	
2025	24,571,455	12,124,428	2,233,769	2,020,738	4,254,507	213,031	4,261	217,291	2,238,029	2,233,769	4,471,798	
2026	26,328,314	13,070,133	2,393,483	2,178,356	4,571,839	215,128	4,303	219,430	2,397,786	2,393,483	4,791,269	
2027	28,210,789	14,089,604	2,564,617	2,348,267	4,912,884	216,350	4,327	220,677	2,568,944	2,564,617	5,133,561	
2028	30,227,860	15,188,593	2,747,987	2,531,432	5,279,419	216,555	4,331	220,886	2,752,318	2,747,987	5,500,306	7.1
2029	32,389,152	16,373,303	2,944,468	2,728,884	5,673,352	215,585	4,312	219,896	2,948,780	2,944,468	5,893,248	
2030	34,704,977	17,650,421	3,154,998	2,941,737	6,096,735	213,261	4,265	217,526	3,159,263	3,154,998	6,314,261	
2031	36,787,275	18,815,349	3,344,298	3,135,891	6,480,189	208,406	4,168	212,574	3,348,466	3,344,298	6,692,764	
2032	38,994,512	20,057,162	3,544,956	3,342,860	6,887,816	202,095	4,042	206,137	3,548,998	3,544,956	7,093,953	
2033	41,334,183	21,380,934	3,757,653	3,563,489	7,321,142	194,164	3,883	198,047	3,761,536	3,757,653	7,519,189	6.0
2034	43,814,233	22,792,076	3,983,112	3,798,679	7,781,791	184,433	3,689	188,121	3,986,801	3,983,112	7,969,913	
2035	46,443,087	24,296,353	4,222,099	4,049,392	8,271,491	172,707	3,454	176,161	4,225,553	4,222,099	8,447,652	
2036	49,090,343	25,754,134	4,462,758	4,292,356	8,755,114	170,403	3,408	173,811	4,466,167	4,462,758	8,928,925	
2037	51,888,493	27,299,382	4,717,136	4,549,897	9,267,033	167,239	3,345	170,583	4,720,481	4,717,136	9,437,616	
2038	54,846,137	28,937,345	4,986,012	4,822,891	9,808,903	163,122	3,262	166,384	4,989,275	4,986,012	9,975,287	5.7
2039	57,972,367	30,673,586	5,270,215	5,112,264	10,382,479	157,951	3,159	161,110	5,273,374	5,270,215	10,543,589	
2040	61,276,792	32,514,001	5,570,617	5,419,000	10,989,618	151,617	3,032	154,650	5,573,650	5,570,617	11,144,267	
2041	64,585,739	34,269,757	5,871,431	5,711,626	11,583,057	159,805	3,196	163,001	5,874,627	5,871,431	11,746,058	
2042	68,073,369	36,120,324	6,188,488	6,020,054	12,208,542	168,434	3,369	171,803	6,191,857	6,188,488	12,380,345	
2043	71,749,330	38,070,821	6,522,666	6,345,137	12,867,803	177,530	3,551	181,080	6,526,217	6,522,666	13,048,883	5.4
2044	75,623,794	40,126,646	6,874,890	6,687,774	13,562,665	187,116	3,742	190,858	6,878,633	6,874,890	13,753,523	
2045	79,707,479	42,293,484	7,246,134	7,048,914	14,295,049	197,220	3,944	201,165	7,250,079	7,246,134	14,496,213	

Source: Consultants' Estimate, 2016

As discussed earlier, development of additional seaports is either in process (Payra) or being considered (Sonadia) to handle container traffic. Further, Mongla port will continue to handle container traffic to the extent of 2% of national demand. It is believed that Payra will become operational to handle container by 2021 and that Sonadia will take ten years to come into operation (2026). Taking into account of these factors, national container traffic is allocated to the ports as assumed in Table 4-36 and the resultant annual forecast in Table 4-38.

Table 4-36: Percentage Distribution of Potential Container Traffic Between the Sea Ports of Bangladesh

Period	Chittagong	Mongla	Payra	Sonadia	Total
2015-20	98%	2%	0%	0%	100%
2021-25	78%	2%	20%	0%	100%
2026-30	58%	2%	30%	10%	100%
2031-35	30%	2%	35%	33%	100%
2036-40	30%	2%	34%	34%	100%
2041-45	30%	2%	32%	36%	100%

Based on the above considerations, the container traffic forecast of seaports is as given in Table 4-38. Based on discussions with Chittagong Port and port users, including some privately operated ICDs located around Chittagong, it was observed that 80% of container traffic is Dhaka regional traffic. It is most likely that all these seaports will have similar O-D pattern as that of Chittagong port. Accordingly, the potential container traffic of BR is estimated for the following scenarios:

- Scenario-1: conservative (5% market capture)
- Scenario-2: realistic (15% market capture)
- Scenario-3: optimistic Scenario (30% market capture)

The above estimate considers that GoB will price the port services competitively in such a way that the overall logistic efficiency will be maintained irrespective of the port choice. In other words, pricing of services will ensure that the savings in time and cost that will accrue to the shippers using new ports will at least be marginally more than increase in direct costs that includes terminal handling charges, railway haulage and ICD charges. Most importantly, BR will develop its ICDs not only in the hinterland, but also at the port head so that there is adequate leverage exist to attract traffic to BR.

Summarizing the forecast, BR container traffic will range from 87,000 TEU to 580,000 TEU under the conservative scenario, from 262,000 TEU to 1.7 million TEU under the realistic scenario and the range goes up from 520,000 thousand TEU to 3.5 million TEU under the optimistic scenario, between 2015 to 2045, as summarised in Table 4-37, detailed out in Table 4-39 (Conservative), Table 4-40 (Realistic) and Table 4-41(Optimistic) and as illustrated in Figure 4-17.

Table 4-37: Potential Container Traffic Forecasts of BR (TEU)

	Conservative	Realistic	Optimistic
2015	87,188	261,565	523,130
2020	125,459	376,376	752,752
2025	178,872	536,616	1,073,232
2030	252,570	757,711	1,515,423
2035	337,906	1,013,718	2,027,436
2040	445,771	1,337,312	2,674,624
2045	579,849	1,739,546	3,479,091

Figure 4-17: BR Container Traffic Forecasts (TEU)

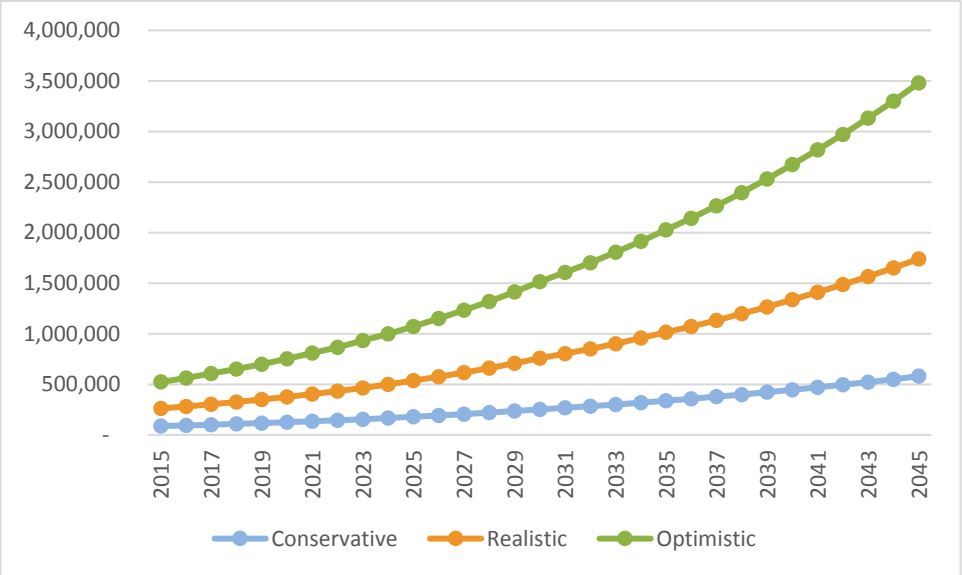


Table 4-38: Bangladesh Container Traffic Forecasts by Port ('000 TEU)

	National Demand			Chittagong			Mongla			Payra			Sonadia		
	Import	Export	Total	Import	Export	Total	Import	Export	Total	Import	Export	Total	Import	Export	Total
2015	1,092	1,088	2,180	1,070	1,066	2,136	22	22	44	-	-	-	-	-	-
2016	1,174	1,170	2,344	1,151	1,147	2,297	23	23	47	-	-	-	-	-	-
2017	1,263	1,259	2,521	1,237	1,233	2,471	25	25	50	-	-	-	-	-	-
2018	1,358	1,354	2,712	1,331	1,327	2,657	27	27	54	-	-	-	-	-	-
2019	1,460	1,456	2,916	1,431	1,427	2,858	29	29	58	-	-	-	-	-	-
2020	1,570	1,566	3,136	1,539	1,535	3,074	31	31	63	-	-	-	-	-	-
2021	1,686	1,681	3,367	1,315	1,311	2,626	34	34	67	337	336	673	-	-	-
2022	1,809	1,805	3,615	1,411	1,408	2,819	36	36	72	362	361	723	-	-	-
2023	1,942	1,938	3,880	1,515	1,512	3,027	39	39	78	388	388	776	-	-	-
2024	2,085	2,081	4,166	1,626	1,623	3,249	42	42	83	417	416	833	-	-	-
2025	2,238	2,234	4,472	1,746	1,742	3,488	45	45	89	448	447	894	-	-	-
2026	2,398	2,393	4,791	1,391	1,388	2,779	48	48	96	719	718	1,437	240	239	479
2027	2,569	2,565	5,134	1,490	1,487	2,977	51	51	103	771	769	1,540	257	256	513
2028	2,752	2,748	5,500	1,596	1,594	3,190	55	55	110	826	824	1,650	275	275	550
2029	2,949	2,944	5,893	1,710	1,708	3,418	59	59	118	885	883	1,768	295	294	589
2030	3,159	3,155	6,314	1,832	1,830	3,662	63	63	126	948	946	1,894	316	315	631
2031	3,348	3,344	6,693	1,005	1,003	2,008	67	67	134	1,172	1,171	2,342	1,105	1,104	2,209
2032	3,549	3,545	7,094	1,065	1,063	2,128	71	71	142	1,242	1,241	2,483	1,171	1,170	2,341
2033	3,762	3,758	7,519	1,128	1,127	2,256	75	75	150	1,317	1,315	2,632	1,241	1,240	2,481
2034	3,987	3,983	7,970	1,196	1,195	2,391	80	80	159	1,395	1,394	2,789	1,316	1,314	2,630
2035	4,226	4,222	8,448	1,268	1,267	2,534	85	84	169	1,479	1,478	2,957	1,394	1,393	2,788
2036	4,466	4,463	8,929	1,340	1,339	2,679	89	89	179	1,518	1,517	3,036	1,518	1,517	3,036
2037	4,720	4,717	9,438	1,416	1,415	2,831	94	94	189	1,605	1,604	3,209	1,605	1,604	3,209
2038	4,989	4,986	9,975	1,497	1,496	2,993	100	100	200	1,696	1,695	3,392	1,696	1,695	3,392
2039	5,273	5,270	10,544	1,582	1,581	3,163	105	105	211	1,793	1,792	3,585	1,793	1,792	3,585
2040	5,574	5,571	11,144	1,672	1,671	3,343	111	111	223	1,895	1,894	3,789	1,895	1,894	3,789
2041	5,875	5,871	11,746	1,762	1,761	3,524	117	117	235	1,880	1,879	3,759	2,115	2,114	4,229
2042	6,192	6,188	12,380	1,858	1,857	3,714	124	124	248	1,981	1,980	3,962	2,229	2,228	4,457
2043	6,526	6,523	13,049	1,958	1,957	3,915	131	130	261	2,088	2,087	4,176	2,349	2,348	4,698
2044	6,879	6,875	13,754	2,064	2,062	4,126	138	137	275	2,201	2,200	4,401	2,476	2,475	4,951
2045	7,250	7,246	14,496	2,175	2,174	4,349	145	145	290	2,320	2,319	4,639	2,610	2,609	5,219

Source: Consultants' Estimate, 2016

Table 4-39: BR Container Traffic Forecasts by OD – Conservative Scenario (TEU)

	Chittagong Dhaka	Mongla Dhaka	Payra Dhaka	Sonadia Dhaka	Total UP Movement	Dhaka Chittagong	Dhaka Mongla	Dhaka Payra	Dhaka Sonadia	Total Down Movement	Total Container Traffic
2015	42,801	873	-	-	43,674	42,644	870	-	-	43,514	87,188
2016	46,028	939	-	-	46,967	45,868	936	-	-	46,804	93,771
2017	49,498	1,010	-	-	50,508	49,335	1,007	-	-	50,342	100,850
2018	53,229	1,086	-	-	54,316	53,065	1,083	-	-	54,148	108,464
2019	57,242	1,168	-	-	58,410	57,077	1,165	-	-	58,242	116,652
2020	61,557	1,256	-	-	62,814	61,392	1,253	-	-	62,645	125,459
2021	52,593	1,349	13,485	-	67,426	52,459	1,345	13,451	-	67,256	134,682
2022	56,455	1,448	14,476	-	72,378	56,320	1,444	14,441	-	72,206	144,583
2023	60,600	1,554	15,539	-	77,693	60,466	1,550	15,504	-	77,520	155,212
2024	65,050	1,668	16,679	-	83,397	64,916	1,665	16,645	-	83,225	166,623
2025	69,827	1,790	17,904	-	89,521	69,694	1,787	17,870	-	89,351	178,872
2026	55,629	1,918	28,773	9,591	95,911	55,529	1,915	28,722	9,574	95,739	191,651
2027	59,600	2,055	30,827	10,276	102,758	59,499	2,052	30,775	10,258	102,585	205,342
2028	63,854	2,202	33,028	11,009	110,093	63,753	2,198	32,976	10,992	109,919	220,012
2029	68,412	2,359	35,385	11,795	117,951	68,312	2,356	35,334	11,778	117,779	235,730
2030	73,295	2,527	37,911	12,637	126,371	73,196	2,524	37,860	12,620	126,200	252,570
2031	40,182	2,679	46,879	44,200	133,939	40,132	2,675	46,820	44,145	133,772	267,711
2032	42,588	2,839	49,686	46,847	141,960	42,539	2,836	49,629	46,793	141,798	283,758
2033	45,138	3,009	52,662	49,652	150,461	45,092	3,006	52,607	49,601	150,306	300,768
2034	47,842	3,189	55,815	52,626	159,472	47,797	3,186	55,764	52,577	159,324	318,797
2035	50,707	3,380	59,158	55,777	169,022	50,665	3,378	59,109	55,732	168,884	337,906
2036	53,594	3,573	60,740	60,740	178,647	53,553	3,570	60,694	60,694	178,510	357,157
2037	56,646	3,776	64,199	64,199	188,819	56,606	3,774	64,153	64,153	188,685	377,505
2038	59,871	3,991	67,854	67,854	199,571	59,832	3,989	67,810	67,810	199,440	399,011
2039	63,280	4,219	71,718	71,718	210,935	63,243	4,216	71,675	71,675	210,809	421,744
2040	66,884	4,459	75,802	75,802	222,946	66,847	4,456	75,760	75,760	222,825	445,771
2041	70,496	4,700	75,195	84,595	234,985	70,457	4,697	75,154	84,549	234,857	469,842
2042	74,302	4,953	79,256	89,163	247,674	74,262	4,951	79,213	89,114	247,540	495,214
2043	78,315	5,221	83,536	93,978	261,049	78,272	5,218	83,490	93,926	260,907	521,955
2044	82,544	5,503	88,046	99,052	275,145	82,499	5,500	87,999	98,998	274,996	550,141
2045	87,001	5,800	92,801	104,401	290,003	86,954	5,797	92,751	104,344	289,845	579,849

Table 4-40: BR Container Traffic Forecasts by OD – Realistic Scenario (TEU)

	Chittagong Dhaka	Mongla Dhaka	Payra Dhaka	Sonadia Dhaka	Total UP Movement	Dhaka Chittagong	Dhaka Mongla	Dhaka Payra	Dhaka Sonadia	Total Down Movement	Total Container Traffic
2015	128,402	2,620	-	-	131,022	127,932	2,611	-	-	130,543	261,565
2016	138,083	2,818	-	-	140,901	137,604	2,808	-	-	140,412	281,313
2017	148,493	3,030	-	-	151,524	148,006	3,021	-	-	151,027	302,551
2018	159,688	3,259	-	-	162,947	159,196	3,249	-	-	162,445	325,392
2019	171,727	3,505	-	-	175,231	171,231	3,495	-	-	174,725	349,957
2020	184,672	3,769	-	-	188,441	184,176	3,759	-	-	187,935	376,376
2021	157,778	4,046	40,456	-	202,279	157,378	4,035	40,353	-	201,767	404,046
2022	169,364	4,343	43,427	-	217,133	168,961	4,332	43,323	-	216,617	433,750
2023	181,800	4,662	46,616	-	233,078	181,397	4,651	46,512	-	232,560	465,637
2024	195,150	5,004	50,038	-	250,192	194,747	4,994	49,935	-	249,676	499,868
2025	209,480	5,371	53,713	-	268,564	209,081	5,361	53,610	-	268,052	536,616
2026	166,886	5,755	86,320	28,773	287,734	166,586	5,744	86,165	28,722	287,218	574,952
2027	178,799	6,165	92,482	30,827	308,273	178,497	6,155	92,326	30,775	307,754	616,027
2028	191,561	6,606	99,083	33,028	330,278	191,260	6,595	98,928	32,976	329,758	660,037
2029	205,235	7,077	106,156	35,385	353,854	204,935	7,067	106,001	35,334	353,336	707,190
2030	219,885	7,582	113,733	37,911	379,112	219,588	7,572	113,580	37,860	378,600	757,711
2031	120,545	8,036	140,636	132,599	401,816	120,395	8,026	140,461	132,434	401,316	803,132
2032	127,764	8,518	149,058	140,540	425,880	127,618	8,508	148,888	140,380	425,395	851,274
2033	135,415	9,028	157,985	148,957	451,384	135,276	9,018	157,821	148,803	450,918	902,303
2034	143,525	9,568	167,446	157,877	478,416	143,392	9,559	167,291	157,731	477,973	956,390
2035	152,120	10,141	177,473	167,332	507,066	151,996	10,133	177,328	167,195	506,652	1,013,718
2036	160,782	10,719	182,220	182,220	535,940	160,659	10,711	182,081	182,081	535,531	1,071,471
2037	169,937	11,329	192,596	192,596	566,458	169,817	11,321	192,459	192,459	566,056	1,132,514
2038	179,614	11,974	203,562	203,562	598,713	179,496	11,966	203,429	203,429	598,321	1,197,034
2039	189,841	12,656	215,154	215,154	632,805	189,728	12,649	215,025	215,025	632,426	1,265,231
2040	200,651	13,377	227,405	227,405	668,838	200,542	13,369	227,281	227,281	668,474	1,337,312
2041	211,487	14,099	225,586	253,784	704,955	211,372	14,091	225,463	253,646	704,572	1,409,527
2042	222,907	14,860	237,767	267,488	743,023	222,786	14,852	237,638	267,343	742,619	1,485,641
2043	234,944	15,663	250,607	281,933	783,146	234,816	15,654	250,470	281,779	782,720	1,565,866
2044	247,631	16,509	264,139	297,157	825,436	247,496	16,500	263,996	296,995	824,987	1,650,423
2045	261,003	17,400	278,403	313,203	870,009	260,861	17,391	278,252	313,033	869,536	1,739,546

Table 4-41: BR Container Traffic Forecasts by OD – Optimistic Scenario (TEU)

	Chittagong Dhaka	Mongla Dhaka	Payra Dhaka	Sonadia Dhaka	Total UP Movement	Dhaka Chittagong	Dhaka Mongla	Dhaka Payra	Dhaka Sonadia	Total Down Movement	Total Container Traffic
2015	128,402	2,620	-	-	131,022	127,932	2,611	-	-	130,543	261,565
2016	138,083	2,818	-	-	140,901	137,604	2,808	-	-	140,412	281,313
2017	148,493	3,030	-	-	151,524	148,006	3,021	-	-	151,027	302,551
2018	159,688	3,259	-	-	162,947	159,196	3,249	-	-	162,445	325,392
2019	171,727	3,505	-	-	175,231	171,231	3,495	-	-	174,725	349,957
2020	184,672	3,769	-	-	188,441	184,176	3,759	-	-	187,935	376,376
2021	157,778	4,046	40,456	-	202,279	157,378	4,035	40,353	-	201,767	404,046
2022	169,364	4,343	43,427	-	217,133	168,961	4,332	43,323	-	216,617	433,750
2023	181,800	4,662	46,616	-	233,078	181,397	4,651	46,512	-	232,560	465,637
2024	195,150	5,004	50,038	-	250,192	194,747	4,994	49,935	-	249,676	499,868
2025	209,480	5,371	53,713	-	268,564	209,081	5,361	53,610	-	268,052	536,616
2026	166,886	5,755	86,320	28,773	287,734	166,586	5,744	86,165	28,722	287,218	574,952
2027	178,799	6,165	92,482	30,827	308,273	178,497	6,155	92,326	30,775	307,754	616,027
2028	191,561	6,606	99,083	33,028	330,278	191,260	6,595	98,928	32,976	329,758	660,037
2029	205,235	7,077	106,156	35,385	353,854	204,935	7,067	106,001	35,334	353,336	707,190
2030	219,885	7,582	113,733	37,911	379,112	219,588	7,572	113,580	37,860	378,600	757,711
2031	120,545	8,036	140,636	132,599	401,816	120,395	8,026	140,461	132,434	401,316	803,132
2032	127,764	8,518	149,058	140,540	425,880	127,618	8,508	148,888	140,380	425,395	851,274
2033	135,415	9,028	157,985	148,957	451,384	135,276	9,018	157,821	148,803	450,918	902,303
2034	143,525	9,568	167,446	157,877	478,416	143,392	9,559	167,291	157,731	477,973	956,390
2035	152,120	10,141	177,473	167,332	507,066	151,996	10,133	177,328	167,195	506,652	1,013,718
2036	160,782	10,719	182,220	182,220	535,940	160,659	10,711	182,081	182,081	535,531	1,071,471
2037	169,937	11,329	192,596	192,596	566,458	169,817	11,321	192,459	192,459	566,056	1,132,514
2038	179,614	11,974	203,562	203,562	598,713	179,496	11,966	203,429	203,429	598,321	1,197,034
2039	189,841	12,656	215,154	215,154	632,805	189,728	12,649	215,025	215,025	632,426	1,265,231
2040	200,651	13,377	227,405	227,405	668,838	200,542	13,369	227,281	227,281	668,474	1,337,312
2041	211,487	14,099	225,586	253,784	704,955	211,372	14,091	225,463	253,646	704,572	1,409,527
2042	222,907	14,860	237,767	267,488	743,023	222,786	14,852	237,638	267,343	742,619	1,485,641
2043	234,944	15,663	250,607	281,933	783,146	234,816	15,654	250,470	281,779	782,720	1,565,866
2044	247,631	16,509	264,139	297,157	825,436	247,496	16,500	263,996	296,995	824,987	1,650,423
2045	261,003	17,400	278,403	313,203	870,009	260,861	17,391	278,252	313,033	869,536	1,739,546

4.3.12 Summary Potential Traffic of BR

There is a vast potential for BR to increase its traffic as summarised in Table 4-42 and shown in Figure 4-18; the details by commodity composition under the three scenarios are: Conservative, Realistic and Optimistic, as shown respectively in Table 4-43,

Table 4-44 and Table 4-45.

Table 4-42: Forecast Potential BR Container Traffic ('000 tonnes)

	Conservative	Realistic	Optimistic
2015	2,825	5,573	10,449
2020	4,457	8,571	14,841
2025	5,533	11,423	20,042
2030	6,897	14,871	26,842
2035	8,309	18,659	34,354
2040	10,005	23,270	43,529
2045	12,025	28,433	53,541

Source: Consultants' Estimate, 2016

Figure 4-18: Forecast Potential BR Container Traffic ('000 tonnes)

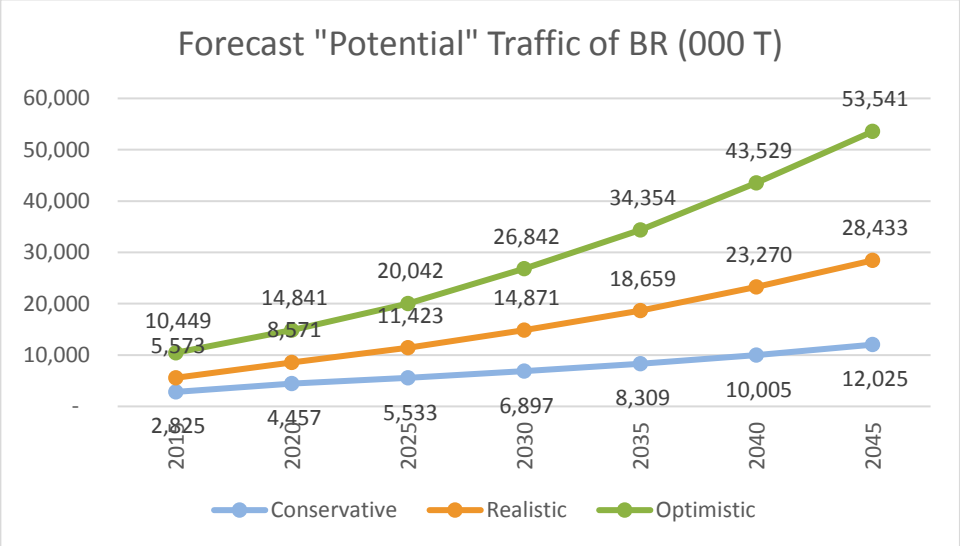


Table 4-43: Forecast BR Potential Traffic by Commodity – Conservative Scenario (in '000 tonnes)

Principal Commodity	2015	2020	2025	2030	2035	2040	2045
Liquid Bulk							
FO	716	888	1,020	1,163	1,280	1,402	1,528
Kerosene	39	49	56	64	70	77	84
Petrol	52	65	75	85	93	102	112
Sub-Total	807	1,002	1,150	1,311	1,444	1,581	1,723
Dry Bulk							

Principal Commodity	2015	2020	2025	2030	2035	2040	2045
Rice	91	99	110	121	130	139	149
Wheat	816	1,764	2,120	2,546	2,944	3,395	3,904
Fertilizer	159	173	179	185	191	197	204
Other Bulk	107	204	241	285	326	373	426
Sub-Total	1,172	2,240	2,650	3,138	3,591	4,104	4,683
Container							
Container	845	1,216	1,733	2,447	3,274	4,320	5,619
Grand Total	2,825	4,457	5,533	6,897	8,309	10,005	12,025
Container (TEU)	87,188	125,459	178,872	252,570	337,906	445,771	579,849

Table 4-44: Forecast BR Potential Traffic by Commodity – Realistic Scenario (in '000 tonnes)

Principal Commodity	2015	2020	2025	2030	2035	2040	2045
Liquid Bulk							
FO	798	1,110	1,456	1,764	2,113	2,501	2,726
Kerosene	39	54	67	81	94	109	119
Petrol	52	69	85	103	120	139	151
Sub-Total	890	1,233	1,608	1,947	2,327	2,748	2,995
Dry Bulk							
Rice	91	199	439	605	779	975	1,045
Wheat	1,513	2,723	3,276	3,940	4,563	5,273	6,078
Fertilizer	265	288	298	308	319	329	339
Other Bulk	280	481	602	728	849	986	1,119
Sub-Total	2,149	3,691	4,615	5,581	6,510	7,563	8,582
Container							
Container	2,535	3,647	5,200	7,342	9,823	12,959	16,856
Grand Total	5,573	8,571	11,423	14,871	18,659	23,270	28,433
Container (TEU)	261,565	376,376	536,616	757,711	1,013,718	1,337,312	1,739,546

Table 4-45: Forecast BR Potential Traffic by Commodity – Optimistic Scenario (in '000 tonnes)

Principal Commodity	2015	2020	2025	2030	2035	2040	2045
Liquid Bulk							
FO	798	1,189	1,593	2,075	2,569	3,126	3,407
Kerosene	39	54	71	95	120	143	156
Petrol	52	83	106	133	160	190	207
Sub-Total	890	1,326	1,770	2,303	2,850	3,459	3,770
Dry Bulk							
Rice	91	397	877	1,452	2,077	2,784	2,986
Wheat	3,122	4,211	5,087	6,143	7,167	8,352	9,717
Fertilizer	530	576	596	617	638	658	679
Other Bulk	748	1,037	1,312	1,642	1,976	2,359	2,676

Principal Commodity	2015	2020	2025	2030	2035	2040	2045
Sub-Total	4,490	6,220	7,873	9,854	11,858	14,153	16,059
Container							
Container	5,069	7,294	10,400	14,684	19,646	25,917	33,712
Grand Total	10,449	14,841	20,042	26,842	34,354	43,529	53,541
Container (TEU)	523,130	752,752	1,073,232	1,515,423	2,027,436	2,674,624	3,479,091

4.3.13 Conclusion

Considering the BR's on-going effort to add new capacity between Chittagong and Dhaka and various other institutional reforms that are underway and planned, it is very likely that "Potential Traffic Forecast under Realistic Scenario" is possible to achieve (i.e. BR traffic could possibly increase from a mere 2 million tonnes to 5 million tonnes in 2025, 10 million tonnes in 2035, and 18 million tonnes in 2045). It is possible that BR could exceed this forecast given the huge potential that exists for BR to capture. If the institutional capacity of BR is enhanced to focus on a business model rather than acting as a social utility operator adopting a "Modern Logistics Operator" concept, the actual traffic could be very likely to be more than what has been forecast even under "Realistic" scenario.

Secondly, container traffic growth of Bangladesh offers enormous potential for BR. In order to convert opportunities to actual business, BR needs a comprehensive approach, developing rail-based ICD's at both ends so that total transportation cost and time to the shippers are minimised. For instance, BR's Container Corporation could consider providing door-to-door service, which calls for a change in the business model from just a transporter between container terminals to a door-to-door logistic service provider. The Container Corporation, in this regard, should consider preparing business plans for the overall operation and go after investment with specific proposals for developing and operating major ICD's with the private sector (who have proven experience in such operation) either on a joint venture basis or landlord concept. In the long run, the Bangladesh Container Company could become a "Railway Operator", owning and operating its fleet of specialised wagons. Thus BR will totally be a commercialized organization with social responsibility to provide passenger service.

5 Opportunities for Bangladesh Railway

Key Messages

- Road and bridge projects in Bangladesh will affect the competitiveness of the railway and its ability to attract modal share.
- There is a new port project at Payra which could supply container traffic to BR. However, the high cost of connection of the railway network to Payra should be studied in detail.
- BR would do well to become a "Multi-Modal Logistic Service Provider" on a commercial basis for the bulk commodities market.
- BR could capture much more of the container market than it currently enjoys. However, substantial infrastructure development would be required.
- BR's passenger traffic is limited by rolling stock capacity. In order to increase passenger traffic, BR should first increase RS efficiency and carriage numbers, then focus on infrastructure upgrades.
- Investment projects for electric traction may be undertaken if the projects become viable in the proposed feasibility studies

5.1 Mega-Projects

5.1.1 Road Projects

Rail was once the dominant transport mode for long-distance passengers and freight. On the rail network major rivers were spanned by bridges. Most roads crossed rivers on slow and congested ferries. Over the last two decades, many road ferries were replaced by bridges, making road transport much more attractive. Accordingly, rail patronage declined.

The nation's most vital transport corridor links its most important city, Dhaka, with its second city, Chittagong, and only major port. Bridges replaced ferries on this road corridor years ago. The Dhaka-Chittagong rail line is circuitous, exiting Dhaka in a northbound direction before turning east and eventually heading south to Chittagong. The journey is 30% longer by rail than by road. For this and other reasons most Dhaka-Chittagong travel is by road. In spite of a large investment to widen the Dhaka-Chittagong highway it is still extremely congested.

Amongst its proposed projects the Public Private Partnership Authority, which resides in the Prime Minister's Office, lists the Dhaka-Chittagong Access Controlled Expressway. The project would design, build, finance, operate and maintain a four-lane access-controlled expressway between Dhaka and Chittagong on a PPP basis. In 2015, a feasibility study[6] analysed five options. The route was evaluated in three sections: Dhaka-Comilla, Comilla-Feni and Feni-Chittagong. The EIRRs were respectively 18.2, 19.7 and 23.8 % pa. The total cost was USD 1.8 billion or BDT 1400 crore.

There is political support for the expressway. It would make rail less competitive; rail's inherent disadvantage is that it is 30% longer than the road route. This would be removed, however, by implementing the Chord Line proposal, first mooted over a decade ago to link south Dhaka to Laksam and found to have 14.4% pa EIRR. Current thinking is to connect the Chord Line to Comilla rather than Laksam.

Another major road project is the Padma Bridge, which is under construction with a four-lane upper deck for road traffic and a lower deck designed for a single-track railway. It is scheduled for completion at the end of 2018. By eliminating ferries the Padma Bridge will shorten the time taken for road traffic between Dhaka and the south-west of the country. Current rail passenger services between Khulna and Dhaka travel the long way around, across Bangabandhu Bridge. They will become uncompetitive. If a new rail line is built utilising Padma Bridge, passenger trains will regain their competitiveness.

5.1.2 Port Projects

By value, Bangladesh's predominant sea traffic is container cargo. Almost entirely, this traffic passes through the riverside port of Chittagong. Chittagong currently receives feeders from Singapore. Ten years ago vessel size was 1000 to 2000 TEU. Average turnaround time was 4.8 days and average parcel size about 1000 TEU. Nowadays, parcel size is about 600 TEU, confirming that Chittagong is being served by feeder vessels.

[6] Consultancy Services for Feasibility Study and Detailed Design (Package-I) Under Technical Assistance for Detailed Study and Design of Dhaka-Chittagong Expressway on PPP Basis (ADB Loan 2856 – BAN) 2016.

A proposal for a Deep Sea Port in the vicinity of Cox's Bazar was the subject of a prefeasibility study[7] of a port at Sonadia Island. In early 2014, developing such a port fueled a flurry of international interest from UAE, China and The Netherlands, and led to the Bangladesh government reportedly "fast tracking" Sonadia Deep Sea Port. Subsequently, proposals developed rapidly and the Sonadia Island location shifted a little northward to Matarbari on Maheshkhali Island where other developments were also being planned (See Figure 5-1). A large area is planned to become a power generation hub and an Exclusive Economic Zone (EEZ) with the following proposed projects and ancillary enterprises:

- Coal-fired power plant under Coal Power Generation Company Bangladesh Limited.[8]
- Petro Chemical complex under the aegis of Kuwait Government and operated by Bangladesh Petroleum Corporation, a statutory body under the Ministry of Power, Energy and Mineral Resources.
- Deep Sea Port under the Ministry of Shipping.
- Industrial township.

The regional hubs (which are Colombo and Singapore) dictate shipping lines' decisions on services in the Bay of Bengal. Routing a Myanmar box through Colombo will be cheaper than through Matarbari, for example. It is unrealistic to think of Matarbari as a continental load centre. It would be a feeder port mainly, but calls by some mainline vessels will commence when volumes and parcel sizes increase. A maritime rule of thumb is that a mainline vessel will call at a port if the parcel size (i.e. box exchange, off plus on) is 25% of a vessel's capacity. Thus, an 8000 TEU Post-Panamax Plus containership will call at Matarbari if the parcel size reaches 2000 TEU.

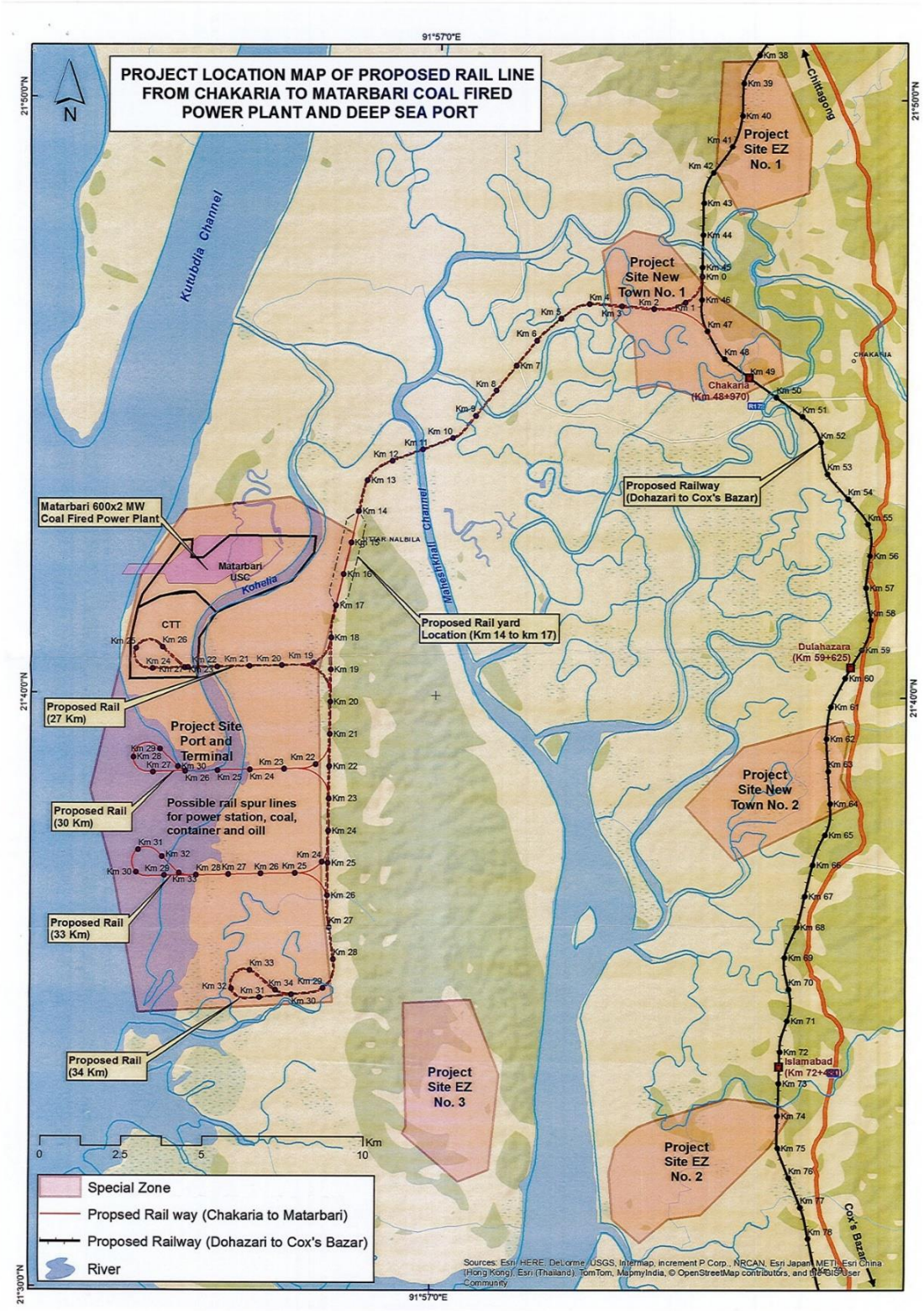
An educated guess is that around 20% of the total TEU throughput at Matarbari would be handled by mainline vessels, primarily on the Bangladesh-Europe trade. Mainline vessels on this trade are currently 8,000 to 12,000 TEU and make multiple (but few) port calls. A terminal with 15m draft can handle all these vessels.

That leaves 80% of the trade being carried by feeder vessels, which are not much disadvantaged by calling at an expanded Chittagong with a draft of 9.4m at the quay. Chittagong has plenty of water frontage available for expansion. The port's limitation is its tidal draft and river channel width, which lacks clearance for ships to arrive and depart simultaneously. Waiting for the tide is a small penalty, and can be offset by the fuel saved by slow steaming to arrive at the right time. Whether feeder vessels switch from Chittagong to Matarbari would depend on port charges and the cost of hauling containers to/from a port which is a little further from the ultimate origin/destination. No matter what planners plan, what actually happens is decided by shipping lines. And the world's dominant container line is Maersk.

7 Techno-Economic Feasibility Study of a Deep Sea Port in Bangladesh, Pacific Consultants International, December 2008.

8 The coal-fired power plant is planned to generate 1200 MW initially, from 2023, and building to 3000 MW. There is also talk of 3000 MW of LNG-fuelled power plants in the area.

Figure 5-1: Planned layout of development at Matabari including a deep sea port

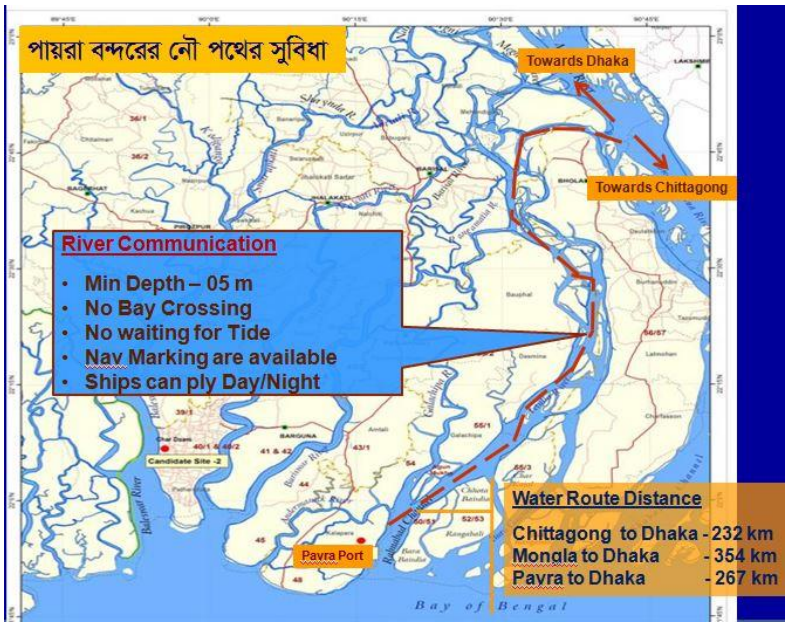


Whether at Sonadia or Matarbari, a regional Deep Sea Port at Matarbari in the vicinity of Cox's Bazar is looking less likely given the government has opted for a new port at Payra.

Payra Sea Port Act 2013 set up the Payra Port Authority to develop a port in Patuakhali District on the Rabnabad channel. In the short term, cargoes will be off-loaded onto lighters from ships

at anchor and be transported to the hinterland through river routes— such as the little-used Pangaon ICD designed for water access and which opened in November 2013.

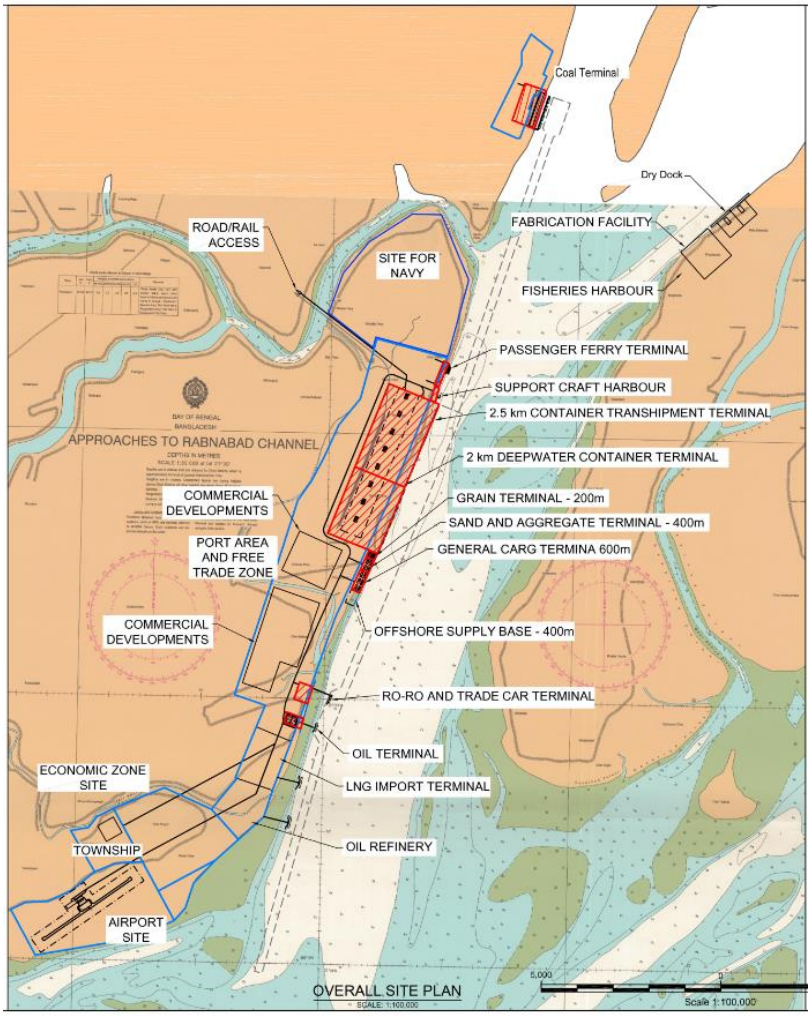
Figure 5-2: Location plan for Payra Port



By 2018 a multipurpose berth and a bulk terminal are planned for vessels up to 12m draft. By 2023 the port is to be fully operational with a 16m channel and a container terminal. An exclusive economic zone (EEZ), airport, port city, dockyard/shipyard and eco-tourism are also planned. The proposal is highly ambitious and very costly. The Authority aspires to become an "economic gateway to South Asia".

If Payra were to develop 4.5km of quayside for containers, as shown on the plan, there would be no need for the Matarbari Deep Sea Port. Whilst Payra has a head start, the costs of development and maintenance dredging are high, so it is still conceivable that Matarbari could overtake Payra as a regional port. It is also conceivable that Chittagong will continue for some years to increase its capacity; this increased capacity could dampen shipping lines' interest in other ports.

Figure 5-3: Payra Port proposed layout



5.2 Freight Market

5.2.1 Current Position

The past traffic trend of BR reveals the following:

- The total traffic of BR is 2.55 million tonnes that traverses on average 272 km resulting in traffic of 694 million TKM in 2014-15.
- 96% of BR traffic consists of 11 major commodities, including containers.
- In 2014-15, liquid bulk constituted 39% of the total BR traffic; dry bulk accounted for 36%; containers 23%; and the remaining 2% was break-bulk freight.
- BR has been witnessing decline in traffic consistently over the last few decades except for 2013-14. This year is remarkable as the annual growth rate was over 25% in tonnage terms and 29% in TKM terms between 2012-13 and 2013-14. This was primarily due to capacity expansion carried out in some of the sections between Dhaka and Chittagong.

BR transported a long list of commodities in 1969-70; in all, 4.8 million tonnes were carried. This traffic dwindled to 2.5 million tonnes in 2013-14; thus the railway witnessed a negative growth rate of (-) 1.5% per annum in the last 44 years.

During the 1970s

BR transported 4.8 million tonnes of freight in 1969-70. There was an array of commodities which constituted the traffic composition - this array even included fruits and vegetables. 19 commodities accounted for 96% of the total freight traffic. The All Other Commodities[9] classification contributed to the highest tonnage of 705 thousand tonnes followed by Raw Jute (654 thousand tonne). Jute Manufactured accounted the lowest tonnage with 46,000 tonnes. The commodity composition reflected the agrarian and subsistence nature of the country's economy at that time.

During the 1980s

BR transported 3.1 million tonnes of cargo in 1979-80 – a decline from the 4.8 million tonnes carried in 1969-70. This represents a negative growth rate of (-)4.2% per annum; 18 commodities contributed to 96% of BR freight tonnage. Wheat contributed to the largest quantity of BR transport (626 thousand tonnes) and Jute Manufactured continued to be the lowest quantity with 36,000 tonnes; Jute Raw, which held 2nd spot in 1969-70 declined to hold 4th spot in 1989-90. Cargoes disappearing from the 96% basket included Rams and Pulses, Wood Unwrought, Provisions and Fruits & Vegetables. Fertilizer had become a major tonnage source for BR during the period.

During the 1990s

The freight traffic further dwindled to 2.4 million tonnes, but the rate of decline came down from 4.2% per annum to 2.6 percent per annum between 1979-80 and 1989-90. Wheat continued to hold the top position, but declined from 626,000 tonnes in 1979-80 to 471,000 tonnes in 1989-90. Also Raw Jute had declined further and occupied seventh spot, down from the fourth spot. Rice became the commodity of lowest quantity of BR traffic. Commodities that vanished from the 96% basket included jute manufactured, Sugar and Kerosene Oil. Commodities that re-emerged included Wood Unwrought and Military Traffic.

During the 2000s

Freight traffic increased from 2.4 million tonnes in 1979-80 to 2.9 million tonnes in 1999-2000, thus registering an annual average compound growth rate (AACGR) of 1.8%. For the first time since 1969-70, freight traffic showed a positive growth. Cement was the largest quantity (639,000 tonnes) transported by BR in 1999-2000 and Sugarcane was the lowest quantity (37,000 tonnes). Coal disappeared from the "96%-basket" but containers entered the list of BR freight.

During the 2010s

BR freight traffic suffered a decline during this period also. The total freight traffic marginally declined at (-) 0.7% p.a. on a compound basis and the traffic transported was 2.7 million tonnes in 2009-10. Wood and Paddy were lost but Sugar came in to the "96% basket". The single highest

[9] Specific BR commodity classifications are shown capitalized.

tonnage carried was container traffic (540 thousand tonnes) and the lowest was Petrol (48,000 tonnes). In total 11 commodities contributed to 96% of the total freight traffic.

During Recent Years

The traffic decline continued in the recent past also. 2.55 million tonnes of freight were carried in 2014-15. However, container traffic between Dhaka and Chittagong port experienced a marginal increase from 540,000 tonnes in 2009-10 to 584,000 tonnes in 2014-15 and containers continue to hold the top position in the basket. However, Coal has vanished, but Petrol continues to be the lowest quantity (38,000 tonnes) transported. 11 commodities constituted 96% of total freight traffic.

There are two important aspects that emerged out of BR market dynamics:

1. BR should focus only on bulk commodities and containers.
2. BR capacity expansion in 2013-14 has resulted in higher market capture indicating clearly that BR traffic potential and market capture is "supply driven" rather than demand driven.

Conclusion

The commodity dynamic analysis, as presented in the foregoing sections, establishes that BR has lost a number of commodities that were of insignificant volume (less than 5000 tonnes per annum). It is likely that these commodities have shifted to road transport gradually over time, resulting in a negative growth rate of (-) 1.5% per annum during the last 44 years.

The foregoing discussion clearly reveals that:

- BR freight traffic has been declining since 1969-70, with a deep fall until 1975, slight fluctuations during 1975-1995, and an increasing trend during 1995-2005 but dwindling growth between 2005-2013.
- BR has the ability to attract traffic as demonstrated during 2013-14.
- BR, which once transported a variety of goods, has now become a "bulk" transporter.

5.2.2 Future Prospects

The traffic forecast undertaken for the Master Plan adopts "Market-Capture" in scenarios to provide the range of "Potential" traffic. Furthermore, bulk commodities are the major commodities that could potentially make BR a viable operating State enterprise. In line with these possibilities, it is recommended that BR market to specific major users with specific service offers that enhance quality of service in terms of wagon availability, reliable schedule and pre-determined delivery time. BR could also consider entering into service contract agreements so that the Railway could make investments with guaranteed traffic. This will, on the one hand, minimize investment risks and on the other, guarantee efficient service delivery to the major users.

The above calls for change in business principle of BR from a Public Utility Oriented State Enterprise to a Commercial-Oriented Transport Service Provider, at least for the freight market and specifically for the following identified commodities:

Liquid Bulk:

- DFO
- Kerosene
- Petrol

Dry Bulk:

- Wheat
- Rice
- Fertilizer

Other Commodities to Watch:

- Coal
- Automobiles (Imported)

5.2.3 Freight Strategy

Specific measures recommended for realizing cargo potential of BR are:

1. Prepare a Market Outreach Programme.
2. Strengthen the Marketing Department with required Business Management Skill-sets.
3. Revamp the IT Department into a Business Intelligence Department.
4. Explore Joint-Venture opportunities to provide door-to-door services with major users (For instance: distribution of fertilizers that may involve setting up of Intermodal IWT/Railway Terminals, modern warehousing and over-land transport to distribution points).
5. Study the feasibility of a new railway operating company/companies with major users such as oil and coal shippers on stand-alone basis.
6. Trans Asian Railway connectivity through Bangladesh for transit traffic of India and Myanmar should be encouraged.
7. To enhance revenue earning potential of BR, Bangladesh should enter into bilateral agreements with India for developing transit corridors to cater to India-Bangladesh-India (north-eastern states of India) traffic. A similar approach is recommended for Myanmar.

At a regional level, the BIMSTEC forum and SASEC could be a platform to further advance this proposition.

Freight Strategy: BR should eventually transform from a "Public-Utility Company" to become not only a dedicated bulk commodities Transporting Company but also to be a "Multi-Modal Logistic Service Provider" on a commercial basis for the bulk commodities market, with a market inclusive approach to enfold the major users as stakeholders in the operation.

BR should evolve the contemplated Market Outreach Programme in close cooperation with major users as the distribution pattern of commodities (especially POL) is a dynamic one and unknown in the long term – industry consultation would be key to a sustainable service. Therefore, it should be 5-yearly based, but an annual rolling plan should also be given importance. This effort calls for a dedicated unit/department for marketing of BR services. The marketing unit/department should be staffed with professionals with business development skill-sets. They should be working in close coordination with the operations and finance departments in order to ensure that the transport efficiency of BR meets the standards of contract service agreements. They should also ensure that investment decisions are implemented on time to cater to traffic growth. Finally, the market outreach programme should be an important input into the BR Business Plan.

5.3 The Container Company of Bangladesh Limited

5.3.1 GoB Initiative

A "Container Service Company" was approved by the GoB on 28 March 2016 with a share capital of BDT 400 crore and a paid-up-capital of BDT 4 million. The Container Company of Bangladesh Limited (CCBL) will be managed by a Board with a Chairman, Dy. Chairman, Managing Director and 7 Directors. It will be a 100% subsidiary of BR and established with the sole motive to run on commercial basis. The company is planning to increase revenue from BDT 3 crore in 2016 to BDT 240 crore by 2026. The market capture is also planned to be increased from 5% in 2016 to 30% in another few years.

5.3.2 Container Market Assessment

The Master Plan supports setting up of CCBL and considers it as a step in the right direction towards making CCBL a viable entity and contributing dividends to the Government. The container market potential assessment carried out for the preparation of this Master Plan demonstrates a wide range of possibilities:

- Scenario-1: Conservative (5% market capture)
- Scenario-2: Realistic (15% market capture)
- Scenario-3: Optimistic Scenario (30% market capture)

The above estimate considers that GOB will price the port services competitively in such a way that the overall logistic efficiency will be maintained irrespective of the port choice. In other words, pricing of services will ensure that the time and cost savings that will accrue to shippers using new ports will at least be marginally more than any increase in direct costs (including terminal handling charges, railway haulage and ICD charges). Most importantly, BR will develop its ICDs not only in the hinterland but also at the port head so that there is adequate leverage to attract traffic to BR.

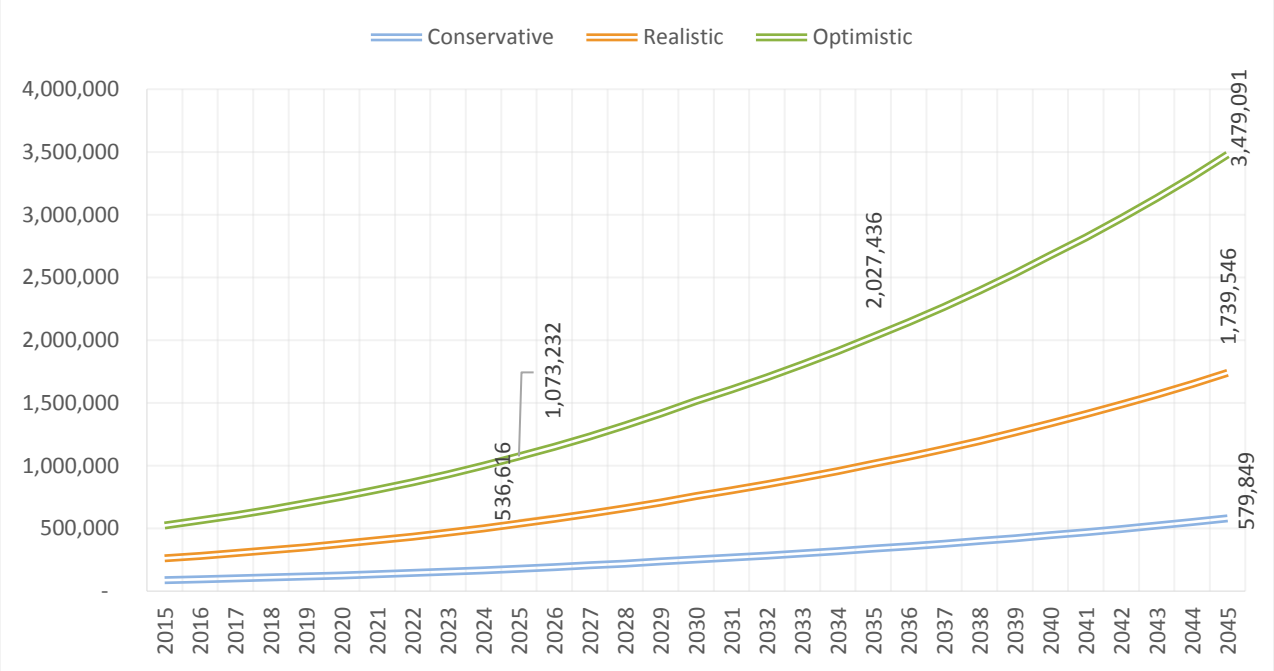
5.3.3 Future Prospects

Summarizing the forecast, BR container traffic will range from 87,000 TEU to 580,000 TEU under the conservative scenario, from 262,000 TEU to 1.7 million TEU under the Realistic scenario and the range goes up from 520,000 thousand TEU to 3.5 million TEU under the Optimistic scenario, between 2015 and 2045. A summary forecast of container traffic potential of BR is given in Table 5-1, and illustrated in Figure 5-4.

Table 5-1: Potential Container Traffic Forecasts of BR (TEUs)

	Conservative	Realistic	Optimistic
2015	87,188	261,565	523,130
2020	125,459	376,376	752,752
2025	178,872	536,616	1,073,232
2030	252,570	757,711	1,515,423
2035	337,906	1,013,718	2,027,436
2040	445,771	1,337,312	2,674,624
2045	579,849	1,739,546	3,479,091

Figure 5-4: BR Container Traffic Forecasts (TEUs)



5.3.4 Future Strategy

The forecast establishes that there is a vast container traffic potential for CCBL. To jump from the present level of a mere 65,000 TEU in 2015 to over 540,000 TEU by 2025 means only 15% market capture; with 30% market capture rail container traffic would be over one million TEU per year. This would likely require a dedicated freight line between the seaports and Inland Terminal.

Some specific measures that BR may wish to consider to enhance the market capture for container traffic include:

a) Enhance the track capacity between seaports and inland container depots.

b) Kamlapur ICD at Dhaka will not be able to handle future growth of this magnitude, but in the short run, BR could set up container freight stations and revamp the land use and internal circulation pattern of containers in such a way that the capacity could be increased to over 150,000 TEU per annum.

c) Dhirasram ICD should be developed in phases and counter rail-based Multi-Modal Terminal should be set up on a fast track basis at Chittagong Port Yard.

d) Railway container transportation and operations should be highly coordinated with container terminal operation and ship calls at the seaport terminals through advanced ICT.

e) Other potential inland ICD sites could be identified in line with the development of “Economic Zones” as proposed by the GoB.

f) Create a business plan for CCBL and particularly for the proposed Multi-Modal Terminal to explore the possibility of implementing it under PPP format.

5.3.5 Inland Container Depots

Container handling in Bangladesh lacks the facilities to make it efficient. The only inland container depots (ICDs) are at Kamlapur, contiguous with the main Dhaka railway station, and at Pangaon, on the Buriganga River, and linked to Chittagong by three small (120 TEU) containerships. Kamlapur serves a tiny fraction of container traffic. Pangaon was inaugurated at the end of 2013 and struggles to attract customers.

Most container cargo travels the road between Dhaka and Chittagong, which is congested by thousands of mainly two-axle trucks. The Dhaka city truck curfew from 6am to 10pm is another a serious constraint on goods movement, especially given the lack of a Dhaka bypass.

About 16 small privately-operated, off-dock container freight stations (CFSs) surround Chittagong to serve the port. Customs does not consider truck transport to be secure for movement of bonded goods, so nearly all international container traffic uses these CFSs.

Kamlapur ICD is distant from the main concentration of the woven garment industry around Tongi and the fast-developing areas to the north, around the Bangabandhu Bridge highway and

up to Mymensingh. Likewise it is far from the export processing zone (EPZ) at Savar, to the north of Dhaka. It is somewhat closer to the knitwear industry which has remained centred on Narayanganj, but Kamlapur ICD is in a crowded area of Dhaka and is subject to the truck curfew.

Proposed ICD at Dhirasram

A new ICD has long been proposed to at Dhirasram, north of Tongi and just south of Joydebpur where the line forks to Bangabandhu Bridge and Mymensingh and is not affected by the truck curfew. Kamlapur-Chittagong is 321km by rail but only 264km by road. The advantage to road transport disappears at Dhirasram, which is 297km from Chittagong by rail and 294km by road.

A feasibility study of Dhirasram ICD was completed in April 2007. The project's estimated economic internal rate of return is 22%pa and financial rate of return 14%pa. The estimated cost is as follows:

Table 5-2: Dhirasram ICD Cost Estimates

Item	BDT Crore (2007)	US$ million (2007)
ICD	294	43.3
Rail line (Pubail to ICD)	297	43.7
Chittagong improvements	58	8.6
Total	**650**	**95.6**

Dhirasram ICD was expected to handle about 100,000 TEUs in its first year. The concept paper envisaged an ultimate capacity of 500,000 TEU/y comprising 360,000 to/from Chittagong and 140,000 to/from the west, mainly India. The ICD feasibility study suggested an ultimate throughput, as follows:

Table 5-3: Dhirasram TEU Throughput

		20-foot	40-foot	TEUs	Dwell time, days
Import	50%	118,000	59,000	236,000	7
Export	40%	94,000	47,000	188,000	1
Empty	10%	24,000	12,000	48,000	15
All	100%	236,000	118,000	472,000	5.4

The Public Private Partnership Authority, which resides in the Prime Minister's Office, lists amongst its proposed projects "Construction of a New Inland Container Depot (ICD) near Dhirasram Railway Station" on 55ha of land and with 6km railway spur from the main line. It is categorised as a USD200-500 million project implemented in 2013-17 to handle 354,000 TEU annually.

South Dhaka ICD

Planned railway developments will necessitate an ICD with rail access to be built in the vicinity of Narayanganj, south of Dhaka. The Padma Bridge is under construction, the lower deck of which is designed to accommodate a single rail track. A construction project to build that track has been prepared. It would connect Dhaka to south-west Bangladesh and to Benapole on the border with India. Trains crossing Padma Bridge can connect to the rail track heading south from Kamlapur which currently terminates at Narayanganj.

The rationale for a rail line across the Padma River is vitally dependent on freight traffic. This means a South Dhaka ICD (with rail access, unlike Pangaon) is needed near Narayanganj. Justification of a rail line over the Padma relies on more than Dhaka freight. It needs freight generated by Chittagong port and the north-eastern states of India which will soon be connected to Bangladesh by a short section of line linking Akhaura Junction and Agatarla, in Tripura.

5.4 Passenger Traffic

5.4.1 Overview

One of the 'visions' for BR is to provide rail access to all corners of the country, including places currently lacking connectivity. Rail connectivity will be valued, however, only if the trunk rail network can satisfy the resulting demand. A fundamental priority, therefore, is to make the trunk network worth the cost of connecting to it.

Trunk rail services must be competitive with road services. Forty years ago, 30% of non-urban passenger trips were by rail. Railway trains scooted over rivers on bridges whereas road vehicles had to queue for ferries. Today roads have bridges, too, and the rail share of non-urban passenger trips is 3%. For rail to compete with road, rail's trunk network must be fast, efficient and capable of meeting demand. BR is mainly a passenger railway, so we may think of this in terms of passengers.

Demand is a multifaceted concept. Basically it is the number of passengers who wish to take the train. Does this include passengers who ride for free, such as on the roof? That question introduces the impediment of price, which has two facets: absolute fare level dictates whether travel is affordable, and takes place; relative fare level determines whether travel takes place by rail or by road. The notion of price can be broadened to mean cost. Even ignoring roof riders, second class carriages often carry twice the number of passengers as seats. The discomfort of crowding, perhaps standing for the whole journey, is a cost in addition to the fare. A further complexity is cost recovery. BR currently recovers only half of its operating costs (and none of its capital costs). Fares depend on the level of cost recovery mandated by the government.

These factors modulate an objective such as 'double passenger services'. No matter how such an objective is expressed, expansion of passenger services depends on the government's appetite for expanding the rolling stock fleet[10] and the absorptive ability of the railway to put the rolling stock into service and maintain an enlarged fleet.

5.4.2 Demand for Passenger Travel

National passenger travel demand is related to population and economic activity. Population growth results in more people travelling. Higher incomes per person result in more travel per person. It follows that total travel is related to Number of People × Income per Person— which is national income, represented by GDP.

Travel also depends on the elasticity of travel demand with respect to GDP (i.e. the rate of change of quantity of transport services demanded with respect to rate of change in GDP). This

[10] BR does not fund capital purchases, which are paid for by the government.

varies between passengers and freight, between transport modes and between countries. A Bangladesh report entitled Guidelines for Development and Approval of Transport Master Plans, Programs and Projects c.2007 (see page 35) used 1.46 and 1.22 as transport elasticities with respect to GDP for passengers and freight respectively. The World Bank data base shows recent GDP growth (constant prices) to be 6.2% over the last decade. Coupled with elasticities of 1.46 and 1.22 this suggests that Bangladesh passenger-kilometres are currently increasing at 9%pa and freight-kilometres at 7.6% pa.

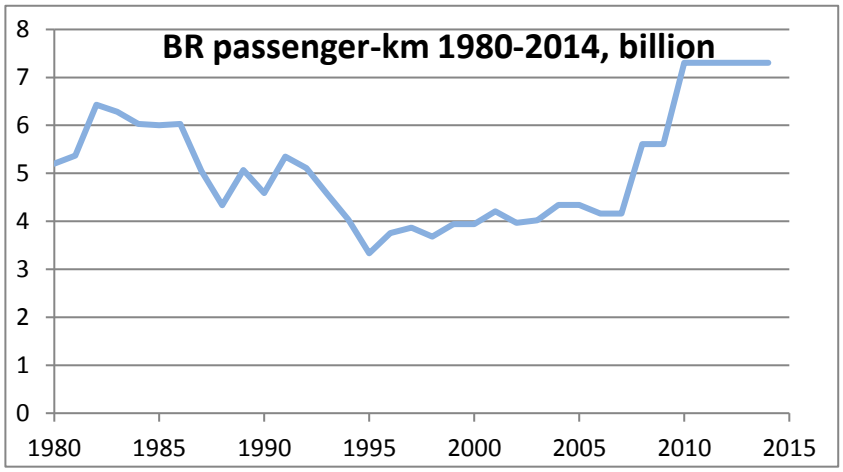
The reasons for rapid economic growth are well known. The ready-made garment (RMG) industry is booming and remittances from workers working abroad is the other mainstay of the economy. What is less well known is the demographic change taking place in Bangladesh.

Population growth has been falling steadily. The rate of growth now stands at 1.2% pa which is less than half what it was 20 years ago. This is due to a marked drop in fertility which has fallen from 6.4 births per woman to the population replacement rate of 2.1. Even so, population will continue to rise for many years. A population bulge caused by high birth rates in earlier years will take decades to pass through the system.

5.4.3 Rail's Market Share

The report Guidelines for Development and Approval of Transport Master Plans, Programs and Projects c.2007 (on page 35) shows that in 1975 the long-distance passenger market was 17 billion passenger-km. Rail share was 30%, or 5.1 billion passenger-km. By 2006 the market had grown more than ten-fold to 178 billion passenger-km of which rail's share had fallen more than ten-fold, to 2.8%. This implies that, since 1975, rail's passenger market (passenger-km) has remained roughly static. This was verified by accessing the World Bank data base (Figure 5-5).

Figure 5-5 Bangladesh Railway passenger-km, 1980-2014



Source: World Bank http://data.worldbank.org/indicator/IS.RRS.PASG.KM

As the figure shows, in 1995-2007 rail patronage was distinctly lower than in 1975. Over this period buses were progressively liberated from the congested ferry crossings on Bangladesh's major rivers. Despite a freeze on rail fares since 1992, BR could not compete with buses. On the busiest corridor of all, Dhaka-Chittagong, rail was further disadvantaged by the rail line being a third longer than the more direct road route which today is free of ferry bottlenecks.

Following the introduction of 100 new carriages in 2006 and 2007, BR's market share rose again then flattened out. It appears that rail's share of the passenger market is limited by train capacity— in other words train frequency and length.

This observation has a surprising repercussion. It is easy to think that rail's position in the passenger market has been maintained by low fares, which remained unchanged from 1992 to October 2012— but in real terms fell, due to inflation. The evidence suggests that rail's market share is determined by availability of rolling stock. Given more rolling stock, rail could have retained a higher market share.

BR's flagship services are Intercity Expresses of which Dhaka-Chittagong is pre-eminent. Mail Express trains stop at more stations and serve shorter journeys. The Mail Express used to provide a parcels service but this has ceased. Short-distance services are provided by local trains which are equipped with the oldest rolling stock. Train numbers are shown in Table 5-4.

Table 5-4: Trains run by gauge and zone 2014 ('000)

	BG	MG West	MG East	MG All
Intercity	9.1	3.8	19.3	23.1
Mail Express	6.2	6.3	18.8	25.0
Local	5.7	3.3	25.7	29.0
All	21.1	13.4	63.7	77.1

Source: BR Information Book 2014, Tables 33 & 36.

Average numbers of carriages per train are listed in Table 5-5. Intercity trains in East Zone are longer on average due to Dhaka-Chittagong services. There is plenty of scope to increase numbers of passengers merely by lengthening trains. Platforms already permit trains of 22 carriages or can be extended easily to accommodate them.

Table 5-5 Mean carriages per train, by gauge and zone 2014

	BG	MG West	MG East	MG All
Intercity	9.6	9.8	14.5	13.0
Mail Express	7.8	7.6	9.1	8.8
Local	6.1	6.3	5.8	6.0
All	8.7	8.2	10.5	9.9

Source: BR Information Book 2014, Tables 40 and 42.

Passenger statistics by train type and class are shown in Table 5-6. The percentages show that "below First Class" travel (i.e. Shovan and Second) accounts for 99% of passengers, 98% of passenger-kilometres and 95% of revenue.

Intercity expresses carry 42% of passengers, account for 78% of the passenger-kilometres and generate 85% of the revenue. Shovan passengers (98% of intercity passengers) average 240km journey length whilst the few passengers who travel AC and First Class average just over 300km.

Table 5-6 Passenger Traffic Statistics by Service and Zone, 2014

PASSENGERS		'000 Passengers			Passenger-km, Mn			Mean passenger journey, km		
		West	East	All	West	East	All	West	East	All
Intercity	AC	32	95	127	13	26	39	417	278	312
	First	70	440	510	24	131	155	347	297	304
	Shovan	9850	15827	25677	2303	3871	6174	234	245	240
	All	*9951*	*16362*	26313	*2340*	*4028*	*6368*	*235*	*246*	*242*
Mail Express	AC		10	10		2	2		222	222
	First		24	24		6	6		257	257
	Second	6657	21803	28460	476	968	1444	71	44	51
	All	*6657*	*19148*	*25805*	*476*	*977*	*1452*	*71*	*51*	*56*
Local	Second	3539	6862	10401	75	239	315	21	35	30
All		***20147***	***42372***	***62519***	***2891***	***5244***	***8135***	***143***	***124***	***130***

Source: BR Information Book 2014, Table 25.

NOTE: 250M passenger-km transferred from east to West Zone for Mail Express Second Class to equalise the revenue per passenger-km which otherwise would have been 0.72 in West Zone and 0.27 in East Zone (which cannot be true).

Table 5-7: Passengers Percentage by Class

Percentages of totals		Passengers, %			Passenger-km, %		
		West	East	All	West	East	All
Intercity	AC	0	0	0	0	0	0
	First	0	1	1	0	2	2
	Shovan	16	25	41	28	48	76
	All	*16*	*26*	42	*29*	*50*	*78*
Mail Express	AC		0	0		0	0
	First		0	0		0	0
	Second	11	35	46	6	12	18
	All	*11*	*31*	*41*	*6*	*12*	*18*
Local	Second	6	11	17	1	3	4
All		***32***	***68***	***100***	***36***	***64***	***100***

Table 5-8: Passenger Revenue by Class

REVENUES		Revenue, Million Taka			Mean fare, Taka			Revenue/pass-km, Taka		
		West	East	All	West	East	All	West	East	All
Intercity	AC	20	49	69	634	515	545	1.52	1.86	1.75
	First	25	122	146	351	276	286	1.01	0.93	0.94
	Shovan	1306	2643	3949	133	167	154	0.57	0.68	0.64
	All	*1351*	*2813*	*4164*	*136*	*172*	*158*	*0.58*	*0.70*	*0.65*
Mail Express	AC		6	6		610	610		2.74	2.74
	First		10	10		421	421		1.64	1.64
	Second	230	347	577	35	16	20	0.48	0.36	0.40
	All	*230*	*363*	*593*	*35*	*19*	*23*	*0.48*	*0.37*	*0.41*
Local	Second	54	73	126	15	11	12	0.71	0.30	0.40
All		***1635***	***3249***	***4883***	***81***	***77***	***78***	***0.57***	***0.62***	***0.60***

Source: BR Information Book 2014, Table 25.

Table 5-9: Passenger Revenue Percentage by Class

Percentages of totals		Revenue, %		
		West	East	All
Intercity	**AC**	0	1	1
	First	1	2	3
	Shovan	27	54	81
	All	*28*	*58*	*85*
Mail Express	**AC**		0	0
	First		0	0
	Second	5	7	12
	All	*5*	*7*	*12*
Local	**Second**	1	1	3
All		***33***	***67***	***100***

Average revenue, shown in Table 5-8, was 0.60 Taka/passenger-km in 2014, reflecting the dominance of "below First Class" travel. In 2011 (before the 2012 fare rise) it was 0.40 Taka/passenger-km.

Commuter services were introduced recently using new diesel-electric multiple units (DEMUs) operating on a number of shorter routes.

Since 2006, BR has issued concessions to the private sector for the business side of some local and mail express services. So far 24 services have been concessioned. BR operates the trains for a fee and the private sector concessionaire markets the services and retains the revenues. BR statistics do not include these passengers. Thus in recent years, true passenger numbers are a little higher than shown in Figure 5-6.

Figure 5-6 Passengers Carried by BR

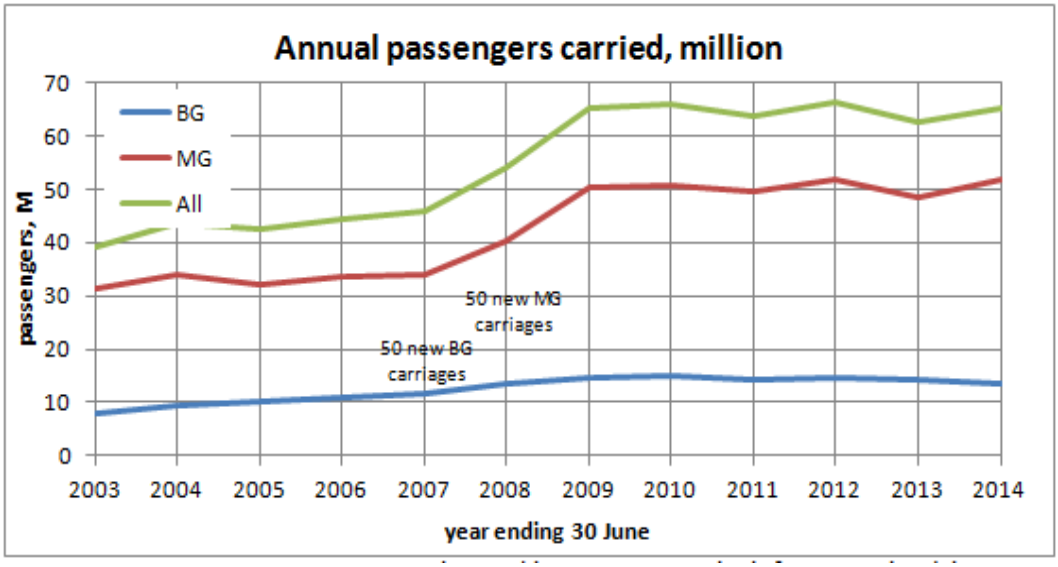
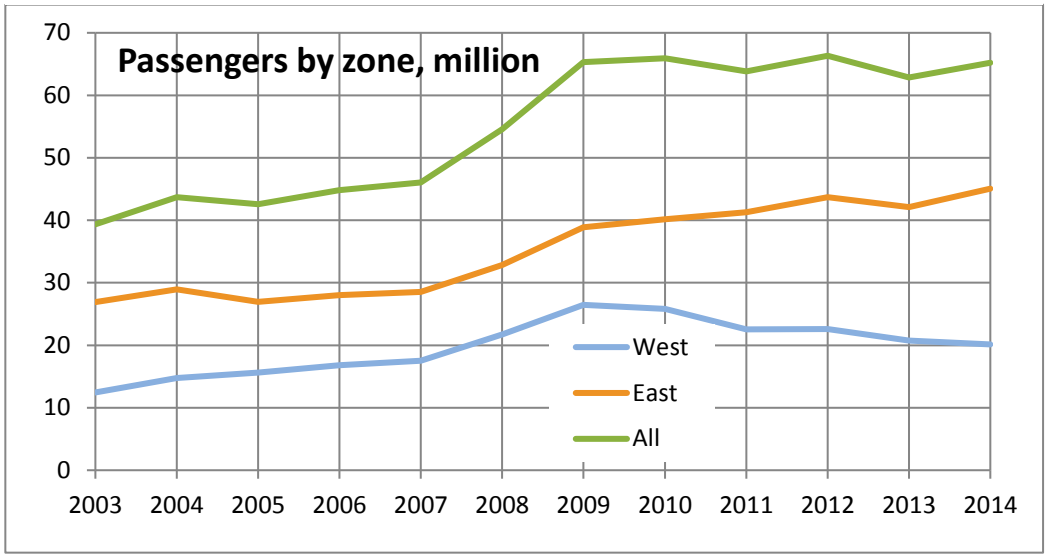


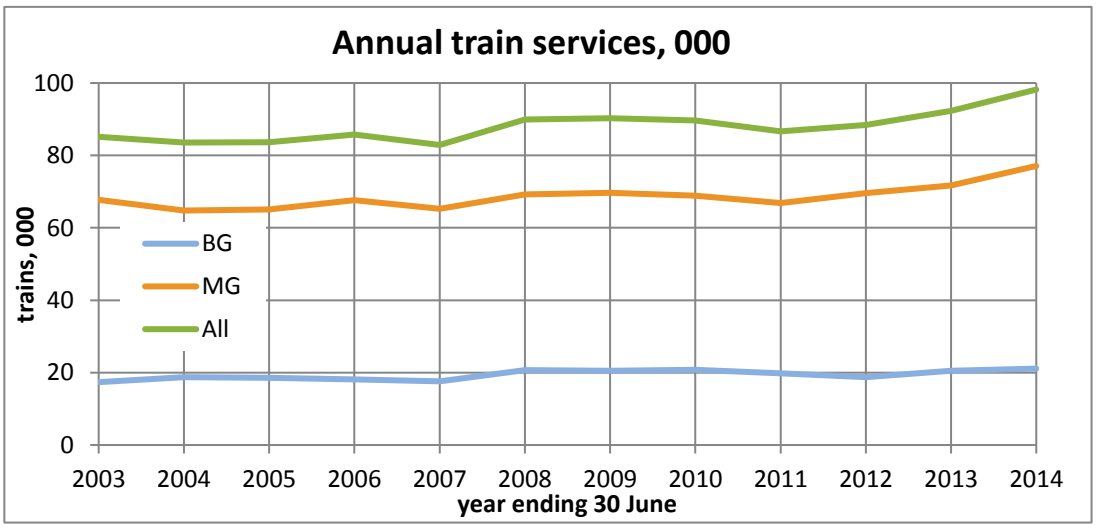
Figure 5-7: BR Passengers by Zone



Source: Bangladesh Railway Information Books, Table 19

Growth in passengers has not been matched by growth in train services (Figure 5-8), which are static.

Figure 5-8 Number of Passenger Train Services Operated 2014



Source: BR Information Book 2014, Tables 33 and 34.

The lack of growth in train numbers partly reflects a lack of rolling stock (motive power and carriages, of which there are 312 BG and 1164 MG). In the last decade, 6 carriages (MG) were scrapped and 50 new BG and 50 new MG carriages introduced, in 2006 and 2007 respectively (years ending 30 June), and 15 MG Diesel-electric multiple units (DEMUs) in 2014. The new carriages resulted in slightly longer trains. More passengers making longer trips is reflected in train load factors (Table 5-10). If roof travellers were counted, load factors would be higher still.

Table 5-10 Load Factors of Intercity trains (%)

Class	BG	MG, West Zone	MG, East Zone	Total system
AC	23	7	75	42
First	30	28	87	66
Shovan	89	68	**184**	128
All	86	66	176	124

Source: BR Information Book 2014, Table 26.

5.4.4 Opportunities for BR

Despite its extensive network, the railway serves a tiny fraction of Bangladesh's passenger transport demand. For at least three decades, increases in passenger demand have been met by buses. Roads and road transport services are everywhere.

Dig a drain in a bog and it fills with water. Dig a drain deeper and it fills with more water. Rail passenger services in Bangladesh are analogous. If BR operates a new train, it fills it with passengers. If BR operates a longer train, it fills with more passengers. The pent up demand for more rail services is demonstrated by the high, indeed extreme, carriage occupancies, particularly in East Zone. Further verification is afforded by looking back a decade or more. Figure 5-6 shows that the only significant increase in BR's passengers followed an injection of new carriages.

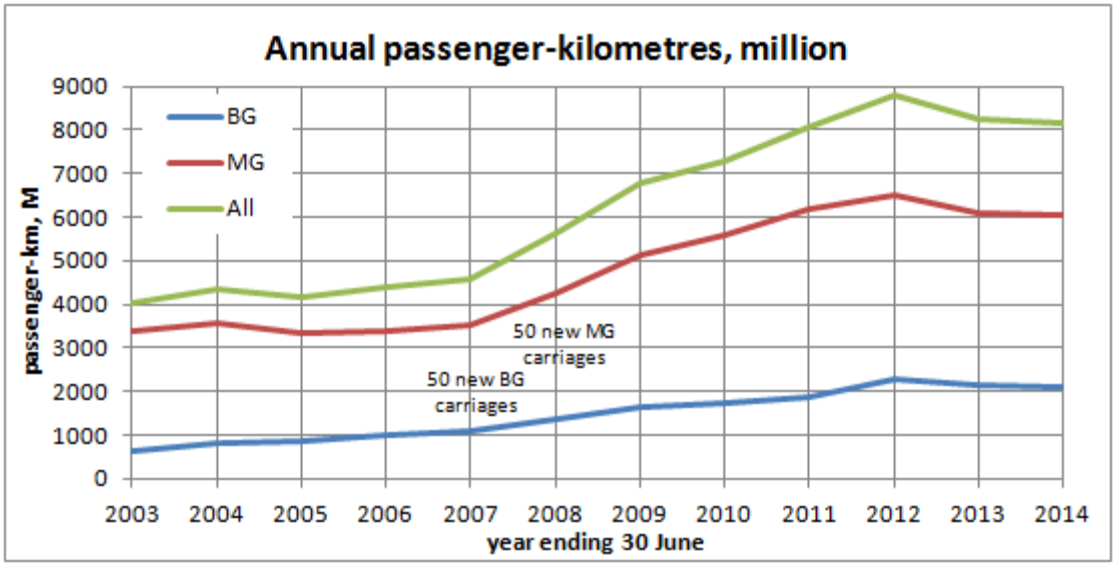
It follows that rail's share of the passenger market is limited by train capacity— in other words train frequency and length. This makes future passenger traffic dependent firstly on government funding of rolling stock purchases and secondly on BR's absorptive capacity to put new rolling stock into service, and maintain it. In developing the master plan it would be reasonable to consider a policy of expanding the rolling stock fleet at, say, 5%pa (compounding). Initially new rolling stock would be used to lengthen trains to 22 carriages. Once that is achieved, new rolling stock would enter service as new 22-carriage train sets in corridors that have high carriage occupancies.

This approach implies an emphasis in the early years on purchase of rolling stock rather than a rights-of-way investment to increase numbers of slots available. In time, corridor investment will focus initially on strategic projects such as dual-gauging Dhaka-Chittagong and the chord line.

5.4.5 Other Relevant Information

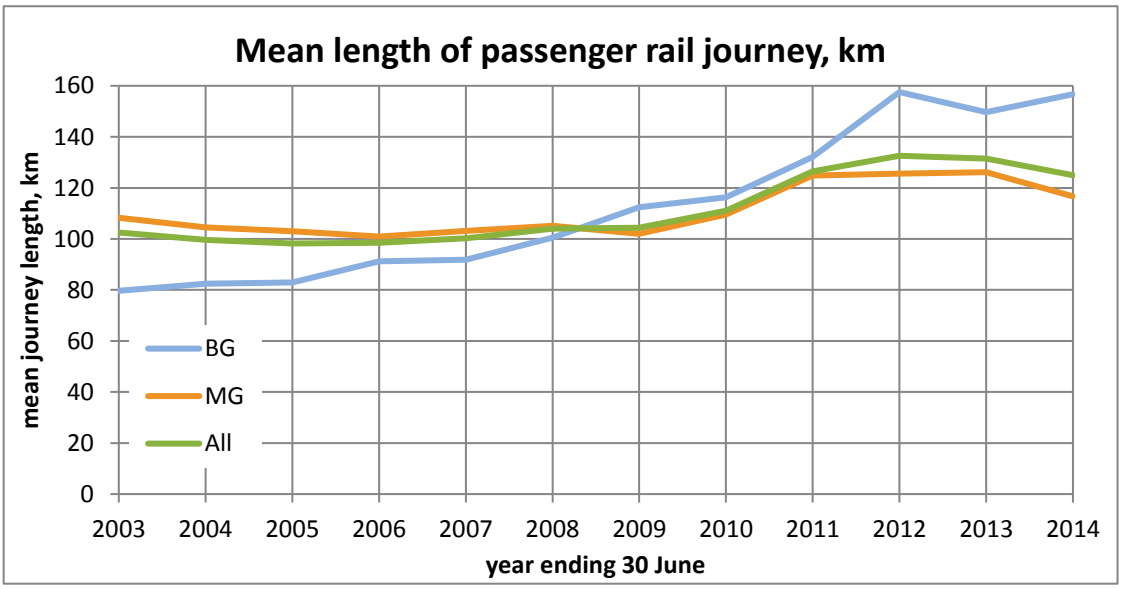
The following graphs are prepared from the data above and other data extracted from BR Information Books.

Figure 5-9 Annual passenger-kilometres, 2014



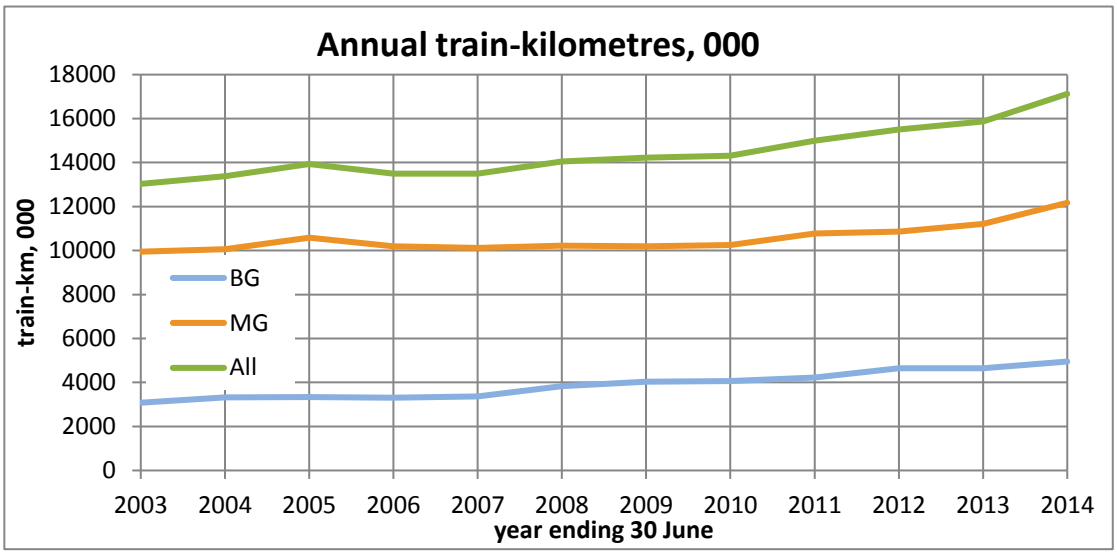
Source: BR Information Book 2014, Table 19

Figure 5-10 Mean length of a passenger rail journey 2014



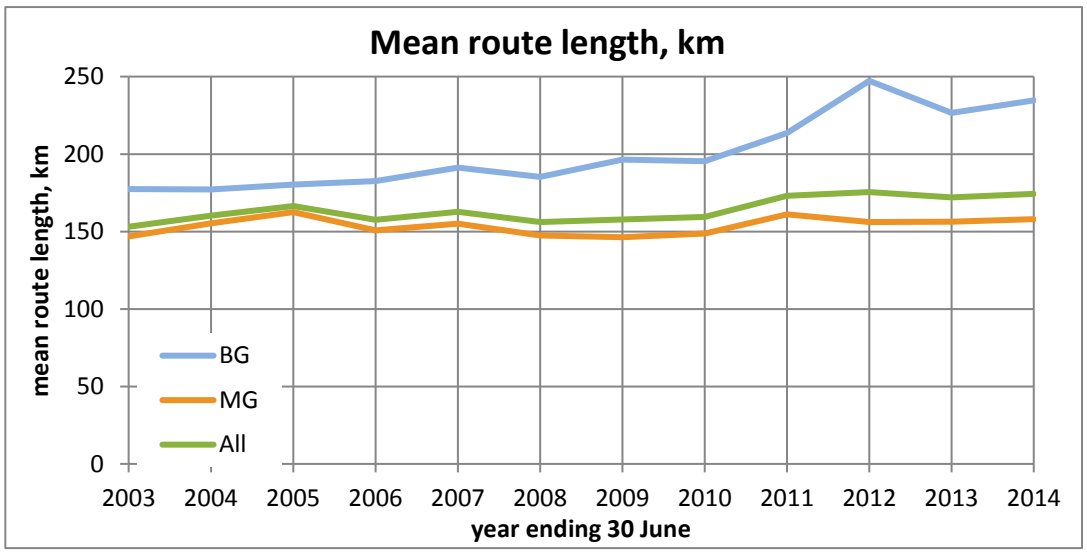
Source: BR Information Book 2014, Table 19

Figure 5-11 Annual train-kilometres, 2014



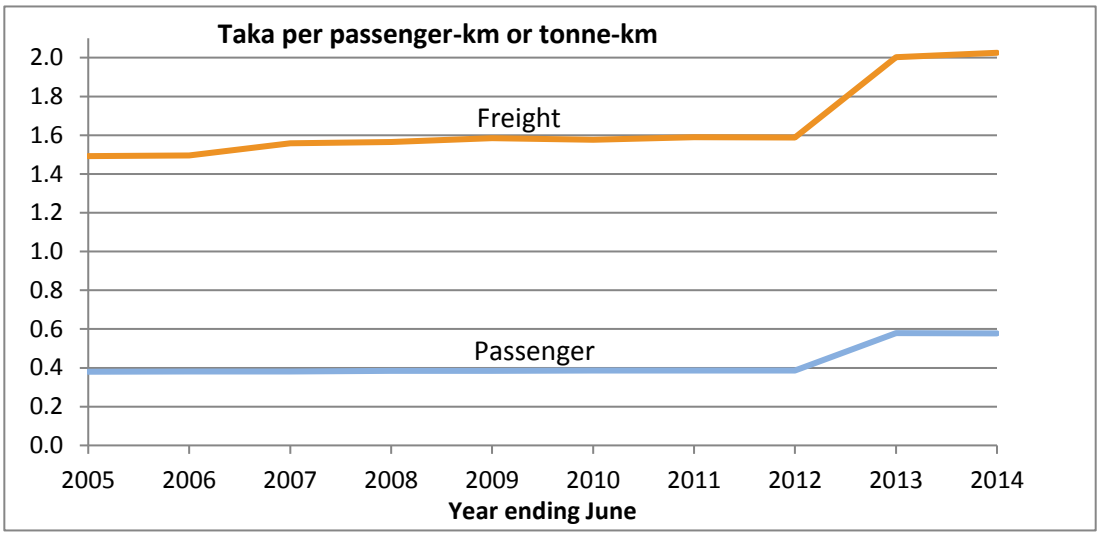
Source: BR Information Book 2014, Tables 33 and 34

Figure 5-12 Mean route length operated by passenger trains 2014



Source: BR Information Book 2014, Tables 33 and 34

Figure 5-13 Mean revenue per passenger-km and per tonne-km 2014



Source: BR Information Book 2014, Table 64

5.5 Commuter Rail

Looking globally, urban passenger transport displays wide variations. Services may be provided by bus, bus or rail rapid transit, heavy rail, light rail, monorail, tram, ferry and more. Ownership, operation and management is highly varied. Advanced systems use integrated ticketing; one ticket serves an entire journey, including transfers within or between modes.

Operators of urban passenger systems are commonly purpose-built entities, such as Urban Transit Authorities. Thus, urban operations are usually separate from long-distance services, but this is by no means a universal rule: Indian Railways operates urban services.

In Dhaka, passenger movement struggles at busy times (which is much of the day) having to cope with a mix of cycle- and auto-rickshaws, buses, cars, etc. This struggle is eased by flyovers[11] in the most seriously congested parts of the network. A revolution in public transport is underway, with a Bus Rapid Transit (BRT) corridor designed from Gazipur to the eastern side of the airport and a 20km elevated Mass Rapid Transit (MRT) rail line running north from Motijheel to Uttara, known as MRT Line-6. Scheduled to open in 2020, Line 6 has 16 stations and is projected to carry 510,000 passengers daily.

BR has taken delivery of diesel-electric multiple units (DEMUs) from China (20) and India (5). At first they were proposed for urban services, which accounts for the absence of toilets, but floor levels above platform height impede rapid boarding/alighting which is essential for urban use. The DEMUs are being deployed on local train services, namely: Chittagong-Comilla, Comilla-Dhaka, Comilla-Noakhali, Comilla-Laksam, Laksam-Chandpur, Chandpur-Comilla, Comilla-Akhaura, Akhaura-Sylhet, Dhaka-Joydebpur, Joydebpur-Mymensing, Dhaka-Narayanganj, Dhaka-Akhaura, Lalmonirhat-Parbatipur and Parbatipur-Thakurgaon.

[11] Note that overpasses prevent the railway from being elevated.

Local train services such as these fall squarely within BR's ambit. DEMUs, passenger trains and freight trains share the same track. BR decides what trains to run to make best use of track capacity.

Urban commuter services are entirely different. Planning transport services for the Dhaka urban area falls under the Dhaka Transport Coordination Authority (DTCA) established in 2012 as successor to the Dhaka Transport Coordination Authority Board (DTCB) established in 2001. The Metro Rail Act 2015 gives DTCA the lead role in licensing construction, development and operation of metro services, including public-private partnerships (PPPs).

In June 2013, Dhaka Mass Transit Company Limited (DMTC) was created[12] as the administrative body implementing the MRT projects. Initially, DMTC is serving as the Project Implementation Unit for MRT rail projects. It is currently implementing MRT Line-6.

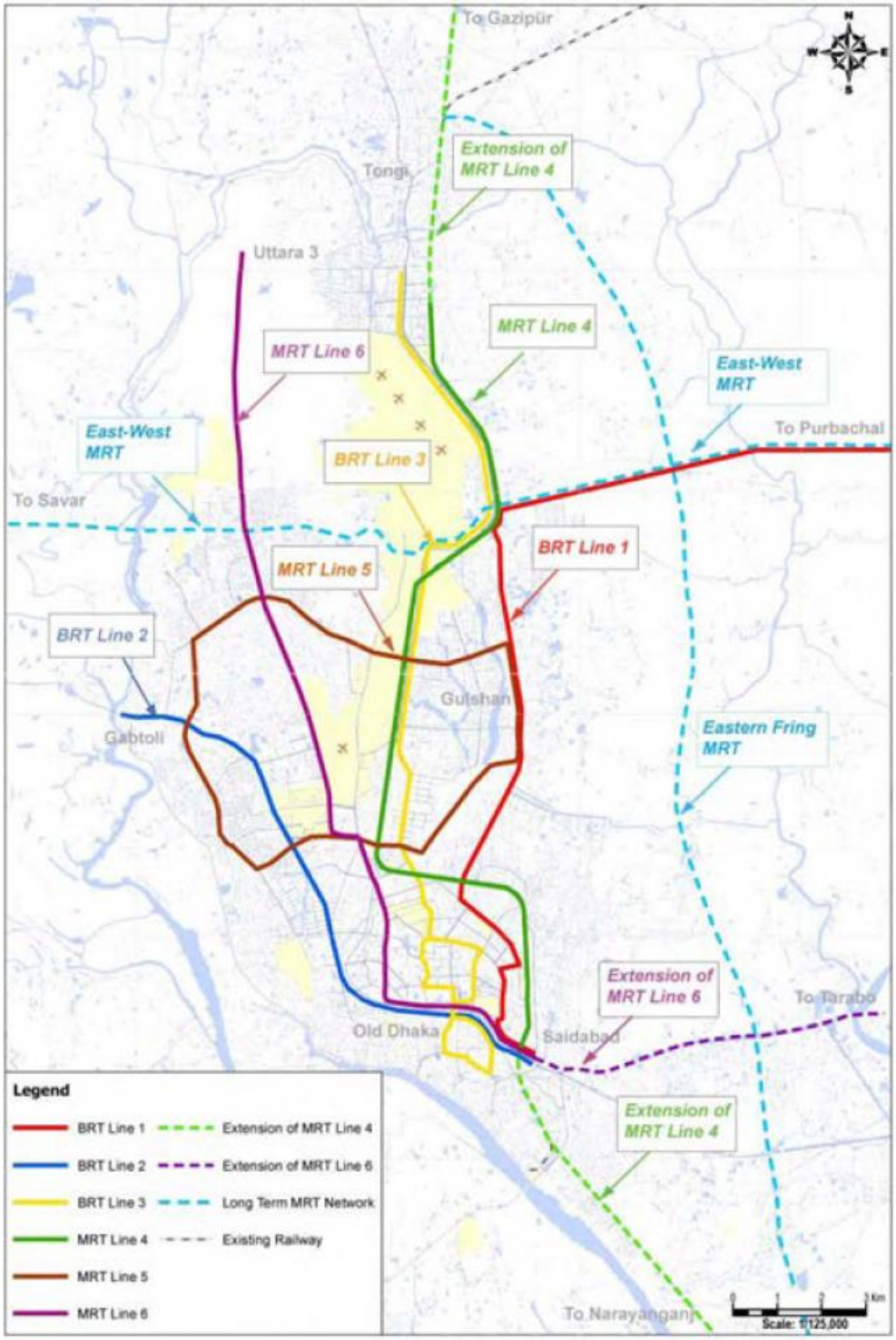
The current urban transport plan originated from a study commissioned by DTCB with assistance from JICA. Dhaka Urban Transport Network Development Study 2010 (known as DHUTS) followed four key policies for public transport development:

- a mass transit system based on hierarchy of transport systems
- integrated public transport
- public transport for low income people
- public transport that promotes urban development

DHUTS prepared a blueprint for urban transport network development showing 8 MRT lines to be constructed by 2050 and 3 BRTs. See Figure 5-14. MRT Line 6 was deemed most urgent.

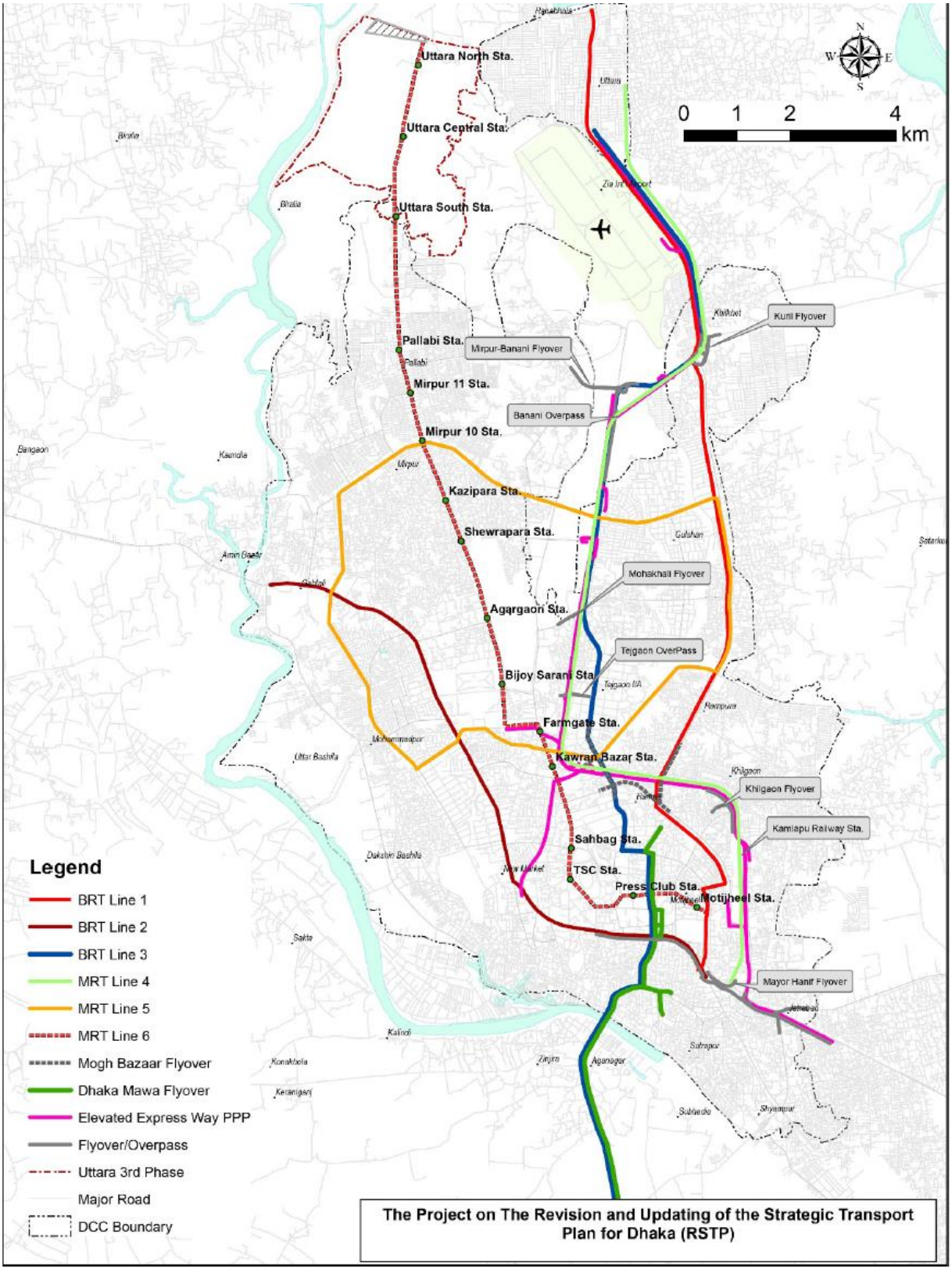
[12] Constituted 21 Jan 2013 by Home Cabinet order with a capital of BDT 10,000 crore. The Road Division of the Ministry of Road Transport and Bridges owns 98.8 per cent of shares and the balance is owned equally by the Dhaka Transport Coordination Authority, the Prime Minister's Office, and Finance, Rail, Home and Local Government ministries.

Figure 5-14: The DHUTS Urban Transport Development Plan



In 2015 DTCB updated DHUTS, assisted by JICA. The Project on the Revision and Updating of the Strategic Transport Plan for Dhaka 2015 augmented and expanded DHUTS. See Figure 5-15.

Figure 5-15: The 2015 Urban Transport Development Plan



Northwards from Kamlapur, MRT Line-4 follows the BR rail right-of-way to beyond the airport. This corridor was double-tracked a decade ago. Adding two more DG tracks is going to cost BDT 1107 crore.

The existing two tracks may be sufficient for many years, however. Train speeds through the urban area can be raised because overbridges are replacing level crossings and efforts can (and should) be made to keep trespassers off the tracks. Also, since freight will be intercepted at ICDs north and south of Dhaka, there will be fewer trains in the urban area.

It is worth exploring whether tracks 3 and 4 could be dedicated to the MRT, with more stations at a suitable platform height.

Southwards from Kamlapur, the MG track to Narayanganj is to gain a second track, which will be DG, at a cost of BDT 379 crore.

DTCA and BR have yet to confer on urban transport projects and services. There may or may not be common interests offering opportunities for collaboration. To date, BR and DTCA have not communicated. It is time to explore such prospects before it is too late.

5.6 Electric Traction

A railway electric traction system supplies electric power to railway locomotive and electric multiple units (EMU); thus trains do not require an on-board fuel source. Electric railways are widespread throughout the world and there are many different varieties but all are based on either direct current or alternating current supplies. Electric traction is used extensively on higher density railways - particularly in Europe and Japan. In North America, its use is largely limited to urban light rail systems and regional passenger railways. Electric traction is not used at all on North American freight railways. The Indian Railways' network is slightly more than 40% electrified and there is a major push to electrify existing lines. The proposed dedicated freight corridors of India will be electrified.

Electric traction has the potential to provide lower energy costs and emissions. However, a stable cost-effective electrical supply is required. Implementation of an electric traction system requires a significant investment in infrastructure and systems for the transmission and distribution of electricity (as well as electric-powered locomotives). As such, high levels of traffic are required to justify the investment.

5.6.1 Fuel Consumption Rates

Table 5-11 displays the diesel consumption (litres per 1000 GTKMs) for typical diesel-electric locomotives in predominantly passenger and predominantly freight service. Also displayed in the figure are the electricity utilization (KWH per 1000 GTKMs) rates for both service types with electric traction locomotives. As expected, diesel-electric and electric traction locomotives are more efficient in freight services on account of the heavier train weights.

Table 5-11: Consumption of diesel/ electricity per 1000 GTKMs (BG) in Passenger and Freight Operations

	Diesel (Litres)	Electricity (KWH)
Mainly passenger traffic	5.29	19.93
Mainly freight traffic	3.18	8.82

5.6.2 Cost Differentials between Diesel and Electric Operation

For this analysis, a diesel cost of 63.55 BDT/liter [13]and electricity cost of 10.48 BDT/KWh was used. [14]

Table 5-12 and Table 5-13 present the range of unit cost differentials (BDT/1000 GTKM) between electric traction versus diesel-electric operation under a range of electricity and diesel prices close to current levels for predominantly passenger and freight operations

Table 5-12: Cost Differential ($ / 1000 GTKM) Electric Traction Versus Diesel-Electric – Mainly Passenger Service

		Electricity - BDT per KWH		
		10	10.5	11
Diesel - BDT per litre	75	197.45	187.49	177.52
	65	144.55	134.59	124.62
	55	91.65	81.69	71.72

Table 5-13: Cost Differential ($ / 1000 GTKM) Electric Traction Versus Diesel-Electric – Mainly Freight Service

		Electricity - BDT per KWH		
		10	10.5	11
Diesel - BDT per litre	75	150.30	145.89	141.48
	65	118.50	114.09	109.68
	55	86.70	82.29	77.88

[13] http://www.globalpetrolprices.com/Bangladesh/diesel_prices/

[14] http://www.reuters.com/article/bangladesh-power-price-idUSL3E7NM45Y20111222

As the figures are all positive, it is clear that is more economical to power trains by electricity than diesel in all scenarios based on the current rates for electricity in Bangladesh.

5.6.3 Traffic Levels Used for Analysis

For analyzing the viability of converting from diesel operation to electric traction, 2013-14 traffic levels on the two busiest track sections were used, as follows:

Section	Pass & mixed trains per day	Freight trains per day	Coaching vehicles per day	Wagons per day	Net tonnes per day
Feni-Laksam	32	6.75	824	346	4,685
Tejgaon-Tongi	76	4.79	1,884	282	4,192

In order to estimate traffic (in gross tonnes), a few key assumptions were made as follows:

Ave weight of coaching vehicle (tonnes)	20
Tare weight of freight wagon (tonnes)	12
Ratio: coaching vehicle per loco	13
Ratio: wagon to loco	25
Weight of loco (tonnes)	30
Operating days per year	365

Using these assumptions, traffic levels (in gross tonnes) were calculated as follows:

Section	Passenger Locos per Day	Freight Locos per Day	Passenger Gross Tonnes per Day	Freight Gross Tonnes per Day	Gross Passenger Tonnes per Year	Gross Freight Tonnes per Year	Gross Tonnes per Year
Feni-Laksam	64	14	16,574	9,252	6,049,510	3,377,053	9,426,563
Tejgaon-Tongi	145	11	37,855	7,914	13,817,075	2,888,756	16,705,831

Thus for the sake of analysis, 9.5 million gross tons were used for predominantly freight operations on the Feni-Laksam line; and 16.7 million gross tons for predominantly passenger operations of the Tejgaon-Tongi line.

5.6.4 Capital Cost of Installation

The capital cost of installing a system of electric traction includes infrastructure and systems; locomotives or electric multiple units; and possible modifications to signals and telecommunications installations and track configurations. For the analysis, only the cost of infrastructure and systems was considered as locomotives and DMUs would need to be procured regardless of electric or diesel operation and the cost of S&T and track modifications are relatively low. In addition, reliable sources of electricity are assumed to be available along the line. As such, the analysis includes only sub-stations, distribution systems (either overhead catenary or third rail), and the necessary systems for the reliable and safe transference of the electricity to the trains. It is estimated that the range

of these costs will be between 4000 to 6000 crore BDT per km. In addition to these costs, if the existing electricity supply is not stable and reasonably priced, a dedicated electricity generation facility may have to be considered.

5.6.5 Rates of Return

In the following figure, the estimate rate of return of return for investment in electric traction is presented as a function of traffic levels (in gross tonnes) and infrastructure and systems investment costs for predominantly passenger operations. It can be seen that on the Tejgaon-Tongi section where traffic is about 16.7 million, the rate of the return is in the range of 3.7% to 5.6%.

Table 5-14: Rate of return for investment in electric traction on predominanrly passenger lines

		Infrastructure Investment (BDT/KM)		
		40,000,000	50,000,000	60,000,000
Traffic (Gross tonnes)	1,000,000	0.3%	0.3%	0.2%
	5,000,000	1.7%	1.3%	1.1%
	10,000,000	3.4%	2.7%	2.2%
	16,500,000	5.6%	4.4%	3.7%
	20,000,000	6.7%	5.4%	4.5%
	25,000,000	8.4%	6.7%	5.6%
	30,000,000	10.1%	8.1%	6.7%
	40,000,000	13.5%	10.8%	9.0%

In the following figure, the estimated rate of return of return for investment in electric traction is presented as a function of traffic levels (in gross ton-km) and infrastructure and systems investment costs for predominantly freight operations. It can be seen that on the Feni-Laksam section where traffic is about 9.5 million, the rate of the return is in the range of 1.8% to 2.7%.

Table 5-15: Rate of return for investment in electric traction on predominanrly freight lines

		Infrastructure Investment (BDT/KM)		
		40,000,000	50,000,000	60,000,000
Traffic (Gross Tons)	1,000,000	0.3%	0.2%	0.2%
	5,000,000	1.4%	1.1%	1.0%
	9,500,000	2.7%	2.2%	1.8%
	15,000,000	4.3%	3.4%	2.9%
	20,000,000	5.7%	4.6%	3.8%
	30,000,000	8.6%	6.8%	5.7%
	40,000,000	11.4%	9.1%	7.6%
	50,000,000	14.3%	11.4%	9.5%

As can be seen from the tables, investment in electric traction will become viable when annual traffic levels reach 40 million gross tons on predominantly passenger lines and 50 million gross tons on predominantly passenger lines. As traffic is not at these levels on

BR's busiest section, it is clear that it will be a few years before such investment is viable, and this will be on limited lines - largely those where there are a very high number of commuter and passenger trains such as on Dhaka – Tongi (or Bhairab Bazar) and Chittagong – Akhaura. Early viability may also be seen on lines with frequent commuter service where the other benefits of electrical (versus diesel) are recognized. It also important to note that the introduction of either overhead catenary or third rail system does not restrict entry of trains under diesel operation.

Detailed feasibility studies will be required prior to introduction of electric traction. To that end, several projects have been added to provide these feasibility studies once traffic levels indicate electric traction may be of benefit. They include:

Proj. No.	Project Name
172	Feasibility study and detail design for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Narayanganj–Dhaka–Joydebpur Section of Bangladesh Railway
173	Feasibility Study for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Tongi–Chittagong Section of Bangladesh Railway
174	Feasibility Study for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Joydebpur- Ishurdi- Khulna Section of Bangladesh Railway
175	Feasibility Study for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Akhaura- Sylhet Section of Bangladesh Railway
176	Feasibility Study for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Ishurdi- Parbatipur Section of Bangladesh Railway

6 The Vision for Bangladesh Railway

Key Messages

- The Vision Statement of Bangladesh Railways is discussed in relation to Bangladesh transport policy
- The current situation of the railway is discussed, as well as projects mandated by policy documents

6.1 Current Situation

The direction of railway development in Bangladesh is guided by the nation's leaders' aspirations for the railway's role in developing the country. Exactly how the railway contributes to national development will, ultimately, be decided by balancing the costs and benefits of candidate courses of action (and not merely support favoured interests). To that end, vision statements and/or mission statements are valuable since they focus attention on actions that form a coherent strategy serving the national interest.

Bangladesh has articulated its aspirations for rail transport. In 2012, the political document Vision 2021 was translated, inter alia, into a railway vision statement supported by strategies for realising that vision. This is reproduced in Figure 6-1.

Figure 6-1: Vision 2021 - Objectives for Bangladesh Railway

PERSPECTIVE PLAN OF BANGLADESH 2010-2021:
Making Vision 2021 a Reality
Planning Commission, April 2012

Railways

Long-term Vision and Objectives

Bangladesh Railway is the thrust sector of transport infrastructure in the Perspective Plan. The vision of the Perspective Plan is to expand and improve the railway system to provide safer, better, a more environmentally friendly and cost effective transport facility to national and international traffic. BR will also foster international rail links to serve regional/sub-regional connectivity and Trans Asian Railway. It will establish e-governance, introduce modern technology such as metro rail in Dhaka and undertake modernization of signalling system to ensure safety.

Strategies

- Rehabilitate, upgrade/improve and replace old-aged infrastructures and rolling stocks to reduce journey time, improve the service quality and to build the image of railway as a safe and reliable means of transport.
- Augmentation of line capacity along selected corridors, acquiring modern locomotives, coaches and wagons.
- Increasing market share in freight transport, in container transport between Dhaka- Chittagong Port and in passenger transport.
- Organizational reforms introducing a modern financial management system, improved maintenance and operational system and human resource development.
- Connect the Capital City with Cox's Bazar, Mongla Port, Tungipara, Barisal, Chittagong Hill Tracts and other areas where rail network does not exists.
- Improve Commuter Train Services to provide better urban transport facilities to the daily passengers around Dhaka, Chittagong, Rangpur, Dinajpur, Parbatipur, Nilphamari, Sylhet, etc.
- Improve efficiency and cost recovery.

A year later, the Railway Sector Master Plan 2013 was released and proposed a vision statement for Bangladesh Railway, reproduced in Figure 6-2.

Figure 6-2: 2013 Railway Sector Master Plan – Vision Statement

Railway Sector Master Plan (to June 2030)

Ministry of Railway, 2013

The Vision for Bangladesh Railway

The vision of Bangladesh Railway is to play an important and dominant role in an integrated transport system for the country by emphasising its strengths. The main strength of rail transport vis-à-vis road transport is in long distance travel and carriage of goods. Bangladesh is a relatively small country, and so for railway to compete with road transport it must be part of a door-to-door service that is integrated with other modes of transport for access and egress. Key areas where railway will seek to achieve the vision are as follows:

Transport of containers. Currently restricted to the Chittagong-Dhaka corridor, the market and market share will be increased through:

- Lower port turnaround, loading and unloading times
- Competitive pricing
- Increased capacity on key corridors
- Increase new train service
- Development of new Inland Container Depots
- Development of Railway Links with all ports and proposed Deep Sea Port at Sonadia
- Improved custom clearance arrangements
- Quality transfer facilities to road transport
- BR to act as a multi-modal transport operator

Inter City Passengers. Currently growing at around 3.8% per year, there is massive potential to increase market share through:

- Increasing track capacity on key corridors
- Increase new train service and expansion of network
- Developing intercity stations, as termini, interchange points, and focuses of land development
- Developing Commuter Services and Metro System in the Capital Dhaka
- Improved rolling stock
- Faster operations
- Competitive pricing
- Improved customer-orientated approaches

Bulk Freight Movements. Focus on commodities where railway is competitive to increase market share through:

- Focussing on POL, sand, stone, food grain, fertiliser, iron and steel
- Improved mechanised handling techniques
- Integration with road transport for door-to-door operations

Role as an International Railway. BR has great potential to play a role in enhancing trade in goods and services through:

- Carrying a greater share of the bilateral trade with India
- Developing railheads for third-country trade and transit
- Playing an active role in the Trans-Asian Railway to make railway the main carrier
- Providing seamless access to Bangladesh ports for Indian cargo.

Similar aspirations were enunciated in older documents, such as the Integrated Multi-Modal Transport Policy, Planning Commission 2008. The perspectives of these older documents are embodied in the more recent documents (shown above).

Although both statements contain much that is sensible, their implementation is not a foregone conclusion. They are viewpoints. Explicit actions are subject to closer scrutiny than aspirations in vision statements. A Master Plan responsive to the vision statement brings those aspirations one step closer to realization.

The vision statements will have shaped the current five year plan for Bangladesh. According to Article 15 of the Constitution 'planned economic growth' is a duty of the Government of Bangladesh. To this end, five-yearly plans are prepared, the current plan being Seventh Five Year Plan 2016-20, Planning Commission, 2015. There are 17 sustainable development goals (SDGs) and 169 targets. Over the plan period GDP growth is projected to rise from 7% p.a. in the first year to 8% p.a. in the last year.

Sector 6: Transport and Communication enumerates key elements of the transport sector strategy and addresses: inter-city highways; Trans-Asian Highway; Chittagong port capacity; international and domestic air traffic; PPP strategy; urban traffic congestion; river and rail as an alternative to road transport; road, rail and inland water cargo linkages to Chittagong Port; and governance and institutional challenges (page xliii).

Some of the transport initiatives in the Seventh Plan are: constructing Padma Bridge; completing Dhaka-Chittagong four-lane highway and broadening it further to at least six lanes; making all national highways at least four-lane highways; constructing elevated roads in major cities; linking Bangladesh Railway system to India, Myanmar and the Asian Railway system; utilising a rail link over Padma Bridge to connect Khulna and Mongla to Dhaka and Chittagong; construction of a deep sea port for handling of coal and other imports at Sonadia[15]; and Cox's Bazar rail connection (page 65).

The following targets are listed in the Outcome Statement 6 (page 155):

Table 6-1: Seventh Plan Development Targets

	2016	2017	2018	2019	2020
RHD: km of four-lane road	377	389	459	519	556
BR: km of rail network	2926	3077	3274	3543	3733
DTCA*: km of MRT rail	0	0	0	10	20

* Dhaka Transport Coordination Authority

In the Sixth Five Year Plan, RHD had a target of 4,672 km of new roads but in the first four years only 628 km were completed (page 389). BR performance also lagged. During the Sixth Plan new carriages entered service and passenger-km rose but tonne-km declined 24% (page 90).

A major setback for the Sixth Plan was an inability to launch PPP initiatives in transport. The Seventh Plan presented the status of the PPP projects considered to be needed to address transport network deficiencies effectively (pages 396-7).

[15] Now planned at Maheshkhali (deep sea port) and Matarbari (coal terminal and power stations).

Table 6-2: Status of PPP Financed Transport Projects

Status of PPP Financed Projects in Transport					
	Sector	Project	Cost Est. $ million	Negotia -tion	Contract Signed
1	Road	Dhaka-Elevated Expressway	1,088	•	•
2	Port	2 Jetties at Mongla Port through PPP	50		
3	Road	Dhaka-Ashulia Elevated Expressway	1,471		
4	Road	Flyover from Santinagar to Mawa Road (New) Bridge over Buriganga River	313		
5	Road	Upgrading of Dhaka Bypass to 4 Lane (Joydevpur-Debogram-Bhulta-Madanpur)	117		
6	Road	Hemayetpur-Singair-Manikganj PPP Road	86		
7	Road	Jatrabari-Sultana Kamal Bridge-Tarabo PPP Road	45		
8	Road	Dhaka-Chittagong Access-controlled Highway	1,625		
9	Port	Construction of Laldia Bulk Terminal	60		
10	Rail Depot	Construction of a New Inland Container Depot (ICD) near Dhirasram Railway Station	205		
11	Rail Bridge	Fulchhari-Bahadurabad MG Railway Bridge	1,435		
12	Rail Bridge	Dual gauge Double line Bangabandhu Bridge	1,025		
13	Port	Construction & Operation of Inland Container Terminal (ICT) at Khanpur	32		
14	Bridge	2nd Padma Multipurpose Bridge Paturia- Goalundo	1,640		
15	Port	3rd Sea Port	1,200		
		Total	10,422	1	1

The Dhaka Transport Coordination Authority Act 2012 established the DTCA to replace the former Board and gave it the mandate to plan, coordinate and modernise the transport system in Dhaka (defined as Narayanganj, Munshiganj, Manikganj, Gazipur and Narshingdi districts).

Subsequently the Metro Rail Act 2015 was passed to deal with metro rail construction, including PPP arrangements. The first project is DTCA's MRT Line-6 project from Uttara to Motijheel serving 16 stations and funded jointly by GoB and JICA. Commissioning of part of the track is planned for 2020.[16]

The Seventh Plan makes no mention of BR involvement in metro rail even though MRT Line-4 is shown in network diagrams as sharing the BR right of way from Narayanganj to near Tongi. The Plan does, however, give emphasis to railways on the grounds that rail is cheaper, safer and

16 http://www.dmtc.org.bd/about/about-mrt-line-6.

fuel-efficient. It concludes with "the railway should get the maximum investment attention" (page 403). The following table spells out what that means (page 404).

Table 6-3: Seventh Five Year Plan Railway Objectives and Targets

Railway Objectives and Targets in the Seventh Five Year Plan		
Goal	Action	Targets
Expand and improve railway system to provide safer, better, environment friendly & less expensive transport facilities for national and international traffic to increase its market share. Market share will increase from 4% to 15% in freight transport, 10% to 15% in container transport between Dhaka-Chittagong Port and 4% to 10% in passenger transport.	Expansion of railway network to expand rail operations	Undertake construction of 856 km of new rail track.
	Double tracking of important sections and gauge unification to overcome operational bottlenecks	Undertake dual gauge double tracking of 1110 km
	Rehabilitate/upgrade existing rails for improved speed and safety	Undertake rehabilitation of 725 km of existing rail track
	Construction of railway bridges and other infrastructure for operational improvement	Undertake construction of rail bridges, improvement of level crossing gates and improvement of other infrastructure.
	Procure new locomotives to improve service quality	Purchase 100 new locomotives, one locomotive simulator and four relief cranes.
	Procure new coaches for passenger comfort.	Purchase 1120 passenger coaches and rehabilitate 624 coaches.
	Upgrade railway workshops and maintenance	Procure modern maintenance equipment
	Improve rail speed and safety	Upgrade rail signal for 81 stations
	Improve rail efficiency	Strengthen railway management
	Improve railway finances	Eliminate operational deficit through price increases and operational efficiency gains

The Seventh Plan continues as follows (starting page 404, emphasis added).

> The railway expansion programme is based on the following strategic considerations.
>
> - Shortening the **Dhaka–Chittagong** rail distance. Due to orientation problem, Dhaka has detoured connection with Chittagong and has only one gateway for trains from all directions, thereby causing undesirable bottleneck and operational problems. To solve these, priority will be given to construct the Dhaka-Laksham elevated cord line via Fatullah in Narayanganj (new gateway). This strategic investment would also act as a catalyst in improving port operational efficiency, can cater Padma Bridge induced train movements and will establish a missing link for establishing transhipment/regional connectivity.
> - Address the biggest capacity constraint found on the single line sections in major railway corridors like Dhaka-Chittagong, Dhaka-Sylhet, Dhaka-Khulna, and Dhaka-Parbatipur. Bangladesh Railways needs to undertake **double tracking** of all major railway corridors by phases.

- Developing a full access controlled right of way, as well as capital intensive grade separated measure to make **level-crossing-free** allowing segregated rail corridor and thereby ensuring operation of commuter trains in urban areas, particularly for Dhaka. Emphasis would be given to higher frequency and speed without affecting the roadway capacity.
- Strengthening South Asia regional and **Trans-Asian railway** connectivity.
- Taking into cognizance that the railway freight transportation cost in Bangladesh is one of the highest in the world and presently it takes about 18 days to bring a container to Dhaka from Chittagong Port mainly due to acute shortage of freight trains, and most importantly [sic] very low average travelling speed[1] (15-20 kmph), besides augmenting rolling stock, development of **dedicated high speed freight corridor** capable of carrying **double layer containers** is a must. Present ground condition is not friendly for modernization of train (Electric Traction System). This is a matter of urgency because an important element in improving the efficiency of the Chittagong Port hinges on developing a balanced multimodal freight transport system, which is now overwhelmingly and unsustainably road biased, to move the containers to and from the hinterland more efficiently and thereby to **make the railway profitable**.
- Priority would be given to connect large EPZ/SEZ mouth [sic] **ICDs** and thereby to develop market oriented container transport friendly new railway infrastructures.
- In the long run for even distribution of traffic load, urban contribution of railway in terms of carrying commuter traffic (which is now less than 1 percent of the total daily trips of Dhaka city) needs to be increased by adopting two-tier railway system, i.e. **suburban and urban rail**. Urban rail network need to be developed by including the circular rail and by integrating fully with the long distance suburban rail (may start from Tongi & Narayanganj) as well as STP (Strategic Transport Plan 2004-2024) and DHUTS (Dhaka Urban Transport Studies 2010-2050) recommended BRT and MRT based urban mass transit network systems.

Along with routine and regular activities/projects/programmes, the following major/remarkable projects are underway to be implemented during Seventh Five Year Plan.

1. Construction of Single Line Dual Gauge Railway Track from **Dohazari to Cox's Bazar** via Ramu and Ramu to Gundum near Myanmar Border.
2. **Padma Bridge Rail Link** Project (Dhaka-Mawa-Bhanga- Jessore)
3. Construction of Double Track **Standard Gauge Railway Line from Dhaka to Chittagong** via Comilla/Laksam (expressway)
4. Construction Modern **Railway Workshop** at Rajbari.
5. Construction of Double Line (Dual Gauge) Railway Track between **Joydebpur-Iswardi** (Ishurdi) sections;
6. Construction of **Bangabandhu Railway Bridge** (2nd) over the River Jamuna;
7. Construction of Railway line from **Khulna to Mongla** Port with feasibility Study; and
8. Construction of Dual Gauge Double Rail Line and Conversion of Existing Rail Line into Dual Gauge between **Akhaura and Laksam**.

Source: Seventh Five Year Plan FY2016-FY2020

Government has undertaken several projects to convert the Dhaka-Chittagong corridor into double lines, including construction of 2nd Bhairab and 2nd Titas Rail Bridges. Government has also developed a plan to upgrade rail transport between Dhaka and Sylhet. This may include establishing a container terminal either at Shayestagonj or Srimangal [50km south of Sylhet]. The Plan also envisages strengthening rail capacity from the proposed new port at Matarbari[17] to the power stations to support growing coal import requirements.

The Seventh Plan also supports institutional strengthening of Bangladesh Railway:

> "In railways, a combination of service inefficiency and pricing has constrained the financial performance of the railways [and its] ability to achieve the railway operational deficit reduction targets set in the Sixth Plan. The Railway Ministry should prepare an action plan to ensure the elimination of the railway operational [deficit][18] by the end of the second year of the Seventh Plan." (page 412)

> "Railway institutional reforms are the responsibility of the Ministry of Railways. The main challenge is to convert the management of the rail system from a bureaucracy to a commercial enterprise. A detailed railway reform programme was developed in 2005 that also contained substantial institutional reforms. The rail ministry should … prepare an actionable Programme for government approval and implementation during the Seventh Plan." (page 413)

Electronic and mobile-friendly ticketing was introduced in March 2010. The uptake has been enthusiastic on the routes on which the service is available. Finally, note that the Seventh Five Year Plan supersedes the National Land Transport Policy approved by Cabinet in 2004. As well as being up-to-date, the Seventh Plan covers more comprehensively the matters addressed by the Land Transport Policy.

6.2 Implications for the Master Plan

The 2013 Railway Master Plan translated its vision (Figure 6-2) into a corridor-based master plan. The reason for a corridor approach is not obvious, as it becomes difficult to reconcile the master plan with the objectives in the vision. Compartmentalising the network into 15 geographical portions makes the outcomes of specific projects harder to see. Accordingly, this master plan adopts a project-oriented approach. Projects are grouped according to various development objectives (including the Seventh Five Year Plan) and project priority is developed by consideration of these development objectives. The proposed bouquet of projects are also in harmony with UNDP's Sustainable Development Goals and facilitate achieving the targets prescribed therein.

A summary comparison of projects covered in Phase 1 (2017-2020) with targets prescribed in seventh five year plan (2016-2020) is presented below:

17 The coal terminal and power stations are planned for Matarbari. The deep sea port (formerly planned at Sonadia Island to the south) is now planned to be a little north of Matarbari at a location called Maheshkhali.

18 The text mistakenly says "plan".

S.No	Targets	Achievement under Phase 1 (2017-2020)
1	Undertake construction of 856 km of new rail track.	Master Plan proposes more than 860 Km of new track across new lines and line doubling projects during 2017-2020 period
2	Undertake dual gauge double tracking of 1110 km	Master Plan proposes to undertake more than 690 Km of Line rehabilitation, Gauge conversion and doubling projects during 2017-2020 period.
3	Undertake rehabilitation of 725 km of existing rail track	Master Plan proposes to undertake more than 690 Km of Line rehabilitation, Gauge conversion and doubling projects during 2017-2020 period.
4	Undertake construction of rail bridges, improvement of level crossing gates and improvement of other infrastructure.	Master Plan proposes a number of projects in this regard during 2017-2020 period including new bridges, rehabilitation and construction of railway crossings and upgradation of station buildings, maintenance facilities and other infrastructure
5	Purchase 100 new locomotives, one locomotive simulator and four relief cranes.	Master Plan proposes total of 197 locomotives for procurement towards replacement and fleet expansion. This also includes an ongoing procurement of 111 MG locomotives
6	Purchase 1120 passenger coaches and rehabilitate 624 coaches.	Master Plan proposes total 1218 coaches for procurement towards replacement and fleet expansion which meet this target
7	Procure modern maintenance equipment	Master Plan proposes a number of projects aimed at modernization and mechanization of Rolling stock and Permanent maintenance.
8	Upgrade rail signal for 81 stations	Master Plan proposes signal modernization and upgradation of at least 61 stations and 650 Km track route
9	Strengthen railway management	A number of training and institutional strengthening projects are proposed in this regard
10	Eliminate operational deficit through price increases and operational efficiency gains	A number of projects are proposed to achieve this objective.

Many candidate projects have been identified in vision statements and the Seventh Plan. In the course of preparing this Master Plan, other projects arising from the pursuit of enhanced railway efficiency and capacity were identified. The overall project list (Appendix 1) contains all projects identified at time of writing.

7 The Strategy to Achieve the Vision

Key Messages

- Gauge conversion will allow the achievement of the goal of regional railway integration by permitting broad gauge operation throughout the country and across the borders to India
- S&T enhancements will provide a relatively inexpensive method of line capacity increase and should be considered either as stand-alone projects or parts of other line enhancement projects
- New rail lines will extend the railway to hitherto unserved areas
- RS maintenance enhancement projects will increase the efficiency of the rolling stock complement and reduce maintenance unit costs, leading to better financial performance
- An RDS Unit will lead to increased standardization and more utilization of Bangladeshi suppliers, resulting in greater efficiency and reduced costs

7.1 Gauge Conversion

7.1.1 Objectives of Gauge Conversion

In 2007, Bangladesh signed the Trans-Asian Railway (TAR) Agreement. Bangladesh agreed to convert its track gauge on specified international trade corridors from existing metre gauge to broad gauge to promote the international movement of goods by rail. Bangladesh has embarked upon an ambitious program of dual-gauge track conversion to fulfil its obligations under the TAR.

Under the 2013 Master Plan, Bangladesh Railways (BR) committed to an ambitious program of capital works designed to increase capacity in both freight and passenger transport. Some inroads have been made in that respect. However, much remains to be done.

In updating the master plan, it was soon realized that without a time bound strategy for gauge conversion, it would be quite difficult to efficiently plan infrastructure projects. Having a time-bound gauge conversion plan will also reduce risk in future rolling stock procurement by providing more certainty as to what gauge RS to procure. So, the planning for gauge conversion was undertaken. The objective of this section is to explain the recommended approach to gauge conversion and a rationale for arriving at it.

7.1.2 Current Situation

The existing Bangladesh rail network by gauge and number of tracks can be seen in Figure 7-1. BR is bifurcated into two zones (East and West) by the Jamuna River. The east zone was entirely meter gauge. The West Zone was broad gauge except for the Lalmonirhat division; which was meter gauge. In recent years, dual gauge has been installed to improve operating efficiency and reach. In 1998, the Bangabandhu Bridge was constructed with dual gauge track connecting the two zones by rail for the first time. Currently, the bridge is speed restricted to 20 kmph and to permissible axle load of 18.3 tons.

Table 7-1: Bangladesh Railway by Gauge Type

Zone	Headquarters	Meter Gauge (route-kms)	Broad Gauge (route-kms)	Dual Gauge (route-kms)	All Gauges (route-kms)
East	Chittagong	1205	0	34	1240
West	Rajshahi	386	654	501	1541
Total		**1592**	**654**	**535**	**2781**

Permissible axle loads are very low on meter gauge lines (12 tons) but higher on broad and dual gauge lines (18 tons). In addition new broad and dual gauge lines are now being constructed to permissible axle loads of 25 tons. Low permissible axle loads (especially below 15 tons) provide significant limitations on the availability of locomotives with few manufacturers making equipment to that requirement.

Table 7-2: Maximum Permissible Axle Load and Speed by Zone and Gauge

Gauge	Maximum Axle Load (tonnes)	Maximum Speed (kmph)
East		
Meter	11.165 - 11.96	75
Dual	11.96	75
West		
Meter	10.668 – 12	72
Dual	12 - 18.457	95

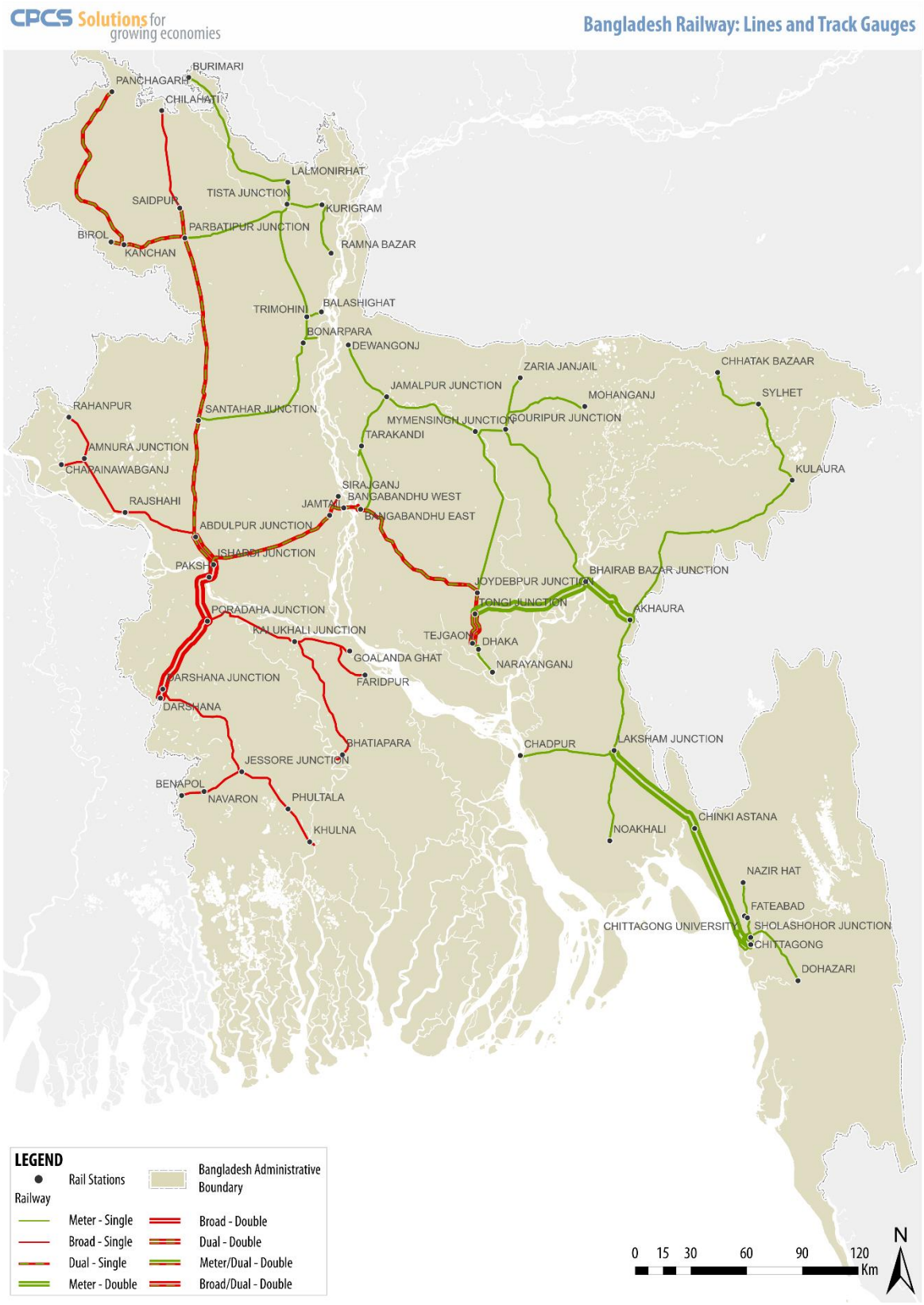
7.1.3 Gauge Conversion Benefits

It is recommended that Bangladesh Railway set a long-term objective to convert its network to a single gauge; specifically Indian broad gauge (1676 mm). The benefits of doing so include:

- Increased seamless (single gauge) reach of the railway
- More efficient use of rolling stock (wagons, coaches and locomotives)
- Better facilitation of the introduction of mechanized track maintenance; and more efficient use of track maintenance machinery and testing equipment
- More efficient passenger and freight rail operations (due to less passenger transfer and freight transhipment)
- Less infrastructure requirements (due to removal of duplicate facilities for two gauges such as maintenance depots and marshalling yards)
- More efficient rolling stock maintenance (fewer facilities leading to improved productivity)

These benefits translates into increased revenue, lower operating costs and lower capital investment in the long run.

Figure 7-1: Gauges and Number of Tracks of the Bangladesh Railway Network



Source: Bangladesh Railway

In recent years, Bangladesh Railways has converted existing lines from meter gauge to dual gauge and has constructed new lines in dual gauge[19]. Dual gauge meets the objective of extending the broad gauge reach but also permits the conveyance of meter gauge trains. However, this comes at costs including:

- Additional infrastructure including a third rail and additional components for each turnout
- Higher rates of component deterioration and more challenging maintenance[20] due to the third rail and the complex turnouts

As such, dual gauge is best used for a transition period until the use of meter gauge equipment is phased out.

An alternative to using dual gauge is to install dual gauge sleepers but only install rail for the meter gauge until a time when the switch is made to broad gauge on the line. At this time, the rail is moved from the center rail seat to the unused outer ones. The benefits of this "gauge convertible" track relative to dual gauge is that it has a lower initial cost (due to one less rail and much simpler turnouts) and easier track maintenance. The drawbacks are that it is that the track is one gauge or the other and the additional costs of converting the track from meter to broad gauge.

[19] However, in recent years some lines have rehabilitated in meter gauge such as the double track Tongi-Bhairab double main track.

[20] Track deterioration is accelerated with dual gauge as compared to broad gauge on account of the asymmetric loading of the track) and maintenance (especially related to track surface) is more complex due to the location of the third rail and complex turnout configurations.

The conversion of meter gauge track to dual or broad gauge is a very significant undertaking that typically involves reconstruction of the track structure, bridges and culverts; and an addition to or even reconstruction of the roadbed. Very few track materials are re-used except for the possibility of some ballast and rail, if it is 90A or better and in good condition. As such, the cost of gauge conversion is largely the same of constructing a new line except for savings in land acquisition and roadbed construction and perhaps some re-used rail and ballast. Given the higher standards now being used for permanent way, the new line will have higher permissible axle loads and likely higher operating speeds. As such, it is important to recognize that this improved track is a direct benefit of a gauge conversion projection but is not a justification of making the decision.

7.1.4 Gauge Conversion Plan

Recommended objectives for the gauge conversion plan are, as follows;

- To permit the passage of broad gauge rolling stock on the entire network by 2040 and on the core network by 2035
- To do so with no shutdown of passenger and freight to important hubs
- Minimising infrastructure costs by way of prioritizing broad gauge to dual gauge and gauge convertible track; and prioritizing gauge convertible track to dual gauge track

With these objectives, the gauge conversion plan was developed as follows;

Item	Timing
All new line constructed in dual or broad gauge or gauge-convertible track	Effective immediately
All additional main track constructed in dual or broad gauge or gauge-convertible track	Effective immediately
All meter track to be rehabilitated be gauge converted at the same time to dual or broad gauge or gauge-convertible track	Effective immediately
At least one main track of all core lines to be dual or broad gauge by 2030	By 2030
All main tracks of all core lines will be dual, broad or gauge convertible track by 2035	By 2035
All main tracks will be dual, broad or gauge convertible track by 2040	By 2040
All train service using broad gauge equipment by 2045	By 2045
All third rail for meter gauge service on dual gauge removed by 2046	By 2046

Maps showing the development of this plan over time (as well as other Permanent Way projects such as line doubling or line rehabilitation) can be seen in Appendix 3. Gauge conversion projects to be undertaken and completed in each five-year period are shown highlighted in yellow.

7.1.5 Rolling Stock Procurement

BR should initiate procurement of BG container flat wagons within the next few years to ensure their availability by 2025 when Dhaka - Chittagong route is totally converted to Dual

Gauge. Current MG stock can continue on that route until 2025 (after necessary repairs); after this point, they can be transferred to other routes.

Leasing is also an option for both new BG container flat wagons and 15-20 year old MG wagons as a stop-gap arrangement for 5-6 years.

7.2 Unlocking Line Capacity: Signalling and Telecommunications

7.2.1 Existing System

The following types of signalling are in presently in use on Bangladesh Railways:

- Centralised Traffic Control (CTC)
- Computer Based Interlocking (CBI)
- Route Relay Interlocking (RRI) with Colour Light Signalling
- Double Wire Upper Quadrant Mechanical Signalling
- Single Wire Mechanical Interlocking
- Non-Interlocked (NI) with Colour Light Signalling (CLS)
- Non-Interlocked (NI) Mechanical Signalling

The BR signalling standards and their corresponding permissible maximum speed are:

- Standard III: Unrestricted Speed
- Standard II: Up to 72 kmph
- Standard I: Up to 48 kmph
- Non-interlocked: Up to 16 kmph

Examples of the present signalling system on some of the important sections of Bangladesh Railways are as given below:

Table 7-3: Signalling Systems on Bangladesh Railway

S.No.	Type of Signalling	Sections
1.	Centralised Traffic Control (CTC)	Laksam-Chinkiastana (installed) Chinkiastana-Chittagong (in progress)
2.	Computer Based Interlocking (CBI)	Dhaka-Tongi Tongi-Bhairab Bazar Tongi-Joydevpur Joydevpur-Mirzapur Mirzapur-B.B, Bridge (E) B.B. Bridge (E)-Jamtail Jamtail-Muladuli-Majhgram Sylhet-Akhaura
3.	RRI with Colour Light Signalling	Akhaura-Laksam Jamalpur-Mymensingh Mymensing-Gouripur Mmensing

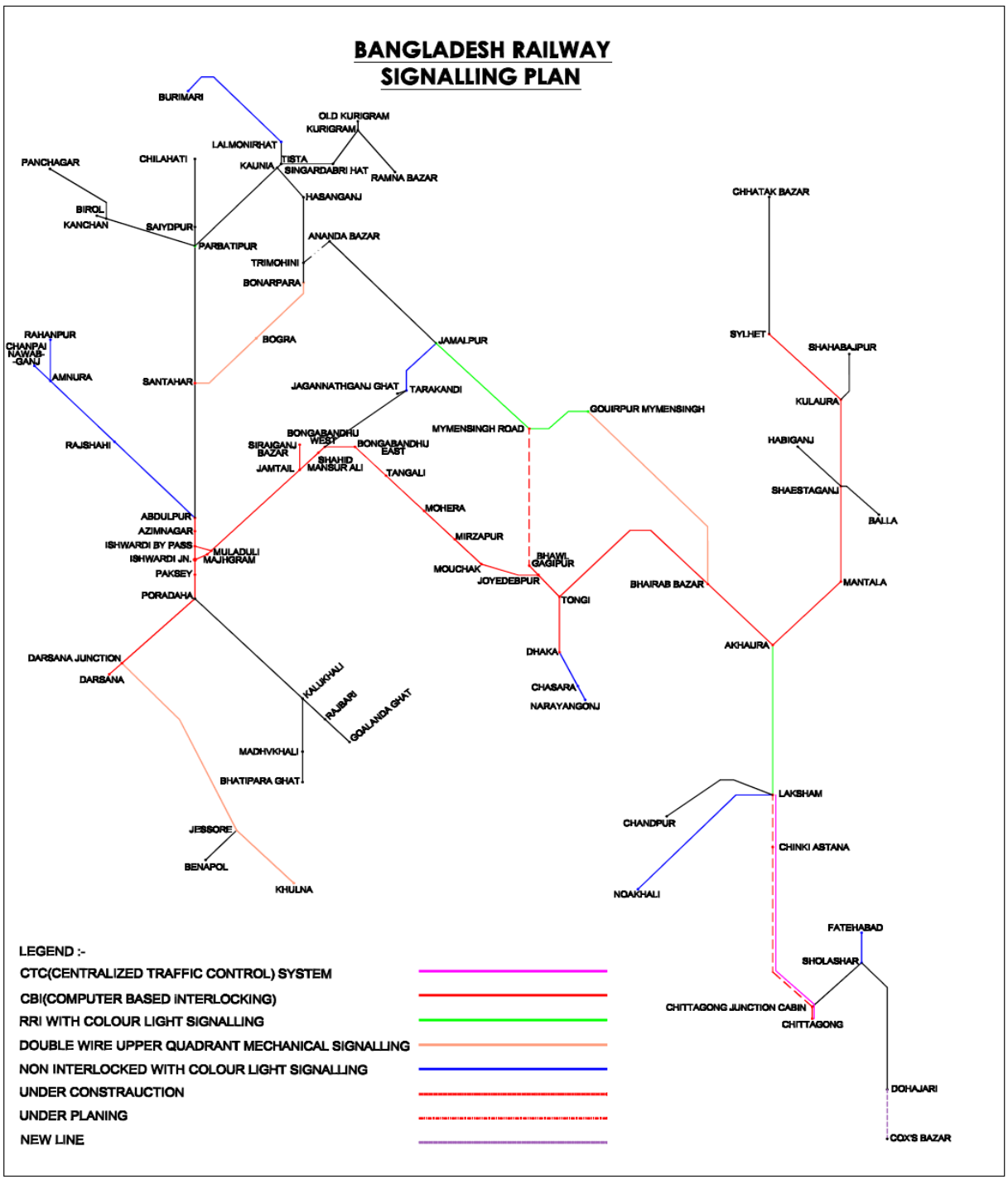
S.No.	Type of Signalling	Sections
		Parbotipur-Santahar
4.	D.W.U.Q. Mechanical Signalling	Gouripur Mmensing -Bhairab Bazar Bonarpara-Santahar Darshana-Benapol Benapol-Khulna
5.	Non Interlocked with Colour Light Signalling	Fatehabad-Sholahshahar Laksam-Noakhali Dhaka-Narayanganj Jamalpur-Jagannathganj Ghat Abdulpur-Rohanpur Lalmonirhat-Burimari

As a part of modernisation of Bangladesh Railways over the past decade, conventional Mechanical Signalling are being progressively replaced by Colour Light Signalling. In recent years Computer Based Interlocking is being introduced on the main lines of Bangladesh Railways.

A Centralised Traffic Control (CTC) system is under installation on the Chittagong – Laksam section.

The existing Signalling Map of Bangladesh Railway is shown below:

Figure 7-2: Bangladesh Railway Signalling Plan



Control Centres

East Zone train services on are controlled from Control Centers at Dhaka and Chittagong. The West Zone has its Train Control Centres at Paksey and Lalmanirhat. Each Control Centre is under control of a Divisional Railway Manager.

Dhaka Control Center controls train movements of 107 stations of the division. This center has 3 control boards which control the daily movement of 129 passenger, freight and local trains. Each Controller talks to station masters of his section on control phones and collects the train

movement information. He manually plots the train movement on his control chart and directs the Stationmasters about crossing, precedence and other issues regarding the trains passing through their stations.

Figure 7-3: Dhaka Control Centre

On the Western Zone there are similar Control Centres at Pakshi and Lalmonirhat.

CTC Control Centre Chittagong

A new CTC system has been installed at Chittagong Control Centre for the section on Laksam – Chinkiastana section and work is in progress for its introduction on Chinkiastana– Chittagong section.

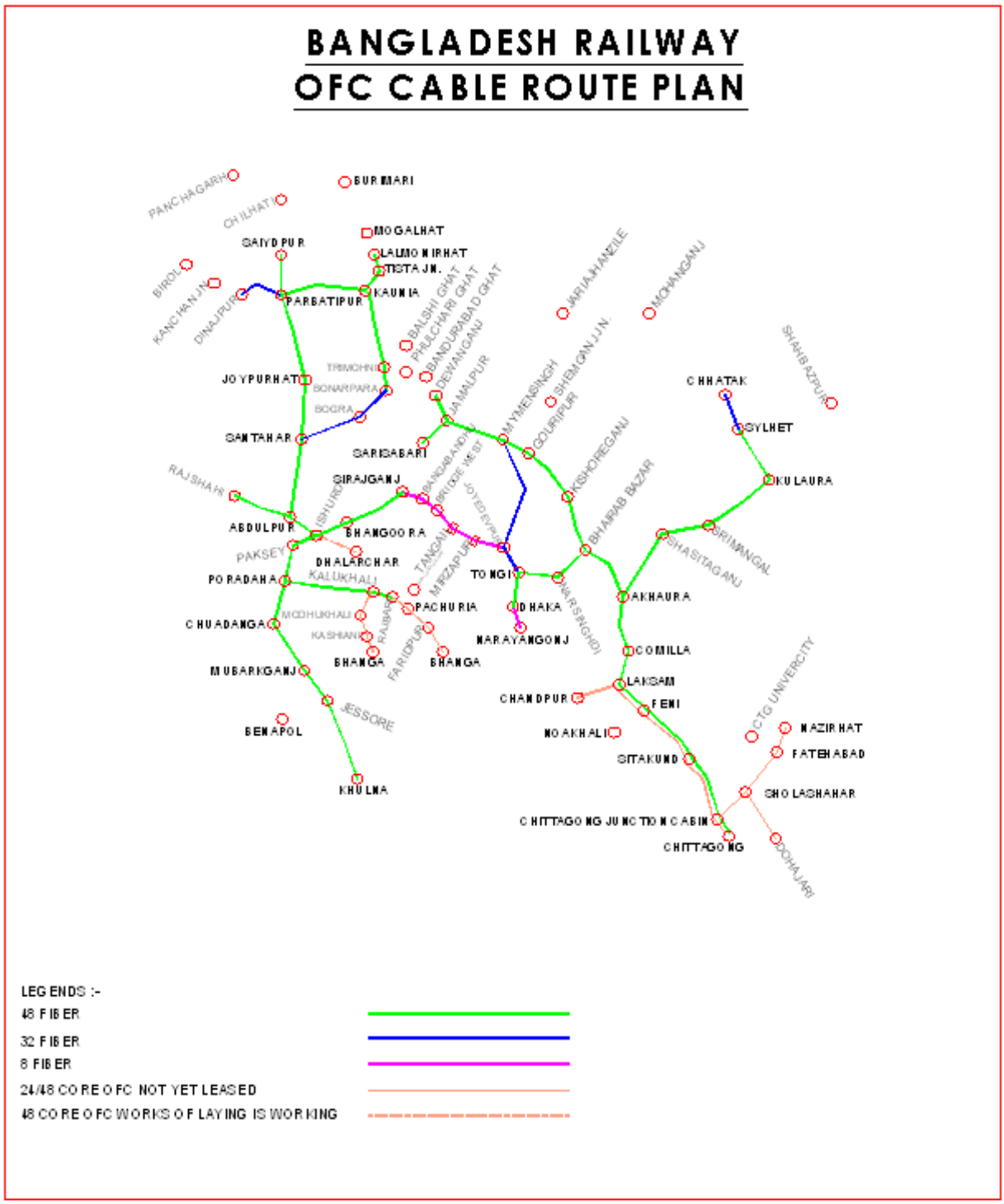
Figure 7-4: CTC Centre Chittagong

7.2.2 Telecommunications

Optical Fibre Cable

Bangladesh Railway has about 2400 km of Optical Fiber Cable (OFC) laid at present. This network was accorded a Nationwide Telecommunication Transmission Network (NTTN) License from BTRC (Bangladesh Telecommunication Regulation Commission) on 20th November, 2014. Out of 2400 km Optical Fiber, 2009 km has been leased out to Grameen Phone Ltd. and the leasing out/renting out of the rest is under process. The network schematic can be seen in Figure 7-5 below.

Figure 7-5: Bangladesh Railway OFC Network



7.2.3 Unlocking Line Capacity by Signalling Modernization

Railways worldwide are optimizing existing rail infrastructure and increasing line capacity by introduction of modern signalling.

Capacity improvement up to 60% has been achieved by introduction of CTC and when block sections are equipped with Automatic Block Signalling /Automatic Permissible Block Signalling.

By introduction of CTC without introducing Automatic Block Signalling/Automatic Permissible Block Signalling in the Block Section, capacity improvement gained are of the order of up to 10%.

On double line sections Automatic Block Signalling provides greater than 50% increase in line capacity. Initially, railways are also splitting the blocks in two by intermediate block signals which increase the line capacity up to 15%.

The manual mode of last vehicle check by station masters is being replaced by Automatic Check of Last Vehicle using digital axle counters. This system brings an increase of 2 to 3 trains per day on a double line section.

By introduction of Radio based Regional ERTMS Level 3 on single line sections, capacity improvement can exceed 30%.

The following is BR's planned modernization of signalling and block working over Phase 1 to 5 (i.e. until 2040):

1. Mechanical semaphore signals will be replaced by colour light signals powered by solar system.
2. Manual token block will be replaced by radio electronic token block (RETB)
3. Mechanical and relay interlocking system will be replaced by modern computer-based interlocking (CBI) system along with colour light signalling, electrically operated point machines, track circuits/axle counters to be operated from PC/VDU.
4. Tokenless block system as integral part of CBI system will be introduced.
5. Automatic block signalling will be introduced on suburban sections running commuter trains.
6. Intermediate block signalling will be installed on mainline sections for increasing line capacity.

CTC Control Centres

BR will establish CTC centres at four Divisional Control Offices and a Supervisory CTC system at Dhaka prior to 2040.

Automatic Train Protection (ATP)

BR plans to update ATP and train control systems before 2040. The Railway will install:

1. Automatic Train Protection (ATP)/Train Protection Warning System (TPWS) on all main line sections.
2. Communication Based Train Control (CBTC)/European Train Control System (ETCS) on corridors identified as international TAR (Trans Asian Railway) routes.

7.2.4 Line Capacity Increases for Bangladesh Railway

Bangladesh Railway presently uses the Absolute Block System which permits one train only between two adjacent stations. The last vehicle verification is being manually done by Stationmasters. Many of the stations are still non-interlocked, requiring a long time for route setting.

Bangladesh Railways has taken an important step in improving operational flexibility by progressively introducing electronic interlocking at the important stations. But there is need to utilize electronic interlocking for increasing line capacity on the block sections and doing remote control operation of way stations.

Based on the study of existing signalling & train control systems and to meet with traffic projections, safety improvement and to provide flexibility in operation, the following modernization of S&T systems is suggested for implementation on Bangladesh Railways. This will enable optimal utilization of track, rolling stock and will allow significant increases of line capacity at a lower cost than infrastructure solutions such as line doubling.

Table 7-4: BR Signalling Modernization Projects

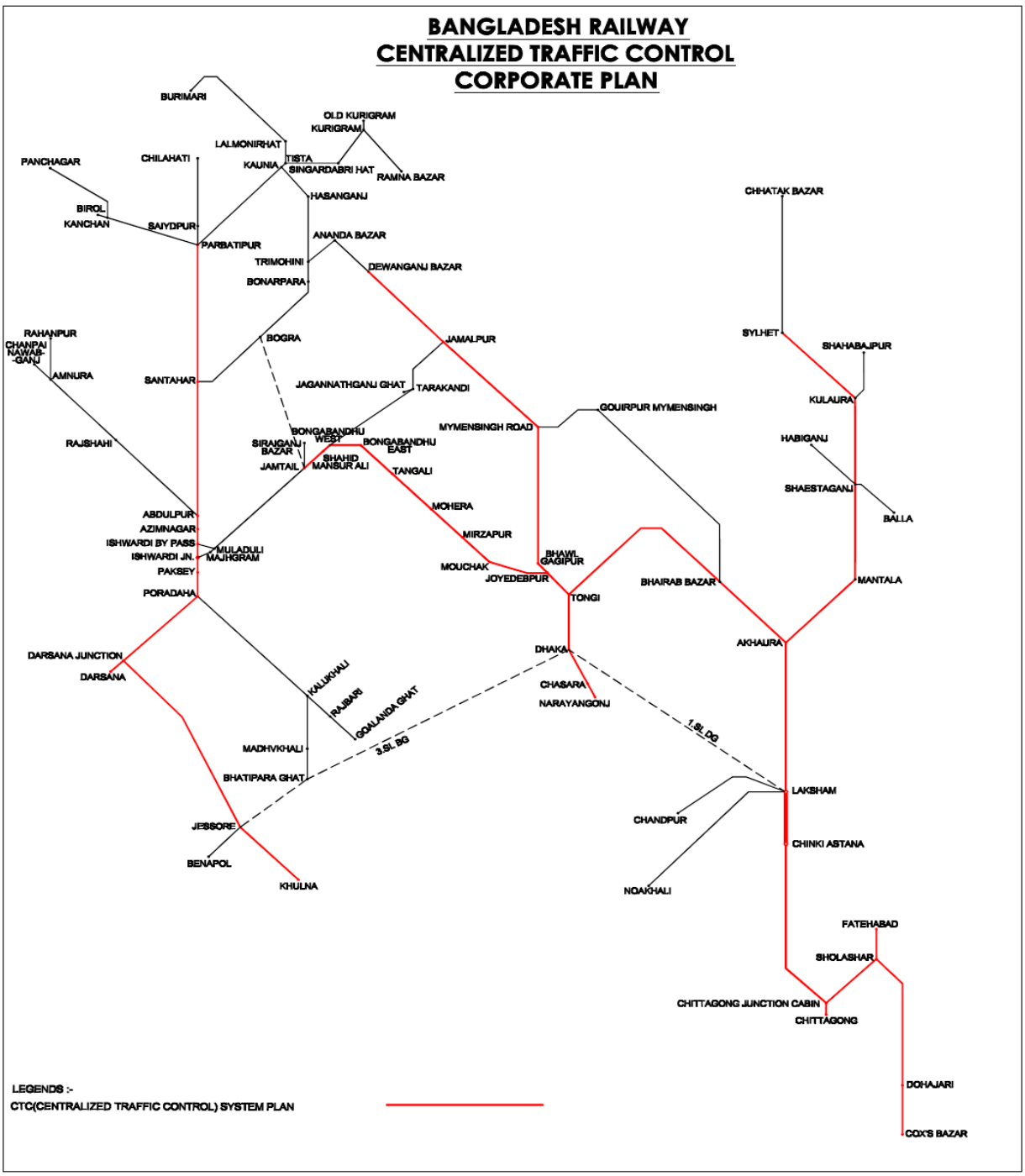
Project No.	Project	Phase	Phase Period	Cost(In BDT Crores)
88	Modernization of Signaling & Interlocking System by CBI (Computer based Interlocking) at 21 Stations in Abdulpur – Parbatipur Section.	1	2016-2020	84
89	Modernization of Signaling & Interlocking System by CBI in 7 stations in Abdulpur–Rajshahi Section, including Ishurdi station.	1	2016-2020	28
90	Modernization of Signaling & Interlocking System by CBI at 18 Stations in Khulna – Darsana section.	1	2016-2020	72
91	Modernization of Signaling & Interlocking System at 8 Stations in the section Chittagong Jn Cabin – Dohazari by centralised CBI and object controllers at stations /L xings with centralised monitoring of the section at Chittagong.	1	2016-2020	32
92	Installation of optical fiber based telecommunication system in the remaining secondary line sections of BR (about 650 km).	1	2016-2020	181
100	Integration of CTC Control system of Chittagong and Dhaka with the CBI Interlocked stations of the two respective divisions	1	2016-2020	600
93	Modernization of signaling & interlocking system by CBI at 24 Stations in Lalmonirhat – Kaunia – Bogra – Santahar Section (except STU).	2	2025-2030	96
94	Modernization of signaling & interlocking system by CBI at 7 Stations in Kaunia–Parbatipur - Syedpur section, excluding Kaunia and Parbatipur station.	2	2016-2020	28
95	Modernization of signaling & interlocking system by CBI at 14 stations in Bhairab Bazar–Kishoregonj – Mymensingh Section.	2	2020-2025	56

Project No.	Project	Phase	Phase Period	Cost(In BDT Crores)
96	Modernization & up gradation of signal workshop at Kadamtali, Chittagong.	2	2020-2025	100
97	Installation of GSM R train radio communication system among driver, guard, SM connecting two divisional train control offices of East Zone of Bangladesh Railway.	2	2020-2025	315
99	Installation of modern signaling & telecommunication training centre at Dhaka.	2	2020-2025	50
102	Installation of radio-based cab signalling ETCS L2/ ETCS L3 in the section: Narayanganj - Dhaka -Chittagong.	2	2020-2025	789
98	Installation of GSM R train radio communication system among driver, guard, SM connecting two divisional train control offices of West zone of Bangladesh Railway.	3	2025-2030	392
101	Installation of CTC Control system at Paksey and Lalmonirhat divisional control office and integration with CBI Interlocked stations of the two divisions .	3	2020-2025	400
104	Replacement of signaling system by CBI at AKA-SYT section (25 Stations).	3	2025-2030	100
105	Installation of radio based ETCS L2 /L3 cab signaling system with moving block in sections Akhaura- Sylhet, Tongi-Jamalpur, Joydevpur-Issurdi, Khulna-Parbatipur in East and West zones of Bangladesh Railway.	3	2025-2030	2173
103	Modernization & up gradation of optical fiber based telecommunication system of Bangladesh Railway (2009 km) presently used by Grameenphone Ltd.	4	2030-2035	560
106	Modernization of signaling system by interlocking of different section of secondary lines replacing non-interlocked mechanical/color light signaling system.	4	2030-2035	612
Total				**6,452**

7.2.5 CTC Roll-Out Plan for BR

Based on the above, a CTC Plan for Bangladesh Railway proposing a CTC system with automatic signalling on double line, automatic permissible block signalling on single lines or radio block control using Regional ERTMS Level 3 is as given below:

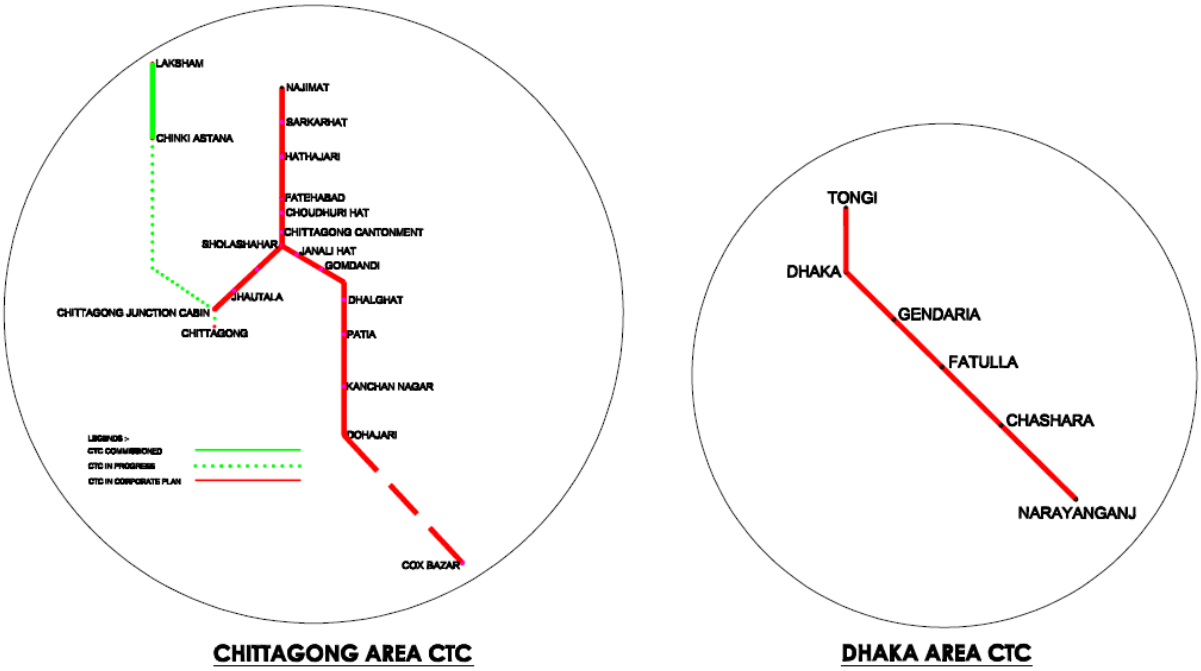
Figure 7-6: Centralized Traffic Control Plan



7.2.6 Modernization of Signalling for Dhaka and Chittagong Areas

The suburbs around Dhaka and Chittagong are growing and will require more frequency of train services. Also, the demand for passenger information systems at stations and on the Internet will grow. Therefore the present non-interlocked signalling system and manual control need to be replaced by electronic interlocking and CTC control.

Figure 7-7: Chittagong and Dhaka CTCs



The cost of modernization of signalling on Dhaka – Narayanganj and Chittagong Suburban section as detailed above will be BDT 65.6 crore and 230 crore respectively.

7.2.7 Optical Fibre Network

For improving availability of OFC network, many countries follow the practice of duplicating the cable run or splitting the OFC so that they run on both sides of the track. This provides redundancy and allows continued operation when the cable on one side is damaged.

When extensions or revisions to the OFC network are considered, BR should consider providing duplicated cables as noted above.

At least 4 fibres should be kept reserved for railway use at each station.

This arrangement along with hot standby of OFC-related equipment will approximately double the cost /km for railway OFC extensions but will dramatically increase the security and stability of the system.

7.2.8 Introduction of Mobile Train Radio Communication System: GSM-R

The GSM-R train radio system encompasses ground-to-train voice and data communications between drivers and CTC/station masters together with the ground based mobile communication needs of maintenance staff, station staff/personnel, railway administration and managerial personnel. The system meets the mobile communications needs of railways.

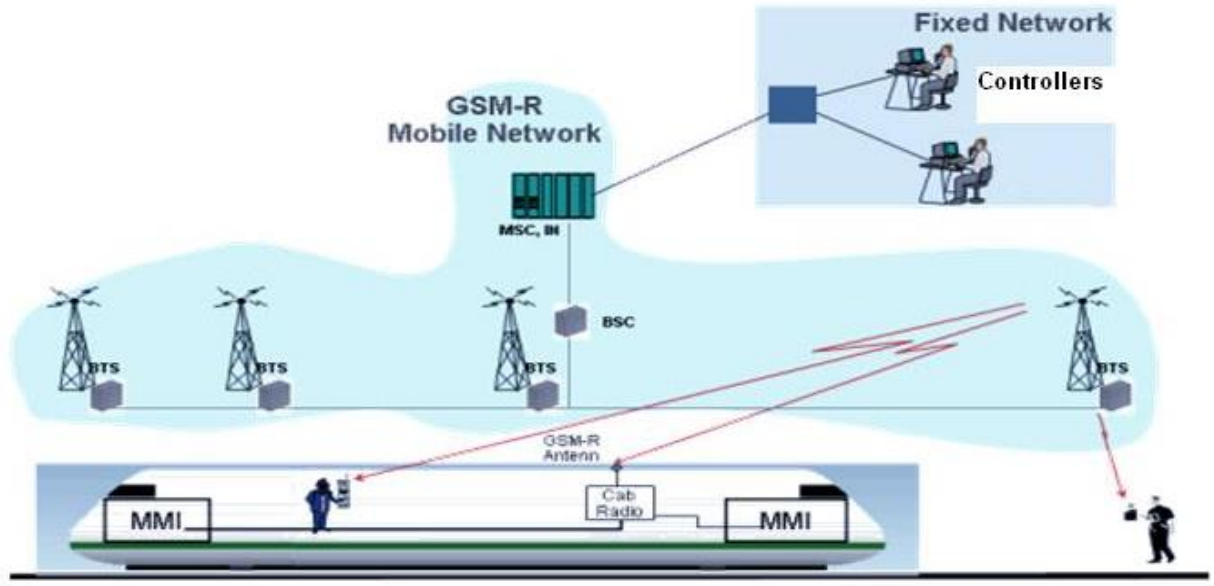
The GSM-R train radio system is based on the ETSI GSM standard. It consists of core network, BSS, mobile equipment such as cab radios, operational hand held (OPH) and general purpose

hand held (GPH). It is being progressively adopted by railways in Europe, Asia and Africa. It can have the following characteristics:

- Provision of voice & data communication between operational staff i.e. drivers, dispatchers, shunting team members, train engineers and station controllers
- Delivery of group calls, pre-emption in case of an emergency
- Delivery of signalling information directly to the train driver, thus helping to enable higher train speeds and traffic density with a higher level of safety
- Enablement of wagon tracking, video surveillance in trains, stations, LC gates and passenger information services.

A schematic diagram of GSM-R Train Radio system is given below

Figure 7-8: GSM-R Mobile Network



With introduction of CTC by Bangladesh Railway, on line monitoring and remote control of trains from the CTC Centre has already begun. As a next step in this direction, introduction of GSM-R will improve operation, provide security and will facilitate providing passenger information services to the travelling public on BR trains.

Cost of GSM-R on BR

The cost of providing Mobile Train Radio Communication on the CTC sections mentioned above will be approximately USD 20 million.

7.2.9 Customer-Faced Information Technology Upgrades

BR will install CCTV at stations, trains and level crossings for real time view by drivers, CTC supervisors and station masters within the plan period. Remote announcement of PA Systems on trains for from the CTC centres will be possible.

BR will also establish an MIS, on-line reservation and ticketing, Passenger Services (Internet Access (Wi-Fi), PIS- Passenger Information Systems, broadband services onboard moving trains.

7.2.10 Telecommunications

BR will establish matching telecommunication and ICT architecture for the above systems. Broad band telecommunication backbone using Optical Fibre, GSM-R, LTE-R, satellites and GPS for Train Control, Train to ground connectivity, connecting station and trackside equipment and systems is envisaged.

7.3 Construction of New Rail Lines

In recent years, the railway system has been the beneficiary of extensive investment in fixed infrastructure, accompanied by purchase of some rolling stock. Dhaka-Chittagong will soon be MG double track all the way but, to serve BG trains, conversion to DG is now in progress.

Other recent network developments include:

- Connecting Tarakandi (where there is a fertiliser plant) to Bangabandhu Bridge (completed in 2012)
- Reconnecting to the BG Indian Railways BG network at Birol border crossing and converting Birol-Parbatipur from MG to DG (2016). The whole MG section west of the Parbatipur-Chilahati BG section has been converted to DG
- Reopening the spur line to Faridpur [20.08.2014] so it can be extended to a line crossing Padma Bridge, if constructed
- The BG branch line Kalu Khali- Bhatiapara ghat which was closed earlier re-opened in early 2013
- Tangi- Bhairab Bazar, which was single line MG track, opened as double line MG track last year. Similarly, Cinkia Astana- Laksam single track MG section was opened as double line MG track recently
- Construction work has started to convert the Akhaura – Laksam single line MG section to double line DG
- Construction work on the Dohazari- Cox's Bazar – Gundum section as single line DG will soon be started
- Construction work on the Dhaka – Narayanganj section to add a DG line to the existing single MG line has already started
- Further construction of 3rd and 4th lines between Dhaka and Tongi and single line to double line conversion from Tongi to Joydebpur will soon start
- Construction of the Ishurdi- Dhalarchar line has started
- Construction work of the Dhaka- Padma- Bhanga- Jessore line (Padma Link) is being started

Several new rail line projects have been assessed in recent years as part of the Bangladesh Railway Sector Improvement Project (BRSIP) and Regional Cooperation and Integration Project (RCIP), both funded by ADB:

1. Rail-only bridge parallel to Bangabandhu Bridge
2. Bogra-Jamtoil (western end of Bangabandhu Bridge)
3. Rail-only bridge north of Bangabandhu bridge
4. Repair or replace Hardinge Bridge
5. New line over the Padma Bridge, from south Dhaka to Jessore
6. New line from Dohazari to Cox's Bazar
7. Double-track Joydebpur-Ishurdi
8. Double-track Akhaura-Laksam

Of these, implementation of the last four (6, 7, 8 and 9) is underway.

Other projects being implemented are:

9. Khulna-Mongla rail link
10. Akhaura-Agartala rail link
11. Adding tracks 3 and 4 to Kamlapur-Tongi
12. Adding a DG track beside the MG Kamlapur-Narayanganj track

The following projects are yet to be subject to feasibility studies:

13. Chittagong Bypass
14. Deep Sea Port and coal terminal rail access
15. Barisal branch line and extension to Payra Port
16. Dhaka-Chittagong via Comilla/Laksam high-speed railway

These are discussed in more detail below.

7.3.1 Rail-only Bridge Parallel to Bangabandhu Bridge

The project proposes a new rail-only bridge 300m upstream of the Bangabandhu Bridge with two DG tracks and opening in 2023.

The project will remove the rail bottleneck caused by severe speed restrictions on Bangabandhu Bridge. The new rail bridge will facilitate direct container trains in SAARC countries. More trains can be operated at higher speeds. Rail freight will be allowed 25 tonne axle loads rather than the restrictive 16 tonne limit currently on Bangabandhu Bridge.

The project benefits road traffic and the Bangladesh Bridge Authority because Bangabandhu Bridge will soon reach its theoretical road traffic carrying capacity. Removing the railway permits Bangabandhu Bridge to reclaim its full four-lane width and defers the need to duplicate the bridge. It is assumed that in 2024, the year after the rail bridge opens, construction will be undertaken to restore the Bangabandhu Bridge to its originally intended width and traffic-carrying capacity, which will then suffice until 2030.

Freight transport demand arises mostly from regional trade with India. The new rail bridge will be well suited to carry container trains to transport national as well as regional traffic. In opening year, an average of four or five slots daily might be used by container trains, and two by a petroleum train to Bogra. This is estimated to rise to eight freight slots when the capacity of the new bridge is reached.

In 2014 values, the project financial cost is BDT 8,460 crore, economic NPV is BDT 2,420 crore discounted to 2023 and EIRR 21.6% pa. The project cost in 2016 values is BDT 9,410 crore.

Additional capacity and benefits can be secured by introducing more intermediate block sections or by double-tracking.

This project has been approved by Government and procurement of consulting services is underway.

7.3.2 Bogra-Jamtoil (Western end of Bangabandhu Bridge)

The project proposed is a new MG single-track between Bogra and Jamtoil with a capacity of nine up and nine down trains daily. It would shorten the journey distance and time for trains operating between East Zone and the north-west of the country, particularly those passing through Bogra, Gaibandha and Lalmonirhat. Importantly, it would ease the capacity constraint between Ishurdi and Jamtoil.

	Capacity	Trains/day
Santahar-Ishurdi	36	22
Ishurdi-Jamtoil	28	24

For passengers, the project catchment area for the Bogra-Jamtoil line is the area served by the existing line from Bogra to Lalmonirhat, plus the area between Bogra and Sirajganj. The project will not serve areas further west as those trains would continue to use the line from Parbatipur to Santahar and Ishurdi Junction. This is due to the track layout at Parbatipur. Reversal of the locomotive is needed at Parbatipur for a train from Dinajpur (a major district centre) to transit Parbatipur in the direction of Lalmonirhat. It would also require another locomotive reversal at Kaunia Junction before the train could head south to Bogra. Two reversals would add almost an hour to the travel time and neutralise the advantage of using Bogra-Jamtoil.

The project's freight catchment is a very productive agricultural area which supplies fresh vegetables to Dhaka. For other freight, journey time is not important. Loss of an hour for locomotive reversals is not a deciding factor. Hence the MG freight catchment comprises the following lines.

- Sirajganj-Bogra-Kaunia Junction-Lalmonirhat-Burimari (border with India)
- Kaunia Junction-Parbatipur-Dinajpur-Kanchan-Birol (border with India)
- Tista – Kumigram – Ramna Bazar branch lines.
- Parbatipur-Saidpur-Nilphamari-Chilahati
- Kanchan-Thakurgaon Road-Panchagarh.

Two additional sources of freight are connected to Parbatipur rail yard by a DG line paralleling the main line towards Bhawanipur before turning eastward to loading facilities at Madhyapara (hard rock) and Barapukuria (coal). Rock and coal arriving at Parbatipur by MG wagons can move directly to Kaunia Junction and, after locomotive reversal, continue to Bogra and beyond.

In 2010 values, the project financial cost is BDT 1,190 crore, economic NPV is BDT 1,170 crore and EIRR is 28.6%pa. In 2016 values the financial cost is BDT 1,750 crore.

7.3.3 New Line Over the Padma Bridge, from South Dhaka to Jessore

This project is timed to open in 2023 as a BG single track. It connects Dhaka to Jessore and beyond to Benapole on the India border. The Dhaka-Benapole rail route over Bangabandhu Bridge is 391km but only 206km over the Padma Bridge, saving 185km. The distance between Dhaka and Khulna will reduce to 207km, saving 215km.

The Padma Bridge is scheduled for completion at the end of 2018. By replacing the slow and congested ferries, the bridge will markedly reduce the travel time between Dhaka and Khulna. The rail passenger services will lose patronage and likely cease. If the Padma rail link is constructed, the passenger rail services will become competitive and resume. Nonetheless, the Padma line will carry few passenger services. Its main function will be to carry freight.

The feasibility study assumed that Indian containers delivered to Benapole are transferred to BR rakes of 49 container flats, double-stacked, with 25% hauled to the ICD in south Dhaka and 75% to Chittagong or the Maheshkhali deep sea port.

At opening year, 6 slots per day are used for passenger trains to and from Khulna, 14.5 for carrying Indian containers and 10 for domestic freight. The feasibility study grew the domestic freight at 5% pa and the Indian containers at 6.5%pa until line capacity of 44 slots per day is reached in 2037. For all freight, 25% is assumed to terminate or originate at south Dhaka ICD and 75% at Chittagong or a deep sea port at Maheshkhali.

In 2014 monetary values the financial cost of the rail infrastructure is BDT 20,970 crore, the economic NPV is BDT 990 crore discounted to 2023, and the EIRR is 12.6%pa. A subsidy of 116% of revenue is needed to reach a financial return of 3.3% pa which is BR's WACC. The project cost in 2016 values is BDT 23,330 crore.

The analysis did not assume a branch line to Barisal and continuing to the port at Payra.

7.3.4 Rail-only Bridge North of Bogra

A proposal for new rail-only bridge north of Bogra has been studied and found to be uneconomic. Even the least costly option (BDT 8,080 crore in 2014 values) managed an EIRR of only 3.1%pa, far below the desired minimum of 12%pa. And this was under the extraordinarily favourable assumption that a rail bridge parallel to Bangabandhu Bridge is not constructed, even though it has a very high EIRR.

If the aim is to provide north-west Bangladesh with a more direct connection with East Zone (especially Dhaka) this is best achieved by building the Bogra-Jamtoil link to connect more directly to Bangabandhu Bridge.

If a new bridge in northern Bangladesh is ever justified it would be for road traffic. Such a road bridge might, like Padma Bridge, be designed to serve rail also.

7.3.5 Replace Hardinge Bridge.

The double-track Hardinge Bridge over the Padma River opened in 1915. It is designed for 18 tonne axle loads. It is proposed to replace it with a bridge designed from 25 tonne axle loads which is the regional design standard. The cost is estimated to be BDT 2,450 crore in 2014 values, or BDT 2,720 crore in 2016 values.

7.3.6 Chittagong bypass

At present, most Chittagong rail services terminate at Chittagong station. Extending the main line from Dohazari to Cox's Bazar has implications for expresses from Dhaka. The track layout at Chittagong necessitates locomotive reversals at Chittagong station. For the traffic volumes contemplated, reversals would not be practical and would damage rail's competitiveness. Construction a Chittagong bypass is essential.

7.3.7 Conversion of Chittagong-Dohazari from MG to DG

The new Cox's Bazar line starts from Dohazari as a DG line. The line from Chittagong to Dohazari needs conversion to DG in order to provide DG continuity, otherwise the additional cost in building a DG line will be wasted.

7.3.8 Rail access to a coal terminal or Deep Sea Port

A regional Deep Sea Port was proposed at Sonadia Island, north of Cox's Bazar on the other side of the inlet. A feasibility study was undertaken in 2008[21] and in November 2013 DP World Ltd expressed interest in developing the port under a government-to-government agreement between Bangladesh and Dubai. Attention has shifted to Maheshkhali Island, immediately north of Sonadia, where two coal-fired plants are planned at a location called Matarbari. Imported coal would be received at a bulk terminal serving large bulk carriers. The current proposal is to develop on Maheshkhali Island a regional Deep Sea Port nearby.

It is questionable whether this regional port proposal can survive the decision to develop a port at Payra. That said, the cost of developing Payra and its supporting infrastructure are daunting, and present ambitions may not be realised.

If only the coal terminal and power stations are developed on Maheshkali Island there is scope for rail transport of coal to other industries, such as brick kilns, and evacuation of fly ash which can be used in cement manufacture. Accordingly, a spur line from the new DG line to Cox's Bazar could be built to Matarbari.

If a regional Deep Sea Port were to be built on Mahaeskhali Island, rail access would be imperative. With such development a spur line from Ramu to Gundum, on the border with Myanmar, should be considered. The Gundum border crossing is currently closed but it is plausible that the Burmese railway might be extended 150km to the border at Gundum (albeit through unfavourable terrain, for a railway) and connect to the regional Deep Sea Port. Such a proposition faces two impediments, however. See Figure 7-9.

[21] Techno-Economic Feasibility Study of a Deep Sea Port in Bangladesh, Pacific Consultants 2008.

- China plans a deep water mega-port (ultimately 92 berths) at Kyaukphyu with road, rail and pipeline links to Kunming. Politics have intervened, however, and only the pipeline is complete.
- India is completing its INR 29.0 billion22 Kaladan Multimodal Transit Transport Project which links "mainland" India to its north-eastern states. It comprises: (i) a 539km maritime link from Kolkata to Sittwe port, where terminal facilities have been built, (ii) 158km of inland waterway on the Kaladan River from Sittwe to Paletwa, (iii) 110km of road to the border with India and (iv) 100km of road from the border to Lawngtlai in Mizoram, India.

At present the credible eventuality is that there is no regional Deep Sea Port and that the coal terminal on Maheshkhali Island is connected by a BG spur line to the new DG line from Dohazari to Cox's Bazar.

Figure 7-9 Sittwe and Kyaukphyu Ports in Myanmar

Source: The Economist 27 April 2013

7.3.9 Barisal branch line and extension to Payra Port

A component of the existing master plan is a branch line to Barisal, an important district centre of Bangladesh. Construction of this line is made possible by the current project connecting Dhaka with Jessore over the Padma Bridge. The line to Barisal accords with the vision to connect all major district centres via the railway network.

The existing master plan shows a tentative extension from Barisal to the south. If this line were built it would most likely terminate at Payra where development of a planned new port has started. The draft at Payra can serve vessels larger than those calling at Chittagong. At this early stage of development, ships will discharge to lighters, until such time as a quayside container terminal opens.

The Payra master plan is ambitious, perhaps idealistic. It makes no claim to be viable economically and financially. Conditions in the alluvial Sundarbans are not favourable for infrastructure needing strong foundations— such as container handling areas and railway lines.

22 http://pib.nic.in/newsite/PrintRelease.aspx?relid=128699

The Barisal-Payra extension proposal is, at this time, too uncertain to be included in this master plan.

7.3.10 Conversion of Laksam-Chittagong double track from MG to DG

Even if the Chord Line were not to eventuate, provision of BG connectivity to Chittagong demands that this section is converted from MG to BG.

7.3.11 Conversion of Tongi-Akhaura double track from MG to DG

Completion of the bridges under construction on Bhairab-Ashuganj will shortly complete MG double-tracking of Bhairab-Akhaura. Conversion of Akhaura-Laksam to DG double track has commenced. If Laksam-Chittagong is converted to DG then Conversion of Tongi-Akhaura double track from MG to DG will complete Dhaka-Chittagong as a double track DG link.

7.3.12 Double track DG connection to Chittagong port

This project will convert the Fauzderhat-CGPY[23] line from MG to DG and constructs a new parallel DG line. The CGPY yard and rail container terminal at Chittagong Port will also be modified.

7.3.13 Dhaka-Chittagong via Comilla/Laksam high-speed railway

The current alignment for the Dhaka-Chittagong line is a 321 km circuitous route passing through Tongi, Bhairab Bazar, Brahmanbaria and Comilla. Several projects have been suggested in the past to connect Dhaka to Chittagong more directly through Comilla and Laksam. This would reduce the distance to about 230 km. Trains could operate at speeds of up to 200 kph. The combination of reduced distance and higher speed could reduce the travel time between Dhaka and Chittagong by four hours or so. An indicative cost is BDT 30,000 crore with construction taking five years. It is not clear whether this cost includes rolling stock.

This project would enhance the viability of several other large projects in Southeastern Bangladesh, including the proposed Sonadia Deep Sea Port and the rail line between Chittagong and Cox's Bazar. It would enhance the viability and increase the timeliness of both passenger and container transport between Chittagong and Dhaka. Finally, by reduction of traffic on the existing line between Dhaka and Akhaura, it would reduce the pressure on that line.

At present the high speed line is a preliminary concept presented to the government by outside interests. The original proposal suggested a standard gauge line. Since it introduces a new gauge, at a time when strenuous efforts are being made to standardise on one gauge, for this project to have merit in SG it would need to be a section of a trans-Asia rail route that is all SG. It could, however, be built as BG.

7.4 Maintenance and Rehabilitation of Infrastructure

Part of the consultants' mandate was an "Assessment for establishment of Mechanized Track Maintenance Unit of BR and recommendations for the strategy, investments and organization". Introduction of MTMU into a railway can be accomplished most economically and efficiently if

[23] Chittagong port yard

there are already modern infrastructure inspection and maintenance processes and technologies in other areas. As such, their analysis went beyond what normally constitutes a MTMU to include all elements of infrastructure maintenance, inspection and monitoring.

Effective infrastructure inspection and monitoring processes are the cornerstones for ensuring the integrity of the infrastructure, the most efficient utilization of track machinery and the most effective capital renewal programs. It is recommended that BR implement in conjunction with its MTMU, a complete renewal of these processes to include qualified and equipped infrastructure inspectors and modern technologies for monitoring infrastructure condition. It is further recommended that inspectors work on fixed schedules assigned territories and follow clear processes with respect to observed defects; and routine recording of inspection details. Inspectors will need to be knowledgeable of infrastructure defects and the fundamentals of infrastructure degradation; which will require qualified individuals with specialized training and relevant experience. It is recommended that inspectors be equipped with rail-cum-road (RCR) vehicles and laptop computers for real time recording of inspection records and monitoring infrastructure condition on their territory.

Geometry Recording Vehicles (GRV) and Rail Flaw Detection (RFD) are recommended inspection technologies. Both types of vehicles will be rail-cum road vehicles for maximum flexibility. Along with visual inspections, these tests will best assure the safe operation of track infrastructure; and as well as information collected will be the foundation for future maintenance and capital renewal programs.

It is recommended that infrastructure maintenance be undertaken by either local or mobile gangs. Local gangs will be located at section headquarters across the rail network and be assigned territories for which they will be responsible for day-to-day maintenance of fixed infrastructure including remedial action for defects and near-defects and emergency response to incidents. They will work closely with track and bridge inspectors and will be equipped with RCR vehicles and hydraulic tools.

The MTMU (also known as mobile gangs) will be responsible for scheduled, centrally-planned track maintenance activities including track tamping, continuous action tamping (CAT) and switch tamping along with ballast profiling. MTMU gangs will be mechanized and designed to most efficiently use short block times and minimize speed restrictions after work is performed. Their work scheduled will be planned well in advance and will be built upon details of visual inspection records and records of defects identified by tests of Geometry Recording Vehicle (GRV).

BR currently has two different gauges as well as dual gauge combined with three sleeper types and track of varying condition. This adds complexity but not unsurmountable challenges to the development of the maintenance organization. The challenges of three sleeper types and varying track condition (especially related to quality and quantity of ballast) are more significant. The proposed solution is to undertake implementation in phases with Phase 1 to include only lines with precast concrete sleepers (PCS) and with a minimum of 250 mm of clean ballast below the sleepers. As there are very few lines that currently meet the requirement for ballast cushion, it is recommended that many lines be upgraded so they can be included in Phase 1. After the implementation of Phase 1, as lines are either constructed or rehabilitated to the minimum standard, MTMU and other recommendations can be implemented.

We recommend a two-tiered maintenance organization with

- System Engineering responsible for policy and strategy; infrastructure testing; and maintenance and sharing of track machinery and vehicles; and
- Zonal Engineering (Eastern and Western) responsible for development of plans and execution of maintenance and renewal programs; visual inspections of infrastructure; and response to incidents and in-service failures.

The proposed maintenance organization will lead to changes in permanent way (track and civil) personnel requirements. Productivity improvements will come from mechanization, technology and improved employee competency. Personnel changes will require training of existing personnel for changed MTMU roles, lateral transition for redundant staff into other areas of BR and, likely, hiring programs. Benchmarking against international railways indicates that BR would initially lag international railways in terms of employee productivity. However, productivity can be expected to improve over time as the investment in mechanization, technology and training began to pay off. In order for investment to pay off over time, the political will needs to be in place to implement and sustain the necessary changes in organizational culture and structure.

Details of the implementation plan for MTM can be seen in the companion report to this document "Mechanized Track Maintenance Unit". The implementation plan has been included in the project database as two phases of the same project:

- Introduction of Mechanized Track Maintenance Phase 1 (capital cost USD 135 million, or BDT 1,040 crore). This includes necessary ballast upgrades prior to actual introduction of MTM. This is scheduled to be undertaken in Phase 1 of this Master Plan timeline, or between 2016 and 2020
- Introduction of Mechanized Track Maintenance Phase 2 (capital cost USD 31.9 million, or BDT 246 crore)). This is scheduled to be undertaken in Phase 2 of this Master Plan timeline, or between 2021 and 2025.

7.5 Maintenance and Rehabilitation of Rolling Stock

7.5.1 Introduction

One of the project objectives is to assess the existing BR maintenance facilities and identify areas where additional capacity and additional inputs are required. This includes evaluation of existing major workshop infrastructure facilities, maintenance practices, machinery and plant condition and all other factors affecting performance of these workshops.

This due diligence and diagnostic analysis is thus the key input into the creation of the future plan for BR Rolling Stock maintenance facilities. It establishes the baseline upon which infrastructure upgrades, operational changes and institutional enhancements will be recommended for the BR facilities.

Further details of the scope, execution and results of analysis of BR Rolling Stock Maintenance can be seen in the Rolling Stock Maintenance Report issued as part of this project, and the

reader is recommended to refer to this report for those details. This section will simply summarize the main findings and list the projects identified as a means of executing those recommendations.

7.5.2 Main Findings of the Rolling Stock Maintenance Report

The analysis identified the following major factors affecting rolling stock maintenance:

- Over age rolling stock – a very high percentage of BR rolling stock is over industry standard economic life. Their failure rate is high and they require frequent attention. Overage stock also has problem of obsolescence and non-availability of spares.

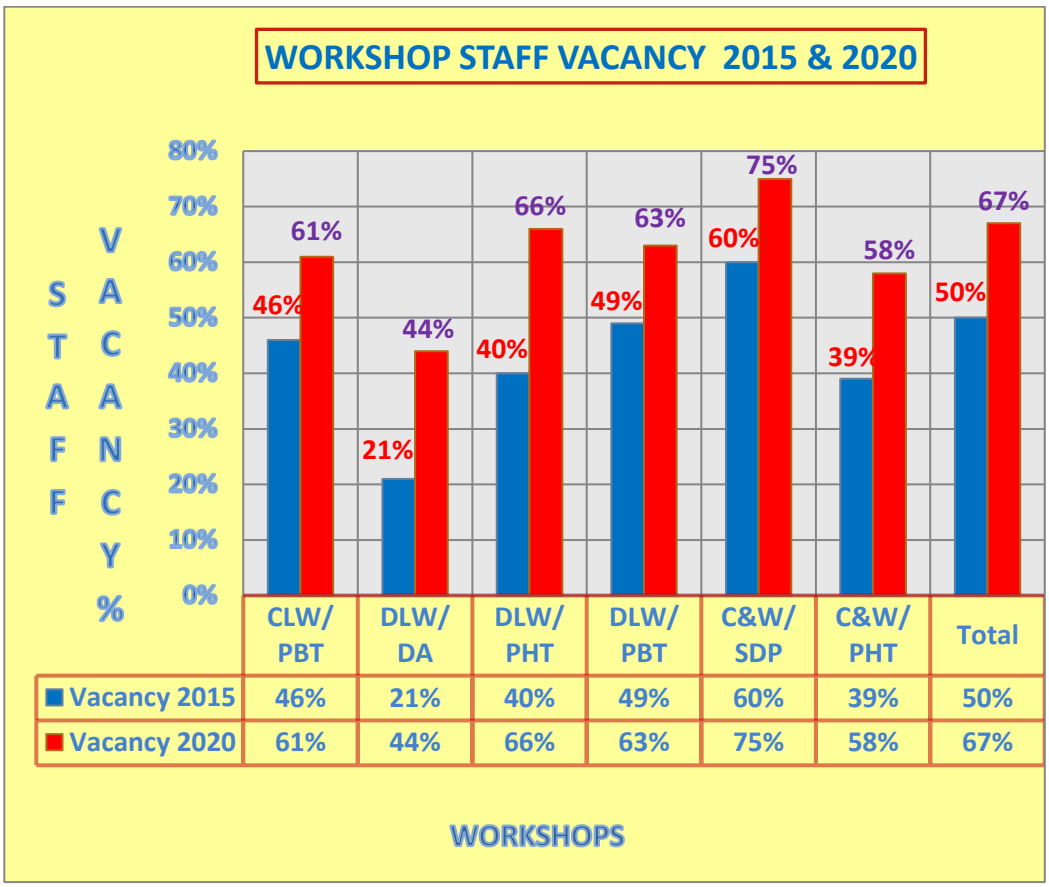
Table 7-5: BR Overage Rolling Stock As At June 2016

S.No.	Type of Rolling Stock		Economic Life Yrs.	Number on Books	No. Overage	Overage %
1.	Locomotive	BG	40	94	31	33
		MG	40	186	66	35
2.	Coaches	BG	35	312	91	29
		MG	35	1165	583	50
3.	Wagon	BG	40	2079	888	42
		MG	40	6850	5448	80

Source: BR Mechanical Department

- Diesel locomotive infrastructure – all three Diesel Locomotive Workshops located at Dhaka, Parbatipur and Pahartali are converted loco running sheds. All three workshops have very low loco berthing capacity, poor support shop facilities, inadequate space to attend components and sub-assemblies, etc.
- Human Resources –all rolling stock maintenance workshops have very serious problems of staff shortage. At present, vacancies vary from 20% to 60% in different workshops and within next five years this will go up to 44% to 75%.

Table 7-6: BR Maintenance Workshop Staff Vacancies As At June 2015 and June 2020



Source: BR Mechanical Department

- Shop floor staff skill level is very poor as they are not given any practical or hands on training. Training units attached to workshops are very poorly equipped and have no facility for practical training.
- Materials, Components and Spare Parts Procurement – the consultants noted during visits to maintenance workshops that all of them had large number of materials, components and spare parts out of stock, affecting maintenance performance.
- Rolling Stock Condemnation Policy – condemnation of rolling stock under current BR condemnation policy is very difficult for procedural reasons. This results in very large numbers of rolling stock continuing on the books even though these assets have been taken off the rails and are no longer functional as rolling stock.
- Inadequate Maintenance Budget Allocation – Many workshops have to lower their out turn level because of low budget allocations. In fact Saidpur and Pahartali workshops have not done the very important coach GOH schedule under their annual budget for the last fifteen or more years and many coaches are running overdue according to this schedule.

7.5.3 Recommendations

Based on above analysis and observations the following new project recommendations are made:

New RS Maintenance Projects 2016 – 2025

Table 7-7: New Projects Recommended for BR Rolling Stock Maintenance 2016-25

Project No.		Project Name	Project Cost (BDT)
59	2018-20	Modernization of Parbatipur Central Locomotive Workshop	770 crore
60	2018-20	Construction of new locomotive workshop at Naryanganj: i. 150 loco maintenance capacity ii. Workshop will be capable of attending BG and MG locomotives iii. All schedules (Sch F & Sch G) will be attended at the workshop iv. Approach and all tracks inside the workshop will be dual gauge v. Staff strength will be approximately 1050	Total Capital Cost of New Workshop - 1155 crore i. 1st year CAPEX – 10% ii. 2nd year CAPEX – 30% iii. 3rd year CAPEX – 50% iv. 4th year CAPEX – 10% (Above cost does not include land cost)
61	2018-20	Construction of Repair & Maintenance Workshop for DEMU at Narayanganj: i. 75 DEMU sets maintenance capacity ii. Workshop will be capable of attending BG and MG DEMU train sets iii. Workshop will attend both power cars and coaches iv. Approach and all tracks inside the workshop will dual gauge v. Staff strength will be approximately 850	Total Capital Cost of New Workshop - 963 crore i. 1st year CAPEX – 10% ii. 2nd year CAPEX – 40% iii. 3rd year CAPEX – 50% (Above cost does not include land cost)
62	2021-25	New Carriage & Wagon Workshop at Rajbari: i. Workshop will have capacity to maintain 1,000 coaches and 2,000 bogie wagons ii. Approach and all tracks inside the workshop will dual gauge iii. Staff strength will be approximately 1,900	Total Capital Cost of New Workshop - 2503 crore i. 1st year CAPEX – 5% ii. 2nd year CAPEX – 20% iii. 3rd year CAPEX – 60% iv. 4th year CAPEX – 15% (Above cost does not include land cost)
63	2021-25	New Diesel Locomotive Workshop at Chittagong: i. 125 loco maintenance capacity expandable to 150 locos ii. Workshop will be capable of attending BG and MG locomotives iii. All schedules (Sch F & Sch G) will be attended at the workshop iv. Approach and all tracks inside the workshop will dual gauge Staff strength will be approximately 1,05	Total Capital Cost of New Workshop - 1155 crore i. 1st year CAPEX – 10% ii. 2nd year CAPEX – 30% iii. 3rd year CAPEX – 50% iv. 4th year CAPEX – 10% (Above cost does not include land cost)

70	2018-20	Upgradation and reconstruction of Dhaka Diesel Loco Shed including equipment upgrade and DG conversion	Total Capital Cost: BDT 500 crore
71	2018-20	Reconstruction of Diesel Loco sheds (09 total) including Equipment upgrade and DG Conversion	Total Capital Cost: BDT 3,500 crore
72	2018-20	Reconstruction of Washing Pits & Coach and Wagon Depots (14 total) including equipment upgrades and DG conversion	Total Capital Cost: BDT 4,000 crore
73	2018-20	Enhancement of Technical Training Facilities at 5 existing Workshop Training Units	Total Capital Cost: BDT 80 crore
211	2021-25	Capacity enhancement and construction of additional new units of Saidpur Carriage & Wagon Workshop	Total Capital Cost: BDT 800 crore
212	2018-20	Capacity enhancement and construction of additional new units of Saidpur Carriage & Wagon Workshop	Total Capital Cost: BDT 754 crore

New RS Maintenance Projects 2026 – 2035

Table 7-8: New Projects Recommended for BR Rolling Stock Maintenance 2026-35

Project No.		Project Name	Project Cost
64	2031-35	BR will have approximately 450 locomotives by 2025. This means there will be 450x6= 2700 traction motors on the system. Average life of a traction motor is 18 years, i.e. approximately 140 motors will be attended every year in addition to breakdown repairs. It is recommended that a new Traction Motor repair and rewinding workshop should be set up at CLW, Parbatipur. i. Workshop capacity will be to attend 200 traction motors (BG and MG) per year for regular maintenance and about 100 motors for special repairs ii. Workshop will be capable of traction motor rewinding, commutator repair and stator repair iii. Staff strength will be approximately 550	Total Capital Cost of New Workshop: 385 crore i. 1st year CAPEX – 20% ii. 2nd year CAPEX – 40% iii. 3rd year CAPEX – 40% (Above cost does not include land cost)
65	2026-30	New Diesel Locomotive Workshop at Rajbari: i. 150 loco maintenance capacity ii. Workshop will attend only BG locomotives	Total Capital Cost of New Workshop: 1155 crore i. 1st year CAPEX – 10% ii. 2nd year CAPEX – 30% iii. 3rd year CAPEX – 50%

		iii. All schedules (Sch F & Sch G) will be attended at the workshop iv. Staff strength will be approximately 1,050	iv. 4th year CAPEX – 10% (Above cost does not include land cost)
66	2026-30	New BG Carriage and Wagon Maintenance Workshop at suitable location of Mymensingh: i. Workshop will have capacity to maintain 1,500 BG -coaches ii. Approach and all tracks inside the workshop will dual gauge iii. Staff strength will be approximately 1500	Total Capital Cost of New Workshop: 2310 crore i. 1st year CAPEX – 5% ii. 2nd year CAPEX – 20% iii. 3rd year CAPEX – 60% iv. 4th year CAPEX – 15% (The above cost does not include land cost)
67	2026-30	New Diesel Electric Multiple Unit maintenance Workshop at Ishurdi: i. 75 DEMU sets maintenance capacity ii. Workshop will be capable of attending BG and MG DEMU train sets iii. Workshop will attend both power cars and coaches iv. Approach and all tracks inside the workshop will dual gauge v. Staff strength will be approximately 850	Total Capital Cost of New Workshop: 963 crore i. 1st year CAPEX – 10% ii. 2nd year CAPEX – 40% iii. 3rd year CAPEX – 50% (The above cost does not include land cost)
213	2031-35	Construction of new Carriage & Wagon Depot and Loco Shed to meet additional traffic demand	Total Capital Cost: BDT 400 crore

New RS Maintenance Projects 2036 – 2045

Table 7-9: New Projects Recommended for BR Rolling Stock Maintenance 2036-45

Project No.		Project Name	Project Cost
68	2036 - 40	Reconstruction of existing Carriage & Wagon Workshop at Chittagong: i. Workshop will have capacity to maintain 1,000 BG -coaches and 3,000 bogie wagons ii. Approach and all tracks inside the workshop will dual gauge iii. Staff strength will be approximately 1900	Total Capital Cost of New Workshop - BDT 2755 crore i. 1st year CAPEX – 5% ii. 2nd year CAPEX – 20% iii. 3rd year CAPEX – 60% iv. 4th year CAPEX – 15% (The above cost does not include land cost)
69	2036-40	New Diesel Electric Multiple Unit maintenance Workshop at Chittagong: i. 75 DEMU sets maintenance capacity ii. Workshop will be capable of attending BG and MG DEMU train sets iii. Workshop will attend both power cars and coaches	Total Capital Cost of New Workshop: BDT 963 crore i. 1st year CAPEX – 10% ii. 2nd year CAPEX – 30% iii. 3rd year CAPEX – 50% iv. 4th year CAPEX – 10%

		iv. Approach and all tracks inside the workshop will dual gauge. v. Staff strength will be approximately 850	(The above cost does not include land cost)

7.5.4 Rolling Stock Maintenance Capacity Enhancement

All new projects identified above will create better and enhanced locomotive, coach and wagon maintenance facilities. But this goal will be achieved only when adequate and timely provision of other major inputs like men, machines, material and money is made.

Maintenance facility enhancement details for each type of rolling stock are shown below:

Table 7-10: Locomotive Maintenance Facility Enhancement

Project No.	Project Completion Date	Project	Locomotives		
			BG	MG	Total Capacity
	Present Status	Diesel Locomotive Workshop, Parbatipur	97	0	97
		Diesel Locomotive Workshop, Dhaka	0	59	59
		Diesel Locomotive Workshop, Pahartali	0	121	121
		TOTAL	97	180	277
60	2022	New 150 loco capacity Dual Gauge Diesel Locomotive Workshop, Dhaka to replace old one.	150		277+150 - 59 = 368
63	2029	New 150 loco capacity Dual Gauge Diesel Locomotive Workshop, Chittagong to replace Pahartali workshop.	150		368+150 - 121= 397
65	2031	New 150 loco capacity BG Diesel Locomotive Workshop, Rajbari to replace Parbatipur workshop.	150	0	397+150 - 97 = 450

Table 7-11: Coach Maintenance Facility Enhancement

Project No.	Project Completion Date	Project	Coaches		
			BG	MG	Total Capacity
	Present Status	C&W Workshop, Saidpur	625		625
		C&W Workshop, Pahartali	0	600	600
		TOTAL			1,225
62	2024	New Dual Gauge C&W Workshop, Rajbari. Capacity 1,000 coaches.	1,000		2,225
66	2033	New Carriage Workshop at location to be decided later. Capacity 1,500 coaches.	1,500		3,725

Project No.	Project Completion Date	Project	Coaches		
			BG	MG	Total Capacity
68	2040	Reconstruction of existing Carriage & Wagon Workshop at Chittagong. Capacity 1,000 BG coaches. Existing MG Workshop at Pahartali will be demolished because unigauge is expected to be completed by 2036.	1,000		3,725+1,000-600 = 4,125

Table 7-12: DEMU Maintenance Facility Enhancement

Project No.	Project Completion Date	Project	DEMU		
			BG	MG	Total Capacity
	Present Status	DEMU Maintenance Facility	0	0	0
61	2023	Dual Gauge DEMU Maintenance Facility, Narayangunj/nearby Dhaka	75 sets		75 sets
67	2035	BG DEMU Maintenance Facility, Ishurdi	75 sets		150 sets
69	2042	BG DEMU Maintenance Facility, Chittagong	75 sets	0	225 sets

Table 7-13:Wagon Maintenance Facility Enhancement

Project No.	Project Completion Date	Project	Wagon		
			BG	MG	Total Capacity
	Present Status	C&W Workshop Workshop, Saidpur	3,500 Bogie Wagons (BW)		6,000 Bogie Wagons
		C&W Workshop, Pahartali	0	2,500 BW	
62	2024	New Dual Gauge C&W Workshop, Rajbari. Capacity 2,000 Bogie Wagons.	2,000		8,000
68	2036	Reconstruction of existing Carriage & Wagon Workshop at Chittagong. Capacity 3,000 BG wagons. Existing MG Workshop at Pahartali will be demolished because unigauge is expected to be completed by 2036.	3,000		8,000 + 3,000 -2,500 = 8,500 bogie wagons

With the commissioning of all recommended projects and provision of all the necessary inputs, BR rolling stock maintenance capacity will be:

i. Locomotive : 400

ii. Coaches : 2,625 vehicles

iii. DEMU : 75 sets of 5 vehicles each

iv. Wagon : 8,500 bogie wagons

7.5.5 Diesel Loco Shed Upgrade

Diesel locomotives light repair schedules and trip inspections are carried out at loco sheds. BR has ten diesel loco sheds:

i. BG loco sheds : 3

ii. MG loco sheds : 4

iii. MG loco sheds : 3

(Only trip inspection)

These sheds have inadequate infrastructure and support shop facilities and very old machinery & plant. BG loco sheds need upgrade and MG sheds should be converted to dual gauge sheds. New dual gauge sheds will have to be constructed wherever MG shed conversion is not possible.

Total cost for upgrading all ten sheds is estimated at BDT 4000 crore (See Projects 70 and 71).

7.5.6 Carriage & Wagon Maintenance Depot Upgrade

Every passenger train has a base station where it is attended to in a washing siding. The washing sidings provide facilities for internal and external cleaning, water filling and minor repairs like brake block change, etc. If any coach has defects that cannot be attended in the washing siding then it is marked to Carriage and Wagon Depot (C&W Depot) located at the same station.

BR has following washing sidings and C&W Depots:

i. BG Washing siding & C&W Depot: 4

ii. MG Washing siding & C&W Depot: 10

All washing sidings and C&W depots have inadequate infrastructure facilities, old machinery & plant, inadequate component and sub-assembly repair facility. These have to be upgraded.

Four BG facilities should be renovated and upgraded to meet current coach technology requirement, air conditioning system and mid-on/end-on generation system.

Ten MG facilities should be replaced by new dual gauge washing siding and C&W depots with all the modern facilities to attend hi-tech coaches.

Total cost for upgrading all 14 facilities is estimated at BDT 4000 crore (see Project No. 72).

7.5.7 Other Recommendations

Technical Training schools

There are five technical Training Units attached to various maintenance workshops. These are:

i. Workshop Training Unit, Pahartali

ii. Workshop Training Unit, Dhaka

iii. Workshop Training Unit, Parbatipuri

iv. Workshop Training Unit, Ishurdi

v. Workshop Training School, Saidpur

All newly recruited supervisors and artisan staff like diesel loco fitters, diesel loco electricians, carriage & wagon fitters and others artisans like welders, machinists, fitters, etc. should undergo theoretical and practical lessons at these units. But these units have very inadequate training facilities particularly in terms of working models, cut models, charts, posters, etc.

Cost: Cost of developing five training Units is estimated at BDT 80 crore (see Project No. 73).

Running Staff Rest Room Upgrade

A comfortable Rest Room facility for running staff is very essential to ensure undisturbed rest during their lay over at outstation. Present running staff rest room facilities are very old and with inadequate capacity.

BR should make provision for upgraded new clean and quiet resting places for running staff along with necessary messing, boarding and recreational facilities round the clock. New running rooms location should be decided taking into consideration noise pollution and air pollution. Proximity to booking lobby should also be considered to the extent possible.

Accommodation in all running rooms should be adequate to ensure not even a single case of a loco pilot/ assistant loco pilot/ guard waiting for a bed after arriving in the running room.

Running rooms may be classified on the basis of number of users per day:

i. Category "A" – 51 or more users

ii. Category "B" – between 21-50 users

iii. Category "C" – up to 20 users

Running rooms will be required at sixteen different places. Total running room facility should be to accommodate approximately six hundred fifty crew members of Mechanical, Electrical and Traffic departments.

Total cost of sixteen Running Rooms upgrade will be approximately BDT 45 crore (see Project No. 74).

Manuals and Codes Updating

All codes and manuals of mechanical and stores department are of steam locomotive and wooden body coach era and have become totally irrelevant to the current rolling stock and workshop practices. These need to be upgraded urgently.

Electrical department does not have a code and a new code is to be written.

Mechanical and Stores departments have the following five manuals:

i.	Code for Mechanical Department	:	Last edition 1964
ii.	Locomotive and Running Shed Manual	:	Last edition 1964
iii.	Carriage and Wagon Manual	:	Last edition 1964
iv.	Mechanical Workshop Manual	:	Last edition 1962
v.	Code for Stores Department	:	Last edition 1964
vi.	Code for Electrical Department	:	New code to be written

Cost of updating/writing all six manuals will be approximately BDT 31 crore (see Project No. 75).

7.5.8 Administrative & Procedural Reforms

The consultants have noted during visits to maintenance workshops and discussions with management that many current administrative orders/procedures are adversely affecting their performance. These are:

Staff Recruitment Policy

All workshops are carrying large vacancies (40-60%) seriously affecting workshop performance. These vacancies will go up to 75% and entire maintenance system will collapse if immediate action to fill up vacancies is not taken.

Procurement Policy Review

All maintenance workshops are facing serious problems of non-availability of critical parts, components and sub-assemblies. There are cases where critical assemblies are not available for the last two years for regular maintenance but are available for rehabilitation of coaches under project. If one arm of BR can procure parts the other should also be able to do it. There is, therefore, a need to review BR procurement policy.

Rolling Stock Condemnation Policy

The consultants noted during discussions that under the present policy rolling stock condemnation is not easy. Therefore, a very large number of rolling stock continues on books even when these have been taken off the rails. Many 100 years and above old wagons are still on BR wagon holding. This not only inflates the ineffective percentage but also gives a wrong picture of total holding. BR must review its rolling stock condemnation policy and make it simpler.

Budget Allocation

Adequate fund allocation is the very base to get the right quality and right quantity output from maintenance facilities. All workshops suffer from low maintenance budget allocation and have to, therefore, restrict procurement of spares, materials, tools, equipment, etc. This is one of the major factors for poor and low performance of various workshops.

Annual budget for maintenance workshops should be based on following scale:

i.	Locomotive	:	$100,000 per loco (BDT 7.7 lakh)
ii.	Air condition coach	:	$ 15,000/AC coach (BDT 1.2 lakh)
iii.	Non air condition coach	:	$ 12,500/Non-AC coach (BDT 1.0 lakh)
iv.	Wagon	:	$ 3,750/Wagon (BDT 28,900)

7.6 Rolling Stock Procurement

7.6.1 Background

Rolling stock requirement depends on a number of operating variables. Networks allowing faster speeds lead to better utilization of rolling stock thereby reducing the actual requirement of bogies/wagons/locomotives to carry same amount of cargo or passengers. Newer lines provide greater capacity enabling faster speeds and more train slots within a day. In this context, it is critical to incorporate the impact of these variables over rolling stock requirement forecasts over the Master Plan horizon.

A network capacity model was developed with following objectives:

- To determine the throughput capacity of BR's main rail corridors for handling both passenger and freight traffic based on current baseline infrastructure conditions.
- To compare available line capacity with future corridor traffic levels and identify capacity gaps that will require infrastructure upgrades and/or additions to meet traffic demand.
- To determine the potential improvement in capacity from various corridor upgrade scenarios that will remove current capacity and velocity constraints, initially without adding track. The results will be used to determine the additional infrastructure expansion investments that are required to support projected corridor traffic flows.
- To determine the impact of planned new linkages and other major infrastructure projects on rail corridor investment requirements, due to resultant changes in traffic flows and/or volumes. Consideration to be made for projects that support regional and sub-regional connectivity initiatives such as SAARC, BCIM corridors and TAR Route, BIMSTEC.
- To estimate rolling stock (RS) fleet requirements to support future traffic flows and infrastructure upgrade scenarios.
- To identify opportunities for increasing passenger capacity through utilisation of spare line capacity, where available and passenger demand justify, as well as from identified BR passenger/commuter service expansion plans.

A graphical illustration of the approach adopted by the model is illustrated in Figure 7-10 below.

Separate models were prepared for passenger and freight RS forecasts mainly because of significant difference in nature of operations and methodology adopted. A detailed summary of the methodology for each category is presented below:

7.6.2 Passenger Rolling Stock Forecasts

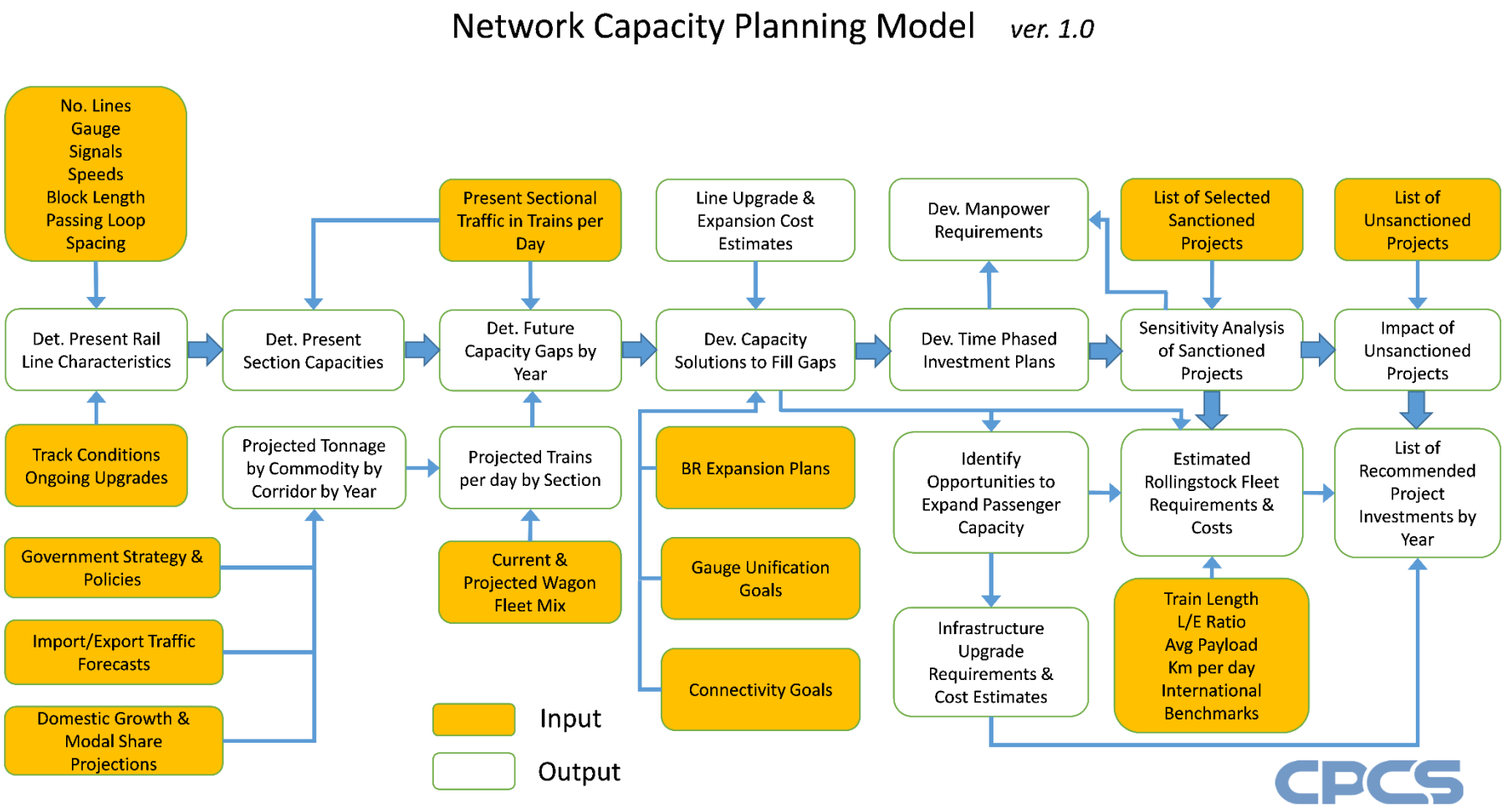
An excel-based model was set up with hardwired current passenger train time tables, train mix sourced from Bangladesh Railway as well as permanent way characteristics at 5-yr periods (2020, 2025, 2030, 2035, 2040, 2045) sourced from our gauge conversion plan. The following assumptions were made for various operational parameters in line with global and local practices in similar railways and consultant's expert judgement:

Parameters		
Growth in Passenger Traffic	5.0%	p.a.
Future Max. Train Size		
Inter City/Mail Trains	22	Carriages
Commuter Trains	10	Carriages
DEMU Trains	3	Carriages/Set
Effective Carriage Ratio		
Inter City Trains	19	Carriages

Parameters		
Mail Express Trains	16	Carriages
Commuter Trains	9	Carriages
Carriage Capacity		
MG	80	passengers
BG	100	passengers
MG Comm	150	passengers
BG Comm	188	passengers

Further, passenger growth factors were applied to the current passenger service schedule to estimate the year on year rolling stock requirements. It was assumed that the year-on-year rolling stock increase shall first result in adding more bogies to an existing train and thereafter introducing new trains, of full length irrespective of 5% increase estimation, which will be added once the trains in a sector reaches maximum bogie capacity. In this context, while some of the increase in rolling stock requirement appear at first glance to be gradual (e.g. 5% annual increase in passenger transport), in reality and given the accepted dictum that if we supply capacity it will be taken up, the actual increase in any one year could be greater than 5% average annual growth factor.

Figure 7-10: Network Capacity Planning Model



7.6.3 Freight Rolling Stock Forecasts

Detailed origin/destination (OD) data were collected from traffic accounts department of BR to assess the nature of current traffic movement on the BR network. These data were analyzed to estimate total tonnage movement across all unique OD pairs and number of wagons required assuming average load capacity for various wagons types as reported by BR. These estimated capacities, listed below, were used as base assumptions.

Capacity				
Commodity wise Average Ton/Wagon		MG	BG	
	Container	9.92	9.92	
	Fertilizer	18.94	23.73	
	Fuel Oil	13.07	20.04	
	Kerosene	20.00	20.00	
	Marble & Stones	18.90	22.36	
	Other Grains	15.87	20.69	
	Others	18.90	23.58	
	Petrol	13.07	20.00	
	Veg Oil	0.00	3.00	
	Wheat	15.87	20.69	
	Rice	15.87	20.69	
	Sugar	15.87	20.69	
Operating Days per year		350.00	350.00	days
Wagons Per Train		50.00	50.00	wagons

Further, due consideration was given to the nature of corridor gauge to arrive at total wagon requirement for current gauge mix on per day basis across all unique commodity wise OD pairs. Cycle time is another variable affecting wagon requirement and is defined as total time elapsed between end of a trip and start of next trip for the train. This includes total downtime for the wagon spent before entering the network again and is the sum of time for shunting operations, loading and unloading time, wagon servicing etc. In this context, the total train requirement per unique commodity-wise OD pair, assuming 50 four wheeler wagons per train was estimated as below:

Total train requirement = (Average Wagon per day required X Average cycle time)/50

The above algorithm does not include locomotives which are estimated separately. Unlike wagons, locomotives do not have to go through loading unloading time and in absence of any cycle time, their productivity is best measured by average loco kilometers travelled per day. Hence, demand for locomotives is directly related to the train kilometers derived as presented below:

$$\text{Locomotive required} = \frac{\text{(Total Trains required per year X Distance between OD pair)}}{\text{(Average Good Loco km per day X Operating Days per year)}}$$

These wagon and locomotive projections were plugged to develop a robust rolling stock demand model which was key to testing the various scenarios and identification of a roadmap for BR which is feasible and scalable. The rolling stock forecasts were extrapolated by various

traffic growth factors, derived from our traffic forecast, to assess actual requirement for five-year intervals over the Master Plan period. These forecasts were further subjected to three growth scenarios as noted below with incremental improvement in key operational parameters:

	Scenario 1- As-is Performance with Traffic Growth	Scenario 2- Improved operating performance, Capacity enhanced and Higher market capture	Scenario 3- Chord-line developed, Modern Rolling stock, Responsive holistic development of BR
Average Speed (KM/hr)	12	15	20
Turnaround time, each side (days)	4	3.5	3
Goods Avg Loco Km/day	174	220	250

Lastly, it was assumed that even if a particular route is converted to dual gauge, BR may shift to BG wagons only after fully utilizing the MG rolling stock over their remainder residual life. Hence, rolling stock forecasts were further fine-tuned assuming that a gradual shift shall be made to an all-BG operations eco-system.

7.6.4 Rolling Stock Procurement Plan

The freight and passenger rolling stock forecast results were further reviewed and fine-tuned by the Consultant's RS specialist and discussed with BR. After this, a rolling stock procurement plan was prepared and is shown in Table 7-14 below. The analysis is based on the BR rolling stock complement as of April 2017; any RS procured after that date should be assumed to be included in the numbers below. It should be noted that all Phase 1 procurement currently has sources of funding.

In addition to the numbers below, a further 100 BG carriages are scheduled to be procured under the Padma Bridge project. This procurement is noted separately as Project 218.

Table 7-14: Rolling Stock Procurement Plan

RS Procurement Summary Table		Phase 1 2017-20	Phase 2 2021-25	Phase 3 2026-30	Phase 4 2031-35	Phase 5 2036-40	Phase 6 2041-45
Locomotives							
	Expansion						
	BG	31	0	48	63	75	64
	MG	37	0	0	0	0	0
	Replacement						
	BG	55	0	0	7	7	13
	MG	74	0	0	0	0	0
	Total	**197**	**0**	**48**	**70**	**82**	**77**
Coaches							
	Expansion						
	BG	216	103	831	775	858	965
	MG	65	171	0	0	0	0
	Replacement						
	BG	241	0	21	0	0	201
	MG	696	0	0	0	0	0
	Total	**1218**	**274**	**852**	**775**	**858**	**1166**
Wagons							
	Expansion						
	BG	1000	0	423	731	1165	1282
	MG	0	0	96	0	0	0
	Replacement						
	BG	140	482	33	0	0	0
	MG	580	0	507	0	0	0
	Total	**1720**	**482**	**1059**	**731**	**1165**	**1282**

7.7 RDS Unit

A component of this project involved the investigation of a potential research and development unit for Bangladesh Railway. The Terms of Reference included the following:

- Investigate the necessity of a Research and Development Wing for Bangladesh Railway.
- Prepare an organization structure to establish the Research and Development Wing. This shall include, but not limited to, scope of work for the wing, job responsibility of the individuals and other human resource development and establishment related facts.
- Provide examples and international practice of such Research and Development Wings in other international railways including discussion on the expected benefits for BR.

The details of the consultants' investigation and consultation with BR can be found in the component report for this aspect: *Draft Final Report: Development and Standardization Unit.*

The consensus opinion from consultations was that BR does not require primary research capability, but that applied or secondary research capability could be useful. Primary research is being adequately done by other bodies and BR can access that research simply by forming liaisons with the appropriate industry organizations. Applied research could be useful in development of standards and investigation of local materials properties. To that end, it is proposed to create not an R&D Unit, but an RDS (Research, Development and Standardization) Unit.

The proposed RDS Unit will be an independent organisation and will have five Directorates:

- Mechanical Engineering (including Electrical Engineering)
- Civil Engineering
- Signal, Telecommunications and IT
- Traffic and Transportation
- Chemist & Metallurgist Laboratory

The unit will be headed by a General Manager and all directorates by a Head of the department. Total staff strength will be 246.

This unit will have to interact with railways and industry for indigenous development of sources. It will also monitor field trials and performance of indigenous components. Therefore, it is recommended that the unit should be located at Dhaka where a large industrial base is available.

Setting up this unit should start in 2018 and completed by 2021. Total estimated cost of fully functional RDS Unit is BDT 2,180 lakh.

7.7.1 General

The RDS Unit will be an independent modern technology based establishment complete with following facilities:

- Chemical and metallurgical testing laboratory
- Petroleum products and rubber testing facilities
- Component inspection facility
- Digitised data storage system and Auto CAD facility
- Technical library
- Auditorium

One of the main functions of this unit will be import substitution - development of indigenous sources for rolling stock components, track items, signalling and telecommunication parts, etc. The unit will also investigate repeated failure cases, find reasons for the failures and suggest design, material or manufacturing processes to overcome the problems.

RDS Unit functioning, therefore, requires close interaction with industry, likely suppliers and BR field units. At initial stages of a product development and prototype testing it will have to liaise

between railway user unit and the manufacturer. The RDS Unit should also liaise with similar international rail research organizations such as India's RDSO, AREMA and UIC.

Dhaka has the biggest industrial base in the country and also railway establishments including a diesel workshop and loco shed. Therefore, best place to locate the RDS Unit will be Dhaka.

7.7.2 Civil Construction and Furnishing Cost

D&S Unit building will have following provisions:

1. Office rooms for GM + HOD + Additional HOD
2. Office rooms for managers
3. Cubicle type office rooms for assistant engineers
4. General offices
5. Library
6. Conference hall
7. Meeting room
8. Rooms for personnel staff
9. Cad operator room
10. Stores
11. Canteen
12. Boundary wall
13. Chemical & Metallurgical laboratory

7.7.3 Machine and Equipment for Chemist and Metallurgist Laboratory

The following machines and equipment will be required for Chemist and Metallurgist laboratory:

1. Universal Testing Machine
2. Direct Reading Spectrograph
3. Metallurgical Microscope
4. Magnetic Crack Detector
5. Rockwell Tester
6. Zyglo Test Equipment
7. Other Smaller M/Cs
8. Miscellaneous Items
9. Granite Surface Table
10. Magnaflux Testing Machine
11. Miscellaneous Measuring Instruments

7.8 Periodic Review of the Master Plan

This Master Plan shows recommendations for around 30 years of projects. This is a very long time and much can change over this period. Periodic review of the Master Plan would be very

useful in keeping the strategic direction of the Railway both appropriate and focused correctly. It is recommended that the projects and recommendations contained in this Master Plan be revisited and updated every five years.

8 Projects of the Railway Master Plan

Key Messages

- All projects proposed under this project have been included in a sortable, filterable database
- Grouping of projects by theme and by cumulative economic benefits is presented
- Financing sources and likely financing of individual projects are discussed

8.1 Introduction

The preceding chapters have detailed the policy environment within which Bangladesh Railway exists as well as the physical composition of the railway and its regional setting. The "Vision" of the Railway has been discussed. Future traffic (both passenger and freight) for the Railway has been projected over the 30 years of the plan period. Other projects (road, rail, port, logistics) that may affect rail prospects in the future have been discussed. Finally, strategic initiatives were outlined which could be undertaken to increase railway's efficiency and productivity. These initiatives are linked to potential projects which, if undertaken and exploited by railway operations personnel, should deliver that increased efficiency and productivity.

In this chapter, all these aspects are combined and the projects ranked to generate a selection of projects to be undertaken over the plan period. These projects are separated into six five-year phases to permit access and disbursement of capital funding over the plan period.

8.2 Project Database

A list of potential projects has been compiled from several sources:

- **The 2013 Railway Master Plan**. Some projects from this list have been completed since the issuance of the Master Plan, and some are underway. It is assumed in the analysis that any projects underway will be completed and therefore do not need to be listed in the project list going forward (Appendix 1). This document contains only projects that are not already in the tender process. However, for the record, projects currently underway can be found in Appendix 4 and completed projects in Appendix 5.
- **Consultation with Bangladesh Railways senior management**. Projects underway or actually completed were collected as well as a list of whatever additional projects which were not on the 2013 Railway Master Plan.
- **Analysis of Rolling Stock Maintenance**. The RS maintenance facilities are in very poor condition (both infrastructure and equipment). Workshop efficiency and output is well below "best practice" in other railways. A number of capital projects to increase both efficiency and output have been identified. Some of these projects already existed in BR planning and some are new.
- **Analysis of the introduction of Mechanized Track Maintenance**. Should BR adopt MTM, acquisition of new equipment and construction of new maintenance facilities will be required. Staff must be transferred and re-trained. A list of projects to accomplish the transition to mechanized track maintenance procedures is provided.
- **Analysis of the inception of a Development and Standardisation Unit**. Both equipment and facilities will be required if BR institutes a D&S Unit. Several projects to accomplish this inception are detailed.
- **Gauge conversion**. In order to properly plan the retirement of MG rolling stock, a plan is required to accomplish the move from MG to (eventually) BG operation. This plan, as well as the resultant line conversion projects, are described in Section 7.1 and included in the project database.

- **Unlocking line capacity: S&T projects**. A number of relatively low-cost initiatives were identified to maximize the traffic potential on individual lines by upgrading signalling/telecom systems and splitting blocks.
- **ADB Aide Memoire of 15-16 November, 2016**. ADB and BR have agreed in principle on potential components of the next ADB loan project. These projects have been included in the project database.

The project database can be seen in Appendix 1. Please note some columns are hidden; for the full project database, the reader is referred to the MS Excel version of the database.

There are some projects included which are preparatory feasibility analysis/detailed design projects – these are preparatory projects prior to implementation of larger infrastructure and procurement projects. These were included on a phase-wise basis: one project for each phase. They were costed by estimating project preparatory work at 1% of the total cost of each phase's CAPEX (the sum of the estimated project costs for that phase). While feasibility and detailed design is usually more than 1% of CAPEX, it is not known at this point which of the projects will be implemented and it is likely that not all of them will be implemented, so 1% is seen as a reasonable estimate. These projects are listed as Projects No. 200-205 and do not appear in the project ranking (Appendix 2).

"Contingency" projects estimated at 2% of each phase's CAPEX were also included. These are simply a project representation of contingency funds to cover events not foreseen at the time of Master Plan creation. An example of a contingent project could be a line reconstruction after a catastrophic flooding event. These projects are listed as Projects 206-211 and do not appear in the project ranking.

8.3 Project Ranking

As part of the project database, fields were included to permit ranking and classification of projects. The TOR suggests ranking by several criteria; fields to permit ranking by project adherence to Bangladesh and BR policy and vision goals were included.

8.3.1 TOR Criteria

The TOR list several criteria by which the projects should be ranked. These are discussed below:

- **Traffic Forecast:** Projects were ranked according to whether they had the potential to increase traffic dramatically, moderately or whether they would have little or no effect on traffic. The following qualitative assessments were used:
  - 3 points: projects which had the potential to increase traffic dramatically. Typical projects in this category would include major bridge projects, line doublings and RS procurement intended to provide additional capacity.
  - 1 point: Projects which would potentially lead to a moderate increase in traffic. Typical projects in this category would include gauge conversion, RS procurement intended to replace existing RS, RS maintenance facility enhancement (for existing RS) and S&T upgrades.

  - 0 points: Projects which would be expected to have little or no effect on traffic levels. Projects in this category would include station enhancements, training, minor branch line extensions or construction.

- **Technical Feasibility**: Unfortunately, most of the projects listed by BR and included in this analysis do not have technical feasibility assessments attached to them – only the larger infrastructure projects (such as the Padma Bridge, the Dhaka-Comilla Chord Line or the rail-only bridge at Banghabandhu) have had formal feasibility assessments done. Some of the larger projects (such as a rail link to Payra Port) have not been studied from a technical feasibility point of view.

  None of the projects developed as part of this study (e.g. RS Maintenance enhancement, S&T enhancements, RS procurement to meet increased demand) have had formal technical feasibility studies done, as detailed feasibility assessments were not part of the consultants' mandate. These projects can, however, be reasonably assumed to be technically feasible on a *prima facie* basis.

  Given this situation, it is assumed that all the projects are technically feasible. Please note that if BR is considering implementing a project for which a technical feasibility assessment has not been done, that assessment should be made prior to implementation.

  To that end, the projects have not been scored for technical feasibility as the assumption that most, if not all, are technically feasible would not change the relative scoring by an appreciable amount.

- **Project Cost**: The project database has the cost for all projects updated to 2016 prices. However, Project Cost was not used as a ranking criterion between projects as there is no objective way to decide whether one project should be undertaken rather than another based on their cost alone. The database can, however, be used to rank projects on a cost basis if needed.

- **Economic and Financial Viability**: Where feasibility assessments were already performed on individual projects, the results of these studies were used. Where feasibility studies have not been performed, projects were assessed on a qualitative basis for economic and financial viability. Two points were given for each criterion (economic and financial viability). Where a project was likely to improve BR's financial performance (e.g. RS Maintenance enhancement, wagon procurement, S&T enhancement), the project was judged to be both economically and financially positive. Where a project was being undertaken to increase social obligations (e.g. procurement of carriages to meet an increase in passenger traffic (which loses money for BR)), the project was judged to be economically positive but financially negative.

- **Impact on Safeguards:** This criterion was also evaluated on a qualitative basis.Where there was little or no safeguards issues attached to the project (e.g. renovation of a "brownfield" maintenance depot or an S&T enhancement project), the score given was two points. Where social safeguards would reasonably have to be taken (e.g. a new rail line or new depot requiring land acquisition), the score was zero.

8.3.2 Bangladesh Transport Policies and BR Vision

Chapter 2 details the various Government of Bangladesh policies and plans affecting the transport sector in general and Bangladesh Railway's role in particular. Each of these documents lists a number of objectives to achieve or strategies to undertake in order to realize its goals. They include:

- National Land Transport Policy (see Figure 2-1)
- Vision 2021 (National Perspective Plan 2010-2021) (see Figure 2-2)
- The Seventh Five Year Plan (see Figure 2-3)
- The National Integrated Multi-Modal Transport Policy (see Figure 2-4)

In addition to these, Bangladesh Railway has its own corporate Vision statement (see Figure 6-1). The objectives in the BR Vision statement are duplicates of those found in the four documents listed above. The BR Vision statement objectives are used in the ranking system, however, as they reinforce the intent of Government and BR to achieve those objectives.

These itemized lists were used in order to rank the various projects. Each project scored one point for each adherence to the objectives/strategies listed above. These were simply totaled across the policy documents to arrive at a total score.

Once the project rankings were completed, they were reviewed with BR and adjusted where necessary to match BR's strategic vision and priorities. Projects which scored in the top 10% are shown arranged by phase in Table 8-1; the full ranked project list can be seen in Appendix 7. As can be seen, the highest priority projects are all in Phases 1 and 2.

Table 8-1: High-Priority Projects

Project No.	Project Name	Master Plan Phase	Project Score	Project Cost (BDT crore)	Phase Period
5	Bangabandhu Railway Bridge Construction	1	29	9,740	2018-2020
6	Construction of Rail line from Bhanga Junction (Faridpur) to Payra Port via Barisal	1	25	28,335	2018-2020
7	Construction of Akhaura-Agartala dual gauge railway link (Bangladesh portion)	1	25	478	2018-2020
8	Conversion of existing MG track to DG track between Akhaura- Sylhet.	1	26	8,619	2018-2020
27	Construction of DG Rail Link from Bogra to Shaheed M. Monsur Ali Station	1	25	6,607	2018-2020
28	Construction of double line between Joydebpur and Ishurdi section of BR	1	26	7,698	2018-2020

Project No.	Project Name	Master Plan Phase	Project Score	Project Cost (BDT crore)	Phase Period
36	Construction of a Dual Gauge Rai Line parallel to the Existing Meter Gauge Rail Line in Joydebpur-Mymensingh -Jamalpur Section.	1	26	7,255	2018-2020
59	Modernization of Parbatipur Central Locomotive Workshop	1	25	770	2018-2020
60	Construction of new locomotive workshop at Narayanganj	1	27	1,155	2018-2020
61	Construction of Repair & Maintenance Workshop for DEMU at Narayanganj	1	25	963	2018-2020
71	Reconstruction of Diesel Loco sheds (09 total) including Equipment upgrade and DG Conversion	1	22	3,500	2018-2020
144	Construction of a new Inland Container Depot (ICD) near Dhirasram railway station.	1	25	1,640	2018-2020
153	Rehabilitation of Jessore-Benapole rail line	1	22	1,502	2018-2020
196	Procurement of 40 BG Locomotives	1	25	2,070	2018-2020
197	Procurement of 400 MG & 300 nos BG covered vans (BC) and 180 MG & 120 BG Bogie Open Wagons(BKC) for Bangladesh Railway	1	22	1,140	2018-2020
23	Construction of overpass/flyover in Narayanganj-Joydebpur section of Bangladesh Railway	2	24	591	2021-2025
29	Construction of Dhaka-Chittagong via Comilla/ Laksam High Speed Railway	2	25	30,995	2021-2025
32	Conversion of existing Metre Gauge double line to Dual Gauge double line between Tongi-Bhairab.	2	25	6,233	2021-2025
111	Construction of Chittagong CGPY Inter-Modal Terminal	2	23	1,200	2021-2025
177	Conversion of Metre Gauge double line in to Dual Gauge double line between Bhairab Bazar and Akhaura including rebuilding of existing Bhairab and Titas bridge	2	25	3,214	2021-2025

8.4 Project Groupings

The simple ranking of projects does not show the inter-relationship between projects. For many of the listed projects, it is of little use to do one project in isolation without considering whether another project is required to make the first effective. Some examples:

- For completion of gauge conversion, all listed projects for a particular corridor for conversion to either DG or BG must be undertaken in order for that corridor to be considered Broad Gauge.
- There is little point in obtaining new rolling stock to meet anticipated demand unless the workshop capacity exists to maintain that rolling stock. Maintenance depot upgrades and new construction must go hand-in-hand with RS procurement.

To that end, the appendices contain some filtering of the project database to present projects linked by theme or interdependence.

8.4.1 Gauge Conversion

Appendix 6 shows the complete set of gauge conversion projects, sorted by phase and corridor. Current status (as at 2016) and cost information are included. As noted earlier, the information on gauge conversion projects by phase can be seen graphically in Appendix 3.

8.4.2 Rolling Stock Maintenance

Some of the RS Maintenance projects listed herein are intended to upgrade the ability of BR to maintain its existing stock. There are also projects listed for procurement of rolling stock to replace existing stock which must be retired. It is strongly recommended that these RS Maintenance projects be undertaken to allow the proper maintenance of the existing stock. These projects (both the RS Maintenance and RS procurement projects are listed in Table 8-2.

Table 8-2: RS Maintenance Enhancement Projects

Project No.	Project Name	Master Plan Phase	Total 2016 Cost (BDT crore)
59	Modernization of Parbatipur Central Locomotive Workshop	1	770
70	Upgradation and reconstruction of Dhaka Diesel Loco Shed including equipment upgrade and DG conversion	1	500
71	Reconstruction of Diesel Loco sheds (09 total) including Equipment upgrade and DG Conversion	1	3500
72	Reconstruction of Washing Pits & Coach and Wagon Depots (14 total) including equipment upgrades and DG conversion	1	4000
73	Enhancement of Technical Training Facilities at 5 existing Workshop Training Units	1	80

Project No.	Project Name	Master Plan Phase	Total 2016 Cost (BDT crore)
75	Update Manuals and Codes (6 total) for Mechanical, Electrical and Stores Department and translated into Bangla	1	31
83	Procurement of replacement rolling stock - Phase 1	1	9,412
84	Procurement of replacement rolling stock - Phase 2	2	742
85	Procurement of replacement rolling stock - Phase 3	3	847
86	Procurement of replacement rolling stock - Phase 4	4	243
87	Procurement of replacement rolling stock - Phase 5	5	243
198	Procurement of replacement rolling stock - Phase 6	6	1,534
179	Rehabilitation of 200 Nos. Broad gauge passenger carriages of Bangladesh Railway	2	150
180	Rehabilitation of 200 Nos. Metre gauge passenger carriages of Bangladesh Railway	1	120
181	Rehabilitation of 21 Nos. Metre gauge Locomotive of Bangladesh Railway	1	250
182	Rehabilitation of 24 Nos. Metre gauge Locomotive of Bangladesh Railway	1	200
183	Rehabilitation of 30 Nos. Broad gauge Locomotive of Bangladesh Railway	2	300
184	Conversion of 300 existing Broad Gauge wagon brake system from vacuum to Air brake	1	45

There is a second set of projects which cater to the provision of additional RS capacity to increase the carriage of both passengers and freight. These projects will enable BR to take a higher modal share of both passenger and freight and to expand overall operations. These projects are listed (sorted by phase) in Table 8-3.

Table 8-3: Rolling Stock Expansion Projects

Project No.	Project Name	Master Plan Phase	Total 2016 Cost (BDT crore)
60	Construction of new locomotive workshop at Naryanganj	1	1,155
61	Construction of Repair & Maintenance Workshop for DEMU at Narayanganj	1	963
62	New Carriage & Wagon Workshop at Rajbari	2	2,503

Project No.	Project Name	Master Plan Phase	Total 2016 Cost (BDT crore)
63	New Diesel Locomotive Workshop at Chittagong	2	1,155
64	New Traction Motor Repair And Rewinding workshop at CLW, Parbatipur	4	385
65	New Diesel Locomotive Workshop at Rajbari	3	1,155
66	New BG Carriage and Wagon Maintenance Workshop at suitable location of Mymensingh	3	2,310
67	New Diesel Electric Multiple Unit maintenance workshop at Ishurdi	4	963
68	Reconstruction of existing Carriage & Wagon Workshop at Chittagong	5	2,755
69	New Diesel Electric Multiple Unit maintenance Workshop at Chittagong	5	963
77	Procure BG and MG rolling stock to meet additional traffic demand - Phase 1	1	6,660
78	Procure BG rolling stock to meet additional traffic demand - Phase 2	2	2,546
79	Procure BG rolling stock to meet additional traffic demand - Phase 3	3	7,659
80	Procure BG rolling stock to meet additional traffic demand - Phase 4	4	7,513
81	Procure BG rolling stock to meet additional traffic demand (incl. maintenance spares) Phase 5	5	9,915
82	Procure BG rolling stock to meet additional traffic demand - Phase 6	6	10,561

8.4.3 Improve East-West Connectivity

Improving connectivity between BR's east and west zones has several trade and operational benefits. The goal of regional connectivity cannot be satisfactorily obtained unless east-west connectivity is improved. Better east-west connectivity would remove the infrastructural bottlenecks restricting the use of a trans-Bangladesh route for Indian traffic going between the North-east states and the remainder of India. Intra-Bangladesh trade and passenger movements would be considerably easier if the connections between east and west zones were better.

There are a number of projects which will contribute to this goal. These are listed by phase in Table 8-4 below.

Table 8-4: Projects which Improve East-West Connectivity

No.	Name	Phase	Cost (BDT crore)
5	Bangabandhu Railway Bridge Construction	1	9,740
27	Construction of DG Rail Link from Bogra to Shaheed M. Monsur Ali Station	1	6,607
31	Conversion of existing Metre Gauge line into Dual Gauge line between Dhaka- Narayanganj	2	784
32	Conversion of existing Metre Gauge double line to Dual Gauge double line between Tongi- Bhairab.	2	6,233
33	Conversion of existing Metre Gauge double line into Dual Gauge double line between Laksam- Chittagong.	2	12,621
39	Construction of Dual Gauge double line between Akhaura- Sylhet.	3	15,077

8.4.4 Improve Movement of Containers between Chittagong and Dhaka

BR has a very low share of the movement of containers between Chittagong and Dhaka – less than 5% of containers are moved by rail. One of the main reasons for this low market share is the capacity of the railway to move containers – there are both permanent way capacity constraints, rolling stock constraints and personnel constraints. The following is a selection of infrastructure projects which could relieve these constraints and enable BR to increase its modal share of this profitable traffic.

Table 8-5: Projects Which Could Improve Movement of Dhaka-Chittagong Containers

No.	Name	Phase	Cost (BDT crore)
8	Conversion of existing MG track to DG track between Akhaura- Sylhet.	1	8,619
29	Construction of Dhaka-Chittagong via Comilla/Laksam High Speed Railway	2	30,995
21	Construction of Circular Rail Line around Chittagong-SRV-CGPY-Saltgola-Dry Dock-Shah Amanat Airport-Dry Dock-Saltgola-CGPY-Fouzderhat-Chittagong (Phase-1)	4	247
32	Conversion of existing Metre Gauge double line to Dual Gauge double line between Tongi- Bhairab.	2	6,233
33	Conversion of existing Metre Gauge double line into Dual Gauge double line between Laksam- Chittagong.	2	12,621
39	Construction of Dual Gauge double line between Akhaura- Sylhet.	3	15,077
41	Construction of Dual Gauge double line between Fauzderhat- CGPY	3	916

8.4.5 ADB Loan Projects

As noted above, the ADB mission of November 2016 concluded that ADB would like to focus near-term loans on projects intended to increase BR rolling stock availability. These projects are under negotiation at present, but include both RS maintenance and RS procurement. The list of rolling stock being procured are all intended for delivery in Phase 1 and include:

Table 8-6: ADB Loan Projects

Name	Phase
Procurement of 40 BG Locomotives	1
Procure replacement RS: 75 MG and 50 BG luggage vans	1
Procurement of 400 Nos. MG and 300 Nos. BG Bogie Covered Vans (BC) and 180 MG and 120 BG Bogie Open Wagons (BKC) for Bangladesh Railway	1

8.5 Project Finance

A framework to provide a high level guidance on financing of the projects identified in the Master Plan is presented in this section.

The overall economy in Bangladesh is on a growth path (exceeding 6% at present) and the Government is committed to reforms that will sustain or increase economic growth. This will enable the Treasury to commit a higher share of funds to BR, as railways remains a critical part of the economy. A fillip to railways / logistics in the country will assist in poverty alleviation in the country through the provision of more opportunities for movement of goods and people.

The criteria used to identify projects under this category comprise a mix of projects that involve routine, ad hoc activities and activities that are typically considered to be funded by directly by the Government. Examples include the following:

- Replacement of machines in locomotive workshops
- Reconstruction of Diesel Loco Sheds (10 total)
- Enhancement of technical training facilities
- Enhancement of running staff rest rooms
- Construction of flyover / overpass
- Renovation of Central Railway Building
- Rehabilitation of specific sections and bridges
- Modernisation and upgradation of signalling

Identification of projects that could potentially attract private financing and thus would be PPP candidates was undertaken. It may be noted that the exercise for developing this list was constrained by the following:

- A lack of information pertaining to detailed financial viability of each of the projects.
- The limited number of areas where private finance is encouraged in railways, as prescribed by NLTP and BR itself.

- A lack of information pertaining to the assessment of the appetite of the private sector – both within Bangladesh and outside – to positively respond to specific PPP opportunities arising out of this Master Plan.

Based on the above, the projects that could be PPP candidates include mainly renovation, enhancement and operation of hospitals, medical colleges and station commercial areas. Construction and operation of ICDs could also be considered. Projects of this type were identified and listed in Table 8-10 below.

For the projects that would likely not find takers in the private sector, financial assistance from abroad was considered. This assistance could be of the following types:

- Loans from multilateral agencies such as the World Bank group, ADB and the upcoming AIIB, keeping in mind the overall country caps that such agencies have for each borrowing country.
- Loans/grants/aid from bilateral agencies such as DFID, USAID, JICA, AusAID, CIDA, etc.
- Government to Government bilateral agreements such as those with China or Malaysia or India.

Using the above criteria, the projects that are candidates for ODA financing include:

- Construction of new lines
- Conversion of MG into BG or DG
- Procurement of rolling stock

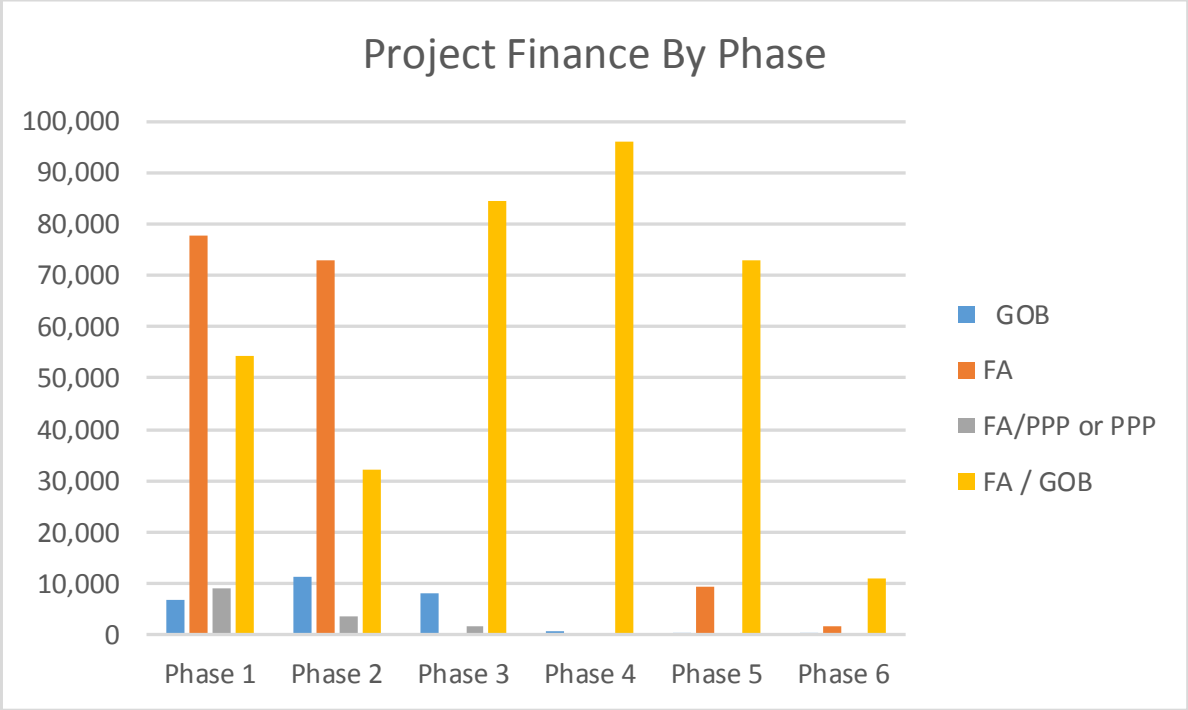
Based on the above, each proposed project was examined and categorised as being potentially financed by Govt. of Bangladesh, Financial Assistance and PPP. The summary results are presented in Table 8-7 below:

Table 8-7: Project Financing Summary (BDT crore)

Phases	Period	Total no. of Projects	GOB	FA	FA/PPP or PPP	FA / GOB	Total Cost
Phase 1 projects	2016-2020	83	6,673	77,673	9,030	54,457	147,833
Phase 2 projects	2021-2025	67	11,412	72,812	3,439	32,017	119,680
Phase 3 projects	2026-2030	37	8,054	-	1,600	84,507	94,161
Phase 4 projects	2031-2035	23	726	-	-	96,159	96,885
Phase 5 projects	2036-2040	14	125	9,448	-	73,076	82,649
Phase 6 projects	2041-2045	6	125	1,534	-	10,795	12,454
Total for all Phases		**230**	**27,115**	**161,467**	**14,069**	**351,011**	**553,662**

The same information is presented graphically in Figure 8-1.

Figure 8-1: Project Financing Summary



Project-wise detail is presented below:

8.5.1 Projects Financed by GoB

Table 8-8: Projects Financed by BR / GoB

Phase: 1 (2016 - 2020)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project Nos. 1, 4	Construction of new lines	1,280
2	Project Nos. 2	Conversion of existing Metre Gauge track into Dual Gauge track between Sylhet-Chatak Bazar section	1,622
3	Project No. 13	Conversion from metre gauge line to dual gauge line from Parbatipur to Kaunia	2,689
4	Project No. 16	Construction of Broad Gauge Rail Line between Chilahati and Chilahati Border for Connectivity with India.	79
5	Project No. 24	Renovation of Central Railway Building in Chittagong as a Heritage Building	100
6	Project Nos. 123 to 124	Installation of sub-station / PS, maintenance of ICT	150
7	Project No. 180 to 182	Rehabilitation of 200 Nos passenger carriages, 45 Nos. Meter gauge Locomotive of Bangladesh Railway	570
8	Project No. 184	Conversion of 300 existing Wagon brake system from vaccum to Air brake	45
9	Project No. 172,173	Feasibility studies and detailed design of electric traction projects	8

Phase: 1 (2016 - 2020)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
10	Project No. 204,205	Rehabilitation, construction and upgradation of level crossing gates	130
Total			**6,673**

Phase: 2 (2021 - 2025)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project Nos. 10 to 12	Construction of BG tracks	7,915
2	Project No. 14	Construction of rail link with Ishurdi EPZ	536
3	Project Nos. 22,23,25,26	Construction of overpass/flyovers, new BG & DG Concrete Sleeper Plant, rehabilitation of bridges	1,381
4	Project Nos. 121 to 122	Development of Darshana and Rohanpur Interchange Yards	118
5	Project No. 125	Improvement and Maintenance of ICT Infrastructure of BR: Phase 2	125
6	Project Nos. 146 and 147	Rehabilitation and upgradation of electrical substations	450
7	Project Nos. 174,175	Feasibility studies and detailed design of electric traction projects	8
8	Project Nos. 179	Rehabilitation of Broad gauge passenger carriages	150
9	Project Nos. 183	Rehabilitation of Meter gauge Locomotives	300
10	Project No. 185	Remodelling of Parbatipur Station including Station yard	300
11	Project No. 206,207	Rehabilitation, construction and upgradation of level crossing gates	130
Total			**11,412**

Phase: 3 (2026 - 2030)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project No. 15	Construction of Railway Bypass for Bhairabbazar, Abdulpur, Jamtoil & Kaunia	295
2	Project No. 17	Conversion of existing Metre Gauge line into Dual Gauge line between Bhairab Bazar-Mymensingh section	211
3	Project No. 19	Construction of Dual Gauge single line from Panchagarh to Banglabandh	7,419
4	Project No. 126	Improvement and Maintenance of ICT Infrastructure of BR: Phase 3	125

Phase: 3 (2026 - 2030)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
5	Project No. 176	Feasibility Study for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Ishurdi- Parbatipur Section of Bangladesh Railway	4
			8,054

Phase: 4 (2031 - 2035)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project No. 20	Conversion of existing Shayestagonj-Balla section into DG track	354
2	Project No. 21	Construction of Circular Rail Line around Chittagong-SRV-CGPY-Saltgola-Dry Dock-Shah Amanat Airport-Dry Dock-Saltgola-CGPY-Fouzderhat-Chittagong (Phase-1)	247
3	Project No. 127	Improvement and Maintenance of ICT Infrastructure of BR: Phase 4	125
Total			**726**

Phase: 5 (2036 - 2040)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project No. 128	Improvement and Maintenance of ICT Infrastructure of BR: Phase 5	125
Total			**125**

Phase: 6 (2041 - 2045)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project No. 129	Improvement and Maintenance of ICT Infrastructure of BR: Phase 6	125
Total			**125**

8.5.2 Projects Financed by External Assistance (Multilateral/Bilateral)

Table 8-9: Projects Financed by External Assistance

Phase: 1 (2016 - 2020)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project Nos. 5 through 9	Construction of Jamuna Railway Bridge, and rail lines	50,871
2	Project No. 27	Construction of DG Rail Link from Bogra to Shaheed M. Monsur Ali Station	6,607
3	Project No. 28	Construction of Double line between Joydebpur to Ishurdi section of BR	7,698
4	Project No. 36	Construction of a Dual Gauge Rai Line Parallel to the Existing Meter Gauge Rail Line in Joydebpur-Mymensingh -Jamalpur Section.	7,255
5	Project No. 120	Environmental assessment study of BR	12
6	Project No. 178	Construction of 2nd Railway cum Road bridge across Karnaphuly River near Kalurghat	2,000
7	Project Nos. 156, 196 and 197	Procurement of 30 BG Locomotives, Bogie Covered Vans and BKC Wagons and Updating of Operations Manuals and Tariff Books	3,229
			77,673

Phase: 2 (2021 - 2025)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project Nos. 29 through 35	Construction of Dhaka-Chittagong HSR and the Dhaka Circular Rail Line, Conversion of existing MG tracks to DG tracks and Construction of DG Double Track s	66,939
2	Project No. 37	Conversion of existing Metre Gauge line into Dual Gauge line between Santahar-Bogra	1,944
3	Project No. 177	Conversion of Metre Gauge double line into Dual Gauge double line between Bhairab Bazar and Akhaura including rebuilding of existing Bhairab and Titas bridge	3,214
4	Project No. 218	100 BG Carriage Procurement under Padma Bridge	715
			72,812

Phase: 5 (2036 - 2040)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project No. 112	Construction of Railway Bridge at Moukuri-Dhalar Char point over River Padma to connect Pabna and Rajbari with the existing railway network	9,448
			9,448

Phase: 6 (2041 - 2045)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project No. 198	Procurement of replacement Rolling Stock	1,534
			1,534

8.5.3 Projects which could be undertaken as PPPs or External Assistance (Multilateral/Bilateral)

Table 8-10: Projects which could be undertaken as PPPs, PPP/FA

Phase: 1 (2016 - 2010)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project Nos. 130 through 132	Beautification & commercial use of station areas	531
2	Project No. 139	Modernization of Railway Hospitals & Construction of Medical Colleges in Dhaka & Chittagong	709
3	Project No. 144	Construction of a new Inland Container Depot (ICD) near Dhirasram railway station.	1,640
4	Project No. 168	Establish Railway Inland Container Terminals with customs facility at Uttara EPZ, Benapole	4,800
5	Project No. 215	Development of 5 star hotel at Jakir Hossain Road, Chittagong at Bangladesh Railway Land on PPP mode.	850
6	Project No. 216	Construction of Multi Modal Transportation Hub at Bimanbandar Railway Station	500
			9,030

Phase: 2 (2021 - 2025)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project No. 141	Modernization of Railway Hospitals & Construction of Medical Colleges in Rajshahi, Khulna & Saidpur of BR	709
2	Project No. 169	Establish Railway Inland Container Terminals with customs facility at Mongla Port and Ishurdi	1600

Phase: 2 (2021 - 2025)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
3	Project No. 214	Development of Shopping Complex cum Guest House at Bangladesh Railway Land near Khulna and Chittagong on PPP mode.	330
4	Project No. 217	Construction of Multi Modal Transportation Hub at Kamalapur Railway Station	800
			3,439

Phase: 3 (2026 - 2030)	Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project No. 170	Establish Railway Inland Container Terminal with customs facility at Darsana, Shahbazpur	1600
			1600

8.5.4 Projects which could be financed by GOB or External Assistance

Table 8-11: Projects which could be financed by GOB or External Assistance

Phase: 1 (2016 - 2010)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project No. 18	Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Narayanganj–Dhaka–Joydebpur Section of Bangladesh Railway	560
2	Project No. 59 through 61	Construction and Modernization of Locomotive / DEMU Workshops	2,888
3	Project Nos. 70 through 77	Enhancement of Diesel Loco Sheds, Washing Sidings & Coach and Wagon Depots, Technical Training Facilities, Staff Rest Rooms, Update Manuals and Codes, Replacement and Renovation Cost of Equipment and Infrastructure and Procurement of BG Rolling Stock	14,825
4	Project Nos. 83	Procure replacement of rolling stock	9,412
5	Project Nos. through 88 to 94	Modernization of Signaling & Interlocking System and Optical Fiber installation	933
6	Project No. 100	Integration of CTC Control system of Chittagong and Dhaka with the CBI Interlocked stations of the two respective divisions	600
7	Project Nos. 107 to 108	Upgrading Training Academy at Chittagong and Introduction of Mechanized Track Maintenance	1,080

Phase: 1 (2016 - 2010)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
8	Project No. 110	Implementation of RDS Unit	22
9	Project No. 113	Modernization of Concrete Sleeper Plant of Bangladesh Railway and construction of Broad Gauge and Dual Gauge Concrete Sleeper Plant at Chatak Bazar	120
10	Project No. 114	Institutional Strengthening and Capacity Building of BR: Phase 1	50
11	Project Nos. 137 , 138	Rehabilitation of Main Line section and Modernization of Railway Training Academy and construction of Railway Museum	1,772
12	Project No. 142	Modernization of Bridge Workshops at Chittagong and Saidpur	200
13	Project No. 149	Construction of Dual Gauge Railway line from Janalihut to Kaptai via CUET	9,445
14	Project No. 153	Rehabilitation of Jessore-Benapole rail line	1,502
15	Project No. 155	Construction of rail line to Feni Economic Zone and Mirersarai Economic Zone	4,685
16	Project Nos. 157 through 162	Construction of rail line from Jamalpur station to EZ, upgradation of printing press, installation, operations and maintenance of call center , automatic ticket vending machine, POS machines for TTE's and station development and up-gradation of ticketing systems	1,233
17	Project Nos. 167	Development, Installation, operations and maintenance of computerized wagon control system for BR	50
18	Project No. 171	Establish railway connection with Chittagong Bay terminal	1,574
19	Project No. 187	Extension and renovation of Platform and Platform Sheds in West zone of Bangladesh Railway (Phase-1)	100
20	Project No. 189	Extension and renovation of Platform and Platform Sheds in East zone of Bangladesh Railway (Phase-1)	100
21	Project No. 191	Extension and rehabilitation of loop lines and sidings in West zone of Bangladesh Railway (Phase-1)	200
22	Project No. 193	Extension and rehabilitation of loop lines and sidings in East zone of Bangladesh Railway (Phase-1)	200
23	Project No. 212	Capacity enhancement and construction of additional new units of Saidpur Carriage & Wagon Workshop	754

Phase: 1 (2016 - 2010)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
24	Project No. 2	Project feasibility, detailed design and Tender preparation-Phase 1	718
25	Project No. 220	Contingent Projects- Phase 1	1,436
Total			**54,457**

Phase: 2 (2021 - 2025)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project No. 42	"Conversion of existing MG track to DG track between Joydebpur- Mymensingh-Jamalpur "	4,562
2	Project No. 46	Conversion of BG single line from Chatak Bazar to Sunamganj	4,722
3	Project Nos. 62,63	New Rolling stock workshops at Rajbari and Chittagong	3,658
4	Project No. 78, 84	"Procure BG rollingstock to meet additional traffic demand (incl. maintenance spares) - Phase 2 And Procurement of replacement Rolling Stock Phase-2	3,288
5	Project Nos. 95 through 97	Modernization of Signaling & Interlocking System by CBI and Modernization & up gradation of signal workshop	667
6	Project No. 99	Installation of modern signaling & telecommunication training centre at Dhaka	50
7	Project Nos. 101, 102	Installation of CTC control system and radio based cab signaling , integration of CBI interlocked stations	1,189
8	Project No. 109	Introduction of Mechanized Track Maintenance Phase 2	246
9	Project No. 111	Construction of Chittagong CGPY Inter-Modal Terminal	1,200
10	Project No. 115	Institutional Strengthening and Capacity Building – Phase 2	50
11	Project No. 133	Construction of Railway Connectivity with Moheshkali and Matarbari	1,181
12	Project No. 135	Construction of Rail line from Jamalpur to Tourism Spots of Sherpur	3,543
13	Project No. 136	Rehabilitation of Main Line section of BR (East Zone) Phase -I	1,181
14	Project No. 140	Construction of Railway Training Institute in Dhaka and Rajshahi	354
15	Project Nos. 143	Remodeling of Dhaka Biman Bandar Station	200
16	Project No. 148	Construction of Kustia Bypass Railway Line from Jagati to Gorai Bridge	496

Phase: 2 (2021 - 2025)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
17	Project No. 163	Station Development and Up-gradation of ticketing systems and entry exit machine installation in 10 stations in Bangladesh	381
18	Project No. 186	Remodelling of Kamalapur Railway Station including Station yard, Washpit and sick line	500
19	Project No. 188	Extension and renovation of Platform and Platform Sheds in West zone of Bangladesh Railway (Phase-2)	150
20	Project No. 190	Extension and renovation of Platform and Platform Sheds in East zone of Bangladesh Railway (Phase-2)	100
21	Project No. 192	Extension and rehabilitation of loop lines and sidings in West zone of Bangladesh Railway (Phase-2)	300
22	Project No. 194	Extension and rehabilitation of loop lines and sidings in East zone of Bangladesh Railway (Phase-2)	200
23	Project No. 195	TA project for preparation of Mechanized Track Maintenance Manual and as such update Way and Works Manual of BR	7
24	Project No. 199	Rehabilitation of signalling and interlocking system in east and west zone of Bangladesh railway (Phase-1)	250
25	Project No. 203	Rehabilitation of Main Line section of BR (West Zone) Phase -2	1,000
26	Project No. 211	Capacity enhancement and construction of additional new units of Saidpur Carriage & Wagon Workshop	800
27	Project No. 220	Project feasibility, detailed design and Tender preparation	580
28	Project No. 226	Contingent Projects- Phase 2	1,161
Total			**32,017**

Phase: 3 (2026 - 2030)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project No. 3	Construction of new Tista Bridge	1,800
2	Project Nos. 38 to 41	Construction of 2nd track (DG) lines and Construction of new connecting BG	40,379
3	Project Nos. 43, 44, 47 to 51	Construction of New BG single line, Reconstruction of Rupsha-Bagherhat BG, Conversion of existing MG track to DG and Reconstruction of Hardinge Bridge	17,221
4	Project No. 53	Conversion of existing Metre Gauge line in to Dual Gauge line from Bogra to Lalmonirhat via Bonarpara and Trimohini-Balashighat	5,946

Phase: 3 (2026 - 2030)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
5	Project No. 65 to 67	New Rolling Stock Workshops at Rajbari, Mymensingh, Ishurdi	4,428
6	Project No. 79	"Procure BG rollingstock to meet additional traffic demand (incl. maintenance spares) - Phase 3 "	7,659
7	Project No. 85	Procurement of replacement rolling stock - Phase 3	847
8	Project Nos. 93, 98	Modernization of Signaling & Interlocking System by CBI, Installation of GSM R Radio communication system	872
9	Project Nos. 104 to 105	Replacement of signaling system by CBI and Installation of radio based ETCS	2,723
10	Project No. 116	Institutional Strengthening and Capacity Building of BR: Phase 3	50
11	Project No. 164	Station Development and Up-gradation of ticketing systems and entry exit machine installation in 10 stations in Bangladesh	381
12	Project No. 200	Rehabilitation of signalling and interlocking system in east and west zone of Bangladesh railway (Phase-2)	250
13	Project No. 202	Rehabilitation of Main Line section of BR (East Zone) Phase -2	500
14	Project No. 208	Feasibility study for construction of Elevated Railway line from Joydebpur to Mymensing & Joydebpur to tangail.	20
15	Project No. 209	Feasibility study for construction of railway line from Tongi to Bhairab Bazar via Narshingdi	10
16	Project No. 210	Feasibility study for construction of High Speed Railway line from Dhaka to Khulna & Ishurdi to Rajshahi.	30
17	Project No. 221	Project feasibility, detailed design and Tender preparation-phase 3	464
18	Project No. 227	Contingent Projects- Phase 3	928
Total			**84,507**

Phase: 4 (2031 - 2035)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project No. 45	Conversion of existing MG track to DG track between Jamalpur-Bangabandhu Bridge East and Jamalpur-Bahadurabad Ghat.	6,040
2	Project Nos. 54	Conversion of Existing MG track to DG track	3,644
3	Project Nos. 55 to 57	Construction of BG single lines	19,677

Phase: 4 (2031 - 2035)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
4	Project No. 64	New Traction Motor repair and rewinding unit at CLW, Parbatipur	385
5	Project No. 80	Procure BG rollingstock to meet additional traffic demand (incl. maintenance spares) - Phase 4	7,513
6	Project No. 86	Procurement of replacement rolling stock - Phase 4 Procurement of 30 BG Shunting cum Branch Line Locomotive against replacement.	243
7	Project No. 103	Modernization & up gradation of optical fiber based telecommunication system of Bangladesh Railway (2009 km) presently used by Grameenphone Ltd.	560
8	Project No. 106	Modernization of signaling system by Interlocking of different section of secondary lines replacing non-interlocked mechanical/color light signaling system.	612
9	Project No. 117	Institutional Strengthening and Capacity Building of BR: Phase 4	50
10	Project No. 134	Construction of Railway connectivity in between Panchagor-Chilahati-Hatibandha of BR.	1,772
11	Project No. 145	Construction of Subway in Dhaka-Tongi Section of Bangladesh Railway	17,000
12	Project No. 150	Construction of new BG line along Jessore-Magura-Sripur-Langolband-Pangsa.	18,890
13	Project No. 154	Construction of Rohanpur-Joypurhat Rail Line	17,316
14	Project No. 165	Station Development and Up-gradation of ticketing systems and entry exit machine installation in 10 stations in Bangladesh	381
15	Project No. 201	Rehabilitation of signalling and interlocking system in east and west zone of Bangladesh railway (Phase-3)	250
16	Project No. 213	Construction of new Carriage & Wagon Depot and Loco Shed to meet additional traffic demand	400
17	Project No. 222	Project feasibility, detailed design and Tender preparation-Phase 4	475
18	Project No. 228	Contingent Projects- Phase 4	951
Total			**96,159**

Phase: 5 (2036 - 2040)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project No. 52	Construction of Railway Bridge Over the Jamuna river near Phulchari- Bahadurabad Ghat including Approach Rail Link	22,704
2	Project No. 58	Conversion of existing MG track to DG track between Lalmonirhat - Burimari and Tista-Ramna Bazar	3,956
3	Project Nos. 68,69	Construction of Rolling Stock workshop	3,718

Phase: 5 (2036 - 2040)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
4	Project No. 81 and 87	Procure BG rollingstock to meet additional traffic demand (incl. maintenance spares) Phase 5, Procurement of replacement rolling stock - Phase 5	10,158
5	Project No. 118	Institutional Strengthening and Capacity Building of BR: Phase 5	50
6	Project Nos. 151 to 152	Construction of new BG lines	30,697
7	Project No. 166	Station Development and Up-gradation of ticketing systems and entry exit machine installation in 15 stations in Bangladesh	572
8	Project No. 212	Project feasibility, detailed design and Tender preparation- Phase 5	407
9	Project No. 218	Contingent Projects- Phase 5	814
Total			**73,076**

Phase: 6 (2041 - 2045)	Master Plan Project Nos.	Nature of Project	Cost (BDT Crore)
1	Project No. 82	Procure BG rolling stock to meet additional traffic demand (incl. maintenance spares) - Phase 6	10,561
2	Project No. 119	Institutional Strengthening and Capacity Building of BR: Phase 6	50
3	Project No. 213	Project feasibility, detailed design and Tender preparation- Phase 6	61
4	Project No. 219	Contingent Projects- Phase 6	123
Total			**10,795**

8.6 Impact on Safeguards

Bangladesh Railway has contributed significantly to nation's development by helping reduce cost of public transport, reduce travel time, connecting people, enhance economic activity while minimizing the carbon foot print of the country compared to other modes like road. While BR has contributed to reduction in greenhouse gas emissions, it has been called upon to play an even bigger role in Government's endeavour to further reduce GHG emissions by 5% (12 $MtCO_2e$) from business as usual levels by 2030. Government of Bangladesh's Intended

Nationally Determined Contribution (INDC[24]) envisages that modal shift from road to rail shall play a central role in this commitment. The proposed Master Plan endeavours to realize this commitment by identifying projects aimed at catalyzing the modal shift to railways.

However, railway development interventions often present a number of adverse risks to society at large pertaining to issues like:

- → Involuntary resettlement, migration, and urbanization
- → Unfair distribution of benefits, local conflicts of interest, and impacts on local economy
- → Impacts on vulnerable populations such as indigenous peoples and the poor, gender equality, and children's rights
- → Impacts on community health and safety (including accidents and epidemics such as HIV/AIDS)
- → Impacts on, or caused by, the labour environment (including occupational health and safety)
- → Impacts on social structures, social infrastructures, and social services
- → Impacts on cultural heritage

In this context, it becomes critical to identify and assess such potential risks during project design, their impacts and develop robust safeguards to mitigate or minimize such adverse impacts associated with the project.

Most International Financing Institutions (IFIs) require the application of safeguards to approve projects, and while protocols and formats vary, the issues considered are common. For eg. World Bank Group's mandates safeguards through a set of policies that serve to identify, avoid, and minimize harms to people and the environment. These policies require borrowing governments to address certain environmental and social risks in order to receive Bank support for investment projects. Examples of these safeguard requirements include development of an Environmental and Social Commitment Plan that covers conducting an environmental and social impact assessment (ESIA), consulting with affected communities about potential project impacts, and restoring the livelihoods of displaced people.

In addition several performance standards for for Environmental and Social Sustainability are prescribed to ensure the ESIA meets such standards, in addition to local requirements.

Table 8-12: Sample IFC Performance Standards (PS) for ESIA

No	IFC Performance Standard	Objectives of the performance standard
Performance Standard 1	Assessment and Management of Environmental and Social Risks and Impacts	To identify and evaluate environmental and social risks and impacts of the project. To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment.

[24] 7 Ministry of Environment and Forests (MOEF), Government of the People's Republic of Bangladesh. Intended Nationally Determined Contributions. September 2015: http://www4.unfccc.int/submissions/INDC/Published%20Documents/Bangladesh/1/INDC_2015_of_Bangladesh.pdf.

No	IFC Performance Standard	Objectives of the performance standard
		To promote improved environmental and social performance of Project Developers through the effective use of management systems.
Performance Standard 2	Labour and Working Conditions	To promote the fair treatment, non-discrimination, and equal opportunity of workers. To establish, maintain, and improve the worker management relationship. To promote compliance with national employment and labor laws. To protect workers, including vulnerable categories of workers such as children,
Performance Standard 3	Resource Efficiency and Pollution Prevention	To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities; To promote more sustainable use of resources, including energy and water. To reduce project-related GHG emissions.
Performance Standard 4	Community Health, Safety, and Security	To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances. To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.
Performance Standard 5	Land Acquisition and Involuntary Resettlement	To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs. To avoid forced eviction. To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. To improve, or restore, the livelihoods and standards of living of displaced persons. To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.
Performance Standard 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	To protect and conserve biodiversity. To maintain the benefits from ecosystem services. To promote the sustainable management of living natural resources through the adoption of practices that integrates conservation needs and development priorities.
Performance Standard 7	Indigenous Peoples	To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples. To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts. To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner.

No	IFC Performance Standard	Objectives of the performance standard
		To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle. To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected communities of Indigenous Peoples when the circumstances described in this Performance Standard are present. To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.
Performance Standard 8	Cultural Heritage	To protect cultural heritage from the adverse impacts of project activities and support its preservation. To promote the equitable sharing of benefits from the use of cultural heritage.

While social impact assessment is not yet a legally mandated requirement in Bangladesh, it is critical for Bangladesh Railway to comply with internationally accepted practices for ensuring robust social safeguards.

Social impact of the project and need for safeguards formed one of the core criterion for evaluating various project options and developing a priority list in this proposed Master Plan. Projects with little or no safeguards issues attached (e.g. renovation of a "brownfield" maintenance depot or an S&T enhancement project), were awarded higher score while projects requirement reasonable or higher social safeguards were awarded no score thereby affecting their overall ranking.

This proposed Master Plan also recommends a comprehensive environmental assessment of BR's operations with the overall objective of ensuring that BR remains an environmentally and socially sustainable organisation. Lastly, given that project impact assessment and development of safeguards are unique to every project, this Master Plan envisages that these activities shall form a core part of the project feasibility study, detailed design, tender preparation and implementation. In this context, suitable budget has been allocated for these activities in the Master Plan.

9 Financial Performance

Key Messages

- Bangladesh Railways has a very high Operating Ratio, averaging 210% over the past nine years
- A large part of the degrading financial performance is due to the non-indexing of rail tariffs to inflation
- Utilization of rolling stock is very poor due to insufficient maintenance and shortage of both operating and maintenance staff
- Maximizing availability of rolling stock will improve financial returns to the railway
- Increasing rolling stock by procurement will increase throughput, but tariff reform will be necessary before these increases improve BR financial performance
- There are several types of line capacity enhancements that should be considered before line doubling

9.1 Current Financial Performance

9.1.1 Bangladesh Railway Financial Reporting

Prior to looking at BR's financial results, it is important to make some comments regarding BR's accounting practices.

The numbers below refer to operating revenues and costs, but BR does not include all of what could be considered "operating revenue" in its books as such. For instance:

- Revenue from the lease of fibre optic lines to Grameen Phone is not included with freight and coaching earnings. However, the O&M costs of the lines are included in operating costs freight and coaching operations. The line itself was installed to assist in running freight and coaching services.
- Many freight-related items such as demurrage, wharfage and siding charges are not included in freight revenue, although they are accrued from freight operations.

The net effect of these accounting practices is to under-represent earnings per passenger-km and tonne-km, and therefore BR shows a lower Operating Ratio than would normally be the case if the accounting practices were more in line with other railways' practice. ADB is assisting BR in the reform of its accounting practices; this will greatly assist in more comparable reporting as well as improved financial ratios for the railway.

However, despite the under-representation of operating revenue, even if the revenue were more conventionally reported operating revenues would still be less than operating costs. BR would still show a financial loss; accounting reform will only bring about a decrease in the size of that loss. To show profitable operations, BR will need to dramatically revise its operations/maintenance and tariff reform would have to be instituted by Government. Thus, the conclusions of the next section are still valid.

In many countries where trains are operated below operating cost on socio-economic and political reasons, governments give subsidies similar to Bangladesh's PSO & Welfare grant. The GOB, on principle, agreed to pay PSO and welfare grant on passenger services excluding Intercity, but this grant is not indexed to inflation or revised annually for other considerations. Bangladesh's persistent inflation rate means that the grant decreases in real terms year by year. Today's 100 taka is not equal next year's 100 taka.

The net effect is that BR's costs are rising due to inflation and other reasons, while its revenues are not rising at the same rate. Both tariffs and the PSO/Welfare grant are not indexed to inflation.

9.1.2 Bangladesh Railway Operating Ratio

Presently (and for most of the recent past), Bangladesh Railways has been operating in a deficit position. BR's operating ratio for both freight and passenger traffic has been far above 100% for several years. In other words, BR is spending much more money to support operations than it earns from those operations. Table 9-1 below shows the Operating Ratio (OR) for the past nine years.

Table 9-1: Bangladesh Railways Operating Ratios

Year	Operating Ratio (%)
2006-07	206
2007-08	194
2008-09	188
2009-10	222
2010-11	237
2011-12	260
2012-13	194
2013-14	200
2014-15	194

Source: BR Information Book 2015

BR's average OR (operating expenses divided by revenue from operations) has averaged 210% over the past nine years. While an OR over 100% can be justified by the social obligation of providing passenger services (especially where tariffs are not set by the railway itself), a profitable railway will have an OR somewhere below 100%.

Table 9-2: International Railway Operating Ratios

Railway (s)	Year	Operating Ratio (%)
North American Class 1 Railways (average) [25]	2014	69.7
Indian Railways[26]	2014-15	91.3
Turkish State Railway[27]	2015	94
Pakistan Railways[28]	2013-14	174

It is clear by comparison to other railways (even discounting for BR's accounting practices) that BR operating ratios can be improved. The projects set out in this Master Plan could assist in that improvement, but only if BR uses the resultant assets to their best advantage.

Reasons for the poor financial performance are many and have been discussed at length throughout the course of this study. They include, but are not limited to:

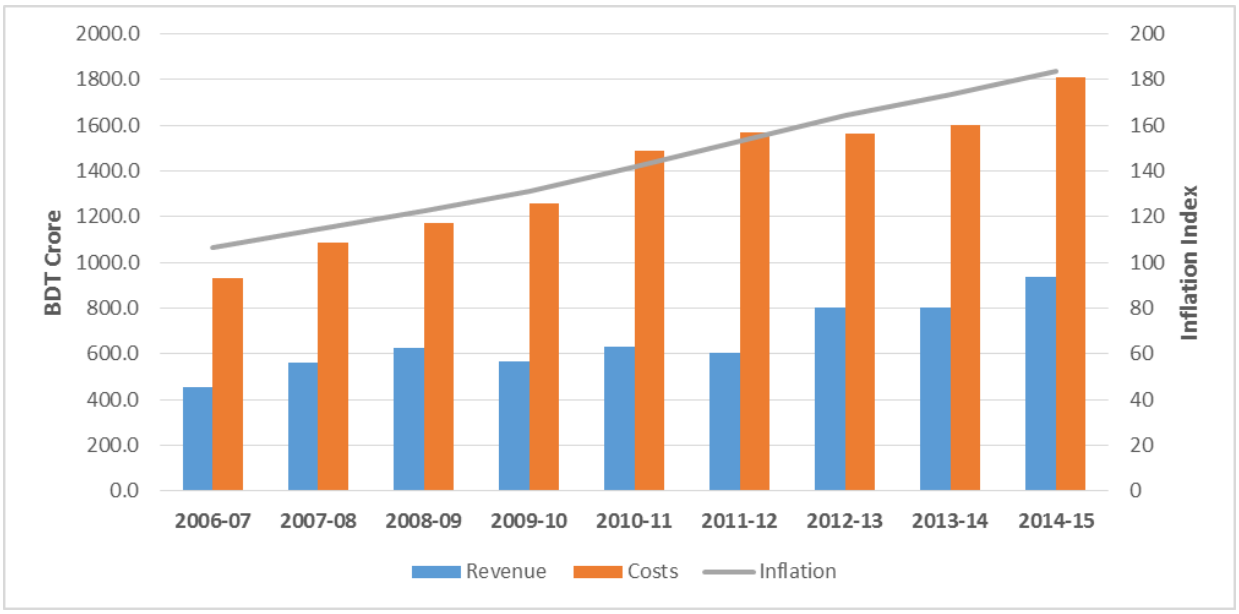
[25] Association of American Railroads
[26] Gov't of India Press Information Bureau
[27] Turkish State Railway 2015 Annual Report
[28] Pakistan Railways statistical tables

- Inadequate RS maintenance facilities
- Poor spares inventory and inefficient spares procurement procedures
- Rolling stock that has exceeded its economic life and should be retired
- Outmoded S&T technology, which prevents the existing lines from being used with full efficiency
- Poor PWay maintenance and deteriorating infrastructure, leading to speed restrictions which lead to inefficient PWay usage
- Manpower shortages which constrain both operations and maintenance
- Passenger and freight tariffs set far below cost recovery levels
- Shortage of locomotives (leading to poor utilization of carriages/wagons as well as staff)
- Shortage of passenger carriages (trains could be longer, generating more revenue for a marginal increase in cost)
- Competition with the Roads sector

Not only is the financial performance poor, it has been degrading over the past decade, mainly due to inflation. Figure 9-1 shows the annual revenue versus cost performance for the railway for the period 2006-1015. Revenue was relatively flat between 2006 and 2011. This is a reflection of the passenger tariff, which had been unchanged since 1992. A tariff increase was made in 2012 and revenue performance improved. However, the inflation index line on the same graph clearly shows that BR's costs have been increasing at roughly the same rate as Bangladesh's inflation index.

This implies that not only should rail tariffs be brought up to (or at least close to) cost recovery levels, they should also be indexed to inflation to avoid further degradation of financial performance. However, willingness to pay on the part of both passengers and freight clients should be carefully studied prior to any tariff increases to ensure that those increases do not result in a dramatic modal shift away from rail.

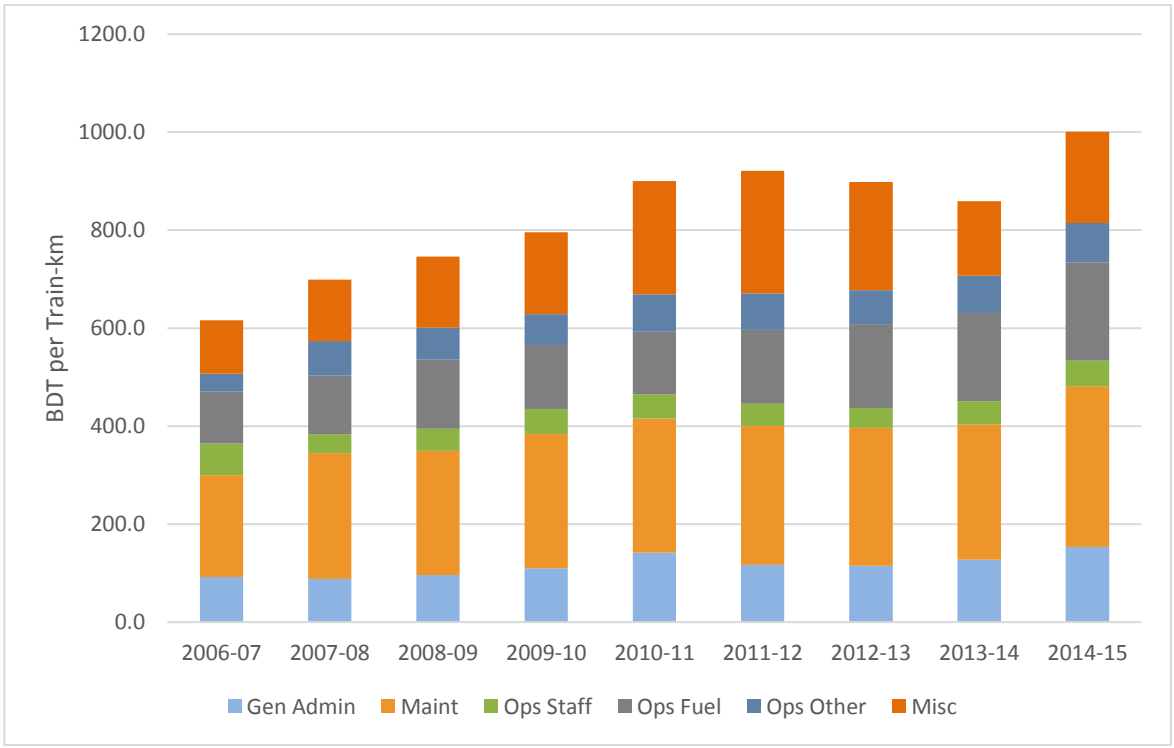
Figure 9-1: BR Costs and Revenue 2006-2015



Source: BR 2014-15 Information Book, WB World Development Indicators

Most of the unit cost increases have been experienced in the fuel, maintenance and general admin cost components as can be seen in Figure 9-2. It should be noted that the largest cost center is maintenance. It is entirely likely that, even with the new projects, the percentage share of maintenance could rise overall, as more maintenance is required in general terms. However, this will be more than offset by greater revenues resulting from better RS availability, as will be shown in the next section.

Figure 9-2: BR Operating Cost Breakdown (BDT per train-km)



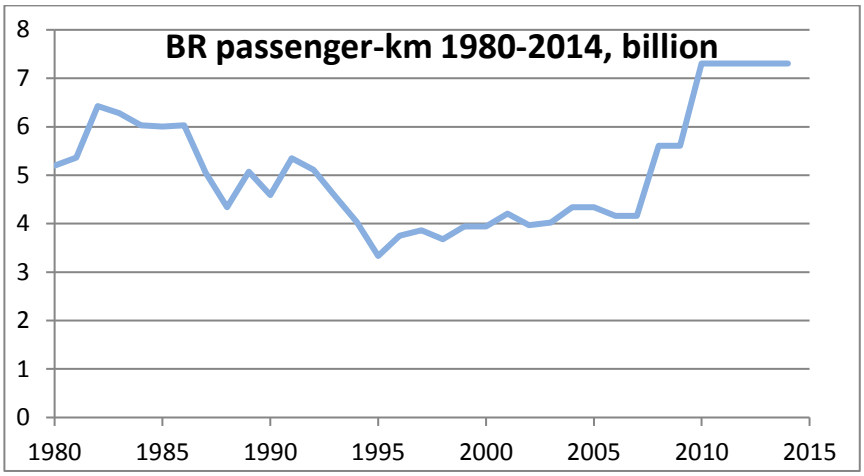
Source: BR 2014-15 Information Book

9.2 Increasing Rolling Stock Availability

Bangladesh Railway has been losing market share for decades, despite the fact that Bangladesh's market for transportation services has been steadily growing. Several studies in the past have pointed out that BR's revenue is not so much dependent on the size of its market as on the ability of BR to operate trains and provide transport services. The report Guidelines for Development and Approval of Transport Master Plans, Programs and Projects (c.2007) on page 35 shows that in 1975 the long-distance passenger market was 17 billion passenger-km. Rail share was 30%, or 5.1 billion passenger-km. By 2006 the market had grown more than ten-fold to 178 billion passenger-km of which rail's share had fallen more than ten-fold, to 2.8%. This implies that, since 1975, rail's passenger market capture (passenger-km) has remained roughly static.

This was verified by accessing the World Bank data base (Figure 9-3).

Figure 9-3: Bangladesh Railway passenger-km, 1980-2014



Source: World Bank http://data.worldbank.org/indicator/IS.RRS.PASG.KM

Following the introduction of 100 new carriages in 2006 and 2007, BR's market share rose again then flattened out. It appears that rail's share of the passenger market is limited by train capacity— in other words, train frequency and length.

This observation has a surprising repercussion. It is easy to think that rail's position in the passenger market has been maintained by low fares, which were held fixed from 1992 to October 2012 but in real terms fell due to inflation. The evidence suggests that rail's market share is determined by availability of rolling stock. Given more available rolling stock, BR could have retained a higher market share. By the same reasoning, BR could increase its current market share by having more rolling stock available.

BR has two ways of increasing rolling stock availability: (1) increasing the percentage of existing rolling stock available for use; and (2) procurement of new rolling stock to supplement existing stocks, presumably at the current low availability rates. The first option is the preferable one: due to the high cost of railway infrastructure and rolling stock, maintenance of those assets to provide the most return on the investment is the best financial course of action. In fact, it could be said that maintenance of railway assets is not negotiable and should not need justification.

However, Bangladesh Railways has not been maintaining its assets and as a result is not seeing the expected returns on asset investments. There are many reasons for this, some of them out of BR's control. As the railway is in a deficit position, it is dependent on funding from Government and other sources even for ongoing expenses such as maintenance. Funds have not been available for proper maintenance. Also, the railway has not been able to maintain either maintenance or operating staff anywhere near allowed levels. As noted in the Rolling Stock Maintenance Report, out-turn of the RS maintenance shops has dropped over the past decade.

However, both BR and its funding agencies should recognize the value of proper maintenance in gaining the best return on investments. A simple thought experiment can show this: assume two identical locomotives are procured and run for 30 years. In the first case, the loco is under-maintained over its life span and has an availability of only 63% (around the average for BR). In the second case, the locomotive is properly maintained and has an availability of 90% (considered "best practice" for railways). Both locos earn the same revenue per km when operating. The table below shows the parameters and return on investment (ROI) for both cases:

Item	Case 1: 63% Availability	Case 2: 90% Availability
Capital cost (BDT Crore)	30.8	30.8
Maintenance (% of CAPEX)	2%	4%
Annual Revenue (BDT Crore)	3.5	5.0
ROI	**8%**	**12%**

This simple experiment shows that maximizing rolling stock availability by proper maintenance maximizes ROI. Even if the maintenance cost is doubled, the ROI is higher simply by virtue of the higher availability.

9.2.1 Analysis of Rolling Stock Maintenance Projects on BR Profitability

The likely effect of the aggregate investment in Rolling Stock Maintenance projects on BR's bottom line was analyzed using figures from BR's Information Books and several years of Costing Profiles. While useful collections of BR operations and maintenance statistics, these documents in some cases did not provide the information required to make a comprehensive analysis in this particular case. To that end, some assumptions and simplifications were made in the analysis. These are listed below.

The first set of projects analyzed are those consisting of the RS maintenance facility enhancement and upgrade projects. These are projects designed to bring the existing facilities to the proper condition to provide adequate maintenance to the existing rolling stocks. These projects are considered separately from those designed to increase RS capacity by procurement of new RS and maintenance of that new RS.

The projects concerned are all scheduled for Phase 1 (2016-2020). The projects considered are:

Table 9-3: RS Maintenance Facility Upgrade Projects

No.	Project Title	Cost (BDT crore)
59	Modernization of Parbatipur Central Locomotive Workshop	770
70	Upgradation and reconstruction of Dhaka Diesel Loco Shed including equipment upgrade and DG conversion	500
71	Reconstruction of Diesel Loco sheds (9 total) including Equipment upgrade and DG Conversion	3,500
72	Reconstruction of Washing Pits & Coach and Wagon Depots (14 total) including equipment upgrades and DG conversion	4,000
73	Enhancement of Technical Training Facilities at 5 existing Workshop Training Units	39
75	Update Manuals and Codes (6 total) for Mechanical and Stores Department	31
Total CAPEX		8,840

Capital costs were assumed to be expended over a three year period, and the benefits accruing after that period.

As noted in the Rolling Stock Maintenance report, existing personnel levels are inadequate to provide proper maintenance to the existing rolling stock. It was also assumed that maintenance facility staffing for all the projects noted above would be increased to 80% of sanctioned levels (from the current 55%). The cost of this was taken as the average annual 2013/14 salary (206,160 taka) increased for contributions to provident fund and gratuities. Salary increases were assumed to start in Year 3 of the 30-year analysis – the facilities are not expected to be operational until Year 4, but training of the new personnel will be required.

As the trains cannot run themselves, a similar increase in Traffic Division staff to run the additional trains was assumed. Finally, an increase in fuel consumption commensurate with the increase in train traffic was estimated.

The benefits consist mainly of an increase in the availability of rolling stock, and the increased revenue that that availability will bring assuming it is utilized efficiently. As current locomotive availability is around 60-65%, a base availability of 63% was assumed, as well as a target availability of 90%. It is important to note that the analysis does not include any assumptions of additional procurement of rolling stock – the benefits accrue simply from better maintenance of the existing rolling stock (replaced as necessary due to economic life expiry).

Inflation was assumed at 6% over the study period, and was applied to fuel costs, personnel costs and revenue. This implicitly implies passenger and freight tariffs will be indexed to inflation.

Assuming the benefits are sourced from increases in coaching and freight revenue proportional to the existing ratios, the Financial Internal Rate of Return (FIRR) to this group of projects is 4.5% (see Appendix 8 for analysis). As Bangladesh Railway currently pays 4% on its accumulated debt to the GoB, this indicates that the projects as a group are worth undertaking. If tariff levels are increased to be closer to cost recovery levels, the return on these projects will increase considerably. For instance, if tariffs are increased 30%, the FIRR increases to 7.5%, well above BR's cost of capital.

It should be noted that there are several potential benefits that have not been included as they cannot be accurately modeled with the information at hand. These include:

- Any accrued benefits from fewer delays due to RS breakdowns (one train breaking down can cause delays to other trains, thus reducing revenue)
- Any accrued benefits from potentially higher operating speeds (assuming speed restrictions are in place due to RS condition)
- Expenditure reductions due to elimination of capitalized maintenance in favour of properly scheduled maintenance
- Reduced need for procurement of replacement rolling stock due to longer economic life produced by better maintenance

These benefits would increase the return on the listed projects.

9.2.2 Increase in Rolling Stock to meet Increases in Freight and Passenger Traffic

There are a number of projects which are designed primarily to increase BR's modal share in both the passenger and freight markets. These include procurement of rolling stock (locomotives, carriages, wagons and DEMUs) as well as installation of the maintenance facilities to provide proper maintenance for that rolling stock. The RS procurement projects include:

Table 9-4: RS Procurement Projects to Increase Modal Share

Project No.	Project Name	Master Plan Phase	Total 2016 Cost (BDT crore)
77	Procure BG and MG rolling stock to meet additional traffic demand - Phase 1	1	6,660
78	Procure BG rolling stock to meet additional traffic demand (incl. maintenance spares) - Phase 2	2	2,546
79	Procure BG rolling stock to meet additional traffic demand (incl. maintenance spares) - Phase 3	3	7,659

Project No.	Project Name	Master Plan Phase	Total 2016 Cost (BDT crore)
80	Procure BG rolling stock to meet additional traffic demand (incl. maintenance spares) - Phase 4	4	7,513
81	Procure BG rolling stock to meet additional traffic demand (incl. maintenance spares) - Phase 5	5	9.915
82	Procure BG rolling stock to meet additional traffic demand (incl. maintenance spares) - Phase 6	6	10,561
Total			**44,854**

Maintenance facility projects include:

Table 9-5: New Maintenance Projects to Increase Modal Share

Project No.	Project Name	Master Plan Phase	Total 2016 Cost (BDT crore)
60	Construction of new locomotive workshop at Narayanganj	1	1,155
61	Construction of Repair & Maintenance Workshop for DEMU	1	963
62	New Carriage & Wagon Maintenance Workshop at Rajbari	2	2,503
63	New Diesel Locomotive Workshop at Chittagong	2	1,155
64	New Traction Motor repair and rewinding unit at CLW, Parbatipur	4	385
65	New Diesel Locomotive Workshop at Rajbari	3	1,155
66	New BG Carriage and Wagon Maintenance Workshop at Kewatkhali, Mymensingh	3	2,310
67	New Diesel Electric Multiple Unit maintenance Workshop at Ishurdi	4	963
68	Reconstruction of existing Carriage & Wagon Workshop at Chittagong	5	2,755
69	New Diesel Electric Multiple Unit maintenance Workshop at Chittagong.	5	963
Total			**14,305**

It is impossible at this point in time to justify these projects financially as BR has been losing money on both passenger and freight service for some time. One of the main reasons for these losses is low tariffs – current tariffs are far below cost recovery levels even for an efficient railway. Addition of new rolling stock (as opposed to increasing availability of existing rolling

stock) to carry more passengers and freight will not overcome those financial constraints. This is impossible without revised tariffs.

It should be noted, though, that additional rolling stock will allow trains to be lengthened. This will allow much better revenue performance in that the marginal costs of operation will rise very slightly while the revenue will rise roughly proportional to train length. This applies to both passenger and freight movements. It is also possible to increase passenger revenue by increasing the number of A/C and First Class coaches, which attract higher fares.

The very fact that the GoB subsidizes BR operations indicates that the economic benefits of the railway are valued. Execution of the projects above would linearly increase the economic and financial benefits obtained from the movement of passengers and freight. Some of those benefits are listed below.

For passenger transport: a 5% annual increase in passenger transport was assumed over the plan period – this is what the scale of the above projects are based on. Starting with the 2014-15 BR passenger carriage of 8,711 million pass-km, it is estimated that 265 trillion pass-km will be diverted from road to rail over the plan period. Benefits arising include:

- Fewer vehicles on Bangladeshi roads, which may assist in postponement of new road construction or expansion as well as faster road travel time.
- If tariffs are not brought into line with bus transport, the lower rail passenger tariff will confer a net financial benefit to travellers over the plan period. This benefit is estimated at 304 trillion (current BDT) over the plan period using the current tariff spread. The economic benefit to travellers (assuming this is higher than the bus tariff) will be even higher.
- Environmental benefits will accrue from diversion of passengers from bus and other road transport to rail.

For freight transport:

- Fewer transport trucks on Bangladeshi roads, with the same associated benefits as noted above for passenger transport.
- Environmental benefits accruing from the diversion of freight from road to rail.
- Given appropriate lead distances, economic and financial benefits from rail transport's inherently more efficient delivery over long distances than road transport.

9.3 Line Capacity Enhancement Projects

There are many ways to increase the capacity of an existing line, and many of the projects contained in this Master Plan use one or several of these methods. They include (roughly in order of increasing cost):

- Lengthening of trains (more carriages or wagons per train). This sometimes involves lengthening passing loops and may include procurement of more powerful locomotives (the latter could be limited by line axle load capacity).

- Increasing the speed of trains over the line. This can involve one or more of:
  - Reduction of temporary or permanent speed restrictions. This can involve more thorough long-term PWay maintenance and/or increasing curve radii (which may involve land acquisition).
  - Increasing the average speed of trains. This is limited by the line design and the capability of the rolling stock, but better maintenance of that rolling stock can allow increased train speeds.
- Installation of more advanced signalling technology. As seen in Chapter 7, BR uses several different types of signalling systems and is in the process of introducing CTC.
- Doubling of lines (this generally also includes upgrade of signalling).

The first two methods, while possible, are limited in the capacity enhancement they can deliver - depending on individual circumstance, gains are limited to under 15%. The two methods which offer the most promise are upgrading of signalling technology and doubling of lines.

There are projects involving both methods, recommended in this Master Plan. The choice between which to choose is mainly related to the capacity increase desired. As seen in Chapter 7, the capacity increase which can be expected from a signalling upgrade is in the order of 40-60%. The capacity increase which can be expected from a line doubling is in the order of 400%.

However, the costs differ vastly as well. On average, the signalling improvement projects herein will cost approximately BDT 4.1 crore/km. The line doubling projects vary greatly, but average around BDT 60 crore/km. The higher cost is due to land acquisition, the cost of additional roadbed and permanent way, and the necessity to either double or reconstruct all bridges. In fact, if a line doubling is done, the signalling is generally upgraded at the same time.

Each of the projects of this type should be subject to a feasibility study prior to implementation, and that feasibility study should determine what the desired capacity enhancement will be. If the additional capacity increase is under 60% of the current capacity for the subsequent ten years (or 5% increase per year), BR may want to strongly consider enhancement of the signalling technology or other means over line doubling.

9.4 Discussion and Conclusions

The analyses presented above indicate that, with the addition of newly procured rolling stock as well as a higher availability of existing rolling stock, operations should increase. This will mean additional staff as well as additional operating expenditures on fuel and other expendables. Therefore, it is expected that operating costs will increase over the long term.

However, these increased operating expenses will be more than offset by increased revenue. Higher RS availability will mean a higher return on investment and will ultimately lead to a lower required subvention from GoB to support BR operations (as a percentage of total revenue).

The subvention could be further lowered by reform of both freight and passenger tariffs. Currently, in addition to subsidizing BR directly, GoB is directly subsidizing passenger travel by setting artificially low fares. A detailed analysis of fares is necessary to find a fare basis that will

maximize overall revenue (this may not be at the same point at which the number of passengers carried is highest).

Freight fares could also be examined. However, rail freight service should be improved before any tariff reform is done in order to show shippers that they are getting value for money.

Tariffs should be indexed to inflation in order to avoid the need for frequent one-off tariff adjustments.

BR could consider other means of increasing revenue. This Master Plan includes a project to increase the reach of BR's fibre optic network – this should provide additional leasing opportunities for data transfer. BR also has significant land holdings which could generate revenue through "transit-based development" – development that capitalizes on the adjacency of the railway. This Master Plan also includes projects which will enhance the ability of the Railway to generate revenue from leasing station space to retail outlets.

The measures listed above should bring BR much closer to "breakeven" – they should assist strongly in improving the financial position of the Railway. However, the social responsibility of the railway for passenger transport (which is usually provided below cost) means that the railway may never break even – few passenger railways in the world actually show a profit.

Appendix 1: Project Database

The columns listed herein are a partial representation of the database information. For full details, the reader is referred to the actual MS Excel-based database "TA 8597 Bangladesh Railway Master Plan – Project Database".

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
1	Construction of new BG Railway Line from Darsana to Meherpur via Damurhuda and Mujibnagar.	1	GOB	Pway	New Line	BG	W	2,3	1,125
2	Conversion of existing Metre Gauge track in to Dual Gauge track between Sylhet-Chatak Bazar section	1	GOB	Pway	Gauge Conversion	DG	E	5	1,622
3	Construction of new Tista Railway Bridge	3	FA/GOB	Works	Bridge Construction	DG	W	6	1,800
4	Construction of rail link with Uttara EPZ, Nilphamari	1	GOB	Pway	New Line	BG	W	2,4B	156
5	Bangabandhu Railway Bridge Construction	1	FA	Works	Bridge Construction	DG	W	3,4,6	9,740
6	Construction of Broad Gauge Rail line from Bhanga Junction (Faridpur) to Payra Port via Barisal	1	FA	Pway	New Line	BG	W	7C	28,335
7	Construction of Akhaura-Agartala dual gauge railway link (Bangladesh portion)	1	FA	Pway	New Line	DG	E	1	478

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
8	Conversion of existing MG track to DG track between Akhaura- Sylhet.	1	FA	Pway	Gauge Conversion	DG	E	5	8,619
9	Construction of Broad Gauge Double line track between Khulna – Darshana junction Section.	1	FA	Pway	Line Doubling	BG	W	2, 3	3,700
10	Construction of 2nd track (BG) between Abdulpur-Rajshahi	2	GOB	Pway	Line Doubling	BG	W	4A	3,386
11	Construction of new BG track on Nabharan to Satkhira section.	2	GOB	Pway	New Line	BG	W	3	1,748
12	Construction of new BG track on Satkhira to Munshiganj section.	2	GOB	Pway	New Line	BG	W	3	2,780
13	Conversion from metre gauge line to dual gauge line from Parbatipur to Kaunia	1	GOB	Pway	Gauge Conversion	DG	W	4B,6	2,689
14	Construction of rail link with Ishurdi EPZ.	2	GOB	Pway	New siding line	BG	W	2,3	536
15	Construction of Railway Bypass for Bhairab Bazar, Abdulpur, Jamtoil & Kaunia	3	GOB	Pway	New Line	BG/ DG	W	4B,6	295
16	Construction of Broad Gauge Rail Line between Chilahati and Chilahati Border for Connectivity with India.	1	GOB	Pway	New Line	BG	W	2,4B	79
17	Conversion of existing Metre Gauge line in to Dual Gauge line between Bhairab Bazar-Mymensingh section	3	GOB	Pway	Line Rehabilitation	DG	E	8B	211

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
18	Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Narayanganj–Dhaka–Joydebpur Section of Bangladesh Railway	1	FA/GOB	Electrical	Electric Traction				560
19	Construction of Dual Gauge single line from Panchagarh to Banglabandh	3	GOB	Pway	New Line	DG	W	4B	7,419
20	Conversion of existing Shayestagonj-Balla section into DG track	4	GOB	Pway	Gauge conversion	DG	E	5	354
21	Construction of Circular Rail Line around Chittagong-SRV-CGPY-Saltgola-Dry Dock-Shah Amanat Airport-Dry Dock-Saltgola-CGPY-Fouzderhat-Chittagong (Phase-1)	4	GOB	Pway	Facility Upgrade	DG	E	1	247
22	Rehabilitation of Important Railway Bridges in West Zone of BR.	2	GOB	Works	Bridge Rehabilitation		W	Var	236
23	Construction of overpass/flyover in Narayanganj-Joydebpur section of Bangladesh Railway	2	GOB	Works	New overpass/ underpass		E&W	Var	591
24	Renovation of Central Railway Building (CRB) in Chittagong as a heritage building	1	GOB	Works	Beautification program		E	1	100
25	Construction of new BG & DG Concrete Sleeper Plant at Santahar	2	GOB	Works	New concrete sleeper plant		W		354
26	Rehabilitation of Important Railway Bridges in East Zone of BR.	2	GOB	Works	Bridge Rehabilitation		E	Var	200

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
27	Construction of DG Rail Link from Bogra to Shaheed M. Monsur Ali Station	1	FA	Pway	New Line	DG	W	6	6,607
28	Construction of double line between Joydebpur and Ishurdi section of BR	1	FA	Pway	Line Doubling	DG	W	3,4	7,698
29	Construction of Dhaka-Chittagong via Comilla/ Laksam High Speed Railway	2	FA	Pway	New Line	TBD	E	1	30,995
30	Construction of Circular Rail Line around Dhaka City.	2	FA	Pway	New Line	SG	E	1	13,189
31	Conversion of existing Metre Gauge line in to Dual Gauge line between Dhaka- Narayanganj	2	FA	Pway	Gauge Conversion	DG	E	1	784
32	Conversion of existing Metre Gauge double line to Dual Gauge double line between Tongi- Bhairab.	2	FA	Pway	Gauge Conversion	DG	E	1	6,233
33	Conversion of existing Metre Gauge double line in to Dual Gauge double line between Laksam- Chittagong.	2	FA	Pway	Gauge Conversion	DG	E	1	12,621
34	Conversion of Metre Gauge double line in to Dual Gauge double line from Chittagong to Sholashahar including construction of Chittagong bypass	2	FA	Pway	Gauge Conversion	DG	E	1	1,141
35	Conversion of Metre Gauge single line in to Dual Gauge single line from Sholashahar to Dohazari	2	FA	Pway	Gauge Conversion	DG	E	1	1,977
36	Construction of a Dual Gauge Rail Line Parallel to the Existing metre Gauge Rail Line in Joydebpur-Mymensingh -Jamalpur Section.	1	FA	Pway	Line Doubling	DG	E	8A	7,255

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
37	Conversion of existing Metre Gauge line in to Dual Gauge line between Santahar-Bogra	2	FA	Pway	Gauge Conversion	DG	W	2, 6	1,944
38	Construction of Dual Gauge double line between Abdulpur and Parbatipur	3	FA/GOB	Pway	Line Doubling	DG	W	2,4B	13,368
39	Construction of Dual Gauge double line between Akhaura- Sylhet.	3	FA/GOB	Pway	Line Doubling	DG	E	5	15,077
40	Construction of new railway line from Tungipara to Mongla via Fakirhat.	3	FA/GOB	Pway	New Line	BG	W	2,7C,7D	11,019
41	Construction of Dual Gauge double line between Fauzderhat- CGPY	3	FA/GOB	Pway	Line Doubling	DG	E	1	916
42	Conversion of existing Metre Gauge line in to Dual Gauge line between Joydebpur- Mymensingh-Jamalpur	2	FA/GOB	Pway	Gauge Conversion	DG	E	8A	4,562
43	Construction of New Broad Gauge single line from Payra to Kuakata	3	FA/GOB	Pway	New Line	BG	W	7C	4,722
44	Reconstruction of Rupsha-Bagherhat Railway line (BG).	3	FA/GOB	Pway	Reconstruction	BG	W	2	2,895
45	Conversion of existing MG track to DG track between Jamalpur-Bangabandhu Bridge East and Jamalpur-Bahadurabad Ghat.	4	FA/GOB	Pway	Gauge Conversion	DG	E	8A	6,040
46	Construction of BG single line from Chatak Bazar to Sunamganj	2	FA/GOB	Pway	New Line	BG	E	5	4,722

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
47	Conversion of existing Metre Gauge line in to Dual Gauge line between Laksam- Chandpur	3	FA/GOB	Pway	Gauge Conversion	DG	E	1	2,659
48	Conversion of existing Metre Gauge line in to Dual Gauge line between Laksam- Noakhali	3	FA/GOB	Pway	Gauge Conversion	DG	E	1	2,535
49	Conversion of existing Metre Gauge line in to Dual Gauge line between Sholashahar- Nazirhat	3	FA/GOB	Pway	Gauge Conversion	DG	E	1	1,579
50	Conversion of existing Metre Gauge line in to Dual Gauge line between Fateyabad- Chittagong University	3	FA/GOB	Pway	Gauge Conversion	DG	E	1	111
51	Reconstruction of Hardinge Bridge	3	FA/GOB	Works	Bridge Construction	BG	W	2,3	2,720
52	Construction of Railway Bridge Over the Jamuna river near Phulchari- Bahadurabad Ghat including Approach Rail Link	5	FA/GOB	Works	New Bridge	BG	E&W	8A	22,704
53	Conversion of existing Metre Gauge line in to Dual Gauge line from Bogra to Lalmonirhat via Bonarpara and Trimohini-Balashighat	3	FA/GOB	Pway	Gauge Conversion	DG	W	6	5,946
54	Conversion of Existing MG track to DG track between Gauripur Mymensingh- Mohanganj and Shaymganj-Jariajanjail	4	FA/GOB	Pway	Gauge Conversion	DG	E	8B	3,644
55	Construction of BG single line from Nazirhat to Khagrachhari	4	FA/GOB	Pway	New Line	BG	E	1	9,445
56	Construction of BG single line from Hathazari to Rangamati	4	FA/GOB	Pway	New Line	BG	E	1	7,084

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
57	Construction of BG single line from Dohazari to Bandarban.	4	FA/GOB	Pway	New Line	BG	E	1	3,148
58	Conversion of existing MG track to DG track between Lalmonirhat - Burimari and Tista-Ramna Bazar	5	FA/GOB	Pway	Gauge Conversion	DG	W	6	3,956
59	Modernization of Parbatipur Central Locomotive Workshop	1	FA/GOB	RS	RS Maintenance		W		770
60	Construction of new locomotive workshop at Naryanganj	1	FA/GOB	RS	RS Maintenance		E		1,155
61	Construction of Repair & Maintenance Workshop for DEMU at Naryanganj	1	FA/GOB	RS	RS Maintenance		E		963
62	New Carriage & Wagon Maintenance Workshop at Rajbari	2	FA/GOB	RS	RS Maintenance		W		2,503
63	New Diesel Locomotive Workshop at Chittagong	2	FA/GOB	RS	RS Maintenance		E		1,155
64	New Traction Motor repair and rewinding unit at CLW, Parbatipur	4	FA/GOB	RS	RS Maintenance		W		385
65	New Diesel Locomotive Workshop at Rajbari	3	FA/GOB	RS	RS Maintenance		W		1,155
66	New BG Carriage and Wagon Maintenance Workshop at suitable location of Mymensingh	3	FA/GOB	RS	RS Maintenance		E&W		2,310

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
67	New Diesel Electric Multiple Unit maintenance Workshop at Ishurdi	3	FA/GOB	RS	RS Maintenance		W		963
68	Reconstruction of existing Carriage & Wagon Workshop at Chittagong	5	FA/GOB	RS	RS Maintenance		E		2,755
69	New Diesel Electric Multiple Unit maintenance Workshop at Chittagong	5	FA/GOB	RS	RS Maintenance		E		963
70	Upgradation and reconstruction of Dhaka Diesel Loco Shed including equipment upgrade and DG conversion	1	FA/GOB	RS	RS Maintenance		E&W		500
71	Reconstruction of Diesel Loco sheds (09 total) including Equipment upgrade and DG Conversion	1	FA/GOB	RS	RS Maintenance		E&W		3,500
72	Reconstruction of Washing Pits & Coach and Wagon Depots (14 total) including equipment upgrades and DG conversion	1	FA/GOB	RS	RS Maintenance		E&W		4,000
73	Enhancement of Technical Training Facilities at 5 existing Workshop Training Units	1	FA/GOB	RS	RS Maintenance		E&W		80
74	Construction of Rest Rooms for Running Staff	1	FA/GOB	Ops	Ops Support		E&W		45
75	Update Manuals and Codes (6 total) for Mechanical, Electrical and Stores Department and translated into Bangla	1	FA/GOB	RS	RS Maintenance		E&W		31
76	Replacement and Renovation of Equipment and Infrastructure of Kadamtoli Bridge Workshop	1	FA/GOB	Works	Bridge Maintenance		E		9.3

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
77	Procure BG and MG rolling stock to meet additional traffic demand - Phase 1	1	FA/GOB	RS	RS Procurement		E&W		6,660
78	Procure BG rollingstock to meet additional traffic demand (incl. maintenance spares) - Phase 2	2	FA/GOB	RS	RS Procurement		E&W		2,546
79	Procure BG rolling stock to meet additional traffic demand (incl. maintenance spares) - Phase 3	3	FA/GOB	RS	RS Procurement		E&W		7,659
80	Procure BG rolling stock to meet additional traffic demand (incl. maintenance spares) - Phase 4	4	FA/GOB	RS	RS Procurement		E&W		7,513
81	Procure BG rolling stock to meet additional traffic demand (incl. maintenance spares) Phase 5	5	FA/GOB	RS	RS Procurement		E&W		9,915
82	Procure BG rolling stock to meet additional traffic demand (incl. maintenance spares) - Phase 6	6	FA/GOB	RS	RS Procurement		E&W		10,561
83	Procurement of replacement rolling stock - Phase 1	1	FA/GOB	RS	RS Procurement		E&W		9,412
84	Procurement of replacement rolling stock - Phase 2	2	FA/GOB	RS	RS Procurement		E&W		742
85	Procurement of replacement rolling stock - Phase 3	3	FA/GOB	RS	RS Procurement		E&W		847
86	Procurement of replacement rolling stock - Phase 4 Procurement of 30 BG Shunting cum Branch Line Locomotive against replacement.	4	FA/GOB	RS	RS Procurement		E&W		243

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
87	Procurement of replacement rolling stock - Phase 5	5	FA/GOB	RS	RS Procurement		E&W		243
88	Modernization of Signaling & Interlocking System by CBI at 21 Stations in Abdulpur – Parbatipur Section including Ishurdi Station	1	FA/GOB	S&T	Signals Upgrade		W	2, 4B	300
89	Modernization of Signaling & Interlocking System with CBI and CTC in 5 stations in Abdulpur–Rajshahi Section including Ishurdi station.	1	FA/GOB	S&T	Signals Upgrade		W	4A	75
90	Modernization of Signaling & Interlocking System with CBI and CTC at 18 Stations in Khulna – Darsana section.	1	FA/GOB	S&T	Signals Upgrade		W	2	270
91	Modernization of Signaling & Interlocking System at 8 Stations in the section Chittagong Jn Cabin – Dohazari by CBI with connectivity with CTC centre at Pahartali, Chittagong.	1	FA/GOB	S&T	Signals Upgrade		E	1	120
92	Installation of optical fiber based telecommunication system in the remaining secondary line sections of BR (about 650 km).	1	FA/GOB	S&T	Signals Upgrade		E&W		78
93	Modernization of Signaling & Interlocking System with CBI at 25 stations in Lalmonirhat – Kaunia – Bogra – Santahar Section (except STU) with CTC connectivity with the Divisional Control Office.	3	FA/GOB	S&T	Signals Upgrade		W	2,4A,6	480

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
94	Modernization of Signaling & Interlocking System with CBI and CTC connectivity at 6 Stations in Kaunia–Parbatipur - Syedpur section excluding Kawnia and Parbatipur station.	1	FA/GOB	S&T	Signals Upgrade		W		90
95	Modernization of Signaling & Interlocking System with CBI and CTC at 14 stations in Bhairab Bazar–Kishoregonj – Mymensingh Section.	2	FA/GOB	S&T	Signals Upgrade		E	8	252
96	Modernization & up gradation of signal workshop at Kadamtali, Chittagong.	2	FA/GOB	S&T	Signals Upgrade		E&W		100
97	Installation of GSM R Train Radio communication system among driver, Guard, SM connecting two divisional train control offices of East zone of Bangladesh Railway.	2	FA/GOB	S&T	Signals Upgrade		E		315
98	Installation of GSM R Train Radio communication system among driver, Guard, SM connecting two divisional train control offices of West zone of Bangladesh Railway.	3	FA/GOB	S&T	Signals Upgrade		W		392
99	Installation of modern signaling & telecommunication training centre at Dhaka.	2	FA/GOB	S&T	Signals Upgrade		E&W		50
100	Integration of CTC Control system of Chittagong and Dhaka with the CBI Interlocked stations of the two respective divisions	1	FA/GOB	S&T	Signals Upgrade		E		600

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
101	Installation of CTC Control system at Paksey and Lalmonirhat divisional control office and integration with CBI Interlocked stations of the two divisions .	2	FA/GOB	S&T	Signals Upgrade		W		400
102	Installation of radio based cab Signalling with automatic Train Protection (ATP)/Train rotection Warning Syatem (TPWS) and Automatic Train Control (ATC) system in the section: Narayanganj - Dhaka - Chittagong.	2	FA/GOB	S&T	Signals Upgrade		E	1	789
103	Modernization & up gradation of optical fiber based telecommunication system of Bangladesh Railway (2009 km) presently used by Grameenphone Ltd.	4	FA/GOB	S&T	Signals Upgrade		E&W		560
104	Replacement and modernization of signaling system on AKA-SYT section (22 Stations) with CBI and CTC connectivity with the Divisional Control office (excluding AKA)	3	FA/GOB	S&T	Signals Upgrade		E	5	550
105	Installation of radio based cab signaling with automatic Train Protection (ATP)/Train Protection Warning System (TPWS) and Automatic Train Control (ATC) System in sections Akhaura-Sylhet, Tongi-Jamalpur, Joydevpur-Ishurdi, Khulna-Parbatipur in east and west zones of Bangladesh Railway.	3	FA/GOB	S&T	Signals Upgrade		E&W	5,1,2,3, 8,6	2,173

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
106	Modernization of signaling system by Interlocking of different section of secondary lines replacing non-interlocked mechanical/color light signaling system.	4	FA/GOB	S&T	Signals Upgrade		E&W		612
107	Upgrading Training Academy at Chittagong for Signalling & Telecom	1	FA/GOB	S&T	Training		E&W		40
108	Introduction of Mechanized Track Maintenance Phase 1	1	FA/GOB	Pway	Pway Maintenance	BG/ DG	E&W		1,040
109	Introduction of Mechanized Track Maintenance Phase 2	2	FA/GOB	Pway	Pway Maintenance	BG/ DG	E&W		246
110	Implementation of RDS Unit	1	FA/GOB	Other	Other		E&W		21.8
111	Construction of Chittagong CGPY Inter-Modal Terminal	2	FA/GOB	Ops	Other	DG	E	1	1,200
112	Construction of Railway Bridge at Moukuri-Dhalar Char point over River Padma to connect Pabna and Rajbari with the existing railway network	5	FA	Works	New Bridge		W	9,7	9,448
113	Modernization of Concrete Sleeper Plant of Bangladesh Railway and construction of Broad Gauge and Dual Gauge Concrete Sleeper Plant at Chatak Bazar	1	FA/GOB	Works	Expansion of Concrete Sleeper Plant		E&W	Var	120
114	Institutional Strengthening and Capacity Building of BR: Phase 1	1	FA/GOB	Other	Inst. Strength.		E&W	Var	50

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
115	Institutional Strengthening and Capacity Building of BR: Phase 2	2	FA/GOB	Other	Inst. Strength.		E&W	Var	50
116	Institutional Strengthening and Capacity Building of BR: Phase 3	3	FA/GOB	Other	Inst. Strength.		E&W	Var	50
117	Institutional Strengthening and Capacity Building of BR: Phase 4	4	FA/GOB	Other	Inst. Strength.		E&W	Var	50
118	Institutional Strengthening and Capacity Building of BR: Phase 5	5	FA/GOB	Other	Inst. Strength.		E&W	Var	50
119	Institutional Strengthening and Capacity Building of BR: Phase 6	6	FA/GOB	Other	Inst. Strength.		E&W	Var	50
120	Environmental Assessment Study of BR	1	FA	Other	Other		E&W		12
121	Development of Darshana Interchange Yard	2	GOB	Ops	ICD		W	2,3	59
122	Development of Rohanpur Interchange Yard	2	GOB	Ops	ICD		W	4A	59
123	Installation of 33/11 KVA 10 MVA Sub-Station and Power supply system in Dhaka.	1	GOB	Electrical	Electrification		E		25
124	Improvement and Maintenance of ICT Infrastructure of BR: Phase 1	1	GOB	ICT	ICT		E&W	Var	125
125	Improvement and Maintenance of ICT Infrastructure of BR: Phase 2	2	GOB	ICT	ICT		E&W	Var	125

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
126	Improvement and Maintenance of ICT Infrastructure of BR: Phase 3	3	GOB	ICT	ICT		E&W	Var	125
127	Improvement and Maintenance of ICT Infrastructure of BR: Phase 4	4	GOB	ICT	ICT		E&W	Var	125
128	Improvement and Maintenance of ICT Infrastructure of BR: Phase 5	5	GOB	ICT	ICT		E&W	Var	125
129	Improvement and Maintenance of ICT Infrastructure of BR: Phase 6	6	GOB	ICT	ICT		E&W	Var	125
130	Beautification & development of station areas for commercial use of Dhaka, Tejgaon, Cantonment, Airport, Narayanganj & Tongi stations.	1	PPP	Works	Beautification program		E	Var	118
131	Beautification & development of station areas for commercial use of Chittagong, Sylhet & other important stations of East Zone of BR.	1	PPP	Works	Beautification program		E	1	177
132	Beautification & development of station areas for commercial use of Rajshahi & other important stations of West Zone of BR.	1	PPP	Works	Beautification program		W	4A	236
133	Construction of Railway Connectivity with Moheshkali and Matarbari	2	FA/GOB	Pway	New Line	BG	E	1	1,181
134	Construction of Railway connectivity in between Panchagor-Chilahati-Hatibandha of BR.	4	FA/GOB	Pway	New Line	BG	W	2, 4B, 6	1,772

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
135	Construction of Rail line from Jamalpur to Tourism Spots of Sherpur.	2	FA/GOB	Pway	New Line	DG	E	8A	3,543
136	Rehabilitation of Main Line section of BR (East Zone) Phase -I	2	FA/GOB	Pway	Line Rehabilitation	DG	E	1,5	1,181
137	Rehabilitation of Main Line section of BR (West Zone) Phase - I	1	FA/GOB	Pway	Line Rehabilitation	DG	W	3,4,6	1,181
138	Modernization of Railway Training Academy and construction of Railway Museum with enhancement of training facilities.	1	FA/GOB	Other	Facility Upgrade		E	Var	591
139	Modernization of Railway Hospitals & Construction of Medical Colleges in Dhaka & Chittagong of BR.	1	PPP	Other	Facility Upgrade		E	Var	709
140	Construction of Railway Training Institute in Dhaka and Rajshahi.	2	FA/GOB	Other	Inst. Strength.		E&W	Var	354
141	Modernization of Railway Hospitals & Construction of Medical Colleges in Khulna, Rajshahi & Saidpur of BR.	2	PPP	Other	Facility Upgrade		W	Var	709
142	Modernization of Bridge Workshops at Chittagong and Saidpur	1	FA/GOB	Works	Bridge Maintenance		E&W	Var	200
143	Remodelling of Dhaka Biman Bandar Station	2	FA/GOB	Works	Facility Upgrade		E		200
144	Construction of a new Inland Container Depot (ICD) near Dhirasram railway station.	1	FA/PPP	Works	New ICD		E	Var	1,640

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
145	Construction of subway from Narayanganj to Tongi	4	FA/GOB	Works	New overpass/ underpass		E	1,3,4,5, 6,7,8	17,000
146	Rehabilitation and improvement of electrical substation of BR -East Zone	2	GOB	S&T	Facility Upgrade		E&W	Var	250
147	Rehabilitation and improvement of electrical substation of BR -West Zone	2	GOB	Electrical					200
148	Construction of Kustia Bypass Railway Line from Jagati to Gorai Bridge	2	FA/GOB	Pway	New Line	BG	W	9B, 7D	496
149	Construction of Dual Gauge Railway line from Janalihut to Kaptai via CUET	1	FA/GOB	Pway	New Line	DG	E	1	9,445
150	Construction of new BG line along Jessore-Magura-Sripur-Langolband-Pangsa.	4	FA/GOB	Pway	New Line	BG	W		18,890
151	Construction of new BG line along Modhukhali-Magura-Jessore.	5	FA/GOB	Pway	New Line	BG	W		13,381
152	Construction of new BG line along Joydebpur-Dhamrai-Manikganj-Paturia	5	FA/GOB	Pway	New Line	BG	E		17,316
153	Rehabilitation of Jessore-Benapole rail line	1	FA/GOB	Pway	Line Rehabilitation	BG	W	3,7	1,502
154	Construction of Rohanpur-Joypurhat Rail Line	4	FA/GOB	Pway	New Line	BG	W	2,4	17,316

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
155	Construction of rail line to Feni Economic Zone and Mirersarai Economic Zone	1	FA/GOB	Pway	New Line	DG	E		4,685
156	Updating of Operations Manuals and Tariff Books	1	FA	Ops	Inst. Strength.		E&W	Var	19
157	Construction of Railway link to Jamalpur Economic Zone	1	FA/GOB	Pway	New Line	DG	E	8	852
158	Upgradation of printing press at Pahartali	1	FA/GOB	Other	Other		E&W	Var	20
159	Installation, operations and maintenance of call center for Bangladesh Railway	1	FA/GOB	Ops	Ops Support		E&W	Var	50
160	Installation, operations and maintenance of automatic ticket vending machine in 100 stations	1	FA/GOB	Ops	Ops Support		E&W	Var	100
161	Installation, operations and maintenance of POS machines for TTE's for local/commuter/mail train	1	FA/GOB	Ops	Ops Support		E&W	Var	20
162	Station Development and Up-gradation of ticketing systems and entry exit machine installation in 5 stations in Bangladesh	1	FA/GOB	Works	Facility Upgrade		E&W	Var	191
163	Station Development and Up-gradation of ticketing systems and entry exit machine installation in 10 stations in Bangladesh	2	FA/GOB	Works	Facility Upgrade		E&W	Var	381

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
164	Station Development and Up-gradation of ticketing systems and entry exit machine installation in 10 stations in Bangladesh	3	FA/GOB	Works	Facility Upgrade		E&W	Var	381
165	Station Development and Up-gradation of ticketing systems and entry exit machine installation in 10 stations in Bangladesh	4	FA/GOB	Works	Facility Upgrade		E&W	Var	381
166	Station Development and Up-gradation of ticketing systems and entry exit machine installation in 15 stations in Bangladesh	5	FA/GOB	Works	Facility Upgrade		E&W	Var	572
167	Development, Installation, operations and maintenance of computerized wagon control system for BR	1	FA/GOB	Ops	Ops Support		E&W	Var	50
168	Establish Railway Inland Container Terminals with customs facility at Uttara EPZ, Benapole	1	FA/PPP	Works	New ICD		E&W	Var	4,800
169	Construction of Railway Inland Container Terminals at Mongla Port and Ishurdi	2	FA/PPP	Works	New ICD		E&W	Var	1,600
170	Establish Railway Inland Container Terminal with customs facility at Darsana, Shahbazpur	3	FA/PPP	Works	New ICD		E&W	Var	1,600
171	Establish railway connection with Chittagong Bay terminal	1	FA/GOB	Pway	New Line	DG	E	1	1,574
172	Feasibility study and detail design for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Narayanganj–Dhaka–Joydebpur Section of Bangladesh Railway	1	GOB	FS	Electrification		E	1	4

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
173	Feasibility Study for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Tongi–Chittagong Section of Bangladesh Railway	1	GOB	FS	Electric Traction		E	1,5	4
174	Feasibility Study for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Joydebpur- Ishurdi- Khulna Section of Bangladesh Railway	2	GOB	FS	Electric Traction		W	2,3,4,6	4
175	Feasibility Study for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Akhaura- Sylhet Section of Bangladesh Railway	2	GOB	FS	Electric Traction		E	5	4
176	Feasibility Study for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Ishurdi- Parbatipur Section of Bangladesh Railway	3	GOB	FS	Electric Traction		W	2,4	4
177	Conversion of Metre Gauge double line in to Dual Gauge double line between Bhairab Bazar and Akhaura including rebuilding of existing Bhairab and Titas bridge	2	FA	Pway	Gauge Conversion	DG	E	1,5	3,214
178	Construction of 2nd Railway cum Road bridge across Karnaphuly River near Kalurghat	1	FA	Works	Bridge Construction	DG	E	1	2,000
179	Rehabilitation of 200 Nos. Broad gauge passenger carriages of Bangladesh Railway	2	GOB	RS	RS Maintenance		E&W		150

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
180	Rehabilitation of 200 Nos. metre gauge passenger carriages of Bangladesh Railway	1	GOB	RS	RS Maintenance		E&W		120
181	Rehabilitation of 21 Nos. metre gauge Locomotive of Bangladesh Railway	1	GOB	RS	RS Maintenance		E&W		250
182	Rehabilitation of 24 Nos. metre gauge Locomotive of Bangladesh Railway	1	GOB	RS	RS Maintenance		E&W		200
183	Rehabilitation of 30 Nos. Broad gauge Locomotive of Bangladesh Railway	2	GOB	RS	RS Maintenance		E&W		300
184	Conversion of 300 existing Broad Gauge wagon brake systems from vacuum to Air brake	1	GOB	RS	RS Maintenance		E&W		45
185	Remodelling of Parbatipur Railway Station including Station yard	2	GOB	Works	Facility Upgrade		W	2,4B	300
186	Remodelling of Kamalapur Railway Station including Station yard, Washpit and sick line	2	FA/GOB	Works	Facility Upgrade		E	7	500
187	Extension and renovation of Platform and Platform Sheds in West zone of Bangladesh Railway (Phase-1)	1	FA/GOB	Works	Facility Upgrade		W		100
188	Extension and renovation of Platform and Platform Sheds in West zone of Bangladesh Railway (Phase-2)	2	FA/GOB	Works	Facility Upgrade		W		150
189	Extension and renovation of Platform and Platform Sheds in East zone of Bangladesh Railway (Phase-1)	1	FA/GOB	Works	Facility Upgrade		E		100

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
190	Extension and renovation of Platform and Platform Sheds in East zone of Bangladesh Railway (Phase-2)	2	FA/GOB	Works	Facility Upgrade		E		100
191	Extension and rehabilitation of loop lines and sidings in West zone of Bangladesh Railway (Phase-1)	1	FA/GOB	Pway	Sidings	BG/ DG	W		200
192	Extension and rehabilitation of loop lines and sidings in West zone of Bangladesh Railway (Phase-2)	2	FA/GOB	Pway	Sidings	BG/ DG	W		300
193	Extension and rehabilitation of loop lines and sidings in East zone of Bangladesh Railway (Phase-1)	1	FA/GOB	Pway	Sidings	BG/ DG	E		200
194	Extension and rehabilitation of loop lines and sidings in East zone of Bangladesh Railway (Phase-2)	2	FA/GOB	Pway	Sidings	BG/ DG	E		200
195	TA project for preparation of Mechanized Track Maintenance Manual and as such update Way and Works Manual of BR	2	FA/GOB	Other	Pway Maintenance		E&W		7
196	Procurement of 40 BG Locomotives	1	FA	RS	RS Procurement		E&W	Var	2,070
197	Procurement of 400 MG & 300 nos BG covered vans (BC) and 180 MG & 120 BG Bogie Open Wagons(BKC) for Bangladesh Railway	1	FA	RS	RS Procurement		E&W	Var	1,140

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
198	Procurement of replacement rolling stock - Phase 6	6	FA	RS	RS Procurement		E&W	Var	1,534
199	Rehabilitation of signalling and interlocking system in east and west zone of Bangladesh railway (Phase-1)	2	GoB/FA	S&T	Signalling Rehab		E&W		250
200	Rehabilitation of signalling and interlocking system in east and west zone of Bangladesh railway (Phase-2)	3	GoB/FA	S&T	Signalling Rehab		E&W		250
201	Rehabilitation of signalling and interlocking system in east and west zone of Bangladesh railway (Phase-3)	4	GoB/FA	S&T	Signalling Rehab		E&W		250
202	Rehabilitation of Main Line section of BR (East Zone) Phase -2	3	GoB/FA	Pway	Line Rehab				500
203	Rehabilitation of Main Line section of BR (West Zone) Phase -2	2	GoB/FA	Pway	Line Rehab				1,000
204	Rehabilitation, construction and upgradation of important level crossing gates of East zone of Bangladesh Railway. Phase1	1	GOB	Works	Level crossing gates				80
205	Rehabilitation, construction and upgradation of important level crossing gates of West zone of Bangladesh Railway. Phase2	1	GOB	Works	Level crossing gates				50

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
206	Rehabilitation, construction and upgradation of important level crossing gates of East zone of Bangladesh Railway. Phase1	2	GOB	Works	Level crossing gates				80
207	Rehabilitation, construction and upgradation of important level crossing gates of West zone of Bangladesh Railway. Phase2	2	GOB	Works	Level crossing gates				50
208	Feasibility study for construction of Elevated Railway line from Joydebpur to Mymensing & Joydebpur to tangail.	3	FA/GOB	FS	Line Doubling	DG	E	1	20
209	Feasibility study for construction of elevated railway line from Tongi to Bhairab Bazar via Narshingdi	3	FA/GOB	FS	Line Doubling	DG	E	1	10
210	Feasibility study for construction of High Speed Railway line from Dhaka to Khulna & Ishurdi to Rajshahi.	3	FA/GOB	FS	New Line	BG	E&W		30
211	Capacity enhancement and construction of additional new units of Saidpur Carriage & Wagon Workshop	2	FA/GOB	RS	RS Maintenance	DG	E		800
212	Capacity enhancement and construction of additional new units of Saidpur Carriage & Wagon Workshop	1	FA/GOB	RS	RS Maintenance	DG	E		754
213	Construction of new Carriage & Wagon Depot and Loco Shed to meet additional traffic demand	4	FA/GOB	RS	RS Maintenance	BG	E		400
214	Development of Shopping Complex cum Guest House at Bangladesh Railway Land near Khulna and Chittagong on PPP mode.	2	PPP	Works	Other		E		330

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
215	Development of 5 star hotel at Jakir Hossain Road, Chittagong at Bangladesh Railway Land on PPP mode.	1	PPP	Works	Other		E		850
216	Construction of Multi Modal Transportation Hub at Bimanbandar Railway Station	1	FA/PPP	Works	Other		E		500
217	Construction of Multi Modal Transportation Hub at Kamalapur Railway Station	2	FA/PPP	Works	Other		E		800
218	100 BG Carriage Procurement under Padma Bridge	2	FA	RS	RS Procurement	BG	E&W		715
219	Project feasibility, detailed design and Tender preparation-Phase 1	1	FA/GOB	Other	Other		E&W	Var	718
220	Project feasibility, detailed design and Tender preparation-Phase 2	2	FA/GOB	Other	Other		E&W	Var	580
221	Project feasibility, detailed design and Tender preparation-Phase 3	3	FA/GOB	Other	Other		E&W	Var	464
222	Project feasibility, detailed design and Tender preparation-Phase 4	4	FA/GOB	Other	Other		E&W	Var	475
223	Project feasibility, detailed design and Tender preparation-Phase 5	5	FA/GOB	Other	Other		E&W	Var	407
224	Project feasibility, detailed design and Tender preparation-Phase 6	6	FA/GOB	Other	Other		E&W	Var	61
225	Contingent Projects- Phase 1	1	FA/GOB	Other	Other		E&W	Var	1,436

Project No.	Project Name	Master Plan Phase	Funding Source	Category	Sub-Category	Gauge (Project)	East or West Zone	Corridor	Total 2017 Cost (BDT crore)
226	Contingent Projects- Phase 2	2	FA/GOB	Other	Other		E&W	Var	1,161
227	Contingent Projects- Phase 3	3	FA/GOB	Other	Other		E&W	Var	928
228	Contingent Projects- Phase 4	4	FA/GOB	Other	Other		E&W	Var	951
229	Contingent Projects- Phase 5	5	FA/GOB	Other	Other		E&W	Var	814
230	Contingent Projects- Phase 6	6	FA/GOB	Other	Other		E&W	Var	123

Appendix 2: POL Consumption

Consumption of POL in Bangladesh (in tonne)

	Petroleum Oil Products					Residual Fuel Oil	Other Products	Liquefied Petroleum Gases	Total
	Motor Gasoline	Jet Fuel	Kerosene	Distillate Fuel Oil	All Others				
1990	92,637	83,466	435,920	835,122	277,045	173,488	103,557	8,945	1,733,135
1991	79,000	85,000	385,000	710,211	575,871	399,646	176,225	8,953	1,844,035
1992	105,000	51,000	424,000	718,189	524,555	430,990	93,565	8,852	1,831,596
1993	120,593	84,257	383,454	923,541	430,703	281,603	149,100	11,580	1,954,128
1994	115,000	128,000	402,000	939,254	615,038	318,804	296,234	14,145	2,213,437
1995	132,000	94,000	404,000	1,159,273	649,855	320,175	329,680	16,228	2,455,356
1996	197,000	101,000	469,000	1,254,229	493,348	366,945	126,403	14,032	2,528,609
1997	221,000	101,000	483,000	1,249,225	622,617	294,666	327,951	18,015	2,694,857
1998	284,000	58,000	486,000	1,342,207	608,798	273,300	335,498	14,932	2,793,937
1999	272,000	130,000	586,000	1,482,212	747,792	351,643	396,149	10,953	3,228,957
2000	269,000	119,000	528,000	1,333,288	1,021,223	314,259	706,964	14,295	3,284,806
2001	265,000	196,000	560,000	1,794,285	1,049,437	383,065	666,372	21,283	3,886,005
2002	257,000	203,000	637,000	1,847,264	996,414	390,495	605,919	22,187	3,962,865
2003	287,000	229,000	613,000	1,855,284	979,325	406,984	572,341	41,278	4,004,887
2004	271,000	235,000	689,000	1,821,277	1,027,440	430,513	596,927	21,249	4,064,966
2005	289,000	222,000	672,000	1,900,290	1,052,067	441,441	610,626	21,306	4,156,663
2006	308,000	266,000	627,000	2,074,283	1,076,492	480,902	595,590	9,273	4,361,048
2007	328,000	237,000	456,000	2,311,000	1,023,534	480,000	543,534	12,000	4,367,534
2008	348,953	206,564	410,121	2,596,093	934,176	492,345	441,831	40,110	4,536,017
2009	368,000	180,000	367,000	2,912,222	983,823	529,408	454,415	40,999	4,852,044
2010	239,000	287,000	360,000	2,568,228	507,223	357,853	149,370	17,026	3,978,477
2011	266,000	336,000	451,000	3,239,269	739,006	617,915	121,091	14,213	5,045,488
2012	281,000	312,000	264,000	3,240,246	1,149,082	974,215	174,867	14,109	5,260,437
2013	280,560	318,000	315,000	2,965,000	1,188,238			19,671	5,086,469
2014	296,126	323,000	290,000	3,243,000	1,315,311			17,529	5,484,966
2015	292,937	339,000	263,000	3,396,000	1,013,062			17,424	5,321,423
AACGR (%)	**4.71**	**5.77**	**(2.00)**	**5.77**	**5.32**			**2.70**	**4.59**

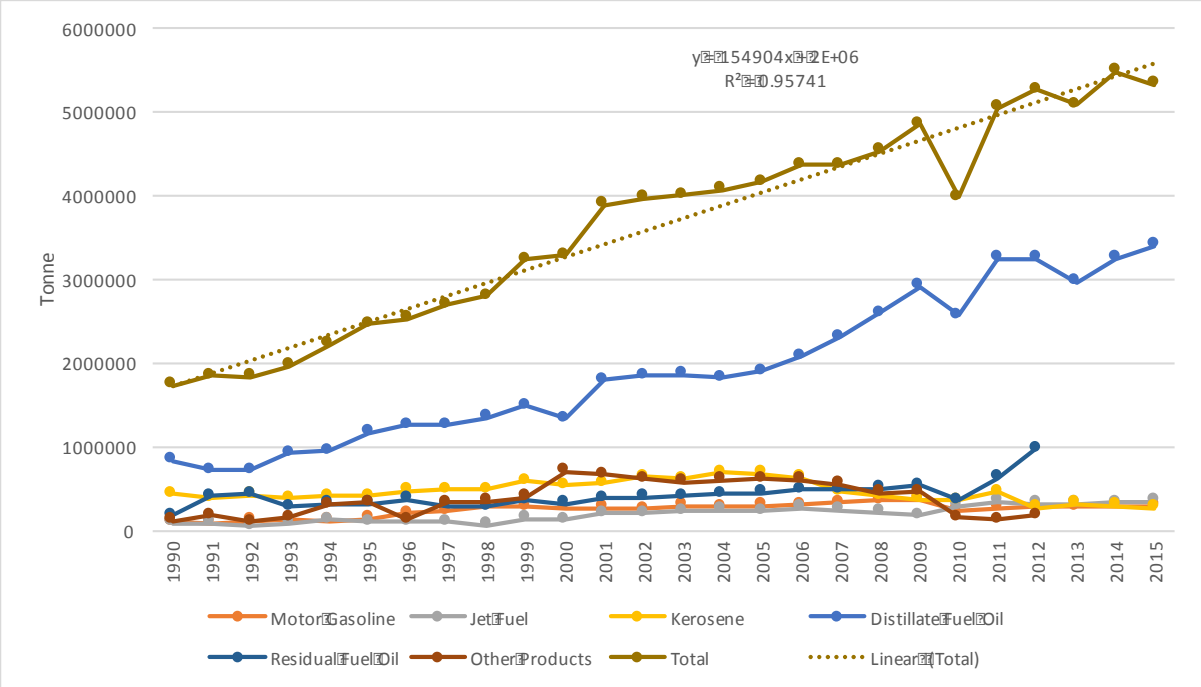
Source: US Energy Information Administration Data Base, 2016

Percentage Share of POL Products Consumed in Bangladesh

	Petroleum Oil Liquid Products					Liquefied Petroleum Gases	Total
	Motor Gasoline	Jet Fuel	Kerosene	Distillate Fuel Oil	All Others		
1990	5.3	4.8	25.2	48.2	16.0	0.5	100.0
1991	4.3	4.6	20.9	38.5	31.2	0.5	100.0
1992	5.7	2.8	23.1	39.2	28.6	0.5	100.0
1993	6.2	4.3	19.6	47.3	22.0	0.6	100.0
1994	5.2	5.8	18.2	42.4	27.8	0.6	100.0
1995	5.4	3.8	16.5	47.2	26.5	0.7	100.0
1996	7.8	4.0	18.5	49.6	19.5	0.6	100.0
1997	8.2	3.7	17.9	46.4	23.1	0.7	100.0
1998	10.2	2.1	17.4	48.0	21.8	0.5	100.0
1999	8.4	4.0	18.1	45.9	23.2	0.3	100.0
2000	8.2	3.6	16.1	40.6	31.1	0.4	100.0
2001	6.8	5.0	14.4	46.2	27.0	0.5	100.0
2002	6.5	5.1	16.1	46.6	25.1	0.6	100.0
2003	7.2	5.7	15.3	46.3	24.5	1.0	100.0
2004	6.7	5.8	16.9	44.8	25.3	0.5	100.0
2005	7.0	5.3	16.2	45.7	25.3	0.5	100.0
2006	7.1	6.1	14.4	47.6	24.7	0.2	100.0
2007	7.5	5.4	10.4	52.9	23.4	0.3	100.0
2008	7.7	4.6	9.0	57.2	20.6	0.9	100.0
2009	7.6	3.7	7.6	60.0	20.3	0.8	100.0
2010	6.0	7.2	9.0	64.6	12.7	0.4	100.0
2011	5.3	6.7	8.9	64.2	14.6	0.3	100.0
2012	5.3	5.9	5.0	61.6	21.8	0.3	100.0
2013	5.5	6.3	6.2	58.3	23.4	0.4	100.0
2014	5.4	5.9	5.3	59.1	24.0	0.3	100.0
2015	5.5	6.4	4.9	63.8	19.0	0.3	100.0
Average	**6.6**	**5.0**	**14.3**	**50.5**	**23.2**	**0.5**	**100.0**

Source: Consultants estimate based on Appendix 1 data

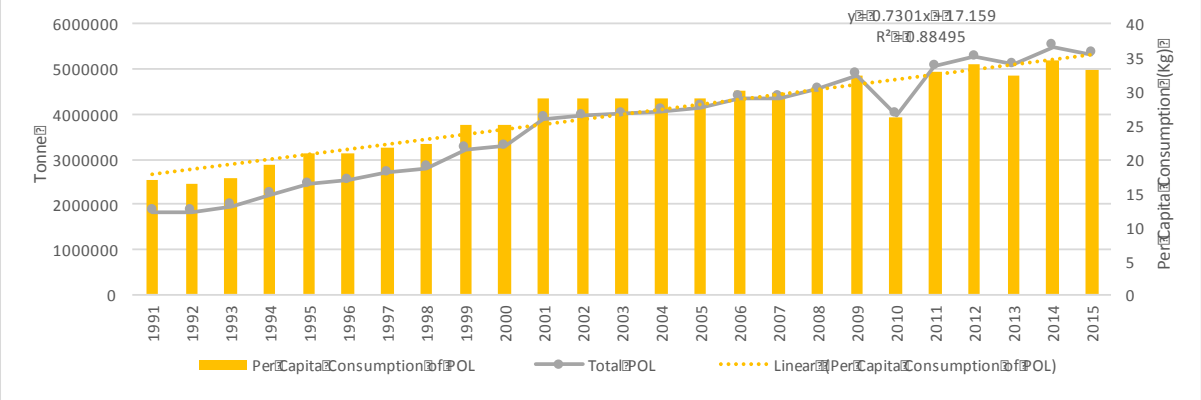
Forecast of National POL Demand Based on Time Analysis (in tonnes)



	Petroleum Oil Products					LPG	Total
	Motor Gasoline	Jet Fuel	Kerosene	Distillate Fuel Oil	All Others		
2016	431,238	369,632	338,830	3,696,323	1,293,713	30,803	6,160,538
2017	442,024	378,878	347,305	3,788,779	1,326,073	31,573	6,314,632
2018	442,024	378,878	347,305	3,788,779	1,326,073	31,573	6,314,632
2019	452,811	388,124	355,780	3,881,236	1,358,432	32,344	6,468,726
2020	**452,811**	**388,124**	**355,780**	**3,881,236**	**1,358,432**	**32,344**	**6,468,726**
2021	463,597	397,369	364,255	3,973,692	1,390,792	33,114	6,622,820
2022	463,597	397,369	364,255	3,973,692	1,390,792	33,114	6,622,820
2023	474,384	406,615	372,730	4,066,148	1,423,152	33,885	6,776,914
2024	474,384	406,615	372,730	4,066,148	1,423,152	33,885	6,776,914
2025	**485,171**	**415,860**	**381,205**	**4,158,605**	**1,455,512**	**34,655**	**6,931,008**
2026	485,171	415,860	381,205	4,158,605	1,455,512	34,655	6,931,008
2027	495,957	425,106	389,681	4,251,061	1,487,871	35,426	7,085,102
2028	495,957	425,106	389,681	4,251,061	1,487,871	35,426	7,085,102
2029	506,744	434,352	398,156	4,343,518	1,520,231	36,196	7,239,196
2030	**506,744**	**434,352**	**398,156**	**4,343,518**	**1,520,231**	**36,196**	**7,239,196**
2031	517,530	443,597	406,631	4,435,974	1,552,591	36,966	7,393,290
2032	517,530	443,597	406,631	4,435,974	1,552,591	36,966	7,393,290
2033	528,317	452,843	415,106	4,528,430	1,584,951	37,737	7,547,384
2034	528,317	452,843	415,106	4,528,430	1,584,951	37,737	7,547,384
2035	**539,103**	**462,089**	**423,581**	**4,620,887**	**1,617,310**	**38,507**	**7,701,478**
2036	539,103	462,089	423,581	4,620,887	1,617,310	38,507	7,701,478
2037	549,890	471,334	432,056	4,713,343	1,649,670	39,278	7,855,572
2038	549,890	471,334	432,056	4,713,343	1,649,670	39,278	7,855,572
2039	560,677	480,580	440,532	4,805,800	1,682,030	40,048	8,009,666
2040	**560,677**	**480,580**	**440,532**	**4,805,800**	**1,682,030**	**40,048**	**8,009,666**
2041	571,463	489,826	449,007	4,898,256	1,714,390	40,819	8,163,760
2042	571,463	489,826	449,007	4,898,256	1,714,390	40,819	8,163,760
2043	582,250	499,071	457,482	4,990,712	1,746,749	41,589	8,317,854
2044	582,250	499,071	457,482	4,990,712	1,746,749	41,589	8,317,854
2045	**593,036**	**508,317**	**465,957**	**5,083,169**	**1,779,109**	**42,360**	**8,471,948**

Per Capita Consumption of POL in Bangladesh

	Population	POL Consumption (MT)	PC Con. POL (kg)
1991	108,509,679	1,844,035	16.99
1992	110,987,459	1,831,596	16.50
1993	113,442,354	1,954,128	17.23
1994	115,913,710	2,213,437	19.10
1995	118,427,768	2,455,356	20.73
1996	120,987,124	2,528,609	20.90
1997	123,574,107	2,694,857	21.81
1998	126,169,583	2,793,937	22.14
1999	128,746,273	3,228,957	25.08
2000	131,280,739	3,284,806	25.02
2001	133,776,064	3,886,005	29.05
2002	136,228,456	3,962,865	29.09
2003	138,600,174	4,004,887	28.90
2004	140,843,786	4,064,966	28.86
2005	142,929,979	4,156,663	29.08
2006	144,839,238	4,361,048	30.11
2007	146,592,687	4,367,534	29.79
2008	148,252,473	4,536,017	30.60
2009	149,905,836	4,852,044	32.37
2010	151,616,777	3,978,477	26.24
2011	153,405,612	5,045,488	32.89
2012	155,257,387	5,260,437	33.88
2013	157,157,394	5,086,469	32.37
2014	159,077,513	5,484,966	34.48
2015	160,996,000	5,321,423	33.05



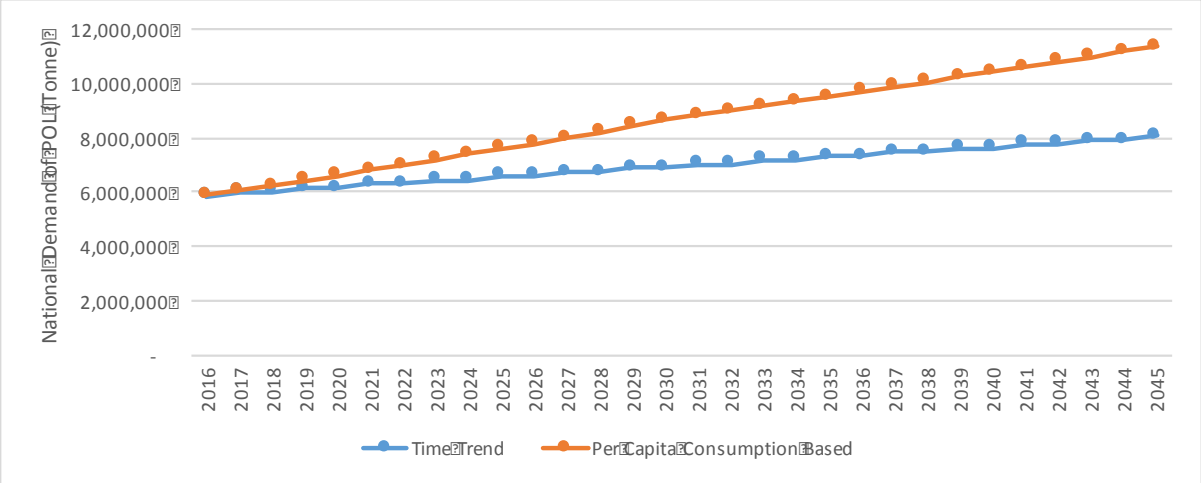
Forecast Per Capita Consumption of POL in Bangladesh

	Population	POL Consumption (MT)	PC Con. POL (kg)
2016	162,579,753	5,875,892	36.14
2017	164,179,085	6,053,562	36.87
2018	165,794,151	6,234,159	37.60
2019	167,425,104	6,417,722	38.33
2020	169,072,101	6,604,294	39.06
2021	170,735,301	6,793,916	39.79
2022	172,414,861	6,986,629	40.52
2023	174,110,944	7,182,477	41.25
2024	175,823,711	7,381,501	41.98
2025	177,553,327	7,583,746	42.71
2026	179,299,958	7,789,256	43.44
2027	181,063,771	7,998,076	44.17
2028	182,844,935	8,210,250	44.90
2029	184,643,620	8,425,824	45.63
2030	186,460,000	8,644,845	46.36
2031	187,217,491	8,816,652	47.09
2032	187,978,059	8,989,712	47.82
2033	188,741,716	9,164,033	48.55
2034	189,508,476	9,339,622	49.28
2035	190,278,352	9,516,486	50.01
2036	191,051,354	9,694,633	50.74
2037	191,827,497	9,874,071	51.47
2038	192,606,793	10,054,807	52.20
2039	193,389,255	10,236,847	52.93
2040	194,174,896	10,420,202	53.66
2041	194,963,728	10,604,877	54.39
2042	195,755,765	10,790,880	55.12
2043	196,551,020	10,978,220	55.85
2044	197,349,505	11,166,903	56.58
2045	198,151,234	11,356,939	57.31

National POL demand forecast Comparison between time trend and per capita consumption methods (tonnes)

Comparision of Forecast POL Demand of Bangladesh
(Time Trend Vs. Per Capita Consumption (in tonnes)

	Time Trend	Per Capita Consumption Based
2015	5,055,352	5,321,423
2016	5,852,511	5,875,892
2017	5,998,900	6,053,562
2018	5,998,900	6,234,159
2019	6,145,290	6,417,722
2020	6,145,290	6,604,294
2021	6,291,679	6,793,916
2022	6,291,679	6,986,629
2023	6,438,068	7,182,477
2024	6,438,068	7,381,501
2025	6,584,458	7,583,746
2026	6,584,458	7,789,256
2027	6,730,847	7,998,076
2028	6,730,847	8,210,250
2029	6,877,236	8,425,824
2030	6,877,236	8,644,845
2031	7,023,626	8,816,652
2032	7,023,626	8,989,712
2033	7,170,015	9,164,033
2034	7,170,015	9,339,622
2035	7,316,404	9,516,486
2036	7,316,404	9,694,633
2037	7,462,793	9,874,071
2038	7,462,793	10,054,807
2039	7,609,183	10,236,847
2040	7,609,183	10,420,202
2041	7,755,572	10,604,877
2042	7,755,572	10,790,880
2043	7,901,961	10,978,220
2044	7,901,961	11,166,903
2045	8,048,351	11,356,939



Forecast BR Traffic Potential: POL Products (in tonnes)

	Forecast POL	DFO	Kerosene	Motor Gasoline
2015	5,321,423	3,192,854	292,678	372,500
2016	5,875,892	3,525,535	323,174	411,312
2017	6,053,562	3,632,137	332,946	423,749
2018	6,234,159	3,740,495	342,879	436,391
2019	6,417,722	3,850,633	352,975	449,241
2020	6,604,294	3,962,577	363,236	462,301
2021	6,793,916	4,076,350	373,665	475,574
2022	6,986,629	4,191,978	384,265	489,064
2023	7,182,477	4,309,486	395,036	502,773
2024	7,381,501	4,428,901	405,983	516,705
2025	7,583,746	4,550,248	417,106	530,862
2026	7,789,256	4,673,554	428,409	545,248
2027	7,998,076	4,798,845	439,894	559,865
2028	8,210,250	4,926,150	451,564	574,717
2029	8,425,824	5,055,494	463,420	589,808
2030	8,644,845	5,186,907	475,466	605,139
2031	8,816,652	5,289,991	484,916	617,166
2032	8,989,712	5,393,827	494,434	629,280
2033	9,164,033	5,498,420	504,022	641,482
2034	9,339,622	5,603,773	513,679	653,774
2035	9,516,486	5,709,892	523,407	666,154
2036	9,694,633	5,816,780	533,205	678,624
2037	9,874,071	5,924,443	543,074	691,185
2038	10,054,807	6,032,884	553,014	703,836
2039	10,236,847	6,142,108	563,027	716,579
2040	10,420,202	6,252,121	573,111	729,414
2041	10,604,877	6,362,926	583,268	742,341
2042	10,790,880	6,474,528	593,498	755,362
2043	10,978,220	6,586,932	603,802	768,475
2044	11,166,903	6,700,142	614,180	781,683
2045	11,356,939	6,814,163	624,632	794,986

Forecast Annual Traffic Potential of BR: DFO under Scenario-2 & 3 (in tonnes)

	National Demand	Conservative	Realistic	Optimistic
2015	3,192,854	715,734	798,213	893,999
2016	3,525,535	790,310	881,384	987,150
2017	3,632,137	814,207	908,034	1,016,998
2018	3,740,495	838,497	935,124	1,047,339
2019	3,850,633	863,187	962,658	1,078,177
2020	3,962,577	888,281	1,109,521	1,188,773
2021	4,076,350	913,785	1,141,378	1,222,905
2022	4,191,978	939,705	1,173,754	1,257,593
2023	4,309,486	966,047	1,206,656	1,292,846
2024	4,428,901	992,816	1,240,092	1,328,670
2025	4,550,248	1,020,018	1,456,079	1,592,587
2026	4,673,554	1,047,659	1,495,537	1,635,744
2027	4,798,845	1,075,745	1,535,631	1,679,596
2028	4,926,150	1,104,283	1,576,368	1,724,152
2029	5,055,494	1,133,277	1,617,758	1,769,423
2030	5,186,907	1,162,736	1,763,548	2,074,763
2031	5,289,991	1,185,844	1,798,597	2,115,996
2032	5,393,827	1,209,121	1,833,901	2,157,531
2033	5,498,420	1,232,567	1,869,463	2,199,368
2034	5,603,773	1,256,184	1,905,283	2,241,509
2035	5,709,892	1,279,972	2,112,660	2,569,451
2036	5,816,780	1,303,933	2,152,209	2,617,551
2037	5,924,443	1,328,067	2,192,044	2,665,999
2038	6,032,884	1,352,376	2,232,167	2,714,798
2039	6,142,108	1,376,861	2,272,580	2,763,949
2040	6,252,121	1,401,522	2,500,848	3,126,060
2041	6,362,926	1,426,361	2,545,170	3,181,463
2042	6,474,528	1,451,379	2,589,811	3,237,264
2043	6,586,932	1,476,576	2,634,773	3,293,466
2044	6,700,142	1,501,954	2,680,057	3,350,071
2045	6,814,163	1,527,514	2,725,665	3,407,082

Forecast Annual Traffic Potential of BR: Kerosene, under Scenario-2 & 3 (in tonnes)

	National Demand	Conservative	Realistic	Optimistic
2015	292,678	39,191	39,191	39,191
2016	323,174	43,275	43,275	43,275
2017	332,946	44,583	44,583	44,583
2018	342,879	45,913	45,913	45,913
2019	352,975	47,265	47,265	47,265
2020	363,236	48,639	54,485	54,485
2021	373,665	50,036	56,050	56,050
2022	384,265	51,455	57,640	57,640
2023	395,036	52,897	59,255	59,255
2024	405,983	54,363	60,897	60,897
2025	417,106	55,852	66,737	70,908
2026	428,409	57,366	68,545	72,830
2027	439,894	58,904	70,383	74,782
2028	451,564	60,467	72,250	76,766
2029	463,420	62,054	74,147	78,781
2030	475,466	63,667	80,829	95,093
2031	484,916	64,933	82,436	96,983
2032	494,434	66,207	84,054	98,887
2033	504,022	67,491	85,684	100,804
2034	513,679	68,784	87,325	102,736
2035	523,407	70,087	94,213	120,384
2036	533,205	71,399	95,977	122,637
2037	543,074	72,720	97,753	124,907
2038	553,014	74,051	99,543	127,193
2039	563,027	75,392	101,345	129,496
2040	573,111	76,742	108,891	143,278
2041	583,268	78,102	110,821	145,817
2042	593,498	79,472	112,765	148,375
2043	603,802	80,852	114,722	150,951
2044	614,180	82,242	116,694	153,545
2045	624,632	83,641	118,680	156,158

Forecast Annual Traffic Potential of BR: Petrol under Scenario-2 & 3 (in tonnes)

	National Demand	Conservative	Realistic	Optimistic
2015	372,500	52,283	52,283	52,283
2016	411,312	57,731	57,731	57,731
2017	423,749	59,476	59,476	59,476
2018	436,391	61,251	61,251	61,251
2019	449,241	63,054	63,054	63,054
2020	462,301	64,887	69,345	83,214
2021	475,574	66,750	71,336	85,603
2022	489,064	68,644	73,360	88,032
2023	502,773	70,568	75,416	90,499
2024	516,705	72,523	77,506	93,007
2025	530,862	74,510	84,938	106,172
2026	545,248	76,529	87,240	109,050
2027	559,865	78,581	89,578	111,973
2028	574,717	80,666	91,955	114,943
2029	589,808	82,784	94,369	117,962
2030	605,139	84,936	102,874	133,131
2031	617,166	86,624	104,918	135,776
2032	629,280	88,324	106,978	138,442
2033	641,482	90,037	109,052	141,126
2034	653,774	91,762	111,142	143,830
2035	666,154	93,500	119,908	159,877
2036	678,624	95,250	122,152	162,870
2037	691,185	97,013	124,413	165,884
2038	703,836	98,789	126,691	168,921
2039	716,579	100,577	128,984	171,979
2040	729,414	102,379	138,589	189,648
2041	742,341	104,193	141,045	193,009
2042	755,362	106,020	143,519	196,394
2043	768,475	107,861	146,010	199,804
2044	781,683	109,715	148,520	203,238
2045	794,986	111,582	151,047	206,696

Appendix 3: Permanent Way Projects

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Appendix 4: Phase 1 (2016-2020) Ongoing Projects

Sl.	Project Name	Cost (In BDT Crore)	Category	Corridor	Current Status (As at August '16)			Gauge unification projects
					Physical Completion	Financial (In BDT Crore)	Percentage Financial Completion	
INVESTMENT PROJECTS								
1	**BANGLADESH RAILWAY SECTOR IMPROVEMENT PROJECTS.**	2,527.4						
	Construction of Double Line Track from Tongi to Bhairabbazar Including Signalling (2nd Revised).	2,212.6	Pway	1	100%	2165.2	98%	
	Reforms of Bangladesh Railway (1st Revised).	314.8	Reform	NW	92%	217.8	69%	
2	Remodelling of Khulna Railway Station & Yard and Development of Operational Facilities of Benapole Railway Station (1st Revised).	75.8	Pway	7A, 7B	77%	50.0	66%	
3	DHAKA-CHITTAGONG RAILWAY DEVELOPMENT PROJECTS.	2,120.7						

Sl.	Project Name	Cost (In BDT Crore)	Category	Corridor	Current Status (As at August '16)			Gauge unification projects
					Physical Completion	Financial (In BDT Crore)	Percentage Financial Completion	
	Improvement of Pahartali Workshop (1st Revised).	217.9	RS	BR-East	50%	49.8	23%	
	Consulting Engineering Service for Dhaka-Chittagong Railway Development Project & Skill Development Program (1st Revised).	170.9	TA	1	0%	150.4	88%	
	Track Doubling Between Laksam and Chinki-Astan (2nd Revised).	1,731.9	Pway	1	100%	1722.3	99%	
4	Export Infrastructure Development Project.	1,140.4			0%	0.0	0%	
5	Construction of Pachuria-Faridpur-Bhanga Sections of Bangladesh Railway (1st Revised).	292.2	Pway	9A	95%	276.3	95%	Reh & recon. BG line
6	Construction of Single Line Dual Gauge (DG) Railway Track from Dohazari to Cox's Bazar via Ramu and Ramu to Gundum Near Myanmar (1st Revised).	18,034.5	Pway	1	2%	1263.7	7%	DG new line
7	Rehabilitation of Kalukhali-Bhatiapara Section and Construction of Kashiani-Gopalganj-Tungipara New Rail Line (1st Revised).	2,023.7	Pway	7D	59%	1116.6	55%	Reh & recon. BG line
8	Construction of a New Railway Line from Ishurdi to Dhalarcha Via Pabna (1st Revised).	1,436.0	Pway	9A, 9B	74%	1000.3	70%	New BG line
9	Rehabilitation of Laksam-Chandpur Section of Bangladesh Railway (1st revised).	170.3	Pway	1	79%	134.9	79%	
10	Construction of 2nd Bhairab & 2nd Titas Bridges with Approach Rail Lines.	959.2	Works	1	81%	647.3	67%	With DG track
11	Construction of Khulna-Mongla Port Rail Link Including Feasibility Study (1st revised).	3,801.6	Pway	7A	24%	1143.3	30%	New BG line

Sl.	Project Name	Cost (In BDT Crore)	Category	Corridor	Current Status (As at August '16)			Gauge unification projects
					Physical Completion	Financial (In BDT Crore)	Percentage Financial Completion	
12	Procurement of 264 nos. MG Passenger Carriages & 2 nos. BG Inspection Car(FCH).	983.2			0%	0.0	0%	
13	Rehabilitation of Sholosahar-Dohazari & Fateabad-Nazirhat Section Including Other Allied Works.	232.4	Pway	1	92%	151.8	65%	
14	Rehabilitation of Kulaura-Shahbazpur Section of Bangladesh Railway.	678.5	Pway	5	3%	1.5	0%	
15	Procurement of 70 nos. MG Diesel Electric Locomotives.	1,945.9	RS	NW	1%	2.2	0%	
16	SECTOR DEVELOPMENT OF BANGLADESH RAILWAY UNDER ADP's 2nd PFR.	399.0						
	Rehabilitation of Yards & Extension of Loops at Different Stations in Darsana-Ishurdi-Sirajganj Bazar Section.	76.8	Pway	(2). (3)	83%	56.6	74%	
	Upgrading of Signalling at 11 Stations Between Ishurdi and Darsana.	176.0	Signal & Telecom	(2). (3)	54%	49.9	28%	
	Technical Assistance for Supervision Consultancy Serviuces for Sector Improvement Project Under 2nd PFR of ADB.	31.5	TA	(2). (3)	66%	10.9	35%	
17	Replacement & Modernization of The Existing Railway Signalling System at 11 Stations of Chinki Astana-Chittagong Section of Bangladesh Railway in East Zone.	224.7	Signal & Telecom	1	20%	46.3	21%	
18	Construction of 3rd & 4th Dual Gauge Line in Dhaka-Tongi and Dual Gauge Double Line in Dhaka-Joydevpur Section of Bangladesh Railway (1st Revised).	1,106.8	Pway	1	3%	1.5	0%	Addition of 2-DG tracks & 2nd track

Sl.	Project Name	Cost (In BDT Crore)	Category	Corridor	Current Status (As at August '16)			Gauge unification projects
					Physical Completion	Financial (In BDT Crore)	Percentage Financial Completion	
19	Thorough Renewal of Worn-Out Rails and Allied Works in Chinki Astana-Ashuganj Section of Bangladesh Railway (1st Revised).	297.4	Pway	1	94%	294.4	99%	
20	Procurement of 100 nos. MG & 50 nos. BG Coaches of Bangladesh Railway.	1,130.3	RS	NW	45%	309.8	27%	
21	Replacement & Modernization of Signalling System of 3 Stations Between Ashuganj & Akhaura Section of Bangladesh Railway in East Zone.	39.8	Signal & Telecom	1	0%	3.2	8%	
22	Expansion of Existing Computer Based Interlocking Colour Light Signalling System to The Newly Constructed Third Line at Four Stations of Ishurdi-Joydebpur Section in West Zone of Bangladesh Railway.	21.4	Signal & Telecom	3, 4	0%	0.1	0%	
23	Construction of Dual Gauge Double Rail Line and Conversion of Existing Rail Line into Dual Gauge Between Akhaura and Laksam.	6,504.5	Pway	1	20%	486.6	7%	Addition of 2nd track (DG) and conv. Exist. MG to DG
24	Procurement of 120 nos. Broad Gauge Passenger Carriages for Bangladesh Railway.	976.0			6000%	533.6	55%	
25	Construction of a Dual Gauge Line Parallel to The Existing Meter Gauge Line in Dhaka-Narayanganj Section.	378.7	Pway	Addition to corridor-1	3%	0.5	0%	Addition of 2nd Track (DG)
26	Construction of Amnura Bypass of Bangladesh Railway.	21.1	Pway	4A	61%	9.0	43%	

Sl.	Project Name	Cost (In BDT Crore)	Category	Corridor	Current Status (As at August '16)			Gauge unification projects
					Physical Completion	Financial (In BDT Crore)	Percentage Financial Completion	
27	Rehabilitation of 50 nos. MG & 50 nos. BG Passenger Coaches.	71.8	RS	NW	33%	30.8	43%	
28	Rehabilitation, Construction and Upgradation of Important Level Crossing Gates of East Zone of Bangladesh Railway.	49.3	Works	BR-East	14%	2.7	6%	
29	Rehabilitation, Construction and Upgradation of important Level Crossing Gates of West Zone of Bangladesh Railway.	47.8	Works	BR-West	7%	3.3	7%	
30	Construction of One 'B' Class Station at Kaliakor in Between Mirzapur-Mouchak Station in Connection with Hi-Teck Park.	48.6	Works	3, 4	23%	9.0	19%	
31	Procurement of Meter Gauge and Broad Gauge Passenger Carriages for Bangladesh Railway.	1,374.5			0%	0.0	0%	
32	Procurement of Locomotives, Relief Cranes and Locomotive Simulator for Bangladesh Railway.	733.6			0%	0.1	0%	
33	Feasibility Study for Construction of Overpass/Underpass in Narayangonj-Joydebpur Section of Bangladesh Railway.	8.6			0%	0.0	0%	
34	Rehabilitation of 100 nos. Meter Gauge Passenger Carriages of Bangladesh Railway.	59.3			10%	0.5	1%	
35	Padma Bridge Rail Link Project.	34,988.9	Pway	7A	5%	4.0	0%	New BG line
36	Conversion of MG Track into Dual Gauge on Parbatipur-Kanchan-Panchagarh & Kanchan-Birol Section and MG Track into Broad Gauge on Birol Station -Birol Boarder Section of Bangladesh Railway.	1,064.2	Pway	4B	99%	1009.1	95%	Conversion to DG track

Sl.	Project Name	Cost (In BDT Crore)	Category	Corridor	Current Status (As at August '16)			Gauge unification projects
					Physical Completion	Financial (In BDT Crore)	Percentage Financial Completion	
TECHNICAL ASSISTANCE PROJECTS								
37	Technical Assistance for Institutional Support of Bangladesh Railway.	15.4	TA	NW	89%	13.8	90%	
38	Technical Assistance for Feasibility Study, Safeguard Policy Study, Detailed Engineering Design & Tendering Service for Project Under World Bank Funding for Bangladesh Railway.	13.8			0%	0.0	0%	
39	Technical Assistance for Project Preparation Towards Implementation of "Export Infrastructure Development Project" Under World Bank Financing.	11.0			0%	0.1	1%	
40	Technical Assistance for Sub-Regional Rail Transport Project Preparatory Facilities.	187.4	TA	NW	100%	181.3	97%	
41	Technical Assistance for SASEC Railway Connectivity Investment Program.	15.4			15%	2.4	16%	
42	Technical Assistance for Dhaka-Chittagong-Cox's Bazar Rail Project Preparatory Facility.	212.6			2%	0.0	0%	
43	Technical Assistance for Capacity Development of Bangladesh Railway for Project Implementation.	7.9			8%	0.9	12%	
	TOTAL =	86431.60				13153.83		

Appendix 5: Projects Completed in Phase 1 (2010-2015) of Existing Master Plan

Sl. No.	Project Name	Implementation Period	Estimated Cost (BDT crore)	Actual Cost (BDT crore)	Completion Date	Source of Funding
1	Rehabilitation of 65 nos. (56 nos. MG & 9 nos. BG) Locomotives (Revised 45 nos. - 36 nos. MG & 9 nos. BG Locomotives) of Bangladesh Railway.	01.07.2004 to 31.12.2010	139.7	134.3	Dec 2010	GoB
2	Supply and Commissioning of Load Monitoring Device on The Track at both Sides of Bangabandhu Bridge.	01.01.2009 to 30.6.2011	8.9	3.9	June 2011	GoB
3	Procurement of 50 nos. MG Flat Wagon (BFCT) & 5 nos. MG Brake Van with Air Brake for Carrying Container.	01.07.2007 to 30.06.2011	32.7	28.0	June 2011	GoB
4	Rehabilitation of Dhaka-Narayanganj Railway Line.	01.07.2007 to 10.01.2011	43.4	40.5	June 2011	GoB
5	Emergency Flood Damage Rehabilitation Project/2007.	01.11.2007 to 30.06.2011	39.4	38.1	June 2011	GoB
6	Construction of Railway Link from Tarakandi To Jamuna Bridge (2nd Revised).	01.07.1999 to 30.06.2011	216.1	210.6	June 2011	GoB
7	Conversion of Vacuum Brake System into Air Brake System of 277 MG BC Wagons of Bangladesh Railway.	01.07.2007 to 30.06.2011	34.3	31.1	June 2012	GoB
8	Procurement of 46 nos. (40 nos. MG & 6 nos. BG) D. E. Locomotives of Bangladesh Railway (2nd Revised).	01.07.1996 to 30.06.2012	936.5	915.0	June 2012	EDCF

Sl. No.	Project Name	Implementation Period	Estimated Cost (BDT crore)	Actual Cost (BDT crore)	Completion Date	Source of Funding
9	Rehabilitation of Fouzdarhat-CGPY-SRV-Chittagong Sections of East Zone of Bangladesh Railway.	01.07.2007 to 30.06.2013	87.2	82.9	June 2013	GoB
10	Rehabilitation of Rajshahi-Rohanpur Border & Amnura-Chapainawabganj Sections of Bangladesh Railway.	01.07.2007 to 30.06.2013	152.0	149.0	June 2013	GoB
11	Rehabilitation of Lalmonirhat-Burimari Section of Bangladesh Railway (1st Revised).	01.07.2007 to 30.06.2013	174.7	173.1	June 2013	GoB
12	Rehabilitation of Gouripur-Jariajhanjail and Shyamganj-Mohanganj Section of Bangladesh Railway.	01.01.2008 to 30.06.2013	180.9	176.7	June 2013	GoB
13	Procurement of 1 no. BG & 1 no. MG Mixed Under Floor Wheel Lathe Machine (1st Revised).	01.07.2006 to 30.06.2014	20.3	19.3	June 2014	GoB
14	Rehabilitation of 200 nos. MG & 60 nos. BG Passenger Carriages of Bangladesh Railway (1st Revised).	01.07.2009 to 30.06.2014	121.1	105.4	June 2014	GoB
15	Procurement of 1 no. 60 M.Ton Capacity MG & 1 no. 80 M.Ton Capacity BG Crane for Accident Relief Train (1st Revised).	15.03.2009 to 30.09.2013	17.3	109.2	June 2014	GoB
16	Rehabilitation of Mymensingh-Jamalpur-Dewanganj Bazar Section of Bangladesh Railway.	01.03.2009 to 31.12.2013	213.0	170.9	June 2014	GoB
17	Procurement of 50 nos. MG Flat Wagon (BFCT) & 5 nos. MG Brake Van with Air Brake for Carrying Container (1st Revised).	01.12.2010 to 30.06.2014	36.8	33.2	June 2014	LoC (India)
18	Chittagong Railway Station Yard Remodelling.	01.07.2007 to 30.06.2016	262.2	243.8	June 2015	JICA
19	Rehabilitation & Modernization of Signalling System of 13 nos. Stations at Joydebpur-Mymensingh Section.	01.07.2007 to 30.06.2015	107.5	93.9	June 2015	GoB

Sl. No.	Project Name	Implementation Period	Estimated Cost (BDT crore)	Actual Cost (BDT crore)	Completion Date	Source of Funding
20	Procurement of 180 nos. BG Bogie Wel Tank Wagon & 6 nos. BG Bogie Brake Van (Revised 165 nos. BG Bogie Wel Tank Wagon & 6 nos. BG Bogie Brake Van) for Bangladesh Railway.	01.08.2010 to 30.06.2015	195.4	173.0	June 2015	LoC (India)
21	Procurement of 10 nos. BG Diesel Electric Locomotives for Bangladesh Railway.	01.08.2010 to 30.06.2015	327.5	323.8	June 2015	LoC (India)
22	Procurement of 100 nos. MG Bogie Tank Wagon & 5 nos. BG Brake Van with Air Brake System for Carrying Aviation Fuel.	01.12.2010 to 30.06.2015	86.1	72.3	June 2015	LoC (India)
23	Procurement of 20 Sets (3 Units/Set) Diesel Electric Multiple Unit (DEMU) of Bangladesh Railway (1st Revised).	01.01.2011 to 30.06.2015	686.6	598.8	June 2015	GoB
24	Feasibility Study for Construction of Railway Line Line from Navaroon to Munshiganj Via Satkhira.	01.04.2010 to 30.06.2015	11.4	11.1	June 2015	GoB
25	Rehabilitation of Saidpur-Chilahati Section of Bangladesh Railway.	01.07.2010 to 30.06.2015	181.6	173.9	June 2015	GoB
	Total (Actual Cost)			**4111.76**		

Appendix 6: Gauge Conversion Projects

Project No.	Project Name	Master Plan Phase	Funding Source	East or West Zone	Corridor(s)	Length (km)	Unit Cost (Lakh BDT per km)	Total 2017 Cost (BDT crore)
2	Conversion of existing Metre Gauge track in to Dual Gauge track between Sylhet-Chatak Bazar section	1	GOB	E	5	33.31		1,622
8	Conversion of existing MG track to DG track between Akhaura- Sylhet.	1	FA	E	5	177	15,742	8,619
13	Conversion from metre gauge line to dual gauge line from Parbatipur to Kaunia	1	GOB	W	4B,6	55.22	4,869	2,689
20	Conversion of existing Shayestagonj-Balla section into DG track	4	GOB	E	5	27.00		354
31	Conversion of existing Metre Gauge line in to Dual Gauge line between Dhaka-Narayanganj	2	FA	E	1	16.1	4,869	784
32	Conversion of existing Metre Gauge double line to Dual Gauge double line between Tongi- Bhairab.	2	FA	E	1	128	4,869	6,233
33	Conversion of existing Metre Gauge double line in to Dual Gauge double line between Laksam- Chittagong.	2	FA	E	1	259.2	4,869	12,621

Project No.	Project Name	Master Plan Phase	Funding Source	East or West Zone	Corridor(s)	Length (km)	Unit Cost (Lakh BDT per km)	Total 2017 Cost (BDT crore)
34	Conversion of Metre Gauge double line in to Dual Gauge double line from Chittagong to Sholashahar including construction of Chittagong bypass	2	FA	E	1	12.88	4,869	1,141
35	Conversion of Metre Gauge single line in to Dual Gauge single line from Sholashahar to Dohazari	2	FA	E	1	40.6	4,869	1,977
37	Conversion of existing Metre Gauge line in to Dual Gauge line between Santahar-Bogra	2	FA	W	2, 6	39.93	4,869	1,944
42	Conversion of existing Metre Gauge line in to Dual Gauge line between Joydebpur-Mymensingh-Jamalpur	2	FA/GOB	E	8A	93.7	4,869	4,562
45	Conversion of existing MG track to DG track between Jamalpur-Bangabandhu Bridge East and Jamalpur-Bahadurabad Ghat.	4	FA/GOB	E	8A	117.03	5,161	6,040
47	Conversion of existing Metre Gauge line in to Dual Gauge line between Laksam-Chandpur	3	FA/GOB	E	1	51.52	5,161	2,659
48	Conversion of existing Metre Gauge line in to Dual Gauge line between Laksam-Noakhali	3	FA/GOB	E	1	49.11	5,161	2,535

Project No.	Project Name	Master Plan Phase	Funding Source	East or West Zone	Corridor(s)	Length (km)	Unit Cost (Lakh BDT per km)	Total 2017 Cost (BDT crore)
49	Conversion of existing Metre Gauge line in to Dual Gauge line between Sholashahar-Nazirhat	3	FA/GOB	E	1	30.6	5,161	1,579
50	Conversion of existing Metre Gauge line in to Dual Gauge line between Fateyabad-Chittagong University	3	FA/GOB	E	1	2.15	5,161	111
53	Conversion of existing Metre Gauge line in to Dual Gauge line from Bogra to Lalmonirhat via Bonarpara and Trimohini-Balashighat	3	FA/GOB	W	6	115.21	5,161	5,946
54	Conversion of Existing MG track to DG track between Gauripur Mymensingh-Mohanganj and Shaymganj- Jariajanjail	4	FA/GOB	E	8B	70.61	5,161	3,644
58	Conversion of existing MG track to DG track between Lalmonirhat - Burimari and Tista-Ramna Bazar	5	FA/GOB	W	6	84.33	4,692	3,956
177	Conversion of Metre Gauge double line in to Dual Gauge double line between Bhairab Bazar and Akhaura including rebuilding of existing Bhairab and Titas bridge	2	FA	E	1,5	66	4,869	3,214

Appendix 7 – Project Rankings

Phase I (2016-2020)

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
1	Bangabandhu Railway Bridge Construction	5	1	9,740	2018-2020
2	Construction of new locomotive workshop at Naryanganj	60	2	1,155	2018-2020
3	Conversion of existing MG track to DG track between Akhaura- Sylhet.	8	3	8,619	2018-2020
4	Construction of double line between Joydebpur and Ishurdi section of BR	28	3	7,698	2018-2020
5	Construction of a Dual Gauge Rail Line Parallel to the Existing metre Gauge Rail Line in Joydebpur-Mymensingh -Jamalpur Section.	36	3	7,255	2018-2020
6	Construction of Broad Gauge Rail line from Bhanga Junction (Faridpur) to Payra Port via Barisal	6	4	28,335	2018-2020
7	Construction of Akhaura-Agartala dual gauge railway link (Bangladesh portion)	7	4	478	2018-2020
8	Construction of DG Rail Link from Bogra to Shaheed M. Monsur Ali Station	27	4	6,607	2018-2020
9	Modernization of Parbatipur Central Locomotive Workshop	59	4	770	2018-2020
10	Construction of Repair & Maintenance Workshop for DEMU at Naryanganj	61	4	963	2018-2020
11	Construction of a new Inland Container Depot (ICD) near Dhirasram railway station.	144	4	1,640	2018-2020
12	Procurement of 40 BG Locomotives	196	4	2,070	2018-2020
13	Upgradation and reconstruction of Dhaka Diesel Loco Shed including equipment upgrade and DG conversion	70	5	500	2018-2020
14	Reconstruction of Diesel Loco sheds (09 total) including Equipment upgrade and DG Conversion	71	5	3,500	2018-2020
15	Rehabilitation of Jessore-Benapole rail line	153	5	1,502	2018-2020

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
16	Procurement of 400 MG & 300 nos BG covered vans (BC) and 180 MG & 120 BG Bogie Open Wagons(BKC) for Bangladesh Railway	197	5	1,140	2018-2020
17	Construction of Broad Gauge Double line track between Khulna – Darshana junction Section.	9	6	3,700	2018-2020
18	Conversion from metre gauge line to dual gauge line from Parbatipur to Kaunia	13	6	2,689	2018-2020
19	Construction of Broad Gauge Rail Line between Chilahati and Chilahati Border for Connectivity with India.	16	6	79	2018-2020
20	Reconstruction of Washing Pits & Coach and Wagon Depots (14 total) including equipment upgrades and DG conversion	72	6	4,000	2018-2020
21	Procure BG and MG rolling stock to meet additional traffic demand - Phase 1	77	6	6,660	2018-2020
22	Modernization of Signaling & Interlocking System by CBI at 21 Stations in Abdulpur – Parbatipur Section including Ishurdi Station	88	6	300	2018-2020
23	Installation of optical fiber based telecommunication system in the remaining secondary line sections of BR (about 650 km).	92	6	78	2018-2020
24	Integration of CTC Control system of Chittagong and Dhaka with the CBI Interlocked stations of the two respective divisions	100	6	600	2018-2020
25	Implementation of RDS Unit	110	6	22	2018-2020
26	Improvement and Maintenance of ICT Infrastructure of BR: Phase 1	124	6	125	2018-2020
27	Rehabilitation of Main Line section of BR (West Zone) Phase - I	137	6	1,181	2018-2020
28	Installation, operations and maintenance of automatic ticket vending machine in 100 stations	160	6	100	2018-2020
29	Station Development and Up-gradation of ticketing systems and entry exit machine installation in 5 stations in Bangladesh	162	6	191	2018-2020
30	Development, Installation, operations and maintenance of computerized wagon control system for BR	167	6	50	2018-2020
31	Rehabilitation of 21 Nos. metre gauge Locomotive of Bangladesh Railway	181	6	250	2018-2020

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
32	Construction of Multi Modal Transportation Hub at Bimanbandar Railway Station	216	6	500	2018-2020
33	Rehabilitation of 24 Nos. metre gauge Locomotive of Bangladesh Railway	182	7	200	2018-2020
34	Extension and renovation of Platform and Platform Sheds in West zone of Bangladesh Railway (Phase-1)	187	7	100	2018-2020
35	Extension and renovation of Platform and Platform Sheds in East zone of Bangladesh Railway (Phase-1)	189	7	100	2018-2020
36	Construction of rail link with Uttara EPZ, Nilphamari	4	8	156	2018-2020
37	Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Narayanganj–Dhaka–Joydebpur Section of Bangladesh Railway	18	8	560	2018-2020
38	Procurement of replacement rolling stock - Phase 1	83	8	9,412	2018-2020
39	Modernization of Signaling & Interlocking System at 8 Stations in the section Chittagong Jn Cabin – Dohazari by CBI with connectivity with CTC centre at Pahartali, Chittagong.	91	8	120	2018-2020
40	Modernization of Concrete Sleeper Plant of Bangladesh Railway and construction of Broad Gauge and Dual Gauge Concrete Sleeper Plant at Chatak Bazar	113	8	120	2018-2020
41	Institutional Strengthening and Capacity Building of BR: Phase 1	114	8	50	2018-2020
42	Construction of Dual Gauge Railway line from Janalihut to Kaptai via CUET	149	8	9,445	2018-2020
43	Installation, operations and maintenance of POS machines for TTE's for local/commuter/mail train	161	8	20	2018-2020
44	Establish railway connection with Chittagong Bay terminal	171	8	1,574	2018-2020
45	Construction of 2nd Railway cum Road bridge across Karnaphuly River near Kalurghat	178	8	2,000	2018-2020
46	Extension and rehabilitation of loop lines and sidings in West zone of Bangladesh Railway (Phase-1)	191	8	200	2018-2020
47	Extension and rehabilitation of loop lines and sidings in East zone of Bangladesh Railway (Phase-1)	193	8	200	2018-2020

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
48	Rehabilitation, construction and upgradation of important level crossing gates of East zone of Bangladesh Railway. Phase1	204	8	80	2018-2020
49	Rehabilitation, construction and upgradation of important level crossing gates of West zone of Bangladesh Railway. Phase2	205	8	50	2018-2020
50	Capacity enhancement and construction of additional new units of Saidpur Carriage & Wagon Workshop	212	8	754	2018-2020
51	Rehabilitation of 200 Nos. metre gauge passenger carriages of Bangladesh Railway	180	9	120	2018-2020
52	Development of 5 star hotel at Jakir Hossain Road, Chittagong at Bangladesh Railway Land on PPP mode.	215	9	850	2018-2020
53	Renovation of Central Railway Building (CRB) in Chittagong as a heritage building	24	10	100	2018-2020
54	Construction of Rest Rooms for Running Staff	74	10	45	2018-2020
55	Update Manuals and Codes (6 total) for Mechanical, Electrical and Stores Department and translated into Bangla	75	10	31	2018-2020
56	Modernization of Signaling & Interlocking System with CBI and CTC in 5 stations in Abdulpur–Rajshahi Section including Ishurdi station.	89	10	75	2018-2020
57	Modernization of Signaling & Interlocking System with CBI and CTC at 18 Stations in Khulna – Darsana section.	90	10	270	2018-2020
58	Modernization of Signaling & Interlocking System with CBI and CTC connectivity at 6 Stations in Kaunia–Parbatipur - Syedpur section excluding Kawnia and Parbatipur station.	94	10	90	2018-2020
59	Introduction of Mechanized Track Maintenance Phase 1	108	10	1,040	2018-2020
60	Updating of Operations Manuals and Tariff Books	156	10	19	2018-2020
61	Feasibility study and detail design for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Narayanganj–Dhaka–Joydebpur Section of Bangladesh Railway	172	10	4	2018-2020
62	Construction of new BG Railway Line from Darsana to Meherpur via Damurhuda and Mujibnagar.	1	11	1,125	2018-2020

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
63	Conversion of existing Metre Gauge track into Dual Gauge track between Sylhet-Chatak Bazar section	2	11	1,622	2018-2020
64	Enhancement of Technical Training Facilities at 5 existing Workshop Training Units	73	11	80	2018-2020
65	Modernization of Railway Training Academy and construction of Railway Museum with enhancement of training facilities.	138	11	591	2018-2020
66	Replacement and Renovation of Equipment and Infrastructure of Kadamtoli Bridge Workshop	76	12	9	2018-2020
67	Installation of 33/11 KVA 10 MVA Sub-Station and Power supply system in Dhaka.	123	12	25	2018-2020
68	Modernization of Railway Hospitals & Construction of Medical Colleges in Dhaka & Chittagong of BR.	139	12	709	2018-2020
69	Modernization of Bridge Workshops at Chittagong and Saidpur	142	12	200	2018-2020
70	Construction of rail line to Feni Economic Zone and Mirersarai Economic Zone	155	12	4,685	2018-2020
71	Construction of Railway link to Jamalpur Economic Zone	157	12	852	2018-2020
72	Establish Railway Inland Container Terminals with customs facility at Uttara EPZ, Benapole	168	12	4,800	2018-2020
73	Beautification & development of station areas for commercial use of Dhaka, Tejgaon, Cantonment, Airport, Narayanganj & Tongi stations.	130	13	118	2018-2020
74	Beautification & development of station areas for commercial use of Chittagong, Sylhet & other important stations of East Zone of BR.	131	13	177	2018-2020
75	Beautification & development of station areas for commercial use of Rajshahi & other important stations of West Zone of BR.	132	13	236	2018-2020
76	Environmental Assessment Study of BR	120	14	12	2018-2020
77	Upgradation of printing press at Pahartali	158	14	20	2018-2020
78	Installation, operations and maintenance of call center for Bangladesh Railway	159	14	50	2018-2020
79	Feasibility Study for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Tongi–Chittagong Section of Bangladesh Railway	173	14	4	2018-2020

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
80	Conversion of 300 existing Broad Gauge wagon brake systems from vacuum to Air brake	184	14	45	2018-2020
81	Upgrading Training Academy at Chittagong for Signalling & Telecom	107	15	40	2018-2020
82	Project feasibility, detailed design and Tender preparation-Phase 1	219	16	718	2018-2020
83	Contingent Projects- Phase 1	225	17	1,436	2018-2020
Total Cost in Phase 1 (BDT Crore)				147,833	

Phase II (2021-2025)

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
1	Construction of Dhaka-Chittagong via Comilla/ Laksam High Speed Railway	29	1	30,995	2021-2025
2	Conversion of existing Metre Gauge double line to Dual Gauge double line between Tongi- Bhairab.	32	1	6,233	2021-2025
3	Conversion of Metre Gauge double line into Dual Gauge double line between Bhairab Bazar and Akhaura including rebuilding of existing Bhairab and Titas bridge	177	1	3,214	2021-2025
4	Construction of overpass/flyover in Narayanganj-Joydebpur section of Bangladesh Railway	23	2	591	2021-2025
5	Construction of Chittagong CGPY Inter-Modal Terminal	111	3	1,200	2021-2025
6	Conversion of existing Metre Gauge double line into Dual Gauge double line between Laksam-Chittagong.	33	4	12,621	2021-2025
7	Procure BG rollingstock to meet additional traffic demand (incl. maintenance spares) - Phase 2	78	4	2,546	2021-2025
8	Improvement and Maintenance of ICT Infrastructure of BR: Phase 2	125	4	125	2021-2025

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
9	Rehabilitation of Main Line section of BR (East Zone) Phase -I	136	4	1,181	2021-2025
10	TA project for preparation of Mechanized Track Maintenance Manual and as such update Way and Works Manual of BR	195	4	7	2021-2025
11	100 BG Carriage Procurement under Padma Bridge	218	4	715	2021-2025
12	Extension and renovation of Platform and Platform Sheds in West zone of Bangladesh Railway (Phase-2)	188	5	150	2021-2025
13	Extension and renovation of Platform and Platform Sheds in East zone of Bangladesh Railway (Phase-2)	190	5	100	2021-2025
14	Conversion of existing Metre Gauge line into Dual Gauge line between Santahar-Bogra	37	6	1,944	2021-2025
15	Conversion of existing Metre Gauge line in to Dual Gauge line between Joydebpur- Mymensingh-Jamalpur	42	6	4,562	2021-2025
16	Procurement of replacement rolling stock - Phase 2	84	6	742	2021-2025
17	Installation of CTC Control system at Paksey and Lalmonirhat divisional control office and integration with CBI Interlocked stations of the two divisions .	101	6	400	2021-2025
18	Introduction of Mechanized Track Maintenance Phase 2	109	6	246	2021-2025
19	Institutional Strengthening and Capacity Building of BR: Phase 2	115	6	50	2021-2025
20	Remodelling of Dhaka Biman Bandar Station	143	6	200	2021-2025
21	Extension and rehabilitation of loop lines and sidings in West zone of Bangladesh Railway (Phase-2)	192	6	300	2021-2025
22	Extension and rehabilitation of loop lines and sidings in East zone of Bangladesh Railway (Phase-2)	194	6	200	2021-2025
23	Rehabilitation, construction and upgradation of important level crossing gates of East zone of Bangladesh Railway. Phase1	206	6	80	2021-2025
24	Rehabilitation, construction and upgradation of important level crossing gates of West zone of Bangladesh Railway. Phase2	207	6	50	2021-2025
25	Conversion of existing Metre Gauge line into Dual Gauge line between Dhaka- Narayanganj	31	7	784	2021-2025

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
26	Modernization of Signaling & Interlocking System with CBI and CTC at 14 stations in Bhairab Bazar– Kishoregonj – Mymensingh Section.	95	7	252	2021-2025
27	Modernization & up gradation of signal workshop at Kadamtali, Chittagong.	96	7	100	2021-2025
28	Installation of GSM R Train Radio communication system among driver, Guard, SM connecting two divisional train control offices of East zone of Bangladesh Railway.	97	7	315	2021-2025
29	Installation of modern signaling & telecommunication training centre at Dhaka.	99	7	50	2021-2025
30	Installation of radio based cab Signalling with automatic Train Protection (ATP)/Train rotection Warning Syatem (TPWS) and Automatic Train Control (ATC) system in the section: Narayanganj - Dhaka -Chittagong.	102	7	789	2021-2025
31	Rehabilitation of 200 Nos. Broad gauge passenger carriages of Bangladesh Railway	179	7	150	2021-2025
32	Rehabilitation of 30 Nos. Broad gauge Locomotive of Bangladesh Railway	183	7	300	2021-2025
33	Construction of 2nd track (BG) between Abdulpur-Rajshahi	10	8	3,386	2021-2025
34	Construction of Circular Rail Line around Dhaka City.	30	8	13,189	2021-2025
35	Conversion of Metre Gauge double line in to Dual Gauge double line from Chittagong to Sholashahar including construction of Chittagong bypass	34	8	1,141	2021-2025
36	Conversion of Metre Gauge single line in to Dual Gauge single line from Sholashahar to Dohazari	35	8	1,977	2021-2025
37	New Diesel Locomotive Workshop at Chittagong	63	8	1,155	2021-2025
38	Development of Darshana Interchange Yard	121	8	59	2021-2025
39	Development of Rohanpur Interchange Yard	122	8	59	2021-2025
40	Construction of Railway Training Institute in Dhaka and Rajshahi.	140	8	354	2021-2025
41	Construction of Kustia Bypass Railway Line from Jagati to Gorai Bridge	148	8	496	2021-2025
42	Station Development and Up-gradation of ticketing systems and entry exit machine installation in 10 stations in Bangladesh	163	8	381	2021-2025

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
43	Rehabilitation of signalling and interlocking system in east and west zone of Bangladesh railway (Phase-1)	199	8	250	2021-2025
44	Rehabilitation of Main Line section of BR (West Zone) Phase -2	203	8	1,000	2021-2025
45	Capacity enhancement and construction of additional new units of Saidpur Carriage & Wagon Workshop	211	8	800	2021-2025
46	Construction of Multi Modal Transportation Hub at Kamalapur Railway Station	217	8	800	2021-2025
47	Construction of rail link with Ishurdi EPZ.	14	9	536	2021-2025
48	Rehabilitation of Important Railway Bridges in East Zone of BR.	26	9	200	2021-2025
49	New Carriage & Wagon Maintenance Workshop at Rajbari	62	9	2,503	2021-2025
50	Remodelling of Parbatipur Railway Station including Station yard	185	9	300	2021-2025
51	Remodelling of Kamalapur Railway Station including Station yard, Washpit and sick line	186	9	500	2021-2025
52	Development of Shopping Complex cum Guest House at Bangladesh Railway Land near Khulna and Chittagong on PPP mode.	214	9	330	2021-2025
53	Construction of Railway Connectivity with Moheshkali and Matarbari	133	10	1,181	2021-2025
54	Construction of Railway Inland Container Terminals at Mongla Port and Ishurdi	169	10	1,600	2021-2025
55	Construction of new BG track on Nabharan to Satkhira section.	11	11	1,748	2021-2025
56	Rehabilitation of Important Railway Bridges in West Zone of BR.	22	11	236	2021-2025
57	Construction of new BG & DG Concrete Sleeper Plant at Santahar	25	11	354	2021-2025
58	Rehabilitation and improvement of electrical substation of BR -East Zone	146	11	250	2021-2025
59	Rehabilitation and improvement of electrical substation of BR -West Zone	147	11	200	2021-2025
60	Construction of BG single line from Chatak Bazar to Sunamganj	46	12	4,722	2021-2025

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
61	Construction of new BG track on Satkhira to Munshiganj section.	12	13	2,780	2021-2025
62	Construction of Rail line from Jamalpur to Tourism Spots of Sherpur.	135	13	3,543	2021-2025
63	Modernization of Railway Hospitals & Construction of Medical Colleges in Khulna, Rajshahi & Saidpur of BR.	141	13	709	2021-2025
64	Feasibility Study for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Joydebpur- Ishurdi- Khulna Section of Bangladesh Railway	174	14	4	2021-2025
65	Feasibility Study for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Akhaura- Sylhet Section of Bangladesh Railway	175	14	4	2021-2025
66	Project feasibility, detailed design and Tender preparation-Phase 2	220	15	580	2021-2025
67	Contingent Projects- Phase 2	226	16	1,161	2021-2025
Total Cost in Phase 2 (BDT Crore)				119,680	

Phase III (2026-2030)

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
1	Procure BG rolling stock to meet additional traffic demand (incl. maintenance spares) - Phase 3	79	1	7,659	2026-2030
2	Improvement and Maintenance of ICT Infrastructure of BR: Phase 3	126	1	125	2026-2030
3	Construction of Dual Gauge double line between Abdulpur and Parbatipur	38	2	13,368	2026-2030
4	Construction of Dual Gauge double line between Akhaura- Sylhet.	39	2	15,077	2026-2030
5	Construction of Dual Gauge double line between Fauzderhat- CGPY	41	2	916	2026-2030

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
6	Procurement of replacement rolling stock - Phase 3	85	3	847	2026-2030
7	Institutional Strengthening and Capacity Building of BR: Phase 3	116	3	50	2026-2030
8	Construction of new Tista Railway Bridge	3	4	1,800	2026-2030
9	Reconstruction of Hardinge Bridge	51	4	2,720	2026-2030
10	Modernization of Signaling & Interlocking System with CBI at 25 stations in Lalmonirhat – Kaunia – Bogra – Santahar Section (except STU) with CTC connectivity with the Divisional Control Office.	93	4	480	2026-2030
11	Installation of GSM R Train Radio communication system among driver, Guard, SM connecting two divisional train control offices of West zone of Bangladesh Railway.	98	4	392	2026-2030
12	Replacement and modernization of signaling system on AKA-SYT section (22 Stations) with CBI and CTC connectivity with the Divisional Control office (excluding AKA)	104	4	550	2026-2030
13	Installation of radio based cab signaling with automatic Train Protection (ATP)/Train Protection Warning System (TPWS) and Automatic Train Control (ATC) System in sections Akhaura-Sylhet, Tongi-Jamalpur, Joydevpur-Ishurdi, Khulna-Parbatipur in east and west zones of Bangladesh Railway.	105	4	2,173	2026-2030
14	Station Development and Up-gradation of ticketing systems and entry exit machine installation in 10 stations in Bangladesh	164	4	381	2026-2030
15	Rehabilitation of signalling and interlocking system in east and west zone of Bangladesh railway (Phase-2)	200	4	250	2026-2030
16	Rehabilitation of Main Line section of BR (East Zone) Phase -2	202	4	500	2026-2030
17	New Diesel Locomotive Workshop at Rajbari	65	5	1,155	2026-2030
18	New BG Carriage and Wagon Maintenance Workshop at suitable location of Mymensingh	66	5	2,310	2026-2030
19	Conversion of existing Metre Gauge line in to Dual Gauge line between Bhairab Bazar-Mymensingh section	17	6	211	2026-2030
20	New Diesel Electric Multiple Unit maintenance Workshop at Ishurdi	67	6	963	2026-2030

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
21	Establish Railway Inland Container Terminal with customs facility at Darsana, Shahbazpur	170	6	1,600	2026-2030
22	Conversion of existing Metre Gauge line in to Dual Gauge line between Laksam- Noakhali	48	7	2,535	2026-2030
23	Construction of New Broad Gauge single line from Payra to Kuakata	43	8	4,722	2026-2030
24	Reconstruction of Rupsha-Bagherhat Railway line (BG).	44	8	2,895	2026-2030
25	Conversion of existing Metre Gauge line in to Dual Gauge line between Laksam- Chandpur	47	8	2,659	2026-2030
26	Conversion of existing Metre Gauge line in to Dual Gauge line between Sholashahar- Nazirhat	49	8	1,579	2026-2030
27	Conversion of existing Metre Gauge line in to Dual Gauge line between Fateyabad- Chittagong University	50	8	111	2026-2030
28	Conversion of existing Metre Gauge line in to Dual Gauge line from Bogra to Lalmonirhat via Bonarpara and Trimohini-Balashighat	53	8	5,946	2026-2030
29	Construction of Railway Bypass for Bhairab Bazar, Abdulpur, Jamtoil & Kaunia	15	9	295	2026-2030
30	Construction of new railway line from Tungipara to Mongla via Fakirhat.	40	9	11,019	2026-2030
31	Feasibility study for construction of Elevated Railway line from Joydebpur to Mymensing & Joydebpur to tangail.	208	9	20	2026-2030
32	Feasibility study for construction of railway line from Tongi to Bhairab Bazar via Narshingdi	209	9	10	2026-2030
33	Feasibility study for construction of High Speed Railway line from Dhaka to Khulna & Ishurdi to Rajshahi.	210	9	30	2026-2030
34	Construction of Dual Gauge single line from Panchagarh to Banglabandh	19	10	7,419	2026-2030
35	Feasibility Study for Introduction of Electric Traction (including Overhead Catenary & Sub-Station) in between Ishurdi- Parbatipur Section of Bangladesh Railway	176	11	4	2026-2030
36	Project feasibility, detailed design and Tender preparation-Phase 3	221	12	464	2026-2030
37	Contingent Projects- Phase 3	227	13	928	2026-2030

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
Total Cost in Phase 3 (BDT Crore)				**94,161**	

Phase IV (2031-2035)

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
1	Improvement and Maintenance of ICT Infrastructure of BR: Phase 4	127	1	125	2031-2035
2	Procurement of replacement rolling stock - Phase 4 Procurement of 30 BG Shunting cum Branch Line Locomotive against replacement.	86	2	243	2031-2035
3	Institutional Strengthening and Capacity Building of BR: Phase 4	117	2	50	2031-2035
4	Procure BG rolling stock to meet additional traffic demand (incl. maintenance spares) - Phase 4	80	3	7,513	2031-2035
5	Construction of subway from Narayanganj to Tongi	145	3	17,000	2031-2035
6	Modernization & up gradation of optical fiber based telecommunication system of Bangladesh Railway (2009 km) presently used by Grameenphone Ltd.	103	4	560	2031-2035
7	Modernization of signaling system by Interlocking of different section of secondary lines replacing non-interlocked mechanical/color light signaling system.	106	4	612	2031-2035
8	Station Development and Up-gradation of ticketing systems and entry exit machine installation in 10 stations in Bangladesh	165	4	381	2031-2035
9	Rehabilitation of signalling and interlocking system in east and west zone of Bangladesh railway (Phase-3)	201	4	250	2031-2035

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
10	Construction of Circular Rail Line around Chittagong-SRV-CGPY-Saltgola-Dry Dock-Shah Amanat Airport-Dry Dock-Saltgola-CGPY-Fouzderhat-Chittagong (Phase-1)	21	5	247	2031-2035
11	Conversion of existing MG track to DG track between Jamalpur-Bangabandhu Bridge East and Jamalpur-Bahadurabad Ghat.	45	5	6,040	2031-2035
12	New Traction Motor repair and rewinding unit at CLW, Parbatipur	64	5	385	2031-2035
13	Construction of new Carriage & Wagon Depot and Loco Shed to meet additional traffic demand	213	5	400	2031-2035
14	Conversion of Existing MG track to DG track between Gauripur Mymensingh- Mohanganj and Shaymganj-Jariajanjail	54	6	3,644	2031-2035
15	Construction of BG single line from Nazirhat to Khagrachhari	55	7	9,445	2031-2035
16	Construction of BG single line from Hathazari to Rangamati	56	7	7,084	2031-2035
17	Construction of BG single line from Dohazari to Bandarban.	57	7	3,148	2031-2035
18	Construction of Railway connectivity in between Panchagor-Chilahati-Hatibandha of BR.	134	8	1,772	2031-2035
19	Construction of Rohanpur-Joypurhat Rail Line	154	8	17,316	2031-2035
20	Conversion of existing Shayestagonj-Balla section into DG track	20	9	354	2031-2035
21	Construction of new BG line along Jessore-Magura-Sripur-Langolband-Pangsa.	150	9	18,890	2031-2035
22	Project feasibility, detailed design and Tender preparation-Phase 4	222	10	475	2031-2035
23	Contingent Projects- Phase 4	228	11	951	2031-2035
Total Cost in Phase 4 (BDT Crore)				**96,885**	

Phase V (2036-2040)

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
1	Procurement of replacement rolling stock - Phase 5	87	1	243	2036-2040
2	Improvement and Maintenance of ICT Infrastructure of BR: Phase 5	128	1	125	2036-2040
3	Construction of new BG line along Joydebpur-Dhamrai-Manikganj-Paturia	152	2	17,316	2036-2040
4	Institutional Strengthening and Capacity Building of BR: Phase 5	118	3	50	2036-2040
5	Procure BG rolling stock to meet additional traffic demand (incl. maintenance spares) Phase 5	81	4	9,915	2036-2040
6	Reconstruction of existing Carriage & Wagon Workshop at Chittagong	68	5	2,755	2036-2040
7	Station Development and Up-gradation of ticketing systems and entry exit machine installation in 15 stations in Bangladesh	166	5	572	2036-2040
8	New Diesel Electric Multiple Unit maintenance Workshop at Chittagong	69	6	963	2036-2040
9	Conversion of existing MG track to DG track between Lalmonirhat - Burimari and Tista-Ramna Bazar	58	7	3,956	2036-2040
10	Construction of Railway Bridge at Moukuri-Dhalar Char point over River Padma to connect Pabna and Rajbari with the existing railway network	112	8	9,448	2036-2040
11	Construction of new BG line along Modhukhali-Magura-Jessore.	151	8	13,381	2036-2040
12	Construction of Railway Bridge Over the Jamuna river near Phulchari- Bahadurabad Ghat including Approach Rail Link	52	9	22,704	2036-2040
13	Project feasibility, detailed design and Tender preparation-Phase 5	223	10	407	2036-2040
14	Contingent Projects- Phase 5	229	11	814	2036-2040
Total Cost in Phase 5 - BDT Crore				**82,649**	

Phase VI (2041-2045)

Sl. No.	Project Name	Database Project No.	Project Ranking in Phase	Project Cost (BDT crore)	Phase Period
1	Improvement and Maintenance of ICT Infrastructure of BR: Phase 6	129	1	125	2041-2045
2	Procurement of replacement rolling stock - Phase 6	198	1	1,534	2041-2045
3	Institutional Strengthening and Capacity Building of BR: Phase 6	119	2	50	2041-2045
4	Procure BG rolling stock to meet additional traffic demand (incl. maintenance spares) - Phase 6	82	3	10,561	2041-2045
5	Project feasibility, detailed design and Tender preparation-Phase 6	224	4	61	2041-2045
6	Contingent Projects- Phase 6	230	5	123	2041-2045
Total Cost in Phase 6 - BDT Crore				**12,454**	

Appendix 8 – Financial Analysis of Rolling Stock Maintenance Enhancement Projects

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RS Maintenance Projects: Financial Analysis

	Inflation factor		1.00	1.06	1.12	1.19	1.26	1.34	1.42	1.50	1.59	1.69	1.79	1.90	2.01	2.13	2.26	2.40	2.54	2.69	2.85	3.03	3.21	3.40	3.60	3.82	4.05	4.29	4.55	4.82	5.11	5.42
		Total CAPEX																														
Costs			**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
79	Replacement of old machines and additional new machines for Central Locomotive Works, Parbatipur	770	257	257	257																											
91	Enhancement of Diesel Loco Sheds (10 total) including general upgrades and DG conversion	4,000	1333	1333	1333																											
92	Enhancement of Washing Sidings & Coach and Wagon Depots (14 total)	2,926	975	975	975																											
93	Enhancement of Technical Training Facilities at 5 existing Workshop Training Units	38.5	13	13	13																											
95	Update Manuals and Codes (6 total) for Mechanical and Stores Department	30.8	10	10	10																											
	Cost of Additional Mechanical Staff to Sanctioned Numbers				41	44	47	49	52	55	59	62	66	70	74	79	83	88	94	99	105	112	118	125	133	141	149	158	168	178	189	200
	Cost of Additional Operations staff				36	38	40	43	45	48	51	54	57	61	64	68	72	77	81	86	91	97	103	109	115	122	130	137	146	154	164	173
	Additional Fuel Consumption					119	126	133	141	150	159	168	178	189	200	212	225	239	253	268	284	301	319	339	359	381	403	428	453	480	509	540
	Total Costs	7765.3	**2588**	**2588**	**2666**	**201**	**213**	**226**	**239**	**253**	**269**	**285**	**302**	**320**	**339**	**359**	**381**	**404**	**428**	**454**	**481**	**510**	**540**	**573**	**607**	**644**	**682**	**723**	**767**	**813**	**861**	**913**
Benefits																																
	Improved Carriage Availability					371	393	417	442	468	497	526	558	591	627	664	704	747	791	839	889	943	999	1059	1123	1190	1261	1337	1417	1502	1592	1688
	Improved Wagon Availability					91	97	102	109	115	122	129	137	145	154	163	173	183	194	206	219	232	246	260	276	292	310	329	348	369	391	415
	Total Benefits	0	**0**	**0**	**0**	**462**	**490**	**519**	**550**	**584**	**619**	**656**	**695**	**737**	**781**	**828**	**877**	**930**	**986**	**1045**	**1108**	**1174**	**1245**	**1319**	**1398**	**1482**	**1571**	**1666**	**1766**	**1871**	**1984**	**2103**
	Benefits less Costs		**-2588**	**-2588**	**-2666**	**261**	**277**	**294**	**311**	**330**	**350**	**371**	**393**	**417**	**442**	**468**	**496**	**526**	**558**	**591**	**627**	**664**	**704**	**746**	**791**	**839**	**889**	**942**	**999**	**1059**	**1122**	**1190**
	NPV		**564**																													
	IRR		**4.5%**																													