Preparation of a Strategic Master Plan for Mongla Port

Interim Report

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Mongla Port Authority

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Abbreviations

Abbreviation	Description
a	Annum (Year)
AC	Air conditioning
APL	American President Line
B/B	Break Bulk
BDT	Bangladesh Taka
BG	Broad Gauge
BWDB	Bangladesh Water Development Board
cbm	Cubic metre
C&F	Clearing & Forwarding
CD	Chart Datum
CIF	Cost, Insurance, Freight
CPA	Chittagong Port Authority
CRTS	Consultancy Research and Testing Services
d	Day
DoE	Director of Environment
EIA	Environmental Impact Assessment
EPZ	Export Processing Zone
ESIA	Environmental and Social Impact Assessment
FiFi	Fire-fighting
FIO	Free In and Out
FY	Financial Year
GRT	Gross Register Ton
GT	Gross Ton
h	Hour
ha	Hectares
HAT	Highest Astronomical Tide
ICD	Inland Container Depot
ICT	Inland Container Terminal
IFC	International Finance Corporation
IL	INROS LACKNER SE
IT	Information technology
IWM	Institute of Water Modelling
KICD	Kamalapur Inland Container Depot
kn	Knots (speed)
LAT	Lowest Astronomical Tide

Abbreviation	Description
LiDAR	Light Detection and Ranging
LPG	Liquid Petroleum Gas
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
ML	Mean Level
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
m/s	Metre per second (speed)
M/V	Motor Vessel
MPA	Mongla Port Authority
MSC	Mediterranean Shipping Company
MSL	Mean Sea Level
MTBF	Mean Time Between Failures
nm	Nautical Mile (= 1,852 metres)
PD	Project Director
PFB	Port Feeder Barge
PGCB	Power Grid Company of Bangladesh
PICT	Pangaon Inland Container Terminal
PIL	Pacific International Line
SIA	Social Impact Assessment
SPMC	Strategic Planning and Management Consultants Ltd
sqm	Square metre
TEU	Twenty Feet Equivalent Unit
ton	Tonne or ton (1,000 kg)
ToR	Terms of Reference
UKC	Under Keel Clearance
U.S.	United States
USD	United States Dollar ($)
USL	United States Line
V	Volt

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A more detailed overview of available data is presented in Appendix A.

0 Executive Summary

0.1 Present Port Layout and Existing Infrastructure

0.1.1 Mongla Port

Mongla Port is located on a peninsula between Pussur River and Mongla Nulla. Most of the port's land bordering Pussur River has been leased to private operators, however, large areas of land are still available for future developments. Currently, MPA operates five jetties (Jetty No. 5 to 9). The quay structures were built in the 1970s and are in considerably good condition, however, some rehabilitation works are required as proposed by third-party studies. Development of new quay structure on a PPP basis is ongoing at Jetty No. 3 and 4. The same is proposed for Jetty No. 1 and 2. Jetty No. 10 and 11 are planned to be developed on a G to G basis with China.

Cargo handling equipment and port vessels are available at Mongla Port. While the cargo handling equipment is mostly in good condition and fully operational, most of the port vessels are rather old and sometimes in a critical condition. It is noted that a large number of different brands of cargo handling equipment is used. This may be reduced in order to streamline spare parts logistics and training of equipment operators.

0.1.2 Roosevelt Jetty

MPA owns a large area of land in Khulna. Roughly a third of the land is used for handling of grain and fertilizer at the so-called Roosevelt Jetty.

The existing infrastructure at Roosevelt Jetty is mostly in a bad condition although the quay apron has been rehabilitated recently. River barges berth at floating pontoons which are connected by bridges to the land. The dolphins on which the pontoons are moored are no longer stable and some are tilting.

Cargo handling equipment is not available so all bagging of cargo and unloading of vessels is done manually. The cargo is stored under tarpaulins as sufficient capacity in sheds is not provided.

0.2 Present Navigational Situation

The available navigation charts over the period 2013 to 2019 as well as third party reports, have been scrutinised to assess the present and past river hydrology and morphology and limitations to navigation from the Bay of Bengal up to Chalna. Assuming that the dredging areas and levels indicated on the charts are maintained and a tidal window with water levels above 2 m above CD, the presently maximum allowable draft is approximately 9.5 m up to the Harbaria anchorages, and about 6 m from Harbaria, past Mongla Port and up to Chalna.

Third party assessment of dredging works to allow larger draft vessels to navigate up to Mongla Port concluded that the implementation of river training works and/or tidal basins is beneficial and would reduce maintenance dredging efforts.

It is recommended to investigate implementation of such works (individually and combined) based on presently existing bed levels, with local dredging between Base Creek and Mongla Port to 5.5 m below CD. The morphological response may by itself allow larger draft vessels

to sail up to Mongla Port. The most promising option can then be taken forward as first phase of development and would allow a maximum (tidally restricted) draft of 9.5 m up to Harbaria anchorages, and up to 6.5 m from Harbaria up to Chalna (considering 1 m total clearance, consisting of 0.5 m under-keel clearance and 0.5 m for vessel squat, trim and exposure).

After the first phase, regular surveying and monitoring over several years is recommended, to assess its effects and the requirements for further interventions. This second phase of development would include an increased dredging depth to provide navigability for vessels with a draft of up to 8 m, requiring bed levels below 7 m below CD in accordance with the above. Subject to the effectiveness of the first phase developments, further river training works or tidal basins may be included. Furthermore, waterfront structures may require strengthening or overhaul to allow sufficiently low adjacent berth bed level of 9 m below CD.

Again, regular surveying, monitoring and assessment should follow implementation of the previous phase. The third and fourth phases of development would see a further increase in dredging depth to allow vessels with a draft up to 10 m and 12 m, respectively. In accordance with the former phases, these developments may comprise further river training works and tidal basins, subject to their effectiveness in earlier phases, and will require dredged bed levels of below 9 m and 11 m below CD. Adaptation or replacement of waterfront structures to ensure structural stability for adjacent bed levels of 11 m and 13 m below CD may be required.

0.3 Hinterland Connections

The hinterland connections of Mongla Port are at present not adequate to serve Dhaka and the capital area of Bangladesh. Furthermore, important parts of the geographically accessible port hinterland are not exploited at present due to the lack of railway connection and the present shape of the main connecting road to the port and between Khulna and Jashore and beyond. The most important infrastructure bottleneck hindering efficient services to the hinterland of Mongla Port is the present shape of the passage of Patma river.

From 2020 onwards and until 2025/2030 significant improvements will be achieved, and Mongla will be connected to the railway network and by improved national roads. The Patma bridge and the respective rail and road connections will shorten the present transport distance to Dhaka and the Bangladesh metropolitan area by 40% and more. Mongla Port is expected to expand the served port hinterland from this time horizon onwards including Dhaka and, with a perspective to long-term developments, also parts of India and the largest part of Bhutan.

0.4 Past and Present Cargo Throughput

The recent cargo throughput is characterised from receipt of cargoes for the local port industry. More than 90 - 95% of the cargoes handled in Mongla during recent were import cargoes, as parts of supply chains for the cement industry and gas bottling plants, followed recently be imported coal for power plants and fertilizers as main drivers. At present Mongla is a pure import port with a market share of nearly 99% of imports in overall port handling. Container trade in Mongla plays not yet an important role with around 60.000 standard containers (TEU) handled in the most recent year. It should be noted that Mongla Port has a market share of nearly 50% in car and road vehicle import which is an interesting area of port activities in combinations with increasing demand for such vehicles.

0.5 Economic Development

The market share of Mongla Port in throughput of the national main ports is between approx. 14% (import) and 2% (export). The positive economic development in Bangladesh as well as in regions in the common hinterland of the sea ports in the Bay of Bengal resulted in demand pushes for imports of cargoes for construction, energy and other industry purposes, including agriculture–industrial input commodities like e.g. fertilisers. The respective capacities of recipient industries are expected to significantly growth in the future.

The exports of Bangladesh focus on general cargoes with textiles and ready-made garments at prominent places, and temperature guided and containerised fish and shrimps. A significant share of exports is destined for Europe. The role of Mongla as export facilitating port is presently neglectable but going to change due to establishment of hinterland connections and due to the allocation of large free trade and export processing zones adjacent to the port. Furthermore, the industrial areas at Rampal power plant, alone boosting import of cooking coal by another four million tons per year from 2022 onwards, and the plots behind the present waterfront line of industrial plots allows for additional settlement of manufacturing and light industries.

The economic growth is expected to grow faster than the population in Bangladesh. The income per capita as well as the industrial productivity and the competitiveness of products is expected to growth further. The above factors in combination with better access to an expanded port hinterland will promote exports via Mongla Port and hence result in a slightly more balance between import and expert via the port in future. Nevertheless Mongla Port will remain to be a major import hub for the port industry and the economy of Bangladesh.

0.6 Port Throughput Development 2020-2040 and until 2070/2100

Mongla Port throughput in 2020 will amount for 15.6 million tons and increase to 33 million tons in 2030. In 2040, the throughput is expected to amount for 72.4 million tons. The port development of Mongla Port shall hence foresee a dynamic development of capacities and installations in order to cope the expected port throughput and the corresponding land and maritime traffic demand until 2040.

The projections for the years 2050, 2060 and 2070 show a long-term growth expectation for Mongla Port throughput of up to 100 million tons. However, the projections consider that increased port competition will result in less dynamic developments and in fluctuations of throughput growth in Mongla. The forecast projection results reflect by the adoption of port competition that in a liberalised market environment and in combination with establishment of additional port capacities at other locations than Mongla will maintain already achieved efficiency and productivity levels in order that the projected level of 132 million tons of cargoes handled in Mongla port in 2100 will be reached.

The master plan measures and the overall concept for 2020 – 2040 should consider the growth perspectives and lay the foundations for flexible and efficient port capability development in Mongla.

1 Introduction

1.1 General

Mongla Port Authority (MPA) has assigned INROS LACKNER SE (IL), of Bremen/Germany in association with Strategic Planning and Management Consultants Ltd (SPMC) of Dhaka/Bangladesh (together the Consultant) with consultancy services for the “Preparation of a Strategic Master Plan for Mongla Port” (the Project).

The consulting contract became effective on 24th July 2019. The Consultant's work has officially commenced on 23rd August 2019.

The main objective of the Project is to prepare a master plan which will be used as a basis for the future development of Mongla Port itself and the Khulna/Mongla area.

The scope of work is understood to cover the activities proposed in the Consultant’s technical and financial proposal to prepare a strategic master plan based on guidance from the ToR, though not negating the practice of due diligence on the part of the Consultant and in line with international quality standards for port master plans.

1.2 Background Information

Mongla Port is the second biggest sea port of Bangladesh (after Chittagong Port). As the economy of Bangladesh continues to grow at a considerable rate, the capacity of Mongla Port is required to cater for the increase of traffic volumes.

The recommendations of the Master Plan for Mongla Port will be in line with the national development planning horizons. The Master Plan will consider interlinks to the achievement of the Strategic Development Goals 2021 and 2041 (National Goals 2021 and 2041) and to the Strategic Vision Documentation 2100 for the Bangladesh Delta (Delta Plan 2100) regarding the port’s contributions to the national economic growth in this respect.

A comprehensive master plan for Mongla Port has never been prepared. The only comparable document is the “Master Plan Layout for Chalna Port Town” which probably stems from the 1980s and projects the development of the port until the year 2000. This document is therefore regarded as outdated. However, a number of feasibility studies were prepared in the past which cover different aspects and areas of Mongla Port. These will be considered when preparing the Strategic Master Plan.

1.3 Project Location

It is located in the south-western part of the country, at the confluence of Pussur River and Mongla Nulla, approximately 71 nautical miles upstream from the Bay of Bengal, see Figure 1-1 at Lat. 21^0 9’N Long. 89^0 34.4’ E, approx. 35 km to the South of Khulna, Bangladesh’s third largest city.

The port is well protected by the world's largest mangrove forest known as the Sundarbans, part of which has been declared as ‘World Heritage’ by the UNESCO in 1997.

Besides Mongla Port, MPA also operates Roosevelt Jetty in Khulna and a pilot station at Hiron Point at Pussur River.

Figure 1-1: Aerial View of Bangladesh with Location of Mongla Port (in white box) [Google Earth 2019]

1.4 Scope – What is a Port Master Plan?

In general, the contents of a port master plan are as described by the World Association for Waterborne Transport Infrastructure (PIANC[1]) hereafter.

A port master plan should establish policies and guidelines to direct the future development of a port. The plan should aim to promote and safely accommodate international and local waterborne freight and may include for fisheries and recreational uses within the overall development plan.

The principal objectives of a port master plan are to:

- Communicate the “vision” for the port to the wide range of stakeholders.
- Develop the port in accordance with international legislation and guidelines.
- Integrate economic, engineering, environmental and safety considerations in the overall plan.
- Promote the orderly long-term development and growth of the port by establishing functional areas for port facilities and operations.
- Allow the port to respond to changing technology, cargo trends, regulations and legislation and port competition.

1.5 Role of the Interim Report

The objective of the Interim Report is

- to provide an overview of gathered data and studies collected by the Consultant and an analysis thereof;
- to emphasize any gaps in the existing information;
- to present and summarise the existing situation at Mongla Port, including:
    - current cargo throughput,
    - infrastructure and superstructure,
    - equipment,
    - navigability of Pussur River;
- to present the methodology and results of the traffic forecast.

In general, the Interim Report shall present the data basis on which the Port Master Plan will be developed. It is therefore of utmost importance that MPA thoroughly checks and verifies the presented data.

[1] PIANC was formerly known as the Permanent International Association of Navigational Congresses, hence the abbreviation

2 Present Port Layout, Infrastructure and Equipment

2.1 Sources of Data

Data and documents made available to the Consultant are listed in “Utilised Documents /Data Sources”. When information from these sources is quoted in this Section, it is referred to this list.

During the Consultant’s site visits in September and October 2019, observations were made regarding the existing infrastructure and the present layout of the port which is summarised in the following.

2.2 Layout and Infrastructure of Mongla Port

2.2.1 Port Layout

Mongla Port is located on a peninsular between Pussur River and Mongla Nulla River approx. 35 km south of Khulna, Bangladesh’s third largest city.

The port area stretches about 6.5 km from North to South and about 2.0 km in East to West direction, see Figure 2-2 (the full scale plan is presented in Appendix B).

South of the Mongla Nulla River, more land below the authority of MPA is located which currently is not used for port operations. This area is called Old Mongla.

Large plots of land have been leased out to private operators or were handed over to the Export Processing Zone (shown in red). The private operators have their own jetty where they handle cargo independent of MPA.

Currently, MPA operates five jetties, called the permanent jetty (No. 5 to 9). More jetties are proposed for development to the South (No. 1 to 4) and North (No. 10 and 11) of the MPA jetties.

Other areas of the port are currently occupied by the Bangladesh Navy, the Coast Guard and other government authorities.

At present, there is one main road from Khulna which enters the port in the North. This road splits after about 2.5 km. While the eastern road runs along the permanent jetty towards the southern tip of the peninsular, the western road runs mostly along non-developed land and ends at the ferry point from where it is possible to transfer to Old Mongla.

The Mongla-Khulna railway line is currently under construction. It enters the port in the North next to the main road. After approx. 2.0 km it splits with the western branch going into the permanent jetty area and the eastern branch going to the proposed railway station next to the ferry point.

Figure 2-1: Railway under Construction at Mongla Port [Google Earth 2019]

From the layout plan it can be seen that there are large areas of land which can be used for future developments of the port (shown in green). However, roughly 50% of the river front is leased to private operators. This will be considered when preparing the Master Plan for Mongla Port.

Figure 2-2: Layout of Mongla Port [Consultant, based on available layout plans]

2.2.2 Port Infrastructure

The only quay structure under direct control of MPA is the so-called permanent jetty, see Figure 2-3. It was built in the 1970s.

Figure 2-3: Arial View of Permanent Jetty [European Space Agency 2019]

The Consultant was able to examine and take pictures of available as-built drawings of the quay structure.

The permanent jetty comprises an open piled quay structure with tubular steel piles and a reinforced concrete deck slab.

The deck rests on 5 rows of piles (row A to E), see Figure 2-4. While rows A to D comprise vertical piles, row D comprises three inclined piles, two towards the front and one towards the rear of the quay structure. At row D there is a sheet pile wall which closes the structure.

On top of each pile are piles caps with the dimensions 1.22 m x 1.22 m (4') which carry the beams.

In total there are 190 lines of piles under the permanent jetty which have lengths between 14.9 m at row A (49') and 6.8 m at row E (22.5').

On row A and B the crane rail beams are located which have the dimensions 0.68 m (2'-3") x 1.08 m (3'-7") and run parallel to the berthing line. The beams perpendicular to the berthing line have the dimensions 0.78 m (2'-7") x 0.9 m (3'-0").

The total thickness of the deck slab is 0.38 m (15") of which 0.23 m (9") are pre-cast elements and 0.15 m (6") are cast in situ concrete.

There are fender systems comprising of fender pile and rubber fender at berthing face.

The jetty is supported by cast-in situ pile foundation system, where, in addition to vertical piles, having length of 49 ft. (24.6"ϕ) at the river side and reducing the length towards the port side up to 22.5 ft. (22.6"ϕ). Batter piles (1:4, 31'-22.87"ϕ) are also provided in regular intervals having three piles in a group. The exposed portion of the piles is found steel cased. Expansion joints are of the jetty structure at almost regular intervals.

Each jetty has a length of 182.88 m (600') and consists of three sections which are separated by expansion joints.

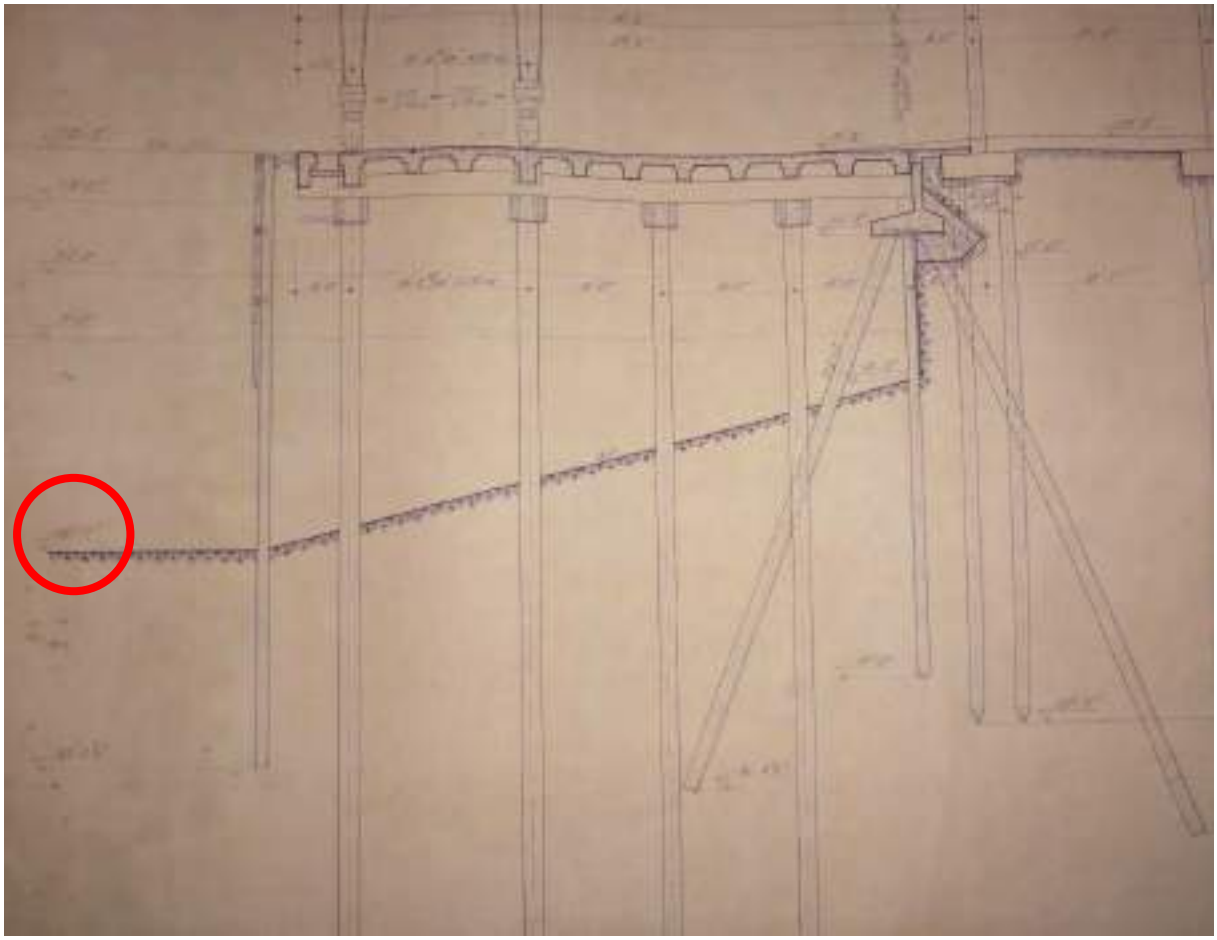


Figure 2-4: Cross Section of Permanent Jetty [MPA]

The jetties were investigated in 2015 and 2016 by the Consultancy Research and Testing Services (CRTS) of the Khulna University of Engineering and Technology. The following conclusion regarding the condition of the quay structures were reached (see [1]):

"Considering the age of the structure, induced corrosion and distress/cracks in several locations of the structure, it is recommended that the load management plan mentioned above must be followed strictly and the proposed rehabilitation works should be completed."

The Consultant inspected the jetties during the fact-finding mission in September 2019 and found that in general the physical condition remains unchanged, see Figure 2-5.

Figure 2-5: Underside of Quay Structure [Consultant]

While the pile caps and transversal beams are mostly in a rather good conditions, the crane rail beams at the front of the quay structure seem to be more damaged, see Figure 2-6.

From the observations it has to be concluded that none of the rehabilitation works proposed by CRTS (see [1]) were undertaken in the meantime.

Figure 2-6: Damage of Beam [Consultant]

The bed level in front of the permanent jetty is currently -7.5 m CD, also see Chapter 3. Based on the as-built drawings, nominal water depths of up to -9.1 m CD (-30' CD) seem possible, see Figure 2-4, while the maximum permittable dredging depth seems to be -10.6 m CD (-35' CD), see Figure 2-7. **This information, however, could not be verified by MPA as structural calculations for the quay structure are not available.**

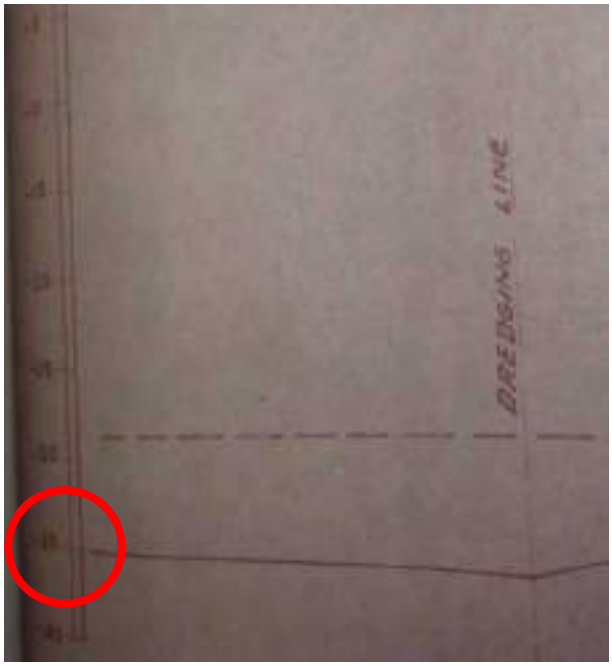


Figure 2-7: Maximum Dredging Depth (lower line) [MPA]

In addition to the permanent jetty, there is a jetty for port vessels of MPA, see Figure 2-8. However, this jetty is presently leased to a private operator.

Figure 2-8: Port Vessel Jetty [European Space Agency 2019]

2.2.3 Buildings

MPA owns several buildings at Mongla, amongst them are:

- MPA Headquarters Building
- Civil and Hydraulics Office Building
- Workshops
- Residential Blocks
- Substations

- Transit Sheds
- MPA Guest House
- Scales, see Figure 2-10
- X-Ray (below Customs Authority)

Figure 2-9 shows the location of MPA's workshops.

Figure 2-9: Location of Workshops [Google Earth 2019]

Figure 2-10: Scales [Consultant]

It is understood that the residential blocks are rather old and dilapidated. It is MPA's wish to replace them.

2.2.4 Utilities

2.2.4.1 Electricity

The electrical network was investigated in basic properties only and only for the powerline voltage levels of 11 kV to 132 kV AC. The 415 V wiring system was not inspected in detail.

The main high voltage powerline connection to Mongla Port is located to the North of the residential area, see Figure 2-11.

Figure 2-11: Location of Main Transformer Station [Google Earth 2019]

The open type transformer station is operated by the PGCB (Power Grid Company of Bangladesh). The area is fenced. The 132 kV overhead lines lead into the area from the East. The 132 kV powerline is neither under control of nor falls below the responsibility of MPA.

The 132 kV line is a high tower infeed line from the West, crossing the Mongla River at the northern end of MPA land, see Figure 2-12.

Figure 2-12: 132 kV Line

Figure 2-13: Transformers and Overhead Powerlines [Consultant]

The outgoing lines are also arranged as overhead lines and split into three main 33 kV powerlines and some smaller 11 kV lines for short distance operation, see Figure 2-13.

At Mongla Port a mixed internal network of 33 kV and 11 kV is used. The 33 kV and 11 kV overhead lines lead along the roads and provide power to the users by short lines to a transformer mast or power substation. The main lines along the road are overhead lines in parallel and partly on same masts with lower voltage short track lines and communication lines, see Figure 2-14.

Figure 2-14: Medium Voltage Lines [Consultant]

All lines are close to ground and can be passed by loaded trucks of typical local height (approx. 6 m above road level).

At least two lines cross the future railway tracks and the main roads.

Power transformation is done from 33 kV level or 11 kV level directly to the 415 V level inside of dedicated substations, see Figure 2-15. In the substations indoor or outdoor transformers (typically 33 kV / 415 V outdoor model, 11 kV / 415 V indoor model) are used. Smaller indoor transformers are either oil cooled or dry type.

Figure 2-15: Open Transformers 33 kV / 11 kV / 415 V behind MPA Service Yard [Consultant]

Mongla Port is also equipped with emergency generators of different types and sizes. Generators are installed in two different versions:

1. Integrated generator inside of a substation,
2. Mobile generator connected to a building or equipment.

The integrated generators were inspected in two dedicated substations, see Figure 2-16.

Figure 2-16: Locations of Inspected Substations with Back-up Generators [Google Earth 2019]

Both inspected generators are of same closed cabin type and are installed inside of buildings. The generators are connected to the output side of the transformer in the same substation house and work as a back-up for the feed line switchboard. The generators' diesel engines run

in automatic mode after the main power line is cut off. Circuit breakers, switchboard and frequency synchro devices are installed in new switchboards.

At location 1 (MPA central workshop infeed) a new generator was installed as main backup with capacity of approx. 1.6 to 2 MVA.

The old generator was installed in an adjacent building and will be the second backup device.

Each generator has a separate, small (appr. 1m³) tank for diesel fuel.

2.2.4.2 Liquified Petroleum Gas

In the area of Mongla Port a set of underground buried LPG pipelines were detected. The pipelines are arranged in parallel to the Western Main Port Road and in between the borderline of the cement- and / or LPG-factories and the road, see Figure 2-17. The track is marked with yellow-red signs and must be crossed by trucks for each entry of the facilities at river edge. The road from EPZ to the permanent jetty and the railway cross the pipelines, too.

Figure 2-17: Arrangement of LPG Pipeline [Google Earth 2019]

2.2.4.3 Sewage

The sewage and sanitary waste water are handled by open ducts or shallow buried ducts and focused to the handling of accommodation and office waste water only. The ducts lead into the river or into the borrow canal without visible treatment. Sanitary waste waters rinse out through open ducts and will be removed by the tide.

A waste water handling unit could not be detected or inspected.

2.2.4.4 Drainage

A drainage system which treats run-off water could not be detected in the port area. The container handling area and car parking of concrete type are drained by smooth slope and natural gravity into the adjacent green fields. The rainwater sinks into ground without visible treatment.

In case of heavy rain, water accumulates on roads and paved areas, due to the lack of scuppers or sinks. The shoulders of the roads are mostly muddy and roads without bituminous or concrete cover become slippery and wet, see Figure 2-18 and Figure 2-19.

Figure 2-18: Road in Heavy Rain [Consultant]

Figure 2-19: Hard Shoulder in Heavy Rain

At the MPA workshops, the ground is heavily contaminated by oil residues and other harmful substances. There is no drainage and no oil separator. Water from this area drains into green field around, including the washed residues from the pavement, see Figure 2-20, Figure 2-21 and Figure 2-22.

Figure 2-20: Wet Area with Oil and Other Waste

Figure 2-21: Puddles in Front of Workshops

Figure 2-22: Puddles at Workshop Office

Around houses a collector trench is arranged to guide main rain water to a dedicated sink place. Collected water is not treated, see Figure 2-23.

Figure 2-23: Typical Drainage Trenches around Houses [Consultant]

2.3 Layout and Infrastructure of Roosevelt Jetty in Khulna

2.3.1 Jetty Layout

Roosevelt Jetty is located in Khalishpur to the North of the city centre of Khulna on the western bank of the Bhairab River, see Figure 2-24 (for full scale layout plans it is referred to Appendix B). It is connected to the national railway system of Bangladesh via a branch line.

Figure 2-24: Location of Roosevelt Jetty in Khulna (yellow markings) [Google Earth 2019]

The total area of land owned by MPA is approx. 70 ha. However, some of the land is leased out to third parties and other areas are used for residential and administrative activities. About 20 ha of land is used or available for cargo handling activities, see Figure 2-25.

Figure 2-25: Layout of Roosevelt Jetty (port operations marked in blue) [Google Earth 2019]

2.3.2 Jetty Infrastructure

Roosevelt Jetty in Khulna comprises a concrete platform with five pontoons. The concrete platform was recently rehabilitated, but the pontoons are mostly in a critical condition. Some of the dolphins on which they are moored are no longer stable, see Figure 2-26. Only limited warehouse capacity is available so that most good are stored outside under tarpaulins. The unloading of vessels is done manually.

Figure 2-26: Collapsing Dolphin at Roosevelt Jetty [Consultant]

It has to be concluded that, in order to keep Roosevelt Jetty operational, considerable investments into the marine and land infrastructure are required.

2.3.3 Buildings

There are several buildings on MPA's land at Roosevelt Jetty, most notably:

- Two Transit Sheds,
- Seven Godowns, and
- One Shed of the Bangladesh Agriculture Development Corporation, see Figure 2-27.

More buildings are located outside the main port operations area.

Figure 2-27: BADC Shed [Consultant]

Most cargo is stored on open areas, see Figure 2-28.

Figure 2-28: Open Storage Areas [Consultant]

At Roosevelt Jetty scales (hydraulic platform weigh system) were inspected, see Figure 2-29. The weighs are operable and offer electronic prints for trucks up to 60 t weight overall.

Figure 2-29: Scales [Consultant]

2.3.4 Utilities

2.3.4.1 Electricity

At the Roosevelt Jetty 11 kV and 33 kV medium voltage networks are used for landside connection to grid, see Figure 2-30. The substations are spread over the whole area and are connected to each other by overhead and ground line cabling of different style and condition. In the main port handling area, near the jetties, no powerline network is installed. Only one underground cable in the eastern area near the scales is visible.

Figure 2-30: Infeed Substations a Roosevelt Jetty [Google Earth 2019]

The power provision to quay edge could be determined by detection of on-floor junction boxes of common type, see Figure 2-31.

Figure 2-31: Junction Boxes at Roosevelt Jetty [Consultant]

2.3.4.2 Sewage

A centralised sewage system with wastewater treatment does not seem to exist at Roosevelt Jetty.

2.3.4.3 Drainage

At Roosevelt Jetty two types of storm water drainage were detected. Type 1 includes area drainage by scuppers, and pipelines to river. The sealed area of the jetty and storage place includes small scuppers of approx. 800 x 800 mm, see Figure 2-32, which are connected to each other and the quay wall by medium diameter pipeline in ground. No oil catcher or waste strainer were detected. All materials go together to an open outlet at quay wall and into the open river. In some places below the open mouth of pipes a collected bunch of waste is visible.

Figure 2-32: Typical Scupper [Consultant]

The transit shed on the jetty platform has no stormwater pipeline and drains direct to the platform. The lowered area around the sliding doors is flooded after rains and collects garbage and salty fertilizer water at the doors' lower ends and also at the foundation of shed. The effect

of constant wetting of the wall is visible by strong “blooming” plastering and rotten brickstones in lower part of the building’s walls, see Figure 2-33.

Figure 2-33: Flooded Shed Door [Consultant]

All oil spills or fertilizer contaminations on the jetty platform will be washed into the river. Cleaning water, from flushing the transit shed floor and open area, drains into river, too. A treatment system could not be detected.

The Type 2 is applied to all accommodation and auxiliary buildings. In the accommodation and auxiliary area, the green field is without any visible drainage ducts. The stormwater from roofs will be collected by surrounding small ducts (open ducts around house) from where the stormwater drains at dedicated corner into the ground. The sinks will be collected by natural effects into big, open basins, visible everywhere at the port area.

The rainwater from roads drains into natural areas around the road into the ground. This leads to large muddy areas after strong rains, see Figure 2-34.

Figure 2-34: Muddy Areas at Godowns and Storages [Consultant]

2.4 Cargo Handling Equipment of MPA

2.4.1 General

The cargo handling equipment of MPA is a set of different load handling and transportation units, used during the daily operation of MPA jetties and storage areas. The equipment is supplemented by equipment owned by private companies, to transport cargo out of the port area and in between the EPZ and the port facilities. This third-party equipment is not part of the MPA related investigation and must be reorganised for future purposes as necessary.

MPA equipment does also include small cars and motorbikes for transport of the managers or workers. Those cars were not inspected and will be seen a minor investment object without significant impact to the function of the current and future port.

All the inspected cargo handling equipment is based in Mongla Port. Cargo handling equipment at Roosevelt Jetty in Khulna does not exist.

2.4.2 Cranes

There are two sorts of cranes which were inspected – fixed cranes and mobile cranes. Cranes mounted on quays, jetties or pontoons are regarded as fixed cranes.

2.4.2.1 Fixed Cranes in Sheds

No fixed cranes in sheds were detected. In the maintenance workshops crane rail beams are installed but the cranes are missing, see Figure 2-35. The absence of cranes is a visible disadvantage for the workshops. Other cranes cannot be used in workshops due to height limitations inside buildings.

Figure 2-35: Crane Beams inside Workshops [Consultant]

2.4.2.2 Rail-Mounted Cranes

The rail-based quay cranes at Mongla Port are of two different types:

1. Type 1 are old Yugoslavian slewing balancer cranes from the beginning of the commercial port operation, see Figure 2-36. The cranes are not operational and partly already dismantled. All of these cranes will eventually be removed.

2. Type 2 is a Turkish quay crane type ISKAR of small capacity, see Figure 2-37. These were installed in the year 2016.

Figure 2-36: Type 1 Cranes being dismantled [Consultant]

Figure 2-37: Type 2 Cranes [Consultant]

The electrical power to the quay cranes is provided by a fixed cable on floor and a submerged wire system with dedicated connection points along the crane rail. The wires are arranged inside quay apron next to the inner crane rail. The connection points for the crane cable is arranged approx. every 50 m and serves the travelling cranes via a cable on a fixed cable roll, see Figure 2-38. Most junction points are currently not used because of reduced number of cranes.

Figure 2-38: Junction Boxes in Quay Apron [Consultant]

The installed cranes on quay can be used for the handling of break bulk up to 5 t SWL. Loads heavier than 5 t must be handled by the Harbour Mobile Crane (Liebherr LHM 425) or other mobile cranes installed temporary on demand.

Crane rails are submerged inside the quay apron (inner rail) or outstanding approx. 10-20 mm (waterside rail). The rails are corroded and at some locations not straight any more. The crane rails have expansion joints which may damage the crane wheels when travelling along, see Figure 2-39.

Figure 2-39: Crane Rails at Permanent Port Jetty [Consultant]

The storm tie downs of the cranes are of friction clamp type, what implies huge pulling loads and shear forces to the crane rails.

When considering the condition of the crane rail beams below the deck (see Section 2.2.2) it is suggested to remove the crane rails completely.

If break bulk handling will be a future option, the crane rails should be shortened to the absolute minimum length needed and junction boxes renewed to current electrical standard. Separate storm tie downs should be foreseen.

2.4.2.3 Mobile Cranes

The mobile cranes are dedicated cranes for loading or offloading ships at the permanent port jetty. At the moment, only one crane is accessible. The crane is a Liebherr brand LHM425, see Figure 2-40, suited to handle containers, break bulk and bulk on demand. The maximum SWL of the crane is 64 t under the hook.

Figure 2-40: Liebherr LHM 425 Harbour Mobile Crane [Consultant]

The LHM is nearly brand new and is equipped with special large pads for the safe operation on the quay apron. Currently, the crane can be used only in limited condition, because the safe support on the existing crane rail (outer rail) cannot be guaranteed. Besides, the passage way between quay sheds and bollard line is too small for safe and fast relocation of the crane.

The LHM is in well suited and serviced condition and can be used without any obligations. The crane is equipped with a set of auxiliary components like:

- Adjustable single FEU spreader,
- Grabs of different sizes,
- Universal hook.

The present LHM 425 is not equipped for fast handling of bulk. Grabs of electrical or two-rope type can be installed on demand. Main purpose of the existing LHM is the effective handling of containers and/or break bulk from ships not wider than approx. 32 m.

It is planned by MPA technical department (tender already active) to purchase an additional LHM in suited condition for the handling of all goods at Jetty No. 5 to 9.

For the future break bulk purposes at Jetty No.5 to 9 the number of two LHM is regarded as sufficient.

Besides dedicated handling cranes for loading and offloading ships, there is a number of universal mobile cranes for following purposes:

- Loading/offloading of containers to/from trucks,
- Loading/offloading of break bulk to/from trucks,

- Loading/offloading of special purpose break bulk to/from ships,
- Service of ships by spare parts and auxiliary load (e.g. workshop containers, machines etc.),
- Service of repair works at MPA ships (deck machinery, rigger works, masts and other deck equipment, engine parts/exchange),
- Service works at rolling stock material in port area or maintenance yard,
- Loading/offloading of objects to/from trucks in maintenance backyard (e.g. spare parts, new machinery etc.).

The mobile cranes for universal use are self-erecting road travelling models with minor capacity. Following truck-based cranes could be identified and inspected at site, see Table 2-1 and Figure 2-41.

Table 2-1: List of Road-going Mobile Cranes

Manufacturer / Model	Type	Remarks
STELOWOLA 35t	Truck mounted mobile crane	Made in 1989, partly damaged, limited capacity
LIEBHERR 100t	Truck mounted mobile crane	Purchased in 2016, fully operable and in good service condition
LIEBHERR 50t	Truck mounted mobile crane	
LOCATELLI 35t	Rough Terrain Crane	Made in 2014, partly not operable, high idle time by repairs

Figure 2-41: Mobile Cranes (35 t Stelowoloa, 30 t RTC Locatelli, 50 t Liebherr, 100 t Liebherr) [Consultant]

The condition of cranes can be derived from the service list. In general, all cranes can be used for daily works. However, the old Yugoslavian model should be exchanged to a newer one to save service costs and idle time by repairs. Besides, the situation with the 35 t - RTC is not suited for a stable and undisturbed port operation.

The Italian Rough Terrain Crane (RTC) of LOCATELLI type is a newer one but has significant safety lacks (by report of service team). The crane needs regular maintenance and repairs and is not fully operable within the planned service period. It should be considered to exchange the existing crane to a more reliable model with a suited service contract closed with a local contractor. The RTC could be used a universal service crane for construction related works inside Mongla Port in the future.

Mobile cranes can also be provided on demand by third-party service providers. Those cranes are not in scope of investigation and can be rented in the future by service contracts.

All existing cranes of MPA have limited capabilities to be used in public space. They are dedicated for public road access in general but must be equipped with safe working illumination and signalling equipment as well.

2.4.3 Container Handling Equipment

Container handling equipment includes all equipment to handle and load / offload containers except the cranes. Besides, minor equipment like fork loaders / lifters will be included.

2.4.3.1 Straddle Carriers

In the stock of MPA at Mongla Port different types of Straddle Carriers of different brand and age are available, see Figure 2-42:

- VALMET (1x 1991),
- NOELL (2x 2011),
- TEREX (3x 2016).

Figure 2-42: Straddle Carriers (Valmet, Noell, Terex) [Consultant]

The older VALMET-3 device was an experimental supply of VALMET company. The Straddle Carrier is out of order now and will be removed.

The NOELL Carriers are of double stack type and can handle 1 FEU container at same time.

The TEREX Carriers are of most modern triple stack type and have same capacity as NOELL Carriers. One of the three devices is out of order and waits for repair.

A general problem of straddle carriers occurs with the uneven floor inside of Mongla Port and the level differences to the maintenance yard. In loaded condition, the steering gear is worn out very fast and must be repaired regularly.

Straddle Carriers cannot serve all areas at Mongla Port, because there are too large height differences (e.g. platform area near to southern car parking) or passage ways are too small for safe carrier operation (e.g. between transit sheds and quay front). A suited service for the straddle carriers is not available because of missing service cranes and/or sheds.

2.4.3.2 Empty Container Handlers

MPA operates different types and sizes of empty container handlers, see Figure 2-43 and Figure 2-44:

- HYSTER (1x 2014),
- SANY (2x 2016), and
- Different types of heavy load fork lifters up to 35 t SWL
    - ZV (35 t SWL, 1x 2003),
    - SANY (35 t SWL, 1x 2016),
    - SVE (30 t SWL, 1985),
    - SVE (35 t SWL, 1985).

The dedicated Container handlers from SANY and HYSTER are of 9 t SWL type and can handle containers in single, double or triple stack mode up to 45'.

All those container handlers are in good shape and need only small, regular maintenance.

Figure 2-43: Empty Container Handlers [Consultant]

The heavy load fork lifters of mentioned type, are capable to operate also containers as follows:

- 10', 20' and half stack with adjustable fork,
- 10' - 45' with dedicated spreader adapter for fork.

The spreader adapters are available at site but are currently not being used due to many technical problems with hydraulic and mechanical gear.

The 30 t SWL heavy load fork lifter of SVE brand is not operational. The 35 t SWL heavy load fork lifter of ZV brand is under rehabilitation and will be used as a fork lift only in future.

Figure 2-44: Heavy Load Fork Lifters [Consultant]

2.4.3.3 Reach Stackers

MPA owns two types of reach stackers, see Figure 2-45:

- SANY (45 t SWL 2x 2016),
- MECLIFT (18 t SWL, 2x 2018).

Figure 2-45: Reach Stackers (MECLIFT, SANY) [Consultant]

The MECLIFT system cannot be used for classical reach stacker works but for stacking empty 20' containers or special containers to the back area. Besides, it can be sued for loading/offloading of trucks. Outreach and drive capacity under full load are limited.

To operate the MECLIFT stackers as a reach stacker, a special spreader must be mounted. In normal mode the stackers can be used as a multifunctional fork lift with significant outreach capacity. Cabin windows were damaged by instable fastened fork beam, see Figure 2-46.

Figure 2-46: Damaged Windows at both MECLIFT Reach Stackers [Consultant]

Both reach stackers of SANY brand are fully operable. The reach stackers are suited for 3-row stacking of 40' containers and can be used for all dedicated purposes. The spreaders can be adjusted to any common container type.

Due to the high load impact to the pavement, the reach stackers of SANY type are not suited for the use on the quay apron. The operation area should be limited to the backyard behind the open piled deck structure.

Otherwise the quay plate must be reinforced significantly to withstand the estimated max. wheel loads of appr. 70 t.

2.4.3.4 Terminal Tractors

Terminal Tractors of MPA are of two types, see Figure 2-47:

- KALMAR Trac (orange/new, 2 x 2011, 2 x 2014, 4 x 2016),
- TM Trac (yellow/old).

Figure 2-47: KALMAR Terminal Tractors [Consultant]

The TM Tracs were leased from the Chittagong Port and are not operational. They will be disposed of. The tractors are stored in MPA maintenance backyard, see Figure 2-48.

Figure 2-48: Terminal Tractors Scrapyard [Consultant]

The new set of terminal tractors is of brand KALMAR and of one type only. The tractors have no air suspension and can handle 50 t SWL trailers on liftable kingpin.

With all terminal tractors of KALMAR type, the engines are very sensitive to the high amount of sulphuric ingredients in the local Diesel fuel. Tractors often are not available because of failed injectors and spend a lot of time idle in repair workshop.

2.4.3.5 Terminal Trailers

There are many terminal trailers available, suited for the use with standard trucks or terminal tractors. All trailers are of 50 t SWL type and suited for 40' or 35' containers. All trailers are of high type and not suited for gooseneck application.

All terminal trailers from Lanka-Trailers brand are of spring-blade suspended single axle design. The trailers are suited for normal roads and single stack container transportation.

No trailer is suited for public road access.

Trailers for public use (e.g. between EPZ and MPA' permanent jetty) must be rented from third parties or must be operated with a special permit.

MPA's trailers are in good serviced condition and can be operated without further obligations. Smaller repairs are done by MPA's service team.

2.4.3.6 Fork Lifts

During the inspection a lot of smaller fork lifts were found at Mongla Port. These lifters are used for different works with break bulk or to handle spare parts etc. Some of the lifters can operate inside the hold of the ship.

Following lifters were observed at the maintenance yard of MPA, mostly parked in the maintenance shed for smaller repairs or maintenance, see Figure 2-49:

- 5 t SWL Fork Lift Diesel type
  - CATERPILLAR 1 x 2004,
  - GODREJ 2 x 2011,
  - TCM 4 x 2017,
  - JUNGHEINRICH 4 x 2017,
- 3 t SWL Fork Lift Diesel type
  - HYUNDAI 5 x 2014,
  - GODREJ 4 x 2011,
  - TCM 6 x 2017,
  - JUNGHEINRICH 4 x 2017.

Figure 2-49: Fork Lifts [Consultant]

The Fork Lifts of brand GODREJ (India) are mostly out of order. The service team stated a general bad quality of the machines, so they will be removed.

One machine of JUNGHEINRICH brand (5 t SWL type) is damaged and will be repaired or discarded of.

2.4.4 Summary

At Roosevelt Jetty no mechanisation or loading assistance is available. All handling operations are applied by manual procedures, either the bagging of fertilizer inside of ships or the loading of trucks or storages.

At Mongla Port a modern and appropriate set of equipment was found, and - after inspection - it was rated mostly as functional and working. The service condition is good in respect to the situation of spare parts availability and the workshop equipment.

It has been noticed that a large number of different brands and types of machines is used (see [2] and [3]). This is a challenge for the maintenance team as it requires an extensive logistical effort regarding the procurement and storage of spare parts. Besides, the training for operators and the service team is very costly and time consuming due to the different principles of operation. Currently eleven different types of machines of 19 brands are operated at the same time. Many machines for the same purpose (e.g. Reach Stackers, Straddle Carriers, Fork Lifts, etc.) are of same capacity and property but from different brands and different ages.

It is recommended to limit the variety of machines to a minimum required by the different work scope.

Some older and even younger equipment (e.g. VALMET-3 Straddle Carrier or GODREJ Fork Lifters) were found to be in bad service condition and partly abandoned due to missing critical spare parts. The machines are of different age and quality; therefore, the reliability of some equipment is no longer on an acceptable level.

The most critical point for unhindered operations is the mismatch of some equipment components to the available quality of fuel. Especially the modern CUMMINS engines of terminal tractors, which are required for a safe and flexible future terminal operation, are too sensitive to the high sulphur content of the local Diesel fuel. The injectors should be replaced by better suited models, or the fuel preparation system should be upgraded soon. Otherwise the MTBF of the tractors will decrease significantly and the repair and maintenance amount will increase to a non-profitable level.

If a fast and effective container handling shall be applied to the future port operation, the type of trailers should be checked for a more effective double stack, high capacity solution with pendulum axis. Besides, a more sensitive air-spring suspension should be foreseen for the next set of terminal tractors to be purchased. The load capacity of carriers and trucks should be larger than 65 t SWL.

The straddle carriers should be checked for improved steering gear to withstand the height differences in the tracks they have to travel. Floors for use of straddle carriers should be improved to a step-free arrangement, so that forces acting on the steering gear of the carriers are reduced.

A suited service workshop with modern machines and cranes for the maintenance of all rolling stock should be incorporated in any future port plans.

Automation systems (e.g. data loggers with WLAN access to TOS) could not be detected with the investigated machines.

2.5 Marine Crafts and Vessels of MPA

2.5.1 General

The MPA fleet consists of 35 ships and boats of different functions (see [4] and [5]). All are based in Mongla Port. The current fleet in service is structured as shown in Table 2-2.

Table 2-2: Vessel List of Mongla Port Authority

Category	Ship/Boat type	No. in service	Year of purchase	Remarks
A	Tug Boat	6	1942 - 2019	Different sizes and pull power, one tug with special FiFi capacity
B	Pilot Boat	4	1967 - 2012	One boat for sales (tender finished already), other boats operable in different conditions
C	Dispatch Boat	3	1968 / 2012	
D	Mooring Boat	4	1967 / 2004	
E	Work Boat	1	1979	
F	Buoy Laying Vessel	1	1984	Currently out of order due to many systems damaged, ready for overhaul
G	Water Crafts	2	1980 / 2004	One in good condition (the older one), one (the younger one) major damaged and near to scrap condition
H	Inspection Launch	1	1986	For sale, auction closed
I	Survey Vessel	1	1994	
J	Dredger Unit	7	2012 / 2016	Not inspected, under condition of leasing to 3rd party operator “as is/where is”, no own service or operation by MPA
K	Spilled Oil Clean Up Vessel	1	2018	Nearly brand new and in operable condition, some minor damages
L	Speed Boat	4	2016 - 2019	Fast boats from GRP with cabin and shafts or Outboard Engine, three (3) boats for inner port area use only (grey boats), one (1) boat with signalling system for outside use also (white boat), grey boats slightly modified from original status
		35	∅ 1993	

In addition to the afore-listed vessels, two water barges (pontoon type) without engine are in fleet service. Both barges are used as mooring pontoons only and not for active water supply anymore. One barge is moored to the South of Jetty No. 5 and one at the southern tip of the Mongla peninsula (end of port road).

The average fleet age is 26 years from purchase, whereas the oldest ship went into service in 1942 (tug boat) and the youngest in 2019 (speed boat). With a normal service life period of 20-25 years the work ships typical lifetime has mostly expired.

At least 17 ships (49%) are significant older than 25 years, and only 15 ships (43%) are less than 10 years. The remaining three ships (8%) are in an intermediate age closer to the end of service life (15 - 25 years old).

The estimated years of service of existing ships are significantly higher than a normal service life period. Machines and engines on ships are mostly old or from a former generation regarding the current safety and environmental rules.

All ships have major or minor defects which cannot be rectified at the port currently.

The following ships were or will be decommissioned / removed and sold from fleet (estimated date of auction at list):

- ML Annesha (2021/22),
- ML Mukta (2020/21),
- MV Ruhi (2021/22),
- MT Meghdut (2021/22).

Two boats are decommissioned for sales and moored south of Jetty No.5 before handover to new owners – the “Chalna Pilot-1” and the “ML Jhnuk”, see Figure 2-50.

Figure 2-50: ML Jhnok and Chalna Pilot-1 [Consultant]

Six boats/ships are scheduled to be commissioned as an exchange or addition to the fleet within the next 10 years. The MPA also plans to acquire new ships and boats for different services as given shown in Table 2-3.

Table 2-3: Vessels under Procurement

Ship/Boat, planned purpose	Status of purchase*	Planned year of purchase
3x mooring pontoon	construction	2020
2x tug boat	specification	>2021
1x pilot boat	specification	>2021
1x SAR ship	pre-planning	>2021
1x survey ship	Pre-planning	>2021
1x oil spill and sewage ship	Pre-planning	>2021

*) pre-planning, specification, tender, bid, contract, construction, commissioning

The fleet of MPA currently offers the following services:

- Tug services for ships in direct port area (jetty mooring service),
- Assistance tug services in the fairway for navigation in tidal current,
- Assistance and emergency tug services in river canal between Hiron Point and Mongla Port,
- Dredging services.

Typical services of port authorities which are currently not provided at Mongla Port are:

- Customs assistance (boarding / de-boarding),
- Medical First Aid, Search & Rescue,
- Fire Fighting (only one integrated tug-FiFi ship with limited rescue capabilities),
- Diver service,
- Police services.

The visual and on-hands inspection and fleet management audit was done between 23/09/2019 and 02/10/2019 at Mongla Port. Results are reported in the following sections. The following ships could be inspected:

- “MT Sarathi-2”,
- “ML Balaka”,
- “MT Shibsha”,
- “BLV Malancha”,
- “ML Jhnuk”,
- “Chalna Pilot-1”,
- “ML Anushandani”.

Following ships/boats could not be inspected at site because of their absence:

- “MT Sundaban” – in service in fairway canal,
- “MT Sarathi-1” – in Dhaka Shipyard,
- “ML Urmee” – in Khulna Shipyard,
- “ML Rajhongsha” – in Khulna Shipyard.

2.5.2 Tug Boats

Tug boats of MPA were inspected by visual inspection of the exemplary ships “MT Sarathi-2” and “MT Shibsha” with the following results, see Table 2-4 and Table 2-5.

MT Sarathi-2

Table 2-4: Inspection Results of “MT Sarathi-2”

Ship main part / equipment	Service condition	Remarks
Hull	Different small damages by accidents, bulwark stiffeners and chock brackets partly rotten away, chocks and clamps partly lose	No comment
Deck	No significant damages or distortions, good coating condition	No comment
Deckhouse	Scupper pipelines rotten away, superstructure underneath scuppers rotten and partly broken, cracks in outer shell plates at ends of deckhouse	Could be increased by small repair works only
Main engine	Full running, good service condition	Engines only running on MDO
Propulsion	Operable and tight	No comment
Auxiliaries/ Gear	Hauling hook in good condition, no significant damages, bollards and mooring pins partly damaged and structure distorted	No comment
Accommodation	Good condition with crew cabins and public area, wheelhouse safe and tight, no AC	No comment
Safety Equipment	No lifebelts, life rafts valid, no FiFi pump	No comment
Navigation equipment	Mostly old but functional equipment, no Radar, old radio system	Not suited for use in international waters

“MT Sarathi-2” was found an active tug boat in functional but not well-maintained condition. It is visible that the tug boat is a “working horse” of the port and can be used without restrictions or obligations. For the better efficiency of the crew, an AC system should be applied. The ventilation system in the ship was designed by the standards of the early 70s and is not suited to the requirements of a tropical environment.

Because the ship has no dedicated firefighting pump or monitors, the full functionality of a modern port tug boat cannot be realised. Besides, the propulsion concept is not suited for a modern and efficient tug boat service. Moreover, the pending bilge water separator and not installed septic tank must be rated a negative factor. Both systems should be added during the next shipyard maintenance repair period.

With respect to the high age of 46 years, the ship is in good condition and can be estimated for good service for the next 5-10 years with a normal maintenance effort, see Figure 2-51.






Figure 2-51: Condition of “MT Sarathi-2” [Consultant]

MT Shibsha

Table 2-5: Inspection Results of “MT Shibsha”

Ship main part / equipment	Service condition	Remarks
Hull	Mainly good, no bigger distortions or damages, no leakage, bulwark rotten and partly lose	Mooring cannot be done safely because of lose chocks and pending bollard posts.
Deck	Mainly good	No comment
Deckhouse	Scuppers and mouseholes not free, scupper pipes mostly rotten away, superstructure partly damaged and rotten away from deck	No comment
Main engine	New engines installed	No comment
Propulsion	New gearbox installed and bushes/gaskets exchanged	No comment
Auxiliaries/Gear	Hauling hook in good condition	No comment
Accommodation	No AC, mostly good maintained	No comment
FiFi equipment	FiFi pump not working because two generators needed but only one operable	No comment
Safety Equipment	No lifebelts, life rafts valid	No comment
Navigation equipment	Old but working equipment, compass not calibrated	No comment

It was observed that “MT Shibsha” is a specialised FiFi tug boat. However, its main parts and functions are not operational / functioning. Especially the non-functional second generator to provide the firefighting pump power is a huge danger for the safety of port operation at Mongla Port. The unique function of “MT Shibsha” as a firefighting tug boat cannot be realised at the moment.

In general, the condition of “MT Shibsha” is visibly bad because of the heavily corroded bulwark (with lose chocks), dysfunctional bilge water separator and pending AC installation onboard. A major rehabilitation is strongly recommended, especially because of the new engine installation, which made the ship a perfect major player in the port. The capacity from new engines and better propulsion cannot be used, yet.

If the “MT Shibsha” shall be used as the main firefighting tug at the port in future, the FiFi pump should be coupled redundant to a main engine gearbox instead of electrical motor only.






Figure 2-52: Selected Pictures of “MT Shibsha” [Consultant]

MT Meghdut

The oldest ship “MT Meghdut” was inspected shortly and from the outside only, see Figure 2-53. The tug boat of 1942 is not more in active service for towing duty. The ship is used for fuel storage and bunker services in the jetty area of Mongla Port only. MT Meghdut is in nearly good service condition but will not more operated due to old navigation and engine equipment. The ship shall be abandoned during the next investment period and needs replacement.

Figure 2-53: Selected Pictures of “MT Meghdut” [Consultant]

MT Agniprohori

The “MT Agniprohori” was seen in service assisting an LPG tank ship during the anchoring manoeuvre at the northern jetty. It was visible that the vessel is in a good operational condition, see Figure 2-54.

Figure 2-54: Selected Pictures of “MT Agniprohori” [Consultant]

2.5.3 Dredgers

Dredgers of the MPA could not be inspected because they were all leased out to a third-party operator. The operator took the dredgers “as is” and must hand back to MPA in same condition. All dredgers are currently in operation.

Figure 2-55: MPA Dredger [Consultant]

2.5.4 Service Fleet

The service fleet includes all boats and ships used for direct services at Mongla Port as follows:

- Mooring boats,
- Work boats,
- Survey boats,
- Barges.

The following boats and ships of MPA's service fleet were inspected:

- "ML Jhnuk",
- "SP Ruhi",
- "MV Trishna".

ML Jhnuk

The former inspection launch and VIP transfer boat “ML Jhnuk” is out of service and was inspected as a significant example. The inspection results are compiled in Table 2-6

Table 2-6: Inspection Results of “ML Jhnuk”

Ship main part / equipment	Service condition	Remarks
Hull	In bad service condition, no big distortions, no leakages	Boat decommissioned and ready for sale
Deck	Partly damaged and distorted	
Deckhouse	Visible rotten and partly dislocated main structure	
Main engine	n.i.	
Propulsion	n.i.	
Auxiliaries/Gear	n.i.	
Accommodation	n.i.	
Safety Equipment	n.i.	
Navigation equipment	n.i.	

The former VIP transfer boat and inspection boat “ML Jhnuk” could only be inspected from the outside because of the abandoned status. The boat shows a lot of significant damages by corrosion and missing maintenance. The “ML Jhnuk” is ready for sale and still floating, see Figure 2-56.

Figure 2-56: Selected Pictures of “ML Jhnuk” [Consultant]

To ensure a safe and attractive journey of inspection team of MPA and/or VIPs the boat should be exchanged to a better suited model of modern type. Alternatively, the existing high-speed boats of the MPA could be used.

SP Ruhi

The self-propelled water barge “SP Ruhi” is in service and was inspected as a significant example. The inspection results are compiled in Table 2-7.

Table 2-7: Inspection Results of “SP Ruhi”

Ship main part / equipment	Service condition	Remarks
Hull		
Deck		
Deckhouse		
Main engine		
Propulsion		
Auxiliaries/ Gear	Fresh water tanks not cooled and only single hull design, coating inside of tanks damaged and partly rusty	
Accommodation		
Safety Equipment		
Navigation equipment	Partly operable, compass not calibrated	

“SP Ruhi” was found an operable and nearly well-maintained ship, see Figure 2-57. Fresh water tanks seem to be tight to the sea, and the hull is in a typical condition without visible major lacks. Reflecting the age of the ship, the “SP Ruhi” is in good condition and can be used without large maintenance efforts.

Figure 2-57: Selected Pictures of “SP Ruhi” [Consultant]

Like all ships of MPA, the “SP Ruhi” also shows a lot of smaller, not repaired damages from mooring accidents. Scuppers and mouseholes are not free and water drips trough the seams of the superstructure.

Fresh water tanks should be separated to the sea by a double hull design and by special cooling system for sanitary safe storage conditions.

The ship has no oil separator system and no working septic tank.

MV Trishna

The self-propelled water barge “MV Trishna” is in service and was inspected as a significant example. The results are compiled in Table 2-8.

Table 2-8: Inspection Results of “MV Trishna”

Ship main part / equipment	Service condition	Remarks
Hull	Rotten, with huge splattering rust and complete rusted off bulwarks, bollards and chocks complete loose or damaged by rusting through	Operational status is visible “inoperable” by safety issues and main structural collapse.
Deck	Rotten, with holes and huge splattering rust	The deck is partly so weak, that pedestrians on top move the deck plate significantly. Every step creates crackling sound. Paint and loose rust can be removed by fingers without any tools.
Deckhouse	Rotten, structure in large areas loose from deck	The whole deckhouse shows significant collapses in main members and connection to ship body, silencer insulation etc. is rotten and fallen of the walls mostly
Main engine	One VOLVO engine ok, one engine with major damages in cooling system	Major overhaul of all piping and cooling system required, machines not operable in safe condition
Propulsion	Shaft gaskets leaking, gearbox ok	
Auxiliaries/ Gear	Water tanks partly muddy (outside incoming water from river?), no septic tank, no oil separator	The function of a fresh water delivery barge for ship service is not guaranteed.
Accommodation	Wet and fouling everywhere, ventilation defect	Living conditions nearly inacceptable, no AC, no ventilation
Safety Equipment	Rescue/work boat pending, life rafts ok, no rescue floater rings	Ship is not in complete condition by safety equipment
Navigation equipment	Compass not calibrated, no GPS, no RADAR function, no radio function	Ship is not navigable

“MV Trishna” is an only 15-year-old ship from Bangladesh shipyard. The condition of the ship is near to the scrap and offers significant quality lacks with used materials and design. The bulwark and some major elements of mooring system are completely corroded. Many holes were detected in the decks, so the inside water tanks will be contaminated by overcoming sea water and rain. Welding in engine room is of very poor quality and corrosion protection system seems to be collapsed completely. Safety equipment is missing or in bad condition.

Like most of the ships also the “MV Trishna” has no operable bilge oil separator and no septic tank. All sanitary sewage and partly oil contaminated leakage water will be pumped outside without treatment.

The overall condition of all ship structure shows the use of minor quality material during the assembly at yard in 2004 (e.g. re-rolling material used instead of 1st class brands). It must be doubted that the assigned classification of the ship is still valid. It is estimated, that the ship cannot be revived by small repairs only but by exchanging main parts of the ship’s hull.

The “MV Trishna” must be sent for major repair and overhaul immediately, if a future use is foreseen. By major maintenance plan of MPA the ship should be in repair already since July 2019.

Figure 2-58: Selected Pictures of “MV Trishna” [Consultant]

2.5.5 Pilotage and other Authority Boats

The pilotage and the other services will be realised by pilot boats. The pilot boats offer two main functions:

- Transfer of Pilots between Mongla Port and Hiron Point (pilot accommodation and taxi),
- Boarding and de-boarding of Pilots to incoming or from outgoing ships (in the whole fairway between Hiron Point and Mongla Port).

For transfer of the Pilots the boats are equipped with a passenger cabin with bed, air condition and table.

ML Balaka

The inspection was done for the Pilot boat “ML Balaka”, see Figure 2-59.

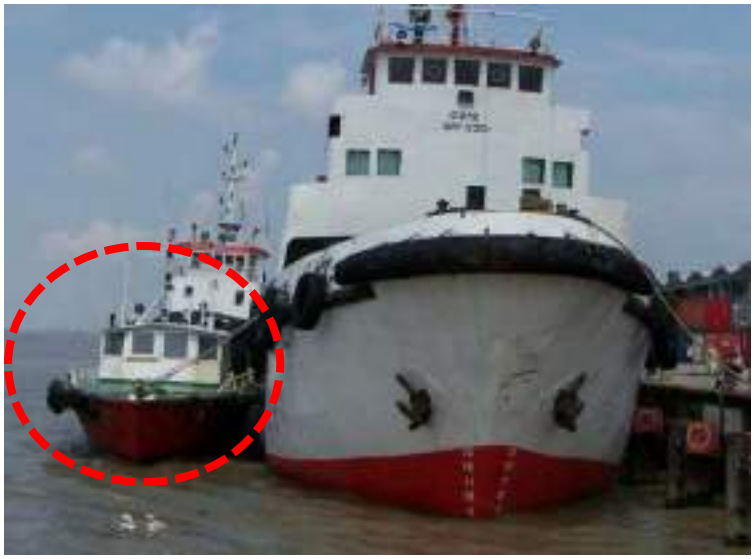


Figure 2-59: Pilot Boat “ML Balaka” (in red circle) [Consultant]

The Pilot boat “ML Balaka” is still in service and was inspected as a significant example. The results are compiled in Table 2-9.

Table 2-9: Inspection Results of “ML Balaka”

Ship main part / equipment	Service condition	Remarks
Hull	Good maintained, no leakages or deformations	Generally in good condition without visible service or maintenance problems, no bilge oil separator, no septic tank
Deck	Good maintained	
Deckhouse	Acceptable, windows sealings and door sealing partly rotten	
Main engine	In good condition, modern system	
Propulsion	All gaskets tight	
Auxiliaries/Gear	Not applied	
Accommodation	Ready for 3 pilots (max. 5), equipped with bed and AC	
Safety Equipment	Complete and valid	
Navigation equipment	Modern and working equipment	

“ML Balaka” is a pilot transfer and boarding boat, used daily. The maintenance condition is between acceptable and good and shows no significant lacks or problems, see Figure 2-60. The problem of all boats of MPA also is visible on “ML Balaka” – pending AC and insufficient ventilation of crew deck. The inner ceilings and wall claddings are partly wet and contaminated by biofouling because of the constant high temperatures and humidity.

Possible speed of 8-12 kn is sufficient for the purpose of pilot transfer and boarding at Hiron Point. For easier taxi between Mongla, Khulna and Hiron Point and saving Pilot’s idle time the pilot boats should have a higher speed capacity.

The boat can be used furthermore.






Figure 2-60: Selected Pictures of “ML Balaka” [Consultant]

Chalna Pilot-1

The pilot boat “Chalna Pilot-1” is out of service and was inspected as a significant example. The results are compiled in Table 2-10.

Table 2-10: Inspection Results of “Chalna Pilot-1”

Ship main part/equipment	Service condition	Remarks
Hull	Acceptable, coating damaged	Boat decommissioned and ready for sale
Deck	Acceptable, some corrosion damages in area of steel-aluminium contact	
Deckhouse	Acceptable	
Main engine	Defect	
Propulsion	defect	
Auxiliaries/Gear	Not applicable	
Accommodation	n.i.	
Safety Equipment	Railing pending, no lifebelts	
Navigation equipment	n.i.	

The Chalna Pilot-1 was taken out of service due to irreparable damage of engines. The boat is made of steel and aluminium and was in good shape except for the engines. The speciality of aluminium decks and accommodations in combination with a steel hull was not observed correctly during construction, so that the boat shows different problems with corrosion protection. The mooring posts and clamps are broken mostly and the safety railing at the stern was broken off, see Figure 2-61.

Figure 2-61: Selected Pictures of “Chalna Pilot-1” [Consultant]

2.5.6 Summary

In general, the MPA fleet is rather old but mostly operating. The inspected ships show significant lacks in service condition and need a regular, more intense overhaul and maintenance. Even the new speedboats are not in a good service condition and offer problems with corrosion protection mostly (e.g. missing anodes for hull protection). The situation with ships can be summarized as follows:

1. Situation with outside hull = between extremely bad and acceptable,
2. Situation with inside structural members = good (except “MT Trishna”),
3. Situation with machinery = between bad and acceptable (some ships inoperable due to engine failure and damages),
4. Situation with crew accommodation = acceptable, AC pending and in one ship no ventilation,
5. Situation with navigation equipment = between bad and acceptable, but not for international fairways, many calibrations pending, navigation and radio partly not working well,
6. Situation with functional equipment = critical or bad, many bollards, chocks and crane equipment not working, life- and working boats pending.

It must be stated, that some ships are no longer operable in a safe way and should be overhauled and reclassified as soon as possible (“MV Trishna”, “MT Shibsha”, “BLV Malancha” etc.).

Main problems on inspected ships were detected as follows:

- Non-functional corrosion protection and missing anodes (nearly all ships of steel type),
- Missing railings or safety guards (nearly all ships, mostly lost by damages or corrosion),

- Pending life rings and rescue boats (especially on buoy service ship and water barges no work / rescue boats),
- Dysfunctional bulwarks and chocks (mostly loose and brackets lost by corrosion),
- Dysfunctional engines and auxiliary engines (many leakages, completely corroded water-cooling systems),
- Not working FiFi-equipment on tug boats,
- Leakages at bushings and gaskets for shaft,
- Dysfunctional or missing radio, navigation or safety equipment,
- No AC for crew,
- No septic tanks on crew manned ships,
- No safe mooring point at Mongla Port (MPA Port Vessel Jetty rented to third party).

Two ships (VIP service vessel “ML Jhnuk”, pilot boat “Chalna Pilot-1”) are in a sales process already, because they show irreparable damages at the accommodation or on the engine. Two ships are not ready for service anymore because of their condition or old equipment (“MT Trishna” and “MT Meghdut”). Both ships are used as barges currently but should be sent for decommissioning soon.

It is visible, that from the missing maintenance facilities and the high age of ships and boats results a low level of maintenance and straight dependency on shipyard services of third parties. The service condition of some important ships (e.g. buoy handling vessel) is critical for the safe and effective operation of the port.

It is recommended to install new fleet members as exchange objects for following purposes:

- FiFi and SAR, should be a high-speed firefighting boat with oil spill recovery capacity,
- Water and fuel barges,
- Waste oil and sewage barge with treatment unit for ship service.

The buoy laying vessel and the tug boats with FiFi capabilities must be repaired immediately to ensure a safe operation of the port and sea canal.

Each boat should have a clear responsibility and capacity to fulfil the job with at least one redundant partner boat in fleet (e.g. primary and secondary firefighting boat, police + customs + MPA, survey + mooring or pilotage etc.).

Existing Pilot boats are suited for the current slow steaming and low vessel traffic. They are not sufficient for a high frequency, high traffic operation of the fairway and port area.

Remark: According to the year of build and the current repair and modernisation status it must be estimated that the ships are contaminated with asbestos in different forms and amount. Before decommissioning and to ensure a proper healthcare for the crews, the ships should be inspected and decontaminated immediately, preferred during the next shipyard service. Asbestos in gaskets etc. can be sealed, but insulation is a source of pollution for the circulating air.

3 Present Navigational Situation

3.1 Definitions and Abbreviations

The following definitions are used:

Bed Level	Bed level as given on the navigation charts, in metres below Chart Datum (CD).
Water Depth	Difference between a given water level and the bed level, in metres.
Maximum Vessel Draft	Depth of penetration into the water column, in metres below the water surface.
Under-Keel Clearance (UKC)	Required allowance between vessel keel and bed level, in metres.
Available Draft	Water depth reduced by UKC, in metres.

3.2 Sources of Data

Assessment of the existing navigation approach from the Bay of Bengal to Mongla Port is based on a set of recent navigation charts (as listed in Table 3-1) and information derived from third-party consultancy reports (refer to list below).

The navigation charts (reproduced in Appendix C) provide a complete coverage of the approach from deep water in the Bay of Bengal up to and beyond of Mongla Port. Whereas the survey data of most charts was collected in the last four years (2016 to 2019), the data for some charts is several years older. It is noted that for the latter, the charts indicate that these stretches generally have larger water depths of lesser constraint to navigation (8 m and above at Lowest Astronomical Tide (LAT) level.

For the present assignment, these charts were only made available in the form of images; no digital data could be obtained. Bed levels can therefore only be derived as readings from these images. Noting that bed levels along the navigation approach are subject to morphological changes, the indicative bed levels obtained in this manner are deemed sufficient for the purpose of the present study.

Table 3-1: List of Navigation Charts

No.	Title	Survey Period	Scale
01	Bay of Bengal – Approaches to Pussur River	December 2018 to January 2019	1:75,000
		December 2017 to January 2018	1:75,000
		November 2016 to January 2017	1:75,000
		December 2015 to January 2016	1:75,000
02	Pussur River – Hiron Point to Tinkwona Dwip	January 2016	1:25,000
03	Pussur River – Twinkona Dwip to Kaga Boga Khal	March 2013	1:25,000
04	Pussur River – Kaga Boga Khal to Sundarikota Khal	March 2013	1:12,500
05	Pussur River – Sundarikota Khal to Cheilabogi Khal	February 2014	1:12,500
06	Pussur River – Mazhar Point to D' Souza Point	January 2019	1:12,500
		November 2017	1:12,500
07	Pussur River – Harbaria to Joymonirgol	January to February 2019	1:12,500
		November 2017	1:12,500
08	Pussur River – Base Creek to Mongla	October 2018	1:12,500
		March 2018	1:12,500
		March 2017	1:12,500
		August to September 2015	1:12,500
09	Pussur River – Mongla to Digraj	August 2019	1:12,500
		November 2018	1:12,500
		February 2017	1:12,500
		August 2015	1:12,500
10	Pussur River – Digraj to Chalna	October 2019	1:12,500
		February 2017	1:12,500

Available third-party consultancy reports are listed in “Utilised Documents / Data Sources”.

Figure 3-1: Area Coverage of Navigation Charts [background: Google Earth 2019]

3.3 Water Levels

Water level information along the navigation approach consists of the astronomic tidal levels given in Table 3-2 below. Actual levels may deviate from these tidal levels due to storm surges, which can be considerable in the Bay of Bengal due to the occurrence of tropical storms and cyclone events. The historical extreme surge height for the last 60 years was reported by [6]

to vary between 1.0 and 10.6 m. No information is however given on the location where these surges apply. As the range consists solely of positive values, it is assumed that levels are not reduced due to negative surges.

Hence, minimal available water depths can be calculated from the lowest tidal levels in Table 3-2 and the bed levels available from the navigation charts.

Table 3-2: Astronomic Tidal Levels (relative to Chart Datum)

Station	LAT	MLWS	MLWN	ML	MHWN	MHWS	HAT
Hiron Point	-0.256	0.225	0.905	1.700	2.495	3.175	3.656
Mongla Port	-0.261	0.325	1.194	2.310	3.427	4.296	4.882

Temporal additional water depths over the higher stages of the tide (above mean level) hence range between 1.7 and 3.6 m at Hiron Point and between 2.3 and 4.8 m at Mongla Port. At Lowest Astronomical Tide (occurring every 18.6 years), the total water depth is approximately 0.25 m less than for a water level of 0 m CD.

3.4 Available Water Depths

In the absence of digital data, the latest reported bed levels as per [6] have been taken as starting point. These are based on navigation charts from 2005 to 2018.

Visualisations of the bed levels are reproduced in Figure 3-2, Figure 3-3 and Figure 3-4. The scale and resolution of these do not allow for a detailed comparison against the latest navigation charts. It is however apparent, that the general river morphology is similar, in terms of deeper and shallower locations. Some differences may be explained by the fact that some of the navigation charts were updated after the date of the report, as well as due to gridding and/or interpolation.

Bed levels along the navigation route for the year 2008 are also presented by [6], as reproduced in Figure 3-5. Whereas this has been based on partially older data, this is the most recent available longitudinal profile. CRTS indicated two areas where water depths are below draft requirements for 9 m and 10 m draft vessels; one consisting of the stretch near the Outer Bar between the Fairway Buoy and Hiron Point and the second in the vicinity of the Inner Bar near Mongla Port. CRTS based this on required minimum depths of 7.5 m and 8.5 m for a 9 m and 10 m draft vessel, respectively. This suggests that CRTS applied a combined additionally available water depth of 1.5 m, presumably based on the water level above Chart Datum and reduced by navigational safety factors (e.g. under-keel clearance). Distances along the x-axis are presumed to be continuous from the Fairway Buoy, rather than referring to Hiron Point and Chelibogi as indicated in the graphs. A 4km gap exists between the graphs near Chelibogi.

In addition, CRTS report that the approximately 16 km reach at the Outer Bar has insufficient depth for a 7.5 m draft vessel, whereas the stretch from Hiron Point up to and including Harbaria Anchorage has sufficient depths for up to 10 m draft vessels. Applying the same 1.5 m additional available water depth as applied above, this suggests minimum water depths of 6 m and 8.5 m in these areas, respectively.

The reported levels in the bed level maps are given as *negative* downward below Chart Datum, whereas the water depths along the navigation route are given as depth below Chart Datum and hence correspond to bed levels, *positive* downward from Chart Datum.

For the purpose of the present study, the level of detail is sufficient to obtain a general impression of the available bed levels, noting that the river morphology is, and will remain to be, subject to morphological changes induced by a variety of factors, including upstream morphology, rainfall patterns, dredging and construction works and the occurrence and characteristics of tropical storms and/or cyclones.

A comparison of preceding to most recent charts shows that, whereas obvious changes in bed levels are seen between years, no distinct trends in large-scale morphological changes can be identified. Rather, the comparison indicates a variation in bed level that is likely to be associated with seasonal and multi-year variations in hydrological and sedimentological conditions, as well as adaptation to other influencing factors such as dredging activities. It is therefore concluded that the latest available charts can be used as appropriately representative conditions for the purposes of this study.

The following key characteristics of bed levels along the navigation route were defined by CRTS:

- Fairway Buoy to Akram Point:
    - Available water depth at Fairway Buoy is above 20 to 25 m.
    - Gradual decrease in water depth due toward river channel.
    - Shoals along outer bar limit entrance to vessels of 20,000 dwt.
- Akram Point to Harbaria:
    - Water depth at Akram Point ranges from 10 to 15 m.
    - Between Akram Point and Kagaboga Khal the water depth varies from 11 to 15 m.
    - Short patch with water depths between 8 and 9.5 m
    - Thereafter, 10 to 21 m water depths up to D'Souza Point.
    - Decreasing water depths from D'Souza Point to Harbaria Khal, where the water depth is 8 m
- Harbaria Anchorage to Chalna:
    - Water depth at Harbaria Anchorage is 8.5 to approximately 10 m.
    - Decreasing water depths from Harbaria to Port Jetty ranging between 5 and 7.5 m.
    - Further decrease in water depth from Port Jetty up to Rampal Power Plant, with a minimum of about 2 to 3 m, only suitable for ordinary inland vessels.

A summary overview of available water depths and channel widths is given in Table 3-3.

Table 3-3: Width and Depth below Chart Datum of Pussur River at Different Segments (positive downward from Chart Datum) [6]

Sl. No.	River Reach	Length of River Reach (km)	Width of Channel (m)	Min. Width of Navigation Channel (m)	Min. Depth (mCD)	Max. Depth (mCD)
01	Fairway Buoy to Hiron Point	46.30	10,500-6,000	1500	6.2	23.0
02	Hiron Point to Tinkona Dwip	18.52	7,500-3,750	3500	10.9	22.6
03	Tinkona Dwip to Kagaboga Khal	16.67	4,000-2,500	1800	9.7	19.4
04	Kagaboga Khal to Sundorikota Khal	9.26	2,625-2,125	1000	9.1	22.5
05	Sundorikota Khal to Cheilabogi Khal	9.26	2,150-1,250	900	8.5	29.6
06	Mazhar Point to D'Souza Point	9.26	2250-950	700	11.7	28.0
07	Harbaria to Joymonirgol	9.26	1,800-1,125	550	6.3	23.2
08	Base Creek to Mongla Nulla	9.26	1,750-760	300	5.2	9.8
09	Mongla Nulla to Digraj	9.26	1,500-700	200	5.0	7.5
10	Digraj to Chalna	9.26	1,000-700	200	1.4	7.5

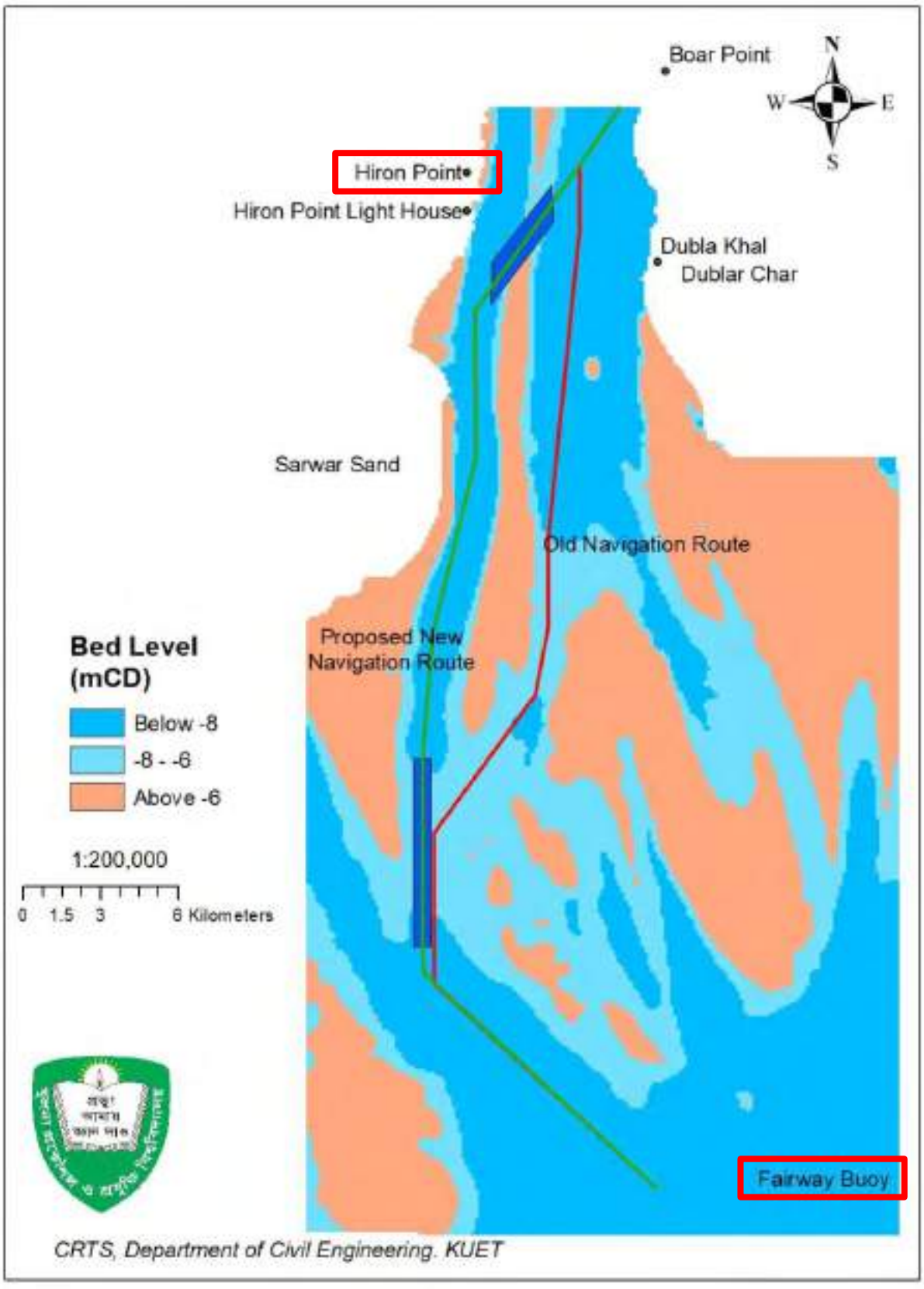


Figure 3-2: Bed levels from Hiron Point to Fairway Buoy (negative downward from Chart Datum) [6]

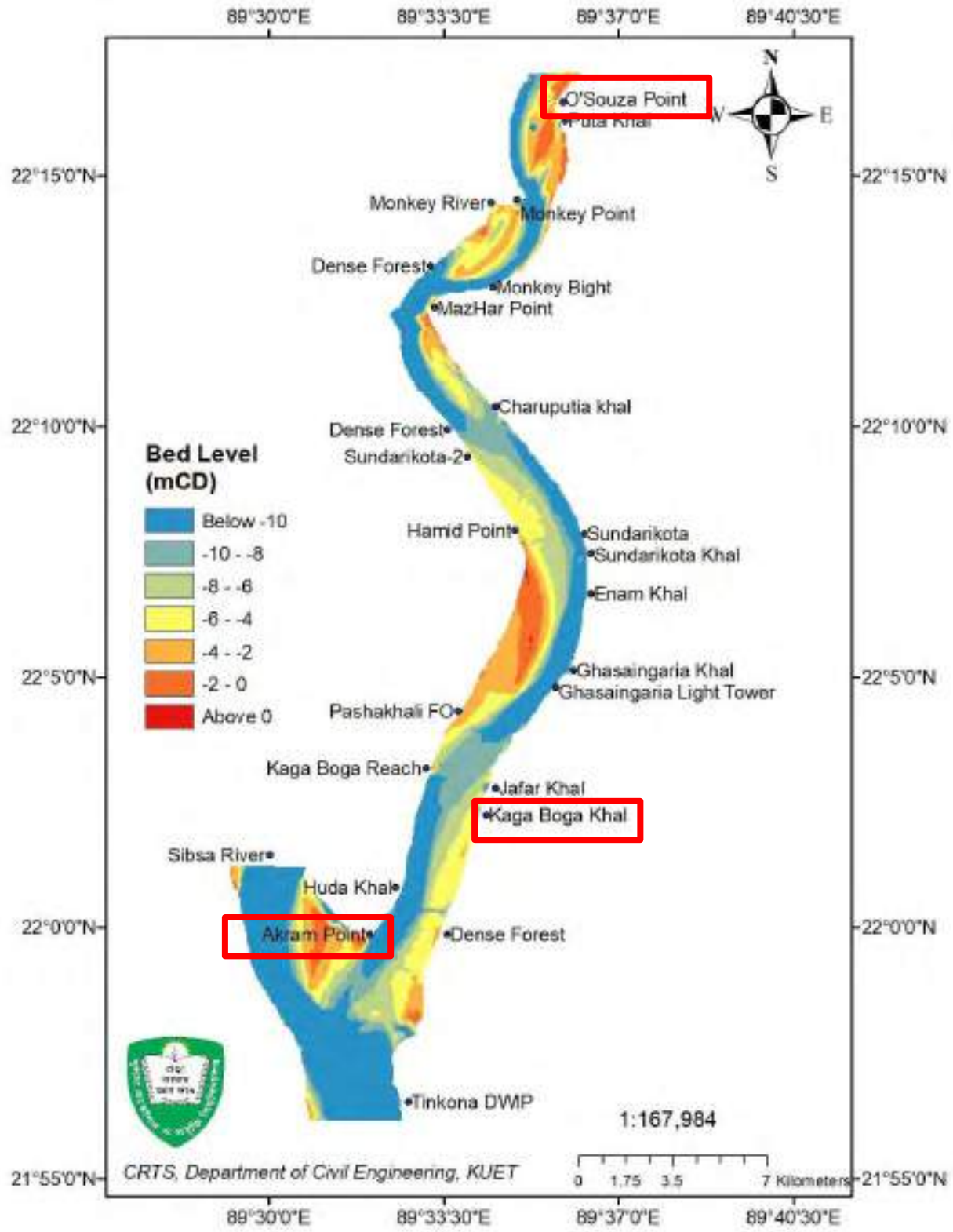


Figure 3-3: Bed levels from D'Souza Point to Tinkona Dwip (negative downward from Chart Datum) [6]

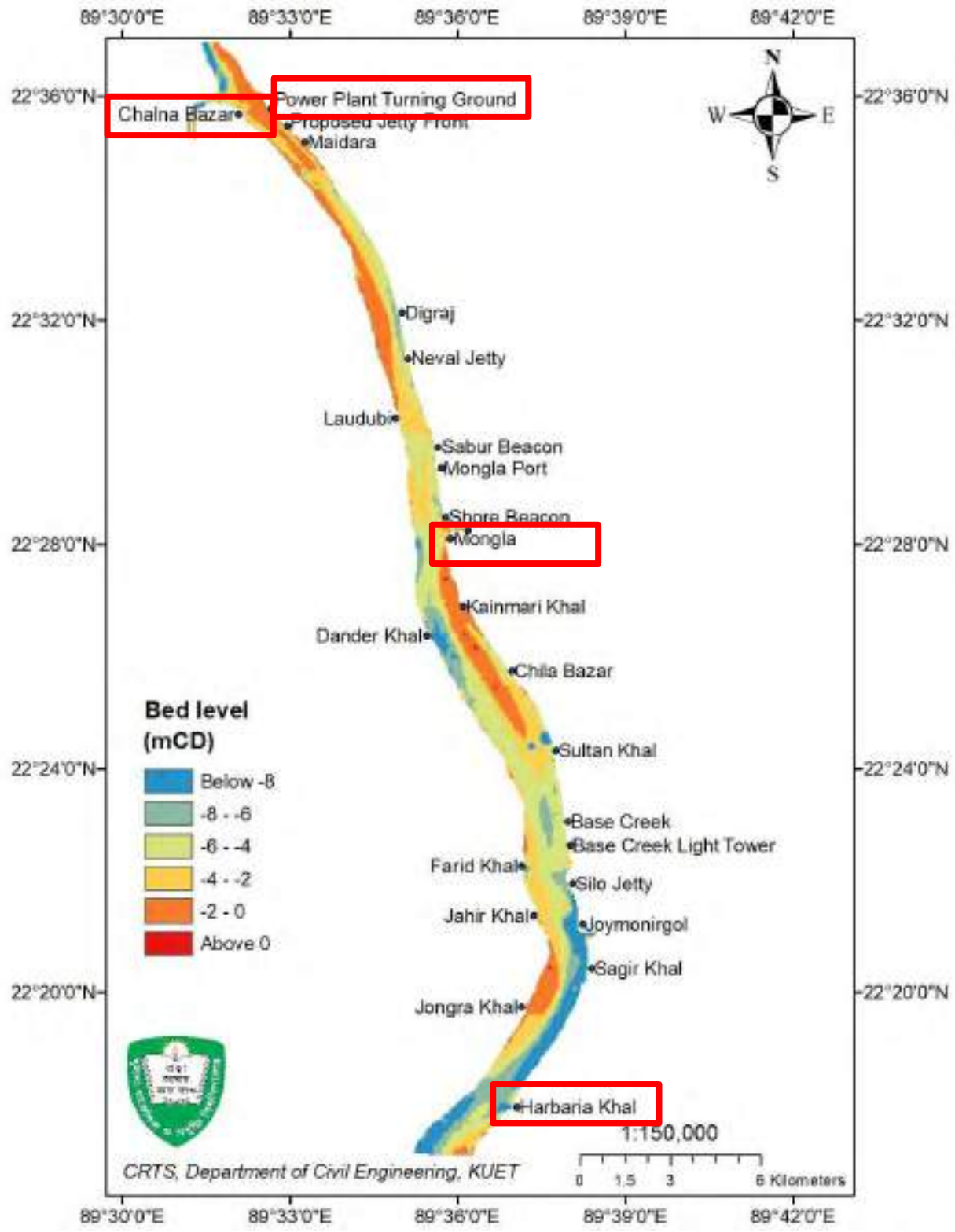


Figure 3-4: Bed levels from Chalna to Harbaria Khal (negative downward from Chart Datum) [6]

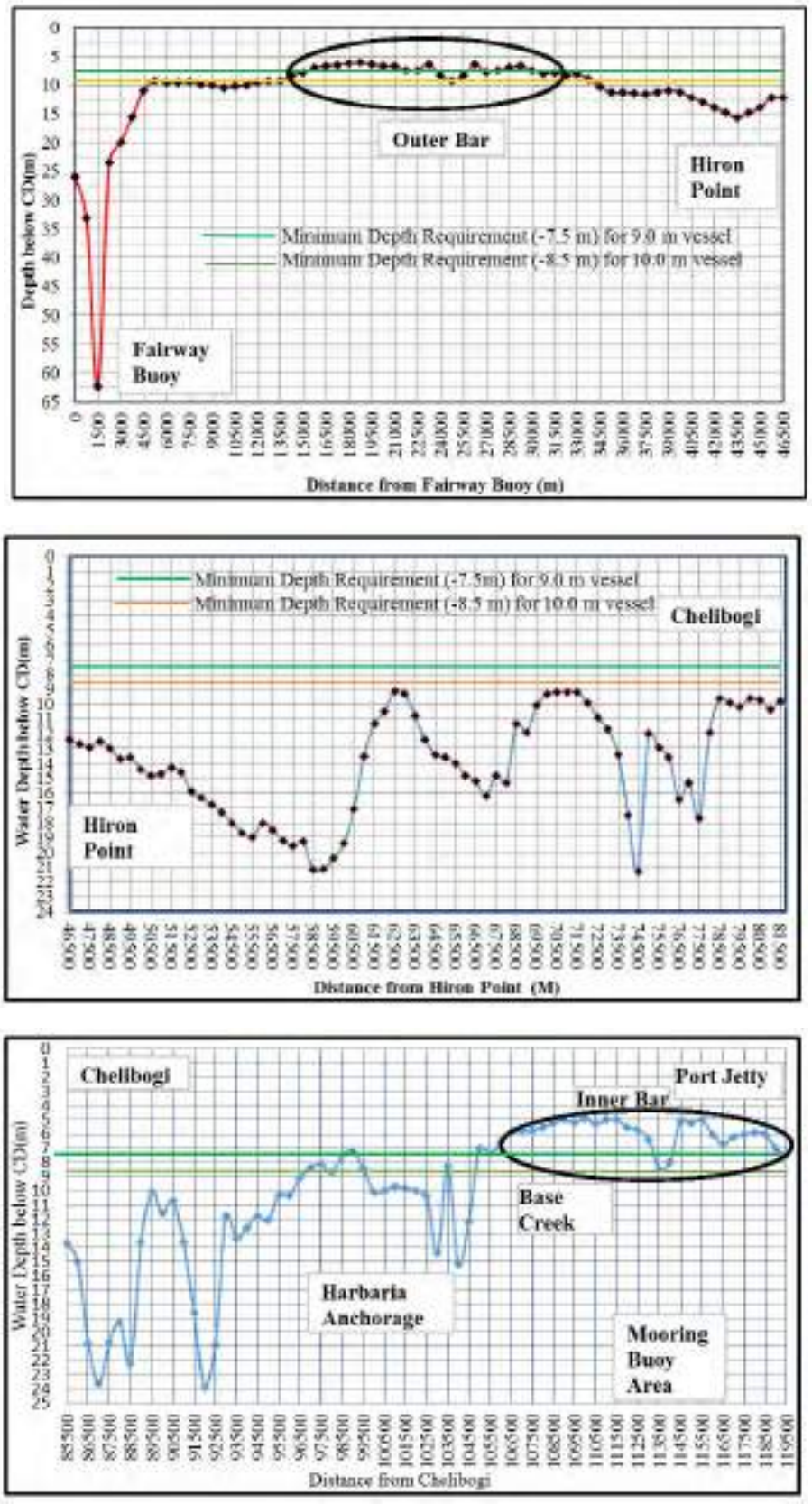


Figure 3-5: Water Depths below CD along Navigation Route for 2008 (positive downward from Chart Datum) [6]

3.5 Comparison of Navigation Charts

As some navigation charts are more recent than those used in the study by [6], typical bed levels were read from the latest charts (as included in Appendix C), following the deepest river reaches. A comparison is shown in Table 3-4. Whereas differences are noted, the general impression of available water depths is similar. Noting that the dynamicity of the river morphology and possibly different routes followed, it can be concluded that the general impression of available water depths is quite similar. Both sources indicate that, with exception of the Outer Bar area and the stretch from Harbaria Anchorage up to Mongla Port, bed levels are mostly below 8.5m below CD. At the Outer Bar, bed levels reach up to roughly 6 to 6.5 m below CD. In the stretch from Harbaria up to the port, bed levels are up to approximately 5 m below CD.

Table 3-4: Typical Bed Levels and Available Water Depths

Location	**Distance from Fairway Buoy (CRTS, 2018)**	**Typical Bed Levels**	
		(CRTS, 2018)	**(Navigation Charts)**
(approximately)	**(km)**	**(m below CD)**	
Fairway Buoy	0 – 3.5	> 15	> 15
	3.5 – 13.5	9 – 11	6.5 – 10.5
Outer Bar	13.5 – 34.5	6.5 – 9	6 – 8.0
	34.5 – 40.5	11 – 12.5	8 – 12
Hiron Point	40.5 – 52.0	12.5 – 15	10 – 16
	52.0 – 61.0	> 15	16 – 22
Akram Point	61.0 – 66.0	9 – 15	9.5 – 22
Kaga Boga Reach	66.0 – 68.0	> 15	10 – 16
Pashakhali FO	68.0 – 73.5	9 – 15	10 – 18
Enam Khal	73.5 – 78.0	12 – 15	15 – 20
Sundarikota Khal	78.0 – 81.5	9.5 – 12	10 – 15
	81.5 – 85.5	Data gap	8.5 – 13
Charaputia Khal	85.5 – 86.0	13.5 – 15	10 – 14
Cheilaboti Khal	86.0 – 89.0	> 15	14 – 29
	89.0 – 91.0	10 – 15	11 – 15
Monkey Point	91.0 – 92.5	> 15	12 – 27
D'Souza Point	92.5 – 96.0	10 – 15	11 – 13
Harbaria Anchorage	96.0 – 100.0	7 – 10	7 – 12
Joymonirgol	100.0 – 103.0	9.5 – 14.5	6.5 – 29
South Silo Jetty	103.0 – 103.5	8.0	5.5 – 6.5
Silo Jetty/Base Creek	103.5 – 104.5	10.5 – 15	5.5 – 6.5
Inner Bar / Port Jetty	104.5 – 119.5	5 – 10.5	5 – 8

Colour-coding for approximate bed levels (H) in m below Chart Datum				
H > 15	15 > H > 12	12 > H > 9.5	9.5 > H > 8	H < 8

Note: values are approximate as based on visual readings of figures by [6] and of navigation charts

3.6 Present Day Dredging Levels

The following bed level information is collated from the available reports and navigation charts:

- Bay of Bengal – Approaches to Pussur River
  - Outer Bar, Section 1: 7,260 m length by 600 m width to 8.5 m below CD.
  - Outer Bar, Section 2: 3,700 m by 900 m to 8.5 m below CD.

These dredging works will provide a navigation route from the Fairway Buoy along the Outer Bar and up to Boar Point with bed levels continuously below at least 8.5 m below CD.

According to [6], at present dredging is carried out to a *dredging depth* of 8.5 m CD. It is presumed that this means the dredging assures a bed level lower than 8.5 m below CD.

It is noted that near Sundarikota-2 Light Tower, the thalweg crosses to the opposite bank and bed levels are only marginally below 8.5 m below CD according to the latest navigation charts. This suggests maintenance dredging may be required in the future to assure continuous bed levels below 8.5 m below CD. Bed levels should be regularly surveyed to assess dredging requirements.

- Pussur River – Harbaria to Joymonirgol
  - South Silo Jetty, Section 1: 1,090 m by 200 m to 5.8 m below CD.
  - South Silo Jetty, Section 2: 1,210 m by 200 m to 5.8 m below CD.
  - Silo Jetty Area: 250 m by 150 m to 9.3 m below CD.
  - Base Creek Khal Area, Section 1: 840 m by 250 m to 5.8 m below CD.

These dredging works will provide a (widened) navigation route along Joymonirgol and the Silo Jetty with bed levels continuously below at least 5.8 m below CD, as well as a berth pocket at the silo with bed levels below at least 9.3 m below CD.

According to [6], a *draft* of 5.5 m CD is maintained from Harbaria to Mongla Port Jetty. It is presumed that this means a bed level of 5.5 m below CD. This approximately accords with the information of the navigation chart given above (5.8 m rather than 5.5 m below CD).

[7] reports drafts (presumably maximum allowable draft) at the Harbaria anchorages of 7 m at H-1 to H-4, 7.5 m at H-5 and H-6, 8 m at H-7 and H-10, 8.5 m at H-8, H-9 and H-11 to H-14. Assuming 0.5 to 1.0 m underkeel clearance, this suggests bed levels below 7.5 m to 9.5 m below CD. These are somewhat higher than bed levels read from the navigation charts: 10 m at H-1 to H-3, 7 m at H-4, 8 m at H-5, 9 m at H-6, below 10 m at H-7 to H-10, 13.5 m at H-11, 18 m at H-12, 12 m at H-13 and 11 m at H-14.

At the Base Creek anchorages, drafts of 5.2 m at BC-1, 5.5 m at BC-2 and BC-3, and 7.0 m at BC-4 and BC-5 are reported in [7], which would translate to bed levels below 5.7 m and 8.0 m below CD. These bed levels differ somewhat from levels on the navigation charts (5 m at BC-1, 6 m at BC-2, 6.5 m at BC-3, 7.5 m at BC-4 and 9 m at BC-5, all below CD), which are assumed to be correct.

Positions of the mooring buoys are given in [8] and [9] reports a maximum allowable draft of 8.0 m at these buoys, suggesting bed levels below 8.5 to 9 m below CD, when assuming 0.5 to 1.0 m underkeel clearance. The navigation charts however indicate bed levels between 3.7

m and 8 m below CD (3.7 m at IMB-2, 5 m at IMB-3, 3.9 m at IMB-4, 5 m at IMB-5, 4 m at IMB-6, 8 m at MB-3 and 6 m at MB-4), suggesting that either the buoys have been repositioned or depths have not been maintained.

- Pussur River – Base Creek to Mongla
    - Base Creek Khal Area: 2,500 m by 250 m to 5.8 m below CD.
    - Sultan Khal Area: 1,350 m by 200 m to 5.3 m below CD.

These dredging works will provide a (widened) navigation route, largely removing the shoal at the Base Creek confluence, and crossing to the right bank with bed levels continuously below at least 5.8 m and 5.3 m below CD, respectively. A relatively narrow navigation route remains along the right bank north of the Danger Khal confluence, with no dredging works indicated.

The above-mentioned maintained *bed level* of 5.5 m below CD, reported by [6], again approximately accords with the information of the navigation chart given above (5.8 m and 5.3 m rather than 5.5 m below CD). It is also reported that dredging at Mongla Port Jetty was carried out in 2014 resulting in a *depth* of more than -8 m CD at the jetty front and -5.5 m CD in the channel. It is presumed that this means bed levels of 8 m and 5.5 m below CD, respectively.

A maximum allowable draft at the port jetties of 7.0 m is reported in [9]. Assuming 0.5 to 1.0 m underkeel clearance, this suggests a bed level below 7.5 m to 8 m below CD, which agrees with the information above as well as with the navigation chart (showing bed levels between 7.4 m and 8.1 m below CD along the jetty, with the exception of 7.1 m below CD at the northern end near the tide gauge.

- Pussur River – Mongla to Digraj
    - Area south of Mongla Nullah: No details given.
    - Adjacent to Mongla Port Jetty J-5 to J9: No details given.
    - Tide Gauge to Delta LPG Jetty: No details given.
    - Dubai Bangladesh CF Jetty to Laugfs LPG Jetty: No details given.

According to [6], at present a *draft* of 7.5 m CD is maintained at the jetty area. It is presumed that this means a bed level of 7.5 m below CD.

It is assumed here that the dredging areas indicated on the navigation charts (without information on design depths) will be maintained to a design level of 5.3 m below CD. This is equal to the design level indicated for the southerly Sultan Khal area, and would hence provide a continuous navigation depth from the Base Creek anchorages up to Mongla Port.

- Pussur River – Digraj to Chalna
    - Digraj to Maidara, Section 1: 1,350 m by 200 m to 5.5 m below CD.
    - Digraj to Maidara, Section 2: 1,350 m by 200 m to 5.5 m below CD.
    - Maidara to Power Plant, Section 1: 1,100 m by 200 m to 5.5 m below CD.
    - Power Plant Jetty Front: 540 m by 200 m to 8.0 m below CD.
    - Power Plant Turning Ground: 500 m by 300 m to 5.5 m below CD.

- Maidara to Power Plant, Section 2: 1,300 m by 200 m to 5.5 m below CD.
- Power Plant to Chalna: 1,000 m by 300 m to 5.5 m below CD.

These dredging works will provide a navigation route from Digraj to Chalna with bed levels continuously below at least 5.5 m below CD, as well as a berth pocket at the Power Plant Jetty Front with bed levels below at least 8.0 m below CD.

According to [6], dredging of up to 5.5 m CD is implemented *at present*. It is presumed this means dredging to a bed level of 5.5 m below CD was carried out (and presumably completed by the end of 2018 or early 2019 as the CRTS report is dated November 2018). This bed level accords with the information of the navigation chart given above.

Summary

Assuming that dredging works are regularly carried out to assure the indicated bed levels are not exceeded, the following presently existing bed levels are derived:

- From the Bay of Bengal through the Outer Bar up to the Pussur River entrance are maintained to be lower than 8.5 m below CD. From Pussur River entrance to Harbaria natural bed levels are also below 8.5 m below CD.
- At the majority of the Harbaria anchorages, bed levels are below 8.5 m below CD, except for anchorages H-4 (6.5 m below CD) and H-5 (8 m below CD).
- From Harbaria to Base Creek anchorages, bed levels are below 5.8 m below CD.
- At the Base Creek anchorages, bed levels at the southern two anchorages BC-4 and BC-5, bed levels are below 7.5 m and 9 m below CD, respectively. The three northerly anchorages, BC-1 to BC-3, have respective levels below 5 m, 6 m and 6.5 m below CD.
- From Base Creek up to the approach to Mongla Port, bed levels are at least 5 m below CD.
- In the approach to Mongla Port and main channel fronting the array of port jetties (up to the LAUGFS jetty), bed levels are generally below 5.5 m below CD.
- Along the northerly port jetties up to the Maidara Nullah confluence, bed levels are generally around 5 m to 6 m below CD.
- From Maidara Nullah to Chalna Bazar, bed levels range between 3 and 7.5 m below CD. This stretch is scheduled to be dredged to a level of 5.5 m below CD, including a berth pocket at the power plant jetty at 8 m below CD.

On this basis the following is concluded with regard to navigational depths:

- A continuous navigation route with bed levels below 8.5 m below CD exists up to the Harbaria anchorages. Vessels can make use of a tidal window with water levels above 2 m above CD, resulting in a total available water depth of 10.5 m, and then use the Harbaria anchorages H-7 to H-14 with larger water depths.

- From Harbaria to Base Creek anchorages, bed levels are at least 5.8 m below CD. Vessels can use the aforementioned tidal window, resulting in a total water depth of 7.8 m, and then use the anchorages BC-4 and BC-5 with larger water depths.
- From Base Creek up to the LAUGFS Jetty, bed levels are at least 5 m below CD. Vessels can use the aforementioned tidal window, resulting in a total water depth of 7 m, and then use Mongla Port jetty berths with bed levels below 7.5 m to 8 m below CD.
- From Mongla Port to Chalna, bed levels (once dredged) will be at least 5.5 m below CD. Vessels can make use of the aforementioned tidal window, resulting in a total water depth of 7.5 m, and then use locally deeper areas (below 7.5 m below CD) at Chalna.

When combining the above with an estimated 1 m total clearance (0.5 m underkeel clearance in combination with vessel-specific other allowances due to e.g. trim, squat, exposure to waves and/or currents), this translates into the following maximum allowable vessel draft:

- From Fairway Buoy up to and including Harbaria anchorages: 9.5 m

  Distance approximately 60 nautical miles or 100 km.
- Upstream Harbaria up to and including Base Creek anchorages: 6.8 m

  Distance approximately 6 nautical miles or 10 km
- Upstream Base Creek up to the LAUGFS Jetty: 6 m

  Distance approximately 9 nautical miles or 14 km
- From LAUGFS Jetty to Chalna (once dredged): 6.5 m

  Distance approximately 8 nautical miles or 12.5 km

3.7 Options for Increasing and Maintaining the Maximum Allowable Draft

The interim report of the presently conducted feasibility study for dredging and river training in Pussur Channel ([6]) recommends two development phases:

- Phase I:

Medium Term Solution – increase *channel depth* up to 8.5 m CD in channel from Fairway Buoy to Chalna and up to 10.5 m CD at Mongla Port and Power Plant jetties, to enable movement of 10 m draft vessels. It is presumed that this means a bed level of 8.5 m and 10.5 m below CD, respectively.

- Phase II:

Long Term Solution - increase *depth of channel* up to 10 m CD in channel from Fairway Buoy to Chalna and up to 12 m CD at Mongla Port and Power Plant jetties, for 12 m draft vessels. It is presumed that this means a bed level of 10 m and 12 m below CD, respectively. This solution also includes, in addition to dredging, river training structures at the inner bar and Mongla Port jetty area.

The following is noted:

- Both recommended phases are understood to consider a tidal window with water levels of at least 2 m above CD.

Logically, the tidal window does not apply for berthing vessels at the jetties, as berthing time exceeds the length of the tidal window (typically a quarter tidal cycle; about 3 hours).

The tidal window should be sufficiently long to allow vessels to sail safely between locations with adequate water depths at lower tidal stages.

- An additional 0.5 m is taken into consideration for Phase I, but not for Phase II.

It is presumed this margin represents the required underkeel clearance, making it unclear why this is not included in the Phase II recommendation. Inclusion would modify the required bed levels to 10.5 m and 12.5 m below CD, respectively for the channel and for the jetties.

Other allowances (e.g. for vessel trim, squat, exposure to waves and/or currents) do not appear to have been considered. These are subject to vessel characteristics and local conditions. Using an estimated 0.5 m for such allowances reduces the maximum allowable drafts by another 0.5 m, which needs to be taken into consideration.

- The lowest allowable bed level without compromising the structural stability of the existing waterfront structures is unknown (it is referred to Section 2.2.2).

This design bed level sets a limit to the extent of the dredging that can be carried out adjacent to these existing structures. Lower bed levels can only be maintained in case of structural strengthening or replacement of waterfront structures.

- The increased water depths result in increased river cross-sections, and hence to lower average flow velocities under the same hydrological regime. In turn, the sediment carrying capacity of the river flow is reduced, resulting in sedimentation.

To maintain similar average flow velocities, either the river discharge needs to be increased or the cross-section needs to be reduced (by narrowing the river channel).

In 2004, IWM [10] investigated two options to achieve:

1. a reduced river cross-section, by means of guide bunds and bank protection measures from Chila Bazar to Mongla Port, and
2. combination of the reduced river cross-section with an increased river discharge (by means of tidal basins on Pussur River north of Digraj and on Mongla Nullah River northeast of Mongla Port).

In addition, they investigated a basic option without interventions but only including dredging to allow vessels with a draft of up to 7 m at Mongla Port.

The following is noted:

- As explained by IWM, the concentration of the river into one main channel, rather than divergence of the ebb and flood channels, will result in larger water depths.

This is evident from the navigation charts at locations where the main channel, and hence the navigation route, swaps to the opposite bank, e.g. at Sundarikota-2 Tower and near Base Creek. A bar is often seen between diverging channels, providing lower water depths for navigation.

River training, such as the proposed bunds and bank protection, may well aid to reduce the level of channel divergence, and hence the dredging requirements.

- Interventions, with the aim to modify the alignment of the main channel(s) and river morphology in general, will need to be planned carefully to avoid impacts at upstream or downstream locations.
- The interventions should still allow the river to accommodate the ranges of possible combinations of discharges during extreme conditions, such as strong monsoon flows, tidal events and storm conditions.
- The IWM study is based on the 2004 river morphology, which is now 15 years old. Any interventions taken forward into design studies or implementation should be investigated based on the most recent bathymetric data, river banks and any structures.
- Combination of river training works with the implementation of tidal basins was shown by IWM to contribute roughly 10% tidal volume for an average tidal cycle, and in this manner increases the river discharge, and therefore the average flow velocities and related sediment carrying capacity, reducing dredging requirements.
- It is concluded in the study that river training works will have positive impacts on the available water depths, reducing maintenance dredging requirements. Similarly, implementation of the tidal basins has positive impacts on navigability. Both assessments were carried out in combination with increased dredging depths.

It may therefore be worthwhile to investigate the benefits of implementing such or similar training works and tidal basins without increased dredging depths. The effects induced by cross-section reduction and increased discharges may improve navigability without large scale dredging works. Limiting locally shallow areas can be dredged as required, to be determined by regular surveying.

- A model study certainly aids in the understanding of fluvial processes and potential positive and negative impacts of any interventions. However, due to the complexity of the combined riverine and tidal processes within the Pussur River and wider river network, model predictions only give an indication and should be treated with due care.

It is therefore recommended to implement dredging works (to previous or larger design depths) and other interventions one step at the time. Regular surveying and monitoring is subsequently required to assess the associated maintenance dredging requirements and any other possible impacts on the river morphology.

Summary

The previously proposed options for dredging to larger depths in combination with river training and, at a later stage, implementation of tidal basins, appear generally feasible and would provide larger navigable water depths up to and beyond Mongla Port.

The design dredging levels need to include appropriate underkeel clearance as well as other allowances, to be defined in accordance with the design vessels and local conditions. They should be in agreement with the lowest allowable bed levels at existing (or possibly

strengthened) waterfront structures, to avoid compromising their structural stability. Potential scour at the structures due to increased flow velocities should also be considered.

Assessment of the benefits of the updated intervention options should be repeated based on the most recent bathymetric data, river banks and any structures for Pussur River as well as the wider river network.

Equally, the estimated costs associated with the intervention options should be updated to reflect present price levels.

As a result of the complexity of the river hydrology and morphology, interventions should be implemented in phases, with regular surveying and monitoring to verify forecasts of dredging requirements. Evaluation of preceding phases should then form the basis for assessment of the feasibility of further interventions.

3.8 Conclusions and Recommendations

The available navigation charts over the period 2013 to 2019 as well as third party reports, have been scrutinised to assess the present and past river hydrology and morphology and limitations to navigation from the Bay of Bengal up to Chalna. Assuming that the dredging areas and levels indicated on the charts are maintained and a tidal window with water levels above 2 m above CD, the presently maximum allowable draft is approximately 9.5 m up to the Harbaria anchorages, and about 6 m from Harbaria, past Mongla Port and up to Chalna.

Third party assessment of dredging works to allow larger draft vessels to navigate up to Mongla Port concluded that the implementation of river training works and/or tidal basins is beneficial and would reduce maintenance dredging efforts.

It is recommended to investigate implementation of such works (individually and combined) based on presently existing bed levels, with local dredging between Base Creek and Mongla Port to 5.5 m below CD. The morphological response may by itself allow larger draft vessels to sail up to Mongla Port. The most promising option can then be taken forward as first phase of development and would allow a maximum (tidally restricted) draft of 9.5 m up to Harbaria anchorages, and up to 6.5 m from Harbaria up to Chalna (considering 1 m total clearance, consisting of 0.5 m underkeel clearance and 0.5 m for vessel squat, trim and exposure).

After the first phase, regular surveying and monitoring over several years is recommended, to assess its effects and the requirements for further interventions. This second phase of development would include an increased dredging depth to provide navigability for vessels with a draft of up to 8 m, requiring bed levels below 7 m below CD in accordance with the above. Subject to the effectiveness of the first phase developments, further river training works or tidal basins may be included. Furthermore, waterfront structures may require strengthening or overhaul to allow sufficiently low adjacent berth bed level of 9 m below CD.

Again, regular surveying, monitoring and assessment should follow implementation of the previous phase. The third and fourth phases of development would see a further increase in dredging depth to allow vessels with a draft up to 10 m and 12 m, respectively. In accordance with the former phases, these developments may comprise further river training works and tidal basins, subject to their effectiveness in earlier phases, and will require dredged bed levels of below 9 m and 11 m below CD. Adaptation or replacement of waterfront structures to ensure structural stability for adjacent bed levels of 11 m and 13 m below CD may be required.

4 Existing Hinterland Connections

4.1 General

The hinterland connections of Mongla Port fall into three main categories, those provided by either inland waterways, railways or roads. Their general current status and foreseeable developments in basic structural terms will be described in the following.

4.2 Inland Waterways

Bangladesh's waterway transport is largely characterised by the widespread running of local rivers, mainly the Padma or Ganges-Brahmaputra delta, making riverine transport an important economic factor in the country, yet, in the absence of canals, entirely dependent on physical geography.

Accordingly, depending on seasonality, the country has a network varying in length from 5,968 km, during monsoon season to 3,865 km, during dry season [11].

Throughout the country, major routes connect the domestic ports of Mongla / Khulna, Barisal, Chittagong. each lying rather in the south of the country, to those situated in central Bangladesh, such as those of Chandpur, Naranyanganj, the country's capital Dhaka and Narsingdi. Further, yet less navigable routes, connect areas of the country lying north-east and north west of Dhaka. Large parts of the country are thereby reachable by ship, with the exception being divisions such as Mymensingh, Rangpur and parts of Chittagong.

Mongla Port's hinterland connection is terms of waterway transport is thus comparatively favourable but provides certain draft restricted stretches as shown below (see Figure 4-1).

Figure 4-1: Bangladesh's Inland Waterways Classification [11]

4.3 Railways

Bangladesh's railway system covers a total of over 2,900 route km [12] and runs through almost all districts of the country, with the exceptions being mostly situated in central southern Bangladesh, thus especially Barisal and partly Dhaka division, parts of Chittagong and Mymensingh division.

Aside the usage of several gauges, the network is generally characterised by a split in two parts, an eastern and a western part, with currently only one connection between the two, the Bangabandhu Bridge connecting Bhuapur on the Jamuna River's east bank to Sirajganj the west.

Quite similarly to the waterway transportation network, railways have hardly any connections to foreign countries. Only a few connections exist, and all are with India, situated in the very North or North-east respectively, see Figure 4-2. Aside being only a few, it is very time-consuming to use them [13].

Yet, several infrastructure projects are currently underway that approach these issues, especially the structural split of the network through the construction of bridges over the Padma, aside providing more connections to India [14].

For Mongla, a major structural change in terms of hinterland connection lies in its general linking to the railway network within the next years via the 64.75 km long, new Khulna-Mongla Port Rail Link branching from the present railway at Phultola Railway stations (see also Table 8-1). The Broad Gauge (BG) railway line including a bridge crossing the Pussur river at Khulna City area is under construction and shall commence in 2020. The distance Mongla Port to Dhaka by rail via Jamuna Bridge will be 460.17 km (single line 382,63 km, double line between Poradah to Ishurdi railway station 77.54 km). However, at present container transport is not permitted over Jamuna Bridge

Further and full advances will come with the completion of the construction of the Padma bridge and of the connecting railway line from existing railway lines from Rupdia station to Kasiny via Narail. In the proposed alignment the length of the railway line from Mongla port to Dhalka will be shortened to 266 km, i.e. by 200 km, and provide for intermodal container transport (single line, planned line capacity 33 trains per day). The possible impacts will be discussed in forthcoming chapters.

Figure 4-2: Bangladesh Railway Network [Bangladesh Railways, 2014]

4.4 Roads

Bangladesh's road network consists of national and regional highways and district / zilla roads. According to own calculations, the network covers more than 20,000 route km [12] and connects all places of relevance throughout the country, yet with greatly varying, often of inadequate quality [15]. The road network is shown in Figure 4-3.

As with the rail network (see Section 4.3), east-western connections are greatly bottlenecked by the existence of only one major bridge crossing the Padma. This circumstance is only partly moderated by the existence of numerous ferry connections.

However, equally similarly to the above said, the situation will ease with time, considering that most of the bridges crossing the Padma in future will also cater for road traffic. Furthermore, the official road master plan for Bangladesh foresees advances in the national road connections of Mongla Port [16].

Significant further road improvement projects are planned or under implementation, i.e. extension and improvement of the Khulna - Jashore highway and of the port connecting road from Khulna to Mongla Port (see Figure 4-4).

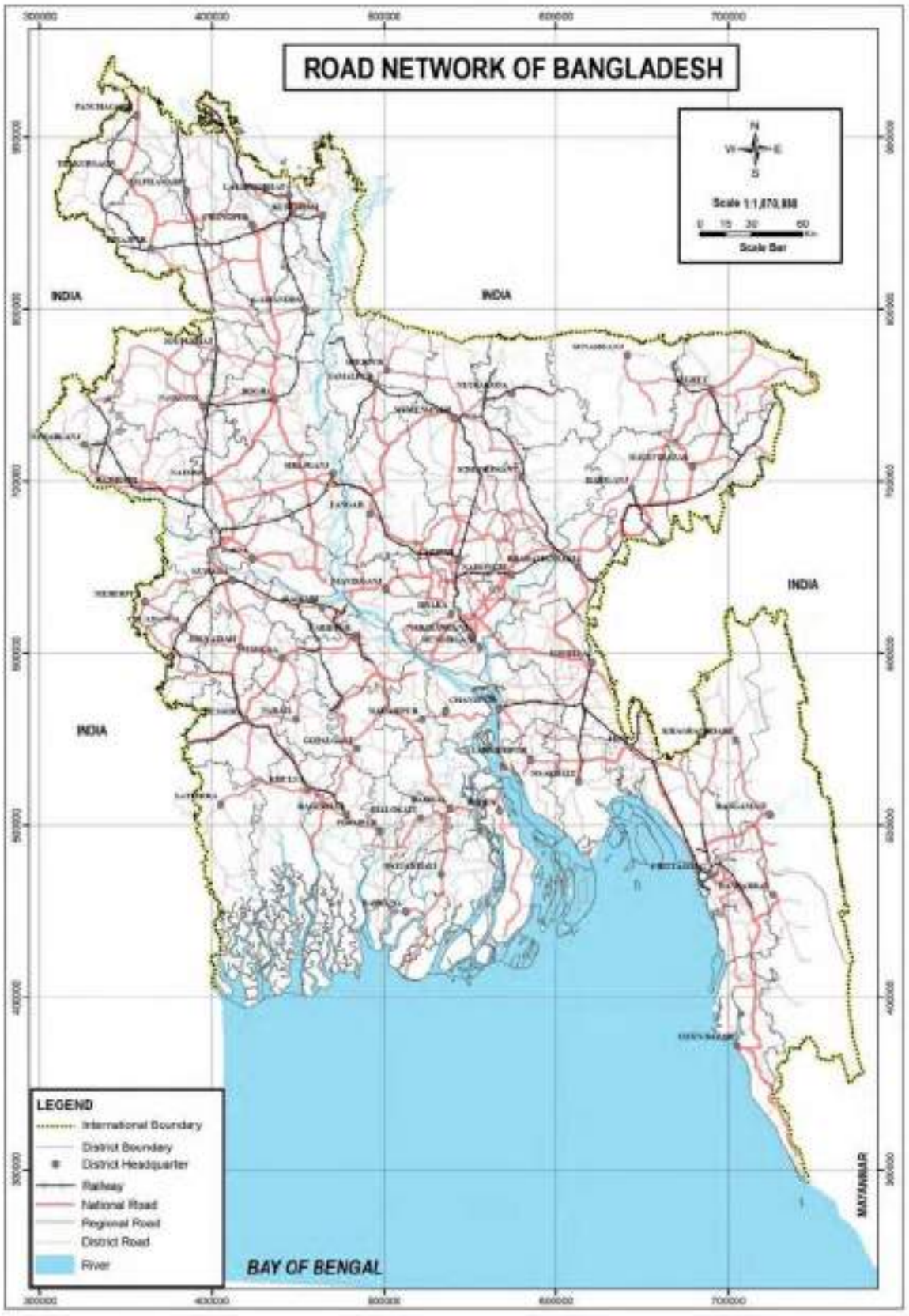


Figure 4-3: Road and Rail Network of Bangladesh [source unknown].

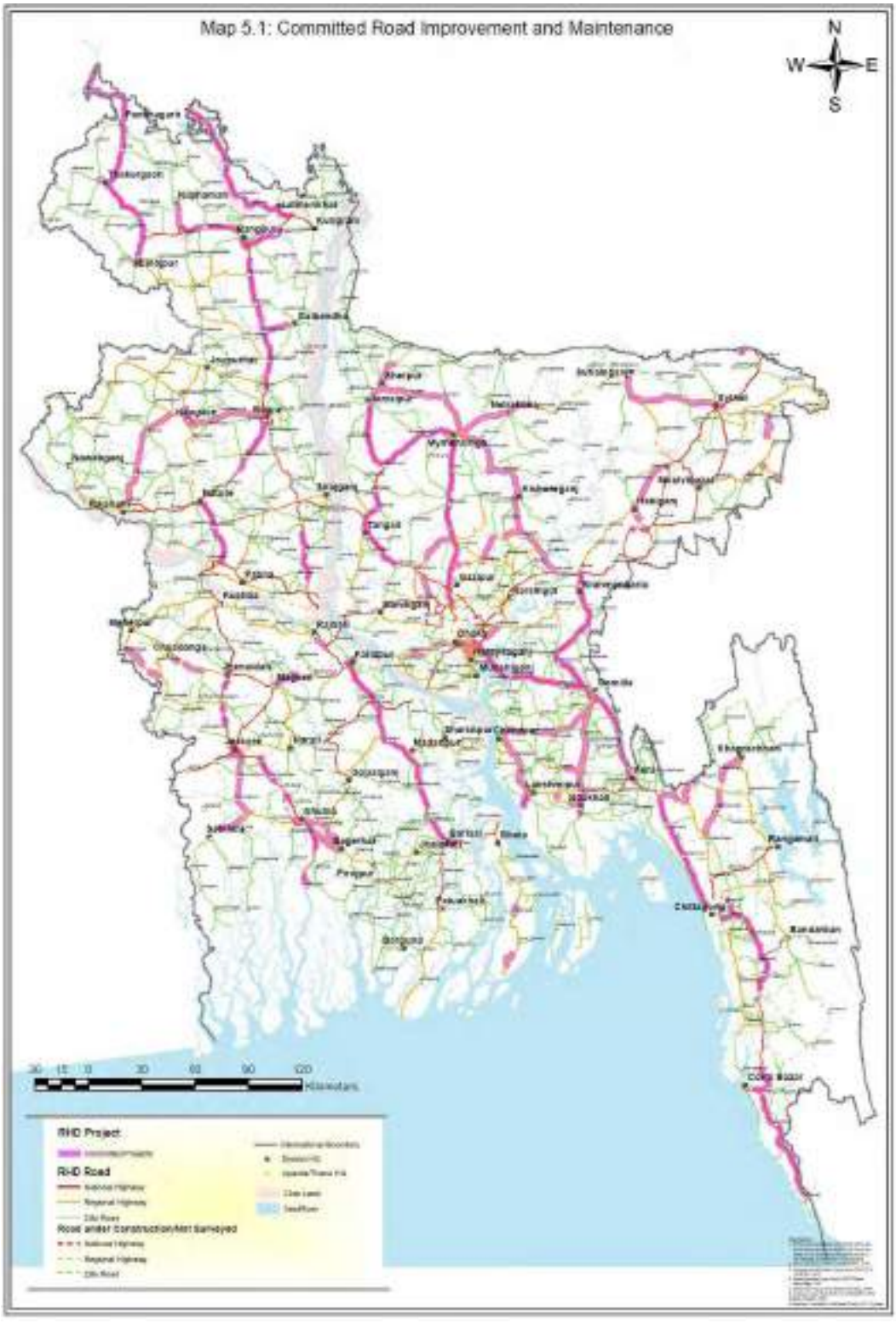


Figure 4-4: Road Network and Improvement Measures [16].

5 Cargo Throughput Analysis

5.1 Sources of Data

Mongla Port Authority's Traffic Department has provided detailed port throughput and container traffic data by commodities, separately for inbound/import and for export/outbound traffic for the Financial Year (FY) 2004/2005 – 2018/2019. Furthermore, Chittagong Port Authority (CPA) publishes port throughput and vessel traffic data. The annual issues of the Statistical Yearbooks of Bangladesh summarise the port throughput data with reference to the respective port authorities for the two most important sea ports of the nation, also separately for import and export and by commodities.

5.2 Mongla Port Throughput Analyses

The cargo throughput details of Mongla Port are described by type of commodity and by prevailing types of handling for both imports and exports from 2004-2018.

The port throughput statistics refer to 31 different commodities reviewed in the traffic flow study; these include product groups ranging from foodstuff (such as fly ash, food grain, shrimp, jute and jute goods), mineral products (clinker, coal, fertilizers, gypsum and limestone), machines (motor vehicles, machinery and car re-shipment), petroleum products (crude oil and leaded gasoline) and other general cargoes.

The quantities of these commodities were measured in metric tons in both import and export traffic flows. This allowed for a clearer understanding of the key imported and exported commodities at the present time which would aid in explaining and defining the impact of national and international industrial and socio-economic developments. In addition to selecting base cargoes lead commodities are identified driving the demand for base-load cargoes and port and shipping services via Mongla Port for the port and the port adjacent industries allocated at or in the vicinity of the port.

Based on the list of cargoes reviewed in the study, there are three categories of cargoes

Dry Bulk Cargoes, carried on sea loose/unpacked in catches, which are handled at port by different types

Type of Handling: grabber or conveyer, stored open of in covered areas

- Coal, cement, clinker, gypsum, limestone, slag, sand, gravel etc

Type of handling: grabber, excavators, conveyer, stored dust and rain protected

- Fertilizers, C. Bone/ B. Griest and salts

Type of handling: excavator/grabber, pneumatic handling, stored dust and humidity protected, ventilates or in silos

- Grain, soy beans, oil seeds, fly ash

Liquid Bulk Cargoes, carried on sea by tankers of various specifications and to be considered for handling at port by following types

Type of handling: Pumped, transported by pipelines and stored in tanks

- Crude oil, mineral oil fuel products

Type of handling: Pressurized/climatized pumped and transported by pipelines and stored in pressured or cooled tanks:

- Liquid gas LPG
- Liquid Natural Gas (LNG; presently not handled in Mongla)
- Liquid chemicals in bulk

General Cargoes, commodities which are carried on sea by freighters, heavy lift or by Roll-on/roll – off or container ships. Stowed or packed, in containers of bagged or as break bulk, or by or as rolling units

Type of handling: Break bulk, lifted by cranes and moved by equipment to stores/warehouses

- For example: Iron/steel, steel piles, paper, wood, sawn timber, in larger quantities, etc.)

Type of handling: Rolling cargo, moved on own wheels or trailers, stored at open or areas

- Cars and vehicles

Type of handling: Heavy lifts, handled with special gear and cranes due to size or weight, stored protected or covered and dedicated areas/stores

- Heavy lifts, project cargo, machinery

Type of handling: Handled with crane and gear, in bags or bails, palletized or not, stored in sheds/warehouses

- All bagged or palletized cargoes not in containers, e.g. wheat, rice, foodstuff, sugar, bagged cement, etc.:

Type of handling: Cargoes of any kind in and handled by standard or special containers carried by container ships, lifted by cranes (ship gear or shore cranes) and stored at container yards

- Chemical products (tank container), fish, seafood, meat, fruits and other perishables, general cargo of any kind not extra specified (n.e.s.).

5.3 Cargo Throughput Development 2004 – 2018

After allocating the commodities handled at Mongla Port under their corresponding commodity group and prevailing type of handling, the cargo volumes for each commodity and commodity group was assessed.

The commodity-wise import and export handled at Mongla Port from 2004/2005 to 2018/2019 is depicted in Appendix D. The Consultant used the information provided to calculate the volumes of each commodity handled in Mongla Port under the predefined commodity group and handling requirement structure.

Based on the Mongla Port throughput details the commodity structures in import and export by main commodities handled at Mongla Port in year 2018/2019 (metric tons) are summarized in Figure 5-1 and Figure 5-2.

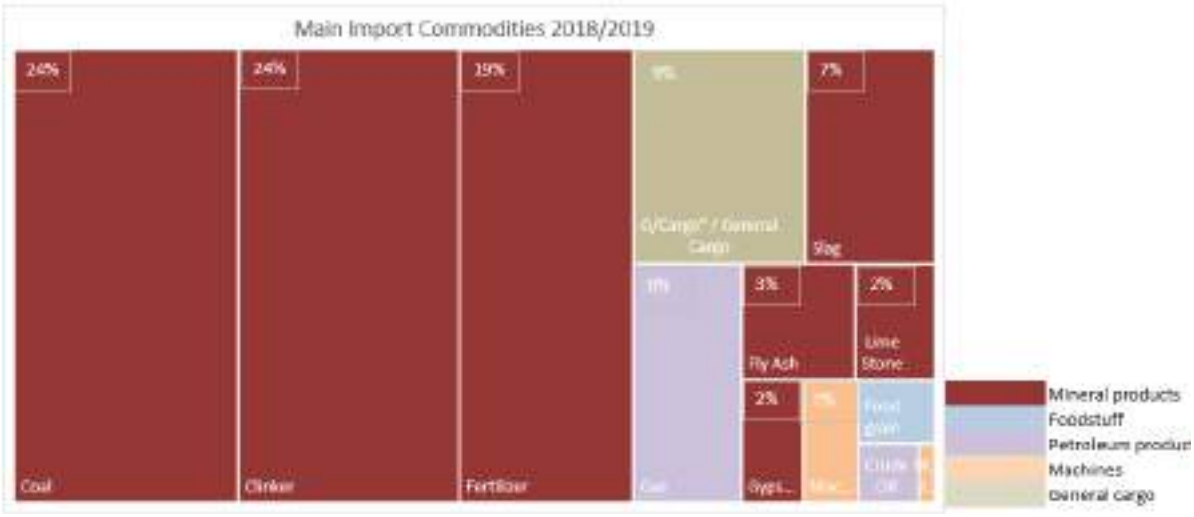


Figure 5-1: Main Import Commodities Handled at Mongla Port by % share in 2018/2019 [Consultant, based on [17]]

Figure 5-1 highlights the main import commodities of 2018/2019 by % share which is calculated based on the import/export traffic split of each cargo type and total traffic by year represented in the tables in Appendix D.

The different types of cargoes are separated by type of commodity group which is highlighted by the different coloured shades. It is clear to see that mineral products are the main type of imports handled at Mongla Port in 2018/2019. These include coal (24%), clinker (24%), fertilizers (19%), slag, fly ash, gypsum and limestone. The second main commodity group are general cargo, after that comes petroleum products with gas and crude oil, then machines with different machinery and motor vehicles and lastly, foodstuff, specifically food grain which make up (1%) of the total imported commodities.

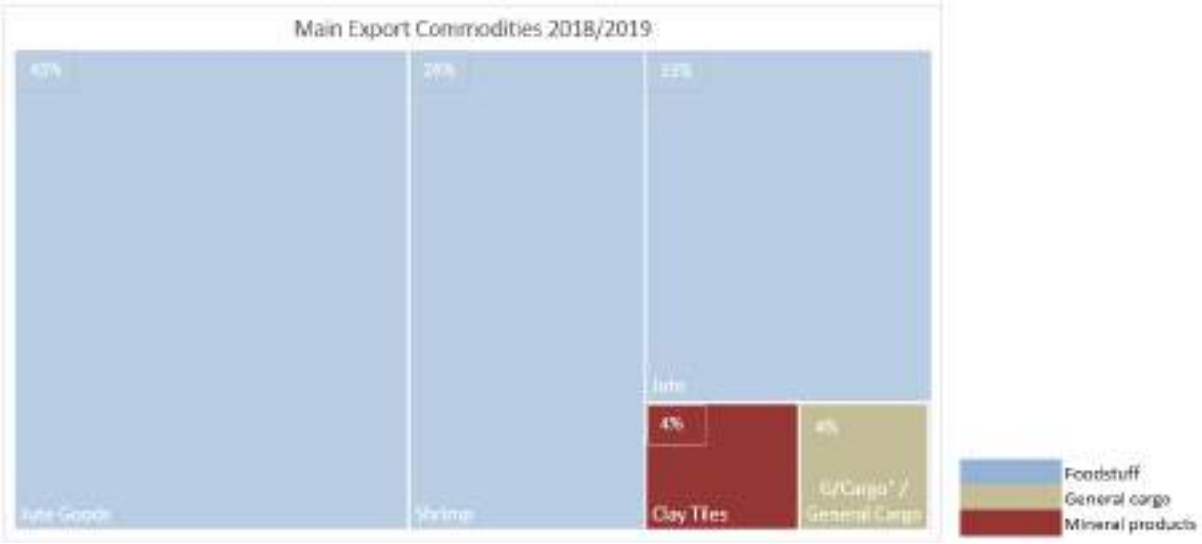


Figure 5-2: Main Export Commodities Handled at Mongla Port by % share in 2018/2019 [Consultant, based on [17]]

Figure 5-2 highlights the main export commodities of 2018/2019 by % share which is calculated based on the import/export traffic split of each cargo type and total traffic by year represented in the tables in Appendix D.

The different types of cargoes are separated by type of commodity group which is highlighted by the different coloured shades. It is clear to see that foodstuff mainly jute goods (43%) and shrimps (26%). General cargo and mineral products like clay tiles are the second key exports, however, they are at (4%) only while foodstuff dominates the main export traffic handled in Mongla Port.

Conclusions that can be drawn from the data above include:

- There is an imbalance in the trade flow as import volumes exceed that of the export volumes handled in Mongla port.
- The port is an import-based handling port providing for the port industries surrounding it.
- The types of imported commodities highlight the activities and types of port industries which include cement factories, tank farms and LPG storage establishments, among others. It is clear to see that what is produced from these sites are being transported and used in Bangladesh rather than re-exported.

The following tables summarize the results of the total annual cargo throughput development handed at Mongla Port, per commodity group for both import and export trade, from 2004 to 2018. The units are represented by metric tons.

Figure 5-3 provides a visual representation of the import cargo volume development.

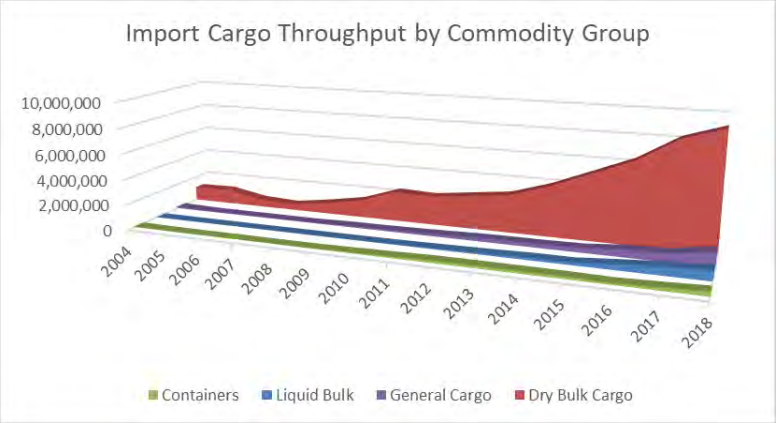


Figure 5-3: Import Volume Annual Development by Commodity Group [Consultant, based on [17]]

Table 5-1: Import Volume Annual Throughput per Commodity Group in metric tons [17]

Commodity Groups	Import/Unloading (unit: metric tons)														
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Containers	58,354	26,093	19,560	30,402	25,295	28,281	73,351	123,604	190,616	195,736	191,552	186,587	138,984	223,793	346,989
Liquid Bulk	26,183	15,904	15,141	14,057	18,194	25,558	32,276	49,306	90,444	127,015	204,534	209,814	447,264	649,250	788,729
General Cargo	126,350	45,399	40,165	42,693	36,429	98,769	115,464	160,009	232,814	294,572	299,792	345,748	589,200	699,535	1,193,576
Dry Bulk Cargo	1,101,841	1,153,769	606,957	461,559	875,091	1,377,723	2,382,113	2,273,117	2,622,964	2,980,815	3,925,123	5,154,102	6,391,641	8,220,114	9,197,573

Table 5-1 summarises the total import volume development throughput by commodity group handled at Mongla port.

Conclusions that can be drawn from the data above include:

- Dry bulk cargo is the dominating type of cargo handled as import in Mongla Port, this commodity group includes coal, cement, clinker, fertilizers and grains etc.
- The second main type of cargo handled is general cargo which include break bulk, machinery, chemical products etc. and the third is liquid bulk which includes crude and mineral oil, liquid gas etc.
- Dry bulk cargo may be the dominating type of cargo handled at Mongla Port, but liquid bulk is seen to develop at a much higher rate. The compounded annual growth rate for liquid bulk results in 28% growth within 15 years while dry bulk cargo is growing at 16% growth rate.

Figure 5-4 and Table 5-2 summarise the total export volume development throughput by commodity group handled at Mongla Port.

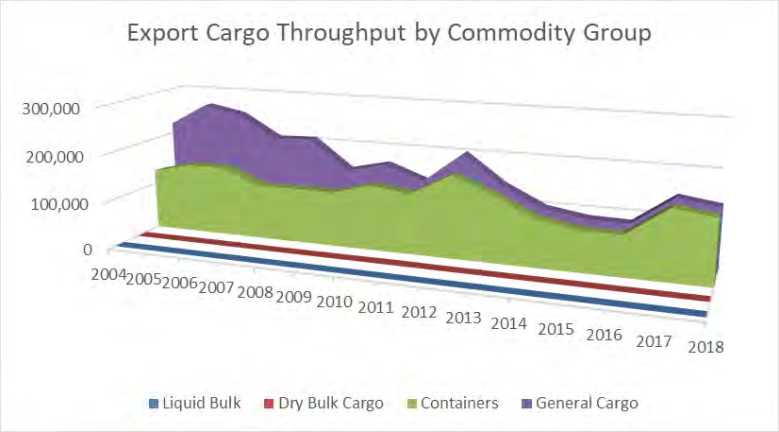


Figure 5-4: Export Volume Annual Development by Commodity Group [Consultant, based on [17]]

Table 5-2: Export Volume Annual Throughput per Commodity Group in metric tons [17]

Commodity Groups	Export/loading														
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Liquid Bulk	0	0	0	0	0	0	0	0	0	0	0	100	50	50	0
Dry Bulk Cargo	213	106	297	0	0	335	529	1,034	279	425	210	305	0	0	0
Containers	128,504	147,330	148,792	115,372	117,077	115,969	138,079	128,023	174,041	141,344	100,830	86,171	85,534	147,029	135,131
General Cargo	221,585	267,466	251,815	204,525	208,112	146,898	165,889	136,431	201,073	141,122	100,620	87,452	85,572	147,101	135,131

Conclusions that can be drawn from the data above include:

- Both general cargo and containers are dominating the exported volumes handled at Mongla Port. However, both types are developing in a decreasing rate, the volume of handled containers for export in the port have been decreasing since 2012 and returning to the same volume from 2004 while the volume of general cargo has been decreasing since 2006 at a -3% rate.
- The volumes of export versus the volumes of import handled at the port is substantially low which highlights the purpose of the port and how it is used as an import handling port focusing on providing for the surrounding port industries.

Table 5-3 shows the development of port throughput and the import and export balance during the years 2004 – 2018.

Table 5-3: Mongla Port Cargo Throughput Development 2004 – 2018 [Consultant, based on [17]]

Import & Export handled at Mongla Port 2004-2005 to 2018-2019 (metric tones)

Year	Total		Total Im- and Exports	Shares in Total Import and Exports		
	Imports	Exports		Imports (%)	Exports (%)	Exports & Imports (%)
2004-2005	1.254.374	221.798	1.476.172	84,97%	15,03%	100,00%
2005-2006	1.215.072	267.572	1.482.644	81,95%	18,05%	100,00%
2006-2007	662.263	252.112	914.375	72,43%	27,57%	100,00%
2007-2008	518.309	204.525	722.834	71,71%	28,29%	100,00%
2008-2009	929.714	208.112	1.137.826	81,71%	18,29%	100,00%
2009-2010	1.502.050	147.233	1.649.283	91,07%	8,93%	100,00%
2010-2011	2.529.853	166.418	2.696.271	93,83%	6,17%	100,00%
2011-2012	2.482.432	137.465	2.619.897	94,75%	5,25%	100,00%
2012-2013	2.946.222	201.352	3.147.574	93,60%	6,40%	100,00%
2013-2014	3.402.402	141.547	3.543.949	96,01%	3,99%	100,00%
2014-2015	4.429.449	100.830	4.530.279	97,77%	2,23%	100,00%
2015-2016	5.709.664	87.857	5.797.521	98,48%	1,52%	100,00%
2016-2017	7.428.105	85.622	7.513.727	98,86%	1,14%	100,00%
2017-2018	9.568.899	147.151	9.716.050	98,49%	1,51%	100,00%
2018-2019	11.179.878	135.131	11.315.009	98,81%	1,19%	100,00%

The share of imports in total port throughput increased from around 80% before 2010 to nearly 99% in the FY 2018/2019. The total port throughput increased during the reference period from 1 – 1.5 million tons in the last decade most recently above 10 million tons and achieved 11.3 million tons of cargo in the FY 2018/2019.

5.4 Container Handling

Mongla Port handed around 58,000 standard containers, measures in Twenty Feet Equivalent Units (TEU) in the last year. The container throughput fluctuated by around 20 – 30,000 TEU before 2010/2011, with increasing dynamics from this term onwards, see Figure 5-5

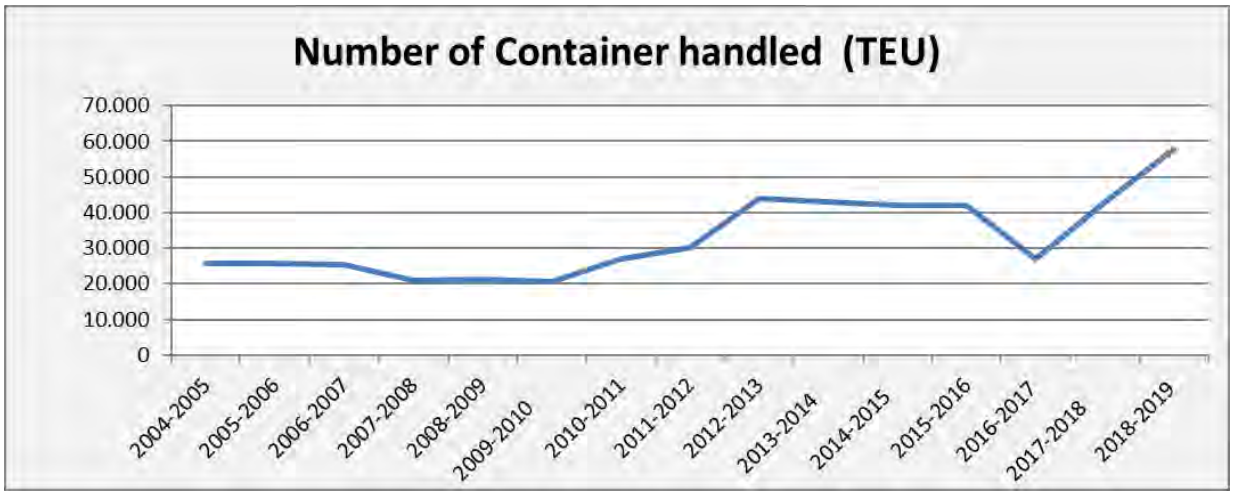


Figure 5-5: Container Throughput Development 2004 – 2018 [Consultant, based on [17]]

The development in container handling is less dynamic compared to the bulk or break bulk and vehicle throughout development but more balanced regarding import and export than the commodity throughput. The rational is that empty container handling filling the gap between container handled with load and without, per direction.

The ratio between handling of 20 feet containers and 40 feet containers is nearly balanced (1.45 during 2004 and 2018, fluctuating recently around 1.5). In other words, nearly half of the containers handled are 40 feet containers, the other 50% 20 feet containers.

Table 5-4 shows the number of container vessel calls per each year, and the containers and cargoes handled per vessel call. The figures show that Mongla is a feeder port, with container feeder vessels calling further ports before sailing from or to one of the regional container hub ports Singapore, Tanjung Pelepas or Colombo.

Table 5-4: Mongla Port Container Traffic 2004 – 2018 [Consultant, based on [17]]

Year	Containers handled per container ship call	Total containerized cargo per ship	Total containerized cargo (metric tons) per	
	TEU	metric tons	TEU	BOX
2004-2005	558	4.062	7,29	10,33
2005-2006	581	3.941	6,78	9,32
2006-2007	539	3.582	6,64	9,24
2007-2008	536	3.738	6,98	9,86
2008-2009	451	3.029	6,72	9,60
2009-2010	626	4.371	6,99	10,12
2010-2011	616	4.805	7,80	10,94
2011-2012	858	7.189	8,38	11,21
2012-2013	933	7.759	8,31	11,79
2013-2014	597	4.682	7,84	11,57
2014-2015	629	4.364	6,94	10,99
2015-2016	912	5.930	6,50	10,66
2016-2017	728	6.068	8,33	13,02
2017-2018	977	8.428	8,63	13,07
2018-2019	962	8.035	8,35	12,21

5.5 Modal Distribution

The present modal split of Mongla Port is characterised by road transport for general cargoes by land-side transport of all products of the local industry, and regarding dry bulk commodities by road and by inland water transport. In this respect interim transhipment transport by barge / inland water transport from midstream operations at lightering places to the port jetties is counted as to our understanding once only. Same for the transport between Mongla Port and Khulna, e.g. to the Roosevelt Jetty belonging to and operated by MPA around 40 km upstream at Khulna.

Table 5-5 and Table 5-6 show the assumed modal share in hinterland traffic of the Port of Mongla as per information received from stakeholders and logistics profiles of reach cargo handling type and lead commodity. The robust estimated include the flows from ship - shore handed cargoes to the port industry. These cargoes are often transported by mechanical equipment and not by vehicles.

Table 5-5: Assumed Modal Split in Hinterland Traffic of Mongla Port 2018 – Import/inbound [Consultant]

Commodities		2018				
		Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total
1	**Dry Bulk Cargo**					
1.1.	Grap or Conveyer					
	Coal	25%	50%	25%	0%	100%
	Cement clinker	90%	10%	0%	0%	100%
	Gypsum	90%	5%	5%	0%	100%
	Lime stone	90%	5%	5%	0%	100%
	Slag, sand, gravel etc.	75%	5%	20%	0%	100%
	Other dry bulk	60%	20%	20%	0%	100%
1.2	Grap, rain protected					
	Fertilizers	20%	50%	30%	0%	100%
	C.Bone/B. Griest		25%	75%	0%	100%
	Salt		25%	75%	0%	100%
	Other cargoes	20%	20%	60%	0%	100%
1.3	Protected or pneumatic handling					
	Grain	60%	10%	30%	0%	100%
	Soya beans, oil seeds	60%		40%	0%	100%
	Fly Ash	80%	20%		0%	100%
	Other cargoes	20%	10%	70%	0%	100%
2	**Liquid Bulk**					
2.1	Oil and fuel					
	Crude Oil	100%			0%	100%
	Mineral oil fuel products	10%		90%	0%	100%
2.2	Liquid gas					
	Liquid Gas LPG	100%			0%	100%
	Liquid Gas LNG	100%			0%	100%
3	**General Cargo**					
3.1	Break Bulk (eg.g. iron/steel, paper, wood)	10%	10%	80%	0%	100%
3.2	Cars and vehicles			100%	0%	100%
3.3	Heavy lifts, project cargo, machinery	5%	5%	90%	0%	100%
3.4	Bags or bails, palletized or not	30%	10%	60%	0%	100%
3.5	Containerization affine cargoes					
	Chemical products	0%	0%	100%	0%	100%
	Fish, meat, fruits, other perishables	5%	0%	95%	0%	100%
	General cargoes, n.e.s	5%	0%	95%	0%	100%
4	**Containers handled**	**10%**	**0%**	**90%**	**0%**	**100%**

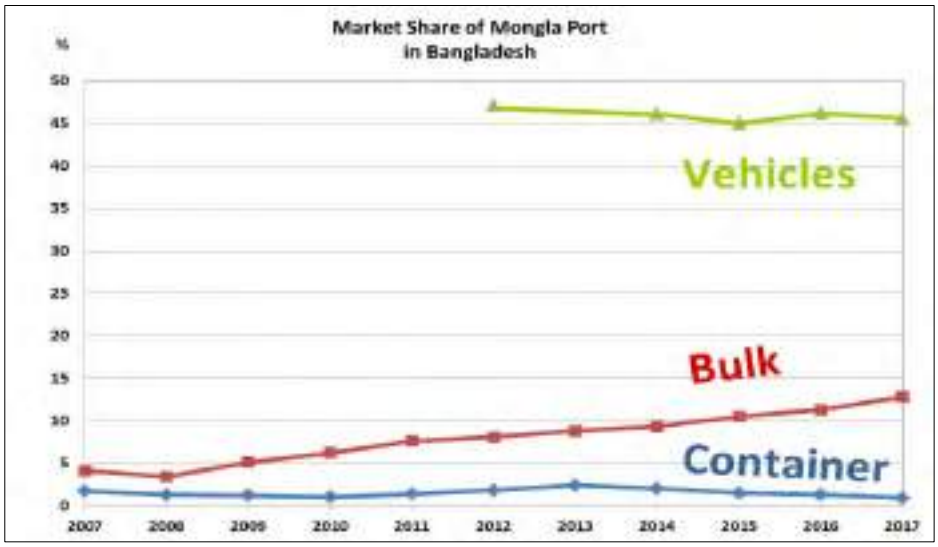
Table 5-6: Assumed Modal Split in Hinterland Traffic of Mongla Port 2018 – Export/outbound [Consultant]

Commodities		2018				
		Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total
1	**Dry Bulk Cargo**					
1.1.	Grap or Conveyer					
	Coal	0%	50%	50%	0%	100%
	Cement clinker	0%	50%	50%	0%	100%
	Gypsum	0%	20%	80%	0%	100%
	Lime stone	0%	50%	50%	0%	100%
	Slag, sand, gravel etc.	5%	45%	50%	0%	100%
	Other dry bulk	5%	20%	75%	0%	100%
1.2	Grap, rain protected					
	Fertilizers	0%	50%	50%	0%	100%
	C.Bone/B. Griest		0%	100%	0%	100%
	Salt		10%	90%	0%	100%
	Other cargoes	20%	5%	75%	0%	100%
1.3	Protected or pneumatic handling					
	Grain	10%	10%	80%	0%	100%
	Soya beans, oil seeds		10%	90%	0%	100%
	Fly Ash	10%	60%	30%	0%	100%
	Other cargoes	20%	0%	80%	0%	100%
2	**Liquid Bulk**					
2.1	Oil and fuel					
	Crude Oil	0%		100%	0%	100%
	Mineral oil fuel products	10%	10%	80%	0%	100%
2.2	Liquid gas					
	Liquid Gas LPG	100%			0%	100%
	Liquid Gas LNG	100%			0%	100%
3	**General Cargo**					
3.1	Break Bulk (eg.g. iron/steel, paper, wood)	0%	5%	95%	0%	100%
3.2	Cars and vehicles			100%	0%	100%
3.3	Heavy lifts, project cargo, machinery	0%	0%	100%	0%	100%
3.4	Bags or bails, palletized or not	60%	10%	30%	0%	100%
3.5	Containerization affine cargoes					
	Chemical products	50%	0%	50%	0%	100%
	Fish, meat, fruits, other perishables	15%	0%	85%	0%	100%
	General cargoes, n.e.s	10%	0%	90%	0%	100%
4	**Containers handled**	**10%**	**0%**	**90%**	**0%**	**100%**

The assumed shares applied to inbound and outbound port throughput of the reference year suppose that out of the 11.2 million tons unloaded in 2018/2019, 5.7 million tons of imported cargoes are destined to the local port industry, 2.8 million tons to inland navigation and 2.65 million tons leave the port by road (see Appendix D for details). The figures for export amount for 30,762 tons from local industry, 3,100 tons by inland water transport and 135,131 tons for export are carried to Mongla Port by road.

5.6 Market Share of Mongla Port

Cargo is always following the most economic available transport chains and ways. This is even more the case with containers due to their intermodal ability. Hence not only the capacity of Mongla needs to be increased by several folds but also competitiveness of the routing via Mongla should become subject of considerations. The market share of Mongla Port in Maritime Transport of Bangladesh is summarised in Figure 5-6.



Source: CPA & MPA

Figure 5-6: Market Share of Mongla Port in Maritime Cargo Handling

The throughout development of Chittagong during recent years is summarised in Appendix E for reference. Chittagong is the main port of Bangladesh as shown in Table 5-7.

Table 5-7: Cargo Throughput Chittagong Port 2006 – 2017

Year	Cargo Throughput in metric tons			Shares in percent		
	Import	Export	Total	Import	Export	Total
2005-2006	23.169.874	2.926.430	26.096.304	88,8%	11,2%	100,0%
2006-07	23.836.293	2.973.799	26.810.092	88,9%	11,1%	100,0%
2007-08	25.346.057	2.300.520	27.646.577	91,7%	8,3%	100,0%
2008-09	26.680.159	3.763.747	30.443.906	87,6%	12,4%	100,0%
2009-10	32.813.235	4.389.342	37.202.577	88,2%	11,8%	100,0%
2010-11	39.914.145	4.980.375	44.894.520	88,9%	11,1%	100,0%
2011-12	36.184.931	4.716.374	40.901.305	88,5%	11,5%	100,0%
2012-13	38.312.028	5.059.640	43.371.668	88,3%	11,7%	100,0%
2013-14	41.960.170	5.336.334	47.296.504	88,7%	11,3%	100,0%
2014-15	43.388.406	5.839.986	49.228.392	88,1%	11,9%	100,0%
2015-16	39.622.398	5.971.634	45.594.032	86,9%	13,1%	100,0%
2016-17	81.549.460	6.725.616	88.275.076	92,4%	7,6%	100,0%
2017-18	78.100.447	6.997.465	85.097.912	91,8%	8,2%	100,0%

Source: CPA, summarized by Statistical Yearbook of Bangladesh, Bangladesh Bureau of Statistics,several isses

While Mongla Port is already handling constantly almost half of Bangladesh's vehicle shipments (entirely imports) and its share in bulk handling is even rising it is the important

containerised cargo, which – being already at low level – has even lost market share over the last years.

For the time being two core problems constrain the growth of Mongla Port, i.e. its ability to take a significantly higher share of Bangladesh's seaborne container trade:

- The port is not well connected to the hinterland, and
- It has a serious problem with the available draft.

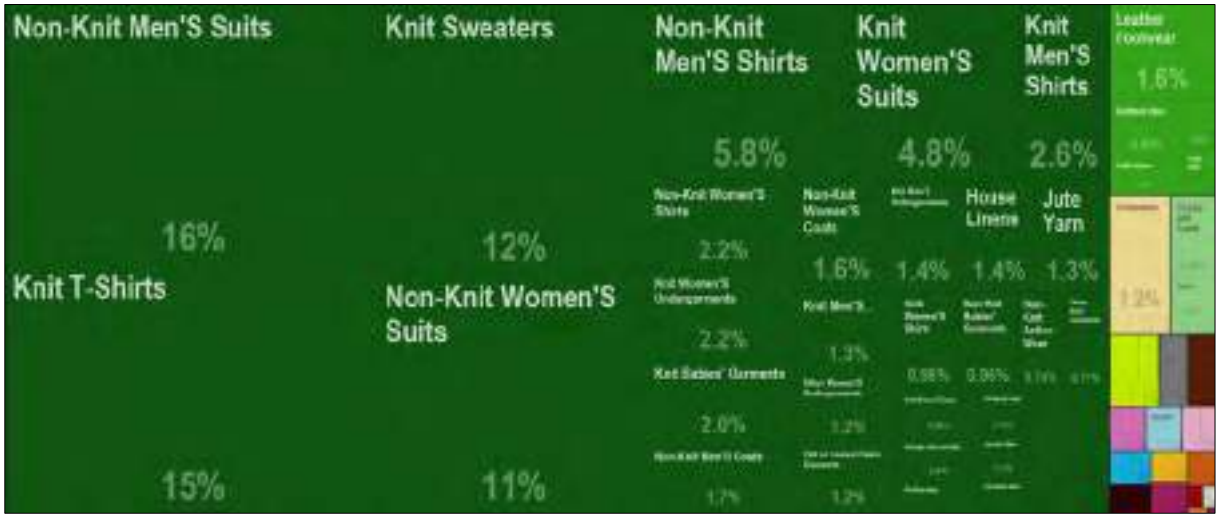
If Mongla Port shall increasingly participate in container trade, relax capacity stress at Chittagong Port for the economic benefit of the entire nation and act as regional economic booster for light industry and manufacturing, the capacity of Mongla Port has to be raised significantly and the hinterland infrastructure once established or improved has to be competitively operated in terms of costs, capacity and reliability.

6 Container Trade and Intermodal Handling

6.1 Container Trade Developments in Bangladesh

In 2018 it is estimated that Bangladesh shipped goods around the globe worth USD 42.2 billion in total. According to Figure 6-1 about 90% of this value was textiles and clothing.[2] There is no other country in the region and probably not even in the world which is so heavily dependent on this industry, see Figure 6-2.

Furthermore, footwear, frozen food as well as jute and leather products contribute to the country's export earnings. The most important import commodities for Bangladesh are petroleum products, edible oils, cotton, machinery and equipment. Due to the principal export commodity of ready-made garments a large quantity of yarn and textiles are required to be imported.[3]



Source: OEC[4]

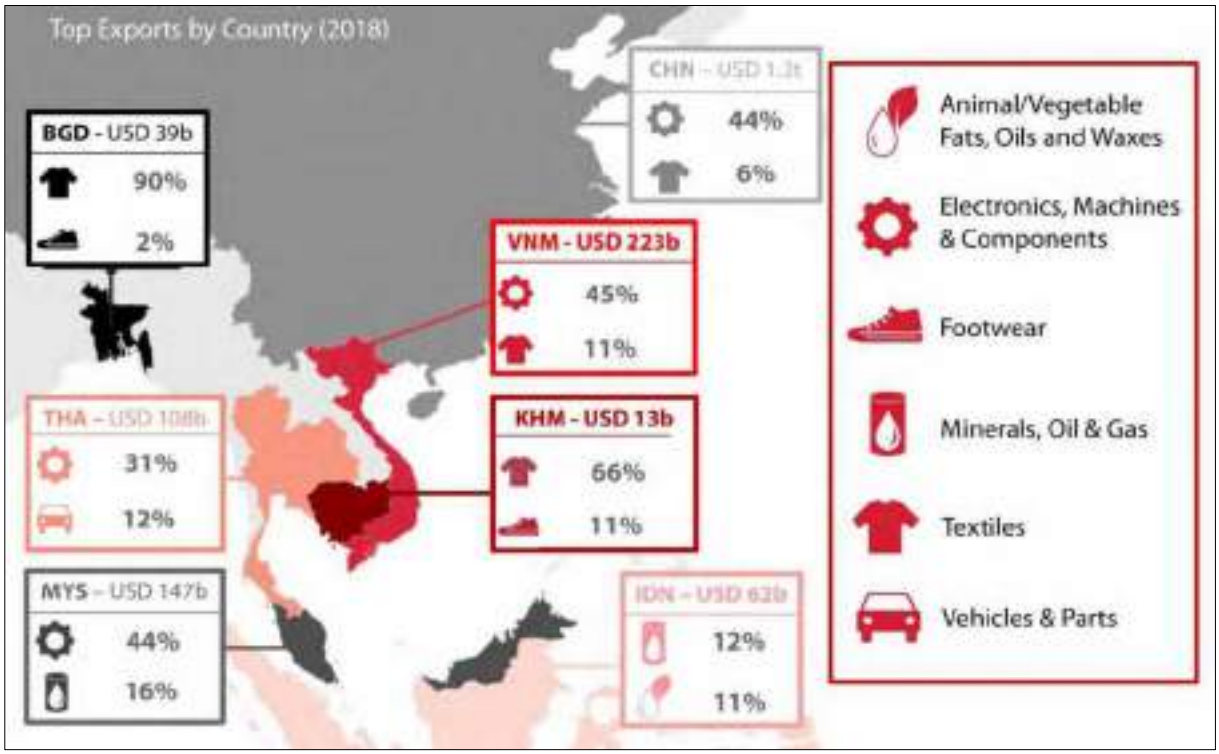
Figure 6-1: Composition of Bangladesh's exports

Textile exports are almost completely shipped in containers. As textiles are generally a low value commodity (at least by its ex-factory value) container logistic costs contribute with a high percentage to its Cost including Freight (CIF) value and hence determines the competitiveness of the nation's dominating export product on the world market.

[2] www.worldstopexport.com (last accessed: Nov. 25, 2019)

[3] People's Republic of Bangladesh: Strategic Master Plan for Chittagong Port, 2015

[4] https://oec.world/en/visualize/tree_map/hs92/export/bgd/all/show/2017/



Source: Fiducia Ltd, Hong Kong

Figure 6-2: Structure of Exports of top textile producers

To a large extend fuelled by the success of its textile industry Bangladesh is experiencing a substantial growth in its annual seaborne container trade for many years now which is distributed only among the seaports of Chittagong and Mongla, see Figure 6-3.

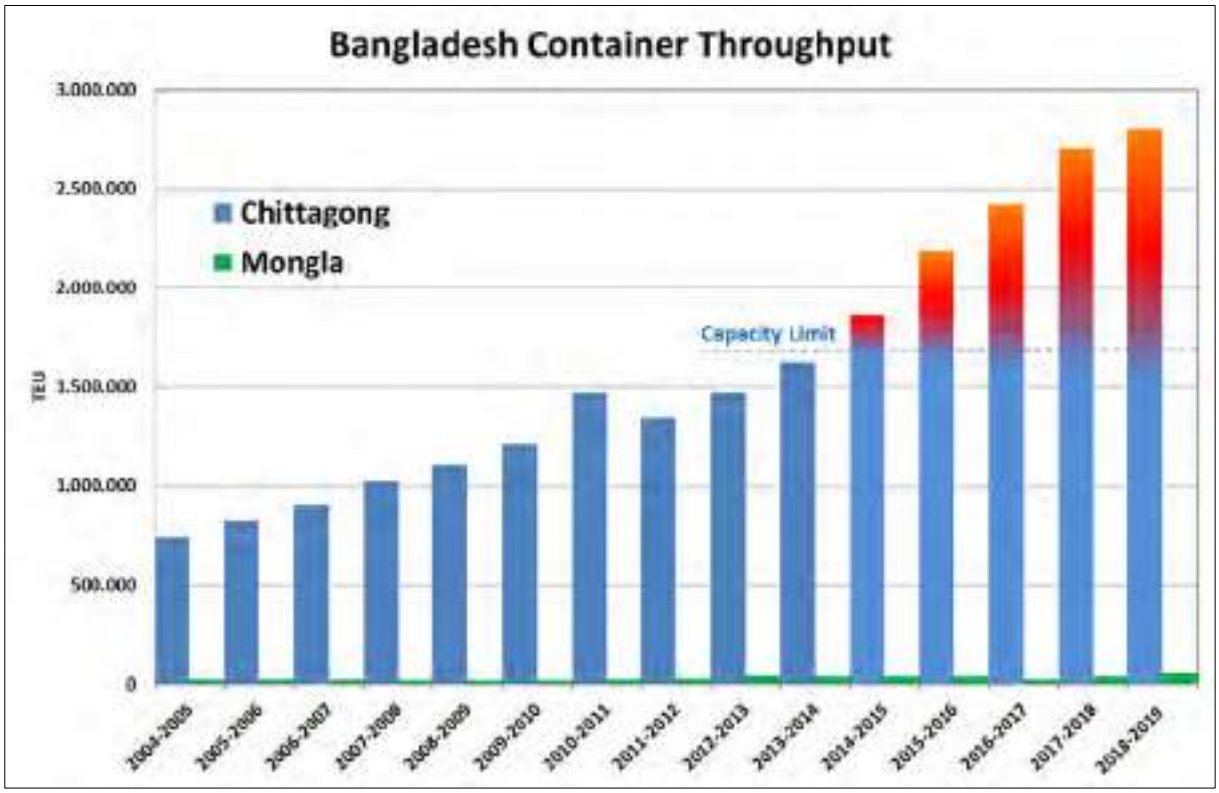
The development of efficient container handling capabilities, container related hinterland transport and logistics over the last decades has shown and will continue to show relevance for the economic development of Bangladesh as a major textile producing and an evolving manufacturing nation.

Bangladesh as nation faces a serious port infrastructure and port capacity deficit. Chittagong as the main port of Bangladesh has been already operating above its nominal capacity limit for a long time. In the financial year 2018/19 Chittagong handled 2,8 Mill TEU – well over its design capacity of approx. 1,7 Mill. TEU. Operating a port above capacity limit always causes increased congestion, delays and costs to all parties involved.

The situation of Mongla as the only other operational seaport able to handle containers is different from that of Chittagong as its key problem is a lack of traffic, rather than too much. Hence there is still some room to manoeuvre. Mongla handled only 58,000 TEU over the same period while it has a theoretical capacity of around 100,000 TEU.[5]

From Figure 6-3 in can be seen that Chittagong is handling most of the entire container volume of the nation.

[5] World Cargo News, Oct. 2019



Source: CPA & MPA

Figure 6-3: Bangladesh Container throughput by main ports 2004 – 2018

With a share of 1% to 3% Mongla has contributed only a fraction over the last years. Even if Mongla worked at its full present capacity it would hardly provide capacities to release pressure from container supply chains via Chittagong.

6.2 Container Hinterland Logistics

The Dhaka region is the centre of the Bangladesh's economy. Almost all consumer goods, manufacturing products and particularly export production from the entire textile industry are related to locations within or around capital. Dhaka is hence at present origin and destination of most of the containerised cargo.

6.2.1 Intermodal Transport in Bangladesh

At present virtually all containers from/to the Dhaka region are routed via Chittagong whereas almost no containers are carried between Dhaka and Mongla. The Chittagong-Dhaka Corridor offers three modes of transport. 70-80% of the containers handled in Chittagong are destined for or originating from Dhaka/Narayanganj area being the main consumption and distribution centre. Presently 90% of the containers are unstuffed/stuffed in Chittagong Port, ICDs in Chittagong and transported as conventional general cargo. Only 10% of the containers are loaded on rail and transferred to Kamlapur Inland Container Depot in Dhaka (KICD), managed and operated by Chittagong Port Authority. KICD was built to resolve the container congestion and to quickly handle Dhaka based containers.

Traffic along the Dhaka-Chittagong corridor is mainly dominated by road service.[6] [7] Currently 95.6% of the 70% of containers going to Dhaka are transported by road; rail moves 4.4% of the containers to Dhaka.[8] Inland navigation plays at present a minor role but provides potentials for increases.

6.2.1.1 Railways

Railway container service in Bangladesh started in 1987, with the debut of the Dhaka-Chittagong parcel express train. This pure container train was introduced in 1991. The related Dhaka Inland Container Depot (DICD), Dhaka, is near Kamalapur Railway Station. The existing rail road distance between Dhaka-Chittagong is 321 km. Three daily trains each are hauling between 120 and 160 TEU are plying between Chittagong and Dhaka.[9]

Table 6-1: Container Handling in Chittagong

FY	CPA throughput [TEU]	DICD throughput [TEU]	DICD share of CPA
2010-11	1.468.914	65.187	4,4%
2011-12	1.343.408	66.705	5,0%
2012-13	1.468.713	62.638	4,3%
2013-14	1.625.509	59.984	3,7%
2014-15	1.866.942	36.831	2,0%
2015-16	2.189.439	37.885	1,7%
2016-17	2.419.481	72.998	3,0%
2017-18	2.705.909	74.741	2,8%
2018-19	2.800.000	88.850	3,2%

According to Table 6-1 DICD has not yet achieved to shift many containers from road to rail. Although DICD is operating close to its capacity limit its current share of CPA's throughput is decreasing.

DICD has a holding capacity of approximately 4,000 TEU. Train capacity is expected to increase significantly when the double tracking of the railway line between the port and Dhaka is completed in 2020. The facility has been operating at near capacity for many years and cannot be increased because of its constraints for expansion. A second facility is urgently needed.

There have been several proposals for a new ICD in Dhaka. The government suggested a new ICD near Dhirasram railway station attached to the Dhaka eastern bypass. To bring the expected efficiency in container handling, the handling capacity of the proposed ICD would be 354,000 TEU and would be developed on approximately 55 ha of land and have a railway spur of 6 km connecting the ICD with the national railway network. There have been proposals also

[6] Habib, Z. / Noor, Albab: Prospects of Inland Waterways for Freight Traffic Movement along Dhaka-Chittagong Corridor and Constraint Analysis of full Operation of the Pangaon Inland Container Terminal, 3rd International Conference on Civil Engineering for Sustainable Development, Khulna, Bangladesh, 2016

[7] Dey, P. et al., Emergence of Inland Container Depots (ICDs) and Inland Container Terminals (ICTs) as a Container Decongestion Strategy of Chittagong Port Authority, Maritime University, Dhaka 2016

[8] People's Republic of Bangladesh: Strategic Master Plan for Chittagong Port, HPC/KS/Sellhorn, 2015

[9] Chittagong-Dhaka rail expansion critical, JOC.com, Jan 21, 2019

for another ICDs near the Banglabandha western rail station and one in the Pubail area in Gazipur district. Appendix J provides brief descriptions of the ICT facilities for reference.

6.2.1.2 Inland Waterways

To date, none of the railway-related projects have matured into implementation. This issue has fostered the emergence of ICTs for barge transport in the Dhaka area supported by the natural infrastructure. The scarcity of land and current road congestion will obviously lead the country to transport more and more cargo through waterways, switching from roadways.

To utilise the waterway between Chittagong and Dhaka the Pangaon Inland Container Terminal (PICT) was inaugurated in 2013 in the Dhaka area. The terminal was intended to help reduce the costs of carrying containers between Dhaka and Chittagong and to ease the traffic pressure on the highway and the railway link between both cities. Bangladesh Inland Water Transport Authority (BIWT) and Chittagong Port Authority (CPA) jointly built the terminal. Official sources are reporting that the terminal handles presently 116,000 TEU p.a.[10] From the industry 100,000 TEU are being reported while its capacity is said to be 160,000 TEU p.a.[11] However official figures from CPA are much less.

The Pangaon Inland Container Terminal (PICT), the first inland container terminal in Bangladesh, was built at South Keraniganj of Dhaka district, see Figure 6-4.

Figure 6-4: Aerial View of of Pangaon ICT [Google Earth 2019]

PICT is considered as being a government terminal. There are also three private ICTs with water access of which two are under construction, see Table 6-2. Upon completion of the construction works a total handling capacity of approx. 1 million TEU shall be provided[12]. Appendix J provides brief descriptions of the ICT facilities for reference.

[10] www.pict.govt.bd (last accessed in October 2019)

[11] Information by Karim Shipping, Dhaka, Oct 2019

[12] Source: Dey et al.17.

Table 6-2: Private ICTs beside PICT in the Dhaka area

Terminal	Planned capacity (TEUs)	Land area	Waterfront access (m)	Status of operations
SAPL (Summit Alliance Port Limited)	Phase 1: 60,000 TEUs; Phase 2: 60,000 TEUs	Phase 1: 15.15 acres; In the process of acquiring 22 acres	215 m Phase 1: 80 m; Quay: 4.5~5 m Draft alongside	Started operation
Rupayan Group	Phase 1: Full: 375,000 TEU	30-acre Phase 1; Additional land acquired	2 × 90 m quay Expansion +90 m	Approval granted Land purchased Design completed Under construction About 40% complete
Ak Khan Group	1st phase: 140,000; 2nd phase: 70,000; Final: 336,000 (in total)	1st phase: 30 acres; In total 50 acres	1st phase: 2 jetties With length of 90 m each.	Approval granted Land purchased Land filling initiated Design completed

The distance of the river route from Chittagong to Dhaka is approximately 157 nautical miles or 290 kilometres. The draft of the river is around 4 - 5 m except for some shallow areas. At high tide vessels with 4 - 5 metre draft can safely navigate. Due to limits in Dhaka the maximum dimensions of the vessels on the route are 83 m x 15 m x 4 m (L x B x D), with a transport capacity of between 128 - 184 standard containers (TEU).

As a major part of the waterway between Chittagong and Dhaka is via the open sea (coastal waters) the vessels need to be classified as coasters or river/sea vessels respectively. Less than 10 vessels are engaged in the trade. They are not exclusively dedicated to the Chittagong-Dhaka service but also deployed in other coastal trades for bulk commodities.

Figure 6-5 shows one of the vessels deployed on the Chittagong to Dhaka trade.

Figure 6-5: M/V “Pangaon Express” [PICT]

Sister vessels M/V. "KSL Gladiator" and M/V. "KSL Pride" are operated by the private Karim Shipping Group, Dhaka, and have also been purchased 2nd hand from China (both built 2008). (see Appendix F for further vessel details).

Since the procurement of the vessels CPA could not attract a sufficient number of intermodal shipments by waterways between Pangaon ICT and Chittagong Port.[13]

Cost Comparison

The water transport of containers between Chittagong and PICT is regulated by CPA tariff (co-owner of PICT). According to the mandatory “free in and out” (FIO) tariff for all – even private – carriers on the route container transport and handling cost are according to Karim group between 264 USD and 360 USD to ship a 20 ft or 40 ft container respectively (see Appendix J).

Time

It takes approx. 24 hours (including all waiting times for tide and restricted navigability) to ship a container on the waterway between Chittagong and Dhaka ICD. both cities. There is no fixed sailing schedule as all operators will line up and wait until their vessel is full. This system results into 2 - 3 sailings per week at present.

Importance and Market Share

After a start at a measured pace six years ago the utilisation of PICT (measured against its published capacity of 116,000 TEU p.a.) has meanwhile improved but is still only in the 20% range. The easing effect on CPA's hinterland traffic is negligible with a marginal share in the entire throughput, see Table 6-3.

Table 6-3: CPA and PICT container throughput 2013-2018 [Source: CPA]

	FY	CPA throughput [TEU]	PICT throughput [TEU]	PICT utilisation	PICT share of CPA
starting year	2013-14	1.625.509	435	0,38%	0,03%
	2014-15	1.866.942	678	0,58%	0,04%
	2015-16	2.189.439	2.856	2,46%	0,13%
	2016-17	2.419.481	11.997	10,34%	0,50%
	2017-18	2.705.909	28.704	24,74%	1,06%
	2018-19	2.800.000	21.674	18,68%	0,77%

6.2.1.3 Roads

It takes approximately 12 to 15 hours, with peaks up to more than 24 hours, to transport goods by road from Chittagong Port to Dhaka (242 km). Industry contacts note that the estimated transportation cost for transport of 20 / 40 feet container amount for between 190 to 202 USD and 278 to 291 USD in 2015.[14]

[13] The Nation, 3. Sep. 2015

[14] Chittagong Port Overview and Other Inland Transportation, GAIN Report, Jan 2016

6.2.2 Summary of Time and Cost of Intermodal Hinterland Transport

Figures on time and costs of the three modes of transport vary from source to source. A comprehensive overview is given by in Table 6-4.

Table 6-4: Alternative conditions for container transportation between Dhaka area and Chittagong[15]

Modes	Expenditure	Time required
Road	US$ 337.5 (regardless of weight)	24 hours (including road congestion and shifting system imposed on trucks and trailers)
Rail	US$ 187.5 (regardless of weight)	12 hours (including preferential passenger shuttle compliance)
Inland Waterway	US$ 165 (up to 15 ton) US$ 195 (above 15 ton to 20 ton) US$ 225 (above 20 ton to 25 ton) US$ 265 (above 25 ton)	24 hours (including all waiting times for tide and navigability)

From various sources these flows have been compiled assuming that 80% of the throughput in Chittagong is bound for the Dhaka area and needs respective on-carriage (the width of the columns corresponds with the number of TEU). It is observed that the main flow uses the road between Chittagong and Dhaka and is consisting of break bulk.

Containers or almost destined or originated in Dhaka area. Mongla does not possess about rail connections and hence cannot provide intermodal services without inter-trucking between the port and Khulna. Intermodal capacities for transport between Chittagong and Dhaka are underutilized and not highly accepted by the market players. Hence the intermodal advantages the container system can provide are at present widely not used in Bangladesh. Instead, most of the cargo volume is stuffed/unstuffed in local ICDs, loaded from/to smaller (often overloaded) trucks, managed by middlemen and causing extra costs, much loss of time and an additional risk for damage or loss.

Mongla does currently not make any nameable contribution to the container logistics to/from Dhaka. Almost all containers which are handled in the port are stuffed/unstuffed within the port. Some cargo might be carried as loose break bulk to/from Dhaka on the road. The road connection is less convenient (although shorter) as it is interrupted by a ferry crossing (until the opening of the Padma Bridge) and due to the condition of the road there is almost no container neither break bulk seaborne cargo from/to Dhaka via Mongla.

Figure 6-6 shows that taking a substantial part of the Chittagong container trade to Mongla would be quite a challenge at present conditions.

[15] Dey, P. et al., Emergence of Inland Container Depots (ICDs) and Inland Container Terminals (ICTs) as a Container Decongestion Strategy of Chittagong Port Authority, Maritime University, Dhaka 2016

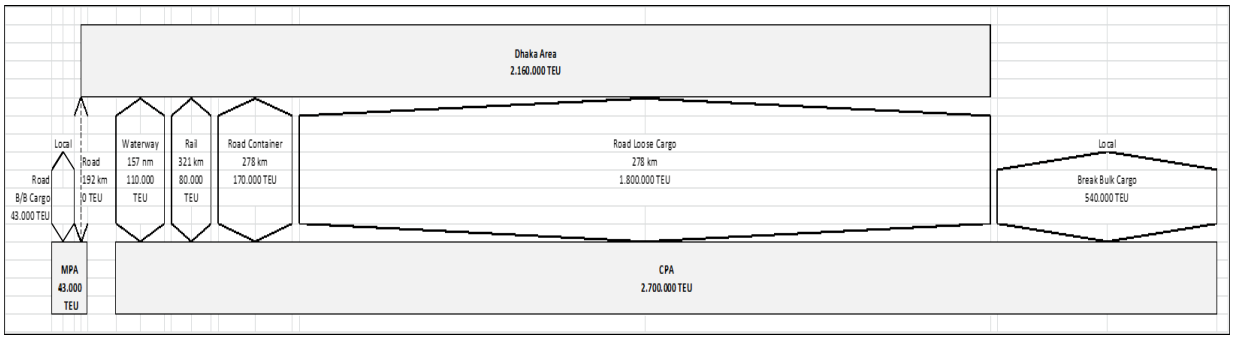


Figure 6-6: Estimated distribution of container cargoes between Dhaka and the seaports 2017/ 2018

6.2.3 Future Developments in Hinterland Logistics

It is expected that the Padma Bridge will be opened in 2020. Then, the distance from Dhaka to Mongla through Padma Bridge will be only 170 km whereas the distance from Dhaka to Chittagong is about 260 km.[16] The bridge will certainly improve the hinterland connectivity of Mongla to the Dhaka region as Bangladesh's main source and destination of seaborne container cargo. Not only the missing bridge is hindering smooth road haulage between the region and the port. The entire length of the road needs to be in good conditions for efficient road transport, including the road Khulna – Mongla at the last kilometres. The present road conditions to connect the port of Mongla do not allow for efficient road transportation, particularly not for general cargoes or containers.

While these observations presently are further contributing to weakness of seaborne container logistics in Bangladesh establishment of reliable and efficient intermodal services could boost the market share of Mongla in Container trade.

6.3 Container Feeder Logistics

For the time being almost 58,000 standard containers (TEU) are handled in Mongla (FY 2018-19) are stuffed/unstuffed within the port limits or remain within the vicinity of the port. The market share of Mongla Port in Bangladesh container trade will increase once Patma bridge and improvements in hinterland accessibility and to Dhaka metropolitan areas have commenced.

A further pre-condition to improve Mongla Port's role in the container logistics of Bangladesh is that the port should become more attractive not only for the cargo owners / shippers in the port adjacent economic zones, the regional industry and in the hinterland but also for shipping lines. Both are dependent from each other. Without a shipping line serving the port on a regular basis no cargo can be shipped by nature. On the other side shipping lines needs the prospect of cargo potential to take the commercial risk to call at the port.

Even after the Padma Bridge will have been opened and even if a container train services are introduced between Mongla and Dhaka ICDs the port of Mongla will be hampered by its presently limited seaborne connectivity. Mongla Port is at present only connected to

[16] Feasibility Study for the Upgradation of Mongla Port, Department of Civil Engineering, Khulna University of Engineering & Technology, 2018

Singapore/Tanjun Pelepas by five and sometimes up to eight sailings per month, provided by only two shipping lines.

According to OEC[17] almost 2/3 of all Bangladesh's exports in 2017/18, mainly textiles, were destined to Western Europe. For this cargo routing via Colombo is generally shorter and more cost efficient. Another 18% were bound for North America. At least for the U.S. East Coast cargo the same would apply.

For the time being Chittagong is enjoying the advantage of being directly connected to Colombo by many shipping lines with between eight to ten sailings per month. There is no feeder link from Mongla to Colombo.

Instead, if using Mongla, the cargo had to deviate to Singapore/Tanjung Pelepas on the way to Europa or the U.S. East Coast which will last longer and will cost more, see Figure 6-7. The feeder rates from Mongla to Singapore are 150-200 USD/TEU higher than from Chittagong.[18] Sea freight from Singapore to Europe is furthermore another 100 USD/TEU higher than from Colombo. Hence a feeder link to Colombo as a real physical short cut would be vital for attracting more export container cargo via Mongla. The availability of a direct container feeder connection between Mongla and Colombo in addition to the connections towards Singapore and Tanjun Pelepas is also of key importance for sustainable success of imports and re-exports of the Free economic Zones and for success of manufactures and export oriented foodstuff producers and other industries, include jute and textiles, in port related industrial areas at Mongla and between Mongla and Khulna.

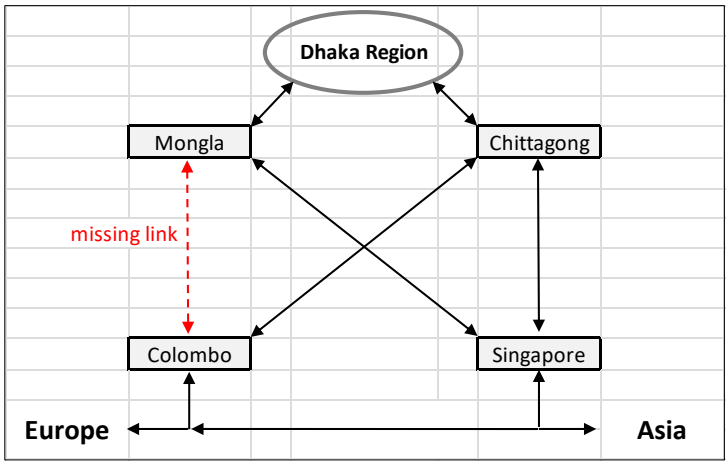


Figure 6-7: Present Container Lines' Connectivity of Mongla & Chittagong

Hence it is essential to develop intermodal hinterland transport once Mongla is accessible by rail, to promote the hinterland accessibility of Dhaka to the market once Patma Bride and is in operations and to market and to actively motivate suitable shipping lines to open feeder services between Mongla and Colombo. Development of efficient container handling facilities at Mongla Port, and of ICT and container related logistics services is a pre-requisite and hence a focus point for any port development planning.

[17] https://oec.world/en/visualize/tree_map/hs92/export/bgd/show/all/2017/

[18] Own estimate according to shipping line market information

7 Cargo Throughput and Economic Development

7.1 Subject of Forecasting

Most of the commodities handled at Mongla consisted of imports. Following the afore mentioned clustering system, the majority of non-containerised goods imported over recent years consisted almost entirely of cement inputs for local mills, coal for energy / electricity production, agricultural inputs, liquified gas and a small but increasing volume of road vehicles. Only the latter commodity is not destined to the port industry, yet. As other cargo was identified as of comparatively low importance, focus of further regression analysis and nationwide forecasting of these commodities, see Figure 7-1.

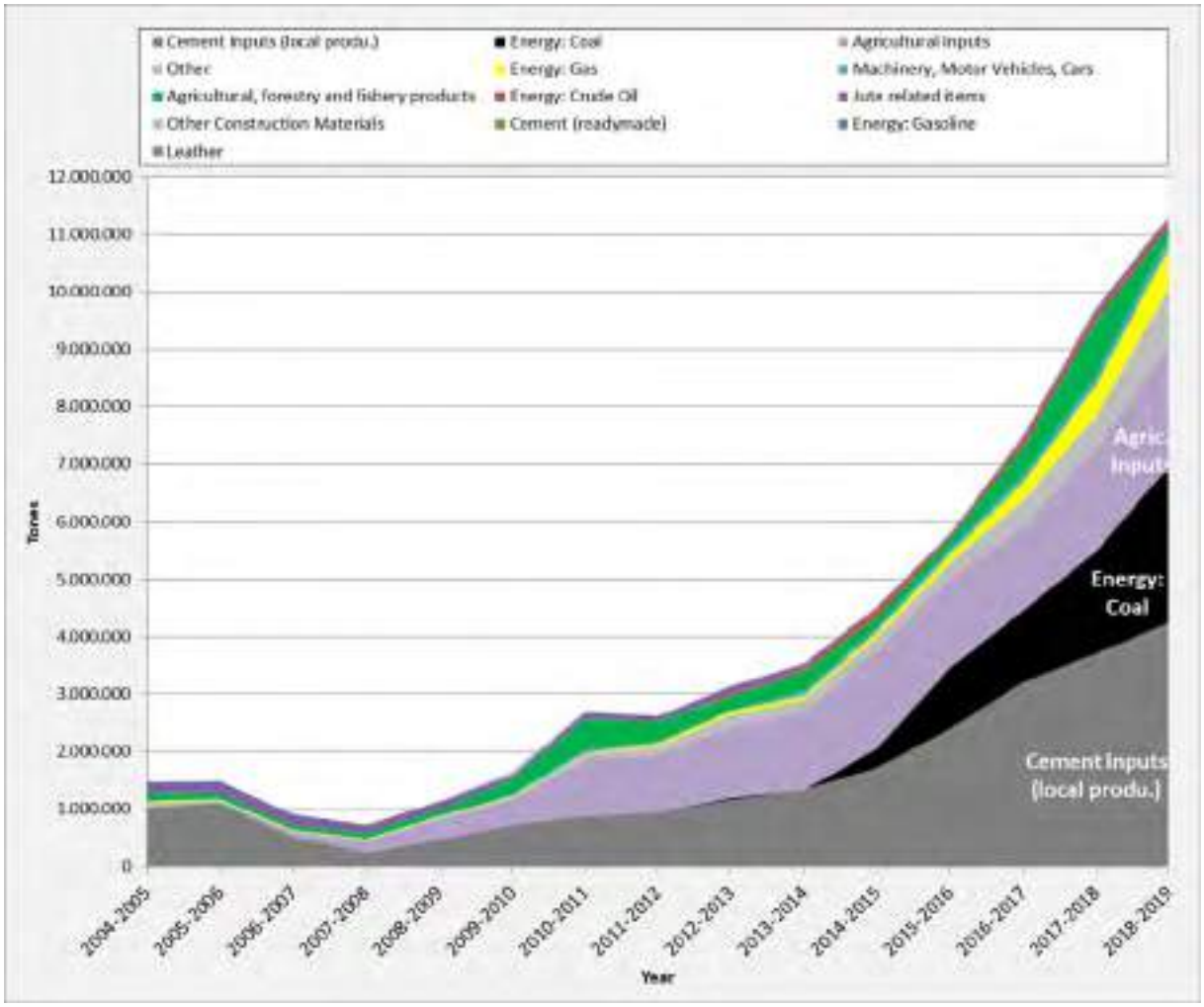


Figure 7-1: Non-containerised Commodities handled at Mongla Port from 2004 to 2019 [Consultant, based on [17]]

The exponential growth in the handling of the afore mentioned goods at Mongla Port could not be witnessed when observing solely containerised goods in metric tonnes, see Figure 7-2.

Sheer weight of containerised freight is, however, an insufficient indicator for the estimation of future port infrastructure needed to cater for cargo handling. Instead, such requires the use of

container cargo units, TEU or Number of containers as highlighted by previous chapter and by Appendix F elaborations.

However, as to the container throughput and cargo handling figures versus the port throughout statistics by commodities, it remained unclear as to whether 20-foot and 40-foot containers handled were counted by the port statistics separately and if or if not the weight of the boxes had been included in the port throughput statistics by commodities in metric tons.

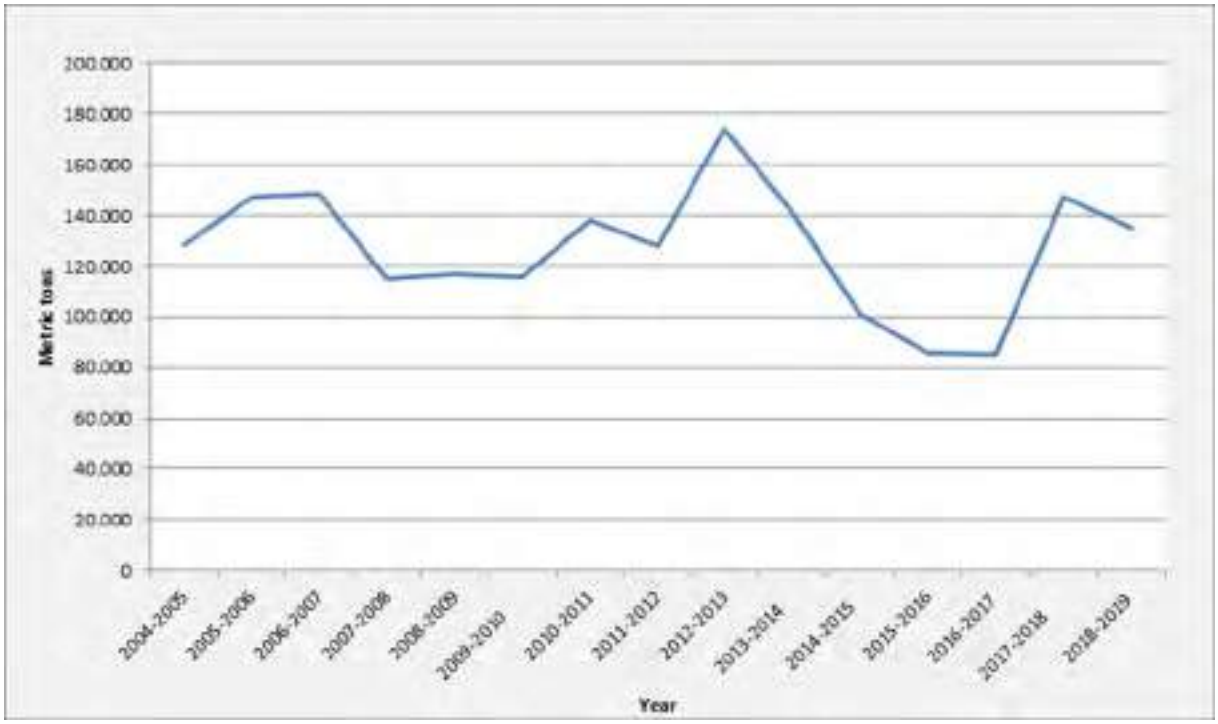


Figure 7-2: Containerised Cargo handled at Mongla Port from 2004 to 2019 in metric tonnes [Consultant based on [17]]

7.2 National Economic Development in Port Hinterland

To understand what shares of the thereby identified, nationwide amounts would in future pass through Mongla Port, the area of investigation and thereby the total potential hinterland of Mongla Port was defined in the next step.

This took place according research requirements as defined by MPA in formal and informal interviews throughout the course of research during the inception phase. The area thereby defined consist of the whole of Bangladesh, Nepal and Bhutan, as well as parts of north-east India. Myanmar was consciously excluded in the analysis, because hardly any railway or road infrastructure connections exist or is planned which would allow better access to this country from Mongla instead of from Chittagong.

Additionally, the locations of currently competing ports (Kolkata, Chittagong and Payra) as well as of those of ports under development in Bangladesh in future (Cox's Bazar) were mapped for further proceedings, see Figure 7-3, namely the identification of catchment areas, thus

regions which should utilise either of the mentioned ports to handle its cargo from an transport economic point of view.

Figure 7-3: Investigation area (green) with relevant ports [Consultant, based on [18]]

To then identify what shares of the total amount of goods will be required in the investigation area and be consumed in the catchment of Mongla Port, GDP per capita, imports and exports and population was analysed within these areas for the years 2020, 2030, 2040 and beyond (see Sections 7.3 and 8.1 for details). Thereby derived numbers were allocated according to shares of modes of transport in trade volumes according to distances and modal affinities to forecast traffic volumes of Mongla Port (see Section 8.3 for details).

7.3 Statistical Modelling / Regression Analysis

One of the most widely used statistical methods in different science is an implementation of regression techniques to determine the relationship between a dependent variable with one or more independent variables. The dependent variable, response and independent variables are also called explanatory variables.

A statistical model can be thought as an adequate summary, i.e. a representative smaller version of the data collected. It should summaries the data as closely as possible (be 'a good fit') but also be as simple as possible.

There are many different statistical measures used to access the variability of data, goodness of fit of data and some measurements to distinguish between two models to select the best model that explains the data best.

A multi variable linear regression models have been developed to predict the GDP growth using other macroeconomic key predictors in literature. Impact of each of these key variables

on GDP growth can be studied individually by analysing different regression analysis models [19].

In this study to predict the population, GDP, other socioeconomic indicators and commodity demand for Bangladesh and catchment areas of Mongla Port, different regression analysis and statistical models have been used and their performance has been compared to choose the best model that describes the data and predict values for the future.

First step in the analysis was to predict the population numbers for Bangladesh, India and Bhutan. National Bangladesh and UNDP Data served for the purpose as a guideline [20, 21, 22].

This was done using GDP, population and GDP per capita projections, transformed by linear regression analysis where appropriate as a second step. And the trend that fits the available data best was used to estimate values for lead variables.

When predicting data for the future different multi variable regression models were considered and the model that fits the data best (with respect to the statistical measures) was selected to predict the values for the future as depicted by Appendix G.

Then the same approach was used to predict the demand of the commodities of interest.

The explored future trends for GDP, population, goods imports and exports (in US$) and for foreign trade and for maritime goods exports and imports (in US$ and metric tonnes) until year 2040 were developed (see Appendix H). Trend analysis was performed using trend function which finds the line that best fits the data by using the least square method.

$y = b_1x_1 + b_2x_2 + \ldots + b_nx_n + a$

Where:

- y - the dependent variable you are trying to calculate.
- x - the independent variable you are using to calculate y.
- a - the intercept (indicates where the line intersects the y-axis and is equal to the value of y when x is 0).
- b - the slope (indicates the steepness of the line).

Maritime goods exports (US$) was calculated by subtracting total Imports of (India, Bhutan and Nepal) from total exports.

Similarly, maritime goods imports (US$) was calculated by subtracting total exports of (India, Bhutan and Nepal) from total imports. Port industry developments as well as e.g. allocation of new or additional enterprises affecting cargo flows due to the order of magnitude of their supply chains need to be assessed and projected in addition to the trend forecasts in order to achieve and to consider realistic future port throughput development. The industrial and the Mongla Port specific industrial and manufacturing developments like e.g. Rampal power plant commencement and the projected impacts on bulk handling in Mongla are summarized by Appendix I.

8 Port Hinterland Development Perspectives

8.1 Transport Economic and Human Geography Approach

The transport economic and geographic approach taken, was used to identify port catchment areas, thus the areas that will utilise services of / transport their cargo through either one of the ports within the investigation area (see Figure 7-3 in Section 7.2) by rail or road, because they are within the fastest reach of that port, and the population in these areas now and in future. This was eventually done to identify the shares of the afore identified, nationwide amounts of commodities that will pass through Mongla Port.

Identification of these catchment areas assumed that transport of cargo will be conducted in the most economically efficient way, that is, that cargo will be taken to that port that is within fastest reach of an area or region, using a specific road or rail network.

The first step in analysis was therefore to define territorial sub-units in the investigation area, thus places from or to where cargo would be transported.

This geographic division took place according to official units and further took account varying levels of detail needed for analysis as was derived from a first glance at the data at hand and by a set focus on areas of special interest, as was derived throughout the inception phase, see Figure 8-1.

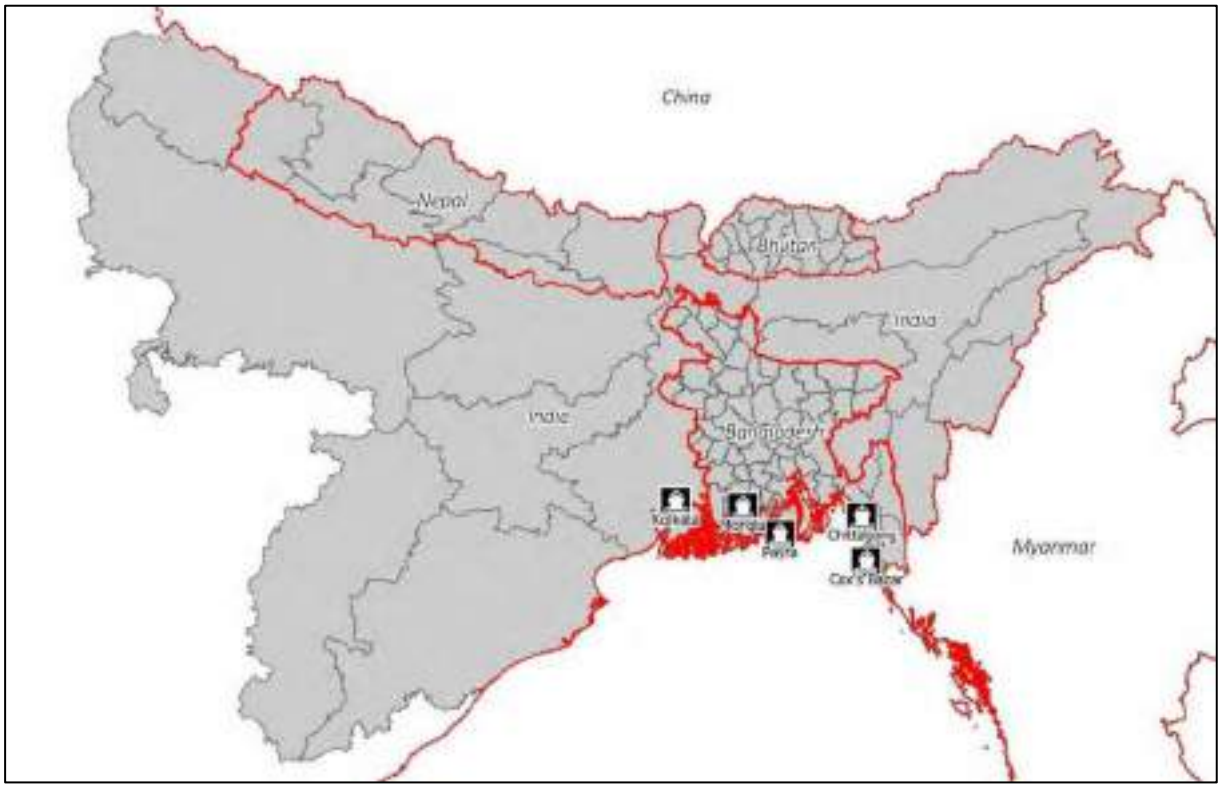


Figure 8-1: Geographic subdivision of investigation area (grey) with international borders (red) and relevant ports [Consultant based on [18]].

Within Bangladesh and Bhutan, subdivision therefore took place at district or Zilla level with the aim of thereby attaining a high level of geographic detail, whilst being able to later apply further public statistics to these areas, since such were hardly available at larger / sub-district or Upazila level.

Consideration of areas outside of Bangladesh allowed for higher level aggregations and were, therefore, subdivided accordingly by large levels. In India this was mostly done at state level with the exception being West Bengal. The areas of this State of India were further sub-divided into districts in later parts of the analysis. Division of Nepal took place at province level.

To then be able to compute where the time-wise closest port to each of these areas would be in terms of road and rail traffic, transport networks were needed as a further basis.

The next step was thus to map and model theses transport network within the investigation area, thus the mapping of rail and road networks with the geographic information system QGIS [23] for each of the years needed for the forecast.

The general basis for doing so, were digital maps of road and railway infrastructure provided by the OpenStreetMap Project and pertaining to the status of infrastructure in 2019 / fiscal year 2019/2020 [12]. These mappings cross-referenced with and partly corrected by official maps attained throughout the inception phase.

To further be able to conduct an analysis of the transport network for the years 2020, 2030, 2040 and beyond and to model rail and road networks, official Bangladesh government information was used as far as available. In sum, a sufficiently detailed map basis for a definition of port catchment areas could be established, considering all railways, primary, secondary and trunk roads in the area. In this regard, however, some aspects should be mentioned:

- For example, even though an official road master plan for Bangladesh exists [16], its plans do not go beyond the year 2029. Aside not covering a sufficed timeframe to account for the years 2030, 2040 and beyond, they also do not provide enough detail on individual infrastructure projects to allow for a modelling of a future road network. The existing road master plan was therefore considered as much as was possible but had to be further enriched. This was done by usage of the Bangladeshi railway master plan, as prepared for ADB and Bangladesh Railways [14].

- The latter, though primarily concerning itself with the expansion and upgradation of the Bangladeshi rail network, was also found usable with regards to roads, as it contained information on major, structural changes in the nations transport system, such as on the construction of bridges that will in future equally be used for road as for rail traffic. However, the therein included projects only list projects until the year 2040, which is why the modelling of transport networks could only cover the timeframe from 2020 to 2040. Further projections making use of the thereby derived catchment areas and going beyond 2040, therefore assume a static infrastructure status.

Information on the transport network developments for areas outside of Bangladesh (e.g. Nepal, Bhutan or India) was researched from publicly available sources, as far as could be identified through online research [24, 25].

With regards to velocity, an average but realistic speed of 20 km/h for trucks and trains was assumed. [26, 27] Additionally, topography, track gauge, infrastructural conditions and individual speeds of trucks and trains that these would allow for were not be considered in economic hinterland analysis. Building such model would exceed the scope of the port masterplan for Mongla to and is not identify cargo handling potentials for transit countries.

To further take account of delays caused by border crossing (e.g. administrative procedures, customs clearance, parking, traffic jams, actual crossing of border etc.), three different scenarios were considered each for road and train networks:

- Scenario 1 ("S1 Road / Train"): taking account of present-day delays caused by borders, being 96 hours delay for road traffic / trucks [26] and 32,6 hours delay for freight trains [13],
- Scenario 2 ("S2 Road / Train"): with a fourth of the afore mentioned delay at borders,
- Scenario 3 ("S3 Road / Train"): with no delays, as would be the case in a customs union / under complete regional trade liberalisation.

8.2 Transport Network Developments

Based on these assumptions, fastest paths between the regional capitals of each of the defined geographic units and the relevant ports (see Figure 8-1) where calculated, using "Network Analysis", namely "Fastest Paths" algorithms in QGIS. Outputs were compared in Excel tables and afterwards transferred back to QGIS for further mapping. The maximum extends of Mongla Port's catchment area was identified as spreading over large parts of Bangladesh, Bhutan and regions of north-east India lying between these. Following analysis focused on these areas (see Figure 8-2).

Mongla Port' catchment areas over time and by scenario are thereby primarily a result of the interplay of the following factors:

a) the level of expansion of road and rail infrastructure,
b) the geometry, nodes / links, esp. transnational connections and new interconnections like bridges in road and rail network systems (see below table),
c) resulting lengths and resulting travel times,
d) delays at border crossings.

Table 8-1: Major Railway Infrastructure Projects of High Relevance for Mongla Port's Connectivity [14]

No.	Project Name	Period
1	Construction of Double Line Track from Tongi to Bhairabbazar Including Signalling (2nd Revised).	2016-2020 / Ongoing
7	Construction of Pachuria-Faridpur-Bhanga Sections of Bangladesh Railway (1st Revised).	2016-2020 / Ongoing
8	Construction of Single Line Dual Gauge (DG) Railway Track from Dohazari to Cox's Bazar via Ramu and Ramu to Gundum Near Myanmar (1st Revised).	2016-2020 / Ongoing
9	Rehabilitation of Kalukhali-Bhatiapara Section and Construction of Kashiani-Gopalganj-Tungipara New Rail Line (1st Revised).	2016-2020 / Ongoing
10	Construction of a New Railway Line from Ishurdi to Dhalarcha Via Pabna (1st Revised).	2016-2020 / Ongoing
11	Rehabilitation of Laksam-Chandpur Section of Bangladesh Railway (1st revised).	2016-2020 / Ongoing
12	Construction of 2nd Bhairab & 2nd Titas Bridges with Approach Rail Lines.	2016-2020 / Ongoing
13	Construction of Khulna-Mongla Port Rail Link Including Feasibility Study (1st revised).	2016-2020 / Ongoing

15	Rehabilitation of "Sholosahar" (/ Sholoshahar Rail Gate / Chittaging) -Dohazari & Fateabad-Nazirhat Section Including Other Allied Works.	2016-2020 / Ongoing
16	Rehabilitation of Kulaura-Shahbazpur Section of Bangladesh Railway.	2016-2020 / Ongoing
27	Construction of Dual Gauge Double Rail Line and Conversion of Existing Rail Line into Dual Gauge Between Akhaura and Laksam.	2016-2020 / Ongoing
39	Padma Bridge Rail Link Project.	2016-2020 / Ongoing
48	Bangabandhu Railway Bridge Construction	2018-2020
53	Construction of Broad-Gauge Rail line from Bhanga Junction (Faridpur) to Payra Port via Barisal	2018-2020
54	Construction of Akhaura-Agartala dual gauge railway link (Bangladesh portion)	2018-2020
55	Construction of DG Rail Link Bogra - Shaheed M. Monsur Ali Station	2018-2020
62	Rehabilitation of Jashore-Benapole rail line	2018-2020
66	Construction of Broad-Gauge Rail Line between Chilahati and Chilahati Border for Connectivity with India.	2018-2020
83	Construction of rail link with Uttara EPZ, Nilphamari	2018-2020
89	Construction of Dual Gauge Railway line from Janali Hat to Kaptai via CUET	2018-2020
91	Establish railway connection with Chittagong Bay terminal	2018-2020
109	Construction of new BG Railway Line from Darsana to Meherpur via Damurhuda and Mujibnagar.	2018-2020
182	Construction of Railway Connectivity with Moheshkali and Matarbari	2021-2025
184	Construction of new BG track on Nabharan to Satkhira section.	2021-2025
189	Construction of BG single line from Chatak Bazar to Sunamganj	2021-2025
190	Construction of new BG track on Satkhira to Munshiganj section.	2021-2025
200	Construction of Dual Gauge double line between Fauzderhat- CGPY	2026-2030
218	Construction of New Broad-Gauge single line from Payra to Kuakata	2026-2030
225	Construction of new railway line from Tungipara to Mongla via Fakirhat.	2026-2030
226	Feasibility study for construction of Elevated Railway line from Joydebpur to Mymensing & Joydebpur to Tangail.	2026-2030
227	Feasibility study for construction of railway line from Tongi to Bhairab Bazar via Narshingdi	2026-2030
229	Construction of Dual Gauge single line from Panchagarh to Banglabandh	2026-2030
248	Construction of BG single line from Hathazari to Rangamati	2031-2035
250	Construction of Railway connectivity in between Panchagor-Chilahati-Hatibandha of BR.	2031-2035
251	Construction of Rohanpur-Joypurhat Rail Line	2031-2035
253	Construction of new BG line along Jashore-Magura- Sripur-Langolband-Pangsa.	2031-2035
257	Construction of new BG line along Joydebpur- Dhamrai-Manikganj-Paturia	2036-2040
264	Construction of Railway Bridge at Moukuri-Dhalar Char point over River Padma to connect Pabna and Rajbari with the existing railway network	2036-2040
265	Construction of new BG line along Modhukhali- Magura-Jashore.	2036-2040
266	Construction of Railway Bridge Over the Jamuna river near Phulchari-Bahadurabad Ghat including Approach Rail Link	2036-2040

For the estimation and projection of population official sources were used as far as available.

In the case of catchment areas in Bangladesh, official population forecasts were available until the year 2100 at district / Zilla level as a low, medium and high variant, of which only the medium variant was used for further proceedings [20].

In the case of Bhutan areas, equally detailed information was available, thus at district level, yet not according to different variants and not for all years under consideration [28]. Missing values and further projections were therefore derived using average annual growth rates, or by application of overall growth and development trends.

In the case of India, hardly any or outdated official information on population was available, partly dating back to 2011 [29]. In these areas, population was therefore estimated using data shared by the UN and generated through computer-aided analysis of high-resolution satellite imagery. The latest dataset for India available by that means referred to 2018 [22]. After being processed in QGIS the numbers thereby derived were projected using average annual growth rates as based on UN data [30], similarly as had been the case with population estimates for Bhutan.

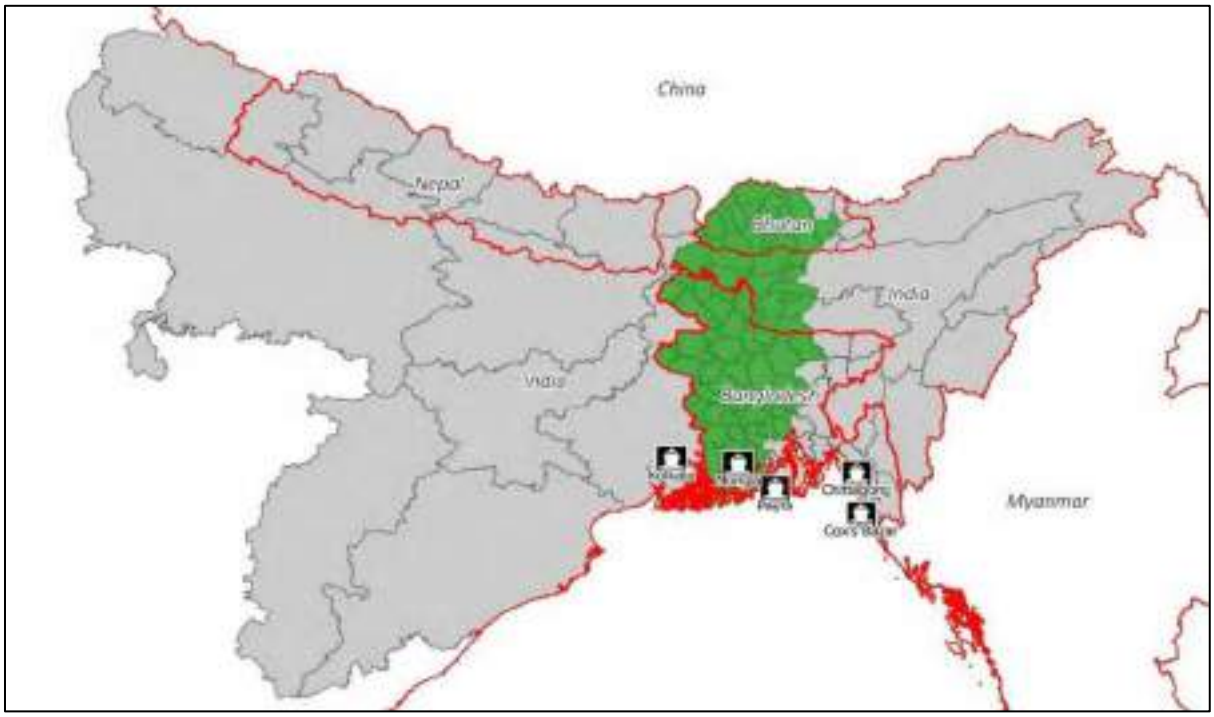


Figure 8-2: Mongla Port's Catchment Area 2020, 2030, 2040 [Consultant based on [18]].

8.3 Modal Split according to Distances and Modal Affinities

The calculated catchment area of the individual ports depends on the mode of transport considered by commodities, the implementation of infrastructure measures related to the specific network development, and border crossing efficiency assumptions. The consideration of the shares of relevant modes of transport in overall transport per lead commodity was assessed by the following parameters:

- Infrastructure availability over time
- Distance by road and by rail
- Assumed travel time during the forecast term
- Development and impact of waiting times at borders or technical (change of locomotive) and or procedural reasons

Logistic performance profiles and requirements and derived modal preferences in relation to travel time and distance as per prevailing type of packing and cargo handling have been assessed in additions to the captioned geographic or technical parameters. The detailed assessment of assumed modal preference and the derived modal split is presented by Appendix K for reference and review.

8.4 Traffic Demand Forecast

8.4.1 Economic Development / Intermediate Results of the Statistical Modelling and Regression Analysis Approach

The forecasted values of the population and GDP of Bangladesh, India and Bhutan several statistics were calculated (see Appendix K) and the summary of the results are explained by this section of the report.

Population of Bangladesh is expected to grow up to 200 million in 2060 and then decrease to 180 million reaching a saturation in year 2100. Population growth rates for Bangladesh, India and Bhutan calculated from the predicted population, show that Bangladesh's and India's growth rates follow similar patterns, see Figure 8-3).

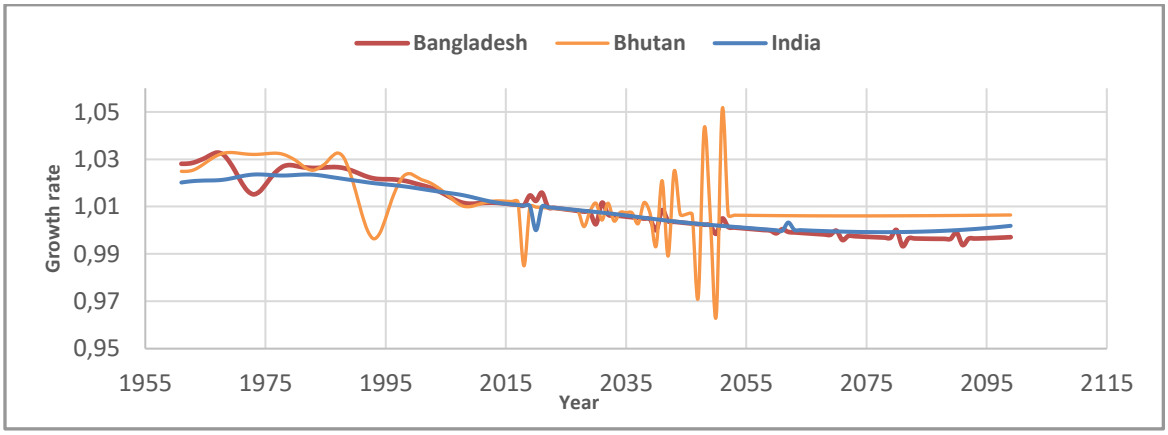


Figure 8-3: Variation of population growth rates of Bangladesh, India and Bhutan 1960 to 2100

GDP and GDP per capita of Bangladesh is expected to grow rapidly from year 2020 to 2100, following similar trend pattern, see Figure 8-4. GDP per capita in Bangladesh is expected to grow from approximately 3,400 USD to 14,600 USD in 2100.

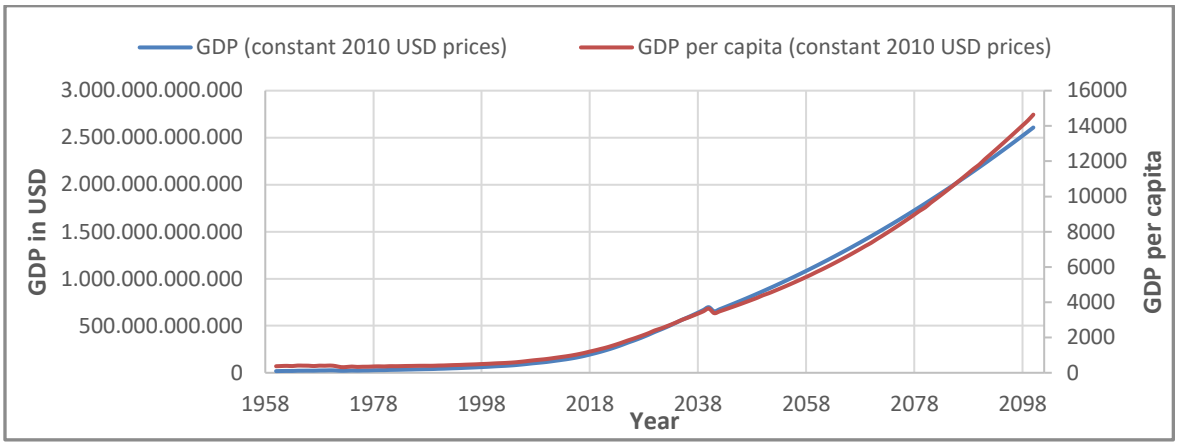


Figure 8-4: GDP and GDP per capita growth of Bangladesh from 1960 to 2100

Following graphs depict the commodity wise demand forecasted and per capita demand forecasted through the years for Bangladesh, see Figure 8-5 and Figure 8-6.

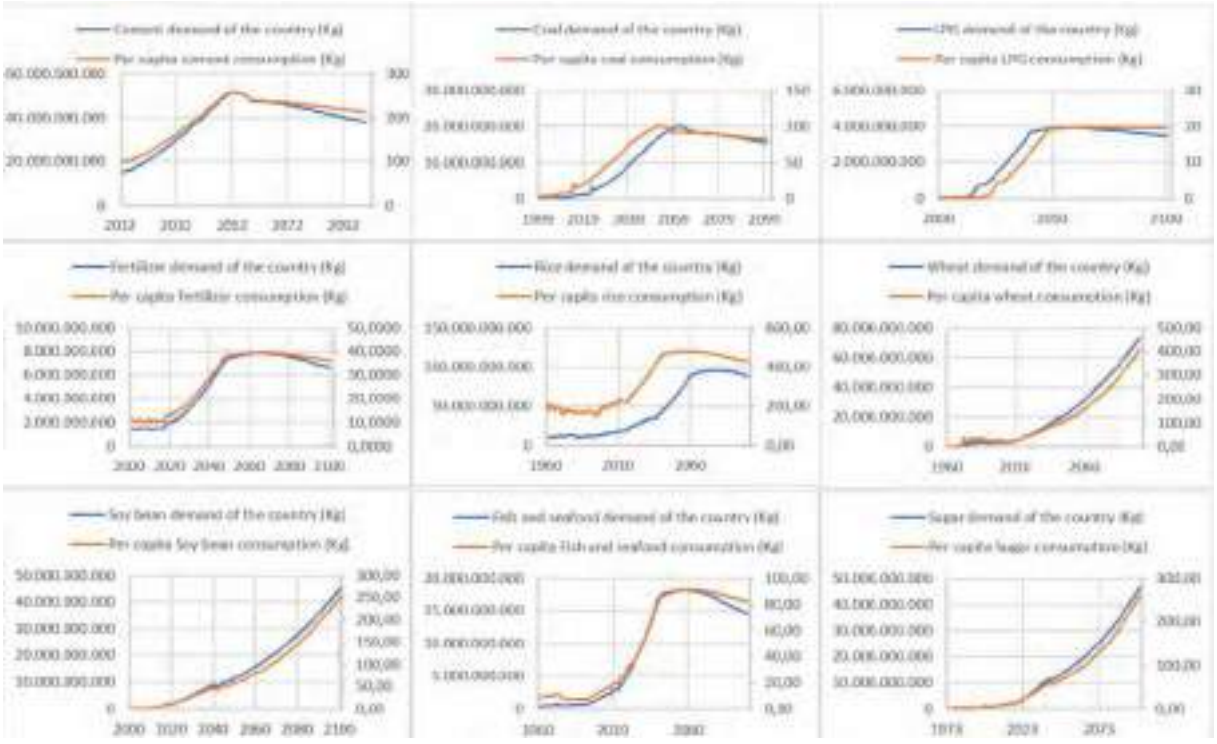


Figure 8-5: Demand/consumption forecast of lead commodities 2020 – 2100 [Consultant].

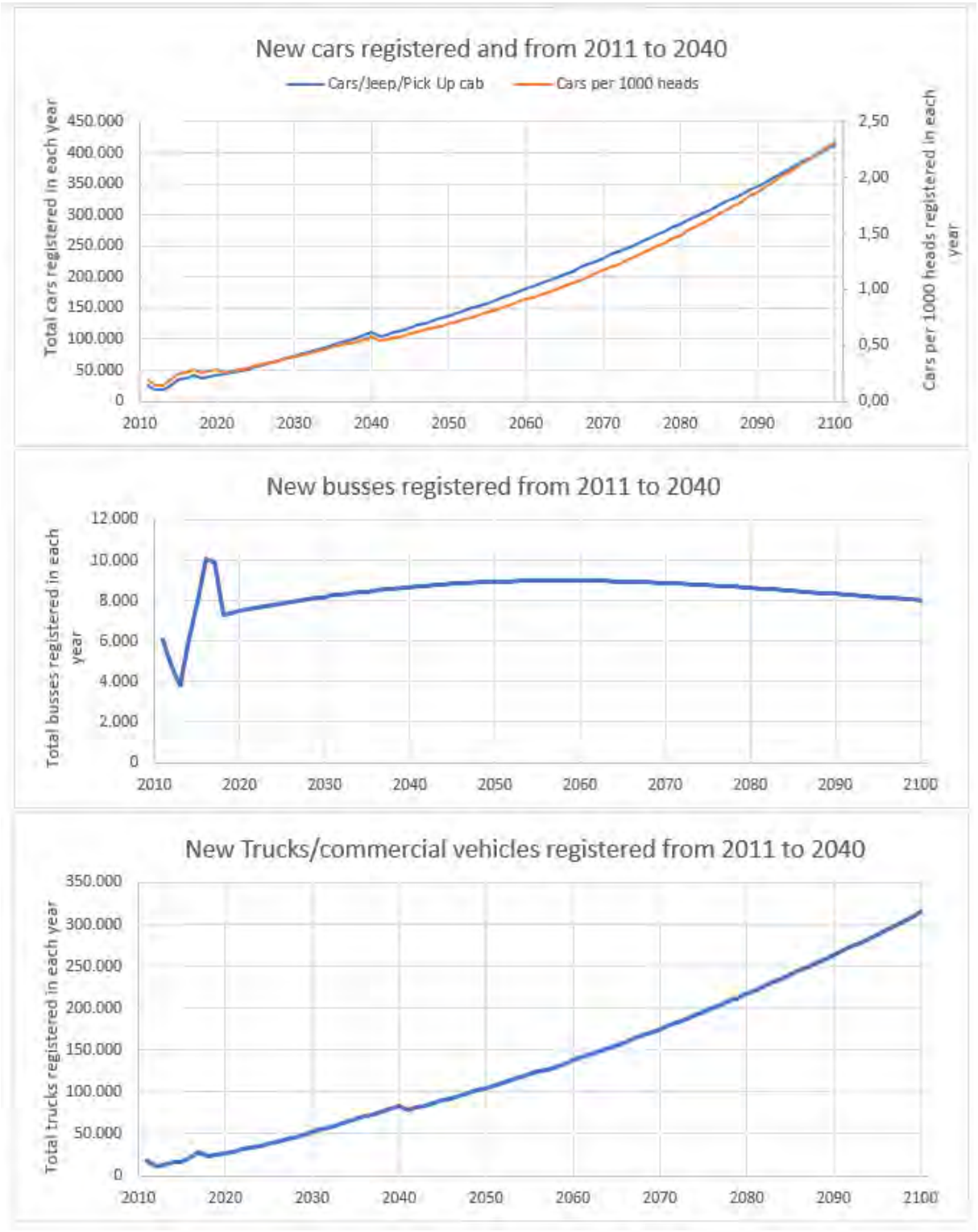


Figure 8-6: Demand for vehicles newly registered in each year predicted [Consultant].

8.4.2 Port Hinterland Economic Catchment Area Assessment

The computation of Mongla Port's catchment / hinterland areas according to varying scenarios and modes of transport has yielded results that primarily give an insight into the spatial extent

of its potential service area, with the scenarios partly reflecting different levels of trade liberalisation, as accounted for by the times needed for border crossings (see Section 8.1).

Through the thereby generate results, it can generally be concluded that catchment areas vary in size by more than a factor of three, between a minimum of 4,044,566 and a maximum of 13,844,172 hectares of land, depending on the scenario, year and mode of transport looked at, see Table 8-2.

Table 8-2: Area size of Mongla Port's Catchment Area by Year, Scenario and Mode of Transport (in ha, own calculations, 2019; *assuming catchment areas as in 2040).

	2020 (ha)	2030 (ha)	2040 (ha)	2050 (ha)*	2100 (ha)*
S1 Road	6,685,020	8,483,207	8,483,207	8,483,207	8,483,207
S2 Road	6,685,020	8,483,207	8,483,207	8,483,207	8,483,207
S3 Road	8,946,123	13,884,172	13,884,172	13,884,172	13,884,172
S1 Train	n. a.	7,831,316	8,175,203	8,175,203	8,175,203
S2 Train	n. a.	7,831,316	7,831,316	7,831,316	7,831,316
S3 Train	n. a.	4,044,566	4,044,566	4,044,566	4,044,566

Small – scale border crossing liberalisation efforts (see Table 8-2, Road scenario 1 vs. 2) do not make much of a difference for Mongla Port's catchment areas in terms of total extent. Overall major alternations are only visible when comparing the status quo (S1) to total liberalisation (S3), as also further depicted in, Figure 8-7 and Figure 8-8.

Another insight derived, was that catchments are frequently largest when considering road transport, thus the highest number of places in the investigation area is reachable by trucks going to or coming from Mongla Port, especially under a customs union scenario (S3 Road).

Under the complete trade liberalisation scenario and from 2030 onwards, an overall maximum of over 13 million ha of land, spreading through the greatest parts of Bangladesh, almost entire Bhutan and parts of north-east India, are thus likely to be served through Mongla Port via road.

On the other side, the smallest catchment areas were equally found when observing the liberalised trade scenario, that is, when looking at rail transport (S3 Train 2030/40). Here competitors, especially the port of Kolkata, overtake large shares of Bangladesh.

Thus, whilst it seems favourable to have completely open borders when looking at road transport in spatial terms, the opposite may be true when looking at cargo going via rail.

Mongla Ports' road catchment sizes are likely to profit highly from Bangladesh's planned expansion of infrastructure, mostly if not entirely due to new bridges being constructed that allow for better transport accessibility of Bangladesh east of the Padma. Even though Mongla Port currently has not rail connection, which is why effects of new constructed railway /road) bridges are assessed when comparing catchment status of 2020 to 2030 or onwards, this also goes for transport via train and even under a liberalised trade scenario (S3).

New bridges are likely to cause enhanced hinterland competition of Mongla Port with Kolkata under fully liberalized border crossing conditions. Same for parts of the regions alternatively served by Payra or Chittagong.

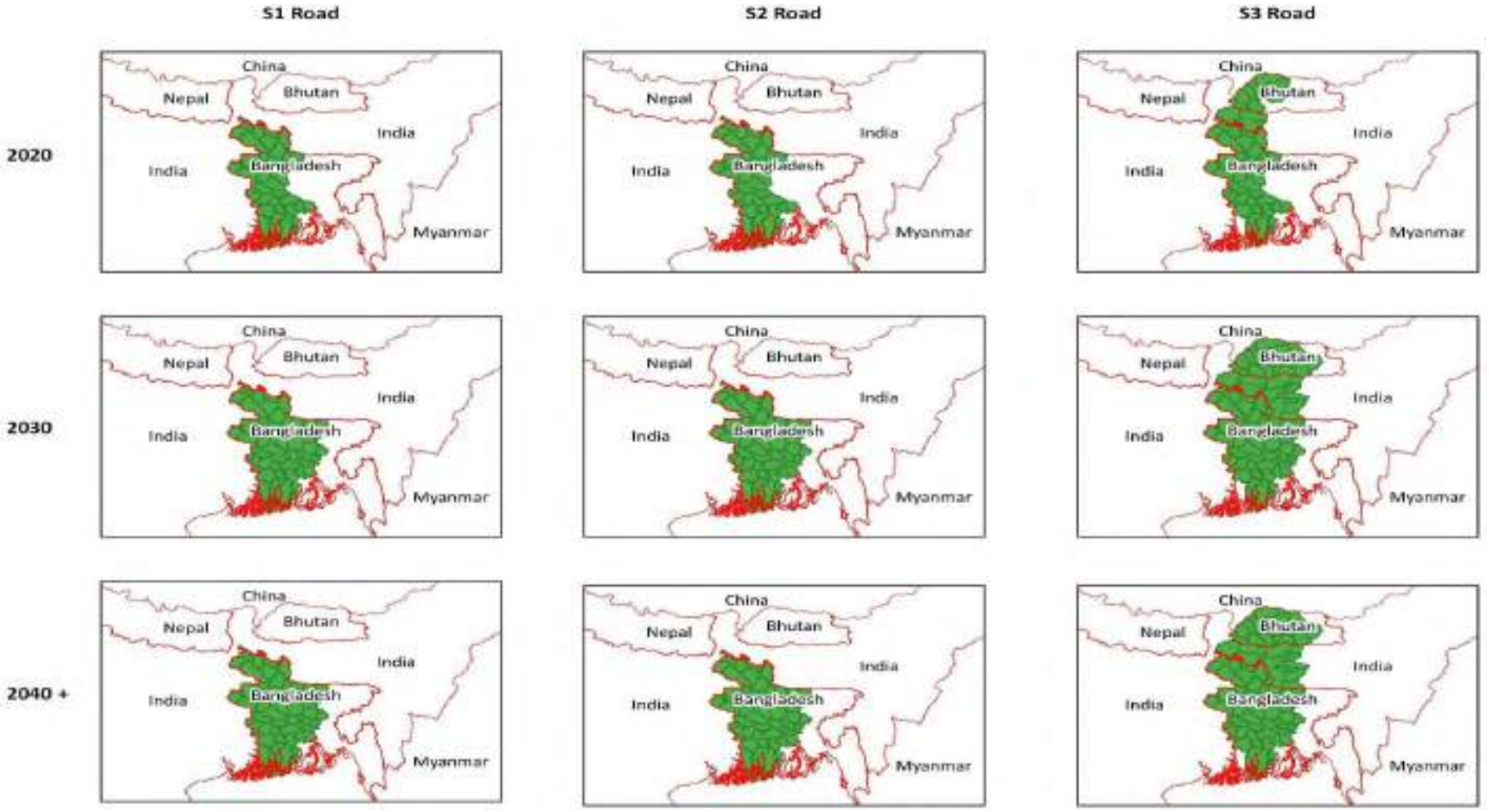


Figure 8-7: Comparison of Mongla Port's road catchment areas (green) by country (borders in red), scenario and year [Consultant based on [18]]

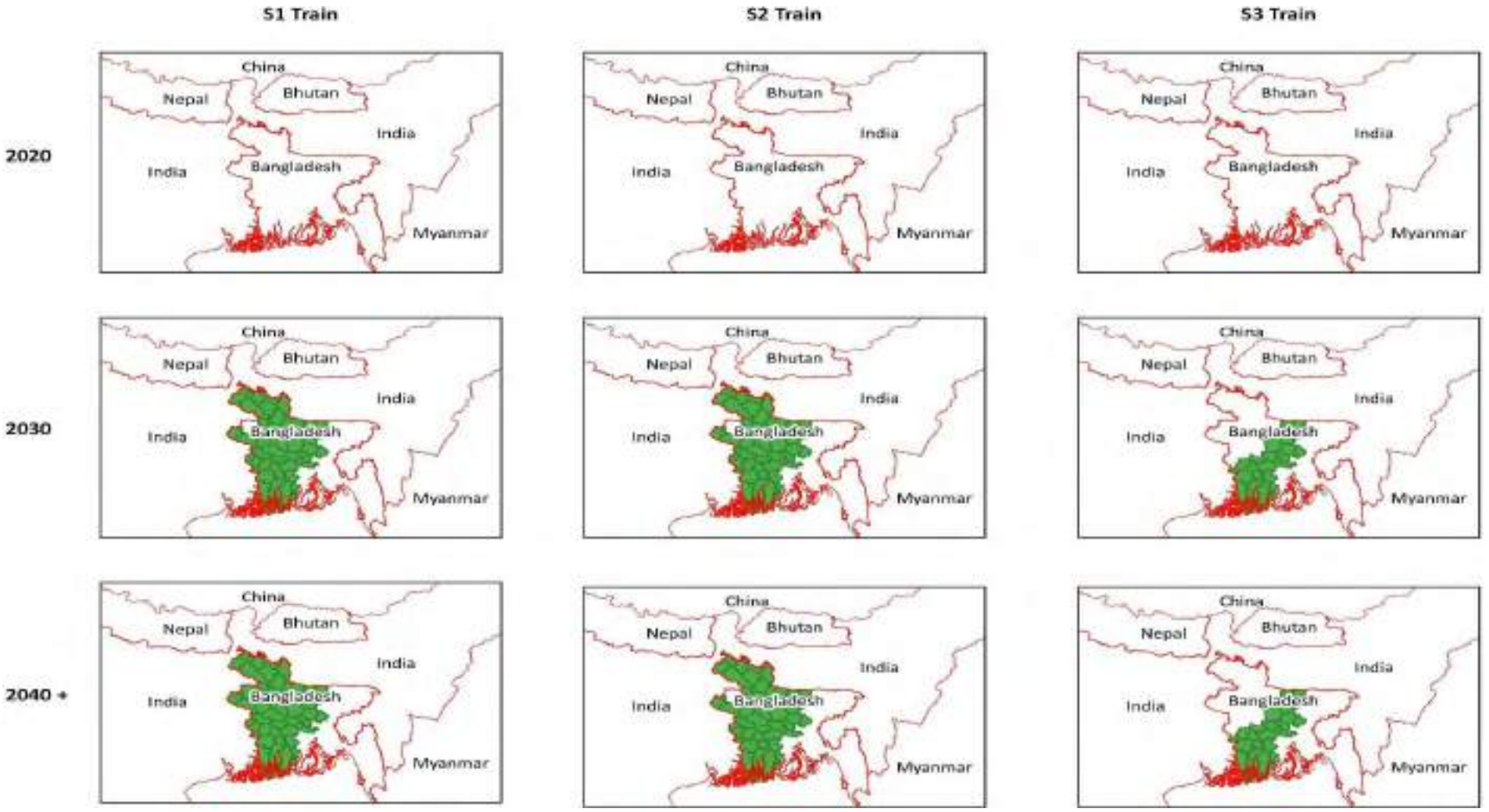


Figure 8-8: Comparison of Mongla Port's train catchment areas (green) by country (borders in red), scenario and year [Consultant based on [18]]

A principally congruent picture emerges when further adding a population / human geography view on catchment areas.

Most of the population is reached by road traffic under a liberalised trade scenario in the year 2050 (S3 Road), followed by the numbers reached under a non- or less liberal scenario (S1 Road and S2 Road), followed by numbers of people served through railway traffic. The exception here is again the population reached by train under a liberalised scenario (S3 Train) when compared to a scenario characterised by a greater extend of protectionism (S1 / S2 Train).

Yet, the afore made statements with regards to catchment sizes in terms of hectares must be somewhat put into perspective. That is because, irrespective of the actual spatial extents of catchments areas, their sizes and alterations according to scenarios, population residing in each of the catchments do not alter as much as land sizes do.

This can partly be explained by the fact that densely populated areas like Bangladesh in general and highly crowed cities like Dhaka especially are constantly included in Mongla Ports' catchments. Also, countries such as Bhutan (included in S3 Road 2020,2030,0240 and beyond) hold only a comparatively small population now and in the future. Shares of population residing in India being in- or excluded from catchments make more of a difference, yet are equally insignificant when compared to the differences areas in Bangladesh can cause (compare Table 8-2, Figure 8-7 and Figure 8-8 above to Table 8-3 and

The differences between the population in the hinterland for Mongla Port as per the crossing scenarios is shown by below table 8-4 by mode of transport and in total.

Table 8-4 below).

In total, the biggest variations in population exist when comparing open border to non-open scenarios in terms of train catchment areas, followed by those with regards to roads as shown by

The differences between the population in the hinterland for Mongla Port as per the crossing scenarios is shown by below table 8-4 by mode of transport and in total.

Table 8-4.

Thus, in this perspective, open borders should generally be welcomed by Mongla Port as it allows it to reach more population. Population will, however, most likely shrink in a long-term perspective.

Furthermore, with regard to general trends, it can be observed that overall population in catchments grows over time, but that demographic change -- thus an "ageing of society" with increased life expectancy and lowered birth rates -- has a moderating effect in all of this and leads to comparatively lower population growth rates, even shrinking of population until the year 2100, see Table 8-3.

Urbanisation processes – a relative growth of urban as compared to rural population – somewhat further milden this trend. Especially high population growth will take place in the Chuadanga and Gazipur, but partly also Dhaka districts, whilst population shrinks in many, rather rural areas throughout the country until the year 2100, see Figure 8-9.

Table 8-3: Total population in Mongla Port's Catchment Area by Year, Scenario and Mode of Transport (own calculations, 2019; *assuming catchment areas as in 2040).

	2020	2030	2040	2050*	2100*
S1 Road	73,657,000	109,590,000	113,829,000	115,535,000	104,127,000
S2 Road	73,657,000	109,590,000	113,829,000	115,535,000	104,127,000
S3 Road	79,202,462	123,354,537	128,638,461	130,877,859	120,853,686
S1 Train	n. a.	99,859,000	106,369,000	107,594,000	95,227,000
S2 Train	n. a.	99,859,000	103,548,000	104,900,000	93,631,000
S3 Train	n. a.	46,878,000	48,928,000	50,146,000	51,747,000

The differences between the population in the hinterland for Mongla Port as per the crossing scenarios is shown by below table 8-4 by mode of transport and in total.

Table 8-4: Population in Mongla Port's Catchment Area by Year, Scenario and Mode of Transport (own calculations, 2019; *assuming catchment areas as in 2040)

		2020	2030	2040	2050*	2100*
S1 Road vs S2 Road	**Bangladesh**	0	0	0	0	0
	India	0	0	0	0	0
	Bhutan	0	0	0	0	0
	Sum	***0***	***0***	***0***	***0***	***0***

		2020	2030	2040	2050*	2100*
S2 Road vs S3 Road	**Bangladesh**	2,188,000	2,256,000	2,248,000	2,175,000	1,379,000
	India	-7,308,731	-15,329,715	-16,303,162	-16,711,493	-16,860,902
	Bhutan	-424,731	-690,822	-754,299	-806,366	-1,244,784
	Sum	***-5,545,462***	***-13,764,537***	***-14,809,461***	***-15,342,859***	***-16,726,686***

		2020	2030	2040	2050*	2100*
S1 Road vs S3 Road	**Bangladesh**	2,188,000	2,256,000	2,248,000	2,175,000	1,379,000
	India	-7,308,731	-15,329,715	-16,303,162	-16,711,493	-16,860,902
	Bhutan	-424,731	-690,822	-754,299	-806,366	-1,244,784
	Sum	***-5,545,462***	***-13,764,537***	***-14,809,461***	***-15,342,859***	***-16,726,686***

		2020	2030	2040	2050*	2100*
S1 Train vs S2 Train	**Bangladesh**	n. a.	0	2,821,000	2,694,000	1,596,000
	India	n. a.	0	0	0	0
	Bhutan	n. a.	0	0	0	0
	Sum	**n. a.**	***0***	***2,821,000***	***2,694,000***	***1,596,000***

		2020	2030	2040	2050*	2100*
S2 Train vs S3 Train	**Bangladesh**	n. a.	52,981,000	54,620,000	54,754,000	41,884,000
	India	n. a.	0	0	0	0
	Bhutan	n. a.	0	0	0	0
	Sum	**n. a.**	***52,981,000***	***54,620,000***	***54,754,000***	***41,884,000***

		2020	2030	2040	2050*	2100*
S1 Train vs S3 Train	**Bangladesh**	n. a.	52,981,000	57,441,000	57,448,000	43,480,000
	India	n. a.	0	0	0	0
	Bhutan	n. a.	0	0	0	0
	Sum	**n. a.**	***52,981,000***	***57,441,000***	***57,448,000***	***43,480,000***

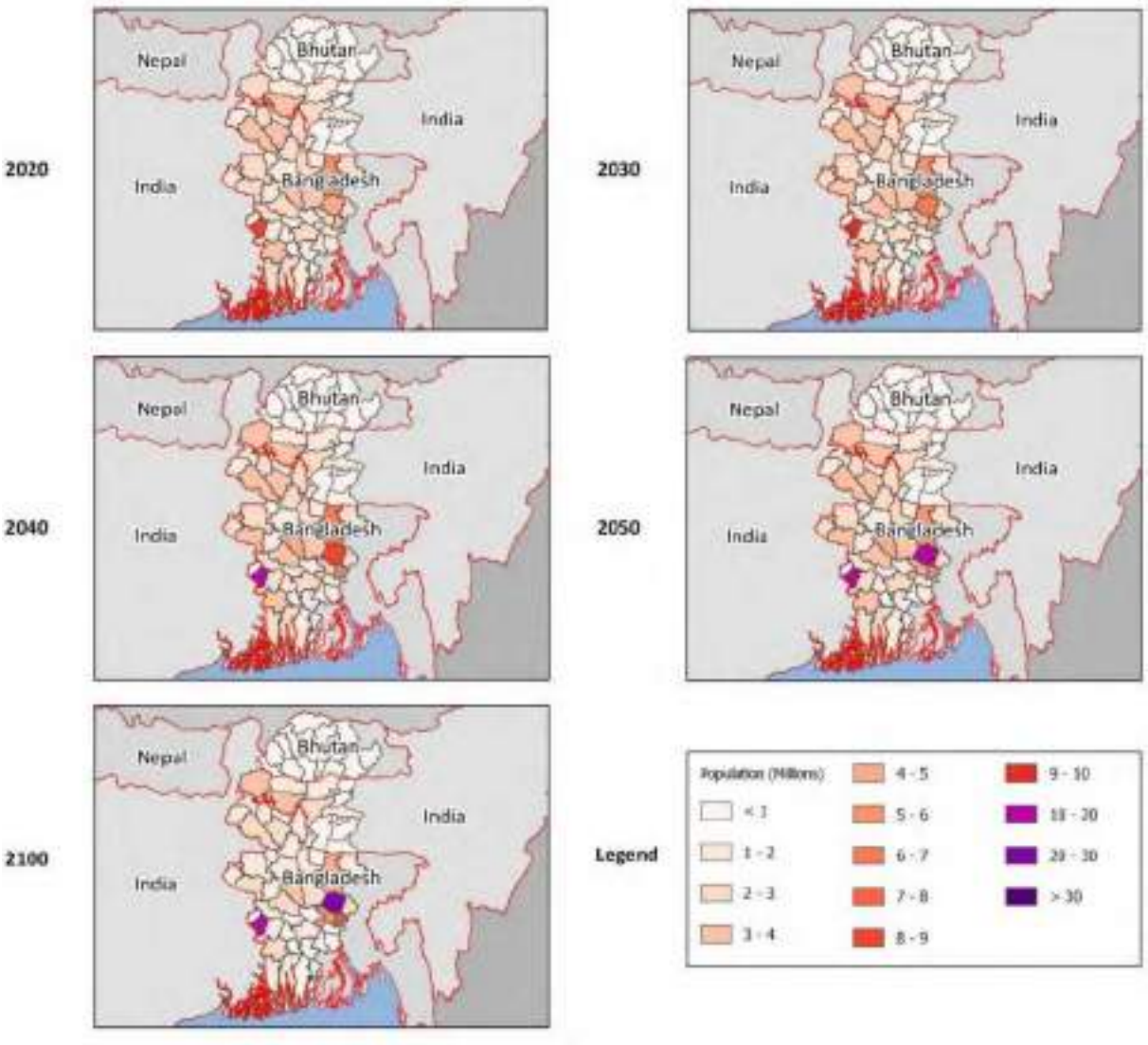


Figure 8-9: Population in Mongla Port's maximum catchment area 2020, 2030, 2040, 2050 and 2100 [Consultant, based on [18]]

9 Mongla Port Cargo Throughput Forecast

9.1 Approach

The cargo throughput forecast is based on recent developments, economic and population growth and foreign trade and maritime import and export development projections. The forecasts take into consideration trade and the depicted socio-economic key development factor data and analysis of the development of productivity and income until 2040, with trend extrapolations until 2050, 2060 and 2070 and an outlook until 2100.

The development factors include the evaluation of socio-economic and trade data, industrial production, consumption and demand drivers as well as determinants for local and regional development trends.

The development factors considered are of key importance since further industrial developments and infrastructure improvements around the port serve as key external drivers for the development of the port as a gateway for the adjacent industrial area.

Economic development depends on production and productivity as key influencing factors for Gross Domestic Product (GDP) development. Higher productivity leased to higher production and, competitiveness of products provided, to increasing exports.

Import of raw materials and input for productions as well as of investment commodities like e.g. machinery or cargo transport vehicles depend on development of the production in Bangladesh, in long term expressed by the GDP, and hence are correlated to the GDP development. Imports of consumer goods are, also in long terms projections, correlated to the development of the income of the population. The average share of the population in socio-economic development indicates in long term projections the development of income and hence of purchase power and demand for commodities and consumer products. Under consideration of long-term trends towards increase of overall average income at all levels the GPD per capita is the key indicator for development of consumption and of import of consumer products including household products, electronics and cars. Agriculture and any kind of food and grain related imports development depends from population growth or the development of income per household (see GDP/capita).

The scenario forecasts anticipate the socio-economic demand drivers or classically will compare or adjust the results by scenario assumptions related to changes in supply and market accessibility. Individual considerations of local port or lead industries development, markets and assumed reaction of markets to introduction of additional or improved transport infrastructure are assessed and integrated into the forecast scenarios.

These types of data required was gathered through interviewing key stakeholders, industrial executives and local and regional players related to manufacturing and trade of semi-processes and finished goods.

Therefore, stakeholder consultations and evaluation of port and local and regional developments have been carried. Findings on lead industries like cement, liquid petroleum gas (LPG), mineral oil processing or power plants, and fertilizers, grain and foodstuff gained by interviews and desk research are depicted in Appendix I.

The traffic forecasts are prepared by different development scenarios, for the catchment area (Mongla – Khulna – Jashore / West Bangladesh), the overall country of Bangladesh and the region as a whole).

The traffic forecast scenarios include a base case scenario, and a modest- and optimistic-level development scenario in order to consider a range of influencing factors and their impacts on potential developments.

Frameworks conditions changes by development of infrastructure, economics and transit trade conditions have been highlighted by Chapter 8.

In view of the required consideration of the Bangladesh Delta Development Visions 2100 time frame the following steps are proposed:

- Forecasts and planning projections for the term 2020-2040 / with an outlook to 2050, were extended by interim figure projections for 2050 and 2060 to 2070 and beyond until 2100 in order to synchronize the Port Master Plan development recommendations with the national planning and the Bangladesh Delta Visions planning time horizon. as follows.
- Three forecast scenarios a) optimistic, b) base case and c) modest growth are developed according to socio economic and logistics parameter modifications. The design of the optimistic and the modest growth scenario shall take place prior to the completion of the forecast by discussion of assumptions and approaches with MPA.
- For each scenario, cargo throughput, vessel movements and port hinterland traffic projections for Mongla Port will be elaborated. This approach will contain the term from 2020/2021 to 2040/2041 in harmony with the time frame set by the national development planning. Hence the Port of Mongla traffic projections by the Master Plan can be considered as mid-term scenario forecasts.
- Timely extended forecast projections will be prepared as an outlook until the year 2050 and beyond will support port development planning in phases until 2060 or 2070.
- Uncertainties are imminent when providing forecasts for terms longer than 20 years. Such long-term forecast will be provided as a high-level forecast, based on trend projections on an aggregated level of lead variables and respective development scenario assumptions until 2100 for consideration of the time frame of the Bangladesh Delta Vision 2100 (Delta Plan 2100). These projections will serve as a guideline for long term development prospects only.

9.2 Methodology

Methods used for the forecast of traffic at Mongla Port and thereby steps followed in analysis were:

1. derive and project the total amounts of various goods / lead commodities needed in Bangladesh, India, Bhutan and Nepal and derive GDP per capita, imports and exports in these areas through statistical modelling, mostly regression analysis, now and in future,
2. derive and project regions within an investigation area that will utilise Mongla Port (are thus part of its catchment areas) accounting for different infrastructural

development over time, modes of transport and scenarios of delays caused by border crossings,

3. derive and project the population in the previously defined catchment areas to forecast the traffic of Mongla Port using previously identified GDP per capita values and
4. combine the afore generated insights with assumed shares of modes of transport in trade volumes according to distances and modal affinities to forecast traffic volumes of Mongla Port in a way that can later be aggregated to cargo handling categories and allows for port area and terminal planning.
5. Include port related industrial and other specific developments with an influence of significance on the development trends of cargoes vial Mongla plan like e.g. establishment of port adjacent powers plats or other industries of magnitude)

Statistical modelling, several interpolation methods, were used to examine and estimate the relationships between variables and then to predict the amount of goods required in the heart- and hinterland of Mongla Port and its competitors. Focus was thereby on the nationwide consumption of Bangladesh, India, Bhutan and Nepal with regards to containers and commodities handled at Mongla Port (see Section 7.3 for details).

Amongst the handled and further analysed commodities were: betel nuts, crushed bone (“bone griest”), cars, cement, clay tiles, clinker, coal, crude oil, fertilizers, fly ash, food grains, gas, general cargo, gypsum, jute, jute goods, leaded gasoline (“r/edb” [sic]), leather, lime stone, machinery, motor vehicles, rice, salt, shrimp, slag, soya beans, steel pipes, sugar, tobacco, white fish, wooden log.

For analysis, commodities were clustered according to the following system:

- Agricultural Inputs, consisting of crushed bone (“bone griest” [sic]) and fertilizers
- Agricultural, forestry and fishery products, consisting of betel nut, food grain, rice, salt, shrimp, soya bean, sugar, tobacco, white fish and wooden log
- Cement (understood as readymade cement)
- Cement inputs for local production, consisting of clinker, fly ash, gypsum, lime stone and slag
- Containerised goods / containers
- Coal for electricity production
- Gas (liquified)
- Gasoline (leaded)
- Crude oil, mainly for local production of diesel fuel oil or gasoline
- Jute related items, consisting of jute and jute goods
- Machinery, motor vehicles and cars, consisting of cars, machinery and motor vehicles
- Leather (goods)
- Other construction materials, consisting of clay tiles and steel pipes
- Other / general cargo (not further defined).

The following chapter summarise the results of the maritime trade and the Mongla Port cargo throughput projections stepwise.

9.3 Mongla Port Throughput 2020 – 2040 and Projections until 2100

The following sections provided the forecast projections for maritime trade via the sea ports in Bangladesh

1. without consideration of cargo potentials for serving as import or export ports for third countries
2. the maritime trade forecast projection results under consideration of the Bangladesh maritime trade and the maritime import and export of the identified hinterland regions (Bangladesh and so-called transit trade) in the neighbouring countries,
3. the port throughput potentials as market shares of Mongla Port in overall maritime trade of the approachable hinterland, and
4. the consideration of Mongla Port specific impacts throughout the developments of the local industry.

Chapter 9.3.5 summaries the impacts and trend projections and provides the results of the projections as the port throughput development forecast for Mongla Port until 2040 and beyond until 2100. All results for years beyond 2040 are trend extrapolations, based on robust assumptions regarding the development of socioeconomic developments during 2040 and 2100 like e.g. the population forecasts of the Bangladesh Delta vision plan (horizon until 2100) or nations/UNDP and World Bank population projections for India and Bhutan (until 2052/2060, with some outlook expectations) depicted therein.

9.3.1 Maritime trade of Bangladesh and Development until 2040 and 2100

The recent and the projected maritime trade of Bangladesh via the Bangladesh sea ports is projected until 2040 and further to 2100 as shown in Table 9-1.

Table 9-1: Development of Maritime Foreign Trade of Bangladesh until 2040 and outlook until 2100

Commodities	Maritime Imports and Exports		Projected Martime Imports and Exports 2020 - 2100 in metric tons								
	2010	2018	2020	2025	2030	2035	2040	2050	2060	2070	2100
Dry Bulk Cargo	16630584	41606406	45878216	79909770	121467247	168023067	217914667	319009910	311379442	320375725	320943031
Grap or Conveyer	9549672	29676373	36032320	65686280	102022581	142734115	186448386	279046399	257666242	250890675	192742376
Coal	0	4301338	4466850	8272546	12940799	18171347	23791088	31517997	29875687	29235683	23687133
Cement clinker	9482842	24182583	30212436	55108227	85615341	119795846	156498210	238270906	219249828	213340260	162679467
Gypsum	23800	202410	276967	534331	850818	1205456	1587025	2437757	2239160	2178052	1654475
Lime stone	0	247783	195497	237837	285175	338036	391678	508759	484411	474431	387720
Slag, sand, gravel etc.	43030	742259	880570	1533339	2330449	3223431	4180385	6310981	5817155	5662249	4333581
Grap, rain protected	3235572	4662950	5260477	7604502	10400556	13530311	16838648	21323579	28703025	37178245	68933742
Fertilizers	2938042	3884772	4267508	5637603	7234343	9020144	10881342	11568155	11770257	11527758	9420840
C.Bone/B. Griest	529	0	768	974	1121	1281	1380	1528	1597	1589	1312
Salt	297001	778178	992202	1965925	3165092	4508886	5955926	9753895	16931171	25648899	59511590
Protected or pneumatic handling	3845340	7267083	4585419	6618988	9044111	11758641	14627633	18639932	25010176	32306805	59266913
Grain	3841580	6914734	4009230	5363448	6948268	8721009	10573355	13312093	17580891	22461651	40356812
Soya beans, oil seeds	0	0	0	0	0	0	0	0	0	0	0
Fly Ash	3760	352349	576189	1255540	2095843	3037632	4054278	5327839	7429285	9845154	18910101
Liquid Bulk	1738727	11104694	11558262	17311247	24216542	31947683	40150206	50473465	67165257	86184042	157075092
Oil and fuel	332770	7903959	7733928	11051508	14999884	19419128	24084200	29963455	39412492	50149736	90090709
Crude Oil	0	96942	131898	188478	255816	331184	410744	511012	672160	855279	1536452
Mineral Oil fuel products	332770	7807017	7602030	10863030	14744068	19087945	23673456	29452443	38740332	49294457	88554257
Edible Oil	1373681	2508948	2781277	3974346	5394262	6983512	8661166	10775464	14173529	18034859	32398441
Liquid gas	32276	691787	1043057	2285392	3822396	5545043	7404840	9734546	13579236	17999447	34585942
Liquid Gas LPG	32276	691787	1043057	2285392	3822396	5545043	7404840	9734546	13579236	17999447	34585942
Liquid Gas LNG	0	0	0	0	0	0	0	0	0	0	0
General Cargo	21529537	43701821	48242105	74023385	104088708	137714073	172773301	217108110	287300683	366519760	659681356
Break Bulk (eg.g. iron/steel, paper, wood)	0	0	38692	61501	89104	120017	152972	194395	261753	338695	626035
Cars and vehicles	33115	24536	28705	42111	58237	75632	94389	119194	159399	205260	376339
Heavy lifts, project cargo, machinery	23012	183047	233644	458719	735662	1045995	1380005	1798740	2487303	3277707	6240226
Bags or bails, palletized or not	1591781	2706034	3403019	5205394	7375663	9805761	12388849	15638143	20903638	26909128	49310713
Containerization affine cargoes	19881629	40788204	44538045	68255659	95830042	126666667	158757086	199357637	263488591	335788970	603128043
Chemical products	58246	39083	68106	71806	74332	77085	78665	81110	81815	80968	73196
Fish, meat, fruits, other perishables	39144	35011	55858	79820	108337	140255	173949	216412	284658	362208	650682
General cargoes, n.e.s	19784239	40714110	44414081	68104034	95647373	126449327	158504472	199060116	263122118	335345795	602404165
Total	**39898848**	**96412921**	**105678583**	**171244402**	**249772497**	**337684823**	**430838174**	**586591484**	**665845382**	**773079527**	**1137699479**

The recent development between 2010 and 2018 showed a rapid development of foreign trade of Bangladesh to countries accessible by sea from 38.9 million metric tons in 2009/10 to 96.4 million tons in 2017/8. The projections until 2040 expect a continuation of growth to a maritime trade potential of 430 million tons, increasing further to via the sea ports in the country from 774 and 1138 million tons until 2070 or 2100 respectively.

Figure 9-1 and Figure 9-2 show the long-term development for import and export (figure 9-1) and by main commodity types (figure 9-2).

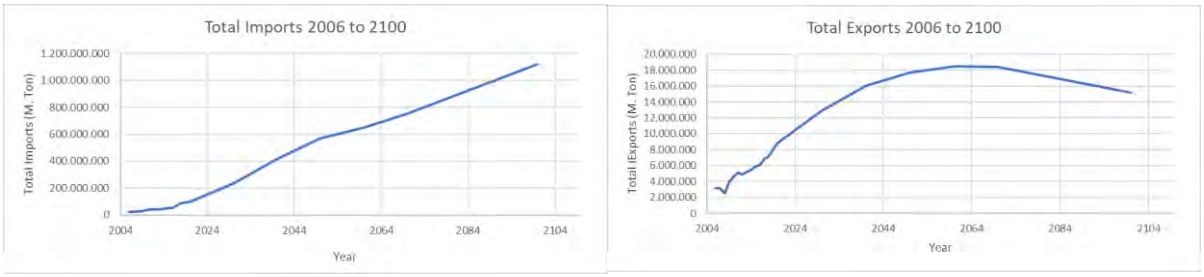


Figure 9-1: Development of maritime imports and exports of Bangladesh until 2100

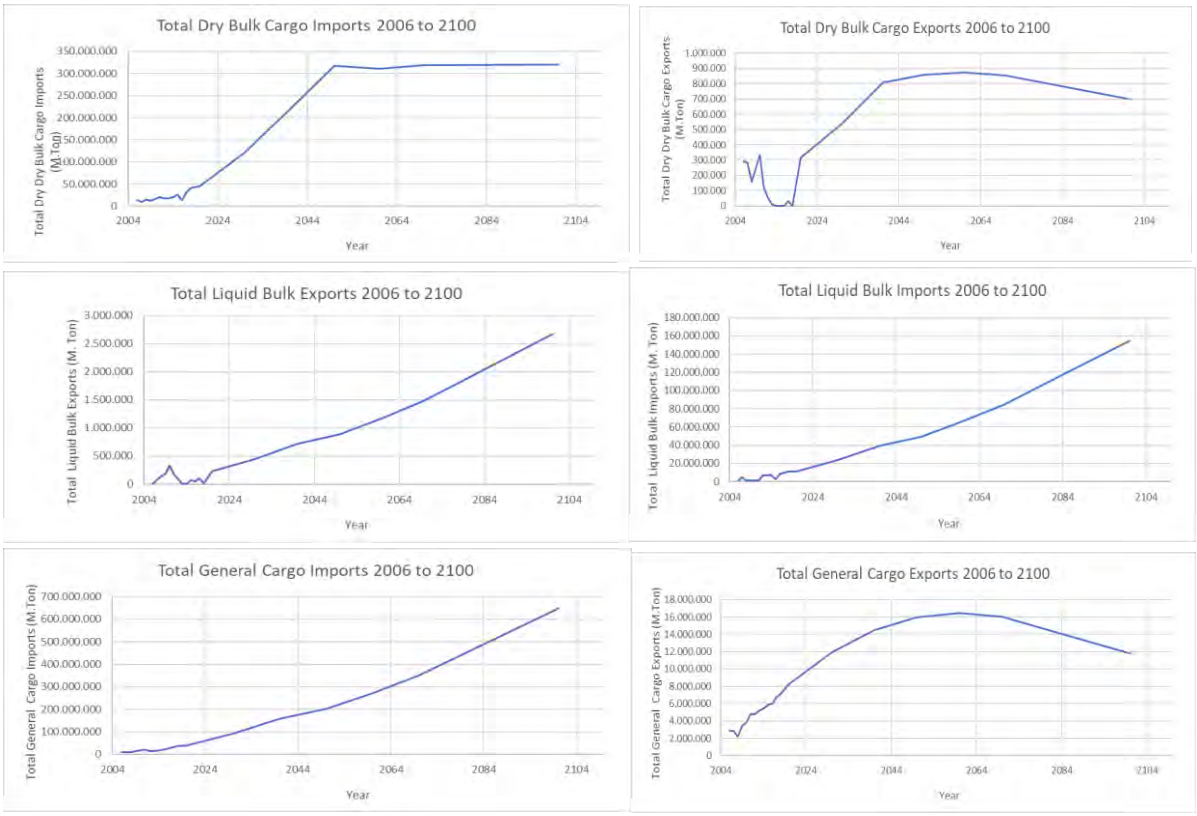


Figure 9-2: Main commodity types maritime imports and exports of Bangladesh until 2100

Details per commodities and handling categories are provided by Appendix H for reference.

The estimated maritime trade volumes include the imports and exports of Bangladesh with all countries except the countries with a land border (India) or accessible via countries with a land border to Bangladesh (Bhutan, Nepal) as per trade statistics, calibrated with the port

throughput data for the main ports of Bangladesh for the years 2006 – 2018, and import and export development projects as per economic and population development trends.

There is a residual uncertainty in data because trade with India can also be shipped by sea to Indian sea ports e.g. at the South or the West coast of India, and trade with Myanmar can also be carried via land border instead of by sea ship/coastal ship to seaports along the Myanmar cost or Rangoon. However, land infrastructure connections capabilities with Myanmar are limited. Shipping is supposed to be the almost always chosen transport mode.

Regarding India the complete attribution of the trade of between Bangladesh and India to non-maritime trade, the deduction of the total trade volumes by land borders prevented for any over estimations or contradictions with the scenario assumptions for border crossing productivity and hinterland transport mode developments (see Chapter 8).

9.3.2 Trade of all countries via all Bangladesh ports 2040 and projections until 2100

The tables below consider the expected maritime trade potential and the cargo potentials gained by maritime trade of Bhutan and regions in India best accessible from Bangladesh minus maritime foreign trade potentials of Bangladesh possibly attracted to be exported via seaports in India depending from the conditions to transport cargoes form or one country to another. Valuated are waiting times at border crossings today (Scenario 1), waiting time and procedures reduced to 25% of present level (Scenario 2), and with a view on an 80 years projection term by scenario 3 “no waiting time” at borders as in Europe within the EU between member countries of the Schengen treaty and associated nations.

The overall maritime trade potential for handling via the Bangladesh or other ports in the Bay of Bengal is assessed by application of the ratio of the population living in the same Kolkata – Chittagong port catchment area and accessible at present of in future by adequate infrastructure according to the road and railway improvement programs in Bangladesh. The assessment until 2040 considers infrastructure improvements in road and rail network. The assessment was prolonged according to population development onto 2100 under the assumption that

- no changes in port hinterland traffic relevant road or rail infrastructure will take place in the region after 2040 which would change accessibility conditions of the ports at the Bay of Bengal.
- Population in India in the port competition region will benefit from economic growth as per overall India average.

The development in the present and the future hinterland catchment region of the competing ports, i.e. all Ports in the Bay of Bengal including Mongla, Chittagong and Kolkata/Haldia is characterized by the following population and GDP features, which show that the overall market potentiation in maritime trade is – depending on the applied difference, between around 8% and 10% higher compared consideration of trade for the hinterland in Bangladesh only, see Table 9-2.

Table 9-2: Development of Maritime Foreign Trade of Bangladesh until 2040 and outlook until 2100

Country	Population or GDP/capita and GDP by Year and Nation and in Bangladesh Ports Catchment Area								
	2020	2030	2040	2050	2060	2070	2080	2090	2100
Bangladesh (medium)	**165.764.000**	**180.919.000**	**191.464.000**	**197.414.000**	**199.131.000**	***196.926.453***	***189.891.500***	***184.021.750***	**178.152.000**
India	1.380.004.000	1.503.642.000	1.592.692.000	1.639.176.000	1.651.156.000	*1.651.423.205*	*1.651.690.454*	*1.651.824.094*	1.653.830.000
of which: catchment area	*7.308.731*	*15.329.715*	*16.303.162*	*16.711.493*	*16.833.637*	*16.836.354*	*16.839.079*	*16.840.441*	*16.860.902*
Bhutan	748.931	814.089	861.437	894.279	994.627	*1.020.482*	*1.047.008*	*1.060.529*	1.285.612
of which: catchment area	*424.731*	*690.822*	*754.299*	*806.366*	*913.397*	*945.629*	*978.920*	*1.009.205*	*1.244.784*
Total	1.546.516.931	1.685.375.089	1.785.017.437	1.837.484.279	1.851.281.627	1.849.370.139	1.842.628.962	1.836.906.374	1.833.267.612
Catchment Area Bangladesh Ports	**173.497.462**	**196.939.537**	**208.521.461**	**214.931.859**	**216.878.034**	**214.708.435**	**207.709.498**	**201.871.396**	**196.257.686**
Additional Maritime Potential by population	4,665%	8,855%	8,909%	8,874%	8,912%	9,030%	9,383%	9,700%	10,163%
GDP/Capital (constant 2010 USD)									
Bangladesh (medium)	1.351	2.400	3.642	4.394	5.730	*6.294*	*6.912*	*7.244*	14.640
India	1.985	2.631	3.389	4.131	5.434	*5.856*	*6.311*	*6.551*	11.479
Bhutan	3.594	5.041	7.134	9.450	11.209	*11.655*	*12.119*	*12.358*	16.561
Total weightened average	1.918	2.607	3.418	4.162	5.469	5.906	6.376	6.624	11.790
GDP/Capital (constant 2010 USD million)									
Bangladesh (medium)	**223.947**	**434.206**	**697.312**	**867.437**	**1.141.021**	**1.239.360**	**1.312.615**	**1.333.124**	**2.608.145**
India catchment area	14.508	40.332	55.251	69.035	91.474	98.593	106.266	110.324	193.546
Bhutan Catchement area	1.526	3.482	5.381	7.620	10.238	11.021	11.864	12.472	20.615
Catchment Area Bangladesh Ports	**239.981**	**478.021**	**757.944**	**944.092**	**1.242.733**	**1.348.974**	**1.430.745**	**1.455.919**	**2.822.306**
Additional Maritime Potential by GDP	7,160%	10,091%	8,695%	8,837%	8,914%	8,844%	9,000%	9,211%	8,211%

The following table summarizes the maritime trade potential development according to application of GDP per capital and population development in the port hinterland including Bangladesh and the port competition regions in Bhutan and in India as per the last rows of the above table.

The additional port throughput potentials for trade of imports or exports for partners in Bhutan or India via Bangladesh ports is shown in Table 9-3. Details by commodities are provide in Appendix H.

The forecasted cargo potential for the ports in the Bay of Bengal within the catchment area in the hinterland including Bhutan and regional in India is estimated 7.6 million tons larger than the maritime trade potential of Bangladesh in 2020. Accessibility by projected infrastructure and border crossing procedures improvements provide, the additional cargo potentials are increasing to 25.2 million metric tons in 2030 and to 37.5 million metric tons in 2040. The trend projected development or additional cargo potentials amounts for 51.8, 59,3 and 68,3 million tons in 2050, 2060 and 2070. The calculated and mathematical projected additional market potential in 2100 amounts for 93.4 million tons of cargo volumes under the assumption of no constraints in hinterland infrastructure ad at border crossings.

Table 9-3: Maritime Trade of all Hinterland regions 2020-2040 and 2050/2060/2070/2100

Commodities	Projected Martime Imports and Exports 2020 - 2100 in metric tons						
	2020	2030	2040	2050	2060	2070	2100
Dry Bulk Cargo	49163034	133724291	236862758	347200785	339136261	348711182	347296446
Grap or Conveyer	38612185	112317498	202660425	303705703	280634987	273080564	208568922
Coal	4786670	14246632	25859768	34303239	32538849	31821417	25632141
Cement clinker	32375606	94254633	170106025	259326884	238794078	232209023	176037474
Gypsum	296798	936672	1725020	2653181	2438762	2370689	1790328
Lime stone	209494	313952	425735	553718	527592	516392	419556
Slag, sand, gravel etc.	943617	2565610	4543877	6868681	6335705	6163043	4689422
Grap, rain protected	5637120	11450057	18302800	23207941	31261654	40466455	74594060
Fertilizers	4573055	7964348	11827496	12590432	12819475	12547324	10194408
C.Bone/B. Griest	823	1234	1500	1664	1740	1729	1420
Salt	1063242	3484475	6473805	10615846	18440440	27917402	64398232
Protected or pneumatic handling	4913729	9956736	15899533	20287141	27239620	35164163	64133464
Grain	4296285	7649405	11492728	14488481	19148077	24448259	43670608
Soya beans, oil seeds	0	0	0	0	0	0	0
Fly Ash	617443	2307330	4406805	5798659	8091542	10715903	20462856
Liquid Bulk	12385818	26660190	43641342	54933801	73152466	93806543	169972911
Oil and fuel	8287667	16513495	26178367	32611323	42925779	54585202	97488277
Crude Oil	141342	281629	446459	556170	732078	930923	1662614
Mineral Oil fuel products	8146325	16231866	25731908	32055153	42193701	53654279	95825663
Edible Oil	2980413	5938587	9414271	11727691	15436978	19629942	35058756
Liquid gas	1117738	4208107	8048705	10594787	14789709	19591399	37425878
Liquid Gas LPG	1117738	4208107	8048705	10594787	14789709	19591399	37425878
Liquid Gas LNG	0	0	0	0	0	0	0
General Cargo	51696174	114592114	187796266	236293933	312911086	398936400	713849399
Break Bulk (eg.g. iron/steel, paper, wood)	41462	98095	166274	211573	285086	368651	677440
Cars and vehicles	30760	64113	102596	129727	173609	223414	407241
Heavy lifts, project cargo, machinery	250372	809896	1500000	1957695	2709024	3567602	6752626
Bags or bails, palletized or not	3646670	8119928	13466082	17020084	22767019	29289091	53359736
Containerization affine cargoes	47726909	105500081	172561314	216974853	286976349	365487643	652652355
Chemical products	72982	81833	85505	88277	89108	88129	79206
Fish, meat, fruits, other perishables	59858	119269	189074	235536	310032	394243	704111
General cargoes, n.e.s	47594069	105298979	172286735	216651040	286577208	365005271	651869038
Total	**113245026**	**274976595**	**468300367**	**638428519**	**725199814**	**841454124**	**1231118755**
Difference / Additional Cargoes (million tons)	7,57	25,20	37,46	51,84	59,35	68,37	93,42

The overall potential of the maritime transport related foreign trade in the hinterland for the seaports at the Bay of Bengal amounts for 113.4 million tons of cargo in 2020, 277 million in 2030, with regard to the expected economic growth in the port hinterland regions 468.3 million tons of cargo in 2040 and according to the trend extrapolations 841.5 million tons in 2070 and more than 1,231 million tons in the year 2100.

9.3.3 Throughput potentials for Mongla Port until 2040 and projections onto 2100

The throughput potential of Mongla Port is the share of the port in the overall hinterland transport potential. As referred to by Chapter 8, the development of the catchment area of Mongla Port depends on the

- availability and capabilities of infrastructure to connect Mongla Port by all modes of hinterland transport,
- the commencement of connections and bridges to shortening transport distances
- measures accelerating transport from and to Mongla Port, and at border crossing

These developments are in favour of choosing Mongla Port for shipments or as port of entry for imports. In the other hand other ports will also benefit from the afore mentioned developments when in favour of improvements of their respective accessibility. Depending on the field of improvements the fields of activity concern

- techno - administrative issues related to trade facilitation related to border crossing procedures and border post efficiency including eventually re-opening of or additional border posts,
- improvements of road network, including river crossings and adding road capacities
- closing gaps in railway infrastructure and network density and connectivity, also by additional river bridges, and promotion of intermodal operations within Bangladesh and optionally also in cross border trade with India

The objective of this forecast step is to assess the market potential for Mongla according to socio-economic, regional and geographical economics. The forecast projections are input information for strategy building and planning of measures in relation to and answering techno-economic key questions related to if and by what means all or which selection of the identified potentials can and shall best be attracted to Mongla Port, and what are the nautical, port capacity and related port infrastructure, management, organisational, institutional and operations measures required.

For the base case regarding the market share in port hinterland competition the following assumptions apply:

- For 2020 no changes in present practices and workflows at border posts will apply. The share of Mongla rearing attraction of cargos from the hinterland will apply as per Scenario 1 for road transport. Railway connectivity is not regarded for this reference year.
- For 2030 and 2040 availability of Padma bridge and other railway and road network improvement measures as per development plans will be operational. Border procedures will improve with the result of less extreme waiting times at border post as per border crossing Scenario 2.
- From 2060 onwards, i.e. in 40 years, border crossings will not form any significant hindrance for trade due to unexpected or long waiting times as per border scenario 3 assumptions. Furthermore, it is assumed that hinterland transport networks for all modes of transport will be able to cope with the demanded capacities.

The results of the application of the captioned combination of assumptions are summarised in Table 9-4.

Table 9-4: Potential Share of Mongla Port in Maritime Trade 2020-2040 and onto 2100

Shares in percent / GDP values in million USD

Share of population acccessible by road transport	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2100**
Bangladesh	42,45%	60,57%	59,45%	59,45%	57,42%	57,42%	57,67%
India	-	-	-	-	1,02%	1,02%	1,02%
Bhutan	-	-	-	-	90,17%	90,17%	96,82%
Share in Rail Transport accessibility							
Bangladesh	-	55,20%	54,08%	53,14%	29,05%	29,05%	29,05%
India	-	-	-	-	-	-	
Bhutan	-	-	-	-	-	-	-
Captive Population GDP as per Road share (million USD)	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2100**
Bangladesh	95.075	263.016	414.565	515.708	655.202	711.671	1.504.231
India	-	-	-	-	933	1.005	1.973
Bhutan	-	-	-	-	9.232	9.938	19.960
Total GDP per Road share	**95.075**	**263.016**	**414.565**	**515.708**	**665.367**	**722.614**	**1.526.164**
Share road accessible regions in GDP/Total GDP	39,62%	55,02%	54,70%	54,62%	53,54%	53,57%	54,08%
Total GDP	**239.981**	**478.021**	**757.944**	**944.092**	**1.242.733**	**1.348.974**	**2.822.306**
Captive Population GDP as per Rail share (million USD)	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2100**
Bangladesh	-	239.662	377.122	460.931	331.427	359.991	757.576
India	-	-	-	-	-	-	-
Bhutan	-	-	-	-	-	-	-
Total GDP per Rail share	**-**	**239.662**	**377.122**	**460.931**	**331.427**	**359.991**	**757.576**
Share railway accessible regions in GDP/Total GDP	0,00%	50,14%	49,76%	48,82%	26,67%	26,69%	26,84%
Total GDP	**239.981**	**478.021**	**757.944**	**944.092**	**1.242.733**	**1.348.974**	**2.822.306**
Average weightened share Road/rail accessible catchment area for Mongla port in Total GDP of port hinterland catchment area	**39,62%**	**52,58%**	**52,23%**	**51,72%**	**40,10%**	**40,13%**	**40,46%**

Legend:
: Share as per present border crossing conditions
: Share as per reduced waiting times at border crossings
: Share as per open borders/lowest possible waiting time at border crosssings

The assumed modal split in hinterland traffic of ports at the Bay of Bengal and the calculated possible shares of Mongla Port is calculated under consideration of port industry traffic with source or destination of cargoes directly at the port and without need for participation in port hinterland traffic competition, and inland navigation as mode of transport for bulk cargoes and prospectively unitized / containerised cargoes (see the port of Chittagong attempts).

Table 9-5 summaries the calculated potential of Mongla Port in Bangladesh and transit traffic. Annex H provides the details per commodities and import/inbound and export/outbound traffic. The estimated cargo potentials do consider geographical and economic factors under the assumption of unlimited hinterland infrastructure capacities by all modes of transport and unlimited port capacity. Furthermore, the potential assessment does not consider restrictions in nautical accessibility of ports. It describes, therefore, the gross loading potential of Mongla Port under the assumption of unlimited technical means and ideal natural and nautical and land availability conditions.

Table 9-5: Mongla Port traffic potentials 2020-2040 and outlook until 2050/2060/2070 and 2100

Commodities	Projected Imports and Exports 2020 - 2100 in metric tons						
	2020	2030	2040	2050	2060	2070	2100
Dry Bulk Cargo	19477240	70311005	123703768	179584985	136010276	139927279	140511825
Grap or Conveyer	15297241	59055510	105841283	157087733	112548396	109578993	84384393
Coal	1896366	7490748	13505503	17742894	13049675	12768975	10370446
Cement clinker	12826455	49558221	88839446	134133379	95768139	93178476	71222574
Gypsum	117584	492494	900908	1372322	978063	951286	724344
Lime stone	82997	165073	222344	286403	211590	207212	169747
Slag, sand, gravel etc.	373839	1348974	2373082	3552734	2540928	2473043	1897282
Grap, rain protected	2233295	6020335	9558807	12003999	12537457	16237968	30179829
Fertilizers	1811737	4187581	6177019	6512233	5141238	5034863	4124531
C.Bone/B. Griest	326	649	783	860	698	694	574
Salt	421232	1832105	3381004	5490905	7395521	11202411	26054724
Protected or pneumatic handling	1946704	5235160	8303678	10493254	10924424	14110318	25947602
Grain	1702087	4021987	6002184	7493974	7679318	9810349	17668585
Soya beans, oil seeds	0	0	0	0	0	0	0
Fly Ash	244617	1213173	2301495	2999279	3245105	4299969	8279017
Liquid Bulk	4906970	14017683	22792095	28413777	29337727	37641736	68768927
Oil and fuel	3283379	8682644	13671894	16867773	17215343	21903395	39442545
Crude Oil	55996	148078	233167	287671	293599	373551	672673
Mineral Oil fuel products	3227383	8534566	13438727	16580101	16921744	21529844	38769872
Edible Oil	1180770	3122455	4916690	6065992	6190985	7876904	14184337
Liquid gas	442822	2212584	4203510	5480013	5931399	7861437	15142045
Liquid Gas LPG	442822	2212584	4203510	5480013	5931399	7861437	15142045
Liquid Gas LNG	0	0	0	0	0	0	0
General Cargo	20480811	60251482	98078338	122219892	125492695	160081144	288814594
Break Bulk (eg.g. iron/steel, paper, wood)	16426	51578	86838	109434	114333	147929	274084
Cars and vehicles	12186	33710	53582	67100	69626	89649	164765
Heavy lifts, project cargo, machinery	99192	425836	783389	1012592	1086452	1431571	2732028
Bags or bails, palletized or not	1444725	4269384	7032786	8803412	9130691	11752829	21588686
Containerization affine cargoes	18908281	55470975	90121744	112227355	115091593	146659166	264055031
Chemical products	28914	43027	44656	45660	35737	35363	32046
Fish, meat, fruits, other perishables	23714	62711	98746	121828	124338	158198	284875
General cargoes, n.e.s	18855653	55365237	89978342	112059867	114931518	146465605	263738110
Total	**44865021**	**144580171**	**244574201**	**330218654**	**290840698**	**337650158**	**498095346**

The cargo throughput potential as per estimated foreign trade developments and the share in overall maritime trade of the hinterland regions amounts for 44.9 million tons in 2020, 144.6 million tons in 2030 and 244.6 million tons in 2040. These figures indicate the maximum ceiling for the throughput development via Mongla Port.

Figures for the years until 2070 as well as the long – term projections for 2100 are estimated by extrapolation of trends assuming that infrastructure and port capacities and continuation of economic development, consumption, production and trade elasticities will prevail. The results of the calculated 330 million tons for 2050, due to regional accessibility structure change assumptions of 291 million tons in 2060 and 342 million tons for 2070 as well at the 498 million tons of cargo potential for 2100 serve for visualisation of development trends. Reconsideration and re-confirmation or adjustment of all long -term projection figures is strongly recommended during also recommended, regularly masterplan and traffic demand projection updates.

9.3.4 Mongla Port Throughput Forecast until 2040 and Projections until 2100

The trend forecast consider socio-economic development and accessibility criteria of the catchment areas of the port at the Bay of Bengal according to distances and border crossing

scenarios. Port throughput development at port locations is however depending on the development of demand or production of port and port adjacent industries. Investments or de-investment of industrial enterprises or within economic zones of magnitude influence port related supply chains directly and are only in a long – run predictable by trend analyses. Regarding Mongla Port, the

- cement industry developments and the corresponding development of inbound supplies with cement clinker, limestone, gypsum and additives like e.g. ores or fly ash,
- demand for LPG and for distribution stores and bottling plants
- establishment of Rampal power plant around 10 km upstream of Mongla Port permanent jetty and the synergies for supplying further power plants in the hinterland by established maritime and ship/shore handling supply chains driven by the regular and long-term contracted coal supply of 4 million tons per year in addition to the present throughput
- achieved position of Mongla Port as car and road vehicle import port with a market share of around 50% together with port adjacent area availability
- establishment of free zones and export processing zones in the direct vicinity of Mongla Port, requiring the and benefitting from container handling facilities and liner services directly at the location of the manufacturer and industrial premises
- role of Mongla as fertilizer import port and the established supply chain from Mongla Port midstream ship - lightering places to Roosevelt jetty in combination with expected demand trend for fertilizers

together with the already considered infrastructure developments will accelerate the port throughput earlier than expected or define for the port throughput growth according to industry supply chain demand developments (see Annex I) for the forecast terms 2020 – 2040.

On the other hand, trend projected development in mineral oil and petroleum product handling are not yet foreseen by the master planning but allocated to e.g. Payra port and other port development project locations. These potentials are, except for supply of regional demand by tank farms for distribution, not expected to materialize as projected by the trend forecast. Same for sweet-oil handling or chemical product throughput in quantities of magnitude and others than in containers.

As to container trade, the trend - projected potential is overestimated and corrected by adjustment factors. Same for the too dynamic expectations for machinery and heavy lifts imports. Trade with general cargoes in containers and with machinery etc. is methodically tending to over-assessments due to the impact on the trend projections of strongly increasing values at analytical derived elasticities regarding the ration value (in USD) and weight in tons during long term projections.

The detailed adjustments of the import and the export projections are presented by the respective tables in Annex H. Table 9-6, Table 9-7 and Table 9-8 show the Mongla Port throughput forecast results by commodities and handling type classes for inbound/import outbound/export and for the total expected throughput (both directions) for the years 2020 – 2040 and the projections until 2070 as well at the outlook for the year 2100.

Table 9-6: Mongla Port inbound cargo throughput 2020-2040 and outlook 2050/2060/2070/2100

Commodities	Projected throughput 2020 - 2100 in metric tons - Import/Inbound						
	2020	2030	2040	2050	2060	2070	2100
Dry Bulk Cargo local industry and corrections	12408412	21989842	49512493	64972114	51792780	50692598	40124355
Grap or Conveyer local industry development	9901070	15659316	38957783	55843371	40299864	39291243	30718875
Coal as per local development projections	3200000	7490748	13505503	17742894	13049675	12768975	10370446
Local Development projections cement and construction materials							
Cement clinker	5100000	6216872	20834951	31457450	22459893	21852556	16703378
Gypsum	383691	467718	1595326	2430107	1731953	1684536	1282668
Lime stone	469701	572563	1489599	1918762	1417553	1388223	1137224
Slag, sand, gravel etc.	747678	911415	1532404	2294158	1640790	1596954	1225159
Grap, rain protected local industry and corrections	2098766	5709495	9561357	7800000	10330711	10050227	7672500
Fertilizers	1677534	3877390	6241926	9508117	6776498	6590971	5018611
C.Bone/B. Griest	0	0	0	0	0	0	0
Salt	421232	1832105	3319431	4969511	3554212	3459256	2653889
Protected or pneumatic handling local industry/corrections	408575	621031	993353	1328743	1162205	1351127	1732980
Grain	163959	387430	578179	721880	739734	945012	1701980
Soya beans, oil seeds	0	0	0	0	0	0	0
Fly Ash	244617	233601	415174	606863	422471	406116	31000
Liquid Bulk local industry and corrections	1148536	5120368	9501699	12310590	13241191	17476630	33442165
Oil and fuel local industry and corrections	262893	695200	1094678	1350564	1378394	1753755	3158075
Crude Oil	111993	296156	466335	575343	587198	747103	1345346
Mineral Oil fuel products	150900	399043	628343	775222	791195	1006652	1812730
Edible Oil local development projections	0	0	0	0	0	0	0
Liquid gas local industry projections	885643	4425168	8407021	10960025	11862798	15722875	30284090
Liquid Gas LPG	885643	4425168	8407021	10960025	11862798	15722875	30284090
Liquid Gas LNG	0	0	0	0	0	0	0
General Cargo local industry and corrections	1807388	5295558	11539364	14529852	22445957	29008713	53725681
Break Bulk (eg.g. iron/steel, paper, wood) local industry, corrections	16426	51578	86838	109434	114333	147929	274084
Cars and vehicles local industry development	41066	128944	217095	273584	285834	369821	685210
Heavy lifts, project cargo, machinery trend correction	197563	240829	293569	357859	436228	531759	963208
Bags or bails, palletized or not, corrections ==> see containers	0	0	0	0	0	0	0
Containerization affine cargoes as per local industry	1552332	4874208	10941862	13788976	21609563	27959204	51803179
Chemical products	0	0	0	0	0	0	0
Fish, meat, fruits, other perishables	0	0	0	0	0	0	0
General cargoes, n.e.s	1552332	4874208	10941862	13788976	21609563	27959204	51803179
Total as per local industry developments and corrections	**15364336**	**32405768**	**70553555**	**91812556**	**87479928**	**97177941**	**127292202**

Table 9-7: Mongla Port outbound cargo throughput 2020-2040 and outlook 2050/2060/2070/2100

Commodities	Projected Throughput 2020 - 2100 in metric tons - Export/Outbound						
	2020	2030	2040	2050	2060	2070	2100
Dry Bulk Cargo local industry and corrections	326	649	783	860	698	694	574
Grap or Conveyer local industry development	0	0	0	0	0	0	0
Coal as per local development projections	0	0	0	0	0	0	0
Local Development projections cement and construction materials							
Cement clinker	0	0	0	0	0	0	0
Gypsum	0	0	0	0	0	0	0
Lime stone	0	0	0	0	0	0	0
Slag, sand, gravel etc.	0	0	0	0	0	0	0
Grap, rain protected local industry and corrections	326	649	783	860	698	694	574
Fertilizers	0	0	0	0	0	0	0
C.Bone/B. Griest	326	649	783	860	698	694	574
Salt	0	0	0	0	0	0	0
Protected or pneumatic handling local industry/corrections	0	0	0	0	0	0	0
Grain	0	0	0	0	0	0	0
Soya beans, oil seeds	0	0	0	0	0	0	0
Fly Ash	0	0	0	0	0	0	0
Liquid Bulk local industry and corrections	0	0	0	0	0	0	0
Oil and fuel local industry and corrections	0	0	0	0	0	0	0
Crude Oil	0	0	0	0	0	0	0
Mineral Oil fuel products	0	0	0	0	0	0	0
Edible Oil local development projections	0	0	0	0	0	0	0
Liquid gas local industry projections	0	0	0	0	0	0	0
Liquid Gas LPG	0	0	0	0	0	0	0
Liquid Gas LNG	0	0	0	0	0	0	0
General Cargo local industry and corrections	219116	560888	1855110	2071180	3050696	3664065	5162044
Break Bulk (eg.g. iron/steel, paper, wood) local industry, corrections	0	0	0	0	0	0	0
Cars and vehicles local industry development	0	0	0	0	0	0	0
Heavy lifts, project cargo, machinery trend correction	410	821	1000	1096	888	882	730
Bags or bails, palletized or not, corrections ==> see containers	110238	164047	170257	174086	136252	134829	122179
Containerization affine cargoes as per local industry	108468	396020	1683853	1895997	2913557	3528354	5039135
Chemical products	1446	2151	2233	45660	35737	35363	32046
Fish, meat, fruits, other perishables	23714	62711	98746	121828	124338	158198	284875
General cargoes, n.e.s	83308	331158	1582875	1728509	2753482	3334792	4722215
Total as per local industry developments and corrections	**219442**	**561537**	**1855893**	**2072040**	**3051394**	**3664758**	**5162619**

Table 9-8: Mongla Port in- and outbound cargo throughput projections 2020-2040 and 2070/2100

Commodities	Projected Throughput 2020 - 2100 in metric tons - Inbound and Outbound						
	2020	2030	2040	2050	2060	2070	2100
Dry Bulk Cargo local industry and corrections	12408738	21990491	49513276	71650602	51793477	50693292	40124930
Grap or Conveyer local industry development	9901070	15659316	38957783	55843371	40299864	39291243	30718875
Coal as per local development projections	3200000	7490748	13505503	17742894	13049675	12768975	10370446
Local Development projections cement and construction materials							
Cement clinker	5100000	6216872	20834951	31457450	22459893	21852556	16703378
Gypsum	383691	467718	1595326	2430107	1731953	1684536	1282668
Lime stone	469701	572563	1489599	1918762	1417553	1388223	1137224
Slag, sand, gravel etc.	747678	911415	1532404	2294158	1640790	1596954	1225159
Grap, rain protected local industry and corrections	2099092	5710144	9562140	14478488	10331408	10050921	7673074
Fertilizers	1677534	3877390	6241926	9508117	6776498	6590971	5018611
C.Bone/B. Griest	326	649	783	860	698	694	574
Salt	421232	1832105	3319431	4969511	3554212	3459256	2653889
Protected or pneumatic handling local industry/corrections	408575	621031	993353	1328743	1162205	1351127	1732980
Grain	163959	387430	578179	721880	739734	945012	1701980
Soya beans, oil seeds	0	0	0	0	0	0	0
Fly Ash	244617	233601	415174	606863	422471	406116	31000
Liquid Bulk local industry and corrections	1148536	5120368	9501699	12310590	13241191	17476630	33442165
Oil and fuel local industry and corrections	262893	695200	1094678	1350564	1378394	1753755	3158075
Crude Oil	111993	296156	466335	575343	587198	747103	1345346
Mineral Oil fuel products	150900	399043	628343	775222	791195	1006652	1812730
Edible Oil local development projections	0	0	0	0	0	0	0
Liquid gas local industry projections	885643	4425168	8407021	10960025	11862798	15722875	30284090
Liquid Gas LPG	885643	4425168	8407021	10960025	11862798	15722875	30284090
Liquid Gas LNG	0	0	0	0	0	0	0
General Cargo local industry and corrections	2026504	5856446	13394474	16601032	25496654	32672778	58887725
Break Bulk (eg.g. iron/steel, paper, wood) local industry, corrections	16426	51578	86838	109434	114333	147929	274084
Cars and vehicles local industry development	41066	128944	217095	273584	285834	369821	685210
Heavy lifts, project cargo, machinery trend correction	197973	241649	294569	358955	437116	532642	963938
Bags or bails, palletized or not, corrections ==> see containers	110238	164047	170257	174086	136252	134829	122179
Containerization affine cargoes as per local industry	1660801	5270228	12625716	15684973	24523120	31487558	56842314
Chemical products	1446	2151	2233	45660	35737	35363	32046
Fish, meat, fruits, other perishables	23714	62711	98746	121828	124338	158198	284875
General cargoes, n.e.s	1635641	5205366	12524737	15517485	24363045	31293996	56525394
Total Mongla Port Throughput	**15583778**	**32967305**	**72409449**	**100562224**	**90531322**	**100842699**	**132454820**

Mongla Port throughput in 2020 will amount for 15.6 million tons and increase to 33 million tons in 2030. In 2040, the throughput is expected to amount for 72.4 million tons. The port development of Mongla Port shall hence foresee a dynamic development of capacities and installations in order to cope the expected port throughput and the corresponding land and maritime traffic demand until 2040.

The projections for the years 2050, 2060 and 2070 show a long-term growth expectation for Mongla Port throughput of up to 100 million tons. However, the projections consider that increased port competition will result in less dynamic developments and in fluctuations of throughput growth in Mongla. The forecast projection results reflect by the adoption of port competition that in a liberalized market environment and in combination with establishment of additional port capacities at other locations than Mongla will maintain already achieved efficiency and productivity levels in order that the projected level of 132 million tons of cargoes handled in Mongla Port in 2100 will be reached.

The master plan measures and the overall concept for 2020 – 2040 should consider the growth perspectives and lay the foundations for flexible and efficient port capability development in Mongla.

9.4 Modal Spit in Hinterland Traffic of Mongla Port 2020—2040 and Outlook

The assumed development of the share of inland water transport in hinterland traffic from and to Mongla Port as well as the share of cargoes ship-shore handled for port or port adjacent industry purposes is assed for the forecast years 2020 – 2040 and assumed for the years until 2070 with an outlook to 2100 in detail. The results of the modal split assessments are provided per each mode of transport and commodity at Appendix K for reference.

10 Vessel Traffic Features

10.1 General

The development of vessel traffic, counted in the recent and in the future expected number of vessels per year, day or shift to be served at Mongla Port facilities

- Outer Bar,
- lightering places on anchorage
- MPA permanent jetty and future jetties
- industrial/private jetties including the government grain reserve handling facilities

as well as on movement by inland water vessels between trimodal facilities upstream the Pussur river and beyond depends on

- the throughput development according to economic potential and the share of the economic potential accessible according to capacities and port and handling and logistics economics
- the logistics profiles of the maritime trade and particularly on development trends in global shipping regarding markets, vessel sizes and vessel types
- Maritime shipping and port handling and port access specific constraints.

As to the latter, there are hardly any ports on the globe which provide for all kinds of cargoes or all vessel types and sizes of vessels restriction – free accesses. Industry related supply chains define the vessel sizes and economics of ships deployed e.g. in dry bulk or liquid bulk trade. Break bulk and general cargo trade flows will also find adequate vessels in terms of types and sizes frequent cargo flows of significance provided (e.g. for car carriers for vehicles or liquid gas trade with Mongla Port access applied gas tankers, etc.).

Maritime container trade however is following the same gravity principle but considers nautical accessibility and hinterland access economics according to main players' global cost and performance networks. Containers as intermodal loading units are standardized in handling. They are swiftly, scheduled and traceable transportable and can be transhipped from deep-sea vessels to smaller, so called feeder vessels and from port to port depending on hinterland transport efficiency and at foreseeable cost. Container shipping limitations by port accessibility or port performance constraints lead to deviation for container cargoes to other pots and/or to smaller vessels, depending on global and not or rather limited port-influenced factors.

10.2 Container Shipping Trends

The container shipping industry exists only for 50 years now. Nevertheless, dramatic changes have been experienced not only regarding to ship sizes but also regarding size and structure of the players.

10.2.1 Container Ship Sizes and Cost Trends

The container shipping industry has experienced a tremendous growth in ship sizes since the introduction of the container. Figure 10-1 illustrates the development by showing the record-

breaking ship sizes over the years and their respective initiators. The development has followed an incredible exponential growth over the last 50 years.

Apparently over almost 20 years the development has been fuelled by Maersk Line of Denmark which has grown in parallel to the biggest shipping line of the world. In the meantime, Maersk's role as a ship size fore runner has been succeeded by various competitors which felt forced to follow and overtake Maersk's example. The latest news is that Evergreen of Taiwan will lead the development with in total 10 vessels of 23,764 TEU capacity for the first delivery in 2020 beating MSC with its presently record holding vessels of 23,756 TEU.

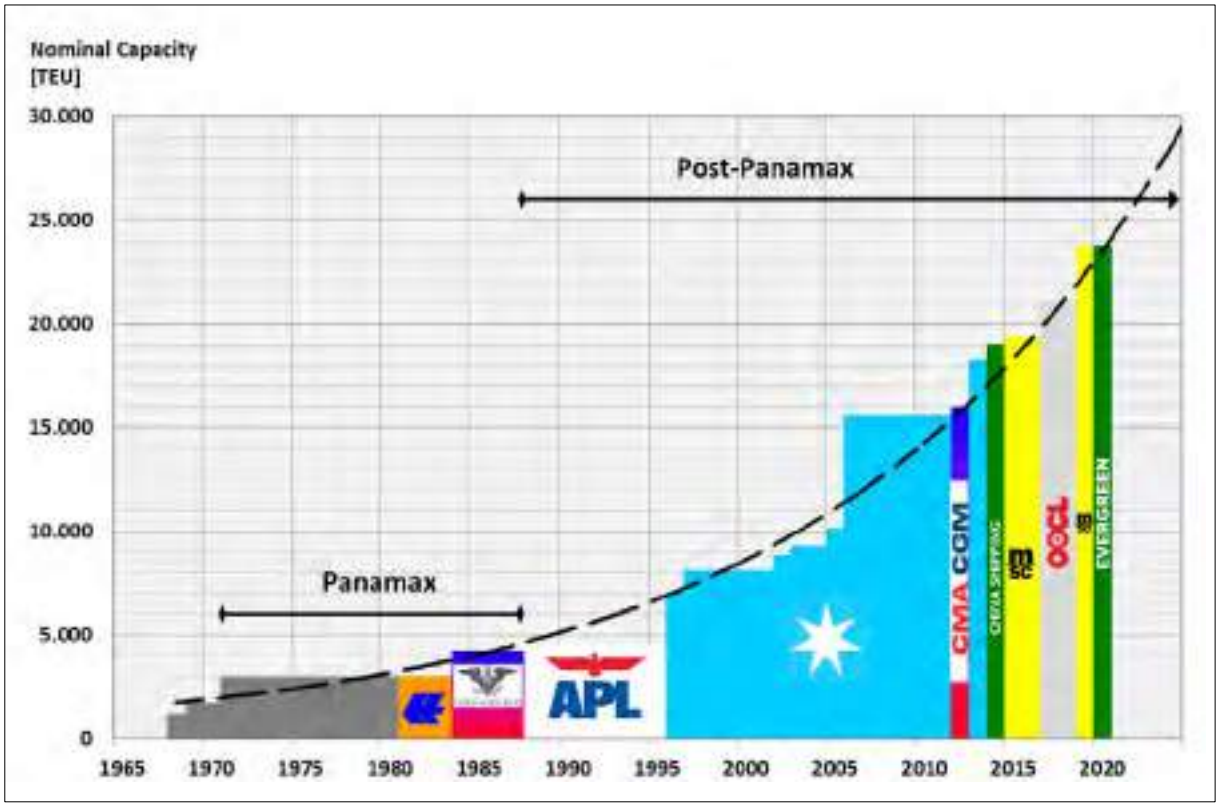


Figure 10-1: Record Breaking Ship Sizes and their Initiators

Shipping lines are aiming to make use out of the Economies-of-Scale (EoS) effect when ordering ever bigger vessels. Due to this effect three major specific cost types in container shipping are being reduced:

- Investment per TEU
- Fuel costs per TEU
- Operating costs per TEU (mostly for crewing)

Figure 10-2 characterises EoS in container shipping schematically.

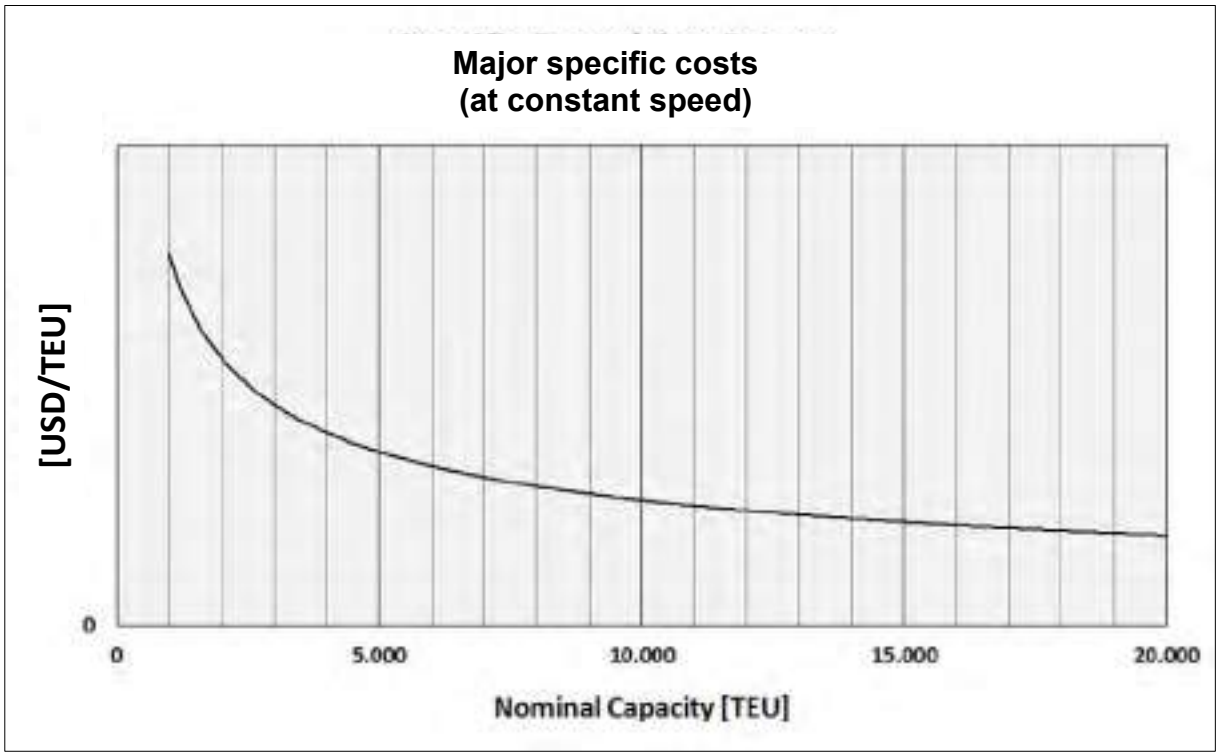


Figure 10-2: Cost per Container Slot in Relation to Vessel Sizes

These three major cost curves are of asymptotic shape and consequently their sum is, too, see Figure 10-2. Hence in principle, the impact of the Economics of Scale effect is lowering the bigger the ships become. Hence already at present mega ship sizes the effect of any further increase in size is only marginal. On the other hand, the costs for related infrastructure (e.g. dredging, turning basins, quay walls, container cranes) are increasing more than linear with the increasing ship sizes. I.e. the benefits for the operator of such vessels are getting smaller but the costs mostly to be borne by the public are heavily increasing, see Figure 10-3.

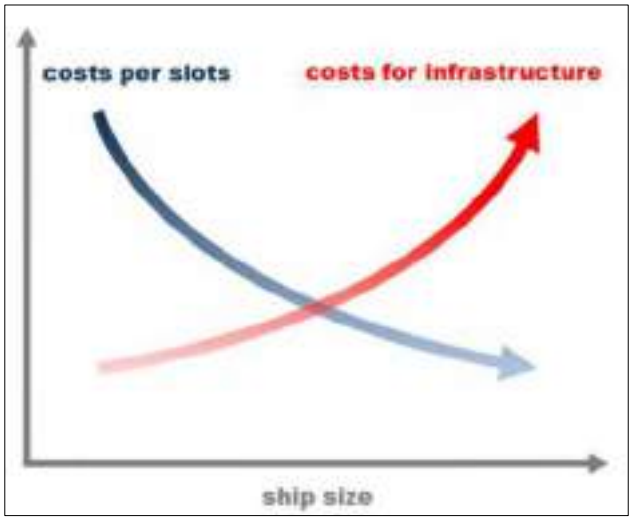


Figure 10-3: Economics of Ship Size and Land Cost

This is not only a shift in sharing of yields or costs, but the total costs of the transport chain are increasing meanwhile despite the EoS effect. It is only the stiff competition among some ports which is paving the way on their costs for ever bigger vessels in order to keep the container lines calling at the ports. It is referred to Appendix L for further data regarding container shipping cost and development trends.

10.2.2 Market Concentration

In parallel to the increasing ship sizes a significant consolidation of the global liner shipping industry has taken place over the last decade, see Figure 10-4.

Figure 10-4: Recent Mergers and Acquisitions in Container Shipping

While each carrier is still acting independently on the marketing and sales side the remaining top carriers have formed three global alliances on the operation side (2M, Ocean Alliance, THE Alliance) as per Figure 10-5[19].

Figure 10-5: The Global Container Ship Alliances

Each alliance agrees on the provided capacity, sailing frequency, schedules as well as on port and terminals to be called at. On the Asian-North Europe trade the market share of the three alliances is nearly 100%, see Figure 10-6. Hence while there is still enough competition among

[19] Major South Korean carrier Hyundai Merchant Marine (HMM) is not member of any alliance but has maintained a strategic partnership previously with 2M but switches recently to THE Alliance.

the carriers towards their customers ports and port service providers are confronted virtually with a port users oligopoly.

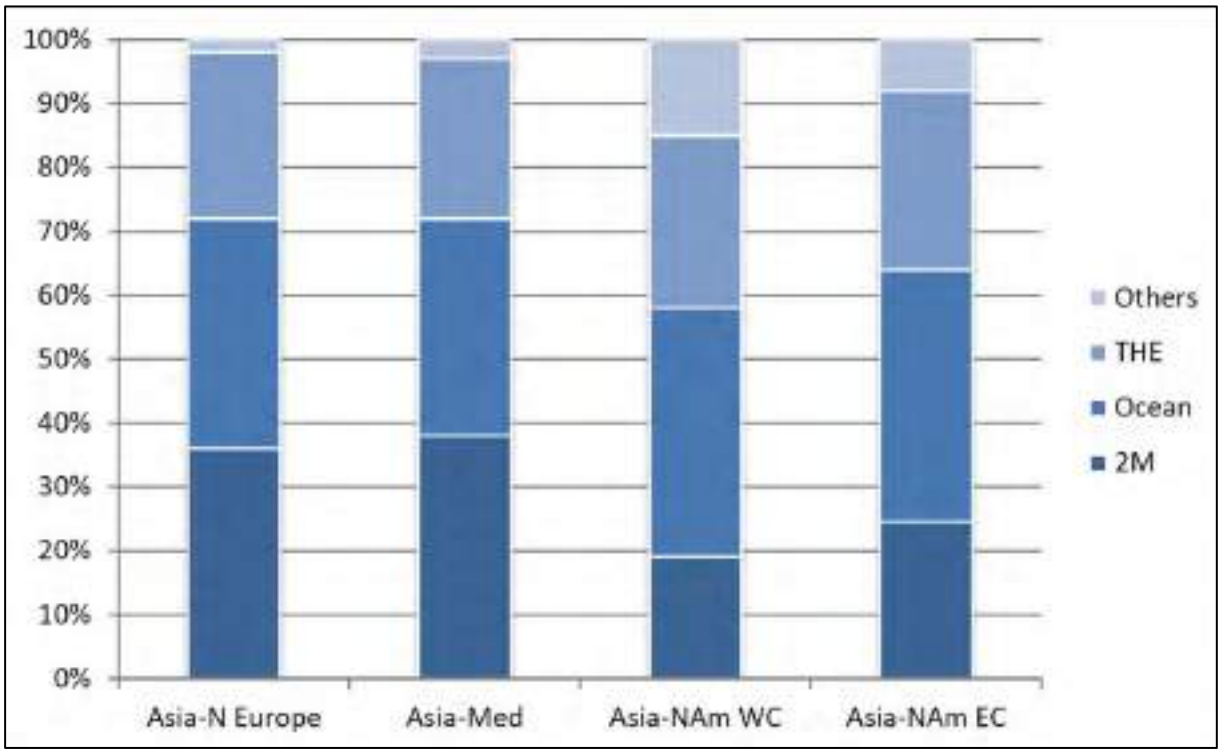
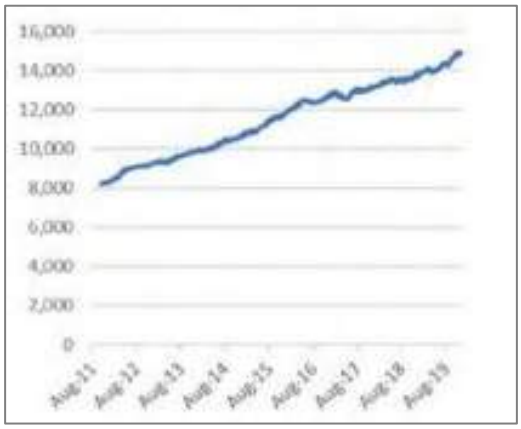


Figure 10-6: Capacity Shares of global alliances on main East-West trade lanes [Consultant, 2018]

The average size of container ships in the Asia-Europe trade has continuously grown to approx. 15,000 TEU at present, see Figure 10-7. Hence container vessels of this size should be considered as the present work horses in the Europe – Asia trade.



Source: Shipping Watch, 04.09.19

Figure 10-7: Average Container vessel size Asia-Europe trade

Virtually all ports around the Bay of Bengal are unable to accommodate such vessels.

10.3 Container Connectivity of Mongla Port

It is unlikely that a Bangladesh ports will be directly called by the captioned container vessels for intercontinental trade between Europe and the Far East. The Bangladesh ports will remain feeder ports which are to be connected to the global liner services via one of the three hub ports in the region, e.g. Singapore, Tanjung Pelepas (Malaysia) or Colombo (Sri Lanka).

The feeder voyage will be more expensive as only small container vessels which can cope with the draft situation in Mongla and Chittagong and additional handling during container or transhipment is required. The draft situation in Mongla provides larger limits than in Chittagong as shown in Table 10-1. Hence maritime international trade of Bangladesh is obliged to accept limitations provided by nature with significant cost disadvantage regarding seaborne container logistics.

Table 10-1: Vessel Size Restriction for Container Ships at Bangladesh Ports

	Chittagong		Mongla	
	at present	planned	at present	planned
Max. draft at container berths	9.5 m[20]		7.0 m	
Max. length	190 m[21]		225 m	
Resulting vessel size	1,800-2,200 TEU[22]		500-800 TEU[23]	
Max. draft at buoy/anchor	-	-	8.5 m	

Source: CPA & MPA

10.3.1 Container Lines serving Mongla Port

Presently only two container lines have included Mongla Port into their network of liner services:

- **Maersk Line**
- **Pacific International Line (PIL)**

With such small attention by the big container lines it is a surprise that not even X-PRESS FEEDERS (based in Singapore) as the largest independent common (feeder) carrier in the world with a wide coverage in the Asian region is presently not serving Mongla.

[20] Valid for the months from July to December 2019

[21] At night the maximum permissible length is reduced to 175 m

[22] Due to the length limitation partly loaded bigger vessels cannot berth

[23] Partly loaded bigger vessels can berth. The length limitation would theoretically allow for vessels up to approx. 3,000 TEU size.

For the time being it is mandatory that all containerships calling Mongla are self-sustained as there are no quay-based container cranes.[24]

Maersk is operating two dedicated Bangladesh feeder services which include calls in Mongla (Bangladesh Feeder 1 & 4). They are connecting the ports of Mongla, Chittagong and Yangoon (Myanmar) with its hub in Tanjung Pelepas (Malaysia) and in case of Bangladesh Feeder 1 also adjacent Singapore. To better cope with the current draft constraints Mongla is mostly served as the last discharging port (as imports prevail). Despite the published duration it can be derived from Maersk's sailing schedule that Mongla is served 2 to 3 time per month in average by this carrier. Transit time to Tanjung Pelepas is abt. 3 or 5 days respectively or 5 days to Singapore (Bangladesh Feeder 1). From Tanjung Pelepas to Mongla it takes abt. 8 days in both cases. From Singapore (Bangladesh Feeder 1) it is one day less. For comparison: In Chittagong at least one vessel of various Maersk services is calling every day.

PIL is based in Singapore and is the 9th largest container carrier of the world with a focus on the Asian region. With two vessels presently in service PIL is maintaining a dedicated Chittagong/Mongla service with a round voyage duration of 17 days between Singapore – Chittagong – Mongla – Singapore. Transit time from Singapore to Mongla is offered with 8 days whereas the return transit is within 5 days. With two vessels 3 to 4 sailings are offered per month. PIL is not only carrying its own containers but acts also as a feeder carrier to a few other deep-sea lines.

The 1,700 to 2,200 TEU vessels operated by Maersk which are presently calling both Chittagong and Mongla do almost reach the limits of Chittagong port regarding to their length and fully utilise the possible draft but only can call Mongla not fully loaded although the length limitation would allow for even bigger vessels.

PIL is operating vessels which are almost tailor made for Mongla Port utilising their max. draft by almost 90% whereas Chittagong port can be even called fully loaded.

Presently Mongla is only connected to the hubs in the Singapore area, i.e. Singapore and Tanjung Pelepas (Malaysia). Maximum draft for Mongla for container vessels berthing at the MPA jetty is currently 7.0 m, whereas the critical outer bar can only be crossed at high tide. Chittagong allows at present for vessels of up to 9.5 m draft.

In average there are 5 (and up to 8) sailings per month with vessels of 800 to 2,200 TEU size. However not even the 800 TEU vessels from PIL line can call Mongla at their full draft.

10.3.2 Container Logistics Cost and Economics

Container logistic costs are a key element for competitiveness of textile industry and manufacturing exports and raw and semi-finished products imports. As textile exports are at least ex-factory very price sensitive logistics costs contribute significantly to the Cost including Freight value of the goods.

Port development in Bangladesh enabling decreases in container logistic costs from door-to-door are supposed to have positive impacts on economic growth and income in Bangladesh.

[24] Only at the time of writing this report a LIEBHERR mobile harbour crane was in the process of being commissioned in Mongla port.

The development of Mongla Port should therefore aim at reducing the entire logistic costs of the transport chain from the Dhaka area to one of the hub ports in order to become a viable alternative to shipping via Chittagong. Otherwise it would be difficult to route cargo via Mongla instead of via Chittagong as the cargo is always following the cheapest way (old forwarders insight) – even if there is congestion.

10.4 Container Port Throughput Costs

The below section is comparing the results of cost comparison. In order to compare the tariff and cost data evaluated for Chittagong and Mongla Port have been calculated at maximum possible draft in Mongla with following vessel's particularities and container numbers, see Table 10-2.

Table 10-2: Port Call and Container Logistics Cost Sample Calculation

Vessel Tonnage:	9,422 GT			
Length:	144 m			
Beam:	23 m			
Actual draft:	7.0 m			
Capacity:	777 TEU			
Port stay:	2 days			
Tugs engaged:	2 x 2 (each approx. 2 hrs)			
	Handling:	20ft	40ft	TEU
Discharged	Full:	200	226	652
	Empty:	13	13	39
Loaded	Full:	100	100	300
	Empty:	124	124	372
	Total:	900		1,363

It is assumed that 50% of all containers are within the limit of the free storage (in general 7 days, except Full Container Load units in Chittagong: 4 days) period but 50% having an average storage period of 10 days.

For Mongla all containers are assumed to be LCL while for Chittagong 15% are assumed to be FCL and the remaining being LCL and needed to be unstuffed or stuffed in the port. This corresponds with the real figures at present. Costs for container and container load related services like e.g. unstuffing and stuffing are directly related to the weight of the cargo. At least it can be concluded that unstuffing/stuffing is significantly less costly in Mongla than in Chittagong and ICD Dhaka as well (more than 2/3 less).

Detailed calculations are depicted in Appendix L. The results are summarised in Table 10-3.

Table 10-3: Total Container Throughput Cost per Port Call (Example)

	Chittagong	Mongla
Port dues	0.241 USD/GRT/call x 9,422 GT = **2,271 USD**	
Pilotage	35.75 USD/1,000 GRT/job x 2 x 9,422 GT = **674 USD**	634 USD x 2 = **1,268 USD**
Tugs	632 USD/hr x 2 hrs x 2 x 2 = **5,056 USD**	594 USD/job x 2 x 2 = **2,376 USD**
Berth occupancy	Jetty 1-13: 2.50 USD/1,000 GRT/hr x 9,422 GT x 48 hrs = **1,130 USD**	30 USD/1,000 GRT/day x 9,422 GRT x 2 = **565 USD**
Move by gantry crane	300 x 15 USD + 326 x 22.5 USD + 137 x 7.5 USD + 137 x 11.25 USD = **14,404 USD**	n/a
Ship's gear[25]		500 USD/d x 17 d = **8,500 USD** crane driver: not known energy for crane: not know
Quay handling	300 x 130 USD + 326 x 195 USD + 137 x 22.1 USD + 137 x 42.6 USD = **111,434 USD**	300 x 0.85 x 130 USD + 300 x 0.15 x 43.4 USD + 326 x 0.85 x 195 USD + 326 x 0.15 x 65.1 + 137 x 22.1 USD + 137 x 42.6 USD = **101,185 USD**
Storage	45 x 3 x 6 USD + 49 x 3 x 12 USD + 218 x 3 x 6 USD + 234 x 3 x 12 USD = **14,922 USD**	150 x 3 x 3 USD + 68 x 3 x 1.5 USD + 183 x 3 x 6 USD + 69 x 3 x 3 USD = **5,571 USD**
Lift on/lift off charge	300 x 1,000 BDT + 137 x 375 BDT + 326 x 1,500 BDT + 137 x 563 BDT = 917,506 BDT ≈ **11,010 USD**[26]	300 x 1,100 BDT + 137 x 550 BDT + 326 x 1,650 BDT + 137 x 825 BDT = 1,056,275 BDT ≈ **12,675 USD**[53]
Total (without river dues and costs for unstuffing/ stuffing)	**160,901 USD**	**134,411 USD**
with 1,363 TEU handled	**118 USD/TEU**	**99 USD/TEU**

River dues are not being considered as they are based on the cargo weight inside the containers as they are identical in both ports.

For the exemplary case the port costs in Mongla are approx. 20% less compared to Chittagong. The difference in costs levied to a container vessel and its cargo between CPA and MPA is less than 20 USD.

The major revenue item for both ports (especially as the respective positions in the tariffs are identical) is quay handling, i.e. the horizontal movement of the containers on the terminal. This component amounts for more than 2/3 of the entire port costs. This is not a surprise as dedicated equipment (e.g. straddle carrier) is needed for this task.

[25] It is assumed that the charter hire for a geared vessel is 500 USD/d higher compared to a gearless vessel of the same size. During the round voyage of 17 days self-sustained operation is assumed to be necessary only in Mongla. Hence the crane costs in Mongla equals to the surplus in the daily charter hire accumulated over the entire duration of one round voyage.

[26] 1 BDT = 0.012 USD (as per 16 Dec 2019)

10.5 Outlook and Options

The draft limitation is and remains essential for port and container handling development at Mongla Port and for container handling techno-economics. Mongla Port can to a certain extent continue to try to balance competitive disadvantages related to nautical access constraints by very competitive tariffs and fees, and by introduction of most modern and highly efficient handling technologies and container trade related logistics and value-adding services.

A further option is to investigate possibilities of mid-stream handling of container. Midstream handling is proven practise in the waters of Mongla Port. Bulk carriers with a draft of up to 8.5 m are frequently discharged at the mooring buoys of Pussur River or on at anchorage, enjoying the benefit of 1.5 more draft compared to MPA permanent jetty.

The share of bulk cargo operations at anchorage or mooring buoys in the Pussur River take place to 90%. Barges and river crafts carry the discharged goods or goods are loaded to and from the private jetties of the industrial enterprises along the river north of the permanent jetty.

Midstream handling of containers is also not unique as it is e.g. practised in Hong Kong. Appendix M introduces a safe, reliable and technically sound but nevertheless innovative technical option for mid-stream handling of containers as indicatively shown in Figure 10-8.

Figure 10-8: Technical concept rendering for container mid-stream handling

The presented port – feeder barge concept provides for a handling platform for interim storage of containers and for movement of the containers to be handled from and to the ship – shore container terminals at e.g. the MPA permanent jetty or to additional terminal facilities to be developed.

11 Port Development Strategy

Short-term growth perspectives of Mongla Port (2020–2030) will be characterised by commencement of additional industrial and manufacturing activities and by significant improvements of accessibility of the port hinterland.

Until 2040/41, the economic development in Bangladesh will continue to grow, and average available income indicated by the Gross-Domestic-Product per Inhabitant, is going to growth with accelerations. This development requires continuation of the growth during recent years in productivity, international competitiveness, and in infrastructure development

Mongla Port Development strategy shall strengthen the strengths and overcome or mitigate weaknesses related first hand to draft limits at the nautical access to the port. Key topics are

- The local cement industry is already increasing production capacities according to demand by up to factor 10.
- Demand for imported LPG as energy supply for households, cooking and – further increasing - vehicle fuel will continue to grow. Respective investment in gas tanks, bottling plants and manufacturing or gas cylinders and bottles are already under commencement at Mongla Port area.
- The establishment of Rampal Power plant alone will boost import of coal by 4 million tons per year from 2022, the first full year of operations, onwards. Respective related material flows will further increase bulk and breakbulk/big-bag handling. The development requires provision of sufficient capacities and technical on the river and at the port and the private/industrial jetties to serve for handling of further bulk cargoes coming or going by inland water transport
- The Rail Connection Mongla – Khulna/Phultola Railway Station will have been established, planned to commence in 2020. Mongla Port will be for the first time connected by all three transport modes with the hinterland.
- The railway and the road connection to the hinterland will further improve after commencement of Padma bridge. Hinterland transport distances and time will become half between Dhaka area and Mongla. Further positive impacts are to be expected after completion of the national road works between Khulna and Jashore, and by planned improvement and extensions of the Railway network.

Successful allocation of further manufacturing enterprises at the Economic Zones and the re-import processing zones in the course of hinterland accessibility improvement will also establish demand for general cargo and hence container handling at the port. This development will be driven by the adjacent clients and, one the Padma bridge is operational, also for general cargo and logistic related to import and export of general cargoes and containers for Dhaka area via Mongla.

Due to the growing port industry and the improved hinterland accesses, base load will be available will is attractive to establish direct container feeder connections to Colombo in addition to the present, future to be intensified services to Singapore and Tanjung Pelepas.

Furthermore, the significant market share of Mongla Port in car imports shall be expanded, and Mongla Port shall be developed to the national car import and pre-delivery inspection and

related logistics service place in Bangladesh. Car carriers are not to the extent depending on deep drafts as e.g. bulkers, tankers or container ships. They can call Mongla already with relatively small restrictions.

Mongla Port shall, therefore, invest in development of area – intensive developments which cannot easy be copied by other port locations at the Bay of Bengal, e.g.

- port industry
- Intermodal facilities port/rail/road and port container handling terminals, optionally also under consideration of inland water transport, and including road/rail handling and container related value-added services like stuffing and de-stuffing, and cargo and container disposition related logistics.
- car and automotive handling and value-added services.
- Industrial and manufacturing development, by appointment with the competent authorities and development drives/stakeholders, container terminal, intermodal facilities and road aces improvements Khulna – Mongla towards a separate 4 lane road ready for heavy trucks and passing by the villages are important topics to implement the development.

Car industry and car import facilitated in other ports in the past the establishment of logistics and supply chains, and of car repair workshops, and technical inspection facilities by the private sector/operators/importers. Transport of imported and user-ready cars to stores or depots of sales organisations by rail shall be preferred in order to ensure punctuality, to reduce damages and to prevent for any other incidents related to imports or conditions of cars and other vehicles. Mongla Port should make use of areas available, activate further areas, and promote the location as the place to go for establishment of more value adding facilities than just rent land as a car park.

Mongla Port has one big competitive advantage compared to Chittagong: Port and port industry land is or can be made availability. Industrial port development will continue to be a main driver for import cargo flows and for enhanced attractivity for container trade.

Mongla Port and port industry areas will continue to enjoy the new and now competitive infrastructure connections to the hinterland. Installations for environmentally sound and modern logistics and intermodal operations will be developed, also by intermodal cooperation schemes in the long run, i.e. beyond 2041. In return, MPA in cooperation with the regional and national authorities must provide for availability of further port and port adjacent extension areas. The master plan should include these aspects accordingly.

From 2040 onwards however coal-fired and other carbon-energy based industry will not continue to grow regarding their input of primary energy supply like coal or gas for firing, or fuel for car driving. While the next 20 -30 years of development in Mongla will be driven from energy and space intensive industries and logistics developments the climate change obligations apply also in Bangladesh and this first hand. Changes in industrial production towards environmental sustainability (including less water consumption) require modification in textile industry production and primary energy supply as well as in power generation. Traffic demand and port development are challenged to be developed for around 20 – 30 years for catering classical industries and related economic growth approaches, and to be change

substantially after that term. The port development strategy shall, therefore consider modular approaches which can be adjusted over time according to actual development, straight focussing on logistics and services in addition to continuation of provision of capacities for industries.

Furthermore, already now inter-modalism needs to be strengthened. Intermodal transport requires more organisational effort and hence a higher degree of organisation and value adding than classical road transport. But intermodal transport will develop to the combined mode of transport organisation with bright future growth perspectives (less road but more rail or inland waterway transport over increasingly shorter distances).

Already now to be considered: Provision and use of regeneratively produced power at port, land power supply for vessels and energy and water saving concepts.

12 Summary and Outlook

12.1 Summary

An overview of the existing layout of Mongla Port and Roosevelt Jetty in Khulna (both under MPA management) are presented. At Mongla Port, most land with access to Pussur River is currently being leased to private companies. MPA operates only the so-called permanent port jetty. However, large areas of land are currently available in the middle of Mongla peninsula.

At Roosevelt Jetty, the existing infrastructure is not capable of handling any further increase in cargo throughput. Investments in new infra- and superstructure are required.

MPA owns a large number of cargo handling equipment from many different brands which makes maintenance and spare part logistics challenging. Based on the existing equipment and the projected future cargo throughput of Mongla Port, a cargo handling equipment concept will be elaborated.

MPA also owns a fleet of auxiliary and support vessels, most of them rather old. Based on the condition of the existing vessels, a vessel concept will be provided with the master plan.

A hydrographic and hydrological study of Pussur River was done based on the available data and studies. An overview of available and planned water depths is given.

The maritime trade and the port throughput forecasts presented for the base case scenario show a clear increase of the traffic and port cargo throughput in Mongla Port. The forecast projection reflect the impacts of continuing economic growth, increases of average income per inhabitant, and regarding the market share of Mongla Port a push in demand in the years 2020 – 2030 and onto 2040 due to availability of adequate infrastructure for accession of further regions in the port hinterland compared to the present situation without railway and without efficient river Padma crossing options for road or rail traffic.

12.2 Outlook

The Consultant intends to use the data and conclusions presented in this Interim Report as the basis for the port master plan. It is therefore regarded as crucial that they will be confirmed by MPA. The Interim Report is submitted one month ahead of schedule in order to allow for sufficient time to discuss the data basis.

The forecast results for the base case need to be discussed, confirmed or adjusted by appointment with MPA. Same for the forecast scenario assumptions stipulated to be applied for the optimistic and the modest growth scenario. The projections will be completed and the hinterland traffic and the vessel traffic projected according to the results of the discussions after submission of this Interim Report.

Furthermore, the scenario assumption for the optimistic traffic projections as well as for the “modest growth” scenario with lesser dynamic development projections will be presented and discussed.

Appendices

A) Available and Required Information / Reports
B) Layout Plans of Mongla Port and Roosevelt Jetty
C) Navigation Charts
D) Mongla Port Throughput Details 2004 - 2018
E) Chittagong Port Throughput 2006 – 2018
F) Container and Hinterland Considerations
G) Socio-Economic Development Assessments
H) Foreign Trade and Production Development
I) Industry Developments at Mongla Port
J) Khalishpur Port and Roosevelt Jetty
K) Details on Port Cargo Throughput Forecast
L) Container Shipping Trends
M) Container Midstream Handling Perspectives

Appendix A – Available and Required Information / Reports

Data inventory

Legend:
Available
Missing

Primary Keywords / Topic:	Secondary Keywords / Topic (if applicable):	Tertiary Keywords / Topic (if applicable):	Available / Missing	Appears Highly Important	Data Type	Year Published:	Title / Content:	File Type:	File / Folder Name:
(Development-) Policies / Plans			Yes	Yes	Study/Publication	2015	Bangladesh Ministry of Planning - SEVENTH FIVE YEAR PLAN FY2016 - 2020	PDF	7th_FYP_18_02_2016.pdf
(Development-) Policies / Plans			Yes		Study/Publication	2017	Bangladesh Planning Commission - Bangladesh Delta Plan 2100 (DRAFT)	PDF	Bangladesh Delta Plan 2100 Draft Report.pdf
(Development-) Policies / Plans			Yes		Presentation	2017	Bangladesh Planning Commission - Bangladesh Delta Plan 2100 (DRAFT)	PDF	Bangladesh Delta Plan 2100-ppt.pdf
(Development-) Policies / Plans			Yes	Yes	Study/Publication	2012	General Economics Division - PERSPECTIVE PLAN OF BANGLADESH 2010-2021 - MAKING VISION 2021 A REALITY	PDF	Perspective-Plan-of-Bangladesh 2021.pdf
(Development-) Policies / Plans			Yes		Study/Publication	2011	Bangladesh Ministry of Planning - SIXTH FIVE YEAR PLAN FY2011-FY2015 - Accelerating Growth and Reducing Poverty	PDF	6th_FYP_17-08-2011.pdf
(Development-) Policies / Plans	Mongla Port: Environmental and Navigational Conditions		Yes	Yes	Study/Publication	2018	General Economics Division, Bangladesh Planning Commission, Ministry of Planning - BANGLADESH DELTA PLAN 2100 Volume 1 Water Resources Management Baseline Studies 1: Sixty Years of Water Resources Development in Bangladesh:Lessons Learnt; 2: River System Management; 3: Water Resources; 5: Coast and Polder Issues; 6: Water Supply and Sanitation; 7: Part A- Sediment Management; 7 Part B- Meghna Estuary Study	PDF	BDP 2100 BL Study Volume 1 Part A Water Resources Management.pdf
(Development-) Policies / Plans	Sustainability Issues		Yes	Yes	Study/Publication	2018	General Economics Division, Bangladesh Planning Commission, Ministry of Planning - BANGLADESH DELTA PLAN 2100 Volume 1 Water Resources Management Baseline Study 4: Groundwater	PDF	BDP 2100 BL Study Volume 1 Part B Water Resources Management.pdf
(Development-) Policies / Plans	Sustainability Issues		Yes	Yes	Study/Publication	2018	General Economics Division, Bangladesh Planning Commission, Ministry of Planning - BANGLADESH DELTA PLAN 2100 Volume 2 Disaster and Environmental Management, Baseline Studies 8: Climate Change; 9: Disaster Management; 11: Ecological Setting	PDF	BDP 2100 BL Study Volume 2 Part A Disaster and Environmental Management.pdf
(Development-) Policies / Plans	Sustainability Issues		Yes	Yes	Study/Publication	2018	General Economics Division, Bangladesh Planning Commission, Ministry of Planning - BANGLADESH DELTA PLAN 2100 Volume 2 Disaster and Environmental Management, Baseline Study 10: Environmental Pollution	PDF	BDP 2100 BL Study Volume 2 Part B Disaster and Environmental Management.pdf
(Development-) Policies / Plans	(Development-) Policies / Plans	General Transport & Logistics	Yes	Yes	Study/Publication	2018	General Economics Division, Bangladesh Planning Commission, Ministry of Planning - BANGLADESH DELTA PLAN 2100 Volume 3 Land use and Infrastructure Development, Baseline Studies12: Land Resources Management; 13: Urbanization and Settlement; 14: Sustainable Transportation and Infrastructure	PDF	BDP 2100 BL Study Volume 3 Part A Land Use and Infrastructure Development.pdf
(Development-) Policies / Plans	(Development-) Policies / Plans	General Transport & Logistics	Yes	Yes	Study/Publication	2018	General Economics Division, Bangladesh Planning Commission, Ministry of Planning - BANGLADESH DELTA PLAN 2100 Volume 3 Land use and Infrastructure Development, Baseline Study 11: Challenges	PDF	BDP 2100 BL Study Volume 3 Part B Land Use and Infrastructure Development.pdf
(Development-) Policies / Plans	(Development-) Policies / Plans	Industries: Agriculture	Yes	Yes	Study/Publication	2018	General Economics Division, Bangladesh Planning Commission, Ministry of Planning - BANGLADESH DELTA PLAN 2100 Volume 4 Agriculture Food Security and Nutrition, Baseline Studies 15: Agriculture and Food Security; 16: Fisheries; 17: LivestockBaseline; 18: Forest and Biodiversity	PDF	BDP 2100 BL Study Volume 4 Agriculture Food Security and Nutrition.pdf
(Development-) Policies / Plans	General Statistics / Information: Economics and Finance, Inflation	General Statistics: Demographics/Population	Yes	Yes	Study/Publication	2018	General Economics Division, Bangladesh Planning Commission, Ministry of Planning - BANGLADESH DELTA PLAN 2100 Volume 5 Socio-Economic Aspects of the Bangladesh Delta, Baseline Studies 19:Population Growth and Management; 20:Socio-Economic and Demographic Condition; 21:Socio-Economic Characteristics of Chittagong Hill Tracts	PDF	BDP 2100 BL Study Volume 5 Socio-economic Aspects of the Bangladesh Delta.pdf
(Development-) Policies / Plans	General Statistics / Information: Economics and Finance, Inflation	(Development-) Policies / Plans	Yes	Yes	Study/Publication	2018	General Economics Division, Bangladesh Planning Commission, Ministry of Planning - BANGLADESH DELTA PLAN 2100 Volume 6 Governance and Institutional DevelopmentVolume, Baseline Studies 22: Institutional Framework and Arrangement; 23 : Information and Knowledge Management; 24: Regional Cooperation; 25: Finance Mechanisms & Arrangements in the Water Sector; 26: Private Sector Engagement in Deltas	PDF	BDP 2100 BL Study Volume 6 Governance and Institutional Development.pdf
Competing Ports: Chittagong			Yes		Organisational Data	2014	LIST OF VESSELS	DOCX	BERTHING FILES Chittagong 01_06_2014.docx
Competing Ports: Chittagong			Yes		Organisational Data	2012	LIST OF VESSELS	DOCX	BERTHING FILES Chittagong 03_06_2012.docx
Competing Ports: Chittagong			Yes		Study/Publication	2015	Strategic Master Plan for Chittagong Port. Final Report, Part 1	PDF	Port Master Plan Chittagong_01.pdf
Competing Ports: Chittagong			Yes		Study/Publication	2015	Strategic Master Plan for Chittagong Port. Final Report, Part 2	PDF	Port Master Plan Chittagong_02.pdf
Competing Ports: Chittagong			Yes		Study/Publication	2015	Strategic Master Plan for Chittagong Port. Final Report, Part 3	PDF	Port Master Plan Chittagong_03.pdf
Competing Ports: Chittagong			Yes		Organisational Data	unknown	Chitagong Container Fees / Tariffs / Charges	PDF	Container Loading tarrif.pdf
Competing Ports: Chittagong			Yes		Organisational Data	unknown	Chitagong Fees / Tariffs / Charges on Goods an Vessels	PDF	CPA-Tariff-ilovepdf-compressed.pdf
Competing Ports: Chittagong			Yes		Organisational Data	unknown	Chitagong Fees / Tariffs / Charges on Containers Goods an Vessels	PDF	Pangaon Tariff.pdf
Competing Ports: Kolkata			Yes		Organisational Data	2013	Kolkata Port Trust - Administrative Report 2012-2013	PDF	Kolkata_Haldia_Port_Trust-Report_2012_13.pdf
Competing Ports: Kolkata			Yes		Organisational Data	2014	Kolkata Port Trust - Administrative Report 2013-2014	PDF	Kolkata_Haldia_Port_Trust-Report_2013_14.pdf
Competing Ports: Kolkata			Yes		Organisational Data	2015	Kolkata Port Trust - Administrative Report 2014-2015	PDF	Kolkata_Haldia_Port_Trust-Report_2014_15.pdf
Competing Ports: Kolkata			Yes		Organisational Data	2016	Kolkata Port Trust - Administrative Report 2015-2016	PDF	Kolkata_Haldia_Port_Trust-Report_2015_16.pdf
Competing Ports: Kolkata			Yes		Organisational Data	2017	Kolkata Port Trust - Administrative Report 2016-2017	PDF	Kolkata_Haldia_Port_Trust-Report_2016_17.pdf
Competing Ports: Kolkata			Yes		Organisational Data	2018	Kolkata Port Trust - Administrative Report 2017-2018	PDF	Kolkata_Haldia_Port_Trust-Report_2017_18.pdf
General Standards and Regulations			Yes		Organisational Data	unknown	Function Description according to ISO 9001:2015, Section 5.3 'Organizational roles, responsibilities and authorities'	DOCX	Example-FunctionDescription_20190926_WO.docx
General Statistics / Information: Economics and Finance, Inflation			Yes	Yes	Study/Publication	2019	Is Bangladesh's Economy Approaching the Lewis Turning Point?	PDF	Bairagi2019LewisturningpointinBangladesh.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes	Yes	Study/Publication	2017	Concurrent Challenges Before Bangladesh Economy	PDF	ConcurrentChallengesbeforeBangladeshEconomy.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes	Yes	Study/Publication	unknown / 2019	Diversification of Export Basket of Bangladesh	DOCX	DiversificationofExportBasket.docx
General Statistics / Information: Economics and Finance, Inflation			Yes	Yes	Study/Publication	2019	Economic Growth and Macroeconomic Fundamentals: Evidence from Bangladesh.	PDF	Economic-Growth-and-Macroeconomic..pdf
General Statistics / Information: Economics and Finance, Inflation			Yes	Yes	Study/Publication	2019	FACTORS INFLUENCING PURCHASING POWER PARITY (PPP) IN BANGLADESH ECONOMY: 1986-2017	PDF	Factors-influencing-purchasing-power-parity-ppp-in-bangladesh-economy-1939-6104-18-2-3551.pdf
General Statistics / Information: Economics and Finance, Inflation	Trade		Yes	Yes	Study/Publication	2015	Foreign direct investment and economic growth - An empirical study on Bangladesh economy	PDF	IJEBR100205SARKER.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes	Yes	Study/Publication	2015	Impact of Macroeconomic Variables on Economic Development of Bangladesh Since Liberation War: An Empirical Study	PDF	ImpactofMacroeconomicVariablesonEconomicDevelopmentofBangladeshSinceLiberationWarAnEmpiricalStudy.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes	Yes	Study/Publication	2019	Bangladesh among Five Fastest Growing Economies	PDF	ISAS-Briefs-No.-649-Bangladesh-Among-Five-Fastest-Growing-Economies-1.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes	Yes	Study/Publication	2013	An Analysis of Macroeconomic Trends in Bangladesh	PDF	khairul_dev_compile.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes	Yes	Study/Publication	2019	Have Inflation Dynamics Changed in Bangladesh?	PDF	pn1901.pdf
General Statistics / Information: Economics and Finance, Inflation	Trade		Yes	Yes	Study/Publication	2019	2019	PDF	TheImpactofMacroeconomicFactorsonExportsEarningsinBangladesh1971-2018.pdf
General Statistics / Information: Economics and Finance, Inflation	Trade		Yes	Yes	Study/Publication	2018	Trade (Exports) as an Opportunity for Bangladesh: A VECM Analysis	PDF	22ndAnnualWesternHemisphericTradeConferencePage249-260httpfreetrade.tamiu.eduwhtc_servicesshowPdf.aspshow22Conf-SessionsdMenu1markCNF.pdf
General Statistics / Information: Economics and Finance, Inflation	Trade		Yes	Yes	Study/Publication	2017	Trade between Bangladesh and Vietnam	PDF	ABriefReport.pdf
General Statistics / Information: Economics and Finance, Inflation	Trade	(Development-) Policies / Plans	Yes	Yes	Study/Publication	2018	Trade Expansion, International Competitiveness and the Pursuit of Export Diversification in Bangladesh	PDF	BIDS-Paper-1_Sarker_TradeExpansion-Feb27-2019.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes		Study/Publication	2019	Bangladesh Economic Review 2019	PDF	Bangladesh_Economic_Review_2019.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes		Study/Publication	2019	Bangladesh Bank - Annual Report (July 2017-June 2018)	PDF	Bangladesh Bank Report 2017_2018.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes		Study/Publication	2019	Moody's Investor Service - Government of Bangladesh – Ba3 stable, Annual credit analysis	PDF	moody_report_july2019.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes		Study/Publication	2019	Bangladesh 'BB-/B' Ratings Affirmed; Outlook Stable	PDF	snprep_july2019.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes		Organisational Data	mixed	Economic data from mixed sources	PDF	Summary Infomration.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes		Organisational Data	2015	World Bank - World Development Indicators, Bangladesh	XLS	WDI_2015_12_29_Bangladesh.xlsx
General Statistics / Information: Economics and Finance, Inflation			Yes		Study/Publication	2015	Ministry of Finance Bangladesh - Year End Report on Fiscal Position Fiscal Year 2014-15	PDF	year_end report_2014_15.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes		Study/Publication	2019	Labour wage of Bangladesh	PDF	109-113.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes		Study/Publication	2018	Constraints to small and medium-sized enterprises development in Bangladesh: Results from a cross-sectional study	PDF	constraints-to-small-and-medium-sized-enterprises-development-in-bangladesh-results-from-a-cross-sectional-study1.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes		Study/Publication	2014	Determinants of Unemployment in Bangladesh: A Case Study	PDF	DeterminantofUnemploymentinBangladesh.pdf
General Statistics / Information: Economics and Finance, Inflation	Trade		Yes		Study/Publication	2008	FOREIGN DIRECT INVESTMENT IN BANGLADESH: A POSITIVE PERSPECTIVE	DOCX	ForeignDirectInvestmentinBangladeshAPositivePerspective.doc
General Statistics / Information: Economics and Finance, Inflation	General Standards and Regulations		Yes		Study/Publication	2019	Investigating Impact of Expansionary Fiscal Policy on Output in Bangladesh Economy: An Econometric Study	PDF	IMPACTOFEXPANSIONARYFISCALPOLICY.pdf

General Statistics / Information: Economics and Finance, Inflation			Yes		Study/Publication	2011	Infrastructure and Growth and Poverty in Bangladesh	PDF	Infrastructure_and_Growth_and_Poverty_in_Banglades.pdf
General Statistics / Information: Economics and Finance, Inflation	Trade		Yes		Study/Publication	2018	An Empirical Assessment of the Nexus between Terms of Trade and Inflation in Bangladesh	PDF	Muntasir_BIDS.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes		Study/Publication	2018	Post-LDC Challenges for Bangladesh Economy	PDF	Post-LDCChallengesforBangladeshEconomy.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes		Study/Publication	unknown / 2019	Impact of Monetary Policy on the Economic Growth of a Developing Country: An Empirical Study on Bangladesh Economy	PDF	SSRN-id3391280.pdf
General Statistics / Information: Economics and Finance, Inflation			Yes		Study/Publication	2019	STRATEGIC DETERMINANTS AND STABILITY OF REAL EXCHANGE RATE IN BANGLADESH: 1976-2017	PDF	Strategic-determinant-and-stability-of-real-exchange-rate-in-bangladesh-1976-2017-1939-6104-18-3-369.pdf
General Statistics / Information: Economics and Finance, Inflation	Trade		Yes		Study/Publication	2017	Global Trade Slowdown and Globalisation Backlash: Trade and Development perspectives from Bangladesh	PDF	00-Tradeslowdown-globalisationbacklash_Razzaque.pdf
General Statistics / Information: Economics and Finance, Inflation	Trade		Yes		Study/Publication	2016	Factors Affecting Volatility of Bangladesh Trade Deficit: An Econometric Analysis	PDF	520-1033-1-SM.pdf
General Statistics / Information: Economics and Finance, Inflation	Trade	(Development-) Policies / Plans	Yes		Study/Publication	2016	Causal Relationship between Government Size and Trade Openness in Bangladesh: An Empirical Analysis	PDF	14982492667.Dr.SakibBinAminMuntasirMurshed.pdf
General Statistics / Information: Economics and Finance, Inflation	Trade		Yes		Study/Publication	2016	Impact of International Trade on Economic Growth in Bangladesh	PDF	HasnainInternationalTrade.pdf
General Statistics / Information: Economics and Finance, Inflation	Trade		Yes		Study/Publication	2019	Problems of Bilateral Trade Deficit between Bangladesh and India: A Regression Analysis	PDF	muntasirmargub2019.pdf
General Statistics: Demographics/Population	Maps		Yes		Study/Publication	2009	Bangladesh Population Density Map and Elevation	PDF	Population_Density_Map_and_Elevation.jpg
General Statistics: Demographics/Population			Yes		Study/Publication	2019	Aging Population in Bangladesh. A new and important group in terms of social and health policy of a country	PDF	Aging-Mahmood-et-al.-Sept-2019.pdf
General Statistics: Demographics/Population			Yes		Study/Publication	unknown	Future Aging through Population Momentum: An Experience with Bangladesh Population	PDF	book_chapt-6.pdf
General Statistics: Demographics/Population			Yes		Study/Publication	2019	Analysing and Projection of Future Bangladesh Population Using Logistic Growth Model	PDF	IJMNTA_20190704144711118.pdf
General Statistics: Statistical Year Books			Yes	Yes	Organisational Data	2011	Statistical Year Book of Bangladesh	PDF	BBS-Yearbook-2011.pdf
General Statistics: Statistical Year Books			Yes	Yes	Organisational Data	2012	Statistical Year Book of Bangladesh	PDF	BBS-Yearbook-2012.pdf
General Statistics: Statistical Year Books			Yes	Yes	Organisational Data	2013	Statistical Year Book of Bangladesh	PDF	BBS-Yearbook-2013.pdf
General Statistics: Statistical Year Books			Yes	Yes	Organisational Data	2014	Statistical Year Book of Bangladesh	PDF	BBS-Yearbook-2014.pdf
General Statistics: Statistical Year Books			Yes	Yes	Organisational Data	2015	Statistical Year Book of Bangladesh	PDF	BBS-Yearbook-2015.pdf
General Statistics: Statistical Year Books			Yes	Yes	Organisational Data	2016	Statistical Year Book of Bangladesh	PDF	BBS-Yearbook-2016.pdf
General Statistics: Statistical Year Books			Yes	Yes	Organisational Data	2017	Statistical Year Book of Bangladesh	PDF	BBS-Yearbook-2017.pdf
General Transport & Logistics	Trade		Yes	Yes	Study/Publication	unknown	India-Bangladesh Trade: The Prospect of Inland Water Transportation System	PDF	2018vol2bmj-02-01-03.pdf
General Transport & Logistics			Yes	Yes	Study/Publication	2019	An Examination of Economic Loss of Poor Port Infrastructure in Bangladesh	PDF	AnExaminationofEconomicLossofPoorPortInfrastructureinBangladesh.pdf
General Transport & Logistics	Sustainability Issues		Yes	Yes	Study/Publication	2019	Bangladesh Railway: Perspective for sustainable transport in Bangladesh	PDF	BangladeshRailway-PerspectiveforsustainabletransportinBangladesh_SaidurRahman_BR.pdf
General Transport & Logistics			Yes	Yes	Study/Publication	2019	Development of Third-Party Logistics Services in International Trade: Bangladesh Perspective	PDF	DevelopmentofThird-PartyLogisticsServicesinInternationalTradeBangladeshPerspective.pdf
General Transport & Logistics			Yes	Yes	Study/Publication	2019	Human Resources Competitiveness in Shipping Industry: Bangladesh Perspective	PDF	ICBM2019ConferencePaperShemonKadirISBN978-984-344-3540.pdf
General Transport & Logistics			Yes	Yes	Study/Publication	2019	Implementation of Deep Sea Port in Bangladesh: Demand and Dilemma	PDF	ImplementationofDeepSeaPortinBangladesh_DemandDilemma.pdf
General Transport & Logistics	Trade		Yes	Yes	Study/Publication	2019	Unfolding Bangladesh-India maritime connectivity in the Bay of Bengal region: a Bangladesh perspective	PDF	MaritimeCooperation-Routledge.pdf
General Transport & Logistics			Yes	Yes	Study/Publication	2016	The Future of Intermodal Freight Transportation in Bangladesh	PDF	Saha2015WCTRS2016_2419Abstract.pdf
General Transport & Logistics	Trade		Yes	Yes	Study/Publication	unknown / 2019	Intermodal freight transportation facilities for two major cities of Bangladesh in providing maritime logistics support to cater to international trade	PDF	Saha2019c.pdf
General Transport & Logistics	Trade		Yes	Yes	Study/Publication	2019	The role of Bangladeshi ports in developing integrated intermodal freight transportation system in South Asia	PDF	SahaRC2019PhDJournal-3.pdf
General Transport & Logistics	Sustainability Issues		Yes		Study/Publication	2017	Sustainable Transport Modes and its Potentiality: Bangladesh Perspective	PDF	04-2-Islam-Transport-Reviewed.pdf
General Transport & Logistics	Sustainability Issues		Yes		Study/Publication	2016	SAFER ROAD INFRASTRUCTURE FOR SUSTAINABLE TRANSPORT DEVELOPMENT IN BANGLADESH	PDF	FinalPaper.pdf
General Transport & Logistics	Sustainability Issues		Yes		Study/Publication	2017	Analysis of Future Aspects of Alternative Fuel Driven Vehicles in Bangladesh	PDF	JSAER2017-04-11-127-134-1.pdf
General Transport & Logistics	Trade		Yes		Study/Publication	2019	Multimodal Transportation and International Trade Facilitation: Bangladesh Perspective	PDF	MultimodalTransportationandInternationalTradeFacilitationBangladeshPerspective.pdf
General Transport & Logistics	Competing Ports		Yes		Presentation	unknown / 2017	Country's Port: Bangladesh	PDF	CountryPresesntationatMIMAMY.pdf
Industries: Agriculture			Yes		Study/Publication	2019	Economic Analysis of Rice Production in Bangladesh	PDF	Paper_Forhad_Hilarius__UIJRTV1I20002.pdf
Industries: Agriculture	Trade	General Transport & Logistics	Yes		Study/Publication	2017	The Vegetable Supply Chain of Bangladesh: Is it Capable to Meet the Requirements of International Trade?	PDF	2nd7.pdf
Industries: Energy			Yes	Yes	Study/Publication	2019	Electricity consumption and GDP nexus in Bangladesh: a time series investigation	PDF	10-1108_JABES-04-2019-0029.pdf
Industries: Energy			Yes	Yes	Study/Publication	2019	An Empirical Investigation on the Relationship between Remittance and Energy Consumption towards Bangladesh Economy	PDF	AnEmpiricalInvestigationontheRelationshipbetweenRemittanceandEnergyConsumptiontowardsBangladeshEconomy.pdf
Industries: Energy			Yes	Yes	Study/Publication	2017	Prospects of Liquefied Gases in Bangladesh Economy as a move towards Fuel Diversification	PDF	Muntasir.pdf
Industries: Energy			Yes	Yes	Study/Publication	2018	Renewable energy in Bangladesh: Status and prospects	PDF	RenewableenergyinBangladeshStatusandprospects.pdf
Industries: Energy			Yes		Study/Publication	unknown / 2018	Power generation capacity continues to grow in response to high demand supply gap	PDF	Bangladesh-Power-Sector-Overview-2018.pdf
Industries: Ship Breaking			Yes		Study/Publication	2019	Ship Breaking and its Future in Bangladesh	PDF	ShipBreakinganditsFutureinBangladesh.pdf
Legislation			Yes		Study/Publication	unknown / 2008	Public Procurement Rules	PDF	4. Public-Procurement-Rules-2008-Bangla1.pdf
Legislation			Yes		Study/Publication	2000	National Shipping Policy	PDF	5. National Shipping Policy 2000.pdf
Legislation			Yes		Study/Publication	2006	Bangladesh Labour Act 2006	PDF	6.-Bangladesh_Labor_Law_2006_Eng-1.pdf
Legislation			Yes		Study/Publication	2017	Essentials of the Laws of the Belt and Road Countries Bangladesh, Pakistan, Sri Lanka	PDF	CHAPTER_2.pdf
Maps	General Statistics: Demographics/Population		Yes	Yes	Study/Publication	unknown	Rail and Road Network Map of Bangladesh	PDF	Bangladesh Road and Rail Map.pdf
Maps	Mongla Port: Environmental and Navigational Conditions	General Transport & Logistics	Yes	Yes	Study/Publication	unknown	Bangladesh Inland Navigation Routes and depths	JPG	Navigation Routes_wo dis name.jpg
Maps			Yes	Yes	Organisational Data	unknown	Google Earth maps of Mongla Port	Folder	GoogleMaps kmz
Maps			Yes	Yes	Organisational Data	unknown	Map of Mongla Port, seemingly based on CAD-Data	PDF	Revised Port Plan_8_MPA-11 component.pdf
Mongla Port: Environmental and Navigational Conditions			Yes	Yes	Study/Publication	2015	Sedimentation processes at the navigation channel of Mongla port on the Pussur-Sibsa river system in Bangladesh	PDF	1577.pdf
Mongla Port: Environmental and Navigational Conditions			Yes	Yes	Study/Publication	2013	ASSESSING THE CAUSES OF DETERIORATION OF THE MONGLAGHASHIAKHALI NAVIGATION ROUTE FOR RESTORATION OF NAVIGABILITY	PDF	ASSESSINGTHECAUSESOFDETERIORATIONOFTHEMONGLA-GHASHIAKHALINAVIGATIONROUTEFORRESTORATIONOFNAVIGABILITY.pdf
Mongla Port: Environmental and Navigational Conditions	Maps		Yes		Study/Publication	unknown	Navigational Charts / Maps : Bay of Bengal, Chalna to Digraj, Digraj to Mongla, Mongla to Base Creek, Joymonirgol to Harbaria, D'Souza Point to Mazhar Point, Cheilabogi Khal to Sundakirota Khal, Sundakirota Khal to Kaga Boga Khal, Kaga Boga Khal to Tinkona DWIP, Tinkona DWIP to Hiron Point	Folder	Navigational Charts
Mongla Port: Equipment			Yes	Yes	Organisational Data	unknown	List of Equipment (e.g. cranes) in Mongla Port	PDF	Mogla_Port_Equipment.pdf
Mongla Port: Fees and Charges	Mongla Port: Administration		Yes	Yes	Study/Publication	unknown / 2019	Mongla Port Fees and charges	PDF	MonglaPortTariff_Gazette.pdf
Mongla Port: Fees and Charges	Mongla Port: Administration		Yes	Yes	Study/Publication	unknown / 2019	Mongla Port Fees and charges	PDF	MPA Port Tariff.pdf
Mongla Port: Fees and Charges	Mongla Port: Administration		Yes	Yes	Study/Publication	2015	Determination of the Transit Fee for Mongla-Ghasiakhali Canal: Savings from the Daily Running Cost of Ships	PDF	56839109d2952.pdf
Mongla Port: Handling Data	Industries: Other		Yes	Yes	Organisational Data	unknown / 2019	Cars handled at Mongla Port from 2008-2009 to 2018-2019	PDF	car handling.pdf
Mongla Port: Handling Data			Yes	Yes	Organisational Data	unknown / 2019	Total weight of Imported / Exported Cargo in Metric Tonnes	PDF	Cargo hnadling.pdf
Mongla Port: Handling Data	Industries: Cement	Mongla Port: Relevant Industries	Yes	Yes	First Hand Data / Interviews	unknown / 2019	Request for Information. Information requirements: Port User Terminals and Port Industry facilities, Cement Clinker mills	DOCX	Cement Factories 190921.docx
Mongla Port: Handling Data	Industries: Container	Mongla Port: Relevant Industries	Yes	Yes	Organisational Data	unknown / 2019	Containers handled at permanent Port jetty, Mongla from 2004-2005 to 2018-2019.	PDF	Container handling.pdf
Mongla Port: Handling Data	Industries: Agriculture	Mongla Port: Relevant Industries	Yes	Yes	First Hand Data / Interviews	unknown / 2019	Request for Information. Information requirements: Port User Terminals and Port Industry facilities, Fertilizers	DOCX	Fertilizers 190921.docx
Mongla Port: Handling Data	Industries: Agriculture	Mongla Port: Relevant Industries	Yes	Yes	First Hand Data / Interviews	unknown / 2019	Request for Information. Information requirements: Port User Terminals and Port Industry facilities, Grain Silo / Grain Importers or Rice Exporters	DOCX	Grain Silo 190921.docx
Mongla Port: Handling Data	Industries: Energy	Mongla Port: Relevant Industries	Yes	Yes	First Hand Data / Interviews	unknown / 2019	Request for Information. Information requirements: Port User Terminals and Port Industry facilities, LPG Tank and Distributions plants	DOCX	LPG tank and distribution plants 190921.docx
Mongla Port: Handling Data	Industries: Energy		Yes	Yes	First Hand Data / Interviews	unknown / 2019	Request for Information. Information requirements: Port User Terminals and Port Industry facilities, Refinery Tank farm	DOCX	Refinery_Tank Farm_190921.docx
Mongla Port: Handling Data			Yes	Yes	Organisational Data	2019	Ships & Cargo handled at Mongla Port by tonnes and commodity 2004-2019	PDF	Commodity-wise Import ExportMongla Port 2004-2019.pdf
Mongla Port: Handling Data			Yes	Yes	Organisational Data	2019	Commodity-wise Import & Export handled at Mongla Port from 2004-2005 to 2019-2020	PDF	Import Export Mongla Port 2004-2019-2020.pdf
Mongla Port: Handling Data	Industries: Container		Yes	Yes	First Hand Data / Interviews	2019	Present connectivity of Mongla Port to the international container trade	DOCX	Mongla Liner Services rev2.docx
Mongla Port: Maps			Yes	Yes	Organisational Data	unknown	Map / detailed Layout plan of Mongla Port	GIS / CAD	Revised Plan_8 MPA-11.dwg
Mongla Port: Maps			Yes	Yes	Organisational Data	unknown	Google maps of Mongla Port and its exclaves	PDF	Google_Maps_of_Mongla_Port_and_Exclaves.pdf
Mongla Port: Maps			Yes	Yes	Organisational Data	unknown	Google maps of Mongla Port's Roosevelt Jetty in Khulna	JPG	Khulna Area Question.jpg
Mongla Port: Maps			Yes	Yes	Organisational Data	unknown	Google Earth maps of Mongla Port's Roosevelt Jetty in Khulna	GIS / CAD	Mongla Port Khulna.kmz
Mongla Port: Maps			Yes	Yes	Organisational Data	unknown	Map of Pussur Channel and Mongla Port Extent, incl. Lighthouses and further details		Map_of_Pussur_Channel_and_Mongla_Port_Extent.pdf Map Pussur Channel.gif
Mongla Port: Maps			Yes	Yes	Study/Publication	unknown	Map Coast Bangladesh	JPG	Map Coast Bangladesh.bmp
Mongla Port: Planning Studies			Yes	Yes	Study/Publication	2019	Mongla Port Authority - Feasibility Study Modernization and Expansion of Mongla Port Facilities	PDF	Modernization and Expansion of Mongla Port Facilities.pdf 1902_Modernization and Expansion of Mongla Port Facilities.pdf
Mongla Port: Planning Studies			Yes	Yes	Study/Publication	2018	Mongla Port Authority - Feasibility Study for the Upgradation of Mongla Port	PDF	REVISED FINAL_181113_Final Report_Upgradation of Mongla Port.pdf 1811_Feasibility Study for Upgradation of Mongla Port.pdf
Mongla Port: Planning Studies			Yes	Yes	Study/Publication	2016	Mongla Port Authority - Detailed Assessment of Structural Capacity and Safety of Jetty No. 5 to 9 at Mongla Port Protected Area	PDF	Jetty_Assessment_Report-KUET.pdf

Mongla Port: Planning Studies	Mongla Port: Environmental and Navigational Conditions		Yes	Yes	Study/Publication	2004	Feasibility Study for Improvement of Navigability of Mongla Port	PDF	0409_Feasibility Study for Improvement of Navigability of Mongla Port.pdf
Mongla Port: Planning Studies	Mongla Port: Infrastructure	Mongla Port: Equipment	Yes	Yes	Study/Publication	2016	Mongla Port Authority - Structural Capacity and Safety of Jetty No. 5 to 9 at Mongla Port Protected Area	PDF	1603_Jetty_Assessment_Report-KUET.pdf
Mongla Port: Planning Studies	Mongla Port: Environmental and Navigational Conditions		Yes	Yes	Study/Publication	2016	Feasibility Study for Improvement of the Navigability of Pussur Channel at Outer Bar Area	PDF	1609_Feasibility Study for Improvement of the Navigability of Pussur Channel at Outer Bar Area.pdf
Mongla Port: Planning Studies	Mongla Port: Infrastructure	Mongla Port: Equipment	Yes	Yes	Study/Publication	2017	Feasibility Study for the Extension of Roosevelt Jetty	PDF	1703_Feasibility Study for the Extension of Roosevelt Jetty.pdf
Mongla Port: Planning Studies	Mongla Port: Infrastructure		Yes	Yes	Study/Publication	unknown	Master Plan Layout for Chalna Port (Historic Document)	PDF	Master Plan Layout for Chalna Port.pdf
Mongla Port: Relevant Industries			Yes	Yes	Organisational Data	2019	Invitation for bids for coal transportation	PDF	INvitation to tender coals logistics.pdf
Mongla Port: Staffing			Yes	Yes	Organisational Data	unknown	Mongla Port Organigram 1	JPG	MPA-Organogram_E.PNG
Mongla Port: Staffing			Yes	Yes	Organisational Data	unknown	Mongla Port Organigram 2	JPG	MPA-Organogram_E1.PNG
Mongla Port: Studies			Yes	Yes	Study/Publication	2019	'Tool port' to 'landlord port': a game theory approach to analyse gains from governance model transformation	PDF	MPM_Toolporttolandlordport-gainsfromgover.PDF
Mongla Port: Studies	Trade		Yes	Yes	Study/Publication	2019	Mongla Port — dealing with future maritime trade	PDF	Saha2019.PDF
Mongla Port: Studies	Maps		Yes	Yes	First Hand Data / Interviews	2019	Pictures of : Cement Jetty Features, Maps Charts Nautical Access, Mongla RL, Roosevelt Jetty, Roosevelt Jetty RL	Folder	Pictures of Mongla Port
Mongla Port: Studies			Yes	Yes	First Hand Data / Interviews	unknown	Mongla Port at a Glance	DOCX	Mongla Port at a Glance.docx
Mongla Port: Studies	Mongla Port: Environmental and Navigational Conditions	Mongla Port: Planning Studies	Yes		Study/Publication	2019	Assessment of heavy metals concentrations in the soil of Mongla industrial area, Bangladesh	PDF	ehemj-Heavymetals.pdf
Mongla Port: Studies	Mongla Port: Environmental and Navigational Conditions		Yes		Study/Publication	2017	Social Sufferings Due to Saline Water Issues in Mongla Upazilla, Bagherhat	PDF	ICERIE_2017_paper_121.pdf
Mongla Port: Studies	Environment and Society	Sustainability Issues	Yes		Study/Publication	2019	Nexus between Vulnerability and Adaptation in the Context of Climate Change: Evidence from Coastal Area in Bangladesh	PDF	NexusbetweenVulnerabilityandAdaptation.pdf
Mongla Port: Studies	Industries: Agriculture	Sustainability Issues	Yes		Study/Publication	2020 / in press	EXORBITANT SHRIMP CULTIVATION INHIBITING AGRO BASED LIVELIHOODS IN MONGLA UPAZILA OF BANGLADESH	PDF	Preprint-ICCESD2020.pdf
Mongla Port: Studies	Mongla Port: Environmental and Navigational Conditions	Sustainability Issues	Yes		Study/Publication	2015	CHANGES OF SEDIMENT DISCHARGE ON THE PASUR RIVER USING FUTURE CLIMATE CHANGE SCENARIO	PDF	Proceeding_of_I3CWE_2015_Gazipur_Khan_et_al_Changes_of_sediment_discharge.pdf
Mongla Port: Studies	General Transport & Logistics	Competing Ports	Yes		Study/Publication	2018	Efficient Fuel Handling and Management in Port: Context Bangladesh	PDF	Saha2018b.pdf
Mongla Port: Studies	Mongla Port: Environmental and Navigational Conditions	Mongla Port: Planning Studies	Yes		Study/Publication	2018	Health Risk Assessment of Heavy Metals in the Leafy, Fruit, and Root Vegetables Cultivated Near Mongla Industrial Area, Bangladesh	PDF	zums-jhehp-v4n4p144-en.pdf
Mongla Port: Support Vessels	Mongla Port: Equipment		Yes	Yes	Organisational Data	unknown / 2018	Vessel Maintenance Schedule 2019-2022	JPG	100_5570.JPG
Mongla Port: Support Vessels	Mongla Port: Equipment		Yes	Yes	Organisational Data	unknown / 2018	List of vessels	PDF	List_of_Vessels.pdf
Studies of Mongla Port			Yes	Yes	Study/Publication	2011	Bangladesh: Port and Logistics Efficiency Improvement (Financed by the Technical Assistance Special Fund) Section 2: Summary and Recommendation for Mongla Port	PDF	ADB Logistics Study Mongla Port-02.pdf
Sustainability Issues	General Statistics / Information: Economics and Finance, Inflation		Yes		Study/Publication	2019	Blue Economy and Climate Change: Bangladesh Perspective	PDF	BlueEconomyandClimateChange.pdf
Sustainability Issues	General Statistics / Information: Economics and Finance, Inflation		Yes		Study/Publication	2016	For sustainable economic development of Bangladesh	PDF	ForsustainableeconomicdevelopmentofBangladesh.pdf
Sustainability Issues	General Statistics / Information: Economics and Finance, Inflation		Yes		Study/Publication	2019	Future Importance of Maritime Activities in Bangladesh	PDF	FutureImportanceofMaritimeActivitiesinBangladesh.pdf
Sustainability Issues	General Statistics / Information: Economics and Finance, Inflation		Yes		Study/Publication	2019	Initial Measures of the Bangladesh Blue Economy	PDF	InitialMeasuresoftheBangladeshBlueEconomy.pdf
Sustainability Issues	General Statistics / Information: Economics and Finance, Inflation	(Development-) Policies / Plans	Yes		Study/Publication	2019	Policy Interventions for the Development of the Blue Economy in Bangladesh	PDF	PolicyOptionsforBlueEconomyinBangladesh.pdf
Trade	General Statistics / Information: Economics and Finance, Inflation		Yes	Yes	Study/Publication	unknown	Free trade zones and global supply chain	JPG	Freetradezonesandglobalsupplychain.jpg
Trade	General Statistics / Information: Economics and Finance, Inflation		Yes	Yes	Study/Publication	2011	Trade Flows of Bangladesh: A Gravity Model Approach	PDF	Trade_Flows_of_Bangladesh_A_Gravity_Model_Approach.pdf
Trade	General Statistics / Information: Economics and Finance, Inflation		Yes	Yes	Study/Publication	2018	Trade (exports) as an opportunity for Bangladesh: A VECM Analysis	PDF	TradeexportsasanopportunityforBangladesh-AVECManalysis.pdf
Trade	General Statistics / Information: Economics and Finance, Inflation		Yes	Yes	Study/Publication	2017	Trade Relations between Bangladesh and Cambodia	PDF	TradeRelationsbetweenBangladeshandCambodia.pdf
Transport & Logistics			Yes	Yes	Study/Publication	2011	Bangladesh: Port and Logistics Efficiency Improvement (Financed by the Technical Assistance Special Fund) Section 3: Summary and Recommendation for Benapole Land Port	PDF	ADB Logistics Study Mongla Port-03.pdf
Transport & Logistics			Yes	Yes	Study/Publication	2011	Bangladesh: Port and Logistics Efficiency Improvement (Financed by the Technical Assistance Special Fund) Section 1	PDF	ADB Logistics Study Mongla Port-01.pdf
Competing Ports: Payra			No / Missing	Yes	Study/Publication		Payra Port Master Plan, Payra Cargo Throughout and Vessel Traffic Statistics		
General Standards and Regulations			No / Missing	Yes	Study/Publication		Bangladesh laws and regulations etc.		
General Standards and Regulations			No / Missing	Yes	Study/Publication		Relevant environmental laws with regard to river and coastal modifications		
General Standards and Regulations			No / Missing	Yes	Study/Publication		Legal regulations for private investments		
General Transport & Logistics			No / Missing	Yes	Study/Publication		Bangladesh Railway – Plans, Maps, technical and operations conditions; investments/ master planning 2020 - 2040		
General Transport & Logistics			No / Missing	Yes	Study/Publication		Ministry of Communications, Bangladesh Road Authority - Plans, Maps, technical and operations conditions; investments/ master planning 2020 - 2040.		
General Transport & Logistics			No / Missing	Yes	Study/Publication		Bangladesh Inland Water Transport Authority (BIWTA) - Plans, Maps, technical and operations conditions; investments/ master planning 2020 - 2040		
General Transport & Logistics			No / Missing	Yes			Mongla Port hinterland infrastructure developments		
Maps	Mongla Port: Maps	General Transport & Logistics	No / Missing	Yes	Study/Publication		Detailed Road, railway and inland waterway map of the region (up to Dhaka) and technical information of these		
Mongla Port: Administration			No / Missing	Yes	Organisational Data		Draft Mongla Port Authority Act 2019		
Mongla Port: Administration			No / Missing	Yes	Organisational Data		MPA's current rules regarding financial and administrative authority etc.		
Mongla Port: Administration			No / Missing	Yes	Organisational Data		Govt. Gazette of MPA Protected area		
Mongla Port: Administration			No / Missing	Yes	Organisational Data		Govt. Gazette of Port Limit		
Mongla Port: Administration			No / Missing	Yes	Organisational Data		Valid SOP of the port		
Mongla Port: Administration			No / Missing	Yes	Organisational Data		Institutional framework and financing scheme of the port		
Mongla Port: Administration			No / Missing	Yes	Organisational Data		Documents/regulations relevant to Mongla Port development		
Mongla Port: Administration			No / Missing	Yes	Organisational Data		Information on potential investors and development partners		
Mongla Port: Environmental and Navigational Conditions	Mongla Port: Infrastructure	Mongla Port: Equipment	No / Missing	Yes	Organisational Data		Size and draft of ships handled at anchorage, mooring buoys and jetties		
Mongla Port: Environmental and Navigational Conditions			No / Missing	No	Study/Publication		Hydrodynamic and Morphological model of Pussur River (done by the Institute of Water Modelling in a separate study)		no longer considered necessary
Mongla Port: Environmental and Navigational Conditions			Yes	Yes	Organisational Data		Tide Tables Pussur River - 2019		
Mongla Port: Environmental and Navigational Conditions			No / Missing	No	Study/Publication		Mathematical Model Study of Pussur-Sibsa River System and Karnafully River Entrance by Danish Hydraulic Institute – 1991		no longer considered necessary
Mongla Port: Environmental and Navigational Conditions			Yes	Yes	Study/Publication		Hydrography Survey Chart of Pussur River for the last 10 years in pdf format.		most charts were handed over
Mongla Port: Environmental and Navigational Conditions			No / Missing	No	Study/Publication		Results from hydrographic and morphological model of Pussur River (provided by IWM)		no longer considered necessary
Mongla Port: Equipment			Yes	Yes	Organisational Data		List of Equipment (aside cranes) in Mongla Port		
Mongla Port: Equipment	Mongla Port: Infrastructure		Yes	Yes	Organisational Data		Latest status of cargo handling equipment at Mongla Port (incl. mobile harbour cranes to be shortly expected).		
Mongla Port: Financial Data			No / Missing	Yes	Organisational Data		Current budgets etc.		
Mongla Port: Infrastructure			No / Missing	Yes	Organisational Data		List of Infrastructure / Assets etc.		
Mongla Port: Infrastructure			No / Missing	Yes	Organisational Data		Present Land Use Plan showing positions of all infrastructure of Mongla Port		various layout plans exist none showing the present situation. The Consultant will draft a new plan.
Mongla Port: Infrastructure			No / Missing	Yes	Organisational Data		Present and future utilities (electricity generation/supply and distribution, potable water supply…)		
Mongla Port: Staffing			No / Missing	Yes	Organisational Data		Numbers on port staff and their payment		
Mongla Port: Support Vessels			Yes	Yes	Organisational Data	2019	Specification of Service Vessels in Mongla Port		list of vessels was handed over
Competing Ports	General Statistics / Information: Economics and Finance, Inflation		No / Missing	Yes			Studies on prospects of competing ports (national and international)		
General Statistics / Information: Economics and Finance, Inflation			No / Missing	Yes			Customs data on (re-)imports, (re-)exports and Transits by commodity type and origin / target, value and weight		
General Statistics / Information: Economics and Finance, Inflation			No / Missing	Yes			Studies on prospects of relevant (agro-)industries and products (e.g. Textiles, Ready Made Garments, energy, Leather & Leather Goods, Pharmaceuticals and other Chemical products, Ceramic Products, Bicycles, Jute and Jute Goods, IT, Agricultural Products, Fish and Seafood)		
Maps	General Statistics / Information: Economics and Finance, Inflation	General Transport & Logistics	No / Missing	Yes			Maps of locations of relevant industries and economic geography in general		
Maps			No / Missing	Yes			Digital maps. E.g. on transport infrastructure and routes	GIS / CAD	
General Transport & Logistics			No / Missing	Yes			Statistical information on technical potential and actual utilisation / traffic volumes on nationwide transport routes (all modes)	XLS	
Mongla Port: Administration			No / Missing	Yes			List of services offered by MPA and financial outlines of these	XLS	
Industries: Energy	Trade		Yes	Yes	Study/Publication	2013	Scenario of Electricity Trading in South Asia: Perspective and Feasibility of Trading between India and Bangladesh	PDF	ScenarioofelectricitytradinginSouthAsiaPerspective.pdf
Industries: Energy			Yes	Yes	Study/Publication	2019	Electricity consumption and income nexus: evidence from Bangladesh	PDF	IJESM-12-2018-0007.pdf
Mongla Port: Environmental and Navigational Conditions			Yes	Yes	Organisational Data	2019	Mongla Draft Chart Jan 19 to Jun19	PDF	Mongla Draft-Chart-Jan-19-To-Jun-19.pdf
Mongla Port: Studies	Competing Ports	Mongla Port: Handling Data	Yes	Yes	Study/Publication	2017	Mongla not fit to take heat off Ctg port	PDF	Mongla not fit to take heat off Ctg port _ The Daily Star.pdf
Mongla Port: Infrastructure	Mongla Port: Planning Studies	Mongla Port: Handling Data	Yes	Yes	Study/Publication	2019	Mongla Port to get 6 new jetties and one container terminal	PDF	Mongla Port to get 6 more jetties, one container terminal _ Independent.pdf
Mongla Port: Planning Studies	Industries: Other	Mongla Port: Handling Data	Yes	Yes	Study/Publication	2019	Mongla Port targets Chittagong apparel exports	PDF	PRESS-REVIEW-20190920.pdf
Mongla Port: Planning Studies	Mongla Port: Handling Data		Yes	Yes	Study/Publication	2011	Port and Logistics Efficieny Improvements: Summary for Mongla Port	PDF	1107_Port and Logistics Efficiency Improvement - Mongla Port.pdf
Competing Ports: Chittagong			Yes	Yes	Study/Publication	2016	Chittagong Port Overview and Other Inland Transportation	PDF	Chittagong Port Overview and Other Inland Transportation_Dhaka_Bangladesh_1-22-2016.pdf
Mongla Port: Studies	Industries: Cement	Mongla Port: Relevant Industries	Yes	Yes	Study/Publication	2017	ENVIRONMENTAL and SOCIAL IMPACT ASSESSMENT on cement mills in Mongla Port	PDF	Revised-Final-ESIA _MCML VRM_7-Jan2019.pdf
Mongla Port: Environmental and Navigational Conditions			Yes	Yes	Study/Publication	2018	HYDROLOGICAL CHARACTERISTICS OF PUSSUR RIVER AND ITS NAVIGABILITY	PDF	Data on Pussur River.pdf
Mongla Port: Infrastructure	Mongla Port: Equipment		Yes	Yes	Study/Publication	unknown	Mongla Port Technical Systems and Equipment	DOCX	Chapter Technical Systems and Equipment.docx
Mongla Port: Studies	Mongla Port: Infrastructure	Mongla Port: Equipment	Yes	Yes	Study/Publication	unknown	Basic Facts on Mongla Port incl Infrastructure and equipment	JPG	Basic facts _ Bangladesh Shipping Agent...h Shipping Agents' Association, Khulna.pdf

Mongla Port: Handling Data	Industries: Container	Industries: Other	Yes	Yes	Organisational Data	unknown / 2018	Commodity-wise Import & Export handled at Mongla Port from 2004-2005 to 2017, incl. differentiation on public / private imports, Wheat, container / conventional ship, renevues earned, No. Of crafts handled, No. of ships called/sailed, Indian-Banglasdesh Protocal vessel	PDF	Vip Set 2016-2017 (1).pdf
Mongla Port: Administration			Yes	Yes	Organisational Data	1995	MPA Authority Ordinance and MPA Ammendment Act	PDF	Nitimala (1).pdf
Mongla Port: Planning Studies	Mongla Port: Relevant Industries		Yes	Yes	Study/Publication	2018	Environmental Impact Assessment (EIA) of the Proposed Dredging Project at the Outer Bar area of Pussur Channel	PDF	Combined_Revised_EIAReport of Outer Bar_March2018_final.pdf
Mongla Port: Handling Data			Yes	Yes	Organisational Data	unknown / 2019	Mongla Port Ship Statistics	PDF	mpa.portal.gov.bd_site_page_b26f1d80-0a49-49db-ac15-9393c040ea9b_-.pdf
Mongla Port: Handling Data	Industries: Container		Yes	Yes	Organisational Data	unknown / 2019	Mongla Port Container Statistics 2004 to 2019	XLS	Mongla_Port_Umschlag_Container_2004_2019.xlsx
Mongla Port: Handling Data	Industries: Container		Yes	Yes	Organisational Data	unknown / 2019	Mongla Port Container Statistics 2004 to 2019	XLS	Mongla_Port_Umschlag_Container_vs_Converntional_2004_2019.xlsx
Mongla Port: Financial Data			Yes	Yes	Organisational Data	unknown / 2019	Revenues of Mongla Port	PDF	Revenue Earned(1) (2).pdf
Mongla Port: Equipment			Yes	Yes	Organisational Data	unknown / 2019	Mongla Port Cargo handling equipment	XLS	\Mongla_Port_Equipment.xlsx
Mongla Port: Environmental and Navigational Conditions	Industries: Cement	Sustainability Issues	Yes	Yes	Study/Publication	2018	Climate change profile of Bangladesh	PDF	Bangladesh.pdf
Port Authorities			Yes	Yes	Study/Publication	01.08.2019	Hamburg Port Authority Organigramme	PDF	Stand_01.08.2019_HPA_Organigramm_Internet.pdf
Port Authorities			Yes	Yes	Study/Publication	2019	Port Information Guide Hamburg 2019	PDF	Port-Information-Guide_2018.pdf
Port Authorities			Yes	Yes	Study/Publication	2019	Organisation Chart Port of Rotterdam Authority	PDF	organisation-chart-port-of-rotterdam-authority.pdf
Port Authorities			Yes	Yes	Study/Publication	2019	Port Of Rotterdam Authority • Highlights of the 2018 Annual Report	PDF	2018-Annual-Report-highlights-EN-PortofRotterdam.pdf
Port Authorities	Sustainability Issues		Yes	Yes	Study/Publication	2019	Maritime and Port Authority of Singapore: Sustainability/Integrated Report 2018	PDF	MPA-Sustainability-Report-2018.pdf
Competing Ports: Payra	General Transport & Logistics	Maps	Yes	Yes	Study/Publication	2019	Railway project to Payra Port	PDF	Payra rail link to bring $7.5b FDI.pdf
Competing Ports: Chittagong	General Transport & Logistics		Yes	Yes	Study/Publication	2019	Chittagong-Cox's Bazar railway project	PDF	46452-002-ffa.pdf
Competing Ports: Chittagong	General Transport & Logistics		Yes	Yes	Study/Publication	2019	Chittagong-Cox's Bazar railway project incl. Information on planned deep-sea port on Matarbari Island	PDF	Chittagong-Cox's Bazar Railway Line.pdf
Competing Ports: Payra	General Transport & Logistics	Maps	Yes	Yes	Study/Publication	2019	FREIGHT RAILWAY FROM DHAKA TO PAYRA PORT	PDF	Rendel Appointed on Bangladeshs 240km Long Freight Railway _ Rendel.pdf
General Transport & Logistics	(Development-) Policies / Plans		Yes	Yes	Study/Publication	2018	Railway Masterplan - Bangladesh SASEC Railway Connectivity Investment Programme Project. Final Report on Updating Railway Master Plan. Including Forecast and prioritised list of projects	PDF	Railway Investment Master Plan 2018.pdf
General Transport & Logistics	(Development-) Policies / Plans		Yes	Yes	Study/Publication	2009	Road Masterplan. Including Forecast and prioritised list of projects	PDF	RoadMasterPlan.pdf
General Transport & Logistics	(Development-) Policies / Plans		Yes	Yes	Study/Publication	2009	Regional Road Connectivity	PDF	rrcbp.pdf
General Transport & Logistics	(Development-) Policies / Plans		Yes	Yes	Study/Publication	2005	Possible Railway Projects in Bhutan	PDF	Pointers March 2005 _ News _ Railway Gazette.pdf
General Transport & Logistics	(Development-) Policies / Plans		Yes	Yes	Study/Publication	2017	Possible Railway Projects in Nepal	PDF	Nepal dreams of railway linking China to India _ China Dialogue.pdf
General Transport & Logistics	(Development-) Policies / Plans		Yes	Yes	Study/Publication	2016	Possible Railway Conncetion India-Myanmar	PDF	India plans Myanmar rail connection _ Mizzima Myanmar News and Insight.pdf
General Transport & Logistics			Yes	Yes	Study/Publication	2006	Quantifying the Transport, Regulatory and Other Costs of IndianOverland Exports to Bangladesh. Incl. Border Crossing Time	PDF	Quantifying the Transport, Regulatory and Other Costs of IndianOverland Exports to Bangladesh .pdf
General Transport & Logistics			Yes	Yes	Study/Publication	2014	India-Bangladesh Trade Potentiality. An Assessment of Trade Facilitation Issues. Incl. Border Crossing Time	PDF	India-Bangladesh_Trade_Potentiality-An_Assessment_of_Trade_Facilitation_Issues.pdf
General Transport & Logistics			Yes	Yes	Study/Publication	2019	Transport Times and Costs within Bangladesh	PDF	Bangladesh India Rail_ New projects promise faster, cheaper India-Bangladesh rail.pdf
General Transport & Logistics			Yes	Yes	Study/Publication	2018	Time needed for trail border crossing. ESCAP (2018): "Study on Border Crossing Practices in International Railway Transport" Bangkok	PDF	Study on Railway Border crossings 46218.pdf
General Transport & Logistics	Industries: Agriculture		Yes	Yes	Study/Publication	2018	Transport Costs, Comparative Advantage, and Agricultural Development: Evidence from Jamuna Bridge in Bangladesh	PDF	Transport Costs, Comparative Advantage, and Agricultural Development.pdf
General Statistics / Information: Demographics/Population			Yes	Yes	Study/Publication	2017	Defintions of "Urban" vs. "Rural" / "Non-Urban"	PDF	UN_2016_Demographic_Yearbook_Definition_of_Urban_Notes06.pdf
Industries: Other	General Statistics / Information: Economics and Finance, Inflation		Yes	Yes	Study/Publication	2019	Manufacturing Sector in Bangladesh / manufacturing industries and their import and export tendencies / Manufacturing and Jobs in South Asia	PDF	ManufacturingPaper_Springer.pdf
Mongla Port: Relevant Industries			Yes	Yes	Study/Publication	2018	Map of industries in Mongla Port	PDF	zums-jbehp-v4n4p144-en.pdf
General Transport & Logistics			Yes	Yes	Study/Publication	2014	ADB. (2014). Bangladesh: Road Maintenance and Improvement Project. Performance Evaluation Report December2014. Place of publishing unknowen. Bangladesh Roads and Highways Department . (2009). Road Master Plan. Volume I: Main Text. Dhaka.	PDF	n.a.
General Statistics / Information: Demographics/Population			Yes	Yes	Study/Publication	2019	Bhutan National Statistics Bureau. (2019). Statistical Yearbook of Bhutan 2019. Thimphu.	PDF	n.a.
General Transport & Logistics			Yes	Yes	Other	2017	China Dialogue. (2017). Nepal dreams of railway linking China to India; URL: https://www.chinadialogue.net/article/show/single/en/10091-Nepal-dreams-of-railway-linking-China-to-India, accessed on 15th November 2019.	n.a.	n.a.
Other			Yes	Yes	Other	2019	CIESIN. (2019). Center for International Earth Science Information Network, http://www.ciesin.org/, accessed on 5th November 2019.	n.a.	n.a.
General Transport & Logistics			Yes	Yes	Study/Publication	2017	CPCS Transcom Limited. (2017). SASEC Railway Connectivity Investment Program. Final Report on Updating Railway Master Plan. Ottawa.	PDF	n.a.
General Transport & Logistics			Yes	Yes	Study/Publication	2006	Das, S., & Pohit, S. (2006). Quantifying the Transport, Regulatory and Other Costs of IndianOverland Exports to Bangladesh. New Delhi: National Council of Applied Economic Research.	n.a.	n.a.
Other			Yes	Yes	Study/Publication	2016	Desa, N., & Bhatia, M. (2016). A Multiple Variable Regression Model for Gross Domestic Product Growth Rate Prediction in India Using Key Macroeconomic Indicators. IOSR Journal of Economics and Finance, Volume 7, Issue 2, pp. 47-51.	PDF	n.a.
General Statistics / Information: Demographics/Population			Yes	Yes	Other	2018	Facebook Connectivity Lab and Center for International Earth Science Information Network. (2018). High Resolution Settlement Layer (HRSL). Source imagery for HRSL © 2016 DigitalGlobe. Accessed on 1st December 2019.	n.a.	n.a.
General Transport & Logistics			Yes	Yes	Other	2019	GADM Maps and Data. (2019). https://gadm.org/, accessed on 9th November 2019.	n.a.	n.a.
General Statistics / Information: Demographics/Population			Yes	Yes	Study/Publication	2018	Government of the People's Republic of Bangladesh, Ministry of Planning, Bangladesh Planning Commission, General Economics Division. (2018). BANGLADESH DELTA PLAN 2100. Baseline Studies: Volume 5. Socio-Economic Aspects of the Bangladesh Delta. Dhaka.	PDF	n.a.
General Transport & Logistics			Yes	Yes	Study/Publication	2018	JOC.com. (2018). New projects promise faster cheaper India-Bangladesh rail; URL: https://www.joc.com/rail-intermodal/new-projects-promise-faster-cheaper-india-bangladesh-rail_20180911.html, accessed on 11th November 2019.	n.a.	n.a.
General Statistics / Information: Demographics/Population			Yes	Yes	Other	2019	Office of the Registrar General & Census Commissioner India. (2019). 2011 Census Data, http://censusindia.gov.in/2011-Common/CensusData2011.html, accessed on 5th December 2019 .	n.a.	n.a.
General Statistics / Information: Demographics/Population			Yes	Yes	Other	2005	Railway Gazette. (2005). Pointers March 2005; URL: https://www.railwaygazette.com/news/single-view/view//pointers-26.html, accessed on 15th November 2019.	n.a.	n.a.
General Statistics / Information: Demographics/Population			Yes	Yes	Other	2019	UNDP. (2019). United Nations Development Programme, https://www.undp.org/, accessed on 5th Novermber 2019.	n.a.	n.a.
General Transport & Logistics			Yes	Yes	Other	2018	UNESCAP. (2018). Study on Border Crossing Practices in International Railway Transport. Bangkok.	PDF	n.a.
General Statistics / Information: Demographics/Population			Yes	Yes	Other	2019	United Nations, Department of Economic and Social Affairs, Population Division. (2019). World Population Prospects 2019", custom data acquired via website on 2nd December 2019.	n.a.	n.a.
General Transport & Logistics			Yes	Yes	Study/Publication	2007	World Bank. (2007). People's Republic of Bangladesh. Revival of Inland Water Transport: Options and Strategies. Dhaka / Washington DC.	PDF	n.a.

Appendix B – Layout Plans of Mongla Port and Roosevelt Jetty

0 100 200 300 400 500m 1,0km 1,5km

1:10.000

Key:

- Port Boundary
- Proposed Railway Line under Construction
- Overhead Power Line
- LPG Pipeline
- Area not available for Port Development
- Area available for Port Development

DRAFT

No.:	Description:	Date:	Drawn:

Project:

Strategie Master Plan for Mongla Port

Client:

Mongla Port Authority

Consultant:

INROS LACKNER.
Consulting Engineers & Architects
Linzer Straße 3 • 28359 Bremen • Germany
Phone: +49 (0)421 65 84-10 Fax: +49 (0)421 65 84-110
eMail: bremen@inros-lackner.de Internet: www.inros-lackner.de

Phase:

Master Plan

Drawn:

Checked:

Approved:

Title:

Layout Plan of Mongla Port

Paper Size:

Project - No.: 2019–0355

Scale: 1:10.000

Drawing - No.: 1

No.:

Plot: P:\2019\2019-0355\Projekt\05\08\CAD\DWGs\Layouts_Mongla-Port.dwg - 20.12.2019

1:5000

0 50 100 150 200 250m 500m 750m

Key:

Boundary of MPA Land

PRELIMINARY

No.:	Description:	Date:	Drawn:

Project:

Strategie Master Plan for Mongla Port

Client:

Mongla Port Authority

Consultant:

INROS LACKNER.
Consulting Engineers & Architects
Linzer Straße 3 • 28359 Bremen • Germany
Phone: +49 (0)421 65 84-10 Fax: +49 (0)421 65 84-110
eMail: bremen@inros-lackner.de Internet: www.inros-lackner.de

Phase:

Master Plan

Drawn:		
Checked:		
Approved:		

Title:

Layout Plan of MPA Land in Khulna

Paper Size:	Project - No.:	
	2019–0355	
Scale: 1:5000	Drawing - No.: 2	No.:

1:2000

0 20 40 60 80 100m 200m 300m

Key:

- Boundary of Roosevelt Jetty
- Railway Line
- Boundary of MPA Land
- Khulna City Corporation

PRELIMINARY

No.:	Description:	Date:	Drawn:

Project:

Strategie Master Plan for Mongla Port

Client:

Mongla Port Authority

Consultant:

INROS LACKNER.
Consulting Engineers & Architects
Linzer Straße 3 • 28359 Bremen • Germany
Phone: +49 (0)421 65 84-10 Fax: +49 (0)421 65 84-110
eMail: bremen@inros-lackner.de Internet: www.inros-lackner.de

Phase: Master Plan

Drawn:		
Checked:		
Approved:		

Title: Layout Plan of Roosevelt Jetty

Paper Size:	Project - No.: 2019-0355	
Scale: 1:2000	Drawing - No.: 3	No.:

Appendix C – Navigation Charts

The following pages include copies of the latest available navigation charts from the Bay of Bengal up to Mongla Port. Survey dates range from March 2013 up to August 2019, as per the table below.

In the latest version of each chart, typical bed levels are indicated. These largely follow previously used navigation routes and aids to navigation. In several instances, the selected route deviates in order to make use of the largest available water depths.

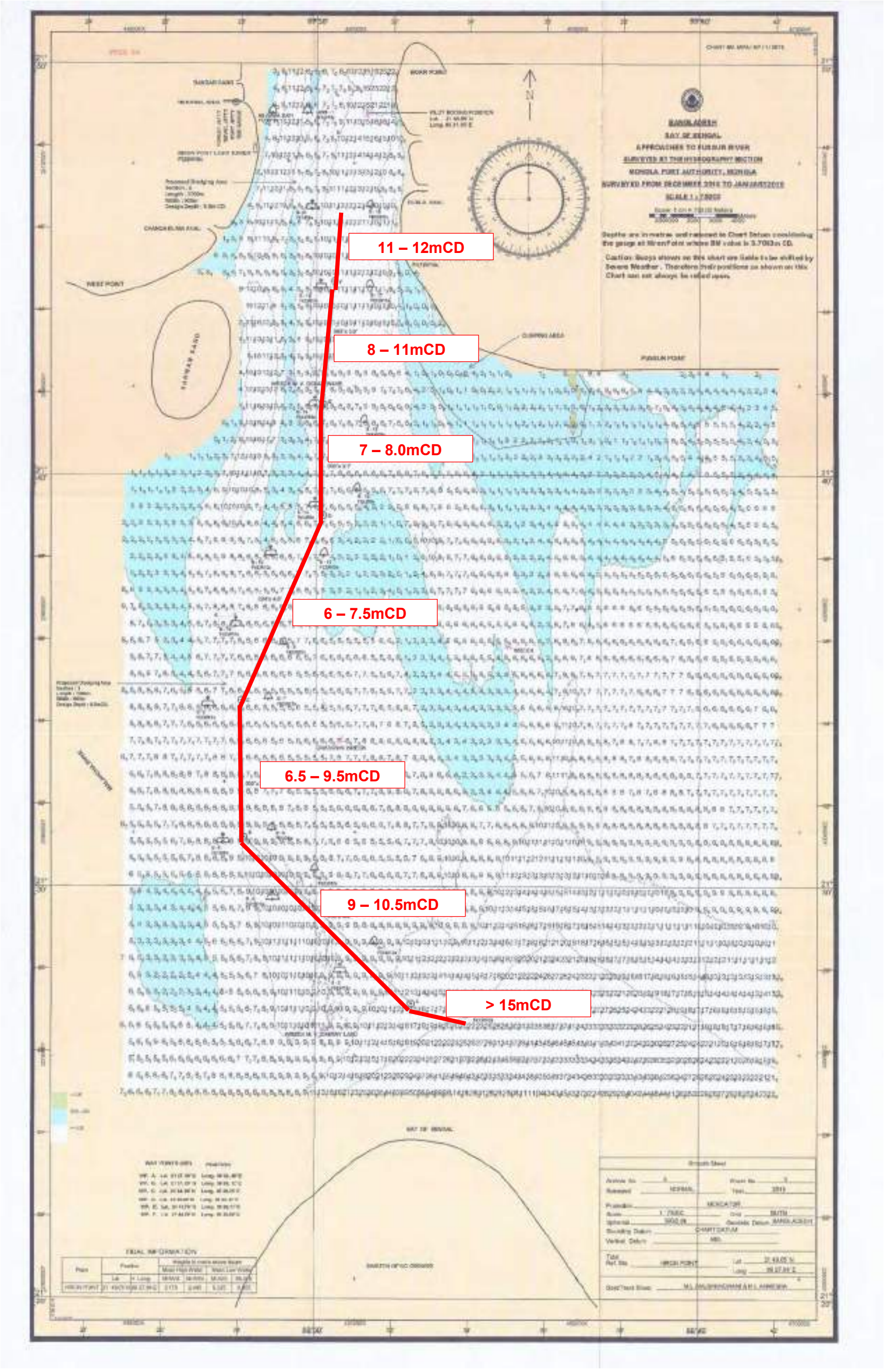
It is noted that bed levels are subject to change due to the dynamics of the river and estuarine morphology, which adapts to a variety of influencing factors including river discharges, tidal flows, tropical storms and cyclone conditions, as well as dredging works and any structural developments along the river banks.

The typical bed levels therefore provide an indication of the general river morphology, in order to assess the overall water depths along the navigation route from the Bay of Bengal up to Mongla Port, and to identify river stretches where depth limitations may either constrain the maximum allowable vessel draft or require dredging works to alleviate such constraints.

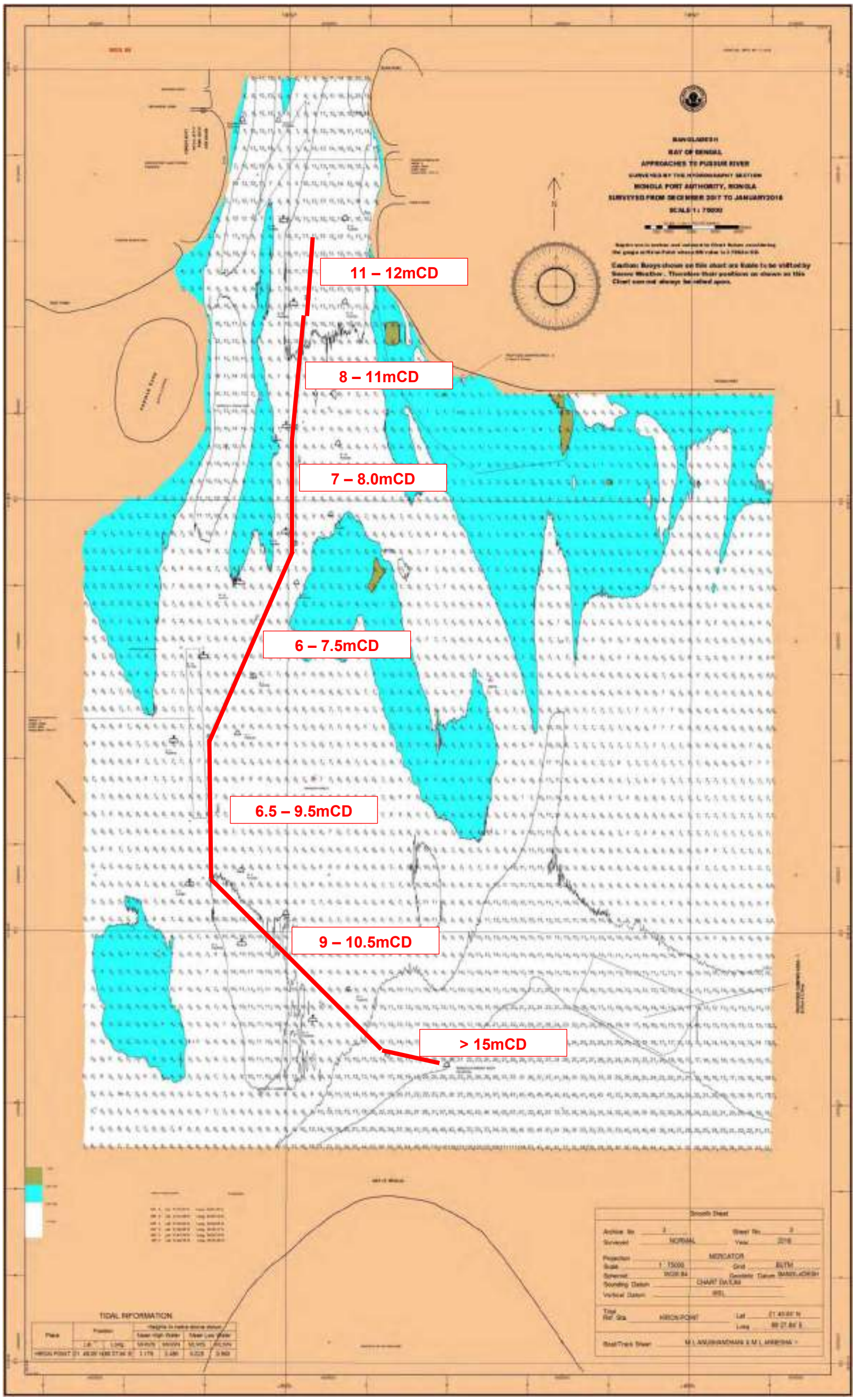
List of Navigation Charts

No.	Title	Survey Period	Scale
01	Bay of Bengal – Approaches to Pussur River	December 2018 to January 2019	1:75,000
		December 2017 to January 2018	1:75,000
		November 2016 to January 2017	1:75,000
		December 2015 to January 2016	1:75,000
02	Pussur River – Hiron Point to Tinkwona Dwip	January 2016	1:25,000
03	Pussur River – Twinkona Dwip to Kaga Boga Khal	March 2013	1:25,000
04	Pussur River – Kaga Boga Khal to Sundarikota Khal	March 2013	1:12,500
05	Pussur River – Sundarikota Khal to Cheilabogi Khal	February 2014	1:12,500

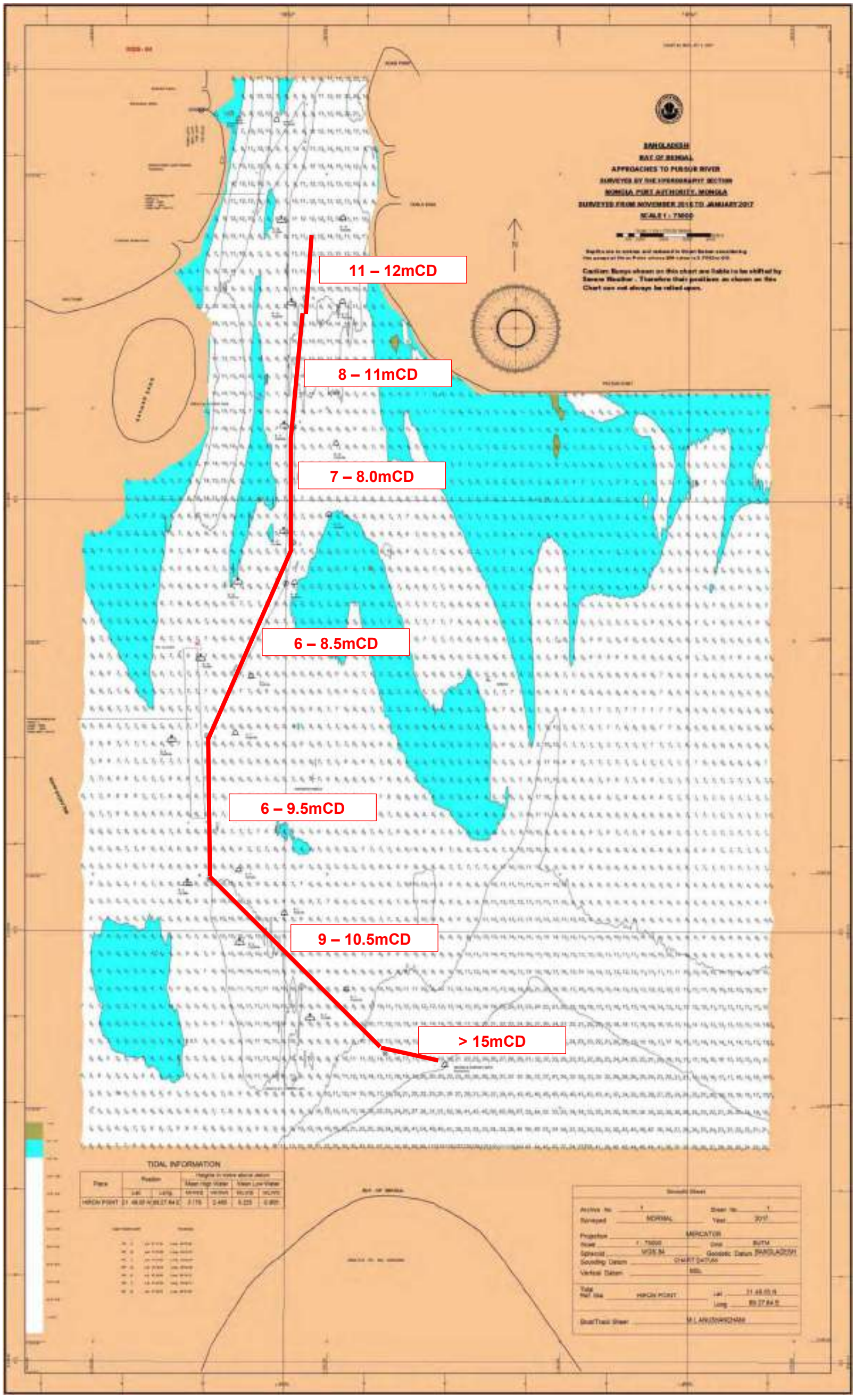
06	Pussur River – Mazhar Point to D' Souza Point	January 2019	1:12,500
		November 2017	1:12,500
07	Pussur River – Harbaria to Joymonirgol	January to February 2019	1:12,500
		November 2017	1:12,500
08	Pussur River – Base Creek to Mongla	October 2018	1:12,500
		March 2018	1:12,500
		March 2017	1:12,500
		August to September 2015	1:12,500
09	Pussur River – Mongla to Digraj	August 2019	1:12,500
		November 2018	1:12,500
		February 2017	1:12,500
		August 2015	1:12,500
10	Pussur River – Digraj to Chalna	October 2019	1:12,500
		February 2017	1:12,500



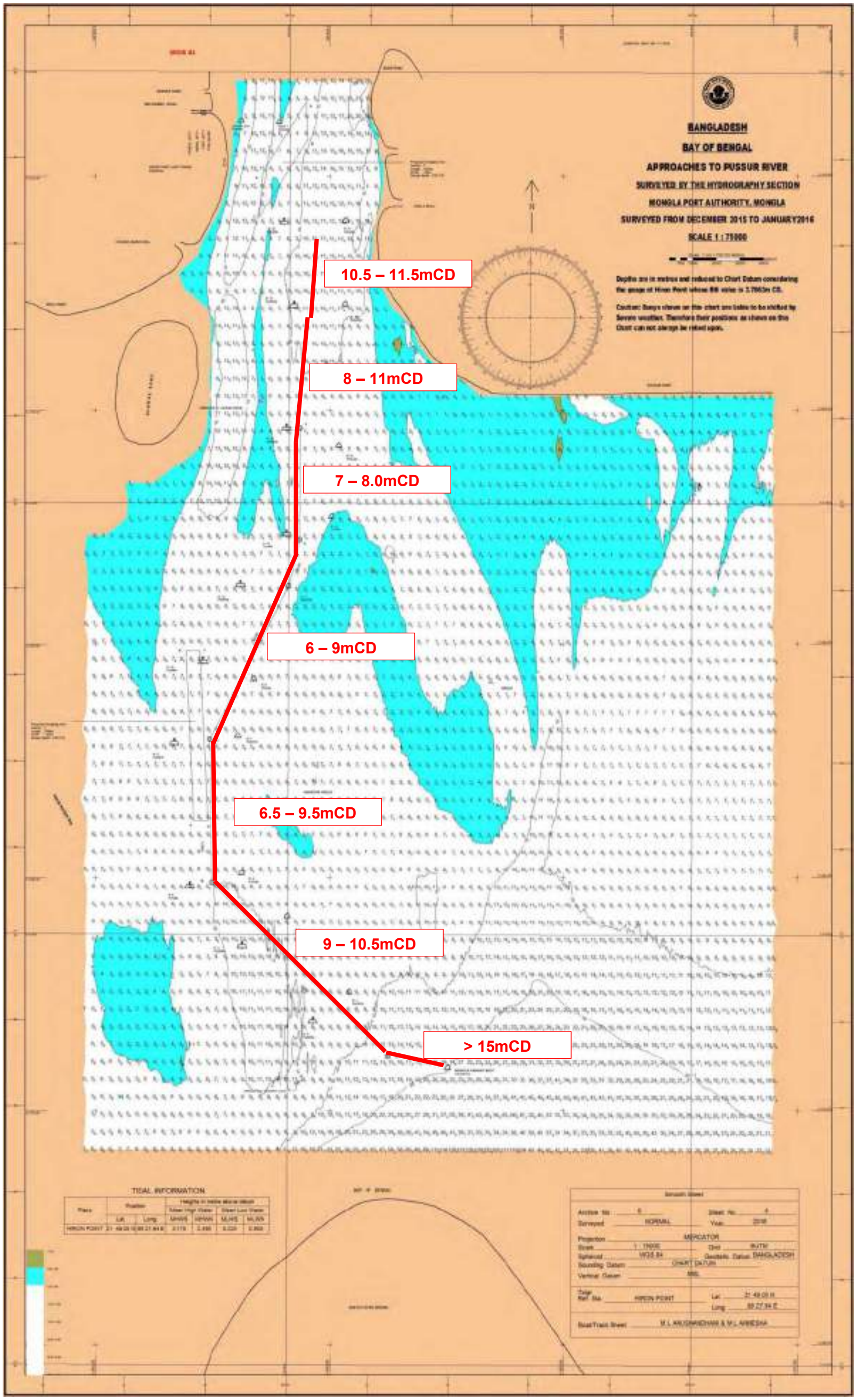
Navigation Chart No. 01 – Bay of Bengal (December 2018 – January 2019)



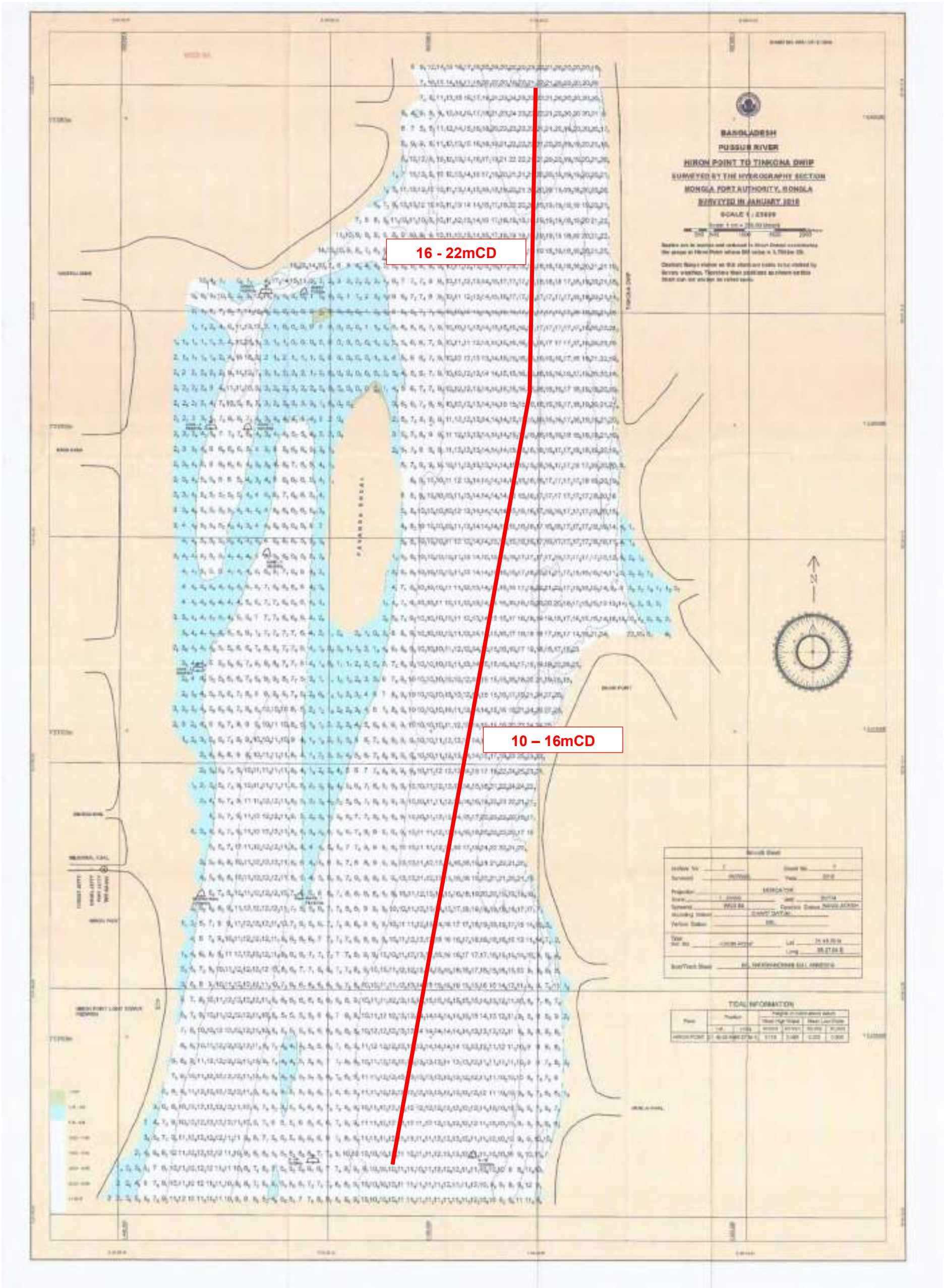
Navigation Chart No. 01 – Bay of Bengal (December 2017 – January 2018)



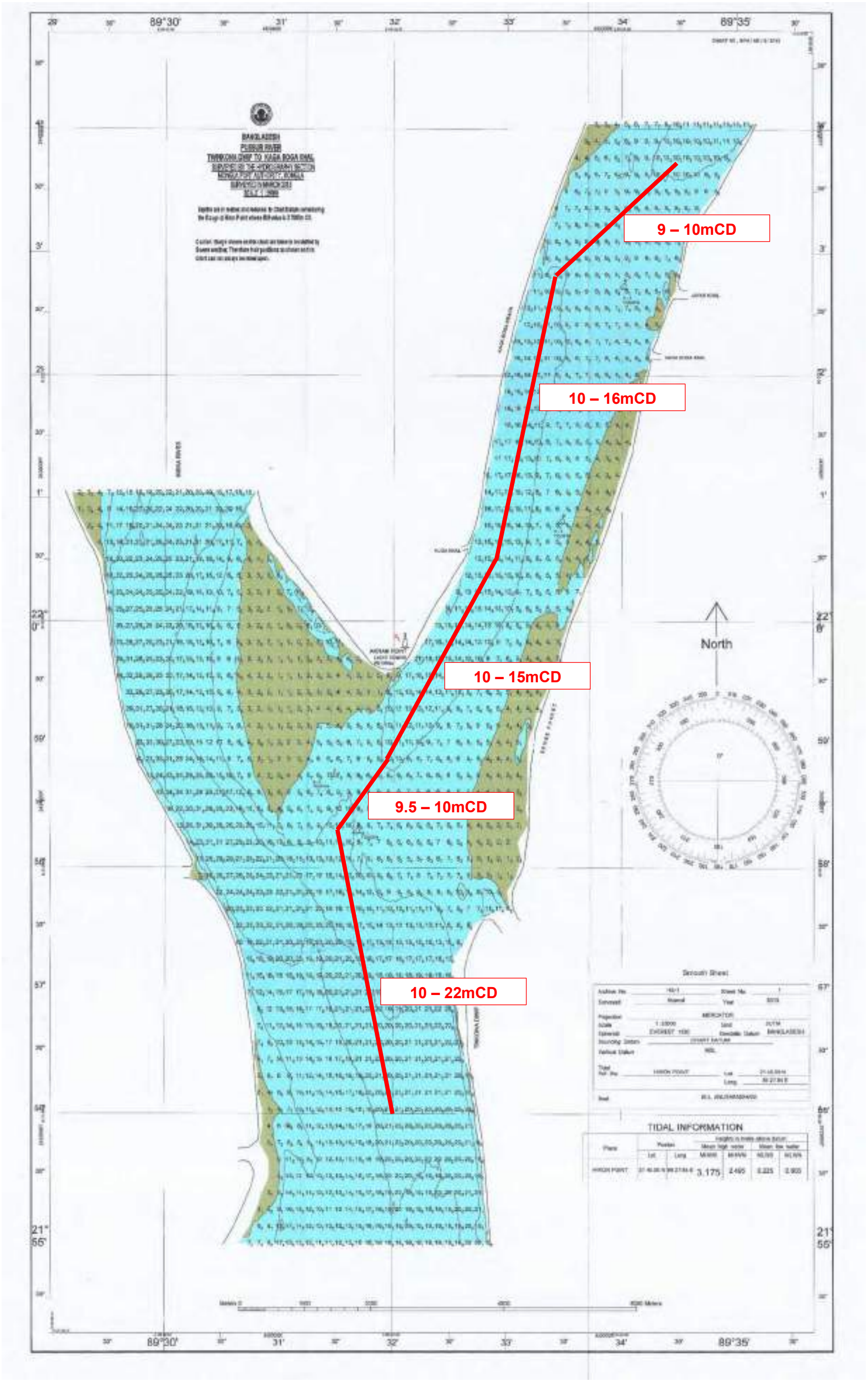
Navigation Chart No. 01 – Bay of Bengal (November 2016 – January 2017)



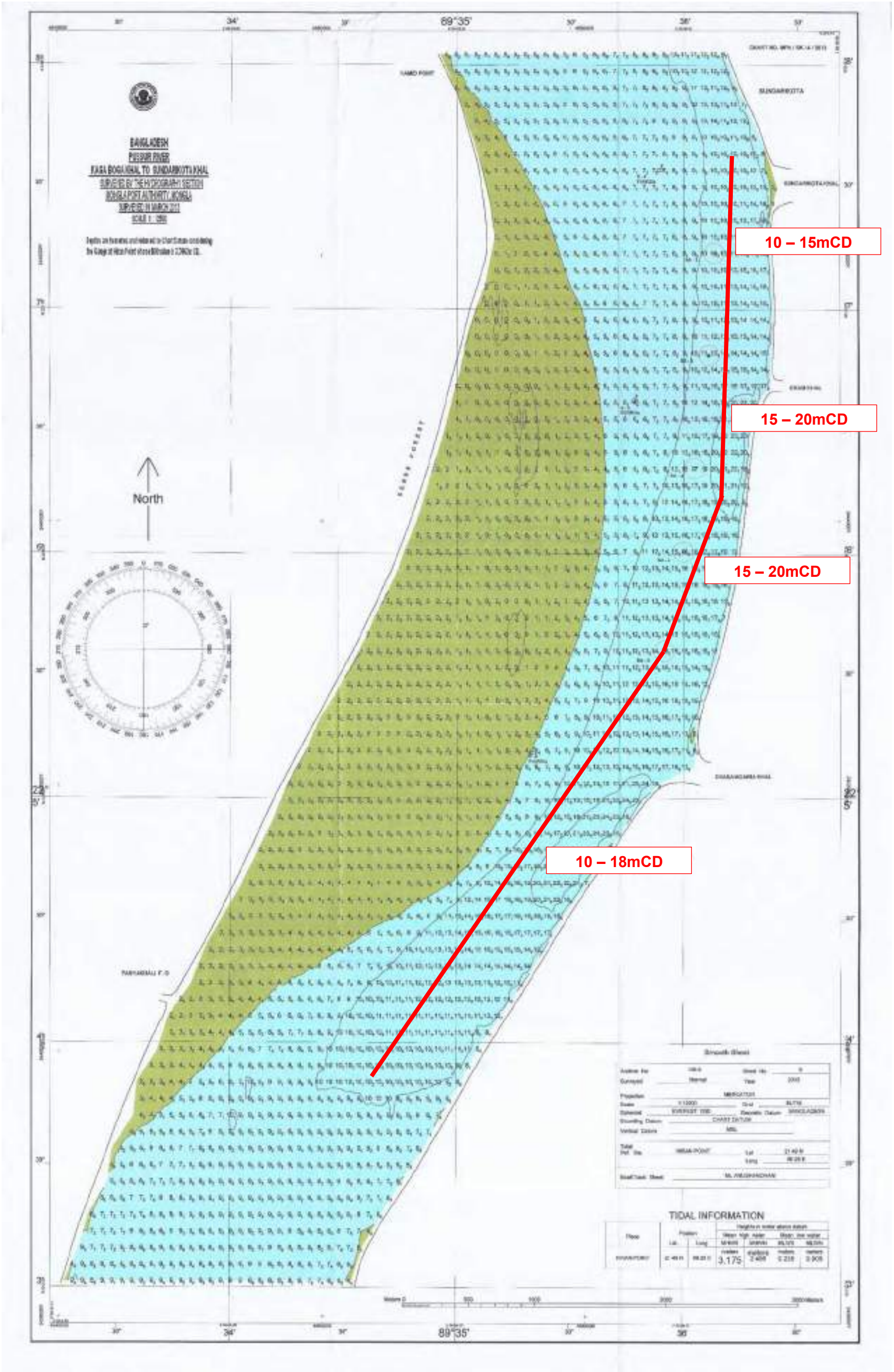
Navigation Chart No. 01 – Bay of Bengal (December 2015 – January 2016)



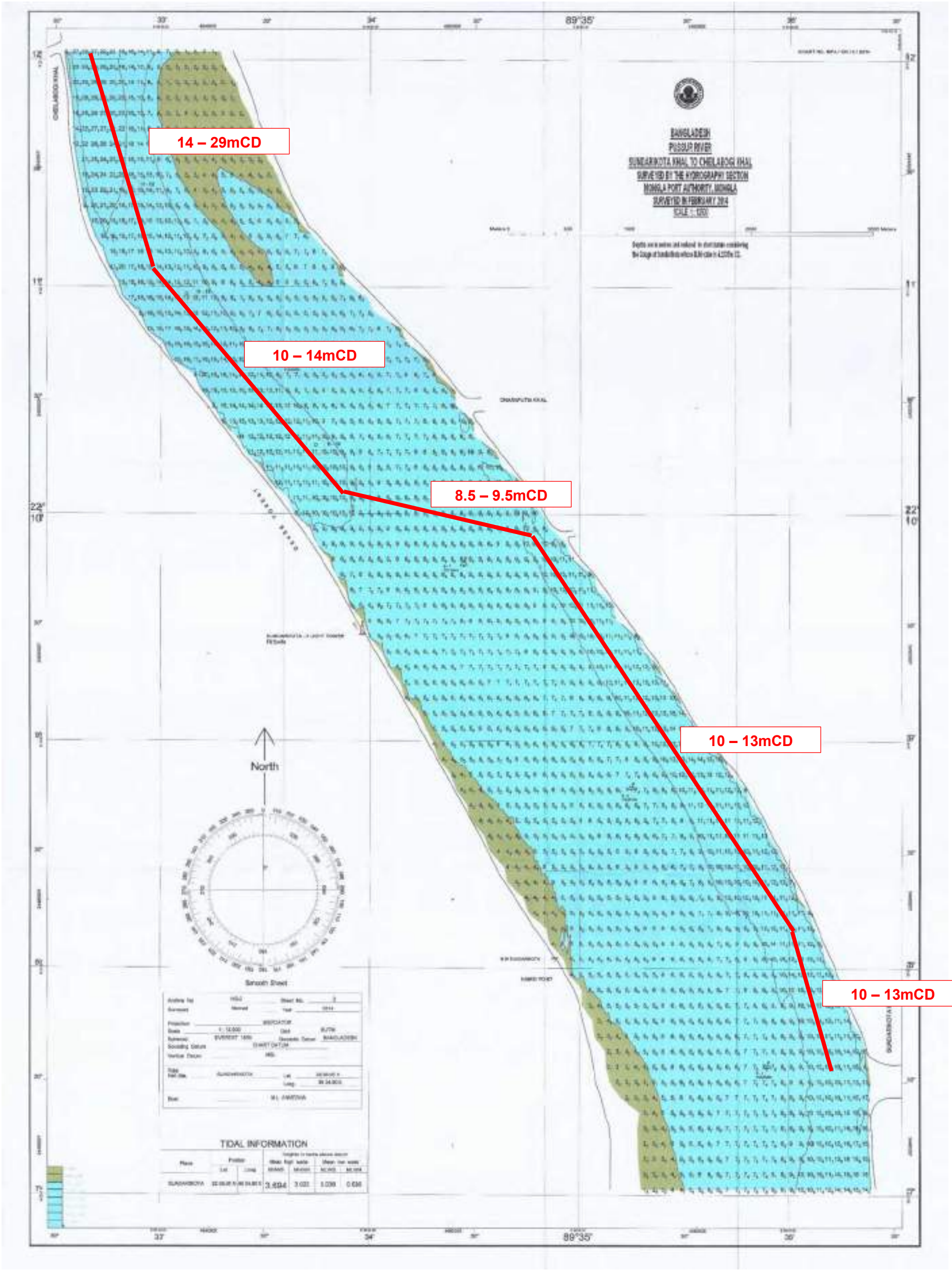
Navigation Chart No. 02 – Hiron Point to Tinkona Dwip (January 2016)



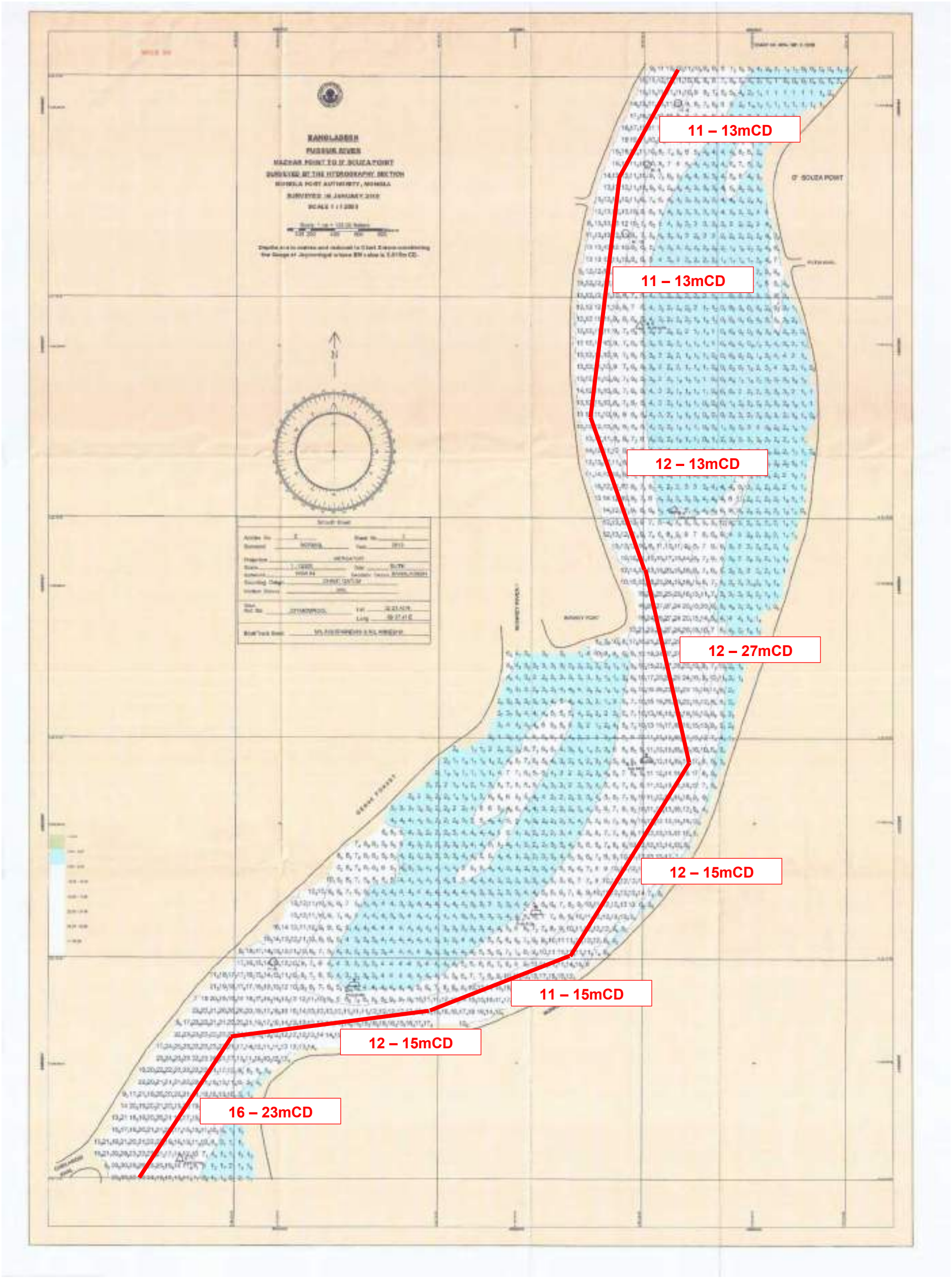
Navigation Chart No. 03 – Twinkona Dwip to Kaga Boga Khal (March 2013)



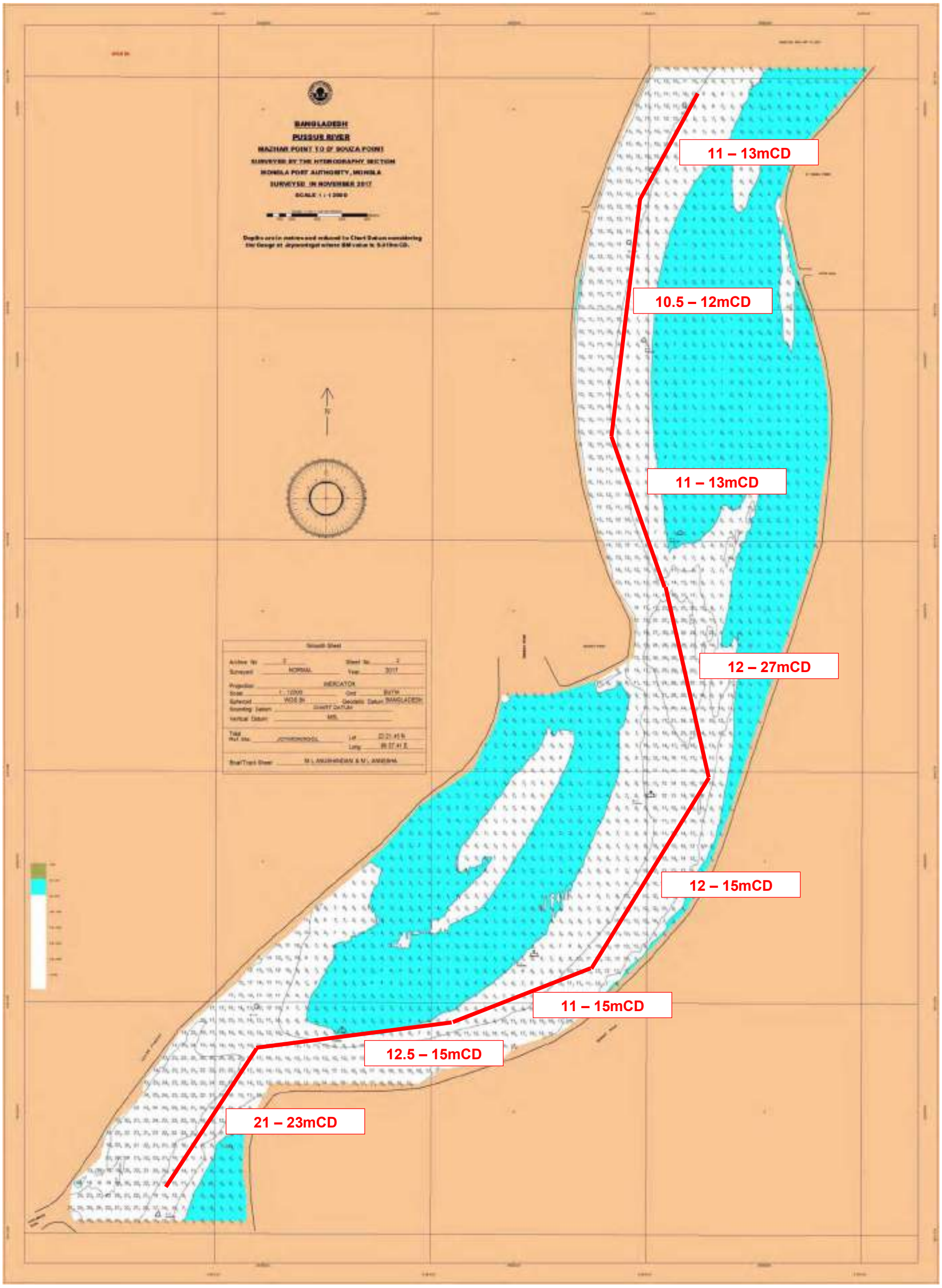
Navigation Chart No. 04 –Kaga Boga Khal to Sundarikota Khal (March 2013)



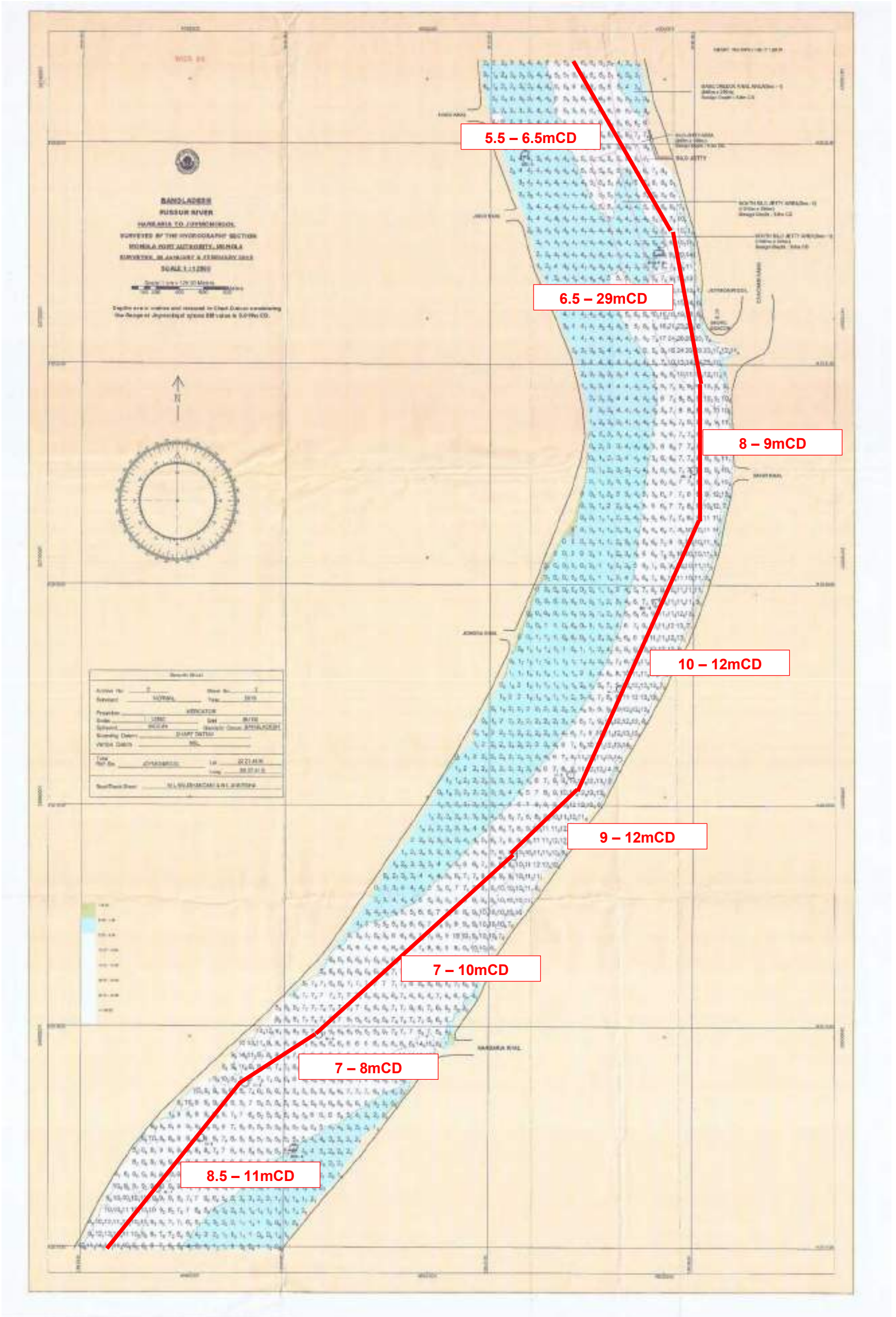
Navigation Chart No. 05 – Sundarikota Khal to Cheilabogi Khal (February 2014)



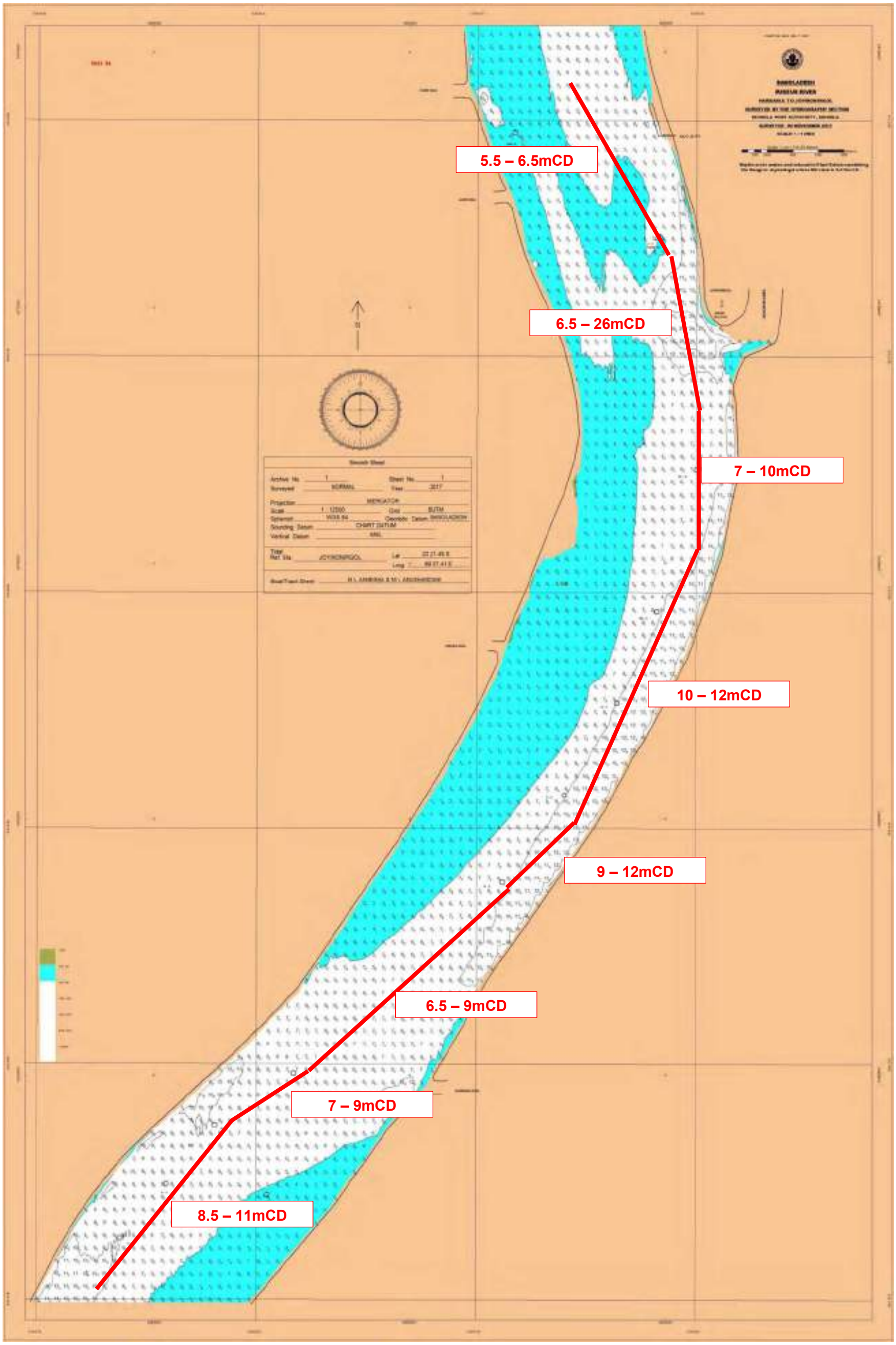
Navigation Chart No. 06 – Mhazar Point to D'Souza Point (January 2019)



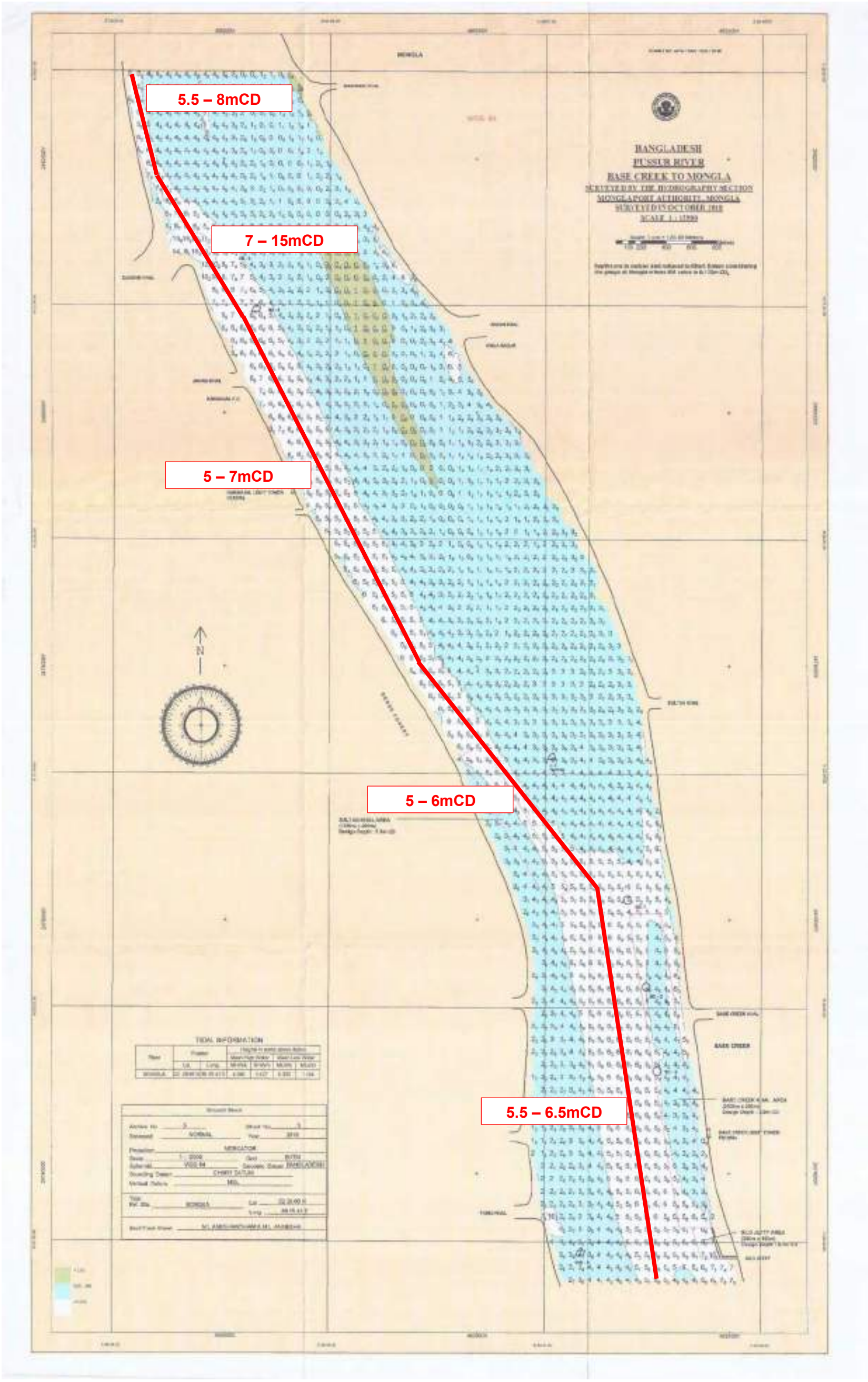
Navigation Chart No. 06 – Mhazar Point to D'Souza Point (November 2017)



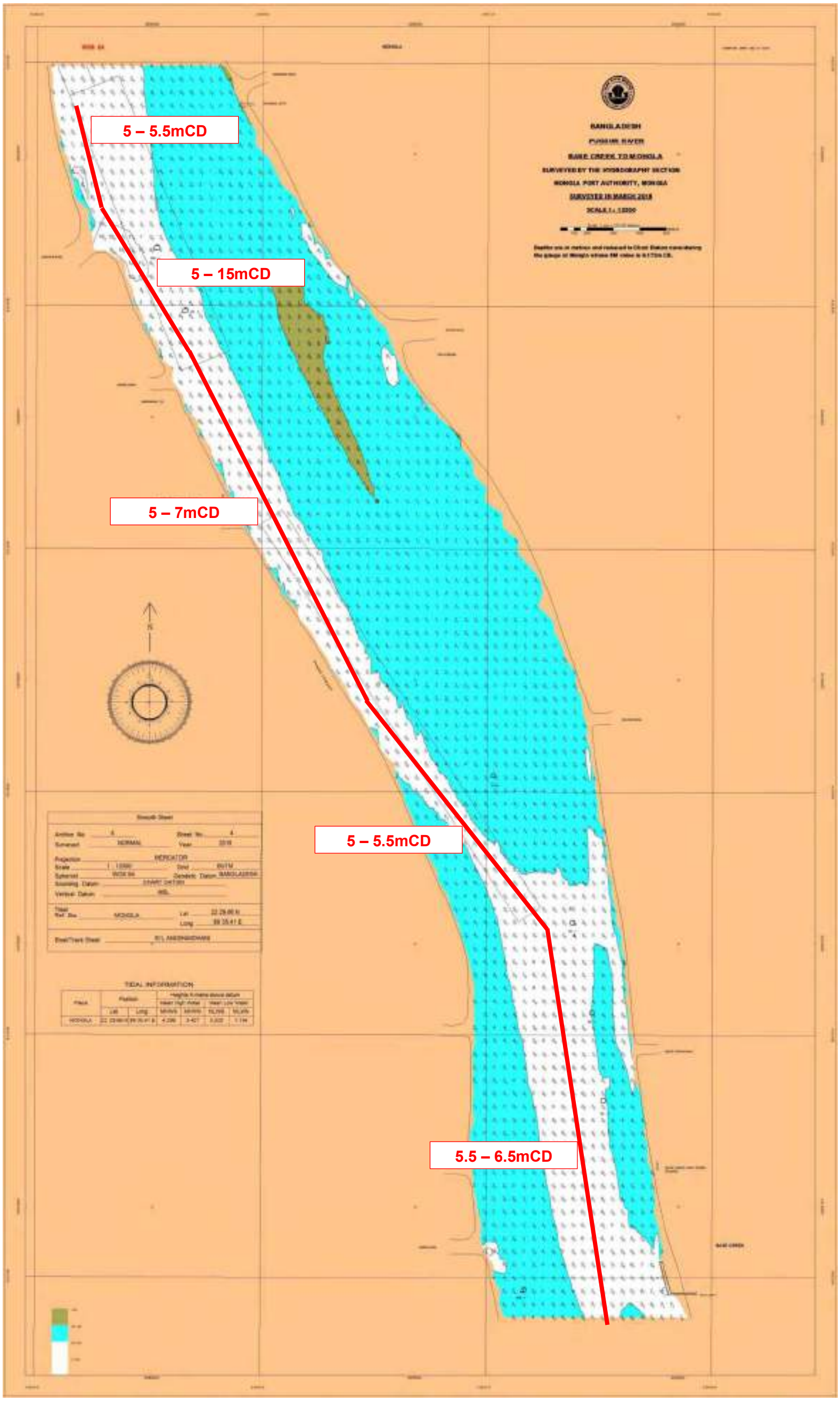
Navigation Chart No. 07 – Harbaria to Joymonirgol (January to February 2019)



Navigation Chart No. 07 – Harbaria to Joymonirgol (November 2017)

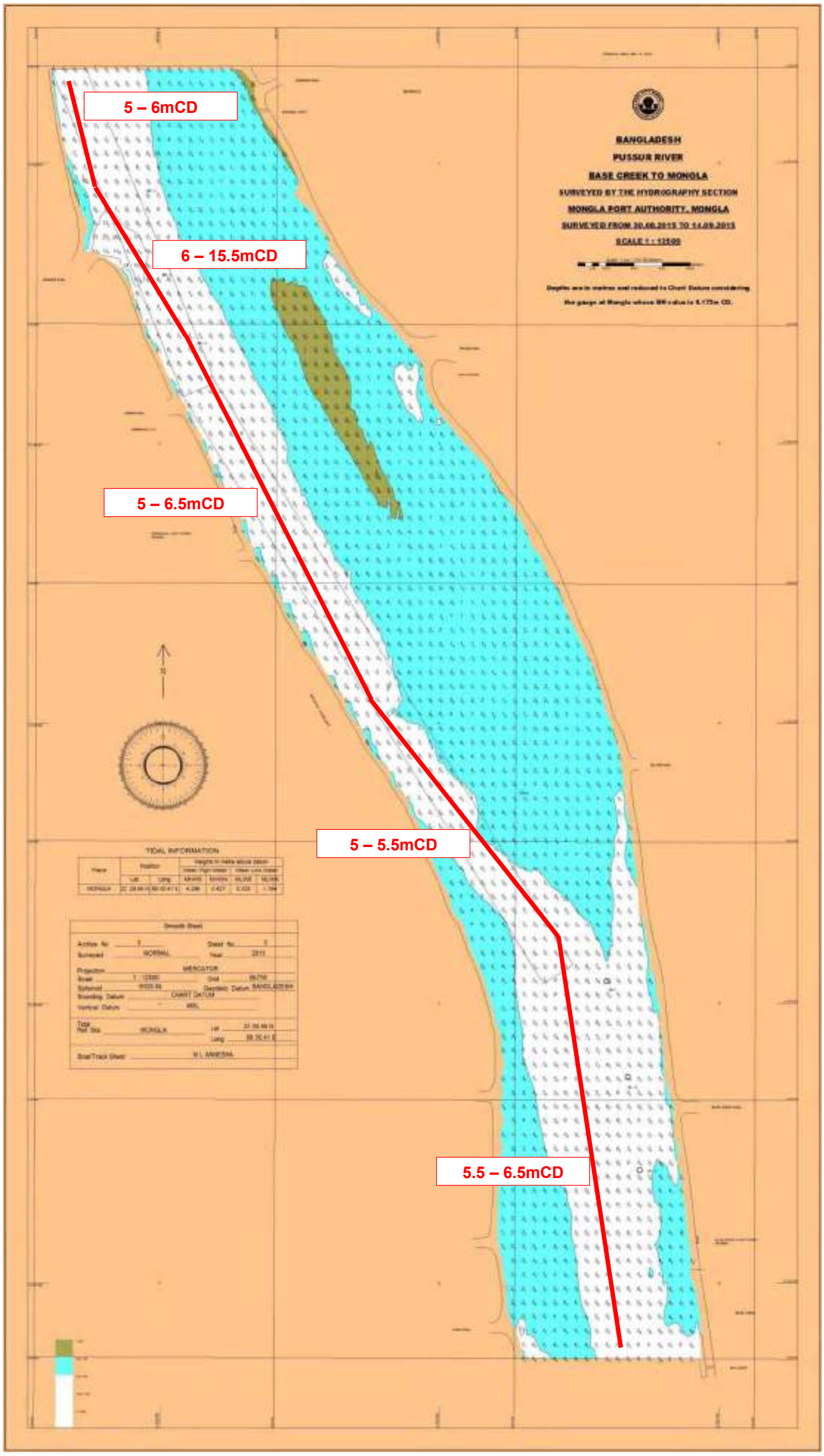


Navigation Chart No. 08 – Base Creek to Mongla (October 2018)

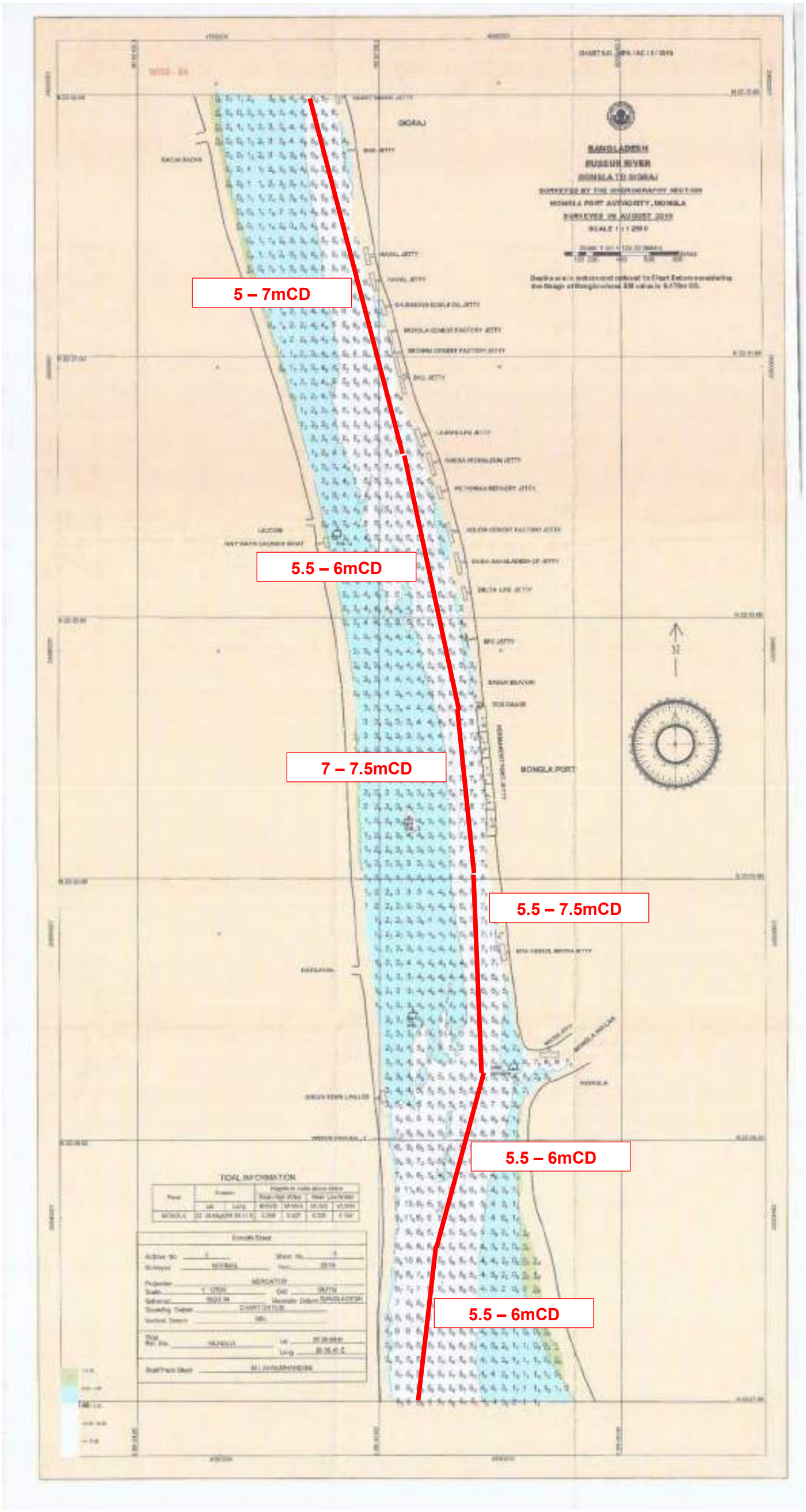


Navigation Chart No. 08 – Base Creek to Mongla (March 2018)

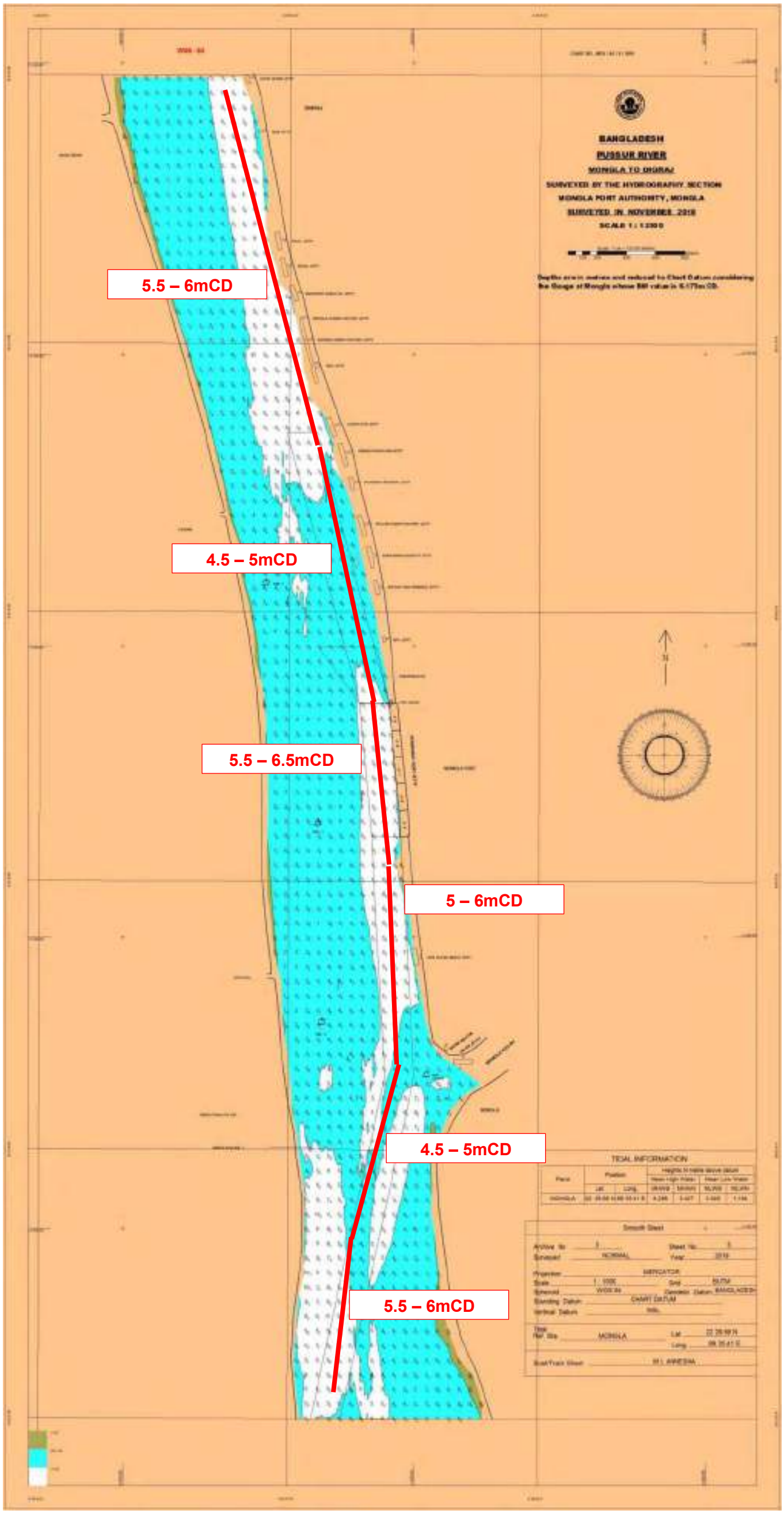
Navigation Chart No. 08 – Base Creek to Mongla (March 2017)



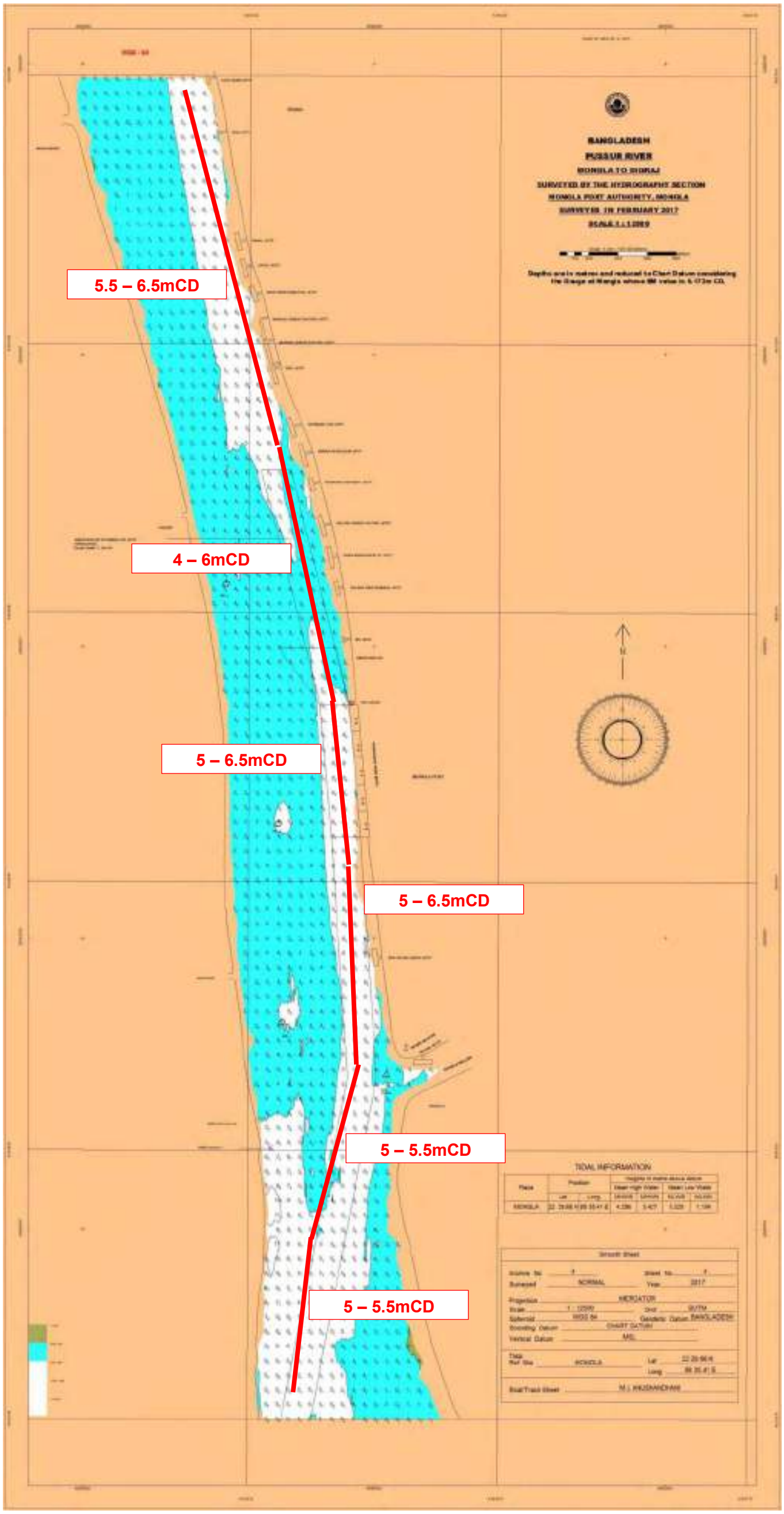
Navigation Chart No. 08 – Base Creek to Mongla (August to September 2015)



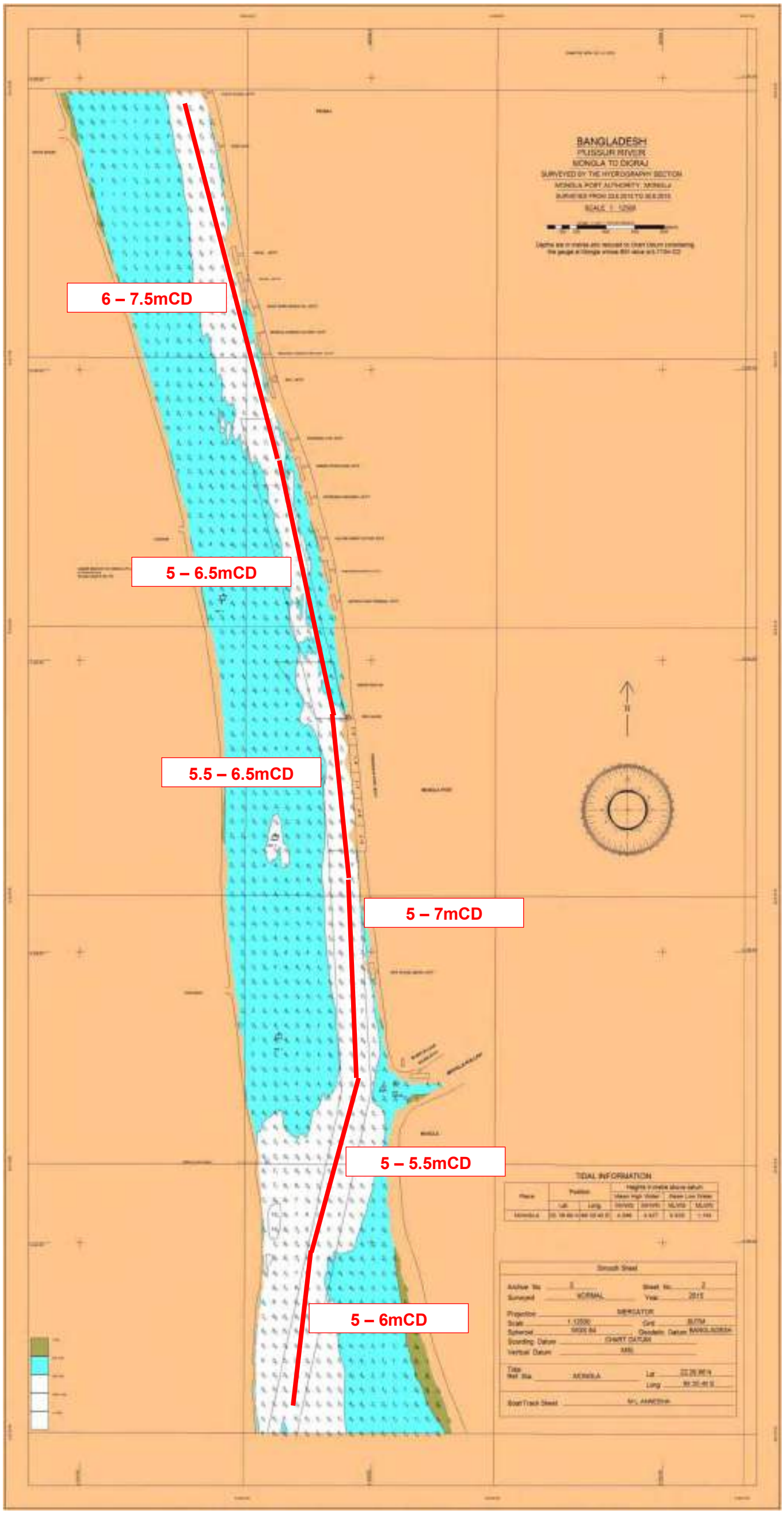
Navigation Chart No. 09 – Mongla to Digraj (August 2019)



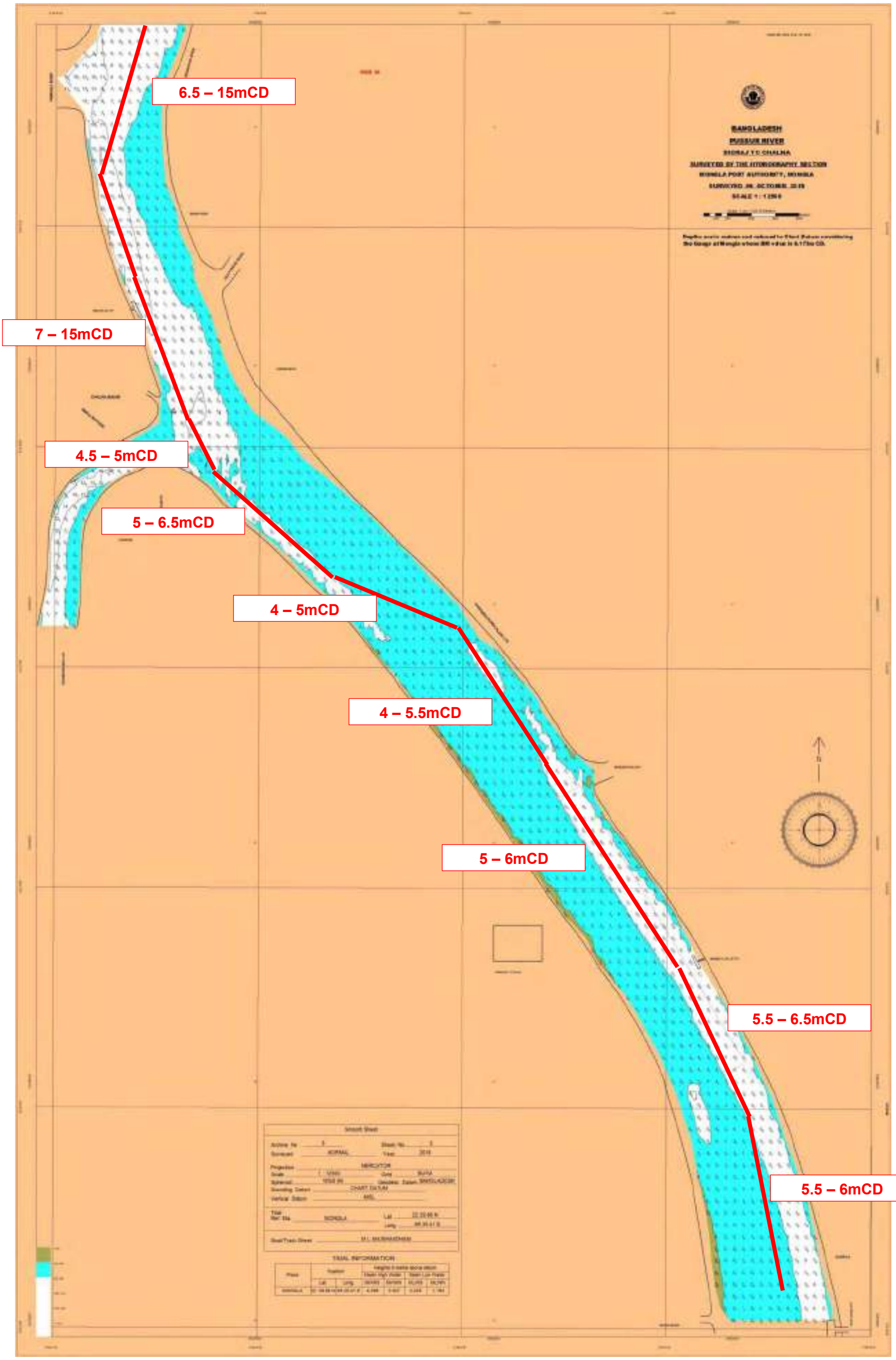
Navigation Chart No. 09 – Mongla to Digraj (November 2018)



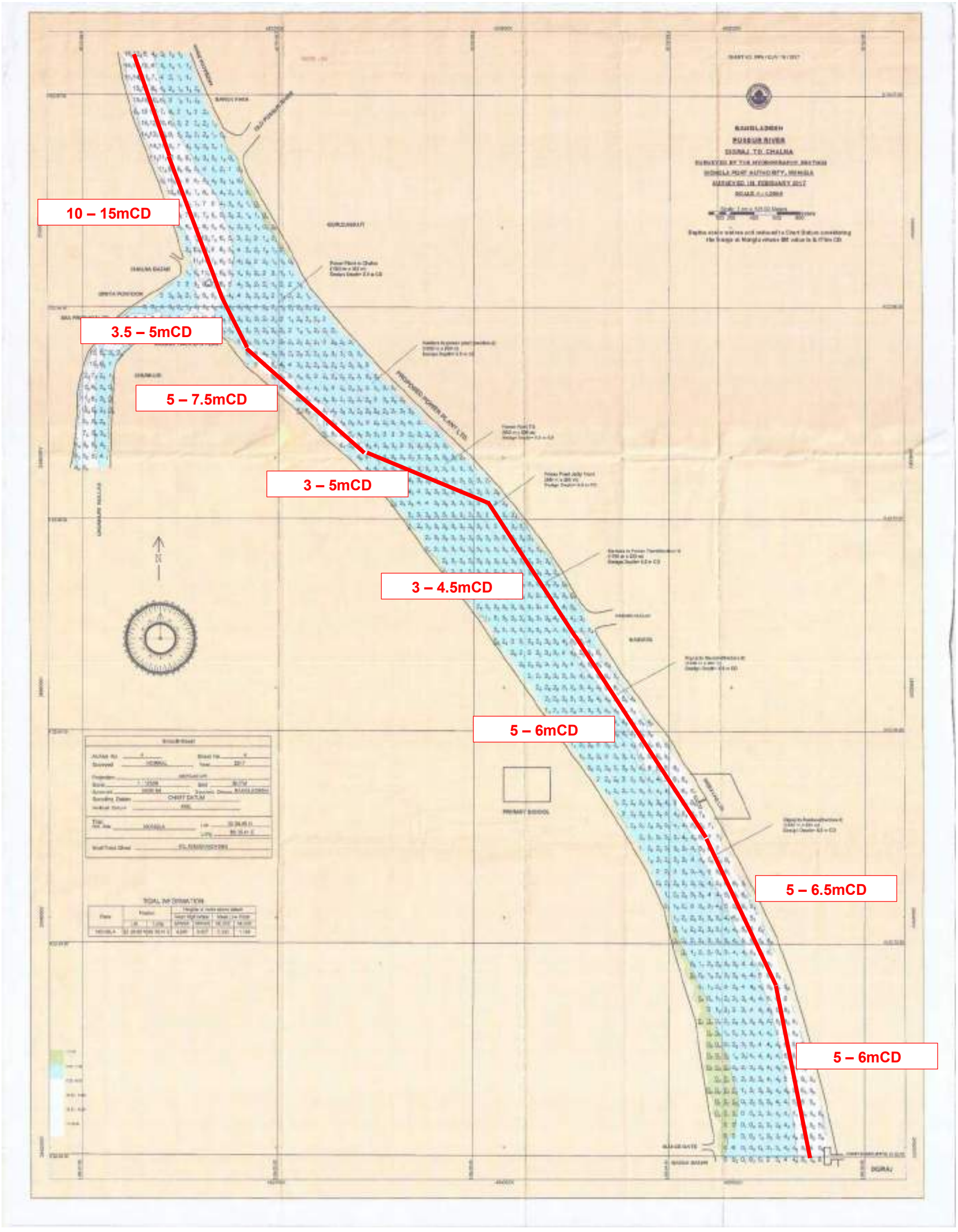
Navigation Chart No. 09 – Mongla to Digraj (February 2017)



Navigation Chart No. 09 – Mongla to Digraj (August 2015)



Navigation Chart No. 10 – Digraj to Chalna (October 2019)



Navigation Chart No. 10 – Digraj to Chalna (February 2017)

Appendix D – Mongla Port Throughput Details

Mongla Port Cargo throughput details

Statement of Commodity-wise Import & Export handled at Mongla Port from 2004-2005 to 2018-2019 (metric tones) - general cargo and commodities in alphabetical order

Year	"G/Cargo" / General Cargo	"G/Cargo" / General Cargo	Betel nut	Betel nut	"C. Bone" / "B. Griest"	"C. Bone" / "B. Griest"	Car Re-shipment	Car Re-shipment	Cement	Cement	Clay Tiles	Clay Tiles	Clinker	Clinker	Coal	Coal
	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
2004-2005	83.446	2.412	0	0	0	213	0	0	4.850	0	0	0	821.614	0	0	0
2005-2006	35.076	4.714	0	0	0	106	0	0	0	0	0	0	853.080	0	0	0
2006-2007	34.877	4.375	0	0	0	297	0	0	0	0	0	0	454.246	0	0	0
2007-2008	34.234	9.687	0	0	0	0	0	0	0	0	0	0	227.411	0	0	0
2008-2009	31.405	12.275	0	0	0	0	0	0	0	0	0	0	430.666	0	0	0
2009-2010	49.012	885	0	2.688	0	335	0	0	0	0	0	9.417	680.501	0	0	0
2010-2011	77.588	1.173	0	2.555	0	529	0	0	0	0	0	7.656	798.967	0	0	0
2011-2012	132.968	1.972	0	3.101	0	1.034	0	0	0	0	0	7.064	887.414	0	0	0
2012-2013	208.284	3.073	0	945	0	279	0	0	0	0	0	5.553	866.241	0	20.000	0
2013-2014	222.339	8.975	0	2.746	0	425	0	0	0	0	0	4.762	1.011.942	0	0	0
2014-2015	212.552	6.443	0	1.522	0	210	0	0	0	0	0	4.721	1.236.442	0	336.325	0
2015-2016	252.268	5.219	0	571	0	305	0	0	0	0	0	5.797	1.572.211	0	1.059.143	0
2016-2017	455.736	3.271	0	0	0	0	0	0	0	0	0	4.806	2.025.269	0	1.263.940	0
2017-2018	536.463	3.413	0	84	0	0	0	4	0	0	0	6.132	2.378.291	0	1.767.844	0
2018-2019	986.001	5.030	0	0	0	0	0	2	0	0	0	5.992	2.690.420	0	2.724.026	0

Mongla Port Cargo throughput details

Statement of Commodity-wise Import & Export handled at Mongla Port from 2004-2005 to 2018-2019 (metric tones) - general cargo and commodities in alphabetical order

Year	Crude Oil	Crude Oil	Fertilizer	Fertilizer	Fly Ash	Fly Ash	Food grain	Food grain	Gas	Gas	Gypsum	Gypsum	Jute	Jute	Jute Goods	Jute Goods
	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
2004-2005	0	0	0	0	146.527	0	74.544	0	26.183	0	58.626	0	0	90.755	0	94.044
2005-2006	0	0	0	0	154.545	0	35.062	0	15.904	0	79.432	0	0	122.476	0	102.423
2006-2007	0	0	58.411	0	49.263	0	19.806	0	15.141	0	11.200	0	0	144.908	0	60.925
2007-2008	0	0	190.470	0	11.716	0	31.962	0	14.057	0	0	0	0	127.759	0	31.488
2008-2009	0	0	338.624	0	8.891	0	66.077	0	18.194	0	0	0	0	119.324	0	38.320
2009-2010	1.838	0	449.343	0	28.344	0	176.440	0	23.720	0	0	0	0	85.791	0	10.482
2010-2011	0	0	1.001.139	0	3.760	0	503.747	0	32.276	0	23.800	0	0	89.208	0	26.124
2011-2012	7.997	0	1.017.454	0	0	0	287.049	0	41.309	0	10.740	0	0	62.934	0	27.023
2012-2013	29.300	0	1.234.648	0	0	0	159.654	0	61.144	0	57.550	0	0	79.099	0	74.783
2013-2014	61.370	0	1.342.361	0	1.018	0	284.351	0	65.645	0	40.500	0	0	42.000	0	47.733
2014-2015	124.981	0	1.727.917	0	54.507	0	140.832	0	79.553	0	28.450	0	0	21.479	0	32.195
2015-2016	44.828	0	1.565.327	0	117.183	0	129.632	0	164.986	0	103.692	0	0	13.152	0	25.171
2016-2017	138.265	0	1.465.570	0	214.622	0	441.359	0	308.999	0	135.225	0	0	25.752	0	19.801
2017-2018	113.621	0	1.813.010	0	303.864	0	896.324	0	535.629	0	227.308	0	0	50.104	0	53.858
2018-2019	96.942	0	2.106.947	0	352.349	0	131.379	0	691.787	0	202.410	0	0	30.998	0	58.092

Mongla Port Cargo throughput details

Statement of Commodity-wise Import & Export handled at Mongla Port from 2004-2005 to 2018-2019 (metric tones) - general cargo and commodities in alphabetical order

Year	Leather	Leather	Lime Stone	Lime Stone	Machinery	Machinery	Motor Vehicle	Motor Vehicle	"R/EDB" / Leaded Gasoline	"R/EDB" / Leaded Gasoline	Rice	Rice	Salt	Salt	Shrimp	Shrimp
	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
2004-2005	0	177	0	0	3.727	0	0	0	0	0	0	0	0	0	0	33.438
2005-2006	0	127	0	0	485	158	0	0	0	0	0	0	0	0	0	37.048
2006-2007	0	0	0	0	0	0	0	0	0	0	0	0	3.531	0	0	41.248
2007-2008	0	0	0	0	1.292	0	0	0	0	0	0	0	0	0	0	35.245
2008-2009	0	0	0	0	3.985	0	317	0	0	0	0	0	0	0	0	37.633
2009-2010	0	0	0	0	0	0	3.847	0	0	0	0	0	35.895	0	0	37.111
2010-2011	0	29	0	0	23.012	0	14.864	0	0	0	0	0	7.670	0	0	38.248
2011-2012	0	0	0	0	13.391	0	13.650	0	0	0	0	0	20.360	0	0	33.440
2012-2013	0	0	0	0	18.357	1.189	6.173	0	0	0	0	0	37.100	0	0	35.959
2013-2014	0	304	59.935	0	61.171	203	11.062	0	0	0	0	0	15.000	0	0	33.862
2014-2015	0	0	46.700	0	68.053	0	15.913	0	0	0	0	0	0	0	0	33.891
2015-2016	0	0	171.600	0	72.403	1.686	21.077	0	0	100	0	0	0	0	0	35.695
2016-2017	0	0	236.756	0	82.577	472	24.291	0	0	50	0	0	18.750	0	0	31.338
2017-2018	0	0	222.709	0	129.928	228	32.587	0	0	50	0	0	15.000	0	0	33.234
2018-2019	0	0	247.783	0	183.041	6	24.534	0	0	0	0	0	0	0	0	34.881

Mongla Port Cargo throughput details

Statement of Commodity-wise Import & Export handled at Mongla Port from 2004-2005 to 2018-2019 (metric tones) - general cargo and commodities in alphabetical order

Year	Slag	Slag	Soya been	Soya been	Steel pipe	Steel pipe	"Sugur" / Sugar	"Sugur" / Sugar	Tobacco	Tobacco	Turtle	Turtle	White Fish	White Fish	Wooden log	Wooden log
	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
2004-2005	0	0	530	0	0	0	34.327	0	0	0	0	0	0	759	0	0
2005-2006	31.650	0	0	0	0	0	9.838	0	0	0	0	0	0	520	0	0
2006-2007	10.500	0	0	0	0	0	5.288	0	0	0	0	0	0	359	0	0
2007-2008	0	0	0	0	0	0	7.167	0	0	0	0	0	0	346	0	0
2008-2009	30.833	0	0	0	0	0	722	0	0	0	0	0	0	560	0	0
2009-2010	7.200	0	0	0	45.910	0	0	0	0	0	0	0	0	524	0	0
2010-2011	43.030	0	0	0	0	0	0	0	0	0	0	0	0	896	0	0
2011-2012	50.100	0	0	0	0	0	0	0	0	310	0	0	0	587	0	0
2012-2013	247.771	0	0	0	0	0	0	0	0	38	0	0	0	434	0	0
2013-2014	225.708	0	0	0	0	0	0	0	0	0	0	0	0	537	0	0
2014-2015	353.950	0	0	0	0	0	0	0	0	0	0	0	0	369	3.274	0
2015-2016	435.314	0	0	0	0	0	0	0	0	0	0	0	0	161	0	0
2016-2017	590.150	0	0	0	26.596	0	0	0	0	18	0	0	0	114	0	0
2017-2018	570.850	0	24.914	0	557	0	0	0	0	0	0	0	0	44	0	0
2018-2019	742.259	0	0	0	0	0	0	0	0	0	0	0	0	130	0	0

Mongla Port Cargo throughput details

Import & Export handled at Mongla Port 2004-2005 to 2018-2019 (metric tones)

Year	Total		Total Im- and Exports	Shares in Total Import and Exports		
	Imports	Exports		Imports (%)	Exports (%)	Exports & Imports (%)
2004-2005	1.254.374	221.798	1.476.172	84,97%	15,03%	100,00%
2005-2006	1.215.072	267.572	1.482.644	81,95%	18,05%	100,00%
2006-2007	662.263	252.112	914.375	72,43%	27,57%	100,00%
2007-2008	518.309	204.525	722.834	71,71%	28,29%	100,00%
2008-2009	929.714	208.112	1.137.826	81,71%	18,29%	100,00%
2009-2010	1.502.050	147.233	1.649.283	91,07%	8,93%	100,00%
2010-2011	2.529.853	166.418	2.696.271	93,83%	6,17%	100,00%
2011-2012	2.482.432	137.465	2.619.897	94,75%	5,25%	100,00%
2012-2013	2.946.222	201.352	3.147.574	93,60%	6,40%	100,00%
2013-2014	3.402.402	141.547	3.543.949	96,01%	3,99%	100,00%
2014-2015	4.429.449	100.830	4.530.279	97,77%	2,23%	100,00%
2015-2016	5.709.664	87.857	5.797.521	98,48%	1,52%	100,00%
2016-2017	7.428.105	85.622	7.513.727	98,86%	1,14%	100,00%
2017-2018	9.568.899	147.151	9.716.050	98,49%	1,51%	100,00%
2018-2019	11.179.878	135.131	11.315.009	98,81%	1,19%	100,00%

Container Throughput Mongla Port 2004 - 2018

Statement of Containers handled at permanent Port jetty, Mongla from 2004-2005 to 2018-2019.

Year	No of Ships	Discharging Container (TEUS)	Shipment Container (TEUS)	Total Container (TEUS)	Discharging Container (BOX)	Shipment Container (BOX)	Total Container (BOX)	Discharging Cargo (M.Ton)	Shipment Cargo (M.Ton)	Total Cargo (M.Ton)
2004-2005	46	12993	12656	25649	9219	8876	18095	58354	128504	186858
2005-2006	44	12733	12838	25571	9230	9375	18605	26093	147330	173423
2006-2007	47	12553	12789	25342	9039	9189	18228	19560	148792	168352
2007-2008	39	10588	10297	20885	7501	7284	14785	30402	115372	145774
2008-2009	47	10437	10764	21201	7300	7528	14828	25295	117077	142372
2009-2010	33	10280	10371	20651	7105	7147	14252	28281	115969	144250
2010-2011	44	13699	13424	27123	9748	9579	19327	73351	138079	211430
2011-2012	35	15460	14585	30045	11588	10866	22454	123604	128023	251627
2012-2013	47	21994	21879	43873	15482	15452	30934	190616	174041	364657
2013-2014	72	21947	21060	43007	14875	14266	29141	195736	141344	337080
2014-2015	67	21036	21101	42137	13188	13415	26603	191552	100830	292382
2015-2016	46	20717	21236	41953	12614	12983	25597	186587	86171	272758
2016-2017	37	14147	12805	26952	9146	8094	17240	138984	85534	224518
2017-2018	44	21760	21229	42989	14341	14032	28373	223793	147029	370822
2018-2019	60	28664	29068	57732	19523	19961	39484	346989	135131	482120

Source: https://mpa.portal.gov.bd/site/page/86781177-ecff-45e2-a81c-794cfdbbfe8a/-

Containers handled per vessel call at Mongla Port 2004 - 2018

Year	Containers handled per container ship call	Total containerized cargo per ship	Total containerized cargo (metric tons) per	
	TEU	metric tons	TEU	BOX
2004-2005	558	4.062	7,29	10,33
2005-2006	581	3.941	6,78	9,32
2006-2007	539	3.582	6,64	9,24
2007-2008	536	3.738	6,98	9,86
2008-2009	451	3.029	6,72	9,60
2009-2010	626	4.371	6,99	10,12
2010-2011	616	4.805	7,80	10,94
2011-2012	858	7.189	8,38	11,21
2012-2013	933	7.759	8,31	11,79
2013-2014	597	4.682	7,84	11,57
2014-2015	629	4.364	6,94	10,99
2015-2016	912	5.930	6,50	10,66
2016-2017	728	6.068	8,33	13,02
2017-2018	977	8.428	8,63	13,07
2018-2019	962	8.035	8,35	12,21

Mongla Cargo Throughput and Hinterland Transport in tons - Import

	Commodities	2018					
		Tons of Cargo	Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total
1	**Dry Bulk Cargo**	**9197573**	**4846348**	**2827759**	**1523466**	**0**	**9197573**
1.1.	Grap or Conveyer	6606898	4064252	1690678	851968	0	6606898
	Coal	2724026	681007	1362013	681007	0	2724026
	Cement clinker	2690420	2421378	269042	0	0	2690420
	Gypsum	202410	182169	10121	10121	0	202410
	Lime stone	247783	223005	12389	12389	0	247783
	Slag, sand, gravel etc.	742259	556694	37113	148452	0	742259
	Other dry bulk		0	0	0	0	0
1.2	Grap, rain protected	2106947	421389	1053474	632084	0	2106947
	Fertilizers	2106947	421389	1053474	632084	0	2106947
	C.Bone/B. Griest	0	0	0	0	0	0
	Salt	0	0	0	0	0	0
	Other cargoes		0	0	0	0	0
1.3	Protected or pneumatic handling	483728	360707	83608	39414	0	483728
	Grain	131379	78827	13138	39414	0	131379
	Soya beans, oil seeds	0	0	0	0	0	0
	Fly Ash	352349	281879	70470	0	0	352349
	Other cargoes		0	0	0	0	0
2	**Liquid Bulk**	**788729**	**788729**	**0**	**0**	**0**	**788729**
2.1	Oil and fuel	96942	96942	0	0	0	96942
	Crude Oil	96942	96942	0	0	0	96942
	Mineral oil fuel products	0	0	0	0	0	0
2.2	Liquid gas	691787	691787	0	0	0	691787
	Liquid Gas LPG	691787	691787	0	0	0	691787
	Liquid Gas LNG	0	0	0	0	0	0
3	**General Cargo**	**1193576**	**58452**	**9152**	**1125972**	**0**	**1193576**
3.1	Break Bulk (eg.g. iron/steel, paper, wood)	0	0	0	0	0	0
3.2	Cars and vehicles	24534	0	0	24534	0	24534
3.3	Heavy lifts, project cargo, machinery	183041	9152	9152	164737	0	183041
3.4	Bags or bails, palletized or not	0	0	0	0	0	0
3.5	Containerization affine cargoes	986001	49300	0	936701	0	986001
	Chemical products	0	0	0	0	0	0
	Fish, meat, fruits, other perishables	0	0	0	0	0	0
	General cargoes, n.e.s	986001	49300	0	936701	0	986001
4	**Containers handled in TEU**	**12993**	1299	0	11694	0	**12993**
Total Cargo Handled		**11179878**	**5693530**	**2836911**	**2649438**	**0**	**11179878**

Mongla Cargo Throughput and Hinterland Transport in tons - Export

Commodities		2018					
		Tons of Cargo	Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total
1	**Dry Bulk Cargo**	**0**	**0**	**0**	**0**	**0**	**0**
1.1.	Grap or Conveyer	0	0	0	0	0	0
	Coal	0	0	0	0	0	0
	Cement clinker	0	0	0	0	0	0
	Gypsum	0	0	0	0	0	0
	Lime stone	0	0	0	0	0	0
	Slag, sand, gravel etc.	0	0	0	0	0	0
	Other dry bulk	0	0	0	0	0	0
1.2	Grap, rain protected	0	0	0	0	0	0
	Fertilizers	0	0	0	0	0	0
	C.Bone/B. Griest	0	0	0	0	0	0
	Salt	0	0	0	0	0	0
	Other cargoes	0	0	0	0	0	0
1.3	Protected or pneumatic handling	0	0	0	0	0	0
	Grain	0	0	0	0	0	0
	Soya beans, oil seeds	0	0	0	0	0	0
	Fly Ash	0	0	0	0	0	0
	Other cargoes	0	0	0	0	0	0
2	**Liquid Bulk**	**0**	**0**	**0**	**0**	**0**	**0**
2.1	Oil and fuel	0	0	0	0	0	0
	Crude Oil	0	0	0	0	0	0
	Mineral oil fuel products	0	0	0	0	0	0
2.2	Liquid gas	0	0	0	0	0	0
	Liquid Gas LPG	0	0	0	0	0	0
	Liquid Gas LNG	0	0	0	0	0	0
3	**General Cargo**	**135131**	**30762**	**3100**	**101269**	**0**	**135131**
3.1	Break Bulk (eg.g. iron/steel, paper, wood)	0	0	0	0	0	0
3.2	Cars and vehicles	2	0	0	2	0	2
3.3	Heavy lifts, project cargo, machinery	6	0	0	6	0	6
3.4	Bags or bails, palletized or not	30998	18599	3100	9299	0	30998
3.5	Containerization affine cargoes	104125	12163	0	91962	0	104125
	Chemical products	0	0	0	0	0	0
	Fish, meat, fruits, other perishables	35011	5252	0	29759	0	35011
	General cargoes, n.e.s	69114	6911	0	62203	0	69114
4	**Containers handled in TEU**	**29068**	2907	0	26161	0	**29068**
Total Cargo Handled		**135131**	**30762**	**3100**	**101269**	**0**	**135131**

Appendix E – Chittagong Throughput 2006 – 2018

Chittagong Port - Cargo Throughput 2006 - 2017

Commodity-Wise Import handled at Chattogram Port

Figures in metric tons

Commodity	2005-2006	2006-07	2007-08	2008-09	2009-10	2010-11	2011-2012	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Foodgrain	1.756.960	1.966.072	2.053.030	3.068.585	3.337.833	4.717.195	1.957.685	1.428.491	2.072.156	2.955.454	3.963.718	504.775	6.783.355
Sugar	496.046	853.841	812.624	955.835	1.356.881	1.370.679	1.863.563	1.474.516	2.044.215	1.989.353	2.095.344	2.134.908	2.468.556
Salt	150.388	109.384	11.675	-	289.331	81.030	-	488.248	-	136.700	324.760	551.956	778.178
Oil seeds							-	-	-	-	-	-	-
Cement							-	-	-	-	-	-	-
Cement clinker	6.299.687	6.187.915	6.938.316	6.324.428	8.683.875	11.479.377	11.023.432	12.031.461	13.580.424	14.209.572	-	19.628.151	21.492.163
Fertilizer	1.235.142	1.245.876	1.168.463	946.675	1.604.133	1.894.270	1.541.968	1.467.554	1.256.454	1.605.124	-	19.628.181	1.777.825
Cotton							-	-	-	-	-	1.416.115	-
Cotton yam							-	-	-	-	-	-	-
Copra piece Goods							-	-	-	-	-	-	-
Iron and steel							-	-	-	-	-	-	-
C.I Sheet							-	-	-	-	-	-	-
Wood pulp							-	-	-	-	-	-	-
Wax							-	-	-	-	-	-	-
Vehicles	-	-	-	-	18.251	-	-	-	-	-	-	-	-
Coal	2.005	511	309	-	-	145	-	40.714	-	1.375.725	2.226.397	1.364.436	1.577.312
Poles (in bulk)	-		-	-	4.029.929	-	-	-	-	-	-	-	-
Soda Ash	3.728.988		3.530.854	-	-	-	-	-	-	-	-	-	-
Petroleum		3.727.819					5.381.533	5.371.990	5.576.296	616.314	5.655.407	7.027.510	7.788.517
Zinger	-	-	-	3.615.333	-	4.971.161	-	-	-	-	-	-	-
Zine							-	-	-	-	-	-	-
Furnace oil							-	-		-	-	-	-
General cargo							-	-	-	-	-	-	-
Edible oil	1.058.390	1.199.608	1.130.810	1.102.409	1.373.681	1.327.706	1.626.714	1.614.218	1.710.798	1.904.320	2.456.364	1.996.578	2.508.948
Others, general cargoes n.e.s	8.442.268	8.545.267	9.699.976	10.666.894	12.119.321	14.072.582	12.790.036	14.394.836	15.719.827	18.595.844	22.900.408	27.296.850	32.925.593
Total	**23.169.874**	**23.836.293**	**25.346.057**	**26.680.159**	**32.813.235**	**39.914.145**	**36.184.931**	**38.312.028**	**41.960.170**	**43.388.406**	**39.622.398**	**81.549.460**	**78.100.447**

Source: CPA, summarized by Statistical Yearbook of Bangladesh, Bangladesh Bureau of Statistics,several isses

Chittagong Port - Cargo Throughput 2006 - 2017

Commodity-Wise Exports handled at Chattogram Port

Figures in metric tons

Commodity	2005-2006	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Jute	155542	134714	161205	149820	143137	136885	204117	165793	190071	165287	157635	215451	206480
Jute Goods	325807	47520	581371	487482	629769	691528	769925	820702	808741	813599	705807	822054	722800
C. Boxes		-	-	-	-	-	-	-	-	-	-	-	-
Tea	3873	7248	11984	3949	2251	505	694	49	495	490	48	-	-
Hides & Skins		-	-	-	-	-	-	-	-	-	-	-	-
Leather	3706	2975	11995	8729	15989	22686	20572	23777	31477	35787	30199	30806	35912
Bone & bonemeal	-	-	-	-	-	-	-	-	-	-	-	-	-
Paper	-	-	-	-	-	-	-	-	-	-	-	-	-
Oilcake	-	-	-	-	-	-	-	-	-	-	-	-	-
Fish (dry) frozen	47805	46560	59161	51540	59391	-	-	-	-	-	-	-	-
Cotton waste							-	-	-	-	-	-	-
Chillies							-	-	-	-	-	-	-
Ammonia	157715	130887	138751	89422	58246	30792	48100	27275	14000	40004	40800	15000	39083
Rayon-							-	-	-	-	-	-	-
H. Hair							-	-	-	-	-	-	-
Sundries							-	-	-	-	-	-	-
Bulk oil, crude oil by product	-	87471	143292	187057	332770	-	-	-	-	-	-	-	-
Naphtha, Molasses							-	-	-	76952	53256	104954	18500
Buner etc.							-	134920	79618	-	-	-	-
News print							-	-	-	-	-	-	-
Frozen Goods	-	-	-	-	-	100542	81134	86884	173429	123846	94108	121893	110555
Bran	-	-	-	-	-	-	-	-	-	-	-	-	-
Fertilizer	289660	284414	157139	239702	332770	123374	50128	12658	80	-	229	31000	-
Shrimp	-	-	-					-	-	-		-	-
C/Bones	-	-	-	-	-	-	-	-	-	-		-	-
Rice	-	-	-	-	-	-	-	-	-	-		-	-
Tobacco	-	-	-	-	-	-	-	-	-	-		-	-
Broom stick	112341	112341	-	-	-	-	-	-	-	-		-	-
Furnace oil	-	-	-	-	-	168641	79752	-	-	-		-	-
Tamarind	-	-	-	-	-	-	-	-	-	-		-	-
Turmeric	-	-	-	-	-	-	-	-	-	-		-	-
Ginger	-	-	-	-	-	-	-	-	-	-		-	-
General Cargo	-	-	-	-	-	-	-	-	-	-		-	-
Garments	1321794	1554017	142757	1747377	1757847	2134710	2063511	2364576	2653198	2760449	2785071	2985944	3422571
Others, general cargoes n.e.s	508187	565652	892865	798669	1057172	1570712	1398441	1423006	1385225	1823572	2104481	2398514	2441564
Total	**2.926.430**	**2.973.799**	**2.300.520**	**3.763.747**	**4.389.342**	**4.980.375**	**4.716.374**	**5.059.640**	**5.336.334**	**5.839.986**	**5.971.634**	**6.725.616**	**6.997.465**

Source: CPA, summarized by Statistical Yearbook of Bangladesh, Bangladesh Bureau of Statistics,several isses

Chittagong Port - Cargo Throughput 2006 - 2017

Commodities imported and exported at Chattogram Port

Year	Cargo Throughput in metric tons			Shares in percent		
	Import	Export	Total	Import	Export	Total
2005-2006	23.169.874	2.926.430	26.096.304	88,8%	11,2%	100,0%
2006-07	23.836.293	2.973.799	26.810.092	88,9%	11,1%	100,0%
2007-08	25.346.057	2.300.520	27.646.577	91,7%	8,3%	100,0%
2008-09	26.680.159	3.763.747	30.443.906	87,6%	12,4%	100,0%
2009-10	32.813.235	4.389.342	37.202.577	88,2%	11,8%	100,0%
2010-11	39.914.145	4.980.375	44.894.520	88,9%	11,1%	100,0%
2011-12	36.184.931	4.716.374	40.901.305	88,5%	11,5%	100,0%
2012-13	38.312.028	5.059.640	43.371.668	88,3%	11,7%	100,0%
2013-14	41.960.170	5.336.334	47.296.504	88,7%	11,3%	100,0%
2014-15	43.388.406	5.839.986	49.228.392	88,1%	11,9%	100,0%
2015-16	39.622.398	5.971.634	45.594.032	86,9%	13,1%	100,0%
2016-17	81.549.460	6.725.616	88.275.076	92,4%	7,6%	100,0%
2017-18	78.100.447	6.997.465	85.097.912	91,8%	8,2%	100,0%

Source: CPA, summarized by Statistical Yearbook of Bangladesh, Bangladesh Bureau of Statistics,several isses

Appendix F – Container and Hinterland Considerations

The Dhaka region is the centre of the Bangladesh economy. Almost the entire textile industry is located around the capital, i.e. it is the origin and destination of almost all containerised cargo.

If Mongla port shall take a substantial portion of the container volume from Chittagong port for the benefit of the entire nation not only the capacity of Mongla port has to be raised significantly but its hinterland connections needed to be made competitive in terms of costs, capacity and reliability.

However, for the time being several core problems constrain the growth of Mongla Port, i.e. its ability to take a significantly higher share of Bangladesh's seaborne container trade: The port is virtually located remote with poor hinterland connectivity and has a serious problem with its draft.

Chittagong-Dhaka Corridor

At present virtually all containers from/to the Dhaka region are routed via Chittagong whereas almost no containers are carried between Dhaka and Mongla.

70-80% of the containers handled in Chittagong are destined for or originating from Dhaka/Narayanganj area being the main consumption and distribution centre. Presently 90% of the containers are unstuffed/stuffed in Chittagong Port, ICDs in Chittagong and transported as conventional general cargo. Only 10% of the containers are loaded on rail and transferred to Kamlapur Inland Container Depot in Dhaka (KICD), managed and operated by Chittagong Port

Authority. KICD was built to resolve the container congestion and to quickly handle Dhaka based containers. However; the Dhaka-Chittagong corridor is mainly dominated by road service.[27] [28]

The Chittagong-Dhaka Corridor offers three modes of transport:

At present all import containers go via the yard, then 19% are transported to off-dock depots, 6-8% to consignees' premises, 3-4% by rail to Dhaka, 10% go to customs inspection, and 60-63% of the import containers are stripped in the port and cargo is loaded on conventional trucks. Currently 95.6% of the 70% of containers going to Dhaka are transported by road; rail moves 4.4% of the containers to Dhaka.[29]

Rail

Railway container service in Bangladesh started in 1987, with the debut of the Dhaka-Chittagong parcel express train. This pure container train was introduced in 1991. The related Dhaka Inland Container Depot (DICD), Dhaka, is near Kamalapur Railway Station. The

[27] Habib, Z. / Noor, Albab: Prospects of Inland Waterways for Freight Traffic Movement along Dhaka-Chittagong Corridor and Constraint Analysis of full Operation of the Pangaon Inland Container Terminal, 3rd International Conference on Civil Engineering for Sustainable Development, Khulna, Bangladesh, 2016

[28] Dey, P. et al., Emergence of Inland Container Depots (ICDs) and Inland Container Terminals (ICTs) as a Container Decongestion Strategy of Chittagong Port Authority, Maritime University, Dhaka 2016

[29] People's Republic of Bangladesh: Strategic Master Plan for Chittagong Port, HPC/KS/Sellhorn, 2015

existing rail road distance between Dhaka-Chittagong is 321 km. Three daily trains each are hauling between 120 and 160 TEU are plying between Chittagong and Dhaka.[30]

Table 1: Container throughput DICD

FY	CPA throughput [TEU]	DICD throughput [TEU]	DICD share of CPA
2010-11	1.468.914	65.187	4,4%
2011-12	1.343.408	66.705	5,0%
2012-13	1.468.713	62.638	4,3%
2013-14	1.625.509	59.984	3,7%
2014-15	1.866.942	36.831	2,0%
2015-16	2.189.439	37.885	1,7%
2016-17	2.419.481	72.998	3,0%
2017-18	2.705.909	74.741	2,8%
2018-19	2.800.000	88.850	3,2%

Source: CPA

According to Table 1 it is obvious that DICD has not very much contributed to shift containers from road to rail. Although DICD is operating close to its capacity limit its current share of CPA's throughput is less than it was 9 years ago.

DICD has a holding capacity of approximately 4,000 TEU. Train capacity is expected to increase significantly when the double tracking of the rail line between the port and Dhaka is completed in 2020. However, as the facility has been operating at near capacity for many years and cannot be increased because of its constraints for expansion a second facility is urgently needed.

There have been several proposals for a new ICD in Dhaka. The government suggested a new ICD near Dhirasram railway station attached to the Dhaka eastern bypass. To bring the expected efficiency in container handling, Bangladesh Railway considered that the project should be implemented under a public–private partnership modality. The handling capacity of the proposed ICD would be 354,000 TEU and would be developed on approximately 55 ha of land and have a railway spur of 6 km connecting the ICD with the national railway network. There have been proposals also for another ICDs near the Banglabandha western rail station and one in the Pubail area in Gazipur district. To date, none of these proposals have matured into implementation.

This issue has fostered the emergence of ICTs for barge transport in the Dhaka area supported by the natural infrastructure. The scarcity of land and current road congestion will obviously lead the country to transport more and more cargo through waterways, switching from roadways.

Inland Waterways

To utilise the waterway between Chittagong and Dhaka the Pangaon Inland Container Terminal (PICT) was inaugurated in 2013 in the Dhaka area. The terminal was intended to

[30] Chittagong-Dhaka rail expansion critical, JOC.com, Jan 21, 2019

help reduce the costs of carrying containers between Dhaka and Chittagong and to ease the traffic pressure on the highway and the railway link between both cities. Bangladesh Inland Water Transport Authority (BIWT) and CPA jointly built the terminal. Official sources are reporting that the terminal handles presently 116,000 TEU p.a.[31] From the industry only 100,000 TEU are being reported while its capacity is said to be 160,000 TEU p.a.[32] However official figures from CPA are much less.

As PICT is considered as being a government terminal it is worth to mention that there are also three private ICTs with water access of which two are still under construction. Upon completion of the construction a total handling capacity of approx. 1 Mill TEU shall be provided.

Table 2: Private ICTs beside PICT in the Dhaka area Source: Dey et al.[28]

Terminal	Planned capacity (TEUs)	Land area	Waterfront access (m)	Status of operations
SAPL (Summit Alliance Port Limited)	Phase 1: 60,000 TEUs; Phase 2: 60,000 TEUs	Phase 1: 15.15 acres; In the process of acquiring 22 acres	215 m Phase 1: 80 m; Quay: 4.5~5 m Draft alongside	Started operation
Rupayan Group	Phase 1: Full: 375,000 TEU	30-acre Phase 1; Additional land acquired	2 × 90 m quay Expansion +90 m	Approval granted Land purchased Design completed Under construction About 40% complete
Ak Khan Group	1st phase: 140,000; 2nd phase: 70,000; Final: 336,000 (in total)	1st phase: 30 acres; In total 50 acres	1st phase: 2 jetties With length of 90 m each.	Approval granted Land purchased Land filling initiated Design completed

The Pangaon Inland Container Terminal (PICT), the first inland container terminal in Bangladesh, was built at South Keraniganj of Dhaka district (Figure 1) and provides for capacities and for space for extensions, if required (see figure 2).

[31] www.pict.govt.bd (last accessed in October 2019)

[32] Information by Karim Shipping, Dhaka, Oct 2019

Figure 1: Location of PICT Source: Google Maps

Figure 2: Skyview of Pangaon ICT Source: Google Maps

Short description of the infrastructural facilities of Pangaon ICT:

- Length of jetty: 180 m (width 26 m)
- Two river sea vessels can be accommodated any time
- Yard area: 55,000 m²
- Stuffing/unstuffing area: 13,969 m²
- CFS: 5,815 m²
- Connecting road to Dhaka-Mawahighway highway: 5 km
- Reefer plugs: 48 nos.
- Yearly handling capacity: 116,000 TEU (to be gradually raised to 160,000 TEU p.a.)
- Storage capacity: 3,500 TEU (2,400 TEU laden, 1,100 TEU empty)

Main handling equipment:

- 1 LIEBHERR mobile harbour crane
- 2 straddle carrier
- 2 tractor trailers

The distance of the river route from Chittagong to Dhaka is approximately 157 nautical miles. The draft of the river is around 4-5 Meter except for some shallow areas. At high tide vessels ranging from 4-5 metre draft can easily navigate.

Due to the limits in Dhaka the max. dimension of the vessels on the route are: 83 m x 15 m x 4 m (L x B x D). In Chittagong the vessels are mostly berthing at NCT5.

As a major part of the waterway between Chittagong and Dhaka is via the open sea (coastal waters) the vessels must be classified as coasters or river/sea vessels respectively. Less than 10 vessels are engaged in the trade. They are not exclusively dedicated to the Chittagong-Dhaka service but also deployed in other coastal trades for bulk commodities.

The first ships on the route were the sister vessels "Pangaon Express", "Pangaon Success" and "Pangaon Vision" (Figure 3) which have a capacity of 128 TEU each and are of hatchless type in order to avoid time consuming handling of the hatch covers.

CPA procured these vessels, which were built 2004 in China, in 2013 and 2014 for carrying container vessels to Pangaon Inland Terminal from a Malaysian Shipping company at a cost of 500,000,000 BDT (≈ 6,000,000 USD)[53]. Failing to successfully operate these vessels, CPA handed them over to private company Summit Alliance Port Ltd (a company of the Summit Group) on a bareboat charter basis with daily rent of 138,000 BDT (≈ 1,656 USD)[53] per working day after a tendering process. Since the procurement of the vessels CPA could not attract a sufficient number of shippers to carry containers through waterways between Pangaon ICT and Chittagong Port in order to avoid road congestions and to minimize transport costs.[33]

Figure 3 M/V. "Pangaon Express" Source: PICT
Tonnage: 2,195 GRT

[33] The Nation, 3. Sep. 2015

Length:	74 m
Beam:	13 m
Draft (scantling):	3.4 m
Capacity:	128 TEU
Deadweight:	3,005 t

Figure 4 M/V. "KSL Gladiator" Source: Karim Group

Tonnage:	1,562 GRT
Length:	83 m
Beam:	15 m
Draft (scantling):	3.4 m
Capacity:	186 TEU
Deadweight:	2,650 t

The sister vessels M/V. "KSL Gladiator" and M/V. "KSL Pride" (see figure 4) are operated by the private Karim Shipping Group, Dhaka, and have also been purchased 2nd hand from China (both built 2008). These vessels have hatch covers. For a better view and a better utilisation of the deck space the wheelhouse is arranged at the bow. They can load 184 TEU. Due to their very low draft the vessels are equipped with a rather rare twin-screw configuration.

Martime Hinterland Trade Cost Comparison

The seaborne container transport between Chittagong and PICT is regulated by CPA (co-owner of PICT). According to the FIO tariff which has been issued by CPA and which is mandatory for all – even private – carriers on the route it could cost (depending on the weight and the height) up to 264 USD or 360 USD to ship a 20 ft or 40 ft container respectively from the Pangaon terminal to Chittagong port (Tab. xxx). It is noteworthy that some rates differ with the trade direction.

Table 3: Barge Freight Tariff Chittagong – Pangon Terminal Source: Karim Group

"BARGE FREIGHT FROM CHATTOGRAM TO PANGAON /SAPL RT AND VICE VERSA"
w.e.f. from 1st January 2019

Tariff Item No. 01
Export, Import & Empty from CGP to PICT & vice versa

SL	Container Size & Cargo weight	Currency	Import Freight	Export Freight	Empty Freight
1	20 ft - up to 10 Ton	USD	110.00	110.00	55.00
2	20 ft - up to 15 Ton	USD	132.00	132.00	55.00
3	20 ft - up to 20 Ton	USD	165.00	165.00	55.00
4	20 ft - up to 25 Ton	USD	198.00	198.00	55.00
5	20 ft - up to 30 Ton	USD	242.00	242.00	55.00
6	20 ft - above 30 Ton	USD	264.00	264.00	55.00
7	40 ft STD - up to 30 Ton	USD	253.00	220.00	110.00
8	40 ft STD - above 30 Ton	USD	275.00	242.00	110.00
9	40 ft HC - up to 30 Ton	USD	308.00	220.00	121.00
10	40 ft HC - above 30 Ton	USD	330.00	242.00	121.00
11	45 ft - up to 30 Ton	USD	319.00	308.00	132.00
12	20 ft - Reefer	USD	220.00	220.00	55.00
13	40 ft STD - Reefer	USD	330.00	308.00	110.00
14	40 ft HC - Reefer	USD	363.00	341.00	121.00

Note: Above freight as approved in the meeting at Ministry of Shipping held on 04.06.2018, subject to change as and when revised freight approved by Authority.

N.B.: ***Above freight on the basis of FIO (Free In and Out)*****& VAT or any Government levy as applicable will be included in the invoices.**

The Barge operator is not responsible for the cost of loading, unloading of container on to / from the vessel and also for on board stevedoring / operational charges.

Time

It takes approx. 24 hours (including all waiting times for tide and restricted navigability) to ship a container on the waterway between both cities. There is no fixed sailing schedule as all operators have to line up and wait until their vessel is full. This system results into 2-3 sailings per week at present.

Table 4: Container Handling at CPA and PICT (Source: CPA)

	FY	CPA throughput [TEU]	PICT throughput [TEU]	PICT utilisation	PICT share of CPA
starting year	2013-14	1.625.509	435	0,38%	0,03%
	2014-15	1.866.942	678	0,58%	0,04%
	2015-16	2.189.439	2.856	2,46%	0,13%
	2016-17	2.419.481	11.997	10,34%	0,50%
	2017-18	2.705.909	28.704	24,74%	1,06%
	2018-19	2.800.000	21.674	18,68%	0,77%

After a start at a measured pace six years ago the utilisation of PICT (measured against its published capacity of 116,000 TEU p.a.) has meanwhile improved but is still only in the 20% range (even with a drop in the last financial year). However the easing effect on CPA's hinterland traffic is negligible with only a marginal share of its entire throughput.

Road

The roadway is not very well suited for tractor trailers for which stuffing/unstuffing at port premise is inevitable.

It takes approximately 12 to 15 hours but sometimes more than 24 hours to transport goods by road from the Chittagong Port to Dhaka (242 km). Industry contacts note that the estimated transportation cost for a 20 / 40 foot container was 190 to 202 USD and 278 to 291 USD in 2015.[34]

Summary

Figures on time and costs of the three modes of transport vary from source to source. A comprehensive overview is given in Table 5.

Table 5: Alternatives for the transportation of 1 TEU between Dhaka area and Chittagong[35]

Modes	Expenditure	Time required
Road	US$ 337.5 (regardless of weight)	24 hours (including road congestion and shifting system imposed on trucks and trailers)
Rail	US$ 187.5 (regardless of weight)	12 hours (including preferential passenger shuttle compliance)
Inland Waterway	US$ 165 (up to 15 ton) US$ 195 (above 15 ton to 20 ton) US$ 225 (above 20 ton to 25 ton) US$ 265 (above 25 ton)	24 hours (including all waiting times for tide and navigability)

[34] Chittagong Port Overview and Other Inland Transportation, GAIN Report, Jan 2016

[35] Dey, P. et al., Emergence of Inland Container Depots (ICDs) and Inland Container Terminals (ICTs) as a Container Decongestion Strategy of Chittagong Port Authority, Maritime University, Dhaka 2016

These parameters have resulted into an estimated container flows in the FY 2017/2018 as per Figure 5 below. From various sources these flows have been compiled assuming that 80% of the throughput in Chittagong is bound for the Dhaka area and needs respective on-carriage (the width of the columns corresponds with the number of TEU). It is obvious that the main flow uses the road between Chittagong and Dhaka and is consisting of break bulk!

Hence the advantages the container system can provide in terms of intermodality are widely not utilised. Majority of the cargo volume is stuffed/unstuffed in local ICDs loaded from/to smaller (mostly overloaded) trucks causing extra costs, much loss of time and an additional risk for damage or loss. These consequences are further contributing to the general weakness of seaborne container logistics in Bangladesh.

Mongla does currently not make any nameable contribution to the container logistics to/from Dhaka. Almost all containers which are handled in the port are stuffed/unstuffed within the port. Some cargo might be carried as loose break bulk to/from Dhaka on the road. But as the road connection is less convenient (although shorter) as it is interrupted by a ferry crossing (until the opening of the Padma Bridge) and due to the poor condition of the road there is almost no container neither break bulk seaborne cargo from/to Dhaka via Mongla.

From Figure 5 it is also shown that taking a substantial port of the Chittagong container trade is quite a challenge.

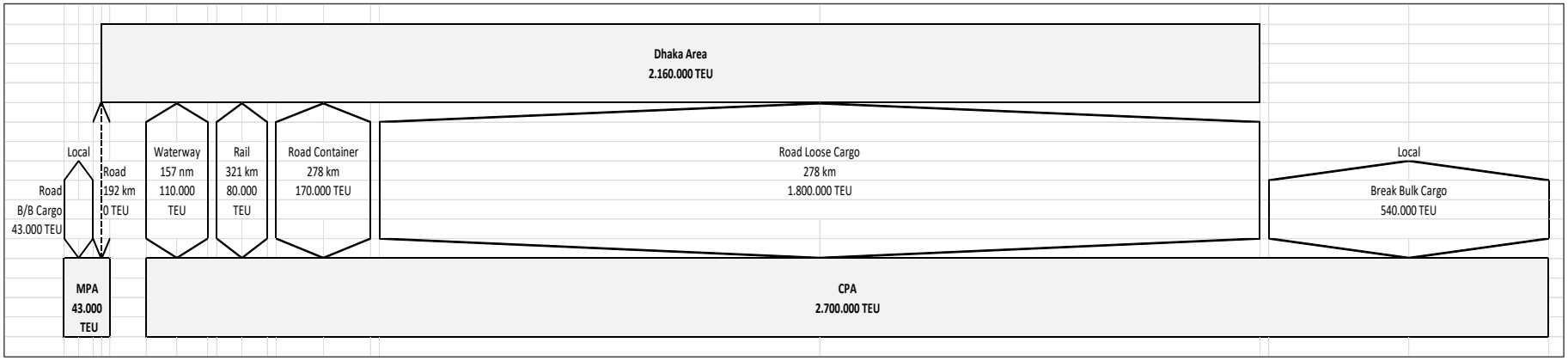


Figure 5: Estimated flow distribution of container cargo between the Dhaka region and the seaports of Chittagong and Mongla in the FY 2017/2018

Feeder Liner Services and Feeder Links

For the time being almost all of the 58,000 TEU of containers handled in Mongla (FY 2018-19) are stuffed/unstuffed within the port limits or remain within the vicinity of the port.

Mongla could provide real intermodality from/to the Dhaka area.

It is expected that the Padma Bridge will be opened in 2020. Then, the distance from Dhaka to Mongla through Padma Bridge will be only 170 km whereas the distance from Dhaka to Chittagong is about 260 km.[36] The bridge will certainly improve the hinterland connectivity of Mongla to the Dhaka region as Bangladesh's main source and destination of seaborne container cargo. However, it was not only the missing bridge which is hindering smooth road haulage between the region and the port. The entire length of the road needs to be sufficient for trucking. E.g. alone the road conditions of the last kilometres before the port prevent from trucking containers.

If Mongla has to play a bigger role in the container logistics of Bangladesh it has to become more attractive not only for the cargo owners but also for shipping lines. Both are dependent from each other. Without a shipping line serving the port on a regular basis no cargo can be shipped by nature. On the other side shipping lines needs the prospect of cargo potential to take the commercial risk to call at the port.

Even after the Padma Bridge has been opened and even if a container train service was introduced between Mongla and Dhaka the port will still suffer from its poor seaborne connectivity as it is only connected to Singapore/Tanjung Pelepas five and sometimes up to eight times per month by only two shipping lines (see figure 6).

Figure 6: Distribution of Bangladesh's exports Source: OEC[37]

[36] Feasibility Study for the Upgradation of Mongla Port, Department of Civil Engineering, Khulna University of Engineering & Technology, 2018

[37] https://oec.world/en/visualize/tree_map/hs92/export/bgd/show/all/2017/

According to OEC almost 2/3 of all Bangladesh's exports in 2017 (which are mostly textiles) were destined to Western Europe. For this cargo the routing via Colombo is generally shorter and more cost efficient. Another 18% were bound for North America. At least for the U.S. East Coast cargo the same would apply. But there is no feeder link from Mongla to Colombo!

For the time being Chittagong is still enjoying the advantage of being directly connected to Colombo by many shipping lines with much more sailings per month as Mongla provides to Singapore/Tanjung Pelepas.

Instead, if using Mongla, the cargo had to follow a zigzag course via Singapore/Tanjung Pelepas to Europa or the U.S. East Coast which will last longer and will cost more (Figure 7). Alone the feeder rates from Mongla to Singapore are 150-200 USD/TEU higher than from Chittagong.[38] The sea freight from Singapore to Europe is furthermore another 100 – 150 USD/TEU higher than from Colombo. Hence a feeder link to Colombo as a real physical short cut would be vital for attracting of more export container cargo via Mongla.

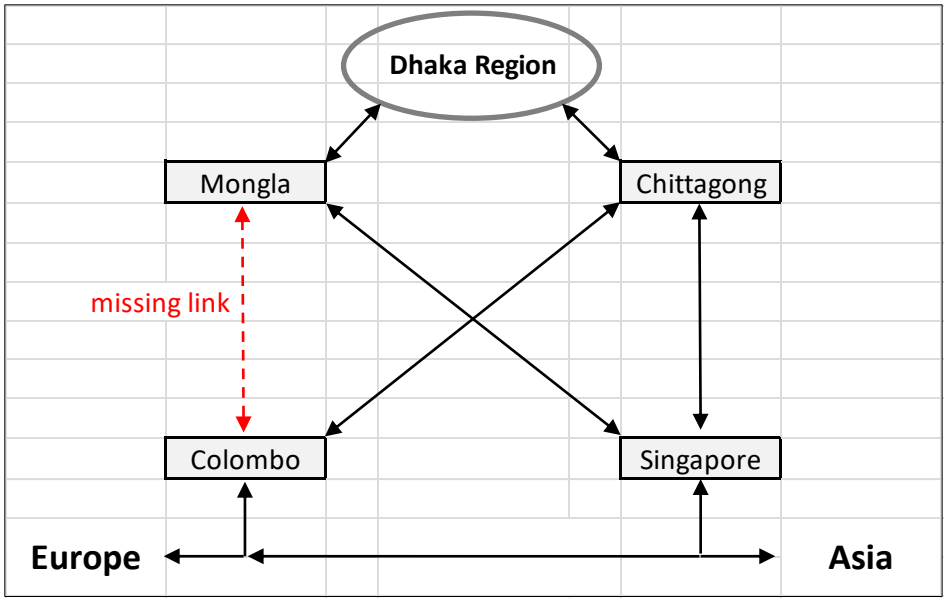


Figure 7: Present container connectivity of Mongla & Chittagong

Hence it is recommended to actively motivate suitable shipping lines to open a line between Mongla and Colombo. As such line appears to be crucial to route more cargo via Mongla even rebates in harbour dues for the shipping line to convince them should be considered.

[38] Own estimate according to shipping line market information

Appendix G – Socio-Economic Development Assessments

The forecast projections were prepared based on empirical data provided by the National Economic Planning of Bangladesh until 2040/2041, the Bangladesh Delta Vision Plan study report data and particularly the elaborations of the base data for social, regional economic and population development, and by Gross Domestic Product projections. The sources are referred to by the main report section and by the below depicted links.

Regression analyses were applied for derivation of GDP and GDP per capita development for Bangladesh and, based on socio-economic projections, for the pre-identified regions within the BINB Bangladesh – India – Nepal – Bhutan countries in the hinterland of Mongla port. For Nepal there is no identified transit traffic potential others than random traffic generated by trade. As far as Bhutan or India are concerned, Bhutan is competitively approachable from Mongla port hinterland infrastructure improvements provided. The hinterland of Mongla Port in India is limited to Eastern West Bengal and the so-called chicken-neck connecting West Bengal and the State of Assam. Socio economic/GDP or population development trend projections available until 2060 (India) or 2052 (population, Bhutan) have been taken into account.

All port hinterland traffic relevant regions in Bangladesh, India (mainly West Bengal) and Bhutan have in common that accessibility and competitiveness of Mongla port versus Chittagong or Kolkata/Haldia as import or export interface depends on the implementation of hinterland infrastructure connection improvements for Mongla port in road or rail network, and on the permissibility or time constraints of border crossings and the development of respective waiting times.

The most suitable tend functions for population and GDP as well as for GDP per capital development were evaluated and applied. Based on this macro -economic trends derived, correlation functions for main or “lead” commodities and the respective consumption, production or maritime import or export development projections were derived for the countries in the port hinterland.

The following functions have been developed and were applied for GDP and commodity wise consumption / demand projections for the base line development scenario.

Socio- Economics

1.1. Population

- Reference: Population projections:
  - Baseline Studies on Socio-Economic Aspects of the Bangladesh Delta, Volume5, 2018 BANGLADESH DELTA PLAN 2100
  - File: BDP 2100 BL Study Volume 5 Socio-economic Aspects of the Bangladesh Delta.pdf
- Calculations for the population during the years not included in the above report were done according to the regression analysis on the available data. The equation used for the regression analysis is as follows.

$$P_y = 1.835055607364 \times Y^4 - 14974.754039469600 \times Y^3 + 45800954.968617900000 \times Y^2 - 62226293390.142300000000 \times Y + 31686035614836.2$$

Y: Year, P: Population

1.2. GDP(Constant 2010 USD)

- Reference: Historical values:
  - World bank data repository
  - Link: https://data.worldbank.org/

1.3. GDP(Current USD)

- Reference: Historical values:
  - World bank data repository
  - Link: https://data.worldbank.org/

1.4. GDP(Constant Local Currency Unit/LCU)

- Reference: Historical values:
  - World bank data repository
  - Link: https://data.worldbank.org/

1.5. GDP(Current LCU)

- Reference: Historical values:
  - World bank data repository
  - Link: https://data.worldbank.org/

1.6. GDP(constant 2010 USD) at different five year average rates

- Reference: Projected values until year 2041:
  - Power System Master Plan2016, Summary
  - File: (E)_FR_PSMP2016_Summary_revised.pdf

Products

Cement - consumption

- Reference: Historical values:
  - European cement market: limited recovery; upgrade CRH
  - File: MSEU20170817566350.pdf
- Summary of statistical model used for prediction up to year 2040.

Equation: ***Cement Consumption = 65.368630×Population + 0.036973×GDP***

```
lm(formula = Cement ~ Population + GDP - 1, data = past)

Residuals:
1          2          3          4          5          6
-110305349  464354486   -5260996 -529282035  -92226467  274285825

Coefficients:
           Estimate Std. Error t value Pr(>|t|)
Population 65.368630  10.340101   6.322   0.0032 **
GDP         0.036973   0.009839   3.758   0.0198 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 384600000 on 4 degrees of freedom
Multiple R-squared:  0.9996,   Adjusted R-squared:  0.9994
F-statistic:  5426 on 2 and 4 DF,  p-value: 1.357e-07
```

Coal consumption

- Reference: Historical values:
  - CEIC, Macro & Micro Economic Data
  - Link:https://www.ceicdata.com/en/indicator/bangladesh/coal-consumption
  - BP Statistical Review of World Energy, 2019 | 68th edition
  - File : bp-stats-review-2019-full-report.pdf

- Summary of statistical model used for prediction up to year 2040.

Equation: ***Coal Consumption = -10.475562×Population + 0.024144×GDP***

```
lm(formula = Coal ~ Population + GDP - 1, data = past)

Residuals:
       Min         1Q     Median         3Q        Max
-607587556  -82044013    9876615   66103947 1098036976

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
Population -10.475562   2.190298  -4.783 0.000173 ***
GDP          0.024144   0.002612   9.243 4.85e-08 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 3.44e+08 on 17 degrees of freedom
Multiple R-squared:  0.9562,   Adjusted R-squared:  0.951
F-statistic: 185.5 on 2 and 17 DF,  p-value: 2.847e-12
```

Fertilizer consumption

- Reference: Historical values:
  - World bank data repository
  - Link: https://data.worldbank.org/indicator/ag.con.fert.zs
  - Arable land: indexmundi
  - Link: https://www.indexmundi.com/facts/bangladesh/arable-land
- Summary of statistical model used for prediction up to year 2040.

Equation: ***Fertilizer Consumption = 4.930e-04×Population + 9.021e-07×GDP***

```
lm(formula = Fertilizer ~ Population + GDP - 1, data = past)

Residuals:
   Min     1Q Median     3Q    Max
-23208  -6824  -1252   8916  24422

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
Population 4.930e-04  1.139e-04   4.330 0.000817 ***
GDP        9.021e-07  1.423e-07   6.341 2.57e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 12730 on 13 degrees of freedom
Multiple R-squared:  0.9955,   Adjusted R-squared:  0.9948
F-statistic:  1442 on 2 and 13 DF,  p-value: 5.466e-16
```

LPG Consumption

- Reference: Historical values:
  - World LPG Association: Sub-Continent Regional Summit.
  - File: 2.5-M.Saidul-Kleenheat-Bangladesh.pdf
  - Red-herring prospectus of omera petroleum limited
  - File: RHP-of-OPL-Octo-27-2019.pdf

- Summary of statistical model used for prediction up to year 2040.

Equation: ***LPG Consumption = -3.9682185×Population + 0.0062999×GDP***

```
lm(formula = LPG ~ Population + GDP - 1, data = past)

Residuals:
       Min         1Q     Median         3Q        Max
-215316008  -89235318   -1818296  101072713  149680943

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
Population -3.9682185  0.6967954  -5.695 2.63e-05 ***
GDP         0.0062999  0.0007894   7.981 3.77e-07 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 114400000 on 17 degrees of freedom
Multiple R-squared:  0.8817,   Adjusted R-squared:  0.8678
F-statistic: 63.34 on 2 and 17 DF,  p-value: 1.32e-08
```

Agricultural Products and inputs - consumption

Rice Consumption

- Reference: Historical values:
  - Imports and Exports: Food and Agricultural Organization of the United Nations Stat
  - Link: http://www.fao.org/faostat/en/#data
  - Production: Indexmundi, United States Department of Agriculture
  - Link:https://www.indexmundi.com/agriculture/?country=bd&commodity=milled-rice&graph=production

- Summary of statistical model used for prediction up to year 2040.

Equation: ***Rice Consumption = 1.421e+02×Population + 8.712e-02×GDP***

```
lm(formula = Rice ~ Population + GDP - 1, data = past)

Residuals:
       Min         1Q     Median         3Q        Max
-4.081e+09 -7.121e+08  1.060e+08  1.016e+09  3.108e+09

Coefficients:
           Estimate Std. Error t value Pr(>|t|)
Population 1.421e+02  5.156e+00   27.56  < 2e-16 ***
GDP        8.712e-02  7.728e-03   11.27 6.43e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.473e+09 on 55 degrees of freedom
Multiple R-squared:  0.9954,   Adjusted R-squared:  0.9953
F-statistic:  6008 on 2 and 55 DF,  p-value: < 2.2e-16
```

Wheat Consumption

- Reference: Historical values:
  - Indexmundi, United States Department of Agriculture
  - Link:https://www.indexmundi.com/agriculture/?country=bd&commodity=wheat&graph=domestic-consumption

- Summary of statistical model used for prediction up to year 2040.

Equation: ***Wheat Consumption = 10.634277×Population + 0.024472×GDP***

```
lm(formula = Wheat ~ Population + GDP - 1, data = past)

Residuals:
       Min         1Q     Median         3Q        Max
-1.222e+09 -6.669e+08 -1.282e+08  5.256e+08  1.754e+09

Coefficients:
           Estimate Std. Error t value Pr(>|t|)
Population 10.634277   2.488945   4.273 7.27e-05 ***
GDP         0.024472   0.003439   7.117 1.87e-09 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 806600000 on 58 degrees of freedom
Multiple R-squared:  0.9369,   Adjusted R-squared:  0.9347
F-statistic: 430.4 on 2 and 58 DF,  p-value: < 2.2e-16
```

Soy bean - Consumption

- Reference: Historical values:
  - Indexmundi, United States Department of Agriculture
  - Link:https://www.indexmundi.com/agriculture/?country=bd&commodity=soybean-oilseed&graph=domestic-consumption

- Summary of statistical model used for prediction up to year 2040.

Equation: ***Soy bean Consumption = -9.4234309×Population + 0.0156610×GDP***

```
lm(formula = SoyBean ~ Population + GDP - 1, data = past)

Residuals:
       Min         1Q     Median         3Q        Max
-251718800  -90563618   45984966  120243844  151717494

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
Population -9.4234309  0.8234762  -11.44 2.07e-09 ***
GDP         0.0156610  0.0009329   16.79 5.12e-12 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 135200000 on 17 degrees of freedom
Multiple R-squared:  0.9739,   Adjusted R-squared:  0.9709
F-statistic: 317.6 on 2 and 17 DF,  p-value: 3.44e-14
```

Fish and Seafood Consumption

- Reference: Historical values:
  - Food and Agriculture Organization of the United Nations (FAO) (2017),
  - Link: http://www.fao.org/faostat/en/?#data/
  - Our World in Data
  - Link: https://ourworldindata.org/grapher/fish-and-seafood-consumption-per-capita?tab=chart&time=1961..2013&country=BGD

- Summary of statistical model used for prediction up to year 2040.

Equation: ***Fish and seafood Consumption = -0.703750×Population + 0.024123×GDP***

```
lm(formula = FishnSeafood ~ Population + GDP - 1, data = past)

Residuals:
       Min         1Q     Median         3Q        Max
-301310386  -85634957   15336724   77547506  320999213

Coefficients:
           Estimate Std. Error t value Pr(>|t|)
Population -0.703750   0.596350   -1.18    0.243
GDP         0.024123   0.001031   23.41   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 131100000 on 51 degrees of freedom
Multiple R-squared:  0.9913,   Adjusted R-squared:  0.991
F-statistic:  2920 on 2 and 51 DF,  p-value: < 2.2e-16
```

Sugar Consumption

- Reference: Historical values:
  - Indexmundi, United States Department of Agriculture
  - Link:https://www.indexmundi.com/agriculture/?country=bd&commodity=centrifugal-sugar&graph=human-domestic-consumption

- Summary of statistical model used for prediction up to year 2040.

Equation: ***Sugar Consumption** = 7.744e+00×Population + -3.704e-02×GDP 2.689e-10×Population×GDP*

```
lm(formula = Sugar ~ Population + GDP + Population * GDP - 1,
    data = past)

Residuals:
       Min         1Q     Median         3Q        Max
-384078658  -72483760   -5171475   72132155  314259564

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
Population      7.744e+00  2.971e+00   2.606  0.01244 *
GDP            -3.704e-02  1.552e-02  -2.386  0.02139 *
```

Vehicles – registration/stock

Cars

- Reference: Historical values:
  - Bangladesh road transport authority
  - Link:https://brta.portal.gov.bd/sites/default/files/files/brta.portal.gov.bd/monthly_report/d4d56177_644f_44f8_99c4_3417b3d7b0f4/MV_statistics-bangladesh-march-18.pdf

- Summary of statistical model used for prediction up to year 2040.

Equation: ***Cars** = 30.370× GDP Per Capita*

```
lm(formula = Cars ~ GDP_Per_Capita - 1, data = past)

Residuals:
    Min      1Q  Median      3Q     Max
-9163.7 -5049.0   648.8  4460.8  6675.3

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
GDP_Per_Capita   30.370      2.438   12.46 1.64e-05 ***
```

Busses

- Reference: Historical values:

- Bangladesh road transport authority
- Link:https://brta.portal.gov.bd/sites/default/files/files/brta.portal.gov.bd/monthly_report/d4d56177_644f_44f8_99c4_3417b3d7b0f4/MV_statistics-bangladesh-march-18.pdf

- Summary of statistical model used for prediction up to year 2040.

Equation: ***Busses = 4.514e-05× Population***

```
Residuals:
    Min      1Q  Median      3Q     Max
-3103.0 -1500.5  -649.4  1752.9  2979.1

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
Population 4.514e-05  5.627e-06   8.021 0.000201 ***
---
```

Trucks/Commercial vehicles

- Reference: Historical values:
  - Bangladesh road transport authority
  - Link:https://brta.portal.gov.bd/sites/default/files/files/brta.portal.gov.bd/monthly_report/d4d56177_644f_44f8_99c4_3417b3d7b0f4/MV_statistics-bangladesh-march-18.pdf
- Summary of statistical model used for prediction up to year 2040.

Equation: ***Trucks = 1.207e-07× GDP***

```
Residuals:
    Min      1Q  Median      3Q     Max
-4864.5 -3651.8  -957.5  1957.1  7240.6

Coefficients:
     Estimate Std. Error t value Pr(>|t|)
GDP 1.207e-07  1.088e-08   11.09 3.21e-05 ***
---
```

GDP forecast for India and Bhutan (Base Line Scenario)

Socio- Economics

Population: **India**

- Reference: Historical values:
  - World bank data repository
  - Link: https://data.worldbank.org/
- Population forecast for the intermediate years were calculated according to the below formula.

$$P_y = 16{,}582828251096 \times Y^4 - 135.010{,}790775373000 \times Y^3 + 412.027.214{,}654352000000 \times Y^2 - 558.612.036.676{,}848000000000 \times Y + 283.877.345.093.843{,}000000000000$$

Y: Year, P: Population

Population: **Bhutan**

- Reference: Historical values:
  - World bank data repository
  - Link: https://data.worldbank.org/
- Population forecast for the intermediate years were calculated according to the below formula.

$$P_y = 0{,}286498530577 \times Y^3 - 1761{,}255256454530 \times Y^2 + 3615149{,}332756140000 \times Y - 2476667631{,}236940000000$$

Y: Year, P: Population

GDP (Constant 2010 USD): **India**

- Reference: Historical values:
  - World bank data repository
  - Link: https://data.worldbank.org/
- Population forecast for the intermediate years were calculated according to the below formula.

$$GDP_y = 1.171.307.793{,}77205 \times Y^2 - 4.622.391.078.815{,}36 \times Y + 4.560.537.797.144.960{,}00$$

Y: Year

GDP (Constant 2010 USD): **Bhutan**

- Reference: Historical values:
  - World bank data repository
  - Link: https://data.worldbank.org/
- Population forecast for the intermediate years were calculated according to the below formula.

$$P_y = 899{,}121472895145 \times Y^3 - 3566426{,}73168945 \times Y^2 + 3615149{,}33275614 \times Y - 3536739311{,}375$$

Y: Year

Appendix H – Foreign Trade and Production Development

Purpose

This section of the Mongla port master plan study aims to predict current and future trend of overall demand for goods Imports (US$) and goods Exports (US$) in Bangladesh.

Data collection

- Time-series data was collected for Economic and trade indicators for Bangladesh from the year 1990 to 2018 from the World Bank database.
- Maritime exports and imports data in volume was collected from statistical yearbook of Bangladesh.
- Bilateral goods trade between Bangladesh and its neighboring countries (India, Nepal and Bhutan) in US$ was collected from World Integrated Trade Solution (WITS) database

Methodology:

The future trends for GDP, Population, goods Imports and Exports (US$) and Maritime Goods Exports and Imports (in US$ and metric tons) as well as for production were explored until year 2040. Trend analysis was performed using trend function which finds the line that best fits the data by using the least square method.

$$y = b_1x_1 + b_2x_2 + \ldots + b_nx_n + a$$

Where:

- *y* - the dependent variable you are trying to calculate.
- *x* - the independent variable you are using to calculate *y*.
- a - the intercept (indicates where the line intersects the y-axis and is equal to the value of y when x is 0).
- b - the slope (indicates the steepness of the line).

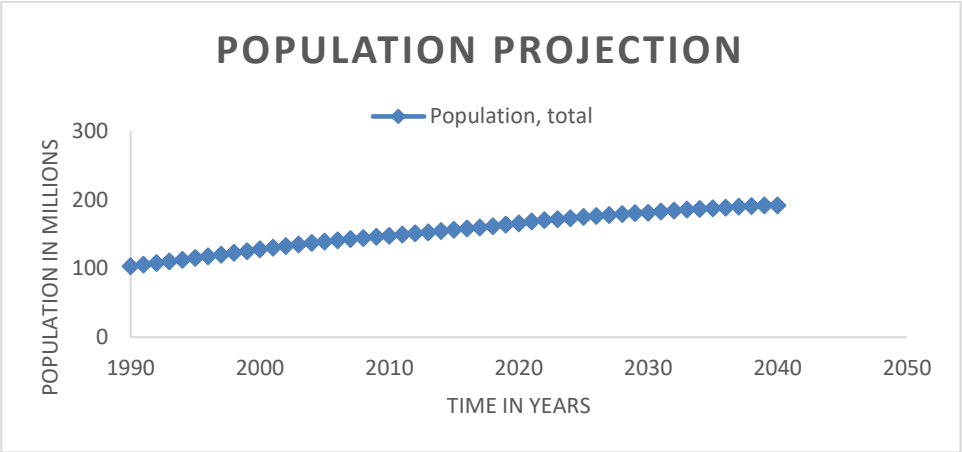
Maritime goods exports (US$) was calculated by subtracting total Imports of (India, Bhutan and Nepal) from total exports

Similarly, Maritime goods Imports (US$) was calculated by subtracting total exports of (India, Bhutan and Nepal) from total imports

Results

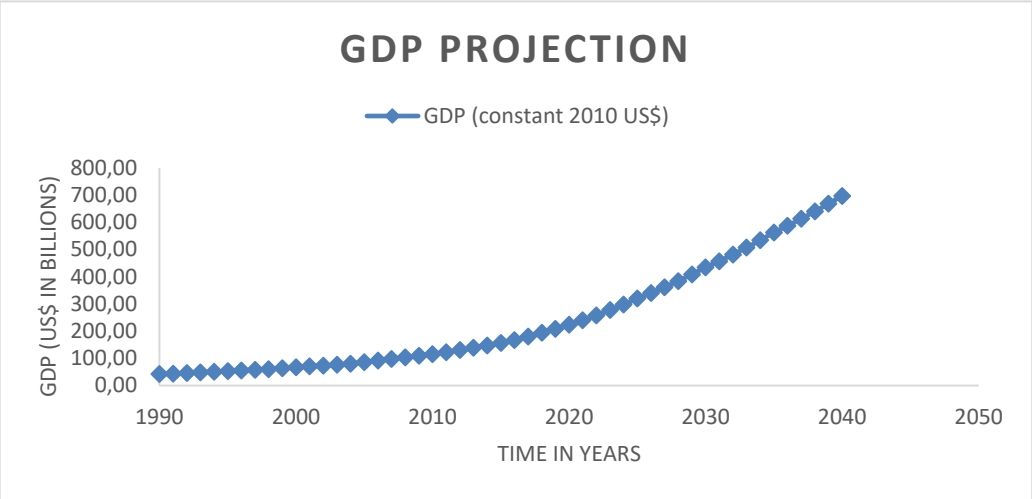
Population

Population of Bangladesh is forecasted to be double in 2040 since 1990 although at a decreasing growth rate over time



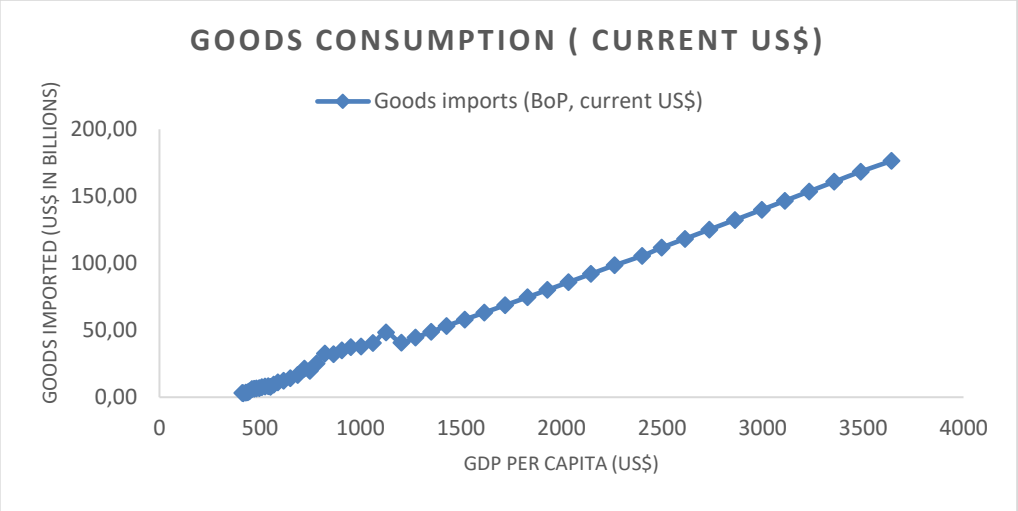
GDP

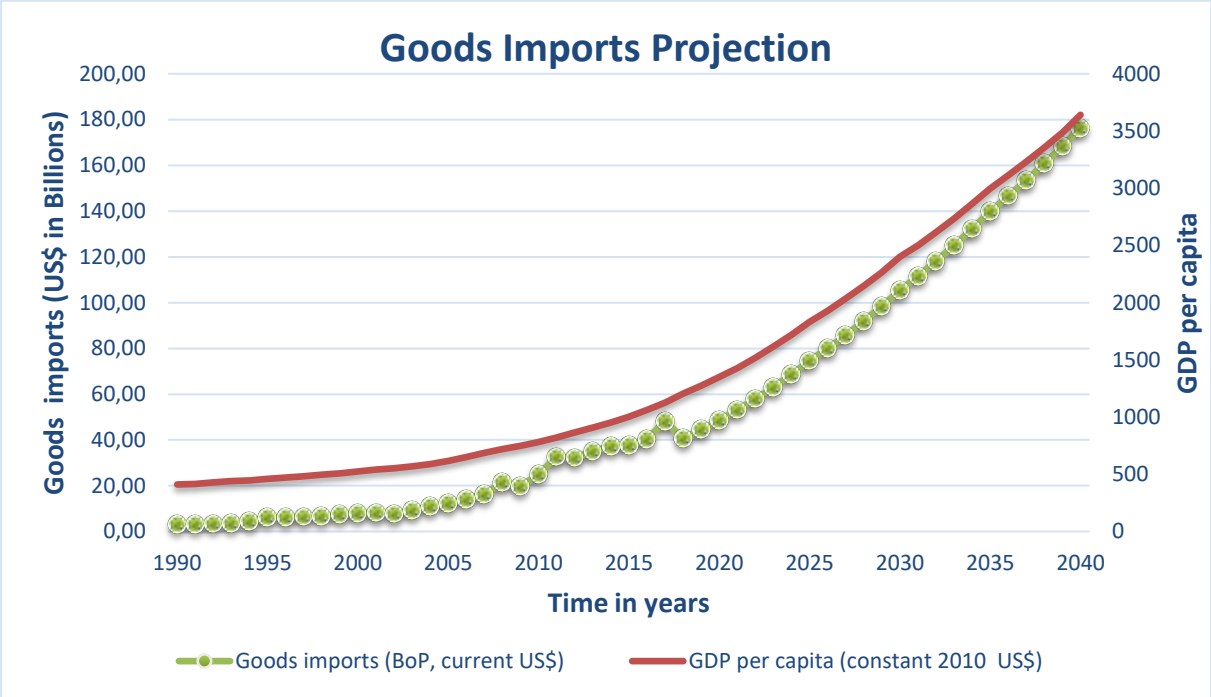
GDP forecast of Bangladesh shows increasing growth rate until 2025 and after that there is percentage drop in growth rate in every five years.



Goods Consumption:

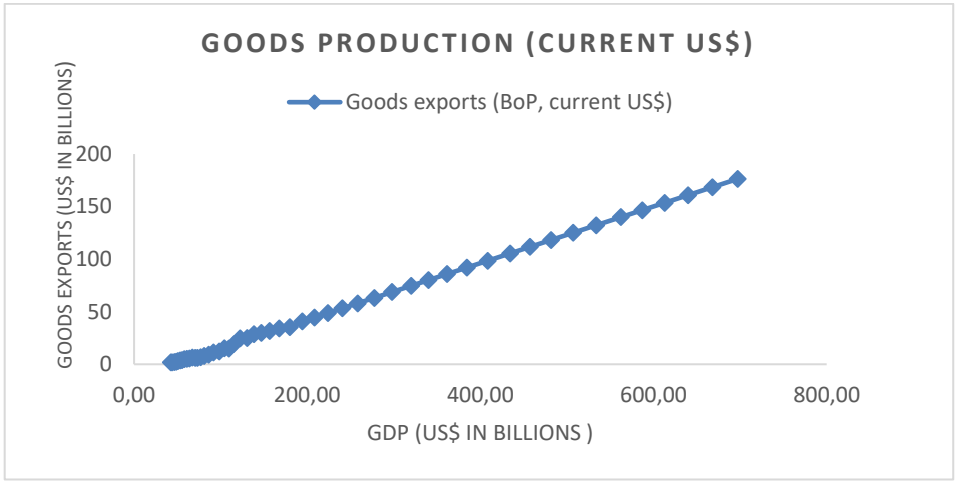
Demand of goods in Bangladesh increase with increase in income per capita and decrease in population.

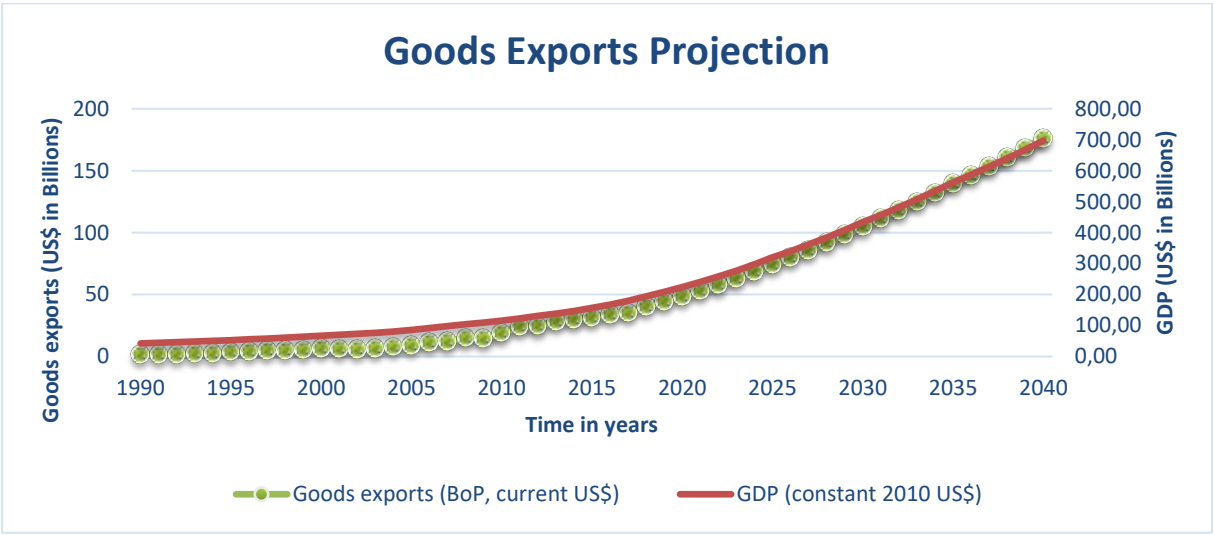


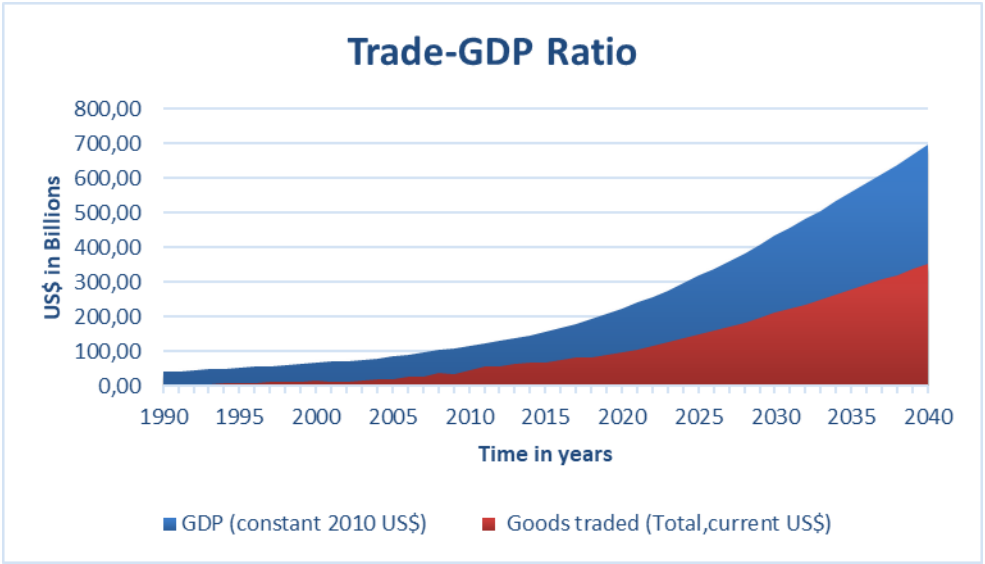


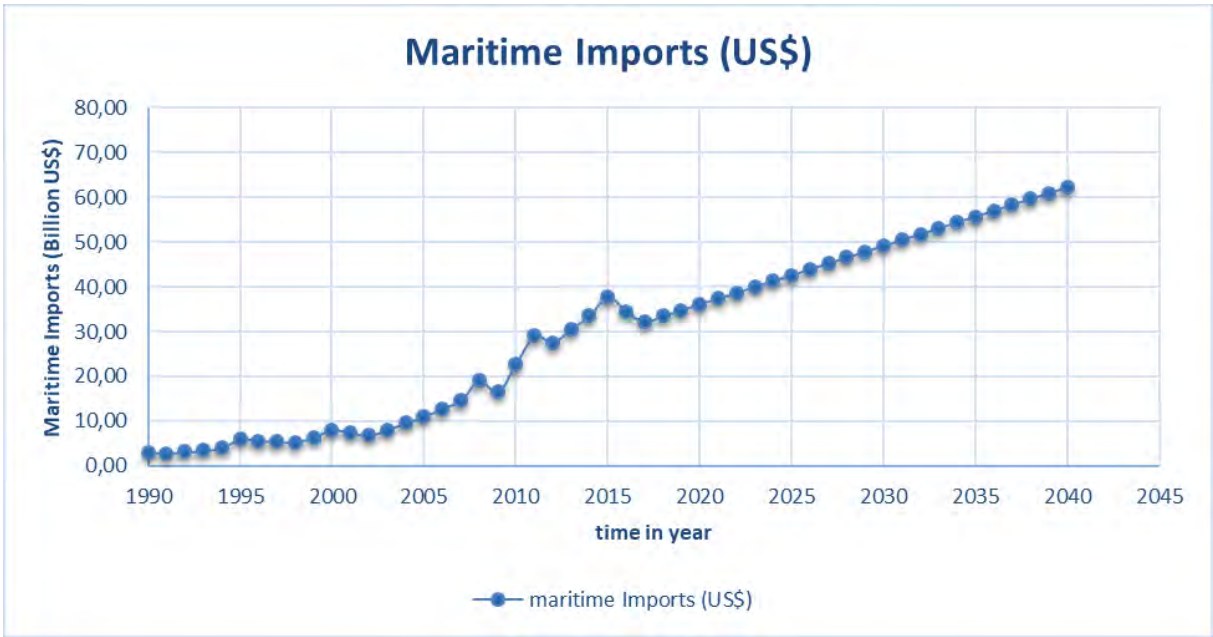
Goods Production

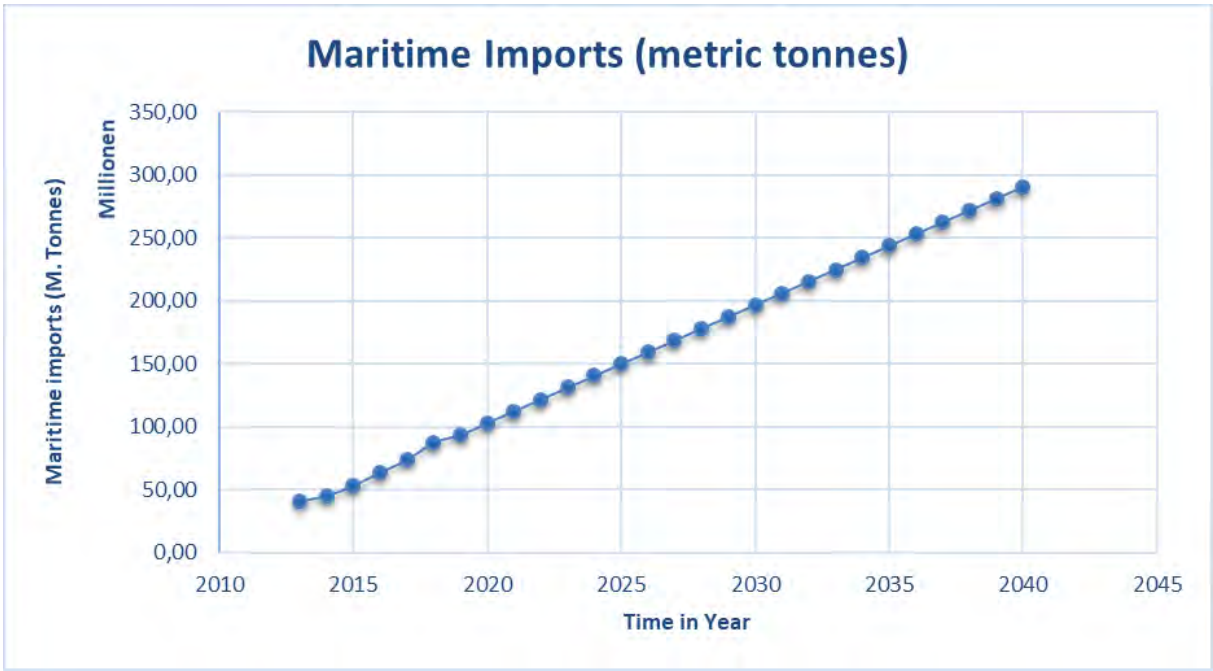
Goods exports increases nearly four times from that of 1990. Production increases with an increase in GDP

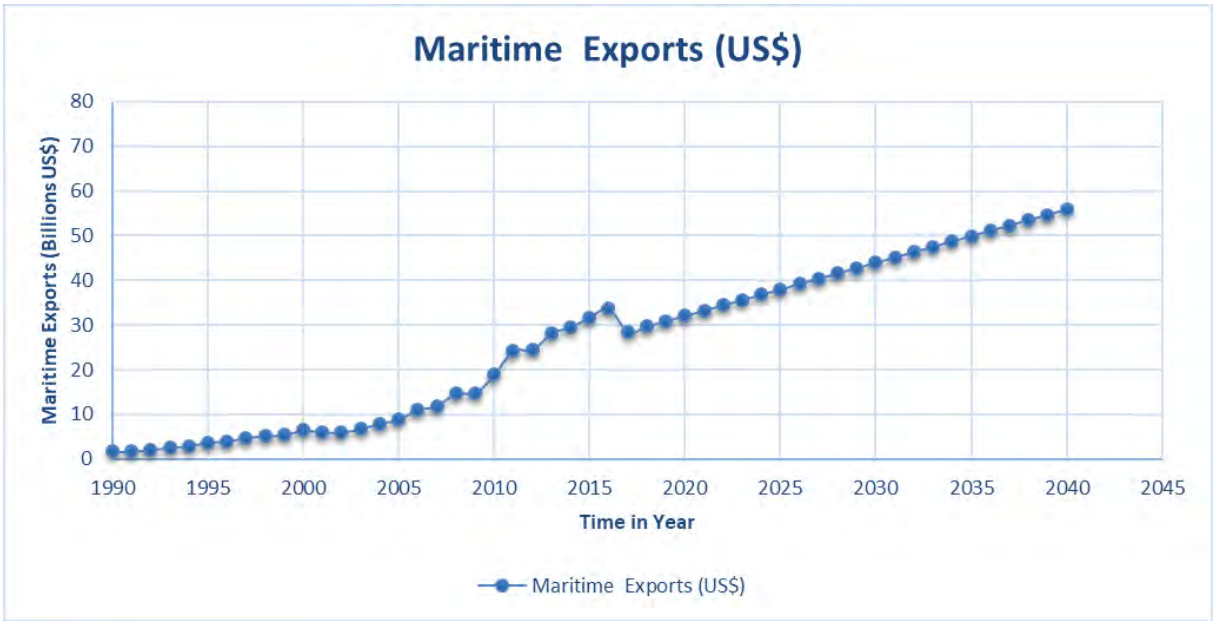

GOODS PRODUCTION (CURRENT US$)
Goods exports (BoP, current US$)
GOODS EXPORTS (US$ IN BILLIONS)
200
150
100
50
0
0,00
200,00
400,00
600,00
800,00
GDP (US$ IN BILLIONS)

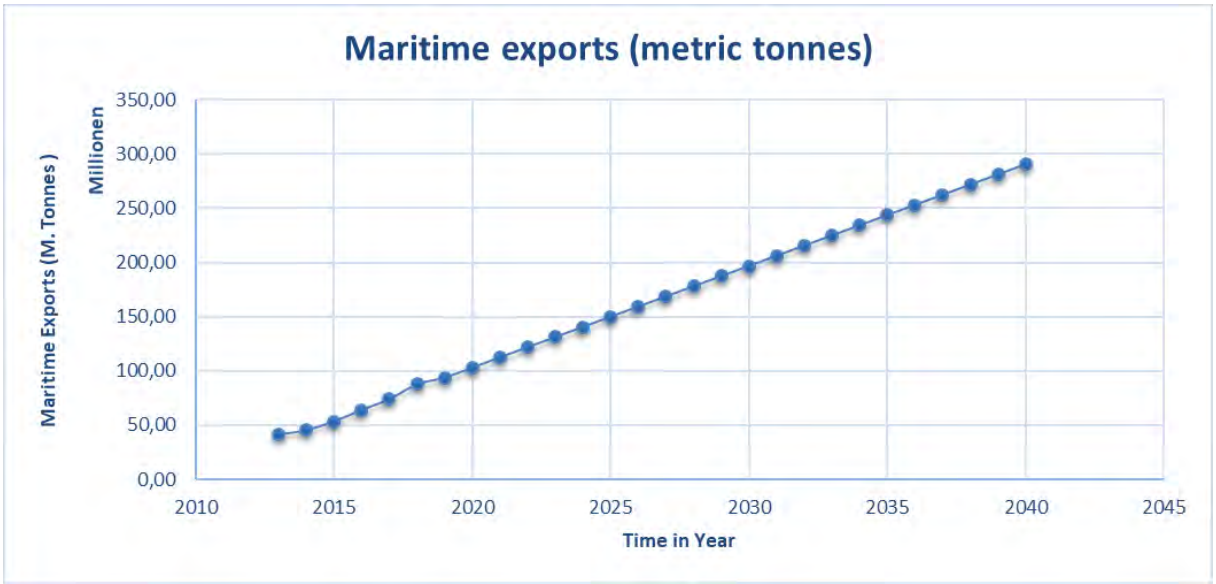

Goods Exports Projection
Goods exports (US$ in Billions)
200
150
100
50
0
800,00
700,00
600,00
500,00
400,00
300,00
200,00
100,00
0,00
GDP (US$ in Billions)
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Time in years
Goods exports (BoP, current US$)
GDP (constant 2010 US$)

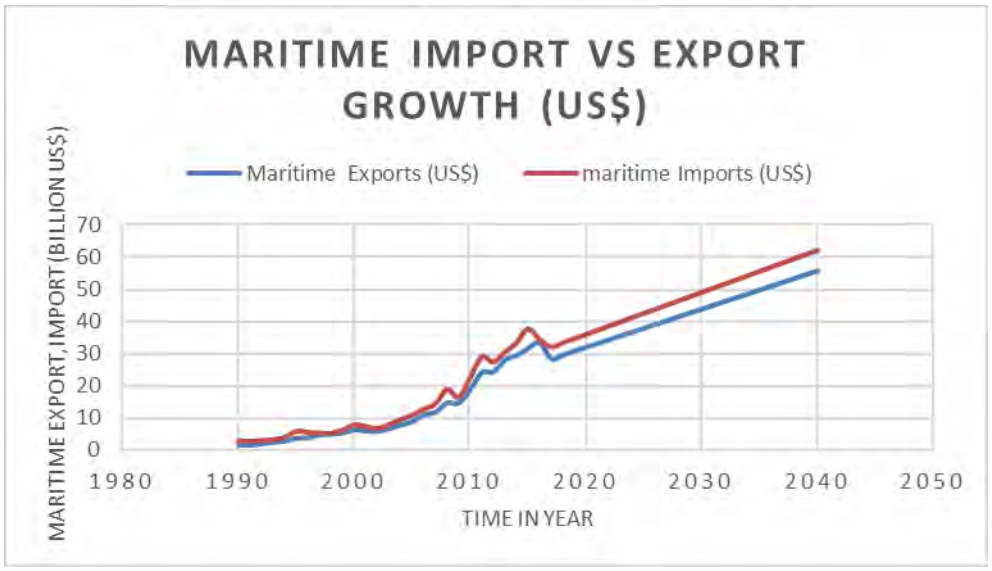

Trade-GDP Ratio
US$ in Billions
800,00
700,00
600,00
500,00
400,00
300,00
200,00
100,00
0,00
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Time in years
GDP (constant 2010 US$)
Goods traded (Total,current US$)


Maritime Imports (US$)
Maritime Imports (Billion US$)
80,00
70,00
60,00
50,00
40,00
30,00
20,00
10,00
0,00
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
time in year
maritime Imports (US$)


Maritime Imports (metric tonnes)
Maritime imports (M. Tonnes)
Millionen
350,00
300,00
250,00
200,00
150,00
100,00
50,00
0,00
2010
2015
2020
2025
2030
2035
2040
2045
Time in Year


Maritime Exports (US$)
Maritime Exports (Billions US$)
80
70
60
50
40
30
20
10
0
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
Time in Year
Maritime Exports (US$)


Maritime exports (metric tonnes)
Maritime Exports (M. Tonnes)
Millionen
350,00
300,00
250,00
200,00
150,00
100,00
50,00
0,00
2010
2015
2020
2025
2030
2035
2040
2045
Time in Year


MARITIME IMPORT VS EXPORT GROWTH (US$)
Maritime Exports (US$)
maritime Imports (US$)
MARITIME EXPORT, IMPORT (BILLION US$)
70
60
50
40
30
20
10
0
1980
1990
2000
2010
2020
2030
2040
2050
TIME IN YEAR

Appendix I – Industry Developments at Mongla Port

Rampal Power Plant „Bangladesh-India Friendship Power Company[39]

The power plant will consist of two blocks and will deliver 2 * 660 MW from 2022 onwards. Operations of block 1 will commence from 02/2021 onwards (660 MW). Block 2 will become operational in 08/2021 onwards and produce further 660 MW.

The power generation will take place by firing of high quality and low sulphur content cooking coal of high quality and energetic content. The coal shall at least provide an energy content of 167,000 Mega Joule (MJ) per ton (5700 SKE equivalent) je Tonne.

The total import demand of cooking coal amounts in view of the input quantities and the coal quality required generate 1.320 MW per year for around 10,500 – 11,000 tons of coal or 4 million tons of cooking coal per year.

Door-to-door coal supply chain management from source of cooking coal/coal mine pier or loading port to the Rampal power plant in will be outsourced to an integrated logistics service provider by a long-term contract. The contract terms include provision of necessary investment into logistics facilities for unloading of coal bulkers with more than 100.000 tons loading capacity (“Cape Size”) and for transport of coal from lightering places out of Outer Bar to Rampal power plan pier by the logistics service provider[40].

The coal supply chain and the handling capacities on anchorage out of Outer Bar must be able to perform unloading of 12-15,000 tons of coal der day, with a peak capacity of up to 20,000 tons per day.

There are subject to offered solutions by prospective logistics partners plans to build and to operate 3 special ships for coal transport between the Outer Bar unloading facility and Rampal power plan pier.

There is in view of planning parameters, supply chain needs, distances and vessel travel times between the unloading facilities out of Outer Bar and Rampal Power Plant Pier around 10 km upstream of MPA Permanent Jetty) either the need to deploy a 4th interim transport ship at Pussur River system, each with a transport capacity of by 5,500-6,000 tons of coal, or to introduce sea-river ships with at least 10.000 tons (better: 12,000 t) loading capacity

The draft at power plan pier is 7 m below chart datum /dredged basin. This means that – at low tide, ships can be served with max. 6 m of effective draft.

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[39] Interview geführt mit Md. Rezaul Karim, Deputy Project Director, September 2019, bestätigt durch öffentlich verfügbare Informationen

[40] Invitation for Bids (IFB) no. BIFPCL/MSTPP/COAL TRANSPORTATION/R/2019/705 dated 16.09.2019 for Coal Transportation including Transshipment for 2x660 MW Maitree Super Thermal Power Project at Rampal, Bangladesh

The length of the power plant pier shall amount for 540 m and serve for inbound (coal) cargo flows and respective unloading of up to 20.000 tons of coal per day by grip cranes/ grip bridges to come to performance, and transport of coal by conveyer belts to the storage areas (after this, supply to coal grinding mills and interim storage at three coal dust silo stores prior to firing). The power plant pier will also serve for outbound material handling, e.g. for loading of reaction gypsum, fly ash (input to Mongla port cement industry in future), slag (construction material) and eventually sulphur acids (liquid hazardous cargo).

Gypsum as filtering product during coal firing is stored at covered storage prior to loading. Each power plant block will produce 6.5 tons of gypsum per operational hour. The total annual output of Rampal power plan during commencement of regular operations (from 2020 onwards) at 360 operations days per year and 24 hours operation for around 110,000 and 114,000 tons of gypsum (average value: 112,000 tons).

Fly Ash will be stored at silos. The volumes of fly ash amount for between 12 – 18 % of the coal input volumes 480 –720.000 tons) or as an average figure for 600.000 tons.

Fly ash as well as gypsum will be, depending on actual demand, with preference by carried to the local cement industry at Mongla since both residual products of coal power plants are input for porcelain cement production at the cement clinker mills. The short distance shuttle will be carried out by inland transport vessels with 300- 450 tons or 900 – 1,000 tons capacity, depending on cost, supply chain organisation and operations organisation (Ganga/Pussur/Patma/Brahmaputra - standard vessels with max. 3.5 - 4 m draft) over a less than 10 km distance downstream to Mongla.

The Rampal power plan development area amounts for 915 Acres, of which up to maximum 430 Acres are required for the purposes of the power plant including supply chain, cargo handling and stores, and offices and all other buildings.

400 – 450 Acres are consequently available for industrial developments or an eventual and not yet planned or envisaged extension of the power plant.

Mongla Port Cement Industry Development

Cement and cement production or distribution related commodities amount for between and per cent of the overall inbound traffic of the port of Mongla, and for between 32.3 and 75.5 percent of the overall traffic (inbound and outbound). The cement industry related material flows are inbound flows. Both figures (imports and total of imports and exports) are summarized by the following table:

Cement and cement pre-products and production related port throughput 2004 – 2018

Year	Cement (readymade)	Cement (readymade)	Cement inputs (local produ.)	Cement Inputs (local produ.)	Cement and cement industry products	Cement and cement industry products	All Commodities	Total Im- & Exports	Share of cement and cement inputs in percent	
	Imports	Exports & Imports	Imports	Exports & Imports	Imports	Exports & Imports	Imports	Exports & Imports	Imports	Exports & Imports
2004-2005	4.850	4.850	1.026.767	1.026.767	1.031.617	1.031.617	1.254.374	1.476.172	82,2%	69,9%
2005-2006	0	0	1.118.707	1.118.707	1.118.707	1.118.707	1.215.072	1.482.644	92,1%	75,5%
2006-2007	0	0	525.209	525.209	525.209	525.209	662.263	914.375	79,3%	57,4%
2007-2008	0	0	239.127	239.127	239.127	239.127	518.309	722.834	46,1%	33,1%
2008-2009	0	0	470.390	470.390	470.390	470.390	929.714	1.137.826	50,6%	41,3%
2009-2010	0	0	716.045	716.045	716.045	716.045	1.502.050	1.649.283	47,7%	43,4%
2010-2011	0	0	869.557	869.557	869.557	869.557	2.529.853	2.696.271	34,4%	32,3%
2011-2012	0	0	948.254	948.254	948.254	948.254	2.482.432	2.619.897	38,2%	36,2%
2012-2013	0	0	1.171.562	1.171.562	1.171.562	1.171.562	2.946.222	3.147.574	39,8%	37,2%
2013-2014	0	0	1.339.103	1.339.103	1.339.103	1.339.103	3.402.402	3.543.949	39,4%	37,8%
2014-2015	0	0	1.720.049	1.720.049	1.720.049	1.720.049	4.429.449	4.530.279	38,8%	38,0%
2015-2016	0	0	2.400.000	2.400.000	2.400.000	2.400.000	5.709.664	5.797.521	42,0%	41,4%
2016-2017	0	0	3.202.022	3.202.022	3.202.022	3.202.022	7.428.105	7.513.727	43,1%	42,6%
2017-2018	0	0	3.703.022	3.703.022	3.703.022	3.703.022	9.568.899	9.716.050	38,7%	38,1%
2018-2019	0	0	4.235.221	4.235.221	4.235.221	4.235.221	11.179.878	11.315.009	37,9%	37,4%

The importance of the local cement industry at Mongla port for the overall port throughput of the recent 15 years is best visualized by the import developments of cement and cement production related products in relation to the development of the overall imports via Mongla port. Starting in the mid of the last decade with a share of by 80 – 90% in overall imports related to cement business the volume of cement related products has grown from less than 0.5 million metric tons in 2008/2009 to more than 4 million tons in 2018/2019, i.e. by factor 9. While imports for other industries, namely energy related imports of coal, liquid gas and mineral oil and petrol oil products have increased even more rapidly cement and cement related products are the main products of dry bulk handled.

The biggest cement plant at Mongla port is operated by the Bashundhara Group. The Bashundhara group[41] is the largest enterprise and industrial group of Bangladesh and possesses, among others, about real estate development, shopping mall, production and distribution plants for cement (Meghna Cement Mills Ltd, Mongla Cement, cement marketed also under the Bashundhara group's label King Brand Cement), oil, petrol, Liquid Petroleum Gas (LPG), hardware, construction material and building materials as well as for paper, consumer products, retail brans and fertilisers and other agriculture products all over in Bangladesh. Among others, the group deploys by its logistics enterprises a fleet of nearly 1000 inland water transport vessels with 60- 70 m length, drafts of up to 4.5 meters and a loading capacity of 900 – 1,200 tons of cargoes, and vessels of 300 – 450 tons transport capacity (around 30 m long with a permissible draft of 3 m), and truck fleets for e.g. cement in bulk (silo trucks) and for any other kind of cargoes.

[41] see http://www.bashundharagroup.com/page/corporate-profile for reference

Meghna Cement and its affiliated company "Mongla Cement", all belonging under the roof of Bashundhara Group, produce Ordinary Portland Cement (OPC; 30% of production) and, as base production line, Porcelain of Porcelain Clay Cement (PCC; 70% or the production). The mill has become operational in 1995/1996 and expanded the capacity to 1,400 t per day of cement as final product (i.e. mainly PCC) in 2018/2019[42]. The production will increase to 16,000 metric tons of cement in the course of 2020, based on 20 operational hours per work day. The investment, civil and mechanical works and installations are under progress.

The inputs per unit of cement are: 65-70% imported cement clinker (coming by ocean ship) and 30 – 35 % additives, of which 4-5% gypsum (imported at present, in future supplied by Rampal power plan and other power plants), 6-8% limestone (OPC mainly) and the rest slag and fly ash and some minor quantities of iron ore or bauxite.

When extrapolating the development role of the Bashundhara Group's cement activities on the overall port throughput of cement and cement industry related product the following relations can be shown:

The Bashundhara group's cement production at Mongla in recent years achieved 1.400 tons per work day, reached capacity at an annual output of 450,000 ton (2018

Marketing and sales potential are apparently assessed to be more than ten times higher than present production can supply. Therefore, additional capacity is added to the plant in order to produce up to 16,000 tons per day of market ready cement per work day from 2020 onwards. 320 work days supposed as per the above figures (counting for 321 workdays at nominal 20h capacity) the Bashundhara group will produce (and sell) up to 5.120,000 tons of cement per year in or from the Mongla plants in future.

Same proportion in input traffic as for the output production supposed the present share in production and hence in cement industry input traffic (clinker, gypsum, fly ash, slag) of Bashundhara group is 10.6 % (2018), 12.2% (2017) and 14.1% (2016).

Even if the competing plants at Mongla port are presently running at capacity limit at present it is likely that the other operators will also increase their production capacity in the course of the next 5 years at least by, in average, factor 2 (factor 1.75 as modest growth, factor 2.25 as optimistic variant).

In total the input demand for cement industry products will hence increase to 5.1 million tons for the Bashundhara plant and to 6.5 million tons for the other plants. In total, the import of cement clinker, gypsum, fly ash and slag would, therefore, come to 11.6 million tons per year in 2030 und base case scenario assumptions.

When considering the impacts of the implementation of Rampal power plant on the inbound supply chains for the cement industry, gypsum, fly ash and slag will be directly carried from the power plant by inland water transport the cheapest way) to the cement plants at Mongla port. This means that – from 2022 onwards, 114,000 tons of gypsum per year and 600,000 tons of fly ash will be needed to be deducted from the above assessed cement industry traffic figures 2030.

[42] Interview Joint Chief Engineer and with Asst. GM of Meghna Cements Mills/Bashundhara Group in Mongla

The short-term projection of the cement industry related port traffic is summarized by the below table for the base case and for optimistic as well as for the modest growth scenarios.

Import of cement and cement industry commodities 2018-2040 (tons)

Year	Base case	Optimistic case	modest growht
2018	4.235.221	4.235.221	4.235.221
2020	6.317.330	6.317.330	6.317.330
2025	8.597.195	9.002.887	8.191.504
2030	10.877.061	11.688.444	10.065.678

All maritime and all inland water transport handling, the latter basically focussing on the groups on inland water transport vessels – are carried out via the own jetties of the plant. This is common to all other cement clinker mills / cement plants allocated at Mongla port. The draft at jetty is 2.5 – 3 m (chart datum), the draft restriction of cement and gypsum import vessels is 6.5 – 7m (chart datum 8.5 m at anchorage place). Clinker, limestone and gypsum are imported mainly by 5,000 – 6,000 dead weight tons (dwt) vessels directly from the cement rotary kiln plant port facilities at e.g. the United Arab Emirates or from India, Thailand or Malaysia mainly (depending on markets and capacities). The ships are lightered on anchorage in the waters of MPA by vessels own gear, and clinker is coming by 1,000 tons freighters of the Bashundhara Group's logistics enterprises.

The output, i.e. OPC and PCC, is sent to the buyers, recipient construction sites or traders and their warehouses in bulk by silo trucks with 26 – 28t loading capacity (110 own and 50 third party trucks), and in bags by own and by third party trucks with 20 tons (6 wheelers) or 30t (10-12 wheelers). The share of road transport amounts to between 80 and 85 %. 15% -20% of the output products are carried by inland water transport vessels, with a load of 200 – 300 tons per vessel of bagged cement for short distance transport and 900-1,000 tons for supply of Dhaka area or beyond. The Bashundhara group deploys also a limited number of cement silo vessels to supply large construction sites like e.g. the project site of the Patma bridge or at Dhaka with a loading capacity of up to 600 tons. Use of railways once access is established in Mongla port is not of core interest because the demanders or the construction sites are usually not or very limited accessible by rail.

Bashundhara group provides also logistics and transport for the other cement clinker mills and cement bagging plants at Mongla port.

Apart from Meghna Cement Mills Ltd/ Bashundhara Cement Mills Ltd there are following cement producers (out of imported clinker plus additives)

- Mongla Cement Mills Ltd
- Dubai-Bangla Cement Mills Ltd
- Holcim (Bangladesh) Ltd.

Mongla Cement Factory is the biggest industrial enterprise of Sena Kalyan Sangstha and has been established near Mongla Port in 1994 on an area of 10.66 acres of land with the

production capacity of 3,90,000 metric tons of cement per year. Dubai Bangladesh Cement Mills Ltd. production capacity of 0.6 million metric tons per year.

Ocean vessel/short see ship via Mongla port- Main sources and origins: Most of the manufacturers import clinker from Vietnam, China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, and Thailand. Some manufacturers also use local limestone collected from Sylhet. Majority portion of imported fly ash is sourced from India; slag is imported from China, India, Japan and Singapore while Gypsum is sourced from China, India, Indonesia and Japan. (Ref: Bangladesh Cement Industry: Resilient; Better Days Await by EBL Securities Ltd.)

LPG Tank and Distributions plants

Orion Gas Ltd. – Mongla Plant
Storage Capacity: 3000 tons (2 nos Spherical storage tank, 1500 metric tons each)
Filling Capacity: 12,000 nos cylinders per day in single shift
Products: Bottled and bulk LP Gas in different pack sizes as:
Domestic/Household Use: 12 kg (Option of 20mm and 22mm valve size)
Commercial Use:35 kg, 45 kg (Option of 20mm, 22mm, Compact and POL Valve Size)
Bulk Supply: Ability to supply bulk LPG by European standard LPG Road Tankers to clients all over Bangladesh. We have a fleet of LPG Road tankers of different size to full fill industrial client's demand.
Satellite Filling Plant: Especially for domestic and industrial cylinders, there would be a number of filling plants near to the major demanding locations to facilitate the distributors at their nearest points and quick delivery.
Plant Location: Plot No. I-20, Mongla Port Industrial Area, Mongla, Bagerhat.
D.LPG Terminal Plant: The Company has its own 8 Acres Industrial Plot with LPG Import Jetty facility and 3000 MT LPG Storage facility. Bulk LPG would be imported by LPG Tanker Vessels from Malaysia, Indonesia, Singapore, UAE, KSA etc.
The Storage Tank from Korea and LPG Filling equipment from Kosan Crisplant, Denmark already installed. Other related accessories from Europe with the latest computer controlled Digital technology which would ensure 100% accurate and safe operations. The plant would be designed, Constructed and commissioned as per the latest version of International Standards. To execute, maintain and operate the plant as per design, there is an efficient management professional team having long experiences at home and abroad. The plant construction, testing and commissioning was completed within December 2016. Marketing started from End of January 2017. Ref: https://orion-group.net/concern/11/32/orion-gas-ltd

Mongla LP Gas Plant
Subsidiary of conglomerates Bashundhara Group. Started 1999 as Bashundhara LPG. The Mongla LPG plant houses 7 gas storage tanks with 5,000 MT capacity. 48 filling posts of the carousel filling system of the plant.

Mongla Cylinder Manufacturing Plant
In 2011, the company saw its establishment of cylinder manufacturing plant in the name of Sundarban Industrial Complex Ltd. situated in Mongla Port Industrial Area on the bank of river

Pussur to meet the growing demand. 40 production stages as well as exclusive lab facilities to ensure safe cylinders in marketplace. Ref: http://www.bashundharalpgas.com/plant-overview

LAUGFS Gas

LAUGFS Gas Bangladesh is part of LAUGFS Gas PLC who is doing LPG Importing, Storing, Bottling, Marketing, Distributing and sales across the Bangladesh. Being the only100% owned international entity, it has entered the local LPG downstream industry in 2001with the brand name of Kleenheat Gas. LAUGFS presently operates LPG import, bottling and distribution facility in Mongla Port with a storage capacity of 2,000 MT and in the process to extend a further 3000 MT by upgrading the storage size of Terminal & setting up satellite filling stations in different parts of the country.

Distribution of LPG for domestic, commercial and industrial customers by a nationwide cylinder distribution network under the brand name of LAUGFS, PETREGAZ & KLEENHEAT. LAUGFS is also pioneer to introduce Autogas to Bangladesh, supplies LPG to service stations across the country. LAUGFS Gas Bangladesh is part of LAUGFS Gas PLC, a fast-expanding energy conglomerate in the region and a part of the diversified multinational LAUGFS Holdings Ltd. With 4,000 employees LAUGFS has a strong presence across 20 industries in the power and energy, retail, industrial, services, leisure and the logistics sectors. LAUGFS has an extensive regional presence in Power and Energy with LPG downstream activities of LAUGFS Gas, logistics services provided by LPG vessels owned and operated by LAUGFS Maritime, renewable energy operations of LAUGFS Power, and petroleum retailing by LAUGFS Petroleum. Ref:https://www.laugfsgas.com.bd/about-us.php

Beximco LPG Mongla Plant

The primary hub for bottling and distribution for Beximco LPG is the Mongla plant, with a production capacity of almost 100,000 MT/year. The plant is located by the Passur River for easy access to the BexPetro-1 ocean tanker. The jetty is used to transfer imported LPG from the ocean tanker to the storage tanks of the Mongla plant, where Smart Cylinders are bottled and Beximco LPG road tankers are filled, ready to transport to LPG industries and auto gas stations. The Mongla plant exists for one purpose – to fulfill the country's energy demands. It provides fuel for the nation for both domestic (cooking oil) and industrial (auto gas and bulk solutions) demands. The plant has a storage capacity of 3000 MT, with an extension for another 3000 MT of storage; this new extension will also provide barge loading facilities to supply the islands in the Bay of Bengal and the rest of the country through the wide river network. Ref: http://bexpetro.com/mongla-plant.php

OMERA PETROLEUM LIMITED

Omera Petroleum Limited (OPL), a subsidiary of MJL Bangladesh Limited, has launched Omera LP Gas in Bangladesh considering the growing demand of customers. OPL has started LPG venture in Bangladesh with utmost commitment to convenience, availability, functionality and safety. To ensure uninterrupted distribution throughout the country, OPL has made robust investment on European standard bottling and storage facilities in Mongla, Ghorashal, Bogra and Mirasharai with consolidated capacity of 100,000 metric ton per year. OPL has a competitive edge in addressing the growing demand as it has the largest bottling and storage complex in Bangladesh. OPL has significantly invested in building three LPG carrying Barge named "M.T Omera Princess", "M.T Omera Glory" and "M.T Omera King" based on Japanese

Navigation & Communication Devices and European Technology. Building of these three barges is itself a revolution in the industry. Ref: http://omeralpg.com/opl/

Annual LPG production and market demand developments

Liquefied Petroleum Gas (LPG) LPG demand is estimated 500000 tones with actual consumption 150000 tones. Demand supply gap is huge (while demand grown 60% in the last 3 years, the consumption has not (only 13% in 5 years). High (87%) import dependence BPC and other private entities supply LPG • Demand is to shoot up with policies of gas tariff increase- CNG price (70 % rise), new gas connection stopped plan to convert consumers (2.3 million NG users) to LPG, environmental awareness will increase demand for LPG more coverage is uneven and low ranging 10-30% across districts. Supply Infrastructure is inadequate and problematic. LPG is costlier than its alternatives (LPG USD 36/MMBTU, while domestic gas (1-3 USD, HSD is 24/MMBTU, KEROSENE 25/MMBTU). Not affordable for many particularly in rural areas (bio-mass based fuel popular). Need to augment supply and distribution infrastructure. Clean energy – lead free and low in sulphur, less frequent refilling needed than CNG for cars.
Source: ADB(2016), Ref: http://www.bids.org.bd/uploads/events/D-2_S-4A_MM.pdf

Bangladesh LPG market now stands approximately at 820,000 MT per year in 2018/2019 and forecasted to increase 2.0 million MT by 2025 and 3.0 million MT by 2030. People's per capita income going high, life style changing, and awareness about clean cooking fuel will push up the numbers targeted so far. It is a huge support to the government plan to provide clean cooking fuel access to all within the shortest possible time and conveniently as well. Apart from this, use of LPG as Autogas is another great aspect of LPG usage variation in Bangladesh.
Ref: http://ep-bd.com/view/details/article/MzIwNA%3D%3D/title?q=sustainability+of+lpg+industry+in+bangladesh

Mongla Port related Industry areas

Mongla port provides large areas and possesses about further land designated for port industry developments along the Pussur river between the MPA permanent jetty /common user port facility of Mongla and quarter of the Bangladesh Navy upstream of the permanent jetty. Behind the Navy area there is land allocated for facilities of the Bangladesh Fishery cooperation.

Behind the port and the port industry areas there is land allocated for the establishment and further development of port railway facilities and, further inland, for the development of free zone, free economic zones and re-export processing industries (BZA, BEZA, EZA) designated for allocation and promotion of export related manufacturing and processing plants adjacent to Mongla port land.

Further upstream of the present fisher cooperative assets upstream of the Navy area there are - in master planning terms for years beyond e.g. 2040 - further areas available for port and port related industry development purposes between the todays fishery cooperative plot and the Rampal power plant development area along the Pussur river, and between the river sections and the port infrastructure accesses (railway line and main road).

For the current land use it is referred to Appendix B.

The premises of all port related, i.e. Pussur river or waterborne supply chain depending, industries at the port of Mongla are established on MPA land and are leased by the respective enterprises or by their parent shareholders or real estate providers on long term contract bases

(30 years, regular term). The contracts are renewable subject to conditions and in order to allow for implementation of port development needs.

The below table summarizes the allocation of port and port industry areas to tenants of Mongla Port Authority for their respective businesses.

Sl. No.	Name of the Industries	Allotted Land (1 acre = 4047 m^2) (1 hectare [ha] = 10000 m^2 = 2.47 acre)	Date of allotment, contract term	Current Situation	Term of Commitment or for modification
1	Mongla Cement Factory	10.66 Acre 43,141.02 m^2 4.31 ha (rounded)	15-05-1990 30 years lease	Cement factory has been set up, production is running	Renewal or modification until 05/2020
2	Meghna Cement Mills Ltd.	9.83 Acre 39,782.01 m^2 3.98 ha (rounded)	06-10-1990 30 years lease	Cement factory has been set up, production is running	Renewal or modification until 10/2020
3	Bashundhara Industrial Complex Ltd.	10.00 Acre 40,470.00 m^2 4.05 ha (rounded)	22-03-1999 30 years lease	Cement factory has been set up, production under significant expansion	Renewal in / changes not before 03/2029
4	Dubai-Bangladesh Cement Mills Ltd.	7.00 Acre 28,329.00 m^2 2.83 ha (rounded)	17-11-1997 30 years lease	Cement factory has been set up, production is running	Renewal in / changes not before 11/2027
5	Saiham Cement Industries Ltd.	i. 9.82 Acre ii. 0.79 Acre 10.61 Acre in total 42,938.67 m^2 4.29 ha (rounded)	13-01-1999 23-07-2000 30 years lease	Cement factory has been set up on the allotted land and is running	Renewal in / changes not before 02/2029
6	Bashundhara LPG Ltd.	10.00 Acre 40,470.00 m^2 4.05 ha (rounded)	27-10-1997 30 years lease	LPG storage, bottling and distribution plant established. Also, energy supply for adjacent cement plant (see nos.3)	Renewal in / changes not before 10/2027
7	Laugfs Gas Bangladesh Ltd.	i. 10.00 Acre ii. 0.47 Acre 10.47 Acre in total 42,372.09 m^2 4.24 ha (rounded)	27-10-1997 17-11-1999 30 years lease	LPG storage, bottling and distribution plant, running	Renewal in / changes not before 10/2027

Sl. No.	Name of the Industries	Allotted Land (1 acre = 4047 m²) (1 hectare [ha] = 10000 m² = 2.47 acre)	Date of allotment, contract term	Current Situation	Term of Commitment or for modification
8	Telidata Marine Solution Ltd.	i. 5.80 Acre ii. 0.28 Acre 6.08 Acre in total 24,605.76 m² 2.46 ha (rounded)	30-11-1998 03-03-2016 30 years lease	Tank farm for mineral oil products and bunkering, running	Renewal in / changes not before 12/2028
9	Omera Petroleum Ltd.	i. 4.35 Acre ii. 8.93 Acre iii. 7.00 Acre iv. 0.45 Acre 20.73 Acre in total 83,894.31 m² 8.39 ha (rounded)	15-11-2002 26-10-1997 26-10-1997 01-07-2014 30 years lease	LPG storage, bottling and distribution plant, running and under expansion	Renewal in / changes not before 11/2032 (see area i.)
10	Senakalyan Sangstha	10.00 Acre 40,470.00 m² 4.05 ha (rounded)	29-11-1999 30 years lease	LPG storage, bottling and distribution plant, running	Renewal or modification not before 11/2029
11	Orion Gas Ltd.	i. 7.97 Acre ii. 0.32 Acre 8.29 Acre in total 33,549.63 m² 3.36 ha (rounded)	20-03-2003 14-12-2003 30 years lease	LPG storage, bottling and distribution plant, running	Renewal in / changes not before 03/2033
12	Sunsing Edible Oil Ltd.	i. 8.55 Acre ii. 0.95 Acre iii. 0.32 Acre 9.82 Acre in total 39,741.54 m² 3.97 ha (rounded)	01-12-1999 14-12-2013 14-12-2003 30 years lease	Edible oil factories have been set up and production is running	Renewal in / changes not before 12/2029 12/2043 (areas i./ ii.)
13	Rupsha Tank Terminals & Refinery Ltd.	i. 7.25 Acre ii. 0.59 Acre 7.84 Acre in total 31,728.48 m² 3.17 ha (rounded)	23-11-2002 11-11-2003 30 years lease	Tank farm for mineral oil products and LPG, running	Renewal in / changes not before 11/2032

Sl. No.	Name of the Industries	Allotted Land (1 acre = 4047 m^2) (1 hectare [ha] = 10000 m^2 = 2.47 acre)	Date of allotment, contract term	Current Situation	Term of Commitment or for modification
14	Petromax Refinery Ltd.	7.115 Acre 28,794.40 m^2 2.88 ha (rounded)	30-12-1998 30 years lease	Condensate fractionation plant has been established and production is running	Renewal in / changes not before 01/2029
15	Sundarban Industrial Complex Ltd.	12.00 Acre 39,741.54 m^2 3.97 ha (rounded)	03-06-2001 30 years lease	LPG cylinder production plant has been established and production is running	Renewal in / changes not before 06/2031
16	Dubai-Bangladesh Bag Factory Ltd.	7.00 Acre 28,329.00 m^2 2.83 ha (rounded)	17-11-1997 30 years lease	Cement bag factory has been established and production is running	Renewal in / changes not before 11/2027
17	Bangladesh Petroleum Corp. Ltd	25.00 Acre 101,175.00 m^2 10.12 ha (rounded)	11-09-2002 30 years lease	Tank farm for petroleum oil has been set up and is awaiting production	Renewal in / changes not before 09/2032. Or to be re-negotiated if start of business fails
18	United Refinery & Bulk Storage Ltd.	12.915 Acre 52,267.00 m^2 5.23 ha (rounded)	30-12-1991 30 years lease	Tank farm for petroleum products has been established. Edible oil factory has been set up and is waiting to start production	Renewal or re-negotiations from end of 2021 onwards

Sl. No.	Name of the Industries	Allotted Land (1 acre = 4047 m2) (1 hectare [ha] = 10000 m² = 2.47 acre)	Date of allotment, contract term	Current Situation	Term of Commitment or for modification
19	Oriental Bitumen Industrial Ltd.	i. 2.00 Acre ii. 0.32 Acre iii. 0.08 Acre 2.40 Acre in total 9,712.80 m² 0.97 ha (rounded)	08-06-2005 14-12-2005 2016 30 years lease	LPG storage, bottling and distribution plant established and is awaiting production	Renewal in / changes not before 05/2035. Or to be re-negotiated if start of business fails
20	Baraka Ltd.	13.14 Acre	2006 30 years lease	The leaser could not establish their factory. MPA has cancelled their allotment on 07-05-2019. The leaser has applied in the High-Court regarding the cancellation of lease contract as per MPA's order.	The contract is cancelled. Depending of decision of High court the land is available for-re-allocation from the planning perspective regarding kind of use and/or the operator

Appendix J – Khalispur Port/Roosevelt Jetty Details

The Khalispur port land area of the Mongla Port Authority land at Khulna amounts for 101.65 acres in total, of which 4.56 acres are eroded by the Bhairab River (synonymously used name of the Pussur River upstream of Mongla). The overall available area of 97.07 acres is in use for numerous purposes such us port operations, jetty hinterland, handling areas, stores, warehouses, go downs/open sheds and covered sheds, port health area, roads, garages, gate, port security and accesses control (around 28.33 acres in total) but also 68.74 (around 69) acres of land in sue for offices, bank, port club, guest- and resthouses, officers residences, tennis courts, school and play grounds, mosque, sanity, ponds and staff quarters, and vacant land.

Roosevelt jetty, the cargo handling and port operations facility at the Khalishpur port area, uses a land area of 7.72 acres in total, plus the sheds or go downs, warehouses and open storage areas as well as loading and truck and equipment parking zones in the hinterland.
95% of the port throughput is carried by road from and to the hinterland. Railway with an estimated share of 5%. Cargoes handled at Roosevelt jetty are fertilizers and food grain (inbound) and in comparatively limited quantities rocks, fly ash, gypsum and limestone (outbound) as shown by the below table.

Roosevelt jetty serves for inland water transport and provides 17 berths and moorings facilities for so –called protocol vessels, which are self-propelled inland navigation ships with a max. permissible draft of around 3.5m – 4 meters, a length of around 60 – 70 m, and a loading capacity of between 700 and 1 000 tons of cargoes.

The most important type of handling, and hence operations at the Roosevelt jetty is bagging of fertilizers or grain onboard the ships, carried the bags to sheds, storage areas or warehouses, and loading of truck by manpower (up to 20 – 35 tons per rigid truck, e.g. 400 - 700 bags 50 kg each). Railcars carry up to 50 tons while fully load if not overladen truck are transporting up to 35 tons in practice when leaving the inland port facilities at Khulna.

The throughput statistics for Roosevelt Jetty are provided below, including an assessment to attribute the commodities by type of handling.

Mongla Port - Roosevelt jetty cargo received by commodities and by prevailing type of handling

Unit: metric tons

Commodity / Prevailing type of handling		Year; Financial years transferred into calendar years as per e.g. 2004/2005 depicted by 2004, etc.														
ID	Commodity	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
I.	**Food Grain**	**35.883**	**12.629**	**19.806**	**29.562**	**65.974**	**60.562**	**124.222**	**73.777**	**67.174**	**100.886**	**28.117**	**35.615**	**21.789**	**84.435**	**11.905**
	Wheat	26.553	12.629	19.806	8.995	44.667	54.651	50.638	44.604	44.010	83.900	22.342	34.400	16.930	19.154	9.799
	Rice	9.330	0	0	20.567	21.307	5.911	73.584	29.173	23.164	16.986	5.775	1.215	4.859	65.281	2.106
II.	**Cement, cement industry and production**	**42.396**	**19.207**	**0**	**2.316**	**9.013**	**28.344**	**3.760**	**534**	**1.705**	**1.018**	**0**	**0**	**600**	**1.885**	**0**
	Cement	4.850	0	0	0	0	0	0	0	0	0	0	0	600	0	0
	Clinker	3.315	0	0	0	122	0	0	0	0	0	0	0	0	0	0
	Flyash	4.291	4.691	0	2.316	8.891	28.344	3.760	534	1.705	1.018	0	0	0	1.885	0
	Gypsum	29.940	14.516	0	0	0	0	0	0	0	0	0	0	0	0	0
III.	**Construction material**	**0**	**0**	**0**	**0**	**1.533**	**0**	**0**	**0**	**0**	**16**	**0**	**2.274**	**26.846**	**40.599**	**2.402**
	Slag	0	0	0	0	1.533	0	0	0	0	16	0	0	0	0	0
	Stone	0	0	0	0	0	0	0	0	0	0	0	2.274	26.846	40.599	2.402
IV.	**Fertililzers**	**0**	**0**	**1.064**	**5.642**	**28.695**	**31.410**	**112.235**	**178.472**	**240.769**	**222.053**	**305.294**	**299.071**	**291.055**	**278.131**	**282.966**
V.	**Other products**	**46.124**	**15.091**	**14.684**	**7.755**	**5.222**	**13.384**	**2.350**	**217**	**3.488**	**644**	**1.304**	**161**	**109**	**14**	**246**
	Machinery	20	0	0	0	0	0	1.742	20	0	0	161	0	2	0	235
	Soyabin	530	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sugar	29.655	8.843	5.288	4.976	0	0	0	0	3.481	0	0	0	0	0	0
	Jute	0	0	0	0	0	0	0	0	0	473	1.098	106	88	0	0
	General cargo n.e.s.	15.919	6.248	9.396	2.779	5.222	13.384	608	197	7	171	45	55	19	14	11
I.-V.	**All Commodities**	**124.403**	**46.927**	**35.554**	**45.275**	**110.437**	**133.700**	**242.567**	**253.000**	**313.136**	**324.617**	**334.715**	**337.121**	**340.399**	**405.064**	**297.519**
	Prevailing Type of handling	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
1	**Dry Bulk Cargo**	**37.546**	**19.207**	**1.064**	**7.958**	**39.241**	**59.754**	**115.995**	**179.006**	**242.474**	**223.087**	**305.294**	**301.345**	**317.901**	**320.615**	**285.368**
1.1.	Grap, conveyer, manually baged at jetty	33.255	14.516	1.064	5.642	30.350	31.410	112.235	178.472	240.769	222.069	305.294	301.345	317.901	318.730	285.368
	Coal															
	Cement clinker	3.315	0	0	0	122	0	0	0	0	0	0	0	0	0	0
	Gypsum	29.940	14.516	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sand, Stones, others	0	0	0	0	1.533	0	0	0	0	16	0	2.274	26.846	40.599	2.402
	Fertizers	0	0	1.064	5.642	28.695	31.410	112.235	178.472	240.769	222.053	305.294	299.071	291.055	278.131	282.966
1.2	Pneumatic handling	4.291	4.691	0	2.316	8.891	28.344	3.760	534	1.705	1.018	0	0	0	1.885	0
	Fertizers															
	Grain															
	Ashes	4.291	4.691	0	2.316	8.891	28.344	3.760	534	1.705	1.018	0	0	0	1.885	0
2	**Liquid Bulk**															
	Crude Oil															
	Mineral oil fuel products															
	Liquid Gas LPG															
	Liquid Gas LNG															
3	**General Cargoes**	**70.938**	**21.472**	**25.094**	**34.538**	**65.974**	**60.562**	**125.964**	**73.797**	**70.655**	**101.359**	**29.376**	**35.721**	**22.479**	**84.435**	**12.140**
3.1	Break Bulk (eg.g. iron/steel, paper, wood															
3.2	Cars and vehicles															
3.3	Heavy lifts, project cargoes	20	0	0	0	0	0	1.742	20	0	0	161	0	2	0	235
3.4	Bags or bails, palletized or not	70.918	21.472	25.094	34.538	65.974	60.562	124.222	73.777	70.655	101.359	29.215	35.721	22.477	84.435	11.905
3.5	Container affine cargoes	15.919	6.248	9.396	2.779	5.222	13.384	608	197	7	171	45	55	19	14	11
	Chemical products															
	Fish, meat, fruits, other perishables															
	General cargoes, n.e.s	15.919	6.248	9.396	2.779	5.222	13.384	608	197	7	171	45	55	19	14	11
1-3	**Total Cargo Handled**	**124.403**	**46.927**	**35.554**	**45.275**	**110.437**	**133.700**	**242.567**	**253.000**	**313.136**	**324.617**	**334.715**	**337.121**	**340.399**	**405.064**	**297.519**

Appendix K – Details on Port Cargo Throughput Forecast

Summary table of the demand/consumption forecasts (in metric tons except for vehicles)

Year	Cement	Coal	Fertilizer	LPG	Rice	Wheat	Soy bean	Fish and sea food	Sugar	Cars/ Jeep/ Pick Up cab	Busses	Trucks/ Commercial vehicles
2000		471,429			25,537,422	2,866,000		1,556,149	900,000			
2001		500,000		28,500	24,460,630	2,950,000	10,000	1,671,640	935,000			
2002		521,429	1,556,839	40,700	26,129,798	3,000,000	1,000	1,797,728	880,000			
2003		498,571	1,318,676	48,600	27,402,366	3,050,000	60,000	1,896,518	935,000			
2004		500,000	1,389,777	60,800	26,591,087	3,000,000	123,000	1,990,413	980,000			
2005		687,143	1,564,390	51,800	29,458,621	2,950,000	127,000	2,092,484	1,030,000			
2006		672,857	1,522,338	49,800	29,560,952	2,800,000	165,000	2,205,416	1,100,000			
2007		882,857	1,441,357	49,800	29,397,298	2,800,000	161,000	2,293,979	1,300,000			
2008		915,714	1,561,100	39,600	32,030,242	3,300,000	150,000	2,383,905	1,330,000			
2009		1,105,714	1,472,297	52,900	31,035,281	3,700,000	127,000	2,708,364	1,538,000			
2010		1,155,714	1,659,202	65,000	32,375,748	4,100,000	163,000	2,854,109	1,464,000			
2011		1,041,429	1,963,760	78,000	35,009,736	4,000,000	333,000	2,937,708	1,646,000	25,619	6,088	17,313
2012		1,288,571	1,997,600	94,402	33,862,013	4,000,000	495,000	2,935,592	1,765,000	18,590	4,732	10,909
2013	15,000,000	1,411,429	1,954,820	139,665	34,646,605	4,400,000	668,000	2,934,609	1,637,000	18,390	3,792	12,642
2014	16,000,000	1,322,857	2,141,340	97,578	35,384,204	4,900,000	892,000	3,437,332	2,173,000	26,497	6,057	16,778
2015	16,000,000	3,242,857	2,311,680	250,000	35,573,987	5,600,000	1,109,000	3,668,472	2,060,000	35,008	7,938	15,674

2016	16,000,000	2,430,000	2,246,980	400,000	34,600,524	7,000,000	1,109,000	3,936,044	2,308,000	36,611	10,109	21,651
2017	17,000,000	2,718,571	2,410,789	650,000	34,286,744	7,300,000	1,260,000	4,229,654	2,232,000	40,911	9,827	28,957
2018	18,000,000	3,045,714	2,546,779	725,000	39,840,211	7,000,000	1,659,000	4,569,912	2,646,000	36,542	7,283	23,424
2019	18,410,754	3,318,268	2,687,743	800,000	41,425,989	7,100,000	1,834,000	4,913,889	2,560,000	38,670	7,390	25,153
2020	19,113,993	3,669,452	2,836,928	752,763	43,058,745	7,242,184	1,944,459	5,284,613	2,585,000	41,022	7,482	27,014
2021	19,898,845	4,041,884	2,999,383	846,687	44,876,605	7,675,684	2,179,108	5,682,452	3,284,583	43,368	7,601	29,013
2022	20,664,894	4,454,198	3,168,061	952,228	46,661,874	8,128,756	2,442,205	6,110,559	3,558,808	46,124	7,675	31,160
2023	21,476,972	4,898,730	3,348,418	1,066,226	48,556,085	8,613,621	2,726,308	6,570,461	3,857,530	49,072	7,748	33,466
2024	22,338,630	5,377,843	3,541,328	1,189,298	50,567,614	9,132,655	3,032,950	7,064,509	4,182,698	52,225	7,819	35,943
2025	23,253,690	5,894,070	3,747,732	1,322,106	52,705,477	9,688,413	3,363,776	7,595,228	4,536,392	55,599	7,888	38,602
2026	24,096,141	6,365,159	3,936,893	1,443,190	54,672,765	10,197,509	3,665,437	8,080,429	4,884,411	58,603	7,955	41,034
2027	24,982,700	6,867,364	4,137,295	1,572,446	56,744,501	10,737,218	3,987,396	8,596,295	5,257,632	61,789	8,020	43,619
2028	25,916,284	7,402,623	4,349,657	1,710,382	58,927,570	11,309,494	4,330,910	9,144,755	5,657,604	65,168	8,084	46,367
2029	26,900,003	7,972,994	4,574,742	1,857,534	61,229,301	11,916,411	4,697,317	9,727,862	6,085,952	68,754	8,145	49,289
2030	27,881,974	8,589,510	4,809,203	2,017,825	63,537,532	12,551,196	5,095,994	10,348,391	6,439,263	72,897	8,166	52,394
2031	28,870,737	9,123,115	5,027,215	2,154,453	65,842,152	13,136,861	5,436,572	10,902,120	6,981,820	75,877	8,261	55,171
2032	29,846,399	9,695,498	5,251,843	2,302,299	68,126,533	13,742,910	5,804,644	11,485,901	7,443,846	79,370	8,316	58,095
2033	30,866,517	10,299,381	5,487,828	2,458,422	70,516,217	14,379,899	6,193,270	12,100,702	7,931,529	83,048	8,369	61,174
2034	31,933,585	10,936,410	5,735,785	2,623,251	73,017,088	15,049,492	6,603,519	12,748,163	8,445,968	86,923	8,419	64,416
2035	33,050,236	11,608,318	5,996,357	2,797,239	75,635,350	15,753,438	7,036,516	13,430,015	8,988,293	91,004	8,468	67,830
2036	34,032,171	12,194,768	6,224,581	2,948,987	77,936,750	16,369,759	7,414,205	14,026,020	9,490,438	94,489	8,515	70,815
2037	35,051,243	12,807,994	6,462,390	3,107,781	80,326,222	17,012,210	7,809,387	14,648,315	10,013,288	98,135	8,559	73,930
2038	36,109,212	13,449,154	6,710,214	3,273,922	82,807,913	17,681,963	8,222,814	15,298,055	10,557,369	101,950	8,601	77,183

2039	37,207,918	14,119,457	6,968,505	3,447,726	85,386,164	18,380,239	8,655,270	15,976,445	11,123,201	105,943	8,641	80,579
2040	38,294,940	14,828,873	7,233,633	3,632,821	87,947,381	19,099,474	9,115,407	16,685,332	11,549,006	110,599	8,642	84,125
2050	49,742,090	19,261,530	7,690,208	3,862,119	93,498,480	24,046,669	11,403,725	17,738,483	13,935,207	137,598	8,910	104,661
2060	47,361,574	18,339,727	7,824,561	3,929,593	95,131,951	31,757,730	15,716,308	18,048,384	18,171,656	180,990	8,988	137,666
2100	37,907,905	14,679,002	6,262,729	3,479,195	76,143,013	72,899,649	44,656,258	14,445,813	46,428,943	413,714	8,041	314,682

Summary table of the population, GDP and GDP per capita forecasts.

	Bangladesh			India			Bhutan		
Year	Population	GDP (constant 2010 USD)	GDP per capita (constant 2010 USD)	Population	GDP (constant 2010 USD)	GDP per capita (constant 2010 USD)	Population	GDP (constant 2010 USD)	GDP per capita (constant 2010 USD)
2000	127,657,854	67,013,463,193	525	1,056,575,549	873,357,345,618	827	591,021	688,733,275	1,165
2001	130,088,702	70,415,929,567	541	1,075,000,085	915,487,809,335	852	603,640	745,235,395	1,235
2002	132,478,086	73,115,059,421	552	1,093,317,189	950,312,739,672	869	616,018	825,183,061	1,340
2003	134,791,603	76,580,396,942	568	1,111,523,144	1,025,010,946,218	922	627,839	888,427,847	1,415
2004	136,986,432	80,592,852,042	588	1,129,623,456	1,106,221,983,522	979	638,815	940,813,179	1,473
2005	139,035,505	85,860,356,478	618	1,147,609,927	1,193,872,693,289	1,040	648,739	1,007,823,159	1,554
2006	140,921,167	91,588,877,879	650	1,165,486,291	1,290,107,534,501	1,107	657,410	1,076,852,656	1,638
2007	142,660,376	98,053,769,823	687	1,183,209,472	1,388,940,404,163	1,174	664,876	1,269,887,377	1,910
2008	144,304,167	103,950,517,391	720	1,200,669,765	1,431,812,818,925	1,193	671,613	1,330,440,106	1,981
2009	145,924,797	109,194,950,718	748	1,217,726,215	1,544,380,258,529	1,268	678,323	1,419,010,481	2,092
2010	147,575,430	115,279,077,465	781	1,234,281,170	1,675,615,312,693	1,358	685,503	1,585,472,534	2,313
2011	149,273,778	122,731,159,566	822	1,250,288,729	1,763,439,576,431	1,410	693,298	1,710,580,807	2,467
2012	151,007,807	130,734,992,459	866	1,265,782,790	1,859,659,673,960	1,469	701,583	1,797,336,501	2,562
2013	152,764,676	138,596,885,516	907	1,280,846,129	1,978,419,519,435	1,545	710,238	1,835,844,374	2,585
2014	154,520,167	146,997,325,017	951	1,295,604,184	2,125,024,908,809	1,640	719,056	1,941,321,989	2,700
2015	156,256,276	156,629,549,345	1,002	1,310,152,403	2,294,947,293,526	1,752	727,876	2,070,314,376	2,844
2016	157,970,840	167,771,375,851	1,062	1,324,509,589	2,482,433,620,958	1,874	736,709	2,236,397,091	3,036
2017	159,670,593	179,992,151,722	1,127	1,338,658,835	2,660,371,703,953	1,987	745,568	2,339,922,180	3,138
2018	161,356,039	194,146,210,563	1,203	1,352,617,328	2,846,127,730,148	2,104	734,374	2,393,521,565	3,259
2019	163,731,550	208,474,554,691	1,273	1,366,417,754	2,603,618,545,157	1,905	741,672	2,558,974,416	3,450
2020	165,764,000	223,901,671,738	1,351	1,366,418,000	2,712,139,645,385	1,985	748,931	2,691,794,155	3,594

2021	168,399,251	240,470,395,447	1,428	1,380,004,000	2,823,003,361,203	2,046	756,131	2,828,378,392	3,741
2022	170,053,388	258,265,204,710	1,519	1,393,409,000	2,936,209,692,609	2,107	763,246	2,968,732,524	3,890
2023	171,666,868	277,376,829,859	1,616	1,406,632,000	3,051,758,639,602	2,170	770,275	3,112,861,943	4,041
2024	173,238,918	297,902,715,268	1,720	1,419,656,000	3,169,650,202,181	2,233	777,223	3,260,772,046	4,195
2025	174,768,804	319,947,516,198	1,831	1,432,456,000	3,289,884,380,349	2,297	784,044	3,412,468,226	4,352
2026	176,255,842	340,104,209,719	1,930	1,445,012,000	3,412,461,174,105	2,362	790,716	3,567,955,879	4,512
2027	177,699,388	361,530,774,931	2,035	1,457,309,000	3,537,380,583,448	2,427	797,264	3,727,240,399	4,675
2028	179,098,843	384,307,213,751	2,146	1,469,339,000	3,664,642,608,377	2,494	798,506	3,890,327,181	4,872
2029	180,453,652	408,518,568,218	2,264	1,481,083,000	3,794,247,248,895	2,562	804,906	4,057,221,619	5,041
2030	180,919,000	434,255,238,015	2,400	1,492,524,000	3,926,194,505,001	2,631	814,089	4,227,929,109	5,193
2031	183,027,336	457,270,765,630	2,498	1,503,642,000	4,060,484,376,695	2,700	817,603	4,402,455,045	5,385
2032	184,245,321	481,506,116,209	2,613	1,514,427,000	4,197,116,863,974	2,771	826,956	4,580,804,821	5,539
2033	185,416,883	507,025,940,368	2,735	1,524,862,000	4,336,091,966,842	2,844	830,176	4,762,983,834	5,737
2034	186,541,686	533,898,315,207	2,862	1,534,914,000	4,477,409,685,298	2,917	836,419	4,948,997,476	5,917
2035	187,619,440	562,194,925,913	2,996	1,544,544,000	4,621,070,019,340	2,992	842,637	5,138,851,144	6,099
2036	188,649,898	586,931,502,653	3,111	1,553,724,000	4,767,072,968,971	3,068	848,830	5,332,550,231	6,282
2037	189,632,859	612,756,488,770	3,231	1,562,439,000	4,915,418,534,190	3,146	851,177	5,530,100,132	6,497
2038	190,568,164	639,717,774,276	3,357	1,570,690,000	5,066,106,714,996	3,225	861,150	5,731,506,243	6,656
2039	191,455,699	667,865,356,344	3,488	1,578,478,000	5,219,137,511,388	3,306	867,281	5,936,773,958	6,845
2040	191,464,000	697,251,432,023	3,642	1,585,809,000	5,374,510,923,369	3,389	861,437	6,145,908,671	7,134
2050	197,414,000	867,459,205,733	4,394	1,636,157,000	7,057,088,900,492	4,313	894,279	8,451,127,570	9,450
2060	199,131,000	1,141,014,257,939	5,730	1,651,456,337	8,973,928,436,371	5,434	994,627	11,148,980,533	11,209
2100	178,152,000	2,608,177,746,709	14,640	1,653,830,895	18,983,902,167,425	11,479	1,285,612	21,290,726,944	16,561

The following set of table shows the development of the maritime trade via the ports of Chittagong and Mongla 2006 – 2018 and the forecast projections until 2040 and as well as trend projections for 2050. 2060, 2070 and for the extension of the trends until the Year 2100, separately for import and export. The detailed forecasts are summarized by prevailing cargo handling types. The Graphs show the corresponding development lines.

Maritime Trade via Bangladesh Ports 2006 - 2018, Forecast until 2040 and projections until 2050/2060/2070 and 2100

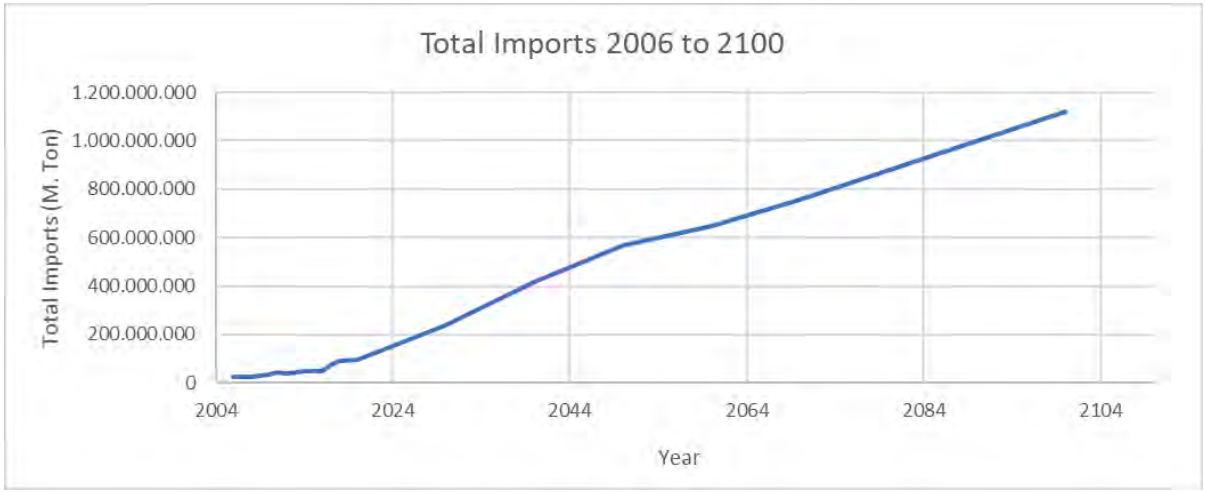
Unit: Metric tons

Commodities	Maritime Imports 2006 - 2018 in metric tons													Projected Martime Imports 2020 - 2100 in metric tons						
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2020	2030	2040	2050	2060	2070	2100
Dry Bulk Cargo	13780127	9971317	14577738	11717411	16297285	20445134	17146049	18437283	20834157	25436677	14303082	31682140	41606406	45561337	120930249	217107262	318151481	310505974	319520229	320243880
Grap or Conveyer	6777638	6415837	7400124	7012129	9549672	12427776	12214994	13410260	15582291	18927257	6477737	26159589	29676373	36032320	102022581	186448386	279046399	257666242	250890675	192742376
Coal	2005	511	309	0	0	145	20000	40714	336325	2434868	3490337	3132280	4301338	4466850	12940799	23791088	31517997	29875687	29235683	23687133
Cement clinker	6753933	6415326	7368982	7004929	9482842	12366791	11889673	13043403	14816866	15781783	2025269	22006442	24182583	30212436	85615341	156498210	238270906	219249828	213340260	162679467
Gypsum	11200	0	0	0	23800	10740	57550	40500	28450	103692	135225	227308	202410	276967	850818	1587025	2437757	2239160	2178052	1654475
Lime stone	0	0	0	0	0	0	0	59935	46700	171600	236756	222709	247783	195497	285175	391678	508759	484411	474431	387720
Slag, sand, gravel etc.	10500	0	30833	7200	43030	50100	247771	225708	353950	435314	590150	570850	742259	880570	2330449	4180385	6310981	5817155	5662249	4333581
Grap, rain protected	1447472	1545730	1518762	1431913	2902273	3013114	2813716	3313163	2984371	3307151	3205646	3792674	4662950	4943598	9863558	16031243	20465150	27829557	36322749	68234590
Fertilizers	1293553	1436346	1507087	1396018	2605272	2911724	2776616	2809915	2984371	3170451	2862136	3225718	3884772	3951396	6698466	10075317	10711255	10898386	10673850	8723000
C.Bone/B. Griest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salt	153919	109384	11675	35895	297001	101390	37100	503248	0	136700	343510	566956	778178	992202	3165092	5955926	9753895	16931171	25648899	59511590
Protected or pneumatic handling	5555017	2009750	5658852	3273369	3845340	5004244	2117339	1713860	2267495	3202269	4619699	1729877	7267083	4585419	9044111	14627633	18639932	25010176	32306805	59266913
Grain	1776766	1998034	2119107	3245025	3841580	5004244	2117339	1712842	2212988	3085086	4405077	1401099	6914734	4009230	6948268	10573355	13312093	17580891	22461651	40356812
Soya beans, oil seeds	0	0	0	0	0	0	0	0	0	0	0	24914	0	0	0	0	0	0	0	0	0
Fly Ash	3778251	11716	3539745	28344	3760	0	0	1018	54507	117183	214622	303864	352349	576189	2095843	4054278	5327839	7429285	9845154	18910101
Liquid Bulk	1073531	4941484	1149004	1127967	1405957	1377012	7098691	7113223	7491628	2730448	8559035	9673338	11086194	11328860	23771618	39435826	49584696	65996212	84696512	154402842
Oil and fuel	1058390	4927427	1130810	1104247	1373681	1335703	7037547	7047578	7412075	2565462	8250036	9137709	10394407	10285803	19949223	32030986	39850150	52416976	66697065	119816900
Crude Oil	0	0	0	1838	0	7997	29300	61370	124981	44828	138265	113621	96942	131898	255816	410744	511012	672160	855279	1536452
Mineral Oil fuel products	0	3727819	0	0	0	0	5381533	5371990	5576296	616314	5655407	7027510	7788517	7372628	14299145	22959076	28563674	37571287	47806927	85882007
Edible Oil	1058390	1199608	1130810	1102409	1373681	1327706	1626714	1614218	1710798	1904320	2456364	1996578	2508948	2781277	5394262	8661166	10775464	14173529	18034859	32398441
Liquid gas	15141	14057	18194	23720	32276	41309	61144	65645	79553	164986	308999	535629	691787	1043057	3822396	7404840	9734546	13579236	17999447	34585942
Liquid Gas LPG	15141	14057	18194	23720	32276	41309	61144	65645	79553	164986	308999	535629	691787	1043057	3822396	7404840	9734546	13579236	17999447	34585942
Liquid Gas LNG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
General Cargo	8978479	9441801	10549029	15336831	17639846	20574431	14886413	16163924	18063834	20930945	25584952	30131293	36587725	40008281	92179245	158277164	201147013	270860817	350495265	647890731
Break Bulk (eg.g. iron/steel, paper, wood)	0	0	0	45910	0	0	0	0	3274	0	26596	557	0	38692	89104	152972	194395	261753	338695	626035
Cars and vehicles	0	0	317	3847	33115	13650	6173	11062	15913	21077	24291	32587	24534	28705	58237	94389	119194	159399	205260	376339
Heavy lifts, project cargo, machinery	0	1292	3985	0	23012	13391	18357	61171	68053	72403	82577	129928	183041	232678	734244	1378244	1796793	2485270	3275686	6238558
Bags or bails, palletized or not	501334	861008	813346	955835	1356881	1370679	1863563	1474516	2044215	1989353	2095344	2134908	2468556	3143355	7092260	12088927	15328901	20591706	26600426	49031644
Containerization affine cargoes	8477145	8579501	9731381	14331239	16226838	19176711	12998320	14617175	15932379	18848112	23356144	27833313	33911594	36564851	84205400	144562632	183707731	247362689	320075198	591618155
Chemical products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish, meat, fruits, other perishables	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
General cargoes, n.e.s	8477145	8579501	9731381	14331239	16226838	19176711	12998320	14617175	15932379	18848112	23356144	27833313	33911594	36564851	84205400	144562632	183707731	247362689	320075198	591618155
Total	**23832137**	**24354602**	**26275771**	**28182209**	**35343088**	**42396577**	**39131153**	**41714430**	**46389619**	**49098070**	**48447069**	**71486771**	**89280325**	**96898478**	**236881112**	**414820252**	**568883190**	**647363003**	**754712006**	**1122537453**

Maritime Trade via Bangladesh Ports 2006 - 2018, Forecast until 2040 and projections until 2050/2060/2070 and 2100

Unit: Metric tons

Commodities	Maritime Exports 2006 - 2018 in metric tons													Projected Martime Exports 2020 - 2100 in metric tons						
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2020	2030	2040	2050	2060	2070	2100
Dry Bulk Cargo	289957	284414	157139	240037	333299	124408	50407	13083	290	305	229	31000	0	316879	536998	807405	858429	873468	855497	699152
Grap or Conveyer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cement clinker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gypsum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lime stone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slag, sand, gravel etc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grap, rain protected	289957	284414	157139	240037	333299	124408	50407	13083	290	305	229	31000	0	316879	536998	807405	858429	873468	855497	699152
Fertilizers	289660	284414	157139	239702	332770	123374	50128	12658	80	0	229	31000	0	316112	535877	806025	856900	871871	853908	697840
C.Bone/B. Griest	297	0	0	335	529	1034	279	425	210	305	0	0	0	768	1121	1380	1528	1597	1589	1312
Salt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Protected or pneumatic handling	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soya beans, oil seeds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fly Ash	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid Bulk	0	87471	143292	187057	332770	168641	79752	0	0	77052	53306	105004	18500	229402	444923	714380	888769	1169045	1487530	2672250
Oil and fuel	0	87471	143292	187057	332770	168641	79752	0	0	77052	53306	105004	18500	229402	444923	714380	888769	1169045	1487530	2672250
Crude Oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mineral Oil fuel products	0	87471	143292	187057	332770	168641	79752	0	0	77052	53306	105004	18500	229402	444923	714380	888769	1169045	1487530	2672250
Edible Oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid Gas LPG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid Gas LNG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
General Cargo	2888585	2806439	2208201	3483886	3889691	4824791	4787567	5188104	5436874	5850486	6003721	6736763	7114096	8233824	11909464	14496137	15961096	16439866	16024494	11790624
Break Bulk (eg.g. iron/steel, paper, wood)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cars and vehicles	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0
Heavy lifts, project cargo, machinery	0	0	0	0	0	0	1189	203	0	1686	472	228	6	966	1418	1762	1948	2033	2020	1668
Bags or bails, palletized or not	300450	262473	280529	238299	234900	203230	284199	210539	213072	179010	183405	265639	237478	259664	283403	299922	309242	311932	308702	279069
Containerization affine cargoes	2588135	2543966	1927672	3245587	3654791	4621561	4502179	4977362	5223802	5669790	5819844	6470892	6876610	7973194	11624642	14194454	15649906	16125902	15713772	11509888
Chemical products	157715	130887	138751	89422	58246	30792	48100	27275	14000	40004	40800	15000	39083	68106	74332	78665	81110	81815	80968	73196
Fish, meat, fruits, other perishables	41607	35591	38193	37635	39144	34027	36393	34399	34260	35856	31452	33278	35011	55858	108337	173949	216412	284658	362208	650682
General cargoes, n.e.s	2388813	2377488	1750728	3118530	3557401	4556742	4417686	4915688	5175542	5593930	5747592	6422614	6802516	7849230	11441973	13941840	15352385	15759429	15270597	10786010
Total	**3178542**	**3178324**	**2508632**	**3910980**	**4555760**	**5117840**	**4917726**	**5201187**	**5437164**	**5927843**	**6057256**	**6872767**	**7132596**	**8760105**	**12891385**	**16017922**	**17708294**	**18482379**	**18367521**	**15162027**


Total Imports 2006 to 2100
Total Imports (M. Ton)
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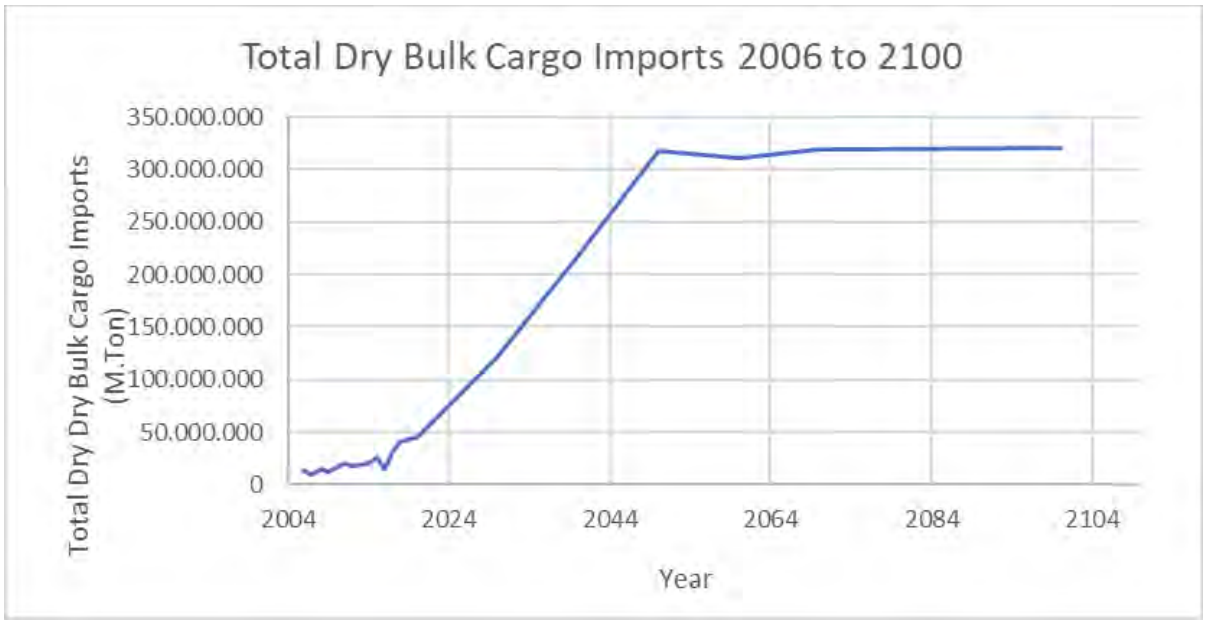
1.000.000.000
800.000.000
600.000.000
400.000.000
200.000.000
0
2004
2024
2044
2064
2084
2104
Year


Total Dry Bulk Cargo Imports 2006 to 2100
Total Dry Dry Bulk Cargo Imports (M.Ton)
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300.000.000
250.000.000
200.000.000
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100.000.000
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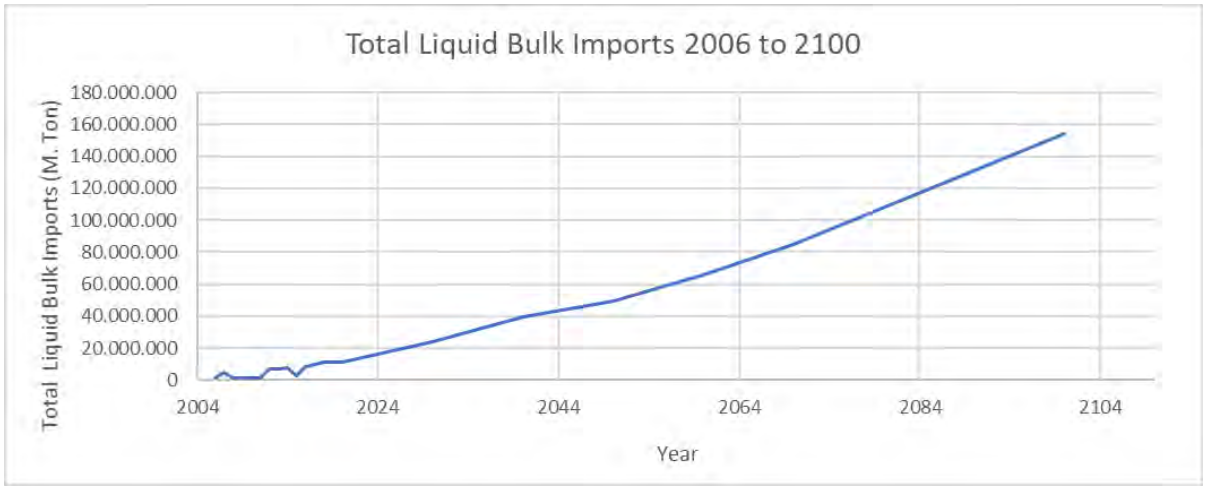
2044
2064
2084
2104
Year


Total Liquid Bulk Imports 2006 to 2100
Total Liquid Bulk Imports (M. Ton)
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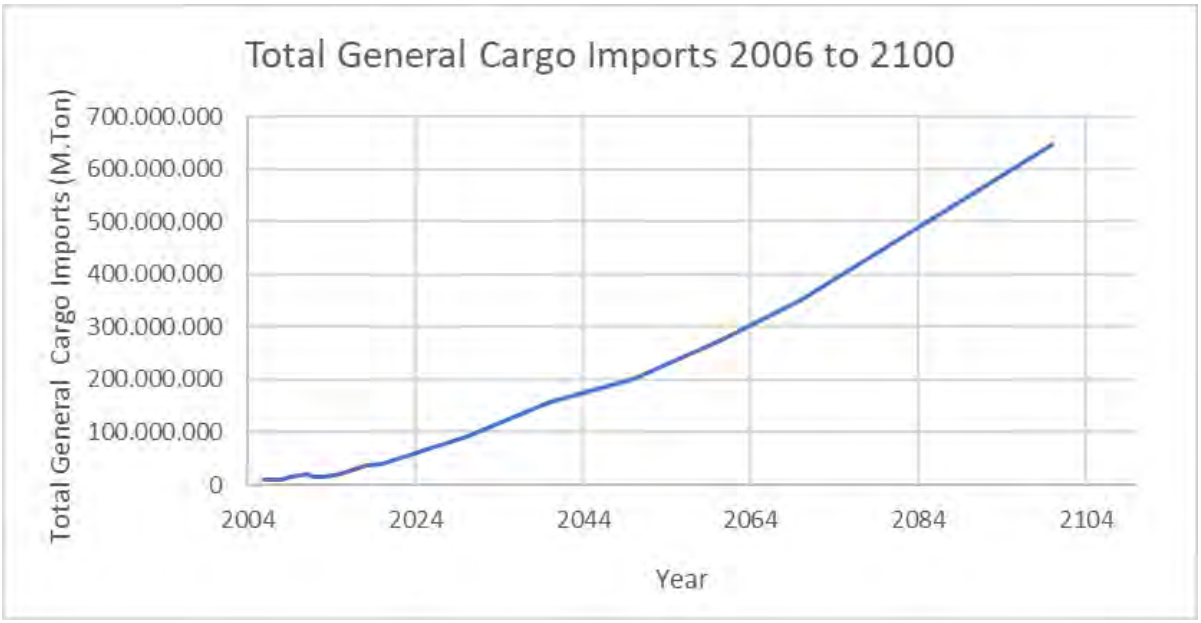
160.000.000
140.000.000
120.000.000
100.000.000
80.000.000
60.000.000
40.000.000
20.000.000
0
2004
2024
2044
2064
2084
2104
Year


Total General Cargo Imports 2006 to 2100
Total General Cargo Imports (M.Ton)
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600.000.000
500.000.000
400.000.000
300.000.000
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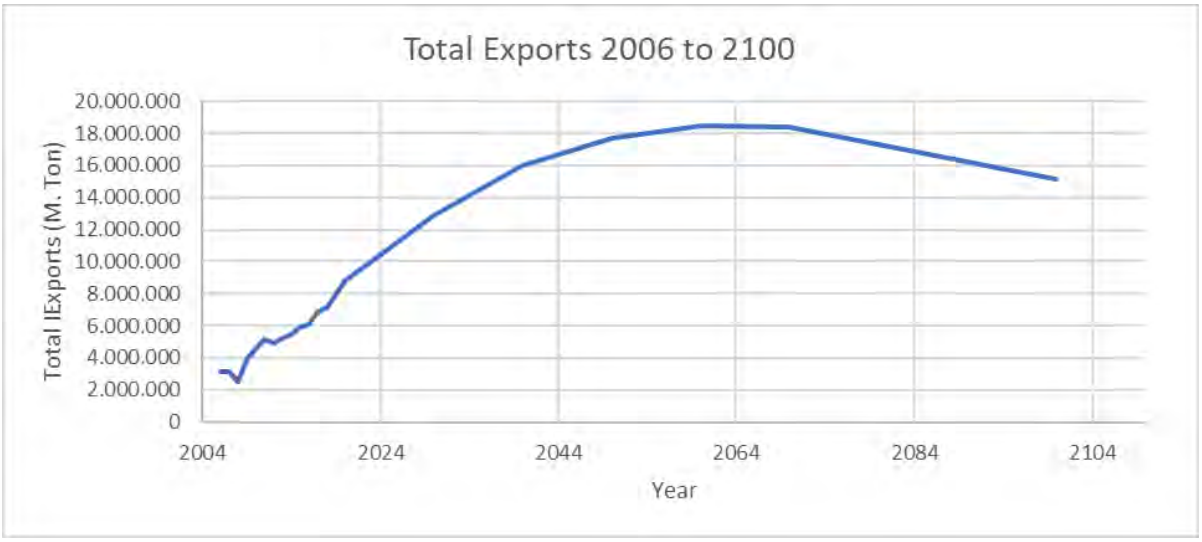
0
2004
2024
2044
2064
2084
2104
Year


Total Exports 2006 to 2100
Total IExports (M. Ton)
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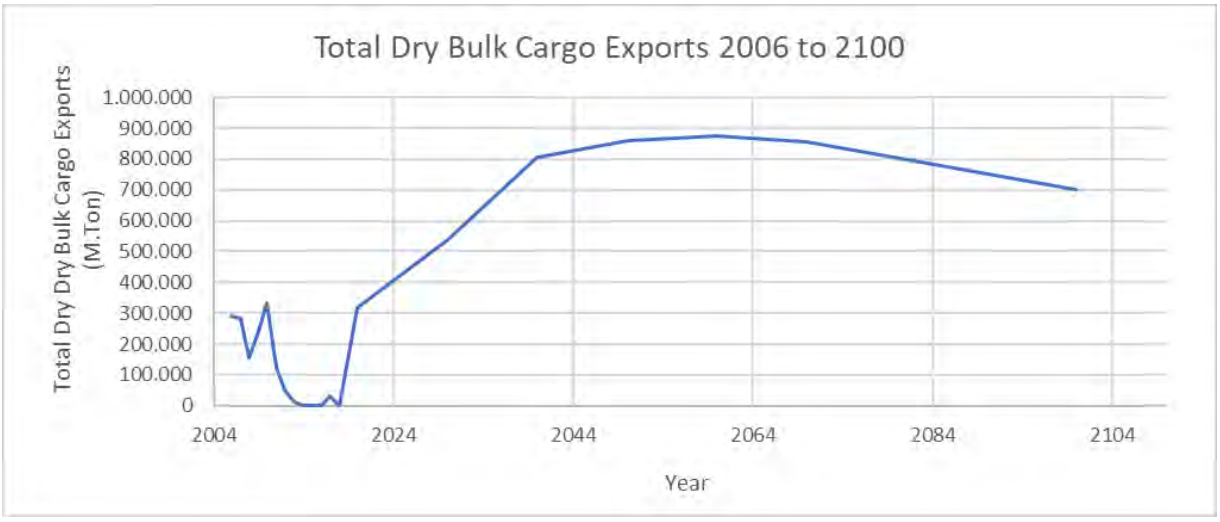
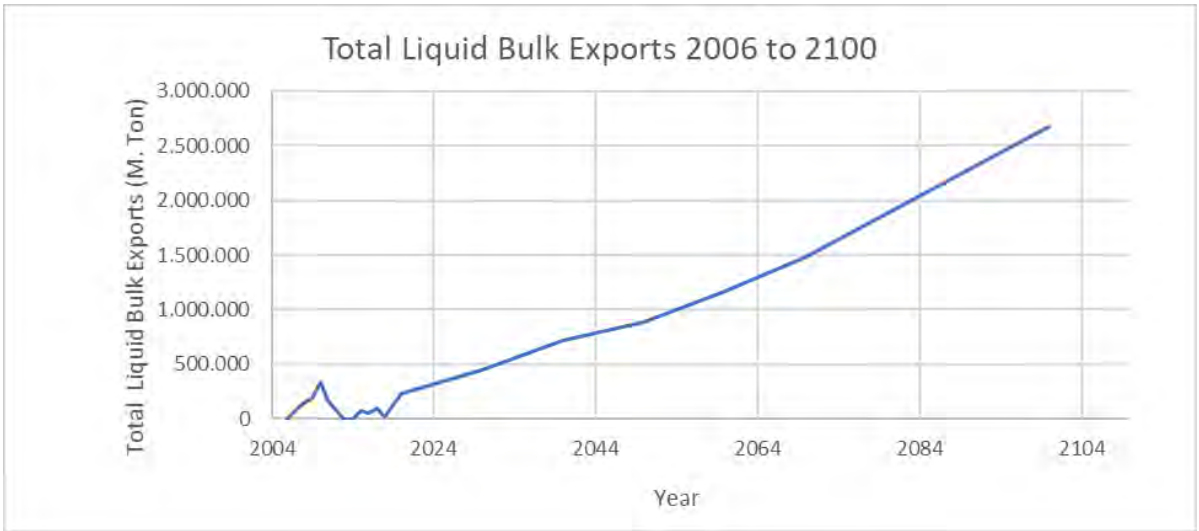
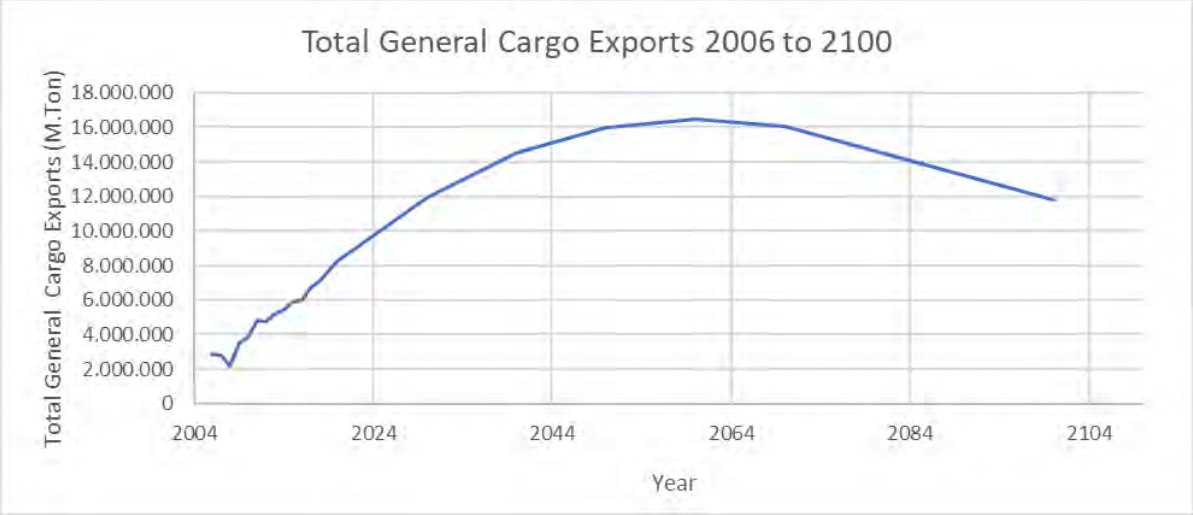
18.000.000
16.000.000
14.000.000
12.000.000
10.000.000
8.000.000
6.000.000
4.000.000
2.000.000
0
2004
2024
2044
2064
2084
2104
Year


Total Dry Bulk Cargo Exports 2006 to 2100
Total Dry Dry Bulk Cargo Exports (M.Ton)
1.000.000
900.000
800.000
700.000
600.000
500.000
400.000
300.000
200.000
100.000
0
2004
2024
2044
2064
2084
2104
Year





The consideration of the complete maritime trade all regions in the Hinterland of the Bangladesh and the Bay of Bengal ports has been calculated by application of the following socio-economic parameters as adjustment factors on the maritime foreign trade identified above for the recent and for the forecast and the projections years

The detailed results are presented by the tables following the attribution parameter presentation.

Maritime Trade all Hinterland regions via Bengal Bay Ports Forecast 2020 - 2040 and projections until 2050/2060/2070/2100

Unit: Metric tons

Commodities	Projected Martime ports hinterland catchment area | Imports 2020 - 2100 in metric tons										
	2020	2025	2030	2035	2040	2050	2060	2070	2080	2090	2100
Dry Bulk Cargo	48823467	85182658	133133105	184240984	235985148	346266497	338184931	347780021	349674043	348849099	346539884
Grap or Conveyer	38612185	70389329	112317498	157137161	202660425	303705703	280634987	273080564	255485224	232978473	208568922
Coal	4786670	8864849	14246632	20004985	25859768	34303239	32538849	31821417	30162307	28027983	25632141
Cement clinker	32375606	59053902	94254633	131884231	170106025	259326884	238794078	232209023	216859702	197237891	176037474
Gypsum	296798	572588	936672	1327096	1725020	2653181	2438762	2370689	2211954	2009096	1790328
Lime stone	209494	254866	313952	372146	425735	553718	527592	516392	490529	457219	419556
Slag, sand, gravel etc.	943617	1643124	2565610	3548701	4543877	6868681	6335705	6163043	5760732	5246284	4689422
Grap, rain protected	5297553	7700431	10858872	14158639	17425189	22273653	30310324	39535295	50052426	61783972	73837498
Fertilizers	4234311	5593748	7374396	9194769	10951385	11657808	11869884	11617893	11036036	10286605	9439267
C.Bone/B. Griest	0	0	0	0	0	0	0	0	0	0	0
Salt	1063242	2106683	3484475	4963870	6473805	10615846	18440440	27917402	39016390	51497368	64398232
Protected or pneumatic handling	4913729	7092899	9956736	12945184	15899533	20287141	27239620	35164163	44136393	54086654	64133464
Grain	4296285	5747464	7649405	9601030	11492728	14488481	19148077	24448259	30434566	37054418	43670608
Soya beans, oil seeds	0	0	0	0	0	0	0	0	0	0	0
Fly Ash	617443	1345435	2307330	3344154	4406805	5798659	8091542	10715903	13701827	17032236	20462856
Liquid Bulk	12139991	18199431	26170370	34537337	42864845	53966491	71879211	92187449	115186998	140793297	167081235
Oil and fuel	8041840	11491503	16023676	20744548	25401870	31644013	41652524	52966108	65760489	79996825	94596602
Crude Oil	141342	201973	281629	364603	446459	556170	732078	930923	1155795	1406011	1662614
Mineral Oil fuel products	7900498	11289531	15742046	20379946	24955411	31087843	40920446	52035185	64604694	78590815	92933988
Edible Oil	2980413	4258904	5938587	7688206	9414271	11727691	15436978	19629942	24371710	29647886	35058756
Liquid gas	1117738	2449023	4208107	6104583	8048705	10594787	14789709	19591399	25054798	31148586	37425878
Liquid Gas LPG	1117738	2449023	4208107	6104583	8048705	10594787	14789709	19591399	25054798	31148586	37425878
Liquid Gas LNG	0	0	0	0	0	0	0	0	0	0	0
General Cargo	42872820	68167385	101480888	136700637	172039662	218922356	295005747	381494628	479573154	588824116	701090617
Break Bulk (eg.g. iron/steel, paper, wood)	41462	65905	98095	132128	166274	211573	285086	368651	463413	568970	677440
Cars and vehicles	30760	45126	64113	83264	102596	129727	173609	223414	279850	342696	407241
Heavy lifts, project cargo, machinery	249338	490248	808335	1149754	1498085	1955575	2706810	3565403	4541599	5630119	6750821
Bags or bails, palletized or not	3368415	5284723	7807927	10471687	13140082	16683515	22427281	28953086	36351422	44591674	53057752
Containerization affine cargoes	39182845	62281384	92702417	124863804	157132626	199941966	269412961	348384074	437936870	537690656	640197363
Chemical products	0	0	0	0	0	0	0	0	0	0	0
Fish, meat, fruits, other perishables	0	0	0	0	0	0	0	0	0	0	0
General cargoes, n.e.s	39182845	62281384	92702417	124863804	157132626	199941966	269412961	348384074	437936870	537690656	640197363
Total	**103836278**	**171549474**	**260784364**	**355478958**	**450889656**	**619155344**	**705069889**	**821462098**	**944434195**	**1078466512**	**1214711737**
Difference / Additional Cargoes (million tons)	6,938	11,462	23,903	32,583	36,069	50,272	57,707	66,750	77,977	90,960	92,174

Maritime Trade all Hinterland regions via Bengal Bay Ports Forecast 2020 - 2040 and projections until 2050/2060/2070/2100

Unit: Metric tons

Commodities	Projected Martime ports hinterland catchment area | Exports 2020 - 2100 in metric tons										
	2020	2025	2030	2035	2040	2050	2060	2070	2080	2090	2100
Dry Bulk Cargo	339568	448544	591185	736992	877611	934288	951330	931160	884537	824473	756561
Grap or Conveyer	0	0	0	0	0	0	0	0	0	0	0
Coal	0	0	0	0	0	0	0	0	0	0	0
Cement clinker	0	0	0	0	0	0	0	0	0	0	0
Gypsum	0	0	0	0	0	0	0	0	0	0	0
Lime stone	0	0	0	0	0	0	0	0	0	0	0
Slag, sand, gravel etc.	0	0	0	0	0	0	0	0	0	0	0
Grap, rain protected	339568	448544	591185	736992	877611	934288	951330	931160	884537	824473	756561
Fertilizers	338745	447500	589952	735582	876111	932625	949591	929431	882883	822928	755141
C.Bone/B. Griest	823	1044	1234	1410	1500	1664	1740	1729	1654	1545	1420
Salt	0	0	0	0	0	0	0	0	0	0	0
Protected or pneumatic handling	0	0	0	0	0	0	0	0	0	0	0
Grain	0	0	0	0	0	0	0	0	0	0	0
Soya beans, oil seeds	0	0	0	0	0	0	0	0	0	0	0
Fly Ash	0	0	0	0	0	0	0	0	0	0	0
Liquid Bulk	245827	351278	489820	634130	776497	967310	1273255	1619094	2010199	2445382	2891675
Oil and fuel	245827	351278	489820	634130	776497	967310	1273255	1619094	2010199	2445382	2891675
Crude Oil	0	0	0	0	0	0	0	0	0	0	0
Mineral Oil fuel products	245827	351278	489820	634130	776497	967310	1273255	1619094	2010199	2445382	2891675
Edible Oil	0	0	0	0	0	0	0	0	0	0	0
Liquid gas	0	0	0	0	0	0	0	0	0	0	0
Liquid Gas LPG	0	0	0	0	0	0	0	0	0	0	0
Liquid Gas LNG	0	0	0	0	0	0	0	0	0	0	0
General Cargo	8823354	11155974	13111226	14909919	15756604	17371577	17905340	17441772	16223243	14581504	12758781
Break Bulk (eg.g. iron/steel, paper, wood)	0	0	0	0	0	0	0	0	0	0	0
Cars and vehicles	0	0	0	0	0	0	0	0	0	0	0
Heavy lifts, project cargo, machinery	1035	1315	1561	1791	1915	2120	2214	2199	2103	1963	1805
Bags or bails, palletized or not	278255	293371	312001	323556	326000	336570	339738	336005	327716	316700	301984
Containerization affine cargoes	8544064	10861288	12797664	14584572	15428688	17032887	17563388	17103568	15893425	14262841	12454993
Chemical products	72982	76947	81833	84864	85505	88277	89108	88129	85955	83066	79206
Fish, meat, fruits, other perishables	59858	85535	119269	154408	189074	235536	310032	394243	489475	595441	704111
General cargoes, n.e.s	8411224	10698807	12596562	14345300	15154109	16709074	17164248	16621197	15317994	13584335	11671676
Total	**9408749**	**11955795**	**14192231**	**16281040**	**17410711**	**19273175**	**20129925**	**19992026**	**19117979**	**17851359**	**16407018**
Difference / Additional Cargoes (million tons)	0,629	0,799	1,301	1,492	1,393	1,565	1,648	1,625	1,578	1,506	1,245

Maritime Trade all Hinterland regions via Bengal Bay Ports Forecast 2020- 2040 and projections 2050/2060/2070/2100

Unit: Metric tons

Commodities	Projected Martime Imports and Exports 2020 - 2100 in metric tons										
	2020	2025	2030	2035	2040	2050	2060	2070	2080	2090	2100
Dry Bulk Cargo	49163034	85631202	133724291	184977975	236862758	347200785	339136261	348711182	350558580	349673572	347296446
Grap or Conveyer	38612185	70389329	112317498	157137161	202660425	303705703	280634987	273080564	255485224	232978473	208568922
Coal	4786670	8864849	14246632	20004985	25859768	34303239	32538849	31821417	30162307	28027983	25632141
Cement clinker	32375606	59053902	94254633	131884231	170106025	259326884	238794078	232209023	216859702	197237891	176037474
Gypsum	296798	572588	936672	1327096	1725020	2653181	2438762	2370689	2211954	2009096	1790328
Lime stone	209494	254866	313952	372146	425735	553718	527592	516392	490529	457219	419556
Slag, sand, gravel etc.	943617	1643124	2565610	3548701	4543877	6868681	6335705	6163043	5760732	5246284	4689422
Grap, rain protected	5637120	8148974	11450057	14895630	18302800	23207941	31261654	40466455	50936962	62608445	74594060
Fertilizers	4573055	6041248	7964348	9930350	11827496	12590432	12819475	12547324	11918918	11109533	10194408
C.Bone/B. Griest	823	1044	1234	1410	1500	1664	1740	1729	1654	1545	1420
Salt	1063242	2106683	3484475	4963870	6473805	10615846	18440440	27917402	39016390	51497368	64398232
Protected or pneumatic handling	4913729	7092899	9956736	12945184	15899533	20287141	27239620	35164163	44136393	54086654	64133464
Grain	4296285	5747464	7649405	9601030	11492728	14488481	19148077	24448259	30434566	37054418	43670608
Soya beans, oil seeds	0	0	0	0	0	0	0	0	0	0	0
Fly Ash	617443	1345435	2307330	3344154	4406805	5798659	8091542	10715903	13701827	17032236	20462856
Liquid Bulk	12385818	18550709	26660190	35171467	43641342	54933801	73152466	93806543	117197197	143238679	169972911
Oil and fuel	8287667	11842781	16513495	21378678	26178367	32611323	42925779	54585202	67770688	82442208	97488277
Crude Oil	141342	201973	281629	364603	446459	556170	732078	930923	1155795	1406011	1662614
Mineral Oil fuel products	8146325	11640809	16231866	21014075	25731908	32055153	42193701	53654279	66614893	81036197	95825663
Edible Oil	2980413	4258904	5938587	7688206	9414271	11727691	15436978	19629942	24371710	29647886	35058756
Liquid gas	1117738	2449023	4208107	6104583	8048705	10594787	14789709	19591399	25054798	31148586	37425878
Liquid Gas LPG	1117738	2449023	4208107	6104583	8048705	10594787	14789709	19591399	25054798	31148586	37425878
Liquid Gas LNG	0	0	0	0	0	0	0	0	0	0	0
General Cargo	51696174	79323359	114592114	151610555	187796266	236293933	312911086	398936400	495796397	603405621	713849399
Break Bulk (eg.g. iron/steel, paper, wood)	41462	65905	98095	132128	166274	211573	285086	368651	463413	568970	677440
Cars and vehicles	30760	45126	64113	83264	102596	129727	173609	223414	279850	342696	407241
Heavy lifts, project cargo, machinery	250372	491563	809896	1151545	1500000	1957695	2709024	3567602	4543702	5632083	6752626
Bags or bails, palletized or not	3646670	5578093	8119928	10795243	13466082	17020084	22767019	29289091	36679138	44908374	53359736
Containerization affine cargoes	47726909	73142672	105500081	139448375	172561314	216974853	286976349	365487643	453830294	551953497	652652355
Chemical products	72982	76947	81833	84864	85505	88277	89108	88129	85955	83066	79206
Fish, meat, fruits, other perishables	59858	85535	119269	154408	189074	235536	310032	394243	489475	595441	704111
General cargoes, n.e.s	47594069	72980191	105298979	139209103	172286735	216651040	286577208	365005271	453254864	551274991	651869038
Total	**113245026**	**183505269**	**274976595**	**371759997**	**468300367**	**638428519**	**725199814**	**841454124**	**963552174**	**1096317872**	**1231118755**
Difference / Additional Cargoes (million tons)	7,57	12,26	25,20	34,08	37,46	51,84	59,35	68,37	79,56	92,47	93,42

The port throughput potential out of development and trade in the hinterland areas and its respective accessibility via Mongla port is depicted by the below tables.

Share of Mongla Port in Maritime Trade of the Hinterland regions of the Bengal Bay Ports - Forecast 2020 - 2040, projections until 2050/2060/2070 and outlook until 2100

Unit: Metric tons

Commodities	Projected Imports 2020 - 2100 in metric tons										
	2020	2025	2030	2035	2040	2050	2060	2070	2080	2090	2100
Dry Bulk Cargo	19342712	33747370	70000165	96872219	123245428	179101737	135628746	139553632	140313646	139982620	140205730
Grap or Conveyer	15297241	27886600	59055510	82621277	105841283	157087733	112548396	109578993	102518514	93487233	84384393
Coal	1896366	3512045	7490748	10518438	13505503	17742894	13049675	12768975	12103224	11246784	10370446
Cement clinker	12826455	23395770	49558221	69343519	88839446	134133379	95768139	93178476	87019257	79145616	71222574
Gypsum	117584	226846	492494	697775	900908	1372322	978063	951286	887590	806190	724344
Lime stone	82997	100972	165073	195671	222344	286403	211590	207212	196835	183468	169747
Slag, sand, gravel etc.	373839	650967	1348974	1865875	2373082	3552734	2540928	2473043	2311608	2105175	1897282
Grap, rain protected	2098766	3050730	5709495	7444482	9100466	11520751	12155927	15864321	20084529	24792044	29873734
Fertilizers	1677534	2216112	3877390	4834525	5719462	6029846	4760406	4661910	4428428	4127704	3819010
C.Bone/B. Griest	0	0	0	0	0	0	0	0	0	0	0
Salt	421232	834618	1832105	2609957	3381004	5490905	7395521	11202411	15656100	20664340	26054724
Protected or pneumatic handling	1946704	2810040	5235160	6806459	8303678	10493254	10924424	14110318	17710603	21703343	25947602
Grain	1702087	2277010	4021987	5048134	6002184	7493974	7679318	9810349	12212473	14868820	17668585
Soya beans, oil seeds	0	0	0	0	0	0	0	0	0	0	0
Fly Ash	244617	533030	1213173	1758325	2301495	2999279	3245105	4299969	5498130	6834523	8279017
Liquid Bulk	4809580	7210187	13760140	18159415	22386562	27913449	28827090	36992042	46221068	56496103	67598991
Oil and fuel	3185988	4552664	8425102	10907293	13266362	16367445	16704705	21253701	26387701	32100313	38272609
Crude Oil	55996	80017	148078	191705	233167	287671	293599	373551	463786	564190	672673
Mineral Oil fuel products	3129992	4472647	8277023	10715588	13033194	16079773	16411106	20880150	25923915	31536123	37599936
Edible Oil	1180770	1687278	3122455	4042388	4916690	6065992	6190985	7876904	9779632	11896802	14184337
Liquid gas	442822	970246	2212584	3209734	4203510	5480013	5931399	7861437	10053735	12498988	15142045
Liquid Gas LPG	442822	970246	2212584	3209734	4203510	5480013	5931399	7861437	10053735	12498988	15142045
Liquid Gas LNG	0	0	0	0	0	0	0	0	0	0	0
General Cargo	16985205	27006318	53357720	71875940	89849306	113234675	118311775	153082287	192438241	236277356	283652549
Break Bulk (eg.g. iron/steel, paper, wood)	16426	26110	51578	69472	86838	109434	114333	147929	185954	228311	274084
Cars and vehicles	12186	17878	33710	43780	53582	67100	69626	89649	112295	137514	164765
Heavy lifts, project cargo, machinery	98782	194225	425015	604530	782389	1011495	1085564	1430689	1822407	2259197	2731298
Bags or bails, palletized or not	1334487	2093683	4105337	5505917	6862529	8629326	8994440	11618000	14586729	17893294	21466507
Containerization affine cargoes	15523324	24674423	48742080	65652242	82063968	103417321	108047813	139796020	175730856	215759041	259015895
Chemical products	0	0	0	0	0	0	0	0	0	0	0
Fish, meat, fruits, other perishables	0	0	0	0	0	0	0	0	0	0	0
General cargoes, n.e.s	15523324	24674423	48742080	65652242	82063968	103417321	108047813	139796020	175730856	215759041	259015895
Total	**41137496**	**67963875**	**137118025**	**186907574**	**235481296**	**320249861**	**282767610**	**329627961**	**378972954**	**432756080**	**491457270**

Share of Mongla Port in Maritime Trade of the Hinterland regions of the Bengal Bay Ports - Forecast 2020 - 2040, projections until 2050/2060/2070 and outlook until 2100

Unit: Metric tons

Commodities	Projected Exports 2020 - 2100 in metric tons										
	2020	2025	2030	2035	2040	2050	2060	2070	2080	2090	2100
Dry Bulk Cargo	134529	177702	310840	387503	458340	483248	381530	373647	354938	330836	306095
Grap or Conveyer	0	0	0	0	0	0	0	0	0	0	0
Coal	0	0	0	0	0	0	0	0	0	0	0
Cement clinker	0	0	0	0	0	0	0	0	0	0	0
Gypsum	0	0	0	0	0	0	0	0	0	0	0
Lime stone	0	0	0	0	0	0	0	0	0	0	0
Slag, sand, gravel etc.	0	0	0	0	0	0	0	0	0	0	0
Grap, rain protected	134529	177702	310840	387503	458340	483248	381530	373647	354938	330836	306095
Fertilizers	134203	177289	310191	386762	457557	482388	380832	372953	354274	330216	305521
C.Bone/B. Griest	326	414	649	741	783	860	698	694	664	620	574
Salt	0	0	0	0	0	0	0	0	0	0	0
Protected or pneumatic handling	0	0	0	0	0	0	0	0	0	0	0
Grain	0	0	0	0	0	0	0	0	0	0	0
Soya beans, oil seeds	0	0	0	0	0	0	0	0	0	0	0
Fly Ash	0	0	0	0	0	0	0	0	0	0	0
Liquid Bulk	97391	139168	257543	333420	405533	500328	510638	649694	806632	981258	1169936
Oil and fuel	97391	139168	257543	333420	405533	500328	510638	649694	806632	981258	1169936
Crude Oil	0	0	0	0	0	0	0	0	0	0	0
Mineral Oil fuel products	97391	139168	257543	333420	405533	500328	510638	649694	806632	981258	1169936
Edible Oil	0	0	0	0	0	0	0	0	0	0	0
Liquid gas	0	0	0	0	0	0	0	0	0	0	0
Liquid Gas LPG	0	0	0	0	0	0	0	0	0	0	0
Liquid Gas LNG	0	0	0	0	0	0	0	0	0	0	0
General Cargo	3495606	4419735	6893763	7839498	8229032	8985217	7180920	6998857	6509898	5851118	5162044
Break Bulk (eg.g. iron/steel, paper, wood)	0	0	0	0	0	0	0	0	0	0	0
Cars and vehicles	0	0	0	0	0	0	0	0	0	0	0
Heavy lifts, project cargo, machinery	410	521	821	942	1000	1096	888	882	844	788	730
Bags or bails, palletized or not	110238	116227	164047	170123	170257	174086	136252	134829	131502	127082	122179
Containerization affine cargoes	3384958	4302987	6728895	7668434	8057775	8810034	7043780	6863146	6377552	5723248	5039135
Chemical products	28914	30484	43027	44621	44656	45660	35737	35363	34491	33332	32046
Fish, meat, fruits, other perishables	23714	33887	62711	81186	98746	121828	124338	158198	196412	238932	284875
General cargoes, n.e.s	3332330	4238616	6623157	7542627	7914374	8642546	6883705	6669585	6146649	5450984	4722215
Total	**3727525**	**4736606**	**7462145**	**8560421**	**9092905**	**9968793**	**8073087**	**8022197**	**7671468**	**7163212**	**6638075**

Share of Mongla Port in Maritime Trade of the Hinterland regions of the Bengal Bay Ports - Forecast 2020 - 2040, projections until 2050/2060/2070 and outlook until 2100

Unit: Metric tons

Commodities	Projected Imports and Exports 2020 - 2100 in metric tons										
	2020	2025	2030	2035	2040	2050	2060	2070	2080	2090	2100
Dry Bulk Cargo	19477240	33925072	70311005	97259722	123703768	179584985	136010276	139927279	140668584	140313457	140511825
Grap or Conveyer	15297241	27886600	59055510	82621277	105841283	157087733	112548396	109578993	102518514	93487233	84384393
Coal	1896366	3512045	7490748	10518438	13505503	17742894	13049675	12768975	12103224	11246784	10370446
Cement clinker	12826455	23395770	49558221	69343519	88839446	134133379	95768139	93178476	87019257	79145616	71222574
Gypsum	117584	226846	492494	697775	900908	1372322	978063	951286	887590	806190	724344
Lime stone	82997	100972	165073	195671	222344	286403	211590	207212	196835	183468	169747
Slag, sand, gravel etc.	373839	650967	1348974	1865875	2373082	3552734	2540928	2473043	2311608	2105175	1897282
Grap, rain protected	2233295	3228432	6020335	7831986	9558807	12003999	12537457	16237968	20439467	25122881	30179829
Fertilizers	1811737	2393401	4187581	5221287	6177019	6512233	5141238	5034863	4782702	4457920	4124531
C.Bone/B. Griest	326	414	649	741	783	860	698	694	664	620	574
Salt	421232	834618	1832105	2609957	3381004	5490905	7395521	11202411	15656100	20664340	26054724
Protected or pneumatic handling	1946704	2810040	5235160	6806459	8303678	10493254	10924424	14110318	17710603	21703343	25947602
Grain	1702087	2277010	4021987	5048134	6002184	7493974	7679318	9810349	12212473	14868820	17668585
Soya beans, oil seeds	0	0	0	0	0	0	0	0	0	0	0
Fly Ash	244617	533030	1213173	1758325	2301495	2999279	3245105	4299969	5498130	6834523	8279017
Liquid Bulk	4906970	7349355	14017683	18492835	22792095	28413777	29337727	37641736	47027700	57477361	68768927
Oil and fuel	3283379	4691832	8682644	11240713	13671894	16867773	17215343	21903395	27194333	33081571	39442545
Crude Oil	55996	80017	148078	191705	233167	287671	293599	373551	463786	564190	672673
Mineral Oil fuel products	3227383	4611815	8534566	11049008	13438727	16580101	16921744	21529844	26730547	32517381	38769872
Edible Oil	1180770	1687278	3122455	4042388	4916690	6065992	6190985	7876904	9779632	11896802	14184337
Liquid gas	442822	970246	2212584	3209734	4203510	5480013	5931399	7861437	10053735	12498988	15142045
Liquid Gas LPG	442822	970246	2212584	3209734	4203510	5480013	5931399	7861437	10053735	12498988	15142045
Liquid Gas LNG	0	0	0	0	0	0	0	0	0	0	0
General Cargo	20480811	31426053	60251482	79715439	98078338	122219892	125492695	160081144	198948139	242128474	288814594
Break Bulk (eg.g. iron/steel, paper, wood)	16426	26110	51578	69472	86838	109434	114333	147929	185954	228311	274084
Cars and vehicles	12186	17878	33710	43780	53582	67100	69626	89649	112295	137514	164765
Heavy lifts, project cargo, machinery	99192	194746	425836	605472	783389	1012592	1086452	1431571	1823251	2259985	2732028
Bags or bails, palletized or not	1444725	2209910	4269384	5676040	7032786	8803412	9130691	11752829	14718232	18020376	21588686
Containerization affine cargoes	18908281	28977410	55470975	73320676	90121744	112227355	115091593	146659166	182108408	221482289	264055031
Chemical products	28914	30484	43027	44621	44656	45660	35737	35363	34491	33332	32046
Fish, meat, fruits, other perishables	23714	33887	62711	81186	98746	121828	124338	158198	196412	238932	284875
General cargoes, n.e.s	18855653	28913039	55365237	73194869	89978342	112059867	114931518	146465605	181877505	221210025	263738110
Total	**44865021**	**72700481**	**144580171**	**195467996**	**244574201**	**330218654**	**290840698**	**337650158**	**386644423**	**439919292**	**498095346**

The following tables summarize the considerations of local industrial and regional economic developments at Mongla port and adjacent industrial and economic development areas. Furthermore, corrections of the trade-based trend projections were considered in order to balance traffic flows and to take furthermore the development of additional port facilities or other ports at other locations than Mongla into account.

Mongla Port throughput forecast under consideration of port industry activities and developments 2020-2040, projections for 2050/2060/2070 and outlook until 2100

Commodities	Projected Imports 2020 - 2100 in metric tons													
	2010	2015	2018	2020	2025	2030	2035	2040	2050	2060	2070	2080	2090	2100
Dry Bulk Cargo trend	2382113	5154102	9197573	19342712	33747370	70000165	96872219	123245428	179101737	135628746	139553632	140313646	139982620	140205730
Dry Bulk Cargo local industry and corrections	2382113	5154102	9197573	12408412	17881597	21989842	38785814	49512493	64972114	51792780	50692598	47830546	44129964	40124355
Grap or Conveyer trend	865797	3341960	6606898	15297241	27886600	59055510	82621277	105841283	157087733	112548396	109578993	102518514	93487233	84384393
Grap or Conveyer local industry development	865797	3341960	6606898	9901070	14498523	15659316	30532532	38957783	55843371	40299864	39291243	36894446	33824454	30718875
Coal as per trend development	0	1059143	2724026	1896366	3512045	7490748	10518438	13505503	17742894	13049675	12768975	12103224	11246784	10370446
Coal as per local development projections	0	1059143	2724026	3200000	7100000	7490748	10518438	13505503	17742894	13049675	12768975	12103224	11246784	10370446
Trend Development cement and construction material														
Cement clinker	798967	1572211	2690420	12826455	23395770	49558221	69343519	88839446	134133379	95768139	93178476	87019257	79145616	71222574
Gypsum	23800	103692	202410	117584	226846	492494	697775	900908	1372322	978063	951286	887590	806190	724344
Lime stone	0	171600	247783	82997	100972	165073	195671	222344	286403	211590	207212	196835	183468	169747
Slag, sand, gravel etc.	43030	435314	742259	373839	650967	1348974	1865875	2373082	3552734	2540928	2473043	2311608	2105175	1897282
Local Development projections cement and construction materials														
Cement clinker	798967	1572211	2690420	5100000	5630812	6216872	16262695	20834951	31457450	22459893	21852556	20408074	18561519	16703378
Gypsum	23800	103692	202410	383691	423626	467718	1235619	1595326	2430107	1731953	1684536	1571744	1427599	1282668
Lime stone	0	171600	247783	469701	518588	572563	1310902	1489599	1918762	1417553	1388223	1318697	1229147	1137224
Slag, sand, gravel etc.	43030	435314	742259	747678	825497	911415	1204878	1532404	2294158	1640790	1596954	1492708	1359405	1225159
Grap, rain protected trend projections	1008809	1565327	2106947	2098766	3050730	5709495	7444482	9100466	11520751	12155927	15864321	20084529	24792044	29873734
Fertilizers	1001139	1565327	2106947	1677534	2216112	3877390	4834525	5719462	6029846	4760406	4661910	4428428	4127704	3819010
C.Bone/B. Griest	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salt	7670	0	0	421232	834618	1832105	2609957	3381004	5490905	7395521	11202411	15656100	20664340	26054724
Grap, rain protected local industry and corrections	1008809	1565327	2106947	2098766	3050730	5709495	7444482	9561357	7800000	10330711	10050227	9383100	8530361	7672500
Fertilizers	1001139	1565327	2106947	1677534	2216112	3877390	4834525	6241926	9508117	6776498	6590971	6149657	5585673	5018611
C.Bone/B. Griest	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salt	7670	0	0	421232	834618	1832105	2609957	3319431	4969511	3554212	3459256	3233442	2944688	2653889
Protected or pneumatic handling trend	507507	246815	483728	1946704	2810040	5235160	6806459	8303678	10493254	10924424	14110318	17710603	21703343	25947602
Grain	503747	129632	131379	1702087	2277010	4021987	5048134	6002184	7493974	7679318	9810349	12212473	14868820	17668585
Soya beans, oil seeds	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fly Ash	3760	117183	352349	244617	533030	1213173	1758325	2301495	2999279	3245105	4299969	5498130	6834523	8279017
Protected or pneumatic handling local industry/corrections	507507	246815	483728	408575	332344	621031	808800	993353	1328743	1162205	1351127	1553000	1775148	1732980
Grain	503747	129632	131379	163959	219340	387430	486277	578179	721880	739734	945012	1176404	1432284	1701980
Soya beans, oil seeds	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fly Ash	3760	117183	352349	244617	113004	233601	322524	415174	606863	422471	406116	376597	342864	31000
Liquid Bulk trend	32276	209814	788729	4809580	7210187	13760140	18159415	22386562	27913449	28827090	36992042	46221068	56496103	67598991
Liquid Bulk local industry and corrections	32276	209814	788729	1148536	2316156	5120368	7319486	9501699	12310590	13241191	17476630	22284858	27646742	33442165
Oil and fuel trend	0	44828	96942	3185988	4552664	8425102	10907293	13266362	16367445	16704705	21253701	26387701	32100313	38272609
Crude Oil	0	44828	96942	55996	80017	148078	191705	233167	287671	293599	373551	463786	564190	672673
Mineral Oil fuel products	0	0	0	3129992	4472647	8277023	10715588	13033194	16079773	16411106	20880150	25923915	31536123	37599936
Oil and fuel local industry and corrections	0	44828	96942	262893	375664	695200	900018	1094678	1350564	1378394	1753755	2177389	2648767	3158075
Crude Oil	0	44828	96942	111993	160034	296156	383409	466335	575343	587198	747103	927571	1128379	1345346
Mineral Oil fuel products	0	0	0	150900	215631	399043	516609	628343	775222	791195	1006652	1249817	1520387	1812730
Edible Oil as per trend development	0	0	0	1180770	1687278	3122455	4042388	4916690	6065992	6190985	7876904	9779632	11896802	14184337
Edible Oil local development projections	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid gas trend projections	32276	164986	691787	442822	970246	2212584	3209734	4203510	5480013	5931399	7861437	10053735	12498988	15142045
Liquid Gas LPG	32276	164986	691787	442822	970246	2212584	3209734	4203510	5480013	5931399	7861437	10053735	12498988	15142045
Liquid Gas LNG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid gas local industry projections	32276	164986	691787	885643	1940491	4425168	6419468	8407021	10960025	11862798	15722875	20107470	24997976	30284090
Liquid Gas LPG	32276	164986	691787	885643	1940491	4425168	6419468	8407021	10960025	11862798	15722875	20107470	24997976	30284090
Liquid Gas LNG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
General Cargo trend	115464	345748	1193576	16985205	27006318	53357720	71875940	89849306	113234675	118311775	153082287	192438241	236277356	283652549
General Cargo local industry and corrections	115464	345748	1193576	1807388	2776953	5295558	9262677	11539364	14529852	22445957	29008713	36445221	44741062	53725681
Break Bulk (eg.g. iron/steel, paper, wood) trend	0	0	0	16426	26110	51578	69472	86838	109434	114333	147929	185954	228311	274084
Break Bulk (eg.g. iron/steel, paper, wood) local industry, corrections	0	0	0	16426	26110	51578	69472	86838	109434	114333	147929	185954	228311	274084
Cars and vehicles as per trend	14864	21077	24534	12186	17878	33710	43780	53582	67100	69626	89649	112295	137514	164765
Cars and vehicles local industry development	14864	21077	24534	41066	65275	128944	173679	217095	273584	285834	369821	464885	570777	685210
Heavy lifts, project cargo, machinery	23012	72403	183041	98782	194225	425015	604530	782389	1011495	1085564	1430689	1822407	2259197	2731298
Heavy lifts, project cargo, machinery trend correction	23012	72403	183041	197563	218126	240829	265894	293569	357859	436228	531759	648211	790166	963208
Bags or bails, palletized or not trend	0	0	0	1334487	2093683	4105337	5505917	6862529	8629326	8994440	11618000	14586729	17893294	21466507
Bags or bails, palletized or not, corrections ==> see containers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Containerization affine cargoes trend	77588	252268	986001	15523324	24674423	48742080	65652242	82063968	103417321	108047813	139796020	175730856	215759041	259015895
Chemical products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish, meat, fruits, other perishables	0	0	0	0	0	0	0	0	0	0	0	0	0	0
General cargoes, n.e.s	77588	252268	986001	15523324	24674423	48742080	65652242	82063968	103417321	108047813	139796020	175730856	215759041	259015895
Containerization affine cargoes as per local industry	77588	252268	986001	1552332	2467442	4874208	8753632	10941862	13788976	21609563	27959204	35146171	43151808	51803179
Chemical products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish, meat, fruits, other perishables	0	0	0	0	0	0	0	0	0	0	0	0	0	0
General cargoes, n.e.s	77588	252268	986001	1552332	2467442	4874208	8753632	10941862	13788976	21609563	27959204	35146171	43151808	51803179
Total as per trend	2529853	5709664	11179878	41137496	67963875	137118025	186907574	235481296	320249861	282767610	329627961	378972954	432756080	491457270
Total as per local industry developments and corrections	**2529853**	**5709664**	**11179878**	**15364336**	**22974705**	**32405768**	**55367977**	**70553555**	**91812556**	**87479928**	**97177941**	**106560625**	**116517768**	**127292202**

Mongla Port throughput forecast under consideration of port industry activities and developments 2020-2040, projections for 2050/2060/2070 and outlook until 2100

Commodities	Projected Exports 2020 - 2100 in metric tons													
	2010	2015	2018	2020	2025	2030	2035	2040	2050	2060	2070	2080	2090	2100
Dry Bulk Cargo trend	529	305	0	134529	177702	310840	387503	458340	483248	381530	373647	354938	330836	306095
Dry Bulk Cargo local industry and corrections	529	305	0	326	414	649	741	783	860	698	694	664	620	574
Grap or Conveyer trend	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grap or Conveyer local industry development	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal as per trend development	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal as per local development projections	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trend Development cement and construction material														
Cement clinker	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gypsum	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lime stone	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slag, sand, gravel etc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Development projections cement and construction materials														
Cement clinker	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gypsum	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lime stone	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slag, sand, gravel etc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grap, rain protected trend projections	529	305	0	134529	177702	310840	387503	458340	483248	381530	373647	354938	330836	306095
Fertilizers	0	0	0	134203	177289	310191	386762	457557	482388	380832	372953	354274	330216	305521
C.Bone/B. Griest	529	305	0	326	414	649	741	783	860	698	694	664	620	574
Salt	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grap, rain protected local industry and corrections	529	305	0	326	414	649	741	783	860	698	694	664	620	574
Fertilizers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C.Bone/B. Griest	529	305	0	326	414	649	741	783	860	698	694	664	620	574
Salt	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Protected or pneumatic handling trend	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grain	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soya beans, oil seeds	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fly Ash	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Protected or pneumatic handling local industry/corrections	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grain	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soya beans, oil seeds	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fly Ash	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid Bulk trend	0	100	0	97391	139168	257543	333420	405533	500328	510638	649694	806632	981258	1169936
Liquid Bulk local industry and corrections	0	100	0	0	0	0	0	0	0	0	0	0	0	0
Oil and fuel trend	0	100	0	97391	139168	257543	333420	405533	500328	510638	649694	806632	981258	1169936
Crude Oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mineral Oil fuel products	0	100	0	97391	139168	257543	333420	405533	500328	510638	649694	806632	981258	1169936
Oil and fuel local industry and corrections	0	100	0	0	0	0	0	0	0	0	0	0	0	0
Crude Oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mineral Oil fuel products	0	100	0	0	0	0	0	0	0	0	0	0	0	0
Edible Oil as per trend development	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Edible Oil local development projections	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid gas trend projections	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid Gas LPG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid Gas LNG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid gas local industry projections	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid Gas LPG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid Gas LNG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
General Cargo trend	165889	87452	135131	3495606	4419735	6893763	7839498	8229032	8985217	7180920	6998857	6509898	5851118	5162044
General Cargo local industry and corrections	165889	87452	135131	219116	293446	560888	1008744	1855110	2071180	3050696	3664065	4461015	4760921	5162044
Break Bulk (eg.g. iron/steel, paper, wood) trend	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Break Bulk (eg.g. iron/steel, paper, wood) local industry, corrections	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cars and vehicles as per trend	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Cars and vehicles local industry development	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Heavy lifts, project cargo, machinery	0	1686	6	410	521	821	942	1000	1096	888	882	844	788	730
Heavy lifts, project cargo, machinery trend correction	0	1686	6	410	521	821	942	1000	1096	888	882	844	788	730
Bags or bails, palletized or not trend	91763	13723	30998	110238	116227	164047	170123	170257	174086	136252	134829	131502	127082	122179
Bags or bails, palletized or not, corrections ==> see containers	91763	13723	30998	110238	116227	164047	170123	170257	174086	136252	134829	131502	127082	122179
Containerization affine cargoes trend	74126	72043	104125	3384958	4302987	6728895	7668434	8057775	8810034	7043780	6863146	6377552	5723248	5039135
Chemical products	0	0	0	28914	30484	43027	44621	44656	45660	35737	35363	34491	33332	32046
Fish, meat, fruits, other perishables	39144	35856	35011	23714	33887	62711	81186	98746	121828	124338	158198	196412	238932	284875
General cargoes, n.e.s	34982	36187	69114	3332330	4238616	6623157	7542627	7914374	8642546	6883705	6669585	6146649	5450984	4722215
Containerization affine cargoes as per local industry	74126	72043	104125	108468	176698	396020	837680	1683853	1895997	2913557	3528354	4328669	4633051	5039135
Chemical products	0	0	0	1446	1524	2151	2231	2233	45660	35737	35363	34491	33332	32046
Fish, meat, fruits, other perishables	39144	35856	35011	23714	33887	62711	81186	98746	121828	124338	158198	196412	238932	284875
General cargoes, n.e.s	34982	36187	69114	83308	141287	331158	754263	1582875	1728509	2753482	3334792	4097766	4360787	4722215
Total as per trend	166418	87857	135131	3727525	4736606	7462145	8560421	9092905	9968793	8073087	8022197	7671468	7163212	6638075
Total as per local industry developments and corrections	**166418**	**87857**	**135131**	**219442**	**293859**	**561537**	**1009486**	**1855893**	**2072040**	**3051394**	**3664758**	**4461679**	**4761541**	**5162619**

Mongla Port throughput forecast under consideration of port industry activities and developments 2020-2040, projections for 2050/2060/2070 and outlook until

Commodities	Projected Imports and Exports 2020 - 2100 in metric tons													
	2010	2015	2018	2020	2025	2030	2035	2040	2050	2060	2070	2080	2090	2100
Dry Bulk Cargo trend	2382642	5154407	9197573	19477240	33925072	70311005	97259722	123703768	179584985	136010276	139927279	140668584	140313457	140511825
Dry Bulk Cargo local industry and corrections	2382642	5154407	9197573	12408738	17882010	21990491	38786556	49513276	71650602	51793477	50693292	47831210	44130583	40124930
Grap or Conveyer trend	865797	3341960	6606898	15297241	27886600	59055510	82621277	105841283	157087733	112548396	109578993	102518514	93487233	84384393
Grap or Conveyer local industry development	865797	3341960	6606898	9901070	14498523	15659316	30532532	38957783	55843371	40299864	39291243	36894446	33824454	30718875
Coal as per trend development	0	1059143	2724026	1896366	3512045	7490748	10518438	13505503	17742894	13049675	12768975	12103224	11246784	10370446
Coal as per local development projections	0	1059143	2724026	3200000	7100000	7490748	10518438	13505503	17742894	13049675	12768975	12103224	11246784	10370446
Trend Development cement and construction material														
Cement clinker	798967	1572211	2690420	12826455	23395770	49558221	69343519	88839446	134133379	95768139	93178476	87019257	79145616	71222574
Gypsum	23800	103692	202410	117584	226846	492494	697775	900908	1372322	978063	951286	887590	806190	724344
Lime stone	0	171600	247783	82997	100972	165073	195671	222344	286403	211590	207212	196835	183468	169747
Slag, sand, gravel etc.	43030	435314	742259	373839	650967	1348974	1865875	2373082	3552734	2540928	2473043	2311608	2105175	1897282
Local Development projections cement and construction materials														
Cement clinker	798967	1572211	2690420	5100000	5630812	6216872	16262695	20834951	31457450	22459893	21852556	20408074	18561519	16703378
Gypsum	23800	103692	202410	383691	423626	467718	1235619	1595326	2430107	1731953	1684536	1571744	1427599	1282668
Lime stone	0	171600	247783	469701	518588	572563	1310902	1489599	1918762	1417553	1388223	1318697	1229147	1137224
Slag, sand, gravel etc.	43030	435314	742259	747678	825497	911415	1204878	1532404	2294158	1640790	1596954	1492708	1359405	1225159
Grap, rain protected trend projections	1009338	1565632	2106947	2233295	3228432	6020335	7831986	9558807	12003999	12537457	16237968	20439467	25122881	30179829
Fertilizers	1001139	1565327	2106947	1811737	2393401	4187581	5221287	6177019	6512233	5141238	5034863	4782702	4457920	4124531
C.Bone/B. Griest	529	305	0	326	414	649	741	783	860	698	694	664	620	574
Salt	7670	0	0	421232	834618	1832105	2609957	3381004	5490905	7395521	11202411	15656100	20664340	26054724
Grap, rain protected local industry and corrections	1009338	1565632	2106947	2099092	3051143	5710144	7445224	9562140	14478488	10331408	10050921	9383763	8530981	7673074
Fertilizers	1001139	1565327	2106947	1677534	2216112	3877390	4834525	6241926	9508117	6776498	6590971	6149657	5585673	5018611
C.Bone/B. Griest	529	305	0	326	414	649	741	783	860	698	694	664	620	574
Salt	7670	0	0	421232	834618	1832105	2609957	3319431	4969511	3554212	3459256	3233442	2944688	2653889
Protected or pneumatic handling trend	507507	246815	483728	1946704	2810040	5235160	6806459	8303678	10493254	10924424	14110318	17710603	21703343	25947602
Grain	503747	129632	131379	1702087	2277010	4021987	5048134	6002184	7493974	7679318	9810349	12212473	14868820	17668585
Soya beans, oil seeds	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fly Ash	3760	117183	352349	244617	533030	1213173	1758325	2301495	2999279	3245105	4299969	5498130	6834523	8279017
Protected or pneumatic handling local industry/corrections	507507	246815	483728	408575	332344	621031	808800	993353	1328743	1162205	1351127	1553000	1775148	1732980
Grain	503747	129632	131379	163959	219340	387430	486277	578179	721880	739734	945012	1176404	1432284	1701980
Soya beans, oil seeds	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fly Ash	3760	117183	352349	244617	113004	233601	322524	415174	606863	422471	406116	376597	342864	31000
Liquid Bulk trend	32276	209914	788729	4906970	7349355	14017683	18492835	22792095	28413777	29337727	37641736	47027700	57477361	68768927
Liquid Bulk local industry and corrections	32276	209914	788729	1148536	2316156	5120368	7319486	9501699	12310590	13241191	17476630	22284858	27646742	33442165
Oil and fuel trend	0	44928	96942	3283379	4691832	8682644	11240713	13671894	16867773	17215343	21903395	27194333	33081571	39442545
Crude Oil	0	44828	96942	55996	80017	148078	191705	233167	287671	293599	373551	463786	564190	672673
Mineral Oil fuel products	0	100	0	3227383	4611815	8534566	11049008	13438727	16580101	16921744	21529844	26730547	32517381	38769872
Oil and fuel local industry and corrections	0	44928	96942	262893	375664	695200	900018	1094678	1350564	1378394	1753755	2177389	2648767	3158075
Crude Oil	0	44828	96942	111993	160034	296156	383409	466335	575343	587198	747103	927571	1128379	1345346
Mineral Oil fuel products	0	100	0	150900	215631	399043	516609	628343	775222	791195	1006652	1249817	1520387	1812730
Edible Oil as per trend development	0	0	0	1180770	1687278	3122455	4042388	4916690	6065992	6190985	7876904	9779632	11896802	14184337
Edible Oil local development projections	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid gas trend projections	32276	164986	691787	442822	970246	2212584	3209734	4203510	5480013	5931399	7861437	10053735	12498988	15142045
Liquid Gas LPG	32276	164986	691787	442822	970246	2212584	3209734	4203510	5480013	5931399	7861437	10053735	12498988	15142045
Liquid Gas LNG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid gas local industry projections	32276	164986	691787	885643	1940491	4425168	6419468	8407021	10960025	11862798	15722875	20107470	24997976	30284090
Liquid Gas LPG	32276	164986	691787	885643	1940491	4425168	6419468	8407021	10960025	11862798	15722875	20107470	24997976	30284090
Liquid Gas LNG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
General Cargo trend	281353	433200	1328707	20480811	31426053	60251482	79715439	98078338	122219892	125492695	160081144	198948139	242128474	288814594
General Cargo local industry and corrections	281353	433200	1328707	2026504	3070398	5856446	10271421	13394474	16601032	25496654	32672778	40906236	49501983	58887725
Break Bulk (eg.g. iron/steel, paper, wood) trend	0	0	0	16426	26110	51578	69472	86838	109434	114333	147929	185954	228311	274084
Break Bulk (eg.g. iron/steel, paper, wood) local industry, corrections	0	0	0	16426	26110	51578	69472	86838	109434	114333	147929	185954	228311	274084
Cars and vehicles as per trend	14864	21077	24536	12186	17878	33710	43780	53582	67100	69626	89649	112295	137514	164765
Cars and vehicles local industry development	14864	21077	24536	41066	65275	128944	173679	217095	273584	285834	369821	464885	570777	685210
Heavy lifts, project cargo, machinery	23012	74089	183047	99192	194746	425836	605472	783389	1012592	1086452	1431571	1823251	2259985	2732028
Heavy lifts, project cargo, machinery trend correction	23012	74089	183047	197973	218647	241649	266836	294569	358955	437116	532642	649055	790954	963938
Bags or bails, palletized or not trend	91763	13723	30998	1444725	2209910	4269384	5676040	7032786	8803412	9130691	11752829	14718232	18020376	21588686
Bags or bails, palletized or not, corrections ==> see containers	91763	13723	30998	110238	116227	164047	170123	170257	174086	136252	134829	131502	127082	122179
Containerization affine cargoes trend	151714	324311	1090126	18908281	28977410	55470975	73320676	90121744	112227355	115091593	146659166	182108408	221482289	264055031
Chemical products	0	0	0	28914	30484	43027	44621	44656	45660	35737	35363	34491	33332	32046
Fish, meat, fruits, other perishables	39144	35856	35011	23714	33887	62711	81186	98746	121828	124338	158198	196412	238932	284875
General cargoes, n.e.s	112570	288455	1055115	18855653	28913039	55365237	73194869	89978342	112059867	114931518	146465605	181877505	221210025	263738110
Containerization affine cargoes as per local industry	151714	324311	1090126	1660801	2644141	5270228	9591312	12625716	15684973	24523120	31487558	39474840	47784859	56842314
Chemical products	0	0	0	1446	1524	2151	2231	2233	45660	35737	35363	34491	33332	32046
Fish, meat, fruits, other perishables	39144	35856	35011	23714	33887	62711	81186	98746	121828	124338	158198	196412	238932	284875
General cargoes, n.e.s	112570	288455	1055115	1635641	2608729	5205366	9507895	12524737	15517485	24363045	31293996	39243937	47512595	56525394
Total as per trend	2696271	5797521	11315009	44865021	72700481	144580171	195467996	244574201	330218654	290840698	337650158	386644423	439919292	498095346
Total as per local industry developments and corrections	**2696271**	**5797521**	**11315009**	**15583778**	**23268564**	**32967305**	**56377463**	**72409449**	**100562224**	**90531322**	**100842699**	**111022304**	**121279308**	**132454820**

The assumed modal split in Mongla port hinterland traffic 2018 and during the forecast period is presented by the following tables for import and export respectively.

Maritime Trade and Sea Port Hinterland Traffic Modal Split - Assumed share of Modes of Transport in trade volumes in percent according to distances and modal affinities

Import/Inbound cargo flows (commodities unloaded)

	Commodities	2018					2020					2030					2040					2070					2100				
		Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total	Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total	Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total	Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total	Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total	Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total
1	**Dry Bulk Cargo**																														
1.1.	Grap or Conveyer																														
	Coal	25%	50%	25%	0%	100%	25%	50%	25%	0%	100%	50%	20%	5%	25%	100%	50%	20%	0%	30%	100%	50%	20%	0%	30%	100%	50%	20%	0%	30%	100%
	Cement clinker	90%	10%	0%	0%	100%	95%	5%	0%	0%	100%	95%	5%	0%	0%	100%	100%	0%	0%	0%	100%	100%	0%	0%	0%	100%	100%	0%	0%	0%	100%
	Gypsum	90%	5%	5%	0%	100%	95%	0%	5%	0%	100%	90%	5%	5%	0%	100%	90%	5%	5%	0%	100%	90%	5%	5%	0%	100%	90%	5%	5%	0%	100%
	Lime stone	90%	5%	5%	0%	100%	90%	5%	5%	0%	100%	80%	5%	5%	10%	100%	80%	5%	5%	10%	100%	80%	5%	5%	10%	100%	80%	5%	5%	10%	100%
	Slag, sand, gravel etc.	75%	5%	20%	0%	100%	85%	5%	10%	0%	100%	70%	5%	15%	10%	100%	70%	5%	15%	10%	100%	70%	5%	15%	10%	100%	70%	5%	15%	10%	100%
	Other dry bulk	60%	20%	20%	0%	100%	60%	20%	20%	0%	100%	40%	20%	20%	20%	100%	30%	20%	20%	30%	100%	30%	20%	20%	30%	100%	30%	20%	20%	30%	100%
1.2	Grap, rain protected																														
	Fertilizers	20%	50%	30%	0%	100%	20%	50%	30%	0%	100%	20%	40%	20%	20%	100%	20%	40%	20%	20%	100%	20%	40%	20%	20%	100%	20%	40%	20%	20%	100%
	C.Bone/B. Griest		25%	75%	0%	100%		25%	75%	0%	100%	20%	40%	20%	20%	100%	20%	40%	20%	20%	100%	0,2	40%	20%	20%	100%	0,2	40%	20%	20%	100%
	Salt		25%	75%	0%	100%		25%	75%	0%	100%	20%	40%	20%	20%	100%	20%	40%	20%	20%	100%	20%	40%	20%	20%	100%	20%	40%	20%	20%	100%
	Other cargoes	20%	20%	60%	0%	100%	20%	20%	60%	0%	100%	20%	20%	60%	0%	100%	20%	20%	60%	0%	100%	20%	20%	60%	0%	100%	20%	20%	60%	0%	100%
1.3	Protected or pneumatic handling																														
	Grain	60%	10%	30%	0%	100%	60%	10%	30%	0%	100%	65%	5%	20%	10%	100%	65%	5%	20%	10%	100%	65%	5%	20%	10%	100%	65%	5%	20%	10%	100%
	Soya beans, oil seeds	60%		40%	0%	100%	60%		40%	0%	100%	60%		20%	20%	100%	60%		20%	20%	100%	60%	0	20%	20%	100%	60%	0	20%	20%	100%
	Fly Ash	80%	20%		0%	100%	90%	10%		0%	100%	80%	20%		0%	100%	80%	20%		0%	100%	80%	20%	0	0%	100%	80%	20%	0	0%	100%
	Other cargoes	20%	10%	70%	0%	100%	20%	10%	70%	0%	100%	65%	5%	20%	10%	100%	65%	5%	20%	10%	100%	65%	5%	20%	10%	100%	65%	5%	20%	10%	100%
2	**Liquid Bulk**																														
2.1	Oil and fuel																														
	Crude Oil	100%			0%	100%	100%			0%	100%	100%			0%	100%	100%			0%	100%	100%	0	0	0%	100%	100%	0	0	0%	100%
	Mineral oil fuel products	10%		90%	0%	100%	10%		90%	0%	100%	10%		40%	50%	100%	5%		25%	70%	100%	5%	0	25%	70%	100%	5%	0	25%	70%	100%
2.2	Liquid gas																														
	Liquid Gas LPG	100%			0%	100%	100%			0%	100%	100%			0%	100%	100%			0%	100%	100%	0	0	0%	100%	100%	0	0	0%	100%
	Liquid Gas LNG	100%			0%	100%	100%			0%	100%	50%		10%	40%	100%	50%		10%	40%	100%	50%	0	0,1	40%	100%	50%	0	0,1	40%	100%
3	**General Cargo**																														
3.1	Break Bulk (eg.g. iron/steel, paper, wood)	10%	10%	80%	0%	100%	10%	10%	80%	0%	100%	10%	10%	40%	40%	100%	15%	5%	40%	40%	100%	15%	5%	40%	40%	100%	15%	5%	40%	40%	100%
3.2	Cars and vehicles			100%	0%	100%			100%	0%	100%			75%	25%	100%			50%	50%	100%	0	0	50%	50%	100%	0	0	50%	50%	100%
3.3	Heavy lifts, project cargo, machinery	5%	5%	90%	0%	100%	5%	5%	90%	0%	100%	5%	5%	75%	15%	100%	5%	5%	70%	20%	100%	5%	5%	70%	20%	100%	5%	5%	70%	20%	100%
3.4	Bags or bails, palletized or not	30%	10%	60%	0%	100%	30%	10%	60%	0%	100%	20%	10%	50%	20%	100%	25%	5%	50%	20%	100%	25%	5%	50%	20%	100%	25%	5%	50%	20%	100%
3.5	Containerization affine cargoes																														
	Chemical products	0%	0%	100%	0%	100%	0%	0%	100%	0%	100%	0%	0%	90%	10%	100%	0%	0%	75%	25%	100%	0%	0%	75%	25%	100%	0%	0%	75%	25%	100%
	Fish, meat, fruits, other perishables	5%	0%	95%	0%	100%	10%	0%	90%	0%	100%	5%	0%	95%	0%	100%	5%	0%	95%	0%	100%	5%	0%	95%	0%	100%	5%	0%	95%	0%	100%
	General cargoes, n.e.s	5%	0%	95%	0%	100%	10%	0%	90%	0%	100%	10%	0%	70%	20%	100%	10%	0%	60%	30%	100%	10%	0%	60%	30%	100%	10%	0%	60%	30%	100%
4	**Containers handled**	10%	0%	90%	0%	100%	10%	0%	90%	0%	100%	10%	0%	65%	25%	100%	10%	0%	60%	30%	100%	10%	0%	60%	30%	100%	10%	0%	60%	30%	100%

Maritime Trade and Sea Port Hinterland Traffic Modal Split - Assumed share of Modes of Transport in trade volumes in percent according to distances and modal affinities

Export/Outbound cargo flows (commodities loaded)

	Commodities	2018					2020					2030					2040					2070					2100				
		Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total	Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total	Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total	Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total	Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total	Local Industry	Inland Water Transport	Road	Train/ Intermodal	Total
1	**Dry Bulk Cargo**																														
1.1.	Grap or Conveyer																														
	Coal	0%	50%	50%	0%	100%	0%	50%	50%	0%	100%	0%	30%	30%	40%	100%	0%	20%	20%	60%	100%	0%	20%	20%	60%	100%	0%	20%	20%	60%	100%
	Cement clinker	0%	50%	50%	0%	100%	0%	50%	50%	0%	100%	0%	40%	40%	20%	100%	0%	30%	40%	30%	100%	0%	30%	40%	30%	100%	0%	30%	40%	30%	100%
	Gypsum	0%	20%	80%	0%	100%	0%	20%	80%	0%	100%	0%	10%	40%	50%	100%	0%	10%	30%	60%	100%	0%	10%	30%	60%	100%	0%	10%	30%	60%	100%
	Lime stone	0%	50%	50%	0%	100%	0%	50%	50%	0%	100%	0%	40%	20%	40%	100%	0%	30%	20%	50%	100%	0%	30%	20%	50%	100%	0%	30%	20%	50%	100%
	Slag, sand, gravel etc.	5%	45%	50%	0%	100%	5%	40%	55%	0%	100%	10%	30%	50%	10%	100%	10%	25%	50%	15%	100%	10%	25%	50%	15%	100%	10%	25%	50%	15%	100%
	Other dry bulk	5%	20%	75%	0%	100%	5%	20%	75%	0%	100%	10%	20%	50%	20%	100%	10%	20%	50%	20%	100%	10%	20%	50%	20%	100%	10%	20%	50%	20%	100%
1.2	Grap, rain protected																														
	Fertilizers	0%	50%	50%	0%	100%	0%	50%	50%	0%	100%	0%	40%	40%	20%	100%	0%	30%	40%	30%	100%	0%	30%	40%	30%	100%	0%	30%	40%	30%	100%
	C.Bone/B. Griest		0%	100%	0%	100%		0%	100%	0%	100%		0%	100%	0%	100%		0%	100%	0%	100%	0	0%	100%	0%	100%	0	0%	100%	0%	100%
	Salt		10%	90%	0%	100%		10%	90%	0%	100%		10%	70%	20%	100%		10%	70%	20%	100%	0%	10%	70%	20%	100%	0%	10%	70%	20%	100%
	Other cargoes	20%	5%	75%	0%	100%	20%	5%	75%	0%	100%	20%	5%	60%	15%	100%	20%	5%	60%	15%	100%	20%	5%	60%	15%	100%	20%	5%	60%	15%	100%
1.3	Protected or pneumatic handling																														
	Grain	10%	10%	80%	0%	100%	10%	10%	80%	0%	100%	10%	5%	60%	25%	100%	10%	5%	60%	25%	100%	10%	5%	60%	25%	100%	10%	5%	60%	25%	100%
	Soya beans, oil seeds		10%	90%	0%	100%		10%	90%	0%	100%		5%	75%	20%	100%		5%	70%	25%	100%	0%	0,05	70%	25%	100%	0%	0,05	70%	25%	100%
	Fly Ash	10%	60%	30%	0%	100%	10%	60%	30%	0%	100%	10%	60%	30%	0%	100%	15%	55%	30%	0%	100%	15%	55%	0,3	0%	100%	15%	55%	0,3	0%	100%
	Other cargoes	20%	0%	80%	0%	100%	20%	0%	80%	0%	100%	20%		70%	10%	100%	20%	0%	70%	10%	100%	20%	0%	70%	10%	100%	20%	0%	70%	10%	100%
2	**Liquid Bulk**																														
2.1	Oil and fuel																														
	Crude Oil	0%		100%	0%	100%	0%		100%	0%	100%	100%			0%	100%	100%			0%	100%	100%	0	0	0%	100%	100%	0	0	0%	100%
	Mineral oil fuel products	10%	10%	80%	0%	100%	10%	10%	80%	0%	100%	10%		80%	10%	100%	10%		80%	10%	100%	10%	0	80%	10%	100%	10%	0	80%	10%	100%
2.2	Liquid gas																														
	Liquid Gas LPG	100%			0%	100%	100%			0%	100%	100%			0%	100%	100%			0%	100%	100%	0	0	0%	100%	100%	0	0	0%	100%
	Liquid Gas LNG	100%			0%	100%	100%			0%	100%	100%			0%	100%	100%			0%	100%	100%	0	0	0%	100%	100%	0	0	0%	100%
3	**General Cargo**																														
3.1	Break Bulk (eg.g. iron/steel, paper, wood)	0%	5%	95%	0%	100%	5%	5%	90%	0%	100%	10%	10%	60%	20%	100%	15%	10%	50%	25%	100%	15%	10%	50%	25%	100%	15%	10%	50%	25%	100%
3.2	Cars and vehicles			100%	0%	100%			100%	0%	100%			90%	10%	100%			90%	10%	100%	0	0	90%	10%	100%	0	0	90%	10%	100%
3.3	Heavy lifts, project cargo, machinery	0%	0%	100%	0%	100%	0%	0%	100%	0%	100%	0%	0%	90%	10%	100%	0%	0%	90%	10%	100%	0%	0%	90%	10%	100%	0%	0%	90%	10%	100%
3.4	Bags or bails, palletized or not	60%	10%	30%	0%	100%	60%	10%	30%	0%	100%	60%	5%	30%	5%	100%	60%	0%	30%	10%	100%	60%	0%	30%	10%	100%	60%	0%	30%	10%	100%
3.5	Containerization affine cargoes																														
	Chemical products	50%	0%	50%	0%	100%	50%	0%	50%	0%	100%	50%	0%	40%	10%	100%	50%	0%	35%	15%	100%	50%	0%	35%	15%	100%	50%	0%	35%	15%	100%
	Fish, meat, fruits, other perishables	15%	0%	85%	0%	100%	15%	0%	85%	0%	100%	20%	0%	80%	0%	100%	20%	0%	80%	0%	100%	20%	0%	80%	0%	100%	20%	0%	80%	0%	100%
	General cargoes, n.e.s	10%	0%	90%	0%	100%	15%	0%	85%	0%	100%	15%	0%	70%	15%	100%	15%	0%	60%	25%	100%	15%	0%	60%	25%	100%	15%	0%	60%	25%	100%
4	**Containers handled**	10%	0%	90%	0%	100%	10%	0%	90%	0%	100%	15%	0%	65%	20%	100%	10%	0%	60%	30%	100%	10%	0%	60%	30%	100%	10%	0%	60%	30%	100%

Appendix L – Container Shipping Trends

The container shipping industry exists only for 50 years now. Nevertheless, dramatic changes have been experienced not only regarding to ship sizes but also regarding size and structure of the players.

Container Ship Sizes

The container shipping industry has experienced a tremendous growth in ship sizes since the introduction of the container. Fig. xxx illustrates the development by showing the development of ship sizes over the years and their respective initiators. The development has followed an incredible exponential growth over the last 50 years. Apparently over almost 20 years the development has been fuelled by Maersk Line of Denmark which has grown in parallel to the biggest shipping line of the world. In the meantime, the role of Maersk as a ship size fore runner has been succeeded by various competitors which felt forced to follow and overtake Maersk's example. The latest news is that Evergreen of Taiwan will lead the development with in total 10 vessels of 23,764 TEU capacity for the first delivery in 2020 beating MSC with its presently record holding vessels of 23,756 TEU.

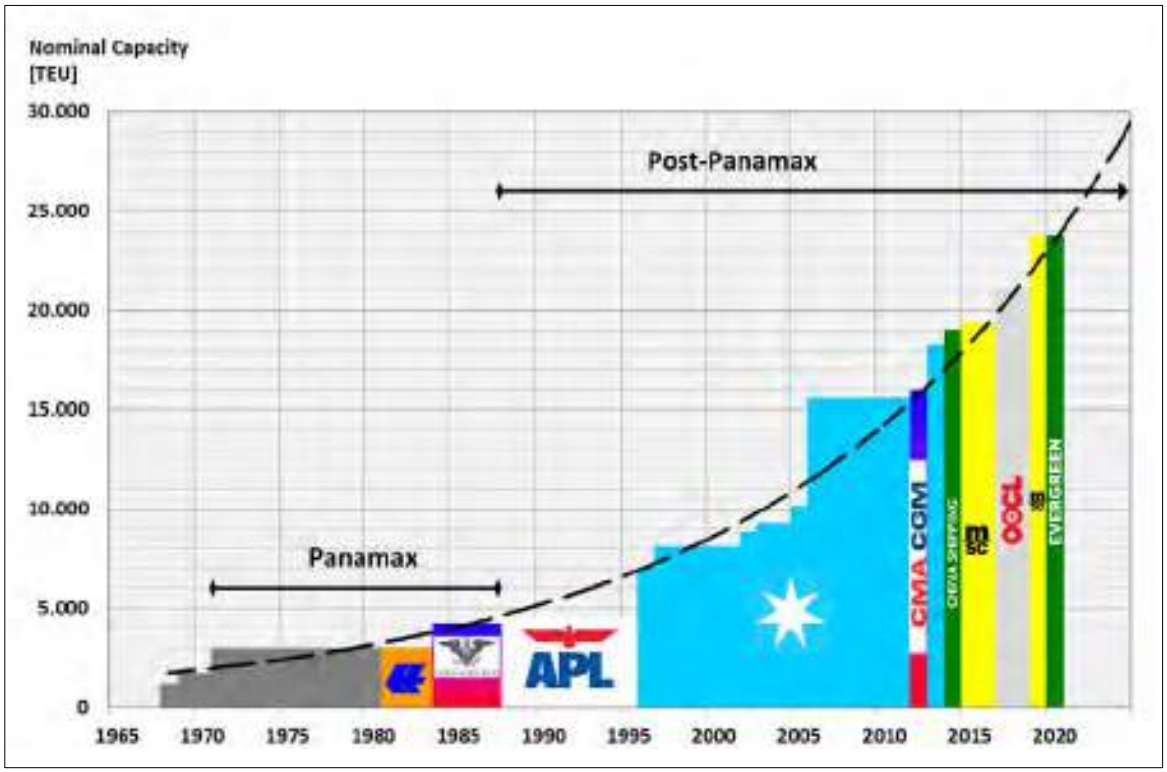


Fig. 1 Record breaking ship sizes and their initiators

Shipping lines are aiming to make use out of the Economies-of-Scale (EoS) effect when ordering ever bigger vessels. Due to this effect three major specific cost types in container shipping are being reduced:

- Investment per TEU
- Fuel costs per TEU
- Operating costs per TEU (mostly for crewing)

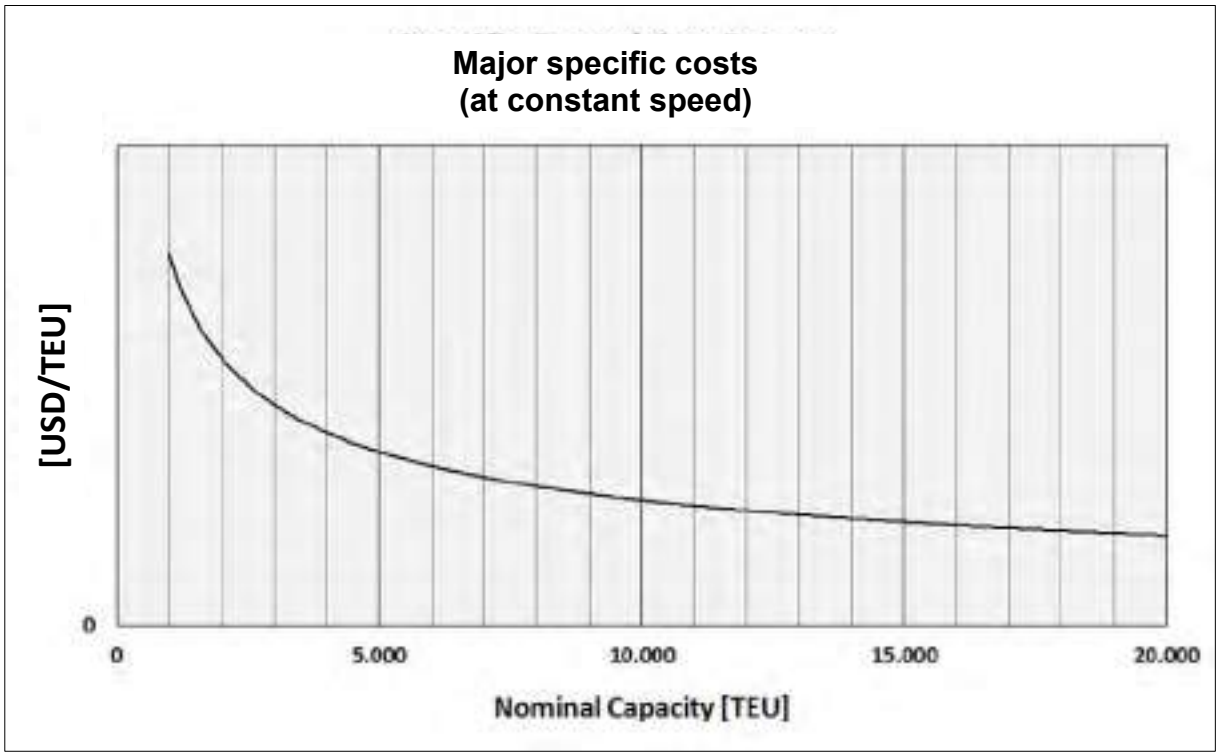


Figure 1: Cost per container slot in relation to vessel sizes

These three major cost curves are of asymptotic shape and consequently their sum is also (see above figure). Hence in principle, the impact of the general Economics of Scale (EoS) effect is getting weaker the bigger the ships become. Hence already at present mega ship sizes the effect of any further increase in size is only marginal. On the other hand the costs for related infrastructure (e.g. dredging, turning basins, quay walls, container cranes) are increasing more than linear with the increasing ship sizes. I.e. the benefits for the operator of such vessels are getting smaller but the costs mostly to be borne by the public are heavily increasing (see below figure).

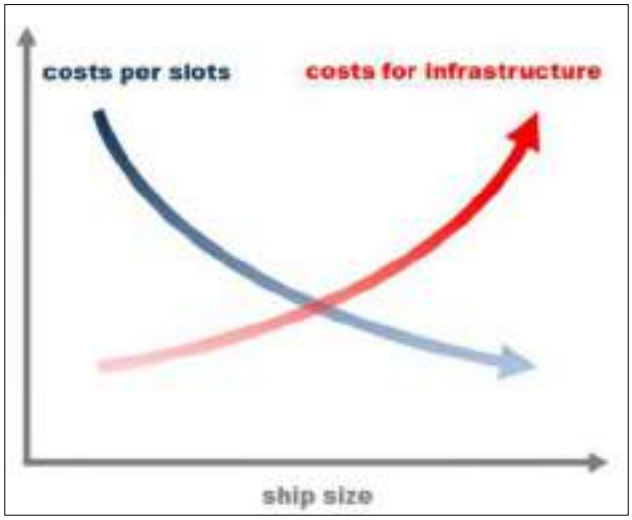


Figure 2: Economics of ship size and land cost

This is not only a shift in sharing of benefits and cost but the total costs of the transport chain are increasing meanwhile despite the EoS effect. It is only the stiff competition among some ports which is paving the way on their costs for ever bigger vessels in order to keep the container lines calling at the ports.

It remains exciting to see whether the further development will still follow the exponential path of the past resulting probably in approx. 30,000 TEU vessels just beyond the year 2025. The consulting firm McKinsey predicts even vessels of 50,000 TEU size in the long run which they assume would be autonomous then.

With the only two exemptions of the so-called 'jumbo vessels' of later bankrupt USL for its round-the-world service in the late 1980s and the first Post-Panamax vessels put in service by APL for trading across the Pacific in the early 1990s all record breaking box ships have been introduced in the Europe - Far East trade for the last 50 years!

Market Concentration

In parallel to the increasing ship sizes a significant consolidation of the global liner shipping industry has taken place over the last decade (figure 3).

Figure 3: Recent mergers and acquisitions in container shipping

While each carrier is still acting independently on the marketing and sales side the remaining top carriers have formed three global alliances on the operation side (2M, Ocean Alliance, THE Alliance) as per Figure 4.[43]

Figure 4: The global container ship alliances

[43] Major South Korean carrier Hyundai Merchant Marine (HMM) is not member of any alliance but has maintained a strategic partnership previously with 2M but switches recently to THE Alliance.

Each alliance agrees on the provided capacity, sailing frequency, schedules as well as on port and terminals to be called at. On the Asian-North Europe trade the market share of the three alliances is nearly 100% (Figure 5). Hence while there is still enough competition among the carriers towards their customers ports and port service providers are confronted virtually with a demand oligopoly.

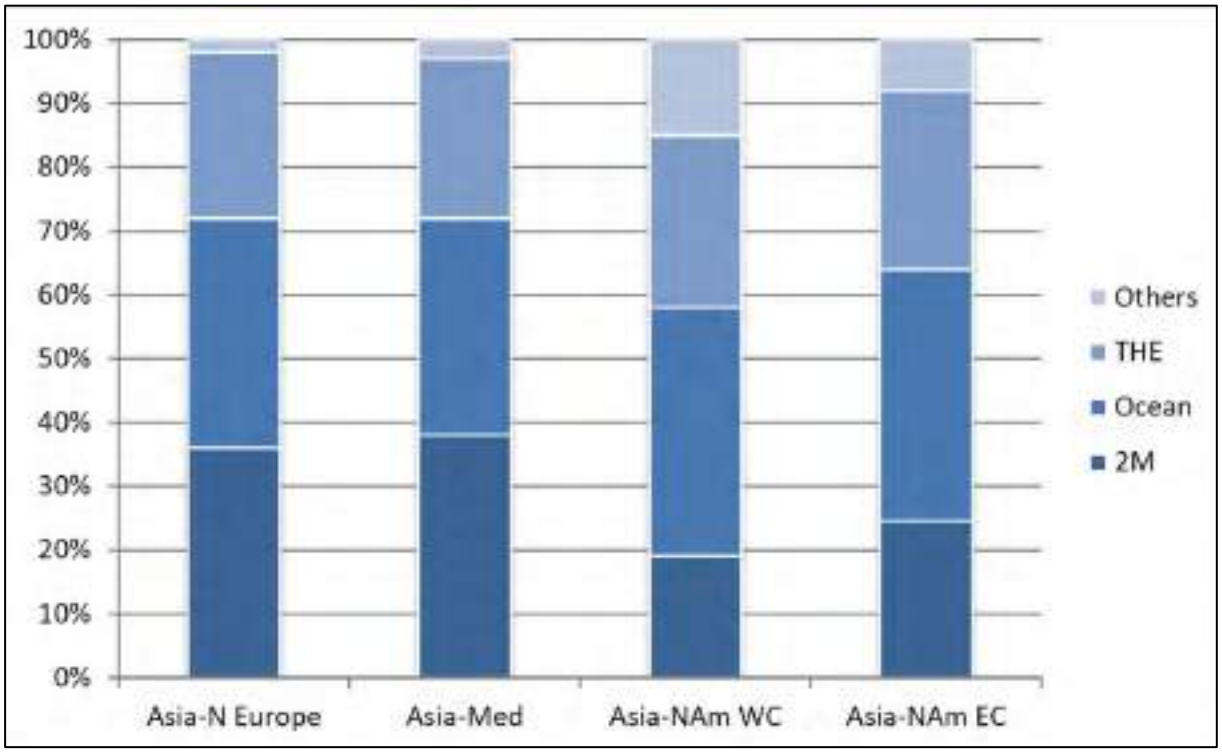
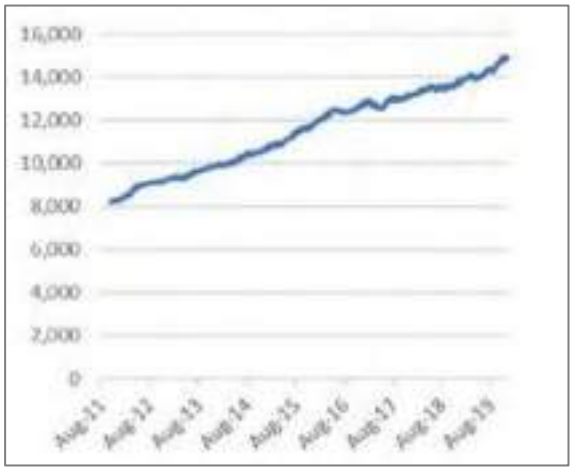


Figure 5: Capacity Shares of global alliances on main East-West trade lanes (2018)

In line with the record-breaking sizes also the average size of container ships in the Asia-Europe trade has continuously grown to approx. 15,000 TEU at present (Figure 6). Hence container vessels of this size should be considered as the present work horses in the Europe – Asia trade.



Source: Shipping Watch, 04.09.19

Figure 6: Average vessel size Asia-Europe

M/V. "Afif" (Figure 7) is a good example of such type. She has a fully laden draft of 15.5 m and could not even berth in empty condition in Mongla or Chittagong. Virtually all ports around the Bay of Bengal are unable to accommodate such vessels.

Figure 7: M/V. "Afif" Source: Hapag-Lloyd

Tonnage:	153,148 GT
Length:	369 m
Beam:	51 m
Draft (scantling):	15.5 m
Capacity:	15,000 TEU
Deadweight:	149,360 tons

Container Connectivity of Mongla Port

Realistically it has to be accepted that none of the Bangladesh ports will ever be directly called by the giant container vessels serving as the workhorses on the Europe – Far East trade lane. I.e. all Bangladesh ports will for ever remain feeder ports which are to be connected to the global liner services via one of the three hub ports in the regions, e.g. Singapore, Tanjung Pelepas (Malaysia) or Colombo (Sri Lanka).

Consequently, the container trade to/from Bangladesh will ever be burdened with the additional costs of a comparatively expensive feeder voyage to one of the hubs and for the related transhipment procedure.

The feeder voyage will be more expensive as only small container vessels which can cope with the draft situation in Mongla and Chittagong can be used, while the situation in Mongla is even worse than in Chittagong. Hence due to its remote location and the draft situation in its ports Bangladesh is obliged to accept limitations provided by nature with a significant cost disadvantage regarding seaborne container logistics.

	Chittagong		Mongla	
	at present	planned	at present	planned
Max. draft at container berths	9.5 m[44]		7.0 m	
Max. length	190 m[45]		225 m	
Resulting vessel size	1,800-2,200 TEU[46]		500-800 TEU[47]	
Max. draft at buoy/anchor	-	-	8.5 m	

Source: CPA & MPA

Table 1: Vessel size restrictions at Bangladesh ports

Container Lines serving Mongla Port

Presently only two container lines have included Mongla Port into their network of liner services:

- **Maersk Line**
- **Pacific International Line (PIL)**

With such small attention by the big container lines it is a surprise that not even X-PRESS FEEDERS (based in Singapore) as the largest independent common (feeder) carrier in the world with a wide coverage in the Asian region is presently not serving Mongla.

For the time being it is mandatory that all containerships calling Mongla are self-sustained as there are no quay based container cranes.[48]

The Danish company has grown to the biggest shipping line of the world. Maersk has been serving Bangladesh since 1996. Through its network Mongla is virtually connected to all parts of the world. In Bangladesh Maersk operates offices in Dhaka, Chittagong and Khulna from

[44] Valid for the months from July to December 2019

[45] At night the maximum permissible length is reduced to 175 m

[46] Due to the length limitation partly loaded bigger vessels cannot berth

[47] Partly loaded bigger vessels can berth. The length limitation would theoretically allow for vessels up to approx. 3,000 TEU size.

[48] Only at the time of writing this report a LIEBHERR mobile harbour crane was in the process of being commissioned in Mongla port.

where the operation in Mongla is controlled. Cargo booking is only via the Dhaka and Chittagong office.

Maersk is operating two dedicated Bangladesh feeder services which include calls in Mongla (Bangladesh Feeder 1 & 4). They are connecting the ports of Mongla, Chittagong and Yangoon (Myanmar) with its hub in Tanjung Pelepas (Malaysia) and in case of Bangladesh Feeder 1 also adjacent Singapore. Each of both services deploys one vessel (M/V. "Maersk Wolgast" & M/V. "Cape Syros") with a roundtrip duration of 14 days. Chittagong as Bangladesh's mainport is additionally served by other Maersk feeder services which do not call at Mongla.

To better cope with the current draft constraints Mongla is mostly served as the last discharging port (as imports prevail). Despite the published duration it can be derived from Maersk's sailing schedule that Mongla is served 2 to 3 time per month in average by this carrier. Transit time to Tanjung Pelepas is abt. 3 or 5 days respectively or 5 days to Singapore (Bangladesh Feeder 1). From Tanjung Pelepas to Mongla it takes abt. 8 days in both cases. From Singapore (Bangladesh Feeder 1) it is one day less. For comparison: In Chittagong at least one vessel of various Maersk services is calling every day.

Ships calling Mongla are mostly vessels which are not owned but chartered by Maersk (even when they a showing the full Maersk colours) in a size range between 1,500 and 2,200 TEU. None of the vessels presently in service can call Mongla at its full draft.

Maersk has a slot charter agreement for its Mongla service at least with the CMA-CGM Group.

Port	Arrives	Departs	Transit (Days)
TANJUNG PELEPAS, MALAYSIA	MON	TUE	—
SINGAPORE, SINGAPORE	WED	WED	1
YANGON MITT, MYANMAR	SUN	MON	3
MONGLA, BANGLADESH	WED	THU	8
TANJUNG PELEPAS, MALAYSIA	MON	TUE	13

Bangladesh Feeder 1

Port	Arrives	Departs	Transit
Tanjung Pelepas, Malaysia	THU	FRI	—
Chittagong, Bangladesh	TUE	THU	5
Mongla, Bangladesh	FRI	SAT	8
Tanjung Pelepas, Malaysia	THU	FRI	13

Bangladesh Feeder 4

Sources: Maersk Line

Figure 8: Bangladesh Feeder Lines calling Mongla Port

The following vessels are in charge of serving the feeder lines operated by Maersk

Figure 9: M/V. "Maersk Wolgast"

Tonnage:	18,123 GT
Length:	175 m
Beam:	28 m
Draft (scantling):	9.5 m
Capacity:	1,713 TEU
Deadweight:	22,314 tons

Figure 10 M/V. "Cape Syros" (entering Chittagong)

Tonnage:	25,165 GT
Length:	184 m
Beam:	30 m
Draft (scantling):	9.5 m
Capacity:	2,190 TEU
Deadweight:	25,332 tons

PIL which is based in Singapore is the 9th largest container carrier of the world with a focus on the Asian region.

With two vessels presently in service PIL is maintaining a real dedicated Chittagong/Mongla service with a round voyage duration of 17 days: Singapore – Chittagong – Mongla – Singapore

Transit time from Singapore to Mongla is offered with 8 days whereas the return transit is within 5 days. With M/V. "Kota Ria" and M/V. "Kota Rukun" two almost identical self-sustained vessels in the 800 to 900 TEU range are presently employed.

With two vessels 3 to 4 sailings are offered per month.

Source: PIL

Figure 11: Chittagong-Mongla Service

PIL is not only carrying its own containers but acts also as a feeder carrier to a few other deep-sea lines.

Figure 12 M/V. "Kota Ria"

Tonnage:	9,725 GT
Length:	146 m
Beam:	23 m
Draft (scantling):	8.1 m
Capacity:	851 TEU
Deadweight:	13,017 tons

Figure 13 M/V. "Kota Rukun"

Tonnage:	9,422 GT
Length:	144 m
Beam:	23 m
Draft (scantling):	8.1 m
Capacity:	777 TEU
Deadweight:	13,058 tons

Conclusions

The 1,700 to 2,200 TEU vessels operated by Maersk which are presently calling both Chittagong and Mongla do almost reach the limits of Chittagong port regarding to their length and fully utilise the possible draft but only can call Mongla not fully loaded although the length limitation would allow for even bigger vessels.

PIL is operating vessels which are almost tailor made for Mongla port utilising their max. draft by almost 90% whereas Chittagong port can be even called fully loaded.

Presently Mongla is only connected to the hubs in the Singapore area, i.e. Singapore and Tanjung Pelepas (Malaysia). Maximum draft for Mongla for container vessels berthing at the MPA jetty is currently 7.0 m, whereas the critical outer bar can only be crossed at high tide. Chittagong allows at present for vessels of up to 9.5 m draft.

In average there are 5 (and up to 8) sailings per month with vessels of 800 to 2,200 TEU size. However not even the 800 TEU vessels can call Mongla at their full draft.

Colombo, the other big hub in the region which is much closer to Europe, has no connection to Mongla at all.

The container logistic costs are a key element for the competiveness of the textile industry of Bangladesh. Hence it is of major importance for the nation's economy. As textiles are generally a low value product (at least ex-factory) logistics costs contribute significantly to the CIF value of the goods. Hence every Taka not spent for logistics improves the competitiveness of the textiles made in Bangladesh or gives some room for social improvements for the textile workers.

Consequently, the port development in Bangladesh has to enable low container logistic costs from the factory which are almost entirely located in the Dhaka area via a Bangladesh seaport to one of the major hub ports in the region. The same applies in the opposite direction for necessary raw materials to be imported for the textile industry.

The development of Mongla Port should therefore aim at reducing the entire logistic costs of the transport chain from the Dhaka area to one of the hub ports in order to become a viable alternative to shipping via Chittagong. Otherwise it would be difficult to route cargo via Mongla instead of via Chittagong as the cargo is always following the cheapest way (old forwarders insight) – even if there is congestion.

Port costs

The below table is comparing the main cost items of the port tariffs of Chittagong and Mongla port which are relevant for container vessels. Very surprisingly the port tariff of CPA has not been changed for 11 years now while the recently updated tariff of MPA shows in some categories the same rates as CPA.

Port dues are to be borne by the ship, i.e. its agent or otherwise by the cargo, i.e. its shipper or consignee or practically the forwarder.

All dues to be borne by the (mostly foreign ships) or their agents respectively are in given USD while the dues to be settled by the (mostly domestic) cargo side are in BDT.

		Chittagong[49]	**Mongla**[50]
Ship's agent	Port dues	0.241 USD/GRT/call	
	Port dues (during lighterage operation within port limits)	0.15 USD/GRT/month	
	Pilotage	35.75 USD/1,000 GRT/job	321 – 1,538 USD/job[51]
	Tug (for vsl > 5,000 GRT)	632 USD/tug/job	594 USD/tug/job
	Berth occupancy:	-Jetty no. 1 – 13: 2.50 USD/1,000 GRT/hr -Jetty no. 14 – 16: 1.25 USD/1,000 GRT/hr -Jetty no. 17: 2.50 USD/1,000 GRT/hr	30 USD/1,000 GRT/day
	At mooring buoy At anchor	n/a	20 USD/1,000 GRT/day 15 USD/1,000 GRT/day
	Move by gantry crane -Full -Empty	20ft / > 20ft 15.00 USD / 22.50 USD 7.50 USD / 11.25 USD	(still) n/a
	Quay handling -FCL -LCL -Empty	20ft 43.40 USD 130.00 USD 22.10 USD	> 20ft 65.10 USD 195.00 USD 33.20 USD
	Floating crane -Full -Empty -Hire	20ft / > 20ft 121.00 USD / 242.00 USD 21.30 USD / 42.60 USD 95.00 USD/4 hrs	n/a
	Container storage (free storage)	FCL import: 4 days, otherwise: 7 days, 28 days in case of transhipment 20ft / > 20ft 1 – 7 days: 6.00 USD/day	7 days, 28 days in case of transhipment 20ft / > 20ft First 10 days:

[49] Tariff on Goods and Vessels etc., CPA, 2008
[50] Schedule of Charges on Goods and Vessels etc., MPA, 2017
[51] Exact rate according to the gross tonnage and the actual draft as per Schedule of Charges on Goods and Vessels etc. issued by MPA

		8 – 20 days:12.00 USD/day 12.00 USD/day > 20 days: 24.00 USD/day 24.00 USD/day 48.00 USD/day	Loaded: 3.00 USD/day 6.00 USD/day Empty: 1.50 USD/day 3.00 USD/day Thereafter: Loaded: 8.00 USD/day 16.00 USD/day Empty: 3.00 USD/day 6.00 USD/day
	Extra container move (ground handling)		20ft > 20ft Loaded: 42.60 USD 63.90 USD 32.50 USD Empty: 21.70 USD
	Reefer connection	9.00 USD/day	8.00 USD/day
Shipper /Agent	River dues -FCL -LCL -Empty	20ft > 20ft Import: 408 BDT/Ctr 816 BDT/Ctr Export: Import: 184 BDT/Ctr 368 BDT/Ctr Export: - 34.10 BDT/1,000 kg Import: - Export: 102 BDT/Ctr 15.30 BDT/1,000 kg 102 BDT/Ctr 204 BDT/Ctr 204 BDT/Ctr	
Shipper	Stuffing Unstuffing Hoisting charge (for CPA equipment)	300 BDT/1,000 kg 300 BDT/1,000 kg + 100%	75 BDT/1,000 kg 92 BDT/1,000 kg + 125%
	Lift on/lift off charge (on/from truck, rail, barge)	20ft > 20ft Loaded: 1,000 BDT/Ctr 1,500 BDT/Ctr 563 BDT/Ctr Empty: 375 BDT/Ctr	20ft > 20ft Loaded: 1,100 BDT/Ctr 1,650 BDT/Ctr 825 BDT/Ctr Empty: 550 BDT/Ctr

Source: CPA, MPA

Table 2: Comparison of port tariffs of CPA and MPA for container handling/vessels (over 5,000 GT)

		ICD Dhaka[49]
Shipper	Stuffing Unstuffing Hoisting charge Receiving & delivery charge	300 BDT/1,000 kg 300 BDT/1,000 kg 56.20 BDT/1,000 kg 56.20 BDT/1,000 kg
	Lift on/lift off charge (on/from truck, rail)	20ft > 20ft Loaded: 900 BDT/Ctr 600 BDT/Ctr 450 BDT/Ctr Empty: 300 BDT/Ctr
	LCL Container handling charge (export/import)	69.28 USD/Ctr 103.92 USD/Ctr
	Container storage (free storage)	FCL import: 4 days, otherwise: 7 days up to 28 days after 28 days
	Import FCL, Export, Empty	20ft 40ft 20ft 40ft 1.50 USD/d 3.00 USD/d 4.50 USD/d 9.00 USD/d

Source: CPA[Error! Bookmark not defined.]

Table 3: Container handling charges at ICD Dhaka

In order to compare the effects of Chittagong and Mongla port tariffs the main cost items of an exemplary but realistic call have been calculated at maximum possible draft in Mongla with following vessel's particularities and container numbers:

E.g.M/V."Kota Rukun“	Tonnage:	9,422 GT		
	Length:	144 m		
	Beam:	23 m		
	Actual draft:	7.0 m		
	Capacity:	777 TEU		
	Port stay:	2 days		
	Tugs engaged:	2 x 2 (each approx. 2 hrs)		
	Handling:	20ft	40ft	TEU
Discharged	Full:	200	226	652
	Empty:	13	13	39
Loaded	Full:	100	100	300
	Empty:	124	124	372
	Total:	900		1,363

Table 4: Port call and container logistics cost sample calculation

It is assumed that 50% of all containers are within the limit of the free storage (in general 7 days, except FCL in Chittagong: 4 days) period but 50% having an average storage period of 10 days.

For Mongla all containers are assumed to be LCL while for Chittagong 15% are assumed to be FCL and the remaining being LCL and needed to be unstuffed or stuffed in the port. This corresponds with the real figures at present. However, the costs for unstuffing and stuffing are directly related to the weight of the cargo. Hence further assumptions had to be made which would make the calculation too arbitrary. At least it can be concluded that unstuffing/stuffing is significantly less costly in Mongla than in Chittagong and ICD Dhaka as well (more than 2/3 less).

Hence only the ship and container related cost items have been calculated below:

	Chittagong	Mongla
Port dues	0.241 USD/GRT/call x 9,422 GT = **2,271 USD**	
Pilotage	35.75 USD/1,000 GRT/job x 2 x 9,422 GT = **674 USD**	634 USD x 2 = **1,268 USD**
Tugs	632 USD/hr x 2 hrs x 2 x 2 = **5,056 USD**	594 USD/job x 2 x 2 = **2,376 USD**
Berth occupancy	Jetty 1-13: 2.50 USD/1,000 GRT/hr x 9,422 GT x 48 hrs = **1,130 USD**	30 USD/1,000 GRT/day x 9,422 GRT x 2 = **565 USD**
Move by gantry crane	300 x 15 USD + 326 x 22.5 USD + 137 x 7.5 USD + 137 x 11.25 USD = **14,404 USD**	n/a
Ship's gear[52]		500 USD/d x 17 d = **8,500 USD** crane driver: not known energy for crane: not know
Quay handling	300 x 130 USD + 326 x 195 USD + 137 x 22.1 USD + 137 x 42.6 USD = **111,434 USD**	300 x 0.85 x 130 USD + 300 x 0.15 x 43.4 USD + 326 x 0.85 x 195 USD + 326 x 0.15 x 65.1 + 137 x 22.1 USD + 137 x 42.6 USD = **101,185 USD**
Storage	45 x 3 x 6 USD + 49 x 3 x 12 USD + 218 x 3 x 6 USD + 234 x 3 x 12 USD = **14,922 USD**	150 x 3 x 3 USD + 68 x 3 x 1.5 USD + 183 x 3 x 6 USD + 69 x 3 x 3 USD = **5,571 USD**
Lift on/lift off charge	300 x 1,000 BDT + 137 x 375 BDT + 326 x 1,500 BDT + 137 x 563 BDT = 917,506 BDT ≈ **11,010 USD**[53]	300 x 1,100 BDT + 137 x 550 BDT + 326 x 1,650 BDT + 137 x 825 BDT = 1,056,275 BDT ≈ **12,675 USD**[53]
Total (without river dues and costs for unstuffing/ stuffing)	**160,901 USD**	**134,411 USD**
with 1,363 TEU handled	**118 USD/TEU**	**99 USD/TEU**

Table 5: Total Container throughput cost per port call (model calculation)

[52] It is assumed that the charter hire for a geared vessel is 500 USD/d higher compared to a gearless vessel of the same size. During the round voyage of 17 days self-sustained operation is assumed to be necessary only in Mongla. Hence the crane costs in Mongla equals to the surplus in the daily charter hire accumulated over the entire duration of one round voyage.

[53] 1 BDT = 0.012 USD (as per 16 Dec 2019)

River dues are not being considered as they are based on the cargo weight inside the containers, which had to be arbitrarily assumed, and as they are identical in both ports and anyhow rather low compared to the other cost items.

For the exemplary case the port costs in Mongla are approx. 20% less compared to Chittagong.

The difference in costs levied to a container vessel and its cargo between CPA and MPA is less than 20 USD.

Although all ship related costs are already included in the sea freight (liner terms) table 5 shows the total costs in port which are induced in average by a TEU and allows an analysis of its components.

The major revenue item for both ports (especially as the respective positions in the tariffs are identical) is quay handling, i.e. the horizontal movement of the containers on the terminal. It is more than 2/3 of the entire port costs. This is not a surprise as expensive equipment (van carrier) is needed for this task.

Appendix M – Container Midstream Handling Perspectives

Midstream handling is proven practise in the waters of Mongla port. Bulk carriers with a draft of up to 8.5 m are frequently discharged at the mooring buoys of Pussur River or on at anchorage, enjoying the benefit of 1.5 more draft compared to MPA permanent jetty. The share of bulk cargo operations at anchorage or mooring buoys in the Pussur River take place to 90%. Barges and river crafts carry the discharged goods or goods ae loaded to and from the private jetties of the industrial enterprises along the river north of the permanent jetty. The main reasons for the high percentage of cargo handled in the river are:

- anchorage and mooring buoys in the middle of the river can accommodate deeper draft vessels than at the jetties,
- loading and discharging operations can take place simultaneously on both sides of the vessel reducing the port stay of the vessel,
- as much cargo is anyhow destined for locations upstream of Mongla barge transportation is much cheaper than road transportation (by about 50%).

A typical handy size bulk carrier anchoring at in Pussur River is e.g. M/V. "Sumatra" (Figure 1). She has a scantling draft of 10.5 m which corresponds with 39,000 tons deadweight in salt water. She can enter Pussur River only partly loaded. At 7.0 m freshwater draft at the MPA jetty her deadweight is reduced to 20,000 tons. At 8.5 m freshwater draft at anchorage or buoys she can load 7,500 tons more.[54] Container vessels could benefit from same principles.

Figure 1: M/V. "Sumatra" at anchorage in Pussur River

An option to increase container handling capacity in Mongla and to allow servicing of bigger container vessels without the need for dredging would be the introduction of midstream handling of containers.

[54] According to the general arrangement and capacity plans of M/V. "Sumatra", Huanghai Shipbuilding Company, Rongcheng/PRC, 2016

Midstream handling of containers has been a common practise e.g. in Hong Kong since the introduction of the container. However, the typical Hong Kong midstream barges are rather simple with only an A-frame derrick as cargo gear and suffer from being not self-propelled but need to be towed instead (Figure 2). Many accidents and damages to the containers and to the ships are being reported. The A-frame derricks have only a single beam just controlled by wires and are not even fitted with a spreader, but instead rely only on steel wires being fitted manually to the corner castings of the containers. Hence persons need to stay on top of the containers, which is a not at all acceptable cargo handling technology which complies hardly with international safety standards.

However, due to draft constraints at seaports upstream main rivers especially for Intra-Asian carriers' midstream operation is a cost effective alternative in Hong Kong to the very costly operation at the container terminals in Kwai Tsing.

Figure 2: Midstream container operation in Hong Kong

To improve container logistics within and around ports the Port Feeder Barge has been developed in Germany (Figure 3). This new type of a self-propelled, self-sustained, double-ended container barge could serve with its own high-performance cargo gear as a very flexible combination of:

- 'Floating (and self-sustained) container truck' for the haulage within ports or to nearby locations (e.g. container freight stations)
- 'Floating terminal' for deep sea container vessels at anchorage
- 'Floating terminal' for coastal shipping at anchorage or within ports
- 'Floating terminal' for inland navigation within ports
- Floating crane for non-containerised cargo

Figure 3: Port Feeder Barge

Tonnage:	1,562 GRT
Length:	64 m
Beam:	21 m
Draft (scantling):	3.1 m
Capacity:	168 TEU
Deadweight:	2,500 tons
Air draft:	approx. 18 m

The Port Feeder Barge (PFB) design comprises of a self-propelled container pontoon with a capacity of 168 TEU (completely stowed on the weather deck), equipped with its own state-of-the-art heavy-duty container crane mounted on a high column (Fig. AJ-4). The crane is equipped with an automatic spreader, extendable from 20 to 45ft, including a turning device. A telescopic over height frame to handle oversized flats is also carried on board. The barge is of double-ended configuration, intended to make it extremely flexible in connection with the sideward mounted crane. Due to the wide beam of the vessel no operational restrictions (stability) for the crane shall occur. The innovative vessel is equipped with 2 electrically driven rudder propellers at each end in order to achieve excellent manoeuvrability and the same speed in both directions. Hence the vessel can e.g. easily turn on the spot. While half of the containers are secured by cell guides to reduce lashing efforts, the other half is not, enabling the vessel to carry also containers in excess of 40ft as well as any over-dimensional boxes or breakbulk cargo. 14 reefer plugs allow for the overnight stowage of temperature guided cargoes in containers.

The key element of the PFB concept is its own container crane. It has a capacity of 40 tons under the spreader (50 tons under the hook), at an outreach of 27 meters (maximum outreach: 29 m).

When berthed, the PFB is able, without being shifted along the quay, to load or discharge 84 TEU in three layers between the rails of a typical quayside gantry crane. This is more than

sufficient, with a total loading capacity of 168 TEU. That is why the full outreach of the crane is not always needed. Berthing the vessel with the crane on the opposite side of the quay (Figure 4) would speed up the crane operation as the turning time of the beam is minimised. Due to its short length of 64 meters the PFB needs only a small gap between two deep sea vessels at any jetty for self-sustained operation.

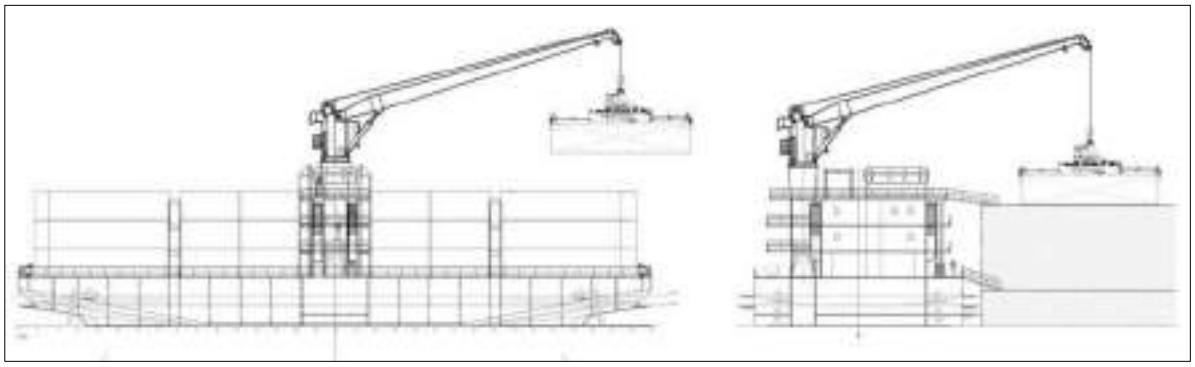


Figure 4: Side view and cross section of the Port Feeder Barge

The height of the crane column and the length of the beam are sufficient to serve container vessels of up to 6,000 TEU size from both sides (Figure 5). This is more than sufficient for container vessels which are calling at Mongla even if capital dredging allows for bigger vessels than the present sizes.

The PFB itself could shuttle the containers between the anchorage and any jetty with only shallow draft or could just load/discharge to/from simple river barges as a floating container crane. The PFB would e.g. allow to open an ICT incl. container freight station in Khulna e.g. at Roosevelt Jetty without the need for any quayside crane. Only a reachstacker would be needed to handle the containers on the ground of the facility. The PFB would also allow to serve gearless container vessels at anchorage, which could save approx. 500 USD/day for the vessel's operator as the charter hire of geared vessels is generally higher by this amount (most feeder vessels employed in this area are chartered vessels).

Hence the PFB could be a smart alternative/add on for the handling of containers in Mongla Port. It may evolve as less costly, quicker to realize than the erection of comparable shore-based facilities and more flexible in its operation (as it can serve several purposes) as well as in its location.

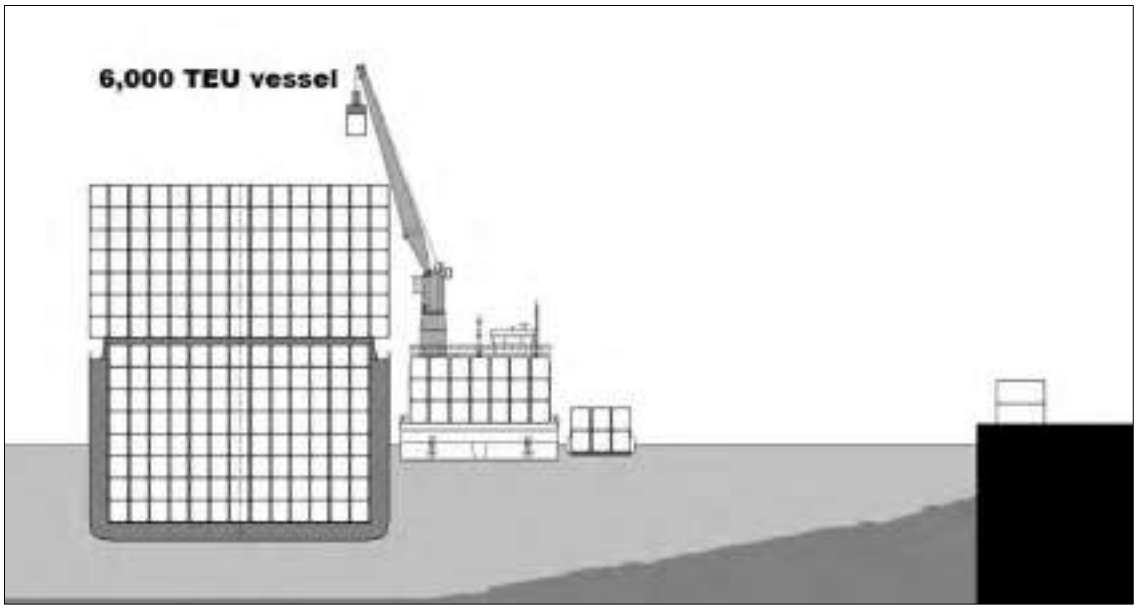


Figure 5: Port Feeder Barge serving a 6,000 TEU vessel at anchorage

The PFB could further navigate through the IWT system up to Dhaka. According to Figure 6 the water depth should be sufficient.

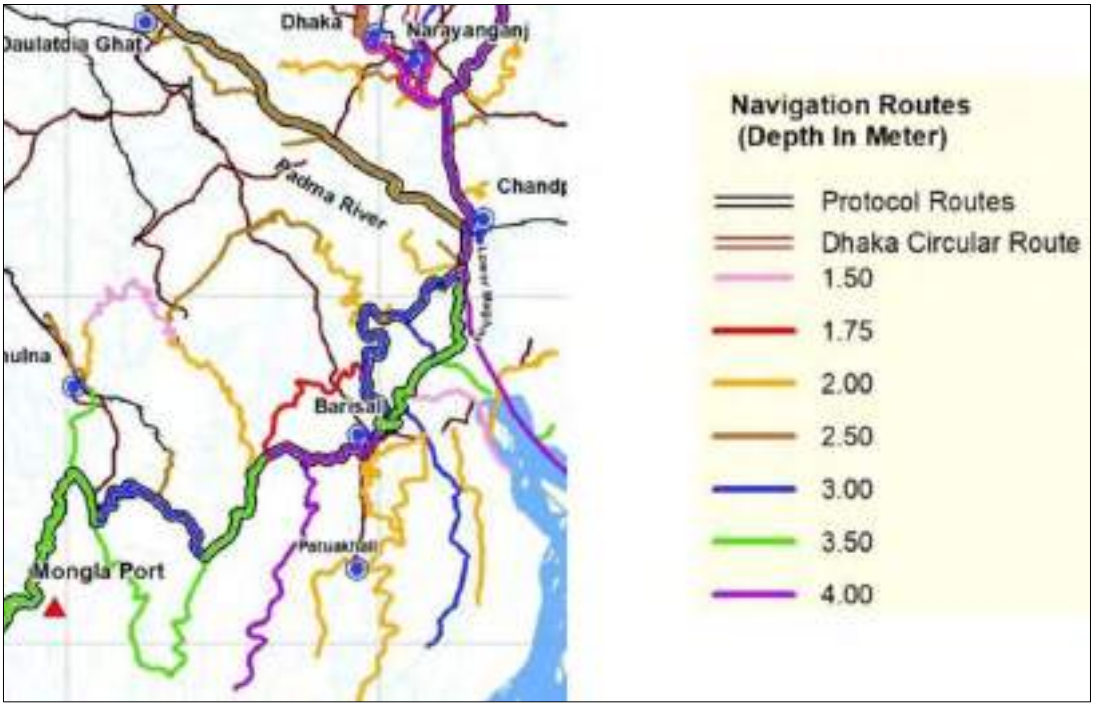


Figure 6: Inland waterway route from Mongla to Dhaka

The PFB could be easily built by shipyards in Bangladesh. Estimated construction time would be approx. only one year.