Technical Assistance Consultant's Report

Project Number: 46452
October 2017

People's Republic of Bangladesh: South Asia Subregional Economic Cooperation Railway Connectivity Investment Program
(Financed by the Technical Assistance Special Funds)

Final Report on Updating Railway Master Plan

Prepared by:

CPCS Transcom Limited

In association with:

e.Gen Consultants Ltd.

Ottawa, Ontario, Canada

Asian Development Bank

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.

Date: October 21, 2017

Quality Assurance

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

CPCS Ref: 15328

Version	Date	Resp.	Approval
Version 1.0	13 November, 2016	Seán McDonnell	Arif Mohiuddin
Version 1.1	30 November, 2016	Seán McDonnell	Arif Mohiuddin
Version 1.2	30 December, 2016	Seán McDonnell	Arif Mohiuddin
Version 1.3	24 April, 2017	Seán McDonnell	Arif Mohiuddin
Version 1.4	03 May, 2017	Seán McDonnell	Arif Mohiuddin
Version 1.5	08 May, 2017	Seán McDonnell	Arif Mohiuddin
Version 1.6	11 May, 2017	Seán McDonnell	Arif Mohiuddin
Version 2.0	30 September, 2017	Seán McDonnell	Arif Mohiuddin
Version 2.1	21 October 2017	Seán McDonnell	Arif Mohiuddin

Filename/location: https://sp.cpcs.ca/cpcs/15328/ProjectExec/Reports and Deliverables/Final Report/Master Plan/TA 8597 FR Master Plan v2.1.docx

72 Chamberlain Ave.
Ottawa, Ontario
Canada K1S 1V9
ottawa@cpcs.ca
www.cpcs.ca

October 21, 2017 CPCS Ref: 15328

Mr. Tsuneyuki Sakai
Transport Specialist
Transport and Communications Division, SA Dept.
Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines

Dear Sakai-san;

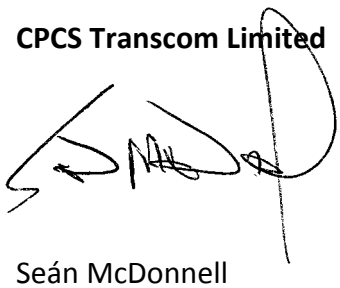
Re: Final Report – TA 8597 BAN: SASEC Railway Connectivity Investment Program

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.

CPCS Transcom Limited
72 Chamberlain Ave
Ottawa, Canada K1S 1V9
613.237.2500
ottawa@cpcs.ca

Table of Contents

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	Total no. of Projects*	GOB	FA	FA/PPP	FA / GOB
Phase 1 projects	76	6,353	77,672	8,980	56,564
Phase 2 projects	63	11,732	72,097	3,439	32,305
Phase 3 projects	30	8,054	-	1600	76,302
Phase 4 projects	22	726	-	-	95,825
Phase 5 projects	12	125	9,448	-	72,833
Phase 6 projects	4	125	-	-	10,795
Total for all Phases	**207**	**27,115**	**159,217**	**14,019**	**344,624**

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

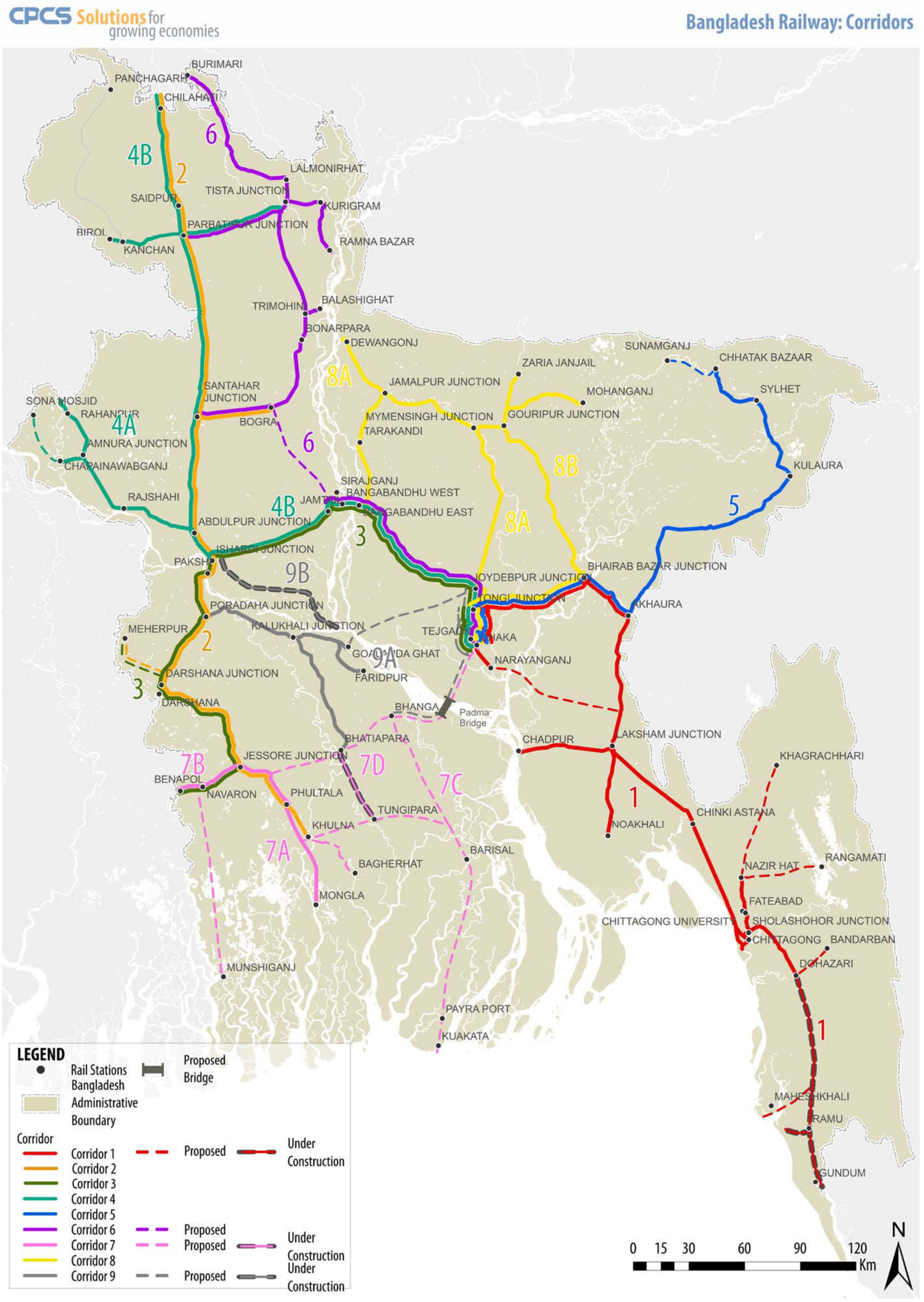
The railway network by corridor can be seen in Figure 1-1. These corridors were chosen by way of their higher passenger and freight loadings. It is 'track network centric' and underplays some of the inter-relationships that a master plan should illuminate.

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



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

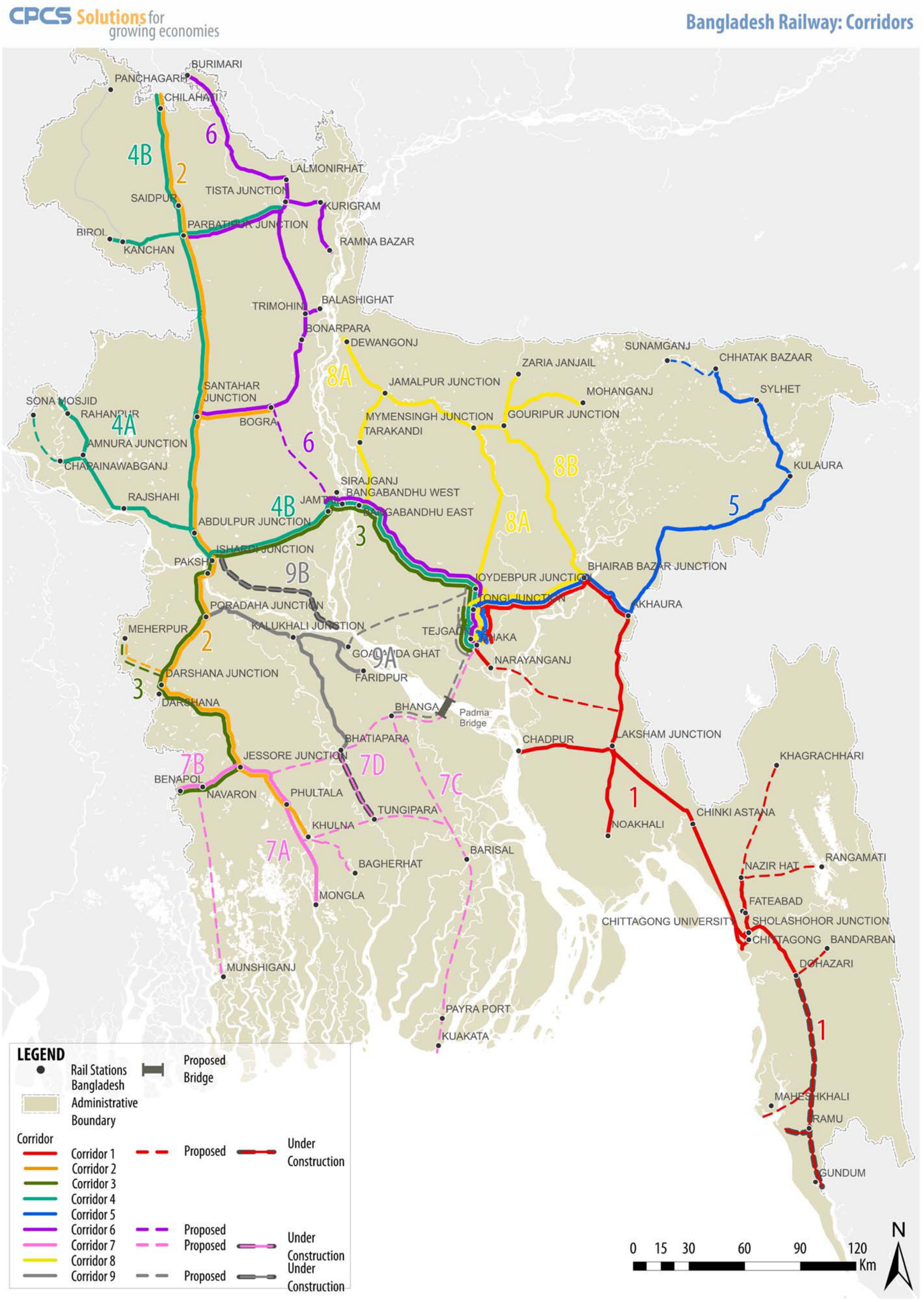


Table 3-2: Regional Networks: Passenger vs. Freight Traffic

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

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

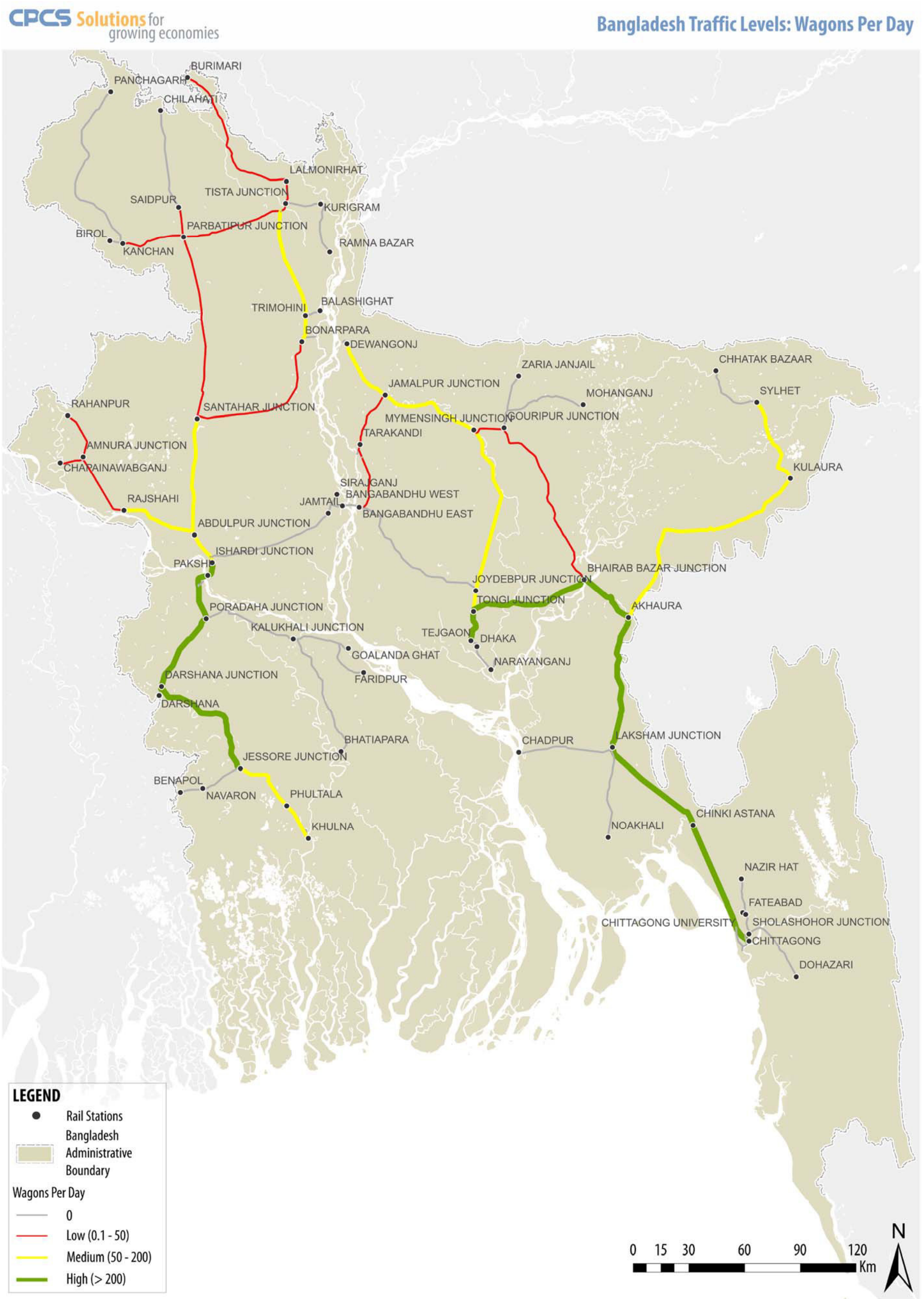


Figure 3-4: Passenger and Mixed Trains per Day in 2013-14

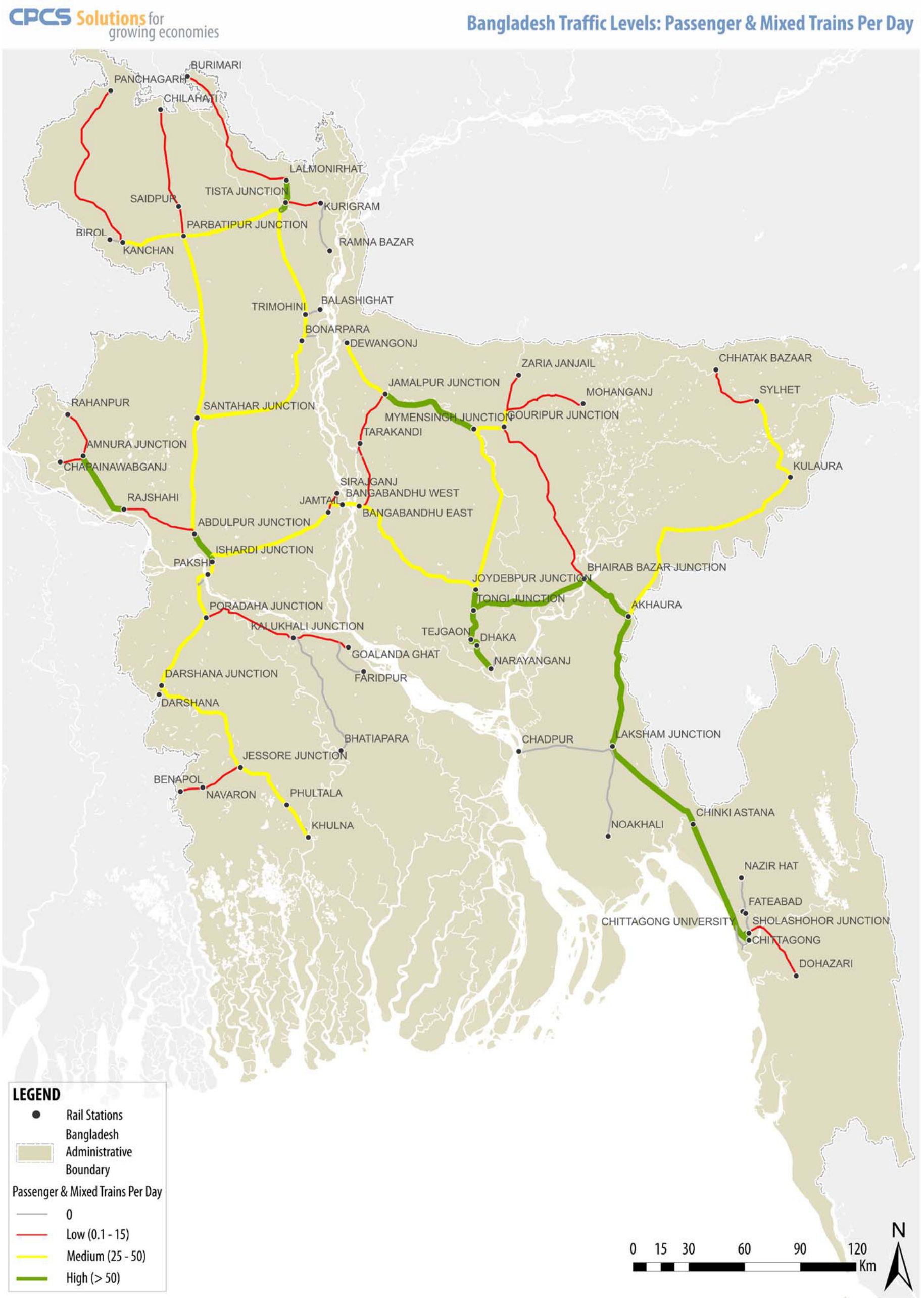


Figure 3-5: Freight Trains per Day in 2013-14

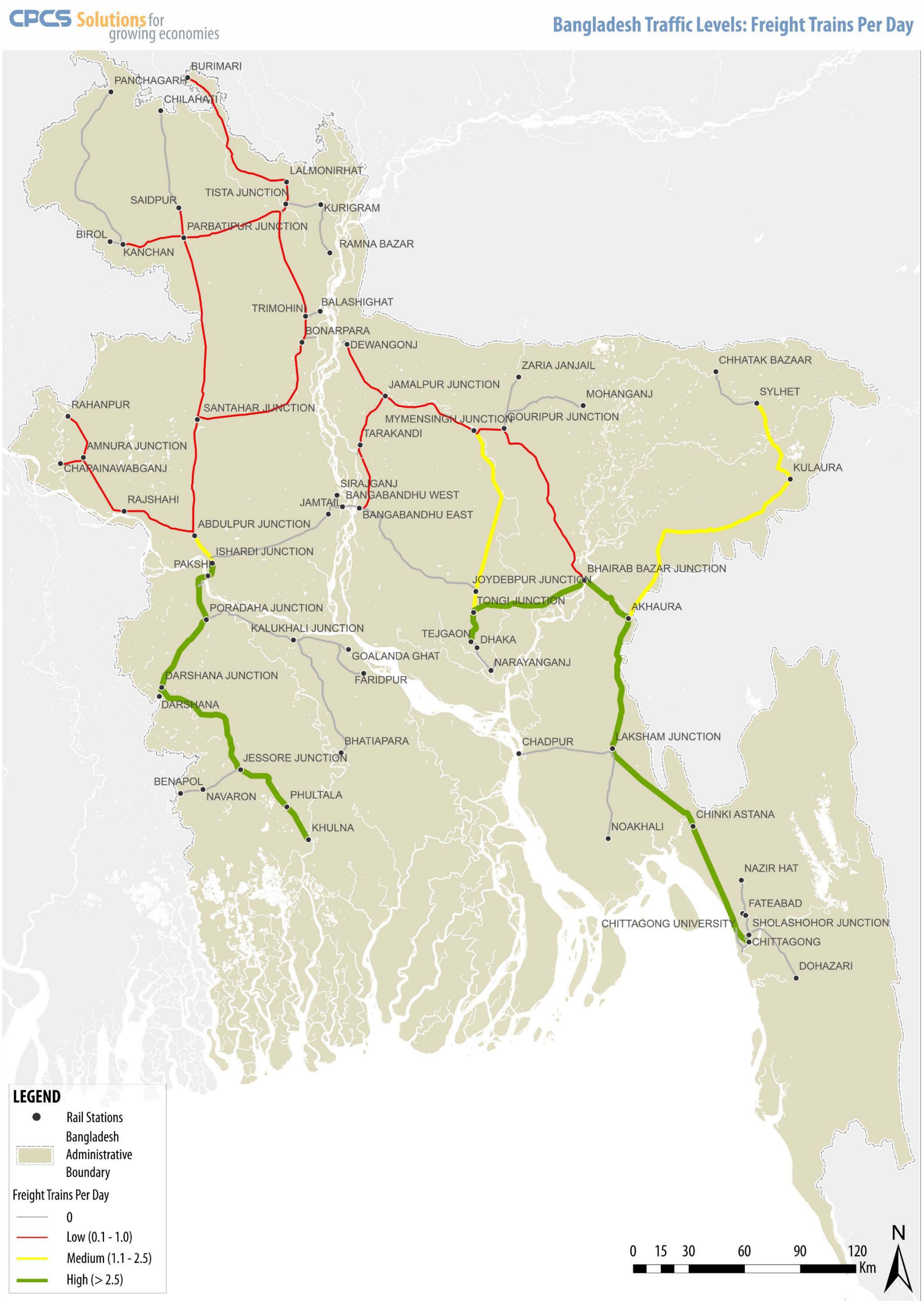
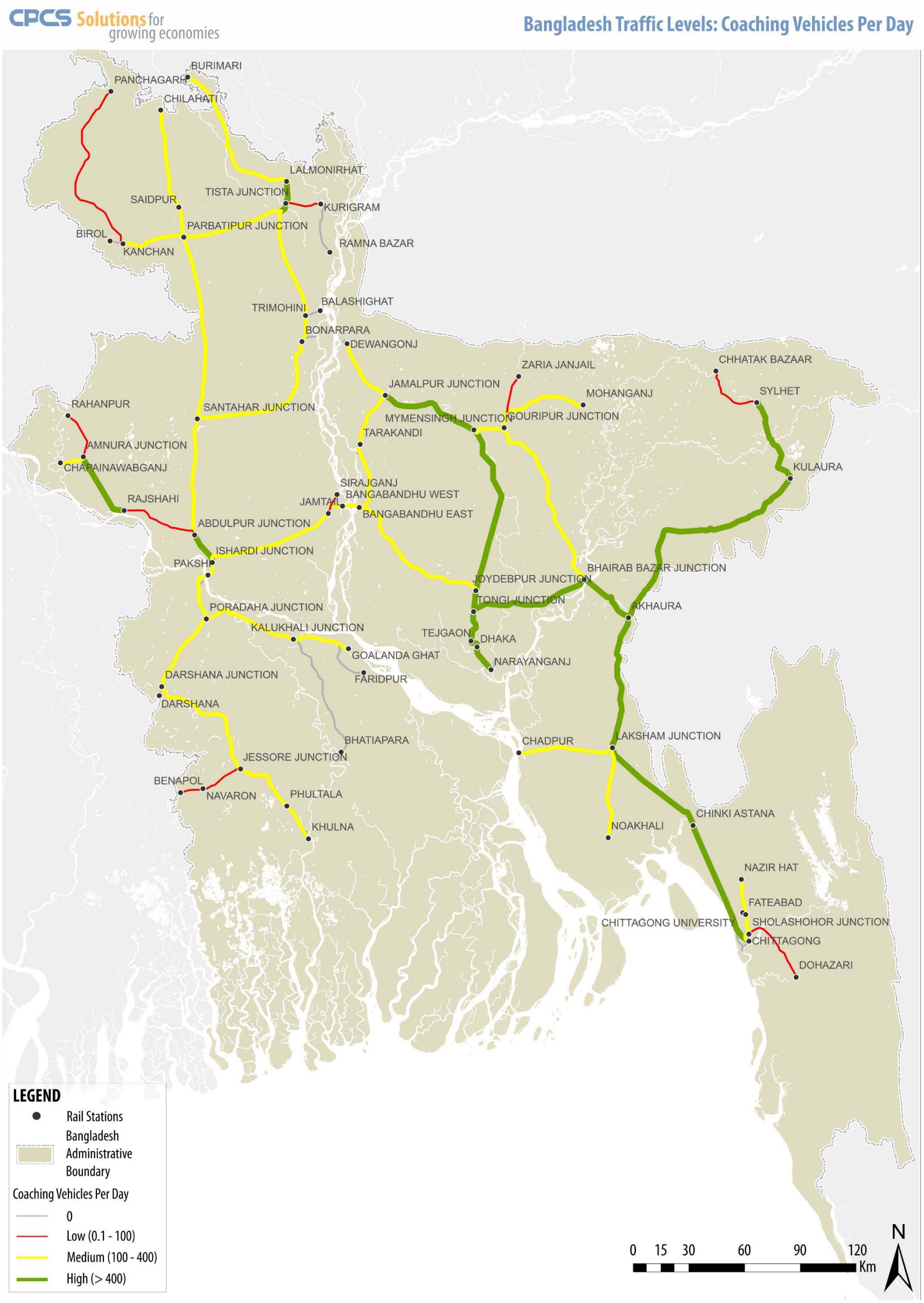


Figure 3-6: Coaching Vehicles per Day in 2013-14



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:

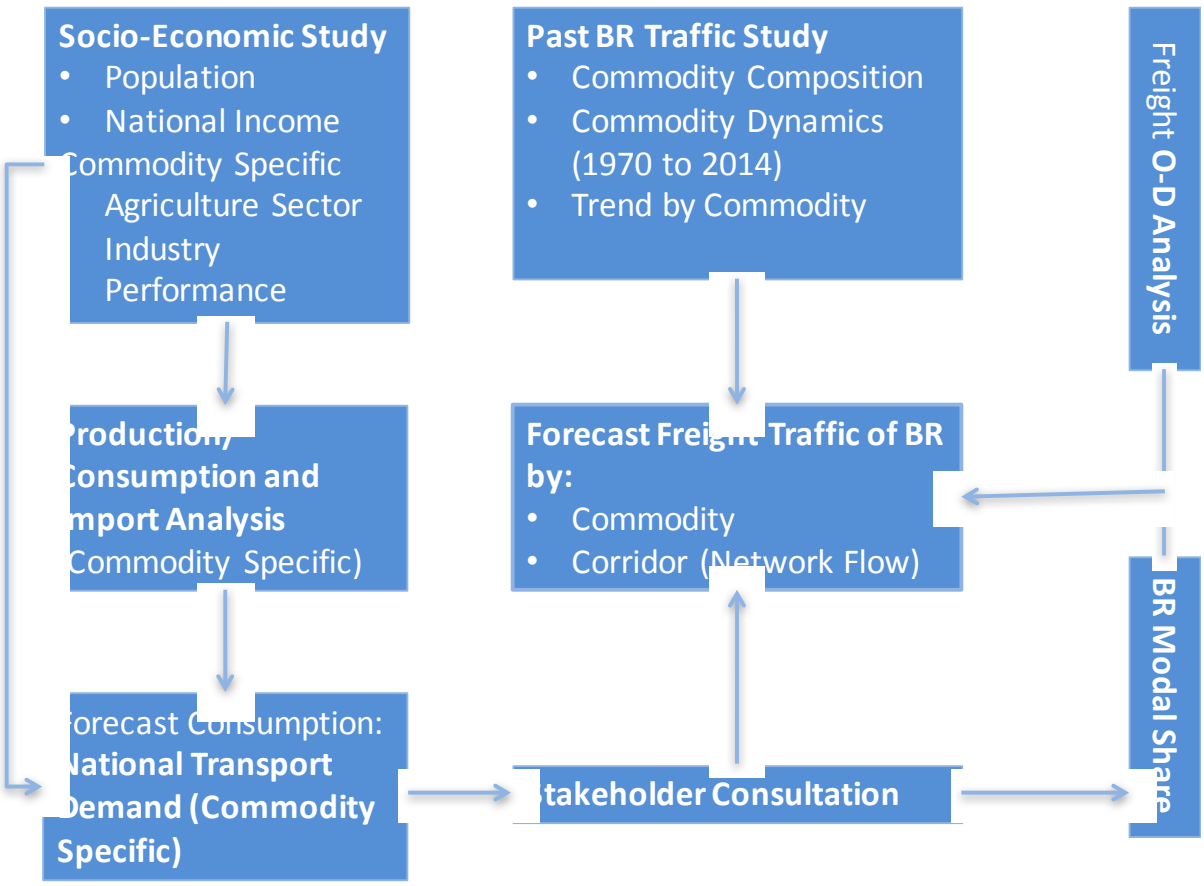
- Fuel Oil
- Kerosene
- Petrol
- Fertilizer
- Wheat
- Rice
- Container

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

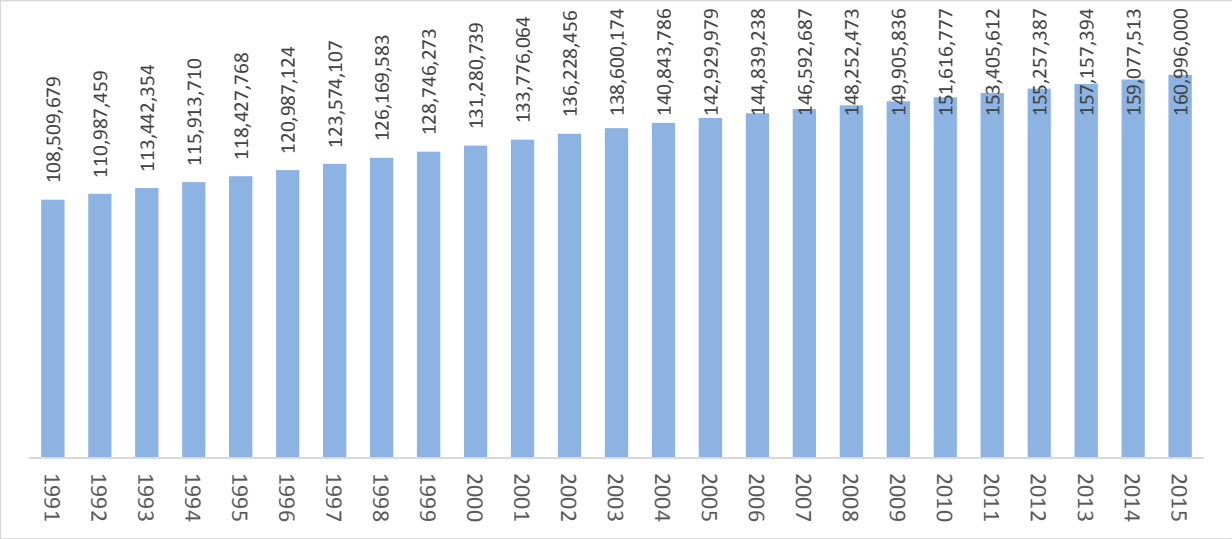


4.3.1 Population

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:

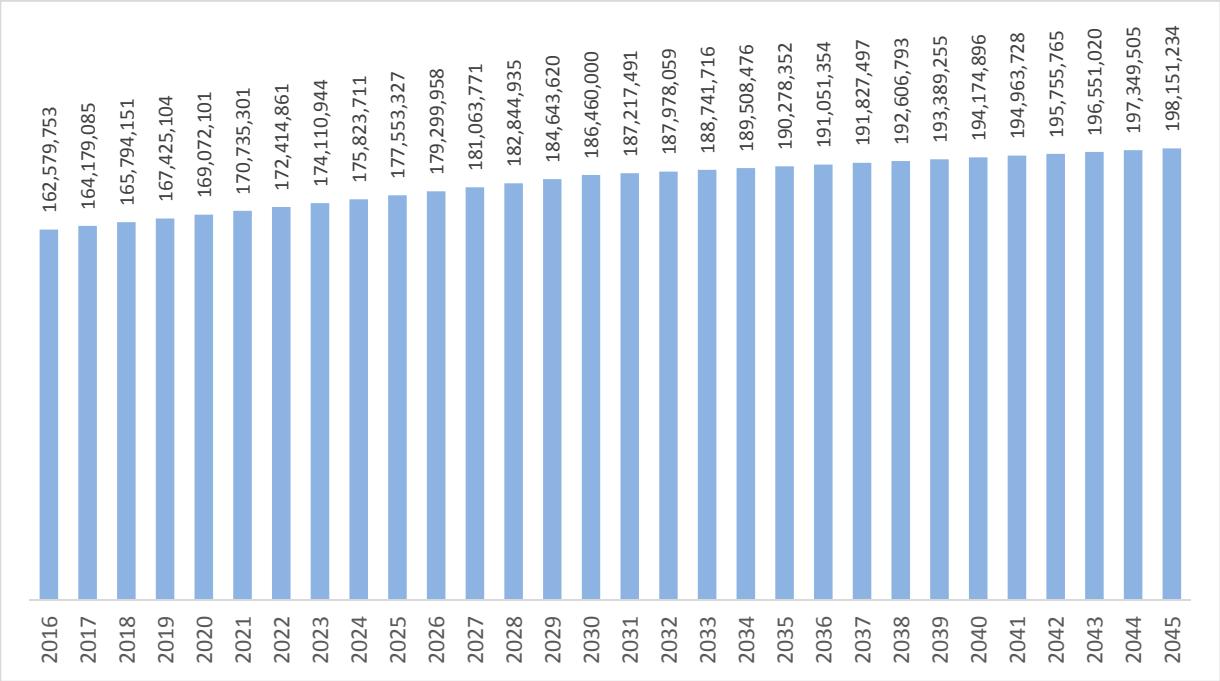
[4] Population Division, Department of Economic and Social Affairs (2015): World Population Forecasts-2015 Revision, Key Findings and Summary, UN, New York.

[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.

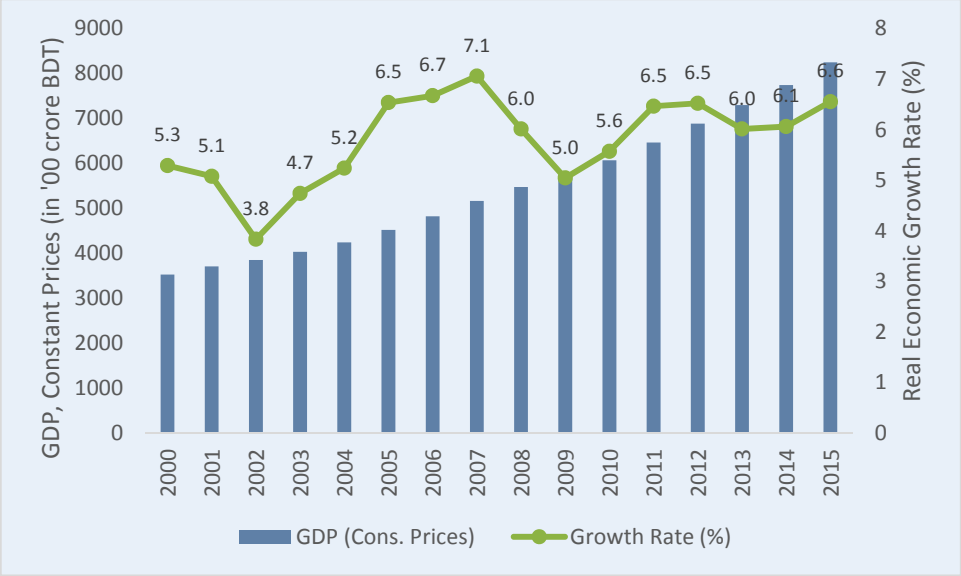
Table 4-3: Trend in National Economic Growth of Bangladesh

	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.

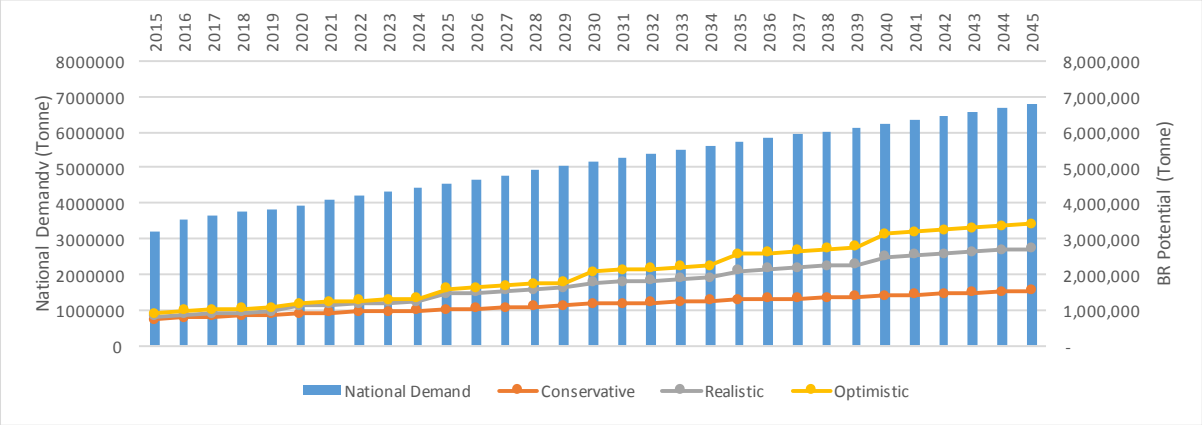
Table 4-7: Scenario Forecast of DFO Tonnages to be Carried by BR ('000 Tonnes)

	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	65,822	8.9%	99,024	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	39.57	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

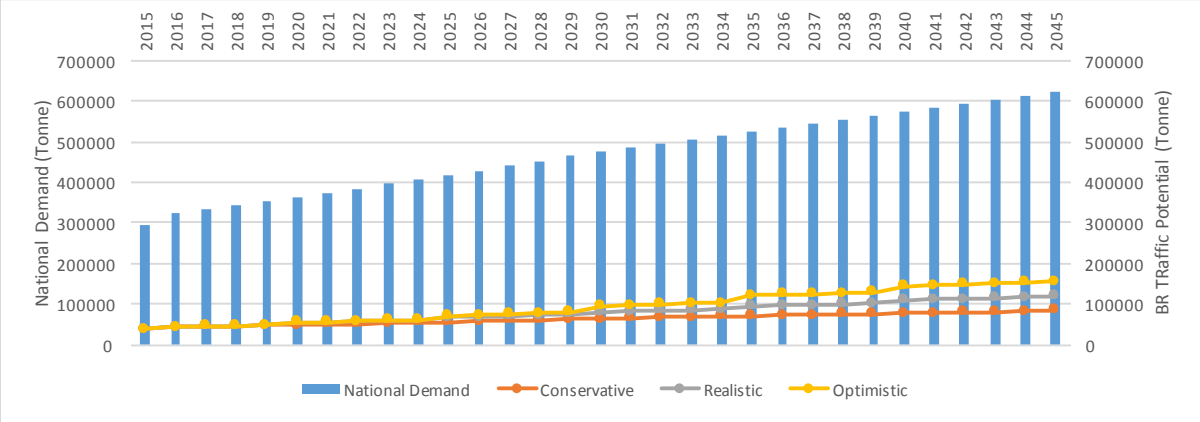
Based on the estimated national demand and considering the market capture as assumed above, the forecast potential traffic of kerosene is estimated as given in Table 4-10 and the same is illustrated in Figure 4-6.

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	633	1.6%	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			374.22	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	379.20	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	365.89	9,771	18.5%	12,813	15,694	19,008	22,155	25,607	27,908
SYT-KRF-AKA-LKM-CTG	SYT	GPTK	377.57	24,872	47.0%	32,614	39,948	48,384	56,395	65,181	71,041
Sub-Total: Down Direction			374.28	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.

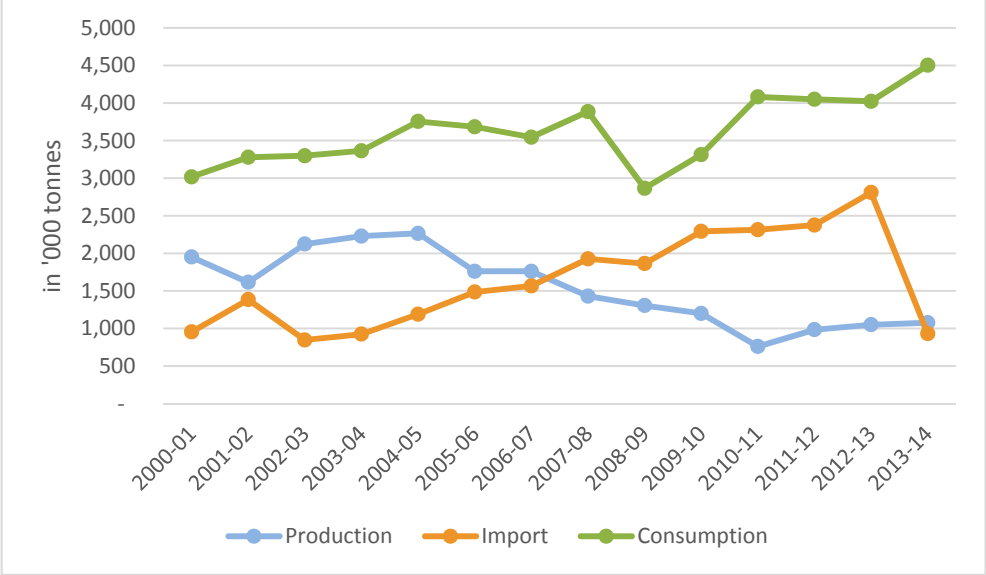
The past trend in production, consumption and import of fertilizer in Bangladesh is illustrated in Figure 4-7: and shown in Table 4-16.

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	125.40	57	0.1%	379	392	406	419	433	446
AKA-BCI, BCI-GRPM, GRPM-JJL	ASZ AFCCL	JJL	130.42	76	0.2%	505	523	541	559	577	595
KLN-JS-DSN-PDB-ISD-JOY-JY	KLN	JY	316.09	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	379.20	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	316.09	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	379.20	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	380.00	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	380.00	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	374.54	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	396.44	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:

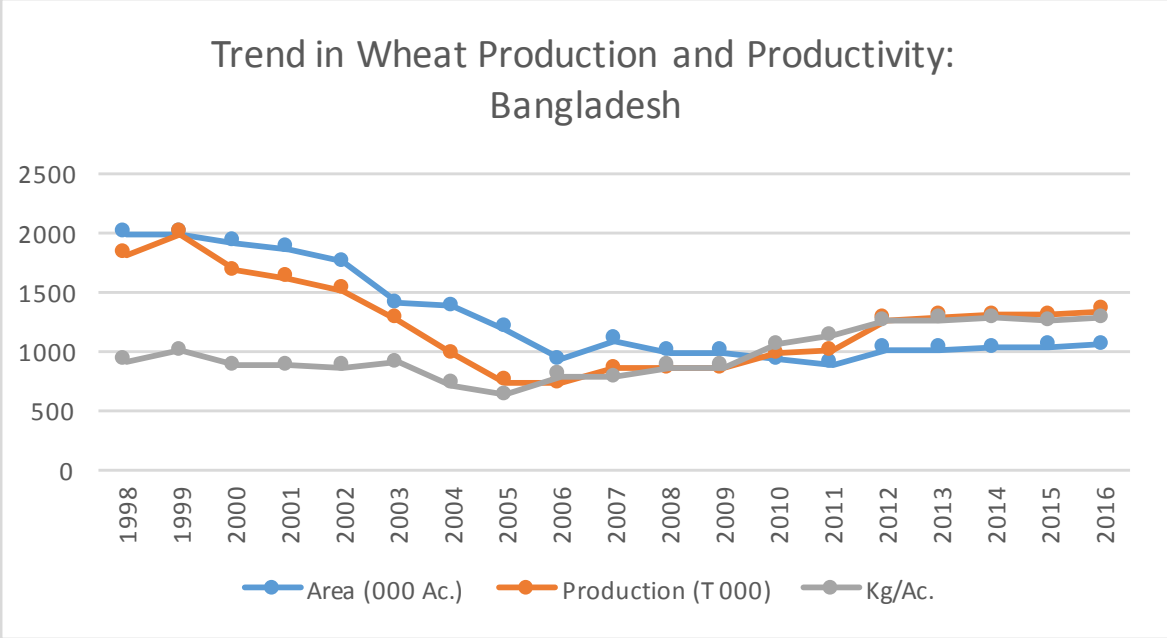
- Area under wheat cultivation: 3.4% p.a.
- Production of wheat: 6.0% p.a.
- Yield rate: 2.6% p.a.

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.

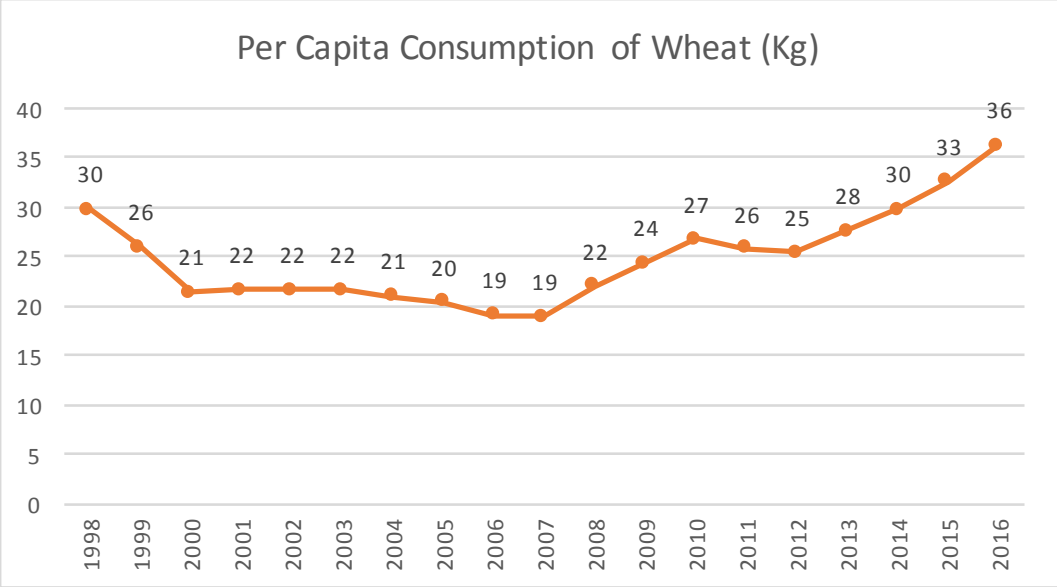
Table 4-23: Trend in Wheat Consumption of Bangladesh

	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

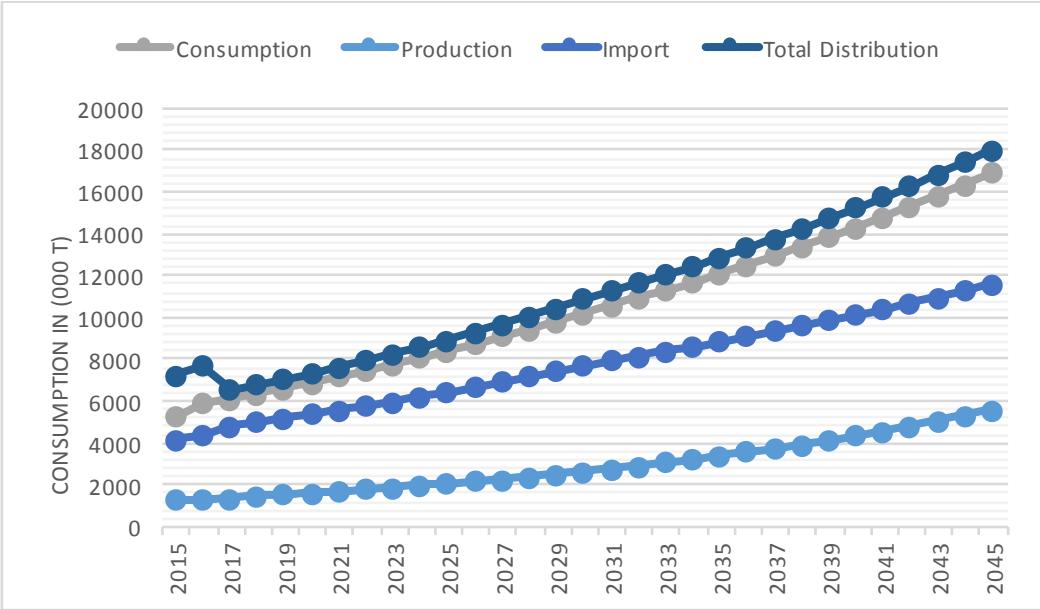


Table 4-24: Estimated Future National Production, Consumption and Import of Wheat in Bangladesh (Area in '000 Ac., Wheat in '000 Tonnes)

	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

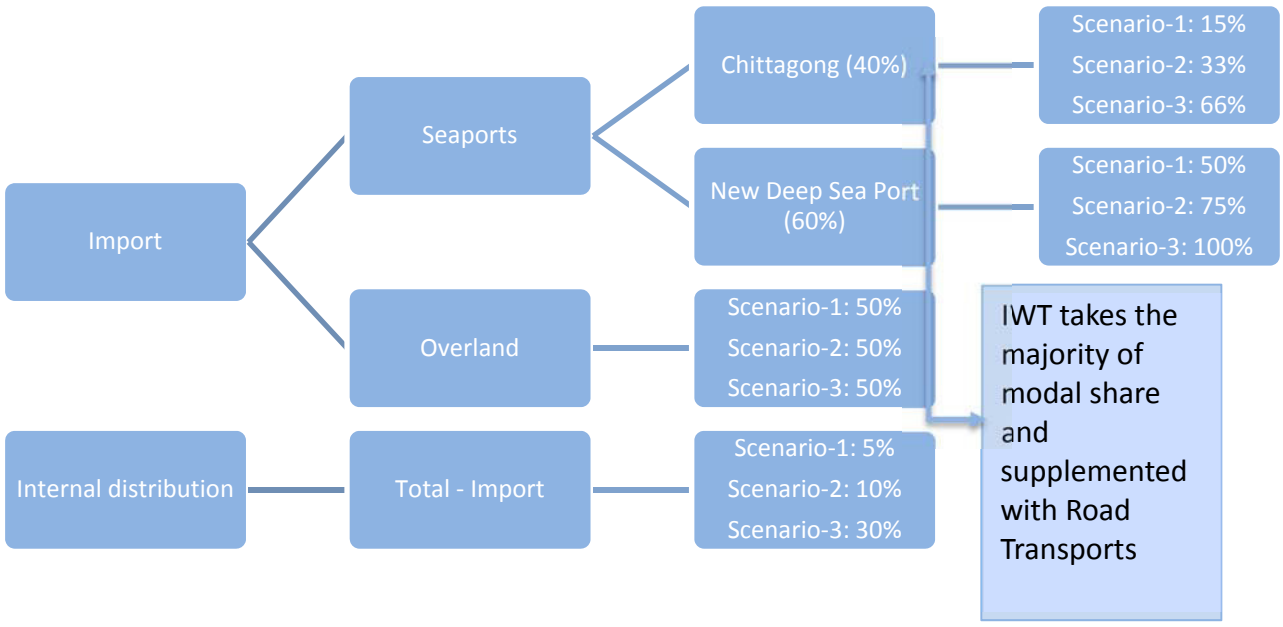
It is recognized that BR will have an opportunity to play a larger role in future for the following type of wheat movement:

- 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)

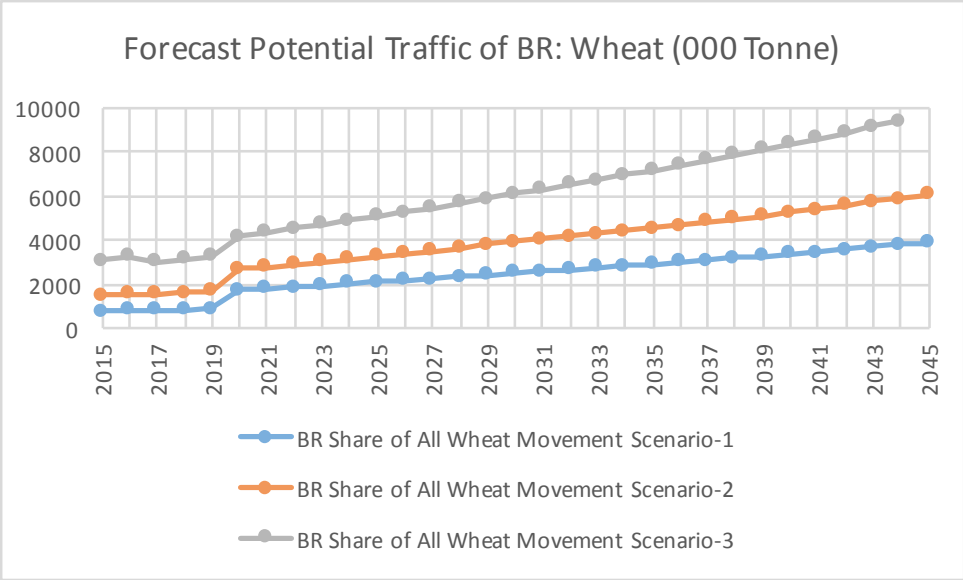


Table 4-26: Forecast Potential Traffic of BR-Fertlizer (in '000 tonnes)

	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	721.01	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	715.44	1,008	0.4%	10,961	13,189	15,858	18,367	21,225	24,465
DSN-PDB, PDB-ISD, 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, PDB-ISD, 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	65,289	26.1%	709,933	854,261	1,027,163	1,189,669	1,374,785	1,584,650
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

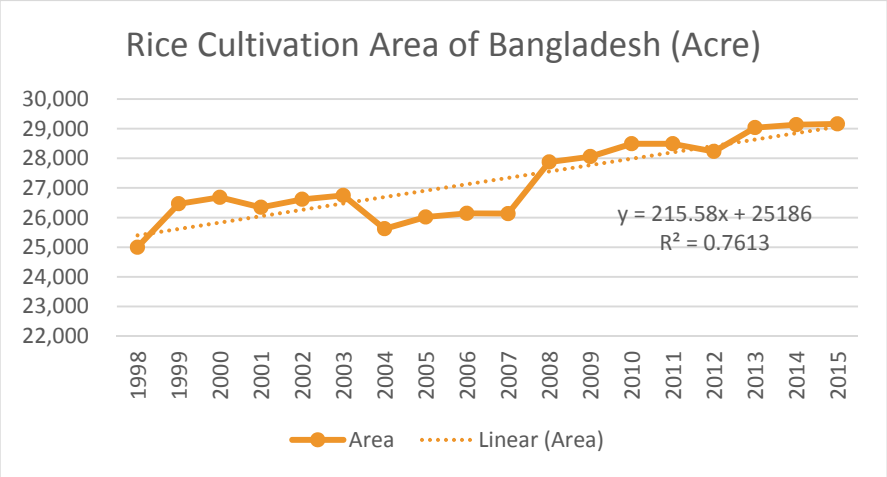
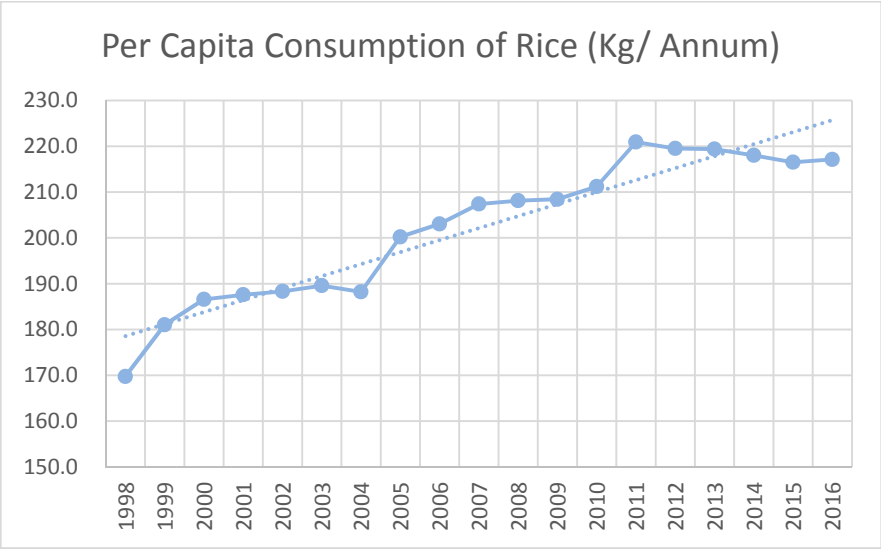


Figure 4-14: Per Capita Consumption of Rice



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	otal 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

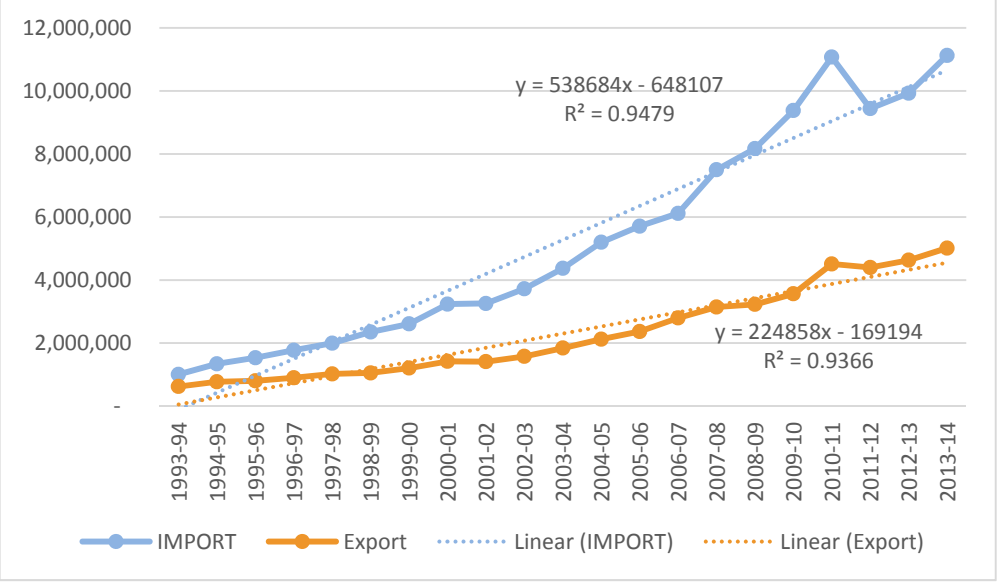
Source: Bangladesh: Trade and Transport Facilitation Programme, KCT Pre-Feasibility Study, World Bank, July 2014

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:

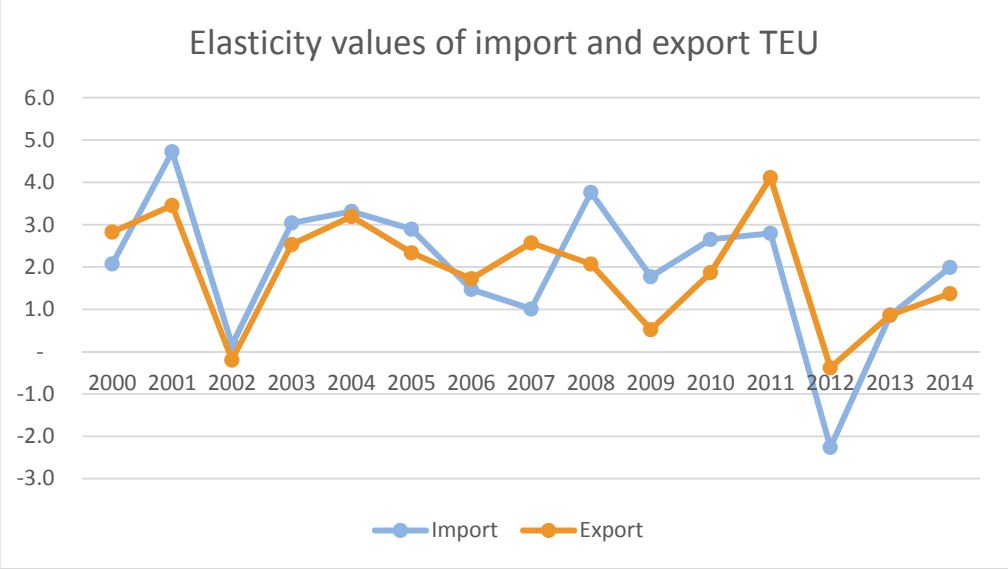
- The elasticity values of import and export container traffic have been volatile when analyzed on an annual basis between 2000 and 2014.
- 5-yearly average elasticity reveals a clear trend: i.e. declining trend but starting at a very high elasticity value, which is in line with the international trend.
- 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)

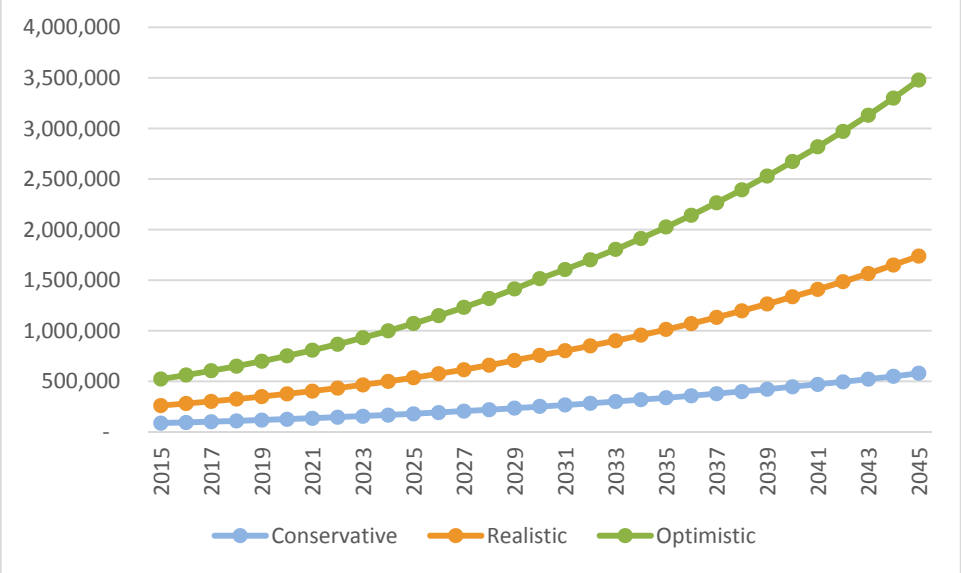


Table 4-38: Bangladesh Container Traffic Forecasts by Port ('000 TEU)

	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)

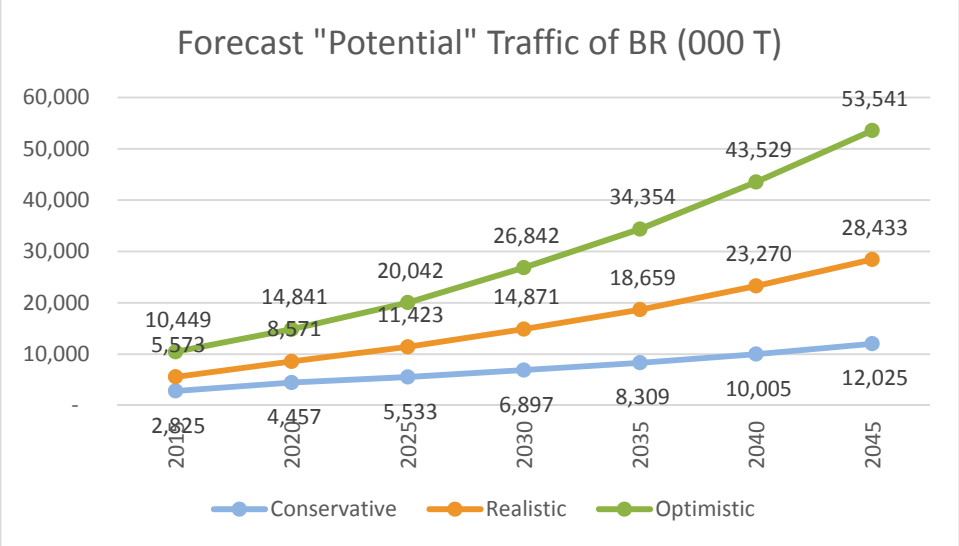


Table 4-43: Forecast BR Potential Traffic by Commodity – Conservative Scenario (in '000 tonnes)

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.