New Mangalore Port Trust

Preparation of Feasibility Report and Detailed Project Report for Mechanization of Berth No. 14

FINAL DETAILED PROJECT REPORT

November 2018

L&T Infra Engineering

L & T Infrastructure Engineering Limited

RP010 Rev B

L&T Infra Engineering

L&T Infrastructure Engineering Ltd.

Client: **New Mangalore Port Trust**
Mangalore, Karnataka State, India

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Chapter 1: Introduction

1 Introduction

The New Mangalore Port (NMPT) is one of the major ports located on the west coast of India playing a key role for the economic development of Karnataka, India since 1975. The Port is an all-weather, lagoon type port situated at Panambur, Mangalore in Karnataka.

Figure 1-1 Aerial view of NMPT

1.1 Need for the study

The NMPT is located just 22 nautical miles from the International Shipping route. The Mangalore refinery and Petrochemicals (MRPL), Hindustan Petroleum Corporation Limited (HPCL) and Udupi Power Corporation Limited (UPCL) are the major users of NMP.

The traffic though the port is observed to increasing at a steady pace over the years. The total traffic handled during 2017-18 was estimated as 38.17 MT. As per the traffic forecast done by NMP, it is likely to reach 84.14 MT by 2025-26.

The smooth transfer of cargo is possible through road and rail connectivity. The National Highway, NH 66 is passing right in front of the port. The Port has rail connectivity to Hassan-Mangalore Railway, Konkan Railway and Southern Railway which provide link to western, eastern and southern region of India. In addition to this the feeder vessel can easily redistribute cargo to other neighbouring Ports like Cochin, Goa and Mumbai etc.

The container traffic is expected to increase at the port in coming years, for the sustained marketing efforts of NMP administration and improved hinterland connectivity. Full commissioning of Mangalore – Hassan BG railway line and commissioning of direct railway route from Hassan to Banglore via Shravanabelagola would definitely account for the improved hinterland connectivity. This will enhance movement of containers from NMP to Mysore, Madikeri, Hassan, Shimoga and Bangalore.

Studies reveal that the berth productivity of container at NMPT is significantly lower than other container handling ports. The Berth No.14 is constructed for handling general and bulk cargo, containers and passenger vessels. At present the berth handles mostly coal and

fertilizers. There are 2 private MHCs operating at the berth. It is also to be noted that the fertiliser volume at NMPT is showing a downward trend at NMP.

In pursuance of the above facts, NMPT finds there is a tremendous scope in mechanizing existing berth No. 14 to handle containers and clean cargo and a fully developed container terminal including appropriate stacking area and also link of rail and road connectivity will attract more cargo and revenue from port's hinterland.

With this background NMPT appointed L&T Infrastructure Engineering Limited (LNTIEL) to prepare feasibility report and detailed project report for mechanisation of berth no. 14 of NMPT.

Upon instigation of the consultancy, the consultant visited NMPT to make a first-hand appreciation of the project site. The consultant also had a kick off meeting with the NMPT officials and collected relevant study reports concerning the project.

The consultant has conducted a detailed feasibility study for the project. Upon finding the project feasible, the NMPT requested to conduct a detailed study to prepare Detailed Project Report which will enable NMPT to obtain approvals for financial close.

In this regard, LNTIEL has prepared a Final Detailed Project Report and is presented in the following sections.

1.2 Scope of Work

Scope of work for the study is as follows:

A. Review of reports available with the Port.
B. Study of the existing facilities and the additional facilities that may be required for handling container & other clean cargoes etc. taking into consideration the future traffic and shipping trends.
C. Study the Traffic reports available with Authority in making demand assessment. Annual growth rate of traffic shall be presumed based on the present scenario and future trend. Variations if suggested to be justified with reasons, including analysis of past trends.
D. Based on the assessment of the traffic and demand of the Project, provide a broad assessment of the need for the project. Also provide sensitivity analysis due to change in assumption of traffic projections.
E. study of berth occupancy and throughputs with a view to ensure that the newly built facilities are adequate to handle envisaged enhanced container and other clean cargo without causing unduly long ship waiting time.
F. To suggest various Cargo handling Equipments for Container and clean cargo.
G. To study the additional land corridor required to handle the envisaged container and other clean cargo.
H. Infrastructures required for the installation of cargo handling equipments and to study for needs for additional port crafts, navigational aids and fire fighting facilities.
I. To provide design details of the equipment, Turnaround time of equipment, capacity etc.
J. To study the existing stack yards and suggest suitable stackyards including orientation and dimension for Container, including reefer blocks, hazardous container block, ODC etc and also for the other clean cargo.
K. To suggest plan, area and capacity of storage required for container cargo and other clean cargo.

L. To study requirement and identification of location for development of Container Freight station (CFS) and Truck Terminal. Planning of required facilities for the same including layout plans, elevation etc.
M. To study the Power and water demand for the project. Identify the sources and recommendations for drawing the same.
N. To study the container handling at existing railway facility including modifications required and yard development etc.
O. Feasibility of providing new railway line to the proposed terminal.
P. Planning of entry and exit to the proposed terminal including gate complex.
Q. Advise on the best mode of execution of the project including the project investment strategy that will result in maximum economic and technical efficiency for the facilities planned.
R. In order to make project viable, suggest Planning of phase wise development of the proposal.
S. A set of detailed drawings of the existing and proposed facility.
T. These drawings along with land requirement plan and preliminary design shall form the basis of preparation of indicative BOQ for the Project facility.
U. To undertake topographic survey of the Project, identify geometric improvements required, new facility and other structures and finalise the location and size of the proposed project facilities and services.
V. Finalise the location and other particulars after taking into account the comments of the Authority on the location and size. The work of preparing cross-sections and Land Plans, etc. shall be undertaken based on the finalised alignment.
W. Arrive at the preliminary designs of various components of the Project keeping in view the requirements of the Authority and Generic structure of the DPR as published by Ministry of Finance and the scope of services described in this TOR.
X. Work out indicative and detailed BOQ of various components respectively and to prepare rough cost estimates of the project with a break up of cost for each component separately
Y. To provide the estimated installation costs, operation and maintenance costs, traffic forecast, revenues etc. as part of its preliminary financial analysis and appraisal of the Project. Assist the Authority and Financial Consultant/Legal Adviser in technical matters in obtaining clearances from the Govt. for the detailed Feasibility report/ Detailed project report such as PIB/PPPAC/SFC and TAMP approval, entire bidding process and till signing of the Concession Agreement.
Z. To suggest Environment protection and identify a package of measures to reduce /eliminate the adverse impact during the construction and operation of the proposed project facility as per provisions of the applicable laws.

1.3 Scope of the Report

This report viz. Final Detailed Project Report is intended to aid for mechanizing Berth No. 14 for handling containers and clean cargo at New Mangalore Port on PPP mode.

1.4 Organization of the report

This report is presented in the following chapters

Chapter 1: Introduction

Chapter 2: Project Site Environment

Chapter 3: Site visit note and kick off meeting

Chapter 4: Data collection and review

Chapter 5: Existing Facilities

Chapter 6: Traffic Study

Chapter 7: Vessel Size analysis

Chapter 8: Surveys and Investigations

Chapter 9: Planning considerations

Chapter 10: Development Plan

Chapter 11: Structural adequacy of Berth no 14

Chapter 12: Initial Environment Examination

Chapter 13: Cost Estimate

Chapter 14: Conclusions

Chapter 2:
Project Site Environment

2 Project Site Environment

The New Mangalore Port (NMP) is located on the alluvial plain at Mangalore on the west coast of India. It is 10 km north of the confluence of Gurupur (Phalguni) and Netravathi Rivers to Arabian Sea.

2.1 Project Site Location

The port location is marked in coordinates as 12°55” N and 74°48” E. It is 170 nautical miles (310 km) south of Mormugao Port and 191 nautical miles (354 km) north of Kochi Port.

Figure 2-1 New Mangalore Port Location

2.2 Berth No.14

NMP has got a shallow water berth (berth No.1) an Eastern dock arm where berths 2 to 7 is located, an iron ore berth (berth 8), Oil dock arm where berths 9 to 13 is located.

Berth No. 14 with 350m length is adjacent to Eastern dock arm parallel to approach channel, dredged to 15.1m which can vessel up to 14 m draft.

For development of storage area of container/clean cargo, this berth has got an area of about 6.5 ha is available near spending beach and another 7.5ha adjacent to this berth. The proposed area of development for Berth No.14 is marked in Figure 2-2

Figure 2-2 Proposed area of development for Berth No.14

2.3 Connectivity

The National Highway 66 passes just outside the port connecting Panvel and Kochi. The Port is served by a Broad Gauge Railway line and is well connected with Southern portion of country through Mangalore, Kerala State and Chennai. The nearest Airport, Bajpe (Mangalore Airport) is just 14 kms from the Port. Mangalore is well connected to Mumbai, Bangalore, Hyderabad, Delhi and Chennai by daily flights.

2.3.1 Rail connectivity

The Railway Marshalling Yard at Panambur, inside the New Mangalore Port, is a part of the Southern Railway. This is connected to the Konkan rail network at Thokur providing access to Mumbai via Coastal Karnataka and Goa and to the South Western railway at Kankanady providing access to the Karnataka heartland and Bangalore and Mysore via Hassan and to Kerala through the southern railway.

The Hassan- Mangalore line has been converted into a broad gauge capable of carrying more tonnage of cargo by rail and now the Port is fully accessible to its hinterland. This broad gauge line made to connect Bangalore from Mangalore and Chennai via Bangalore route is shortened. The Konkan Railway, which is passing along the coast, has given a great boost to the port / rail interface and thereby to industrial development in the adjoining regions and direct connection to Goa and Mumbai.

Recently Container Corporation of India Limited (CONCOR) has shown interest in developing railway handling facilities at NMPT to handle containers.

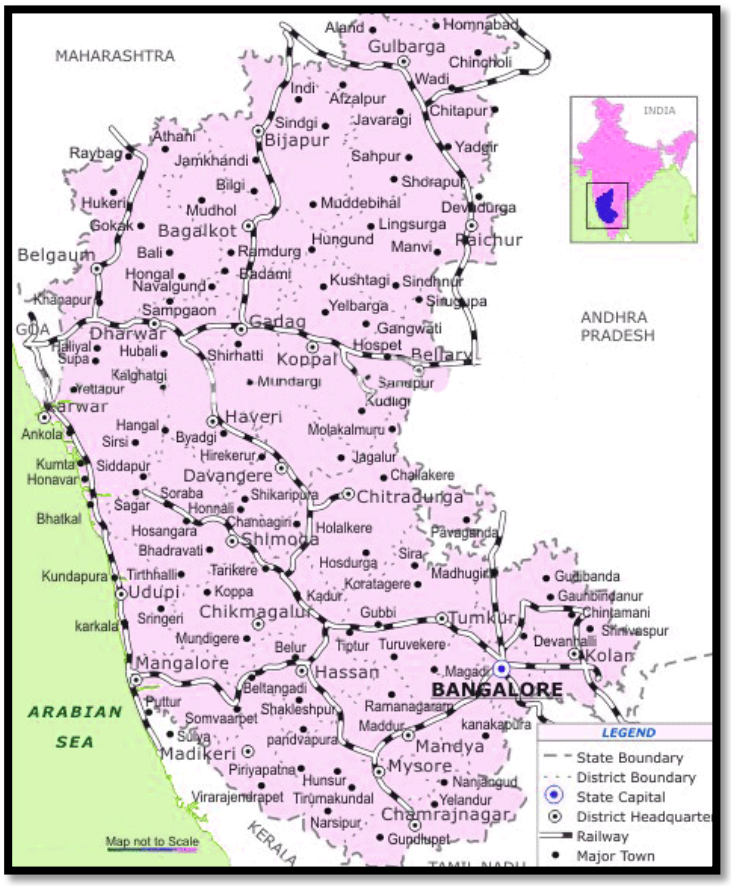


Figure 2-3 Rail connectivity for NMPT

2.3.2 Road connectivity

The Port is connected with 3 National Highways. The main road networks connecting the hinterland to NMPT are as follows:

- NH-66 connecting Kochi – Mangalore – Goa – Mumbai

The National Highway NH 66 stretches from Kochi to Mumbai linking many important cities and towns in its route. The south bound cargo utilizes this route. NH 66 is a four lane road and part of the stretch is two lane roads which are being widened to 4 lanes with a provision to expand to six lanes to accommodate future expansions.

- NH-75 connecting Bangalore – Hassan - Mangalore

The NH 75 connects directly Mangalore to Bangalore via Hassan. This road serves the requirement of eastern and southern Karnataka. National Highway 75 is getting widened and upgraded to the 60-meters wide, 4-lane highway.

- NH-50 connecting Mangalore – Shimoga – Chitradurga – Bijapur – Sholapur

NH 50 aligned north-east connects Mangalore to Sholapur. The north bound traffic utilises this route. This highway is a 2 lane highway which is undergoing up gradation to 4 lanes.

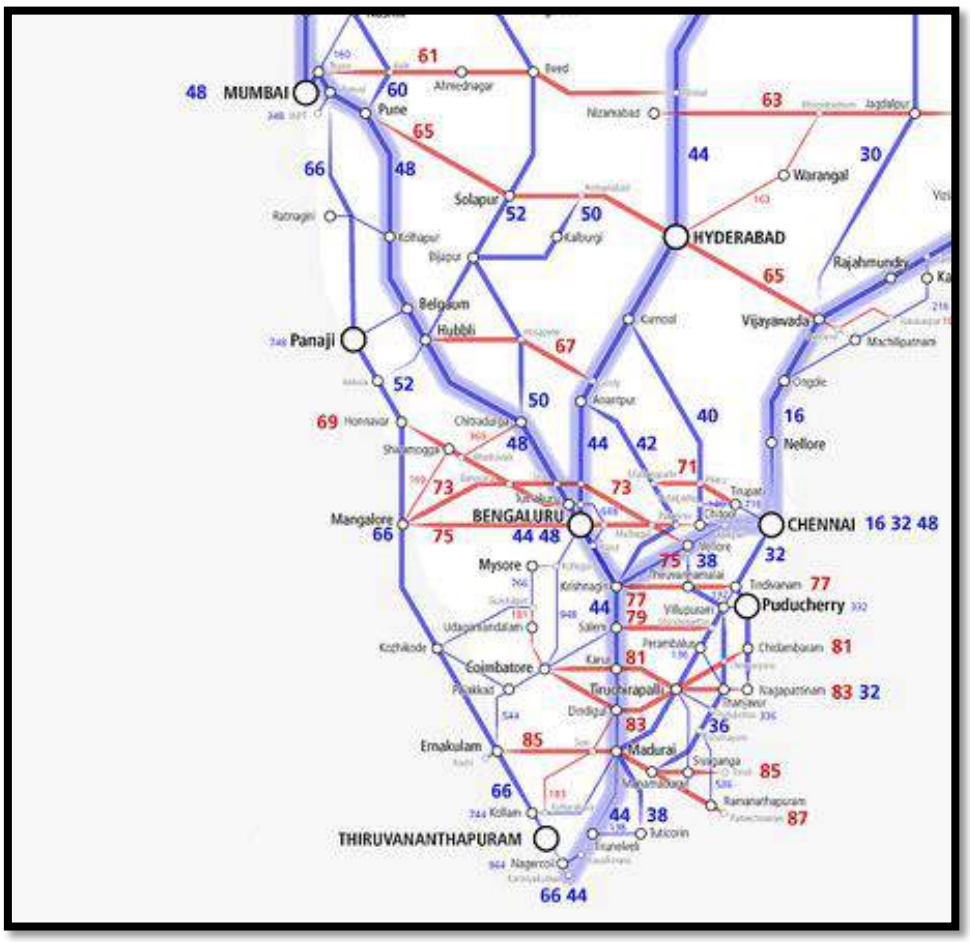


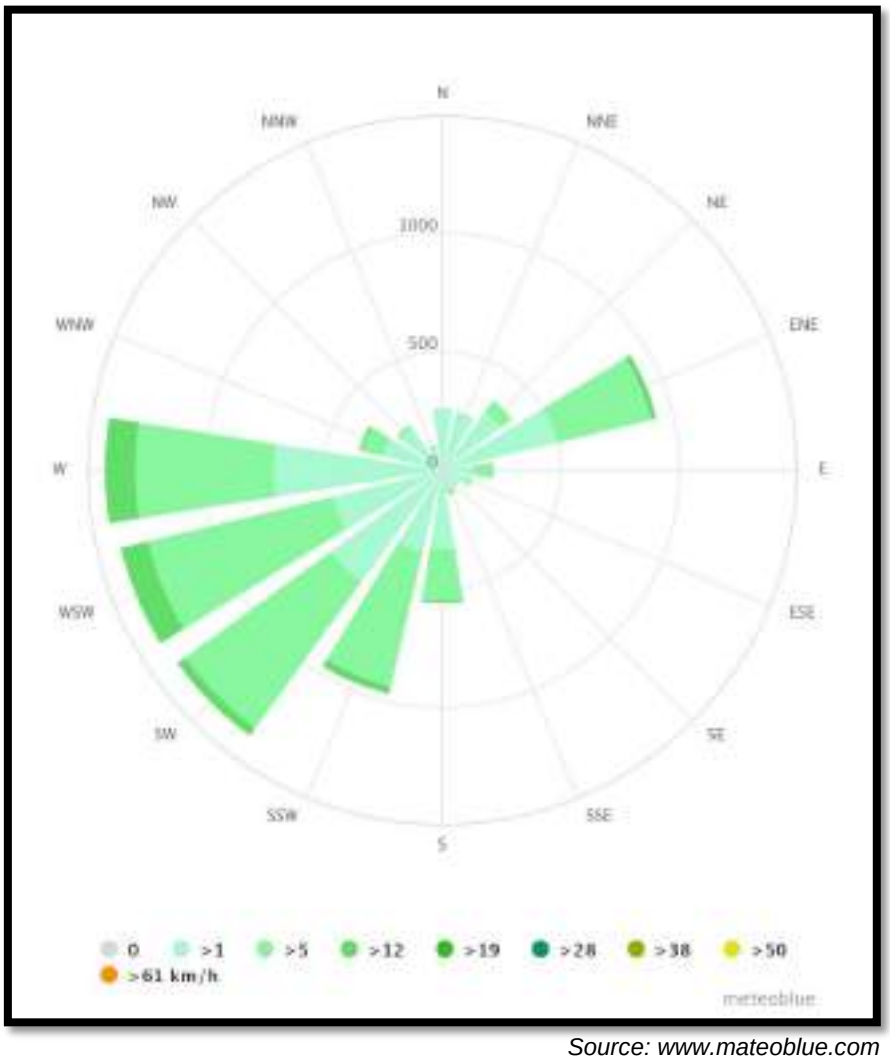
Figure 2-4 Road Connectivity for NMPT

2.4 Meteorological Conditions

Meteorological parameters pertaining to the port location is given in the following sections

2.4.1 Wind

Wind in Mangalore during monsoon months of June, July and August are predominantly from southwest and west with a maximum intensity of 4 on the Beaufort scale. The wind rose diagram is showing the direction and magnitude of wind blowing in hours per year as in Figure 2-5.



Source: www.mateoblue.com

Figure 2-5 Wind Rose Diagram

2.4.2 Rainfall

The average annual rainfall is approximately 3,467 mmm. The rainfall is concentrated in the SW monsoon (June, July, August and September). During this period, the average rainfall is as much as84% of the total annual rainfall. The maximum rainfall is observed to be in July (1,102.7 mm), and it decreases gradually to 1.9 mm in February.

2.4.3 Temperature

Mangalore experiences moderate temperature throughout the year. The temperature varies from 22° C to 36° C. The low temperature occurs during south west monsoon in December

and January. The hottest months are from March to May. The mean temperature in the hottest month, before the onset of SW monsoon, is from 33° C to 37° C and lowest temperature recorded is 16.7° C.

2.4.4 Visibility

Generally visibility is excellent except for a few days during monsoon. During SW monsoon, thick haze develops in Mangalore with a maximum of 3 no. of foggy days.

2.4.5 Cyclones

While the average frequency of cyclonic storms in the Arabian Sea is about one per year, there have been years when two or three such storms have occurred. There have also been years without any storms. The maximum wind speed so far recorded has not exceeded 62 kmph (16.9 m/s), except once during 1965 when the maximum speed recorded was 97 kmph (26.9 m/s).

2.4.6 Relative Humidity

The humidity is high throughout the year. From June to September during monsoon the humidity ranges from 90% to 100%. From October to January it comes down to 50% to 70%. During summer months of February to May average humidity is about 60%.

2.5 Oceanographic Conditions

2.5.1 Waves

The predominant direction of waves at open sea in the vicinity of Mangalore Port during the monsoon months of June, July and August is W and SW whereas the predominant direction during the fair weather months is NW and N. Analysis of the data collected from ships in and around Mangalore revealed that 0.4% of the waves have a height of 4.9 meters above. The wave heights in the non-monsoon months are much less.

Inside the harbour, generally clam conditions prevail throughout the year as is well protected from outside waves by long breakwater on either side of the outer approach channel.

2.5.2 Tides

The tides at Mangalore are semi-diurnal in nature. The tide levels w.r.to Chart Datum (CD) is given below

Table 2-1 Tide levels at NMPT

Tide	Level w.r.to CD (m)
Highest High Water Spring (HHWS)	.+1.68
Mean Highest High Water (MHHW)	+1.48
Mean Lowest High Water (MLHW)	+1.26
Mean Sea Level (MSL)	+0.95
Mean Lowest Low Water (MLLW)	+0.26
Lowest Low Water Spring (LLWS)	+0.03

2.5.3 Currents

The currents along the coast during SW monsoon (from February to September) are generally towards S (from 160° to 200°). During the northeast monsoon (from November to January) the currents are found to be towards N (from 0° to 40° and 320° to 360°).

In the approach channel region covered by breakwater, the current direction lags 6° to 8° behind the coastal currents. The current in the lagoon area further lags behind the approach channel current by another 6°. The subsurface current on an average leads the surface current by 10° to 15°. The magnitude of the current outside the lagoon area during the monsoon season is about 1 to 1.5 knots has been experienced by pilots.

2.5.4 Littoral Drift

Seasonal drift distribution has indicated that during NE monsoon, littoral drift is towards N, whereas during SW monsoon and non-monsoon period the drift is towards S. The northwards drift is comparatively less than the southward drift. The average littoral drift in the region is of the order of 0.58 lakh cum towards south during southwest monsoon and non-monsoon period and 0.08 lakh cum towards N in NE monsoon. The average net littoral drift is 0.5 lakh cum per year towards S.

Major portion of siltation in the port occurs during the monsoon months of June to September every year. The quantity of maintenance dredging is of the order of 5 million cum per annum.

Chapter 3:
Site visit note and kick off meeting

3 Site visit note and Kick off meeting

3.1 Site visit

Following key personnel along with Mr.Vikash AC, Executive Engineer (Civil) visited the site on 14th November 2017 to have a first-hand appreciation on the project site, existing facilities and operations.

- K P Samuval- Team Leader
- SharadGoel- Mechanical and Cargo Handling Equipment Expert
- N Sunil Kumar –Technical Expert
- S. Sajeev-Financial Analyst
- C V Sundararajan –Environmental Expert
- Sanish A-Project Engineer

During the site visit, the team examined the existing Berth No.14 and the backup area for deep draft berth especially the strip of land available for the development of storage for container/clean cargo. Also the existing rail routing inside the port was examined. A visit was also made to the existing container stackyard located near the spending beach. It is understood that presently the containers are handled by MHC at the berth and Reach stackers at the storage yard. Photographs taken during the site visit is presented in the Table 3-1

Table 3-1 Photographs taken during the site visit

	
Roadway near Existing Container Stackyard	View of existing Container Stackyard
	
View from Berth No. 14 towards eastern side	View from Berth No. 14 towards western side

	
Backup area behind Berth No.14. View towards the side UPCL Berth	Proposed Backup area behind Berth No.14.

3.2 Kick-off meeting

The site visit was followed by a kick off meeting with the officials of NMP at 2:30 pm.

Following personnel presented in the meeting.

- Mr.HN Aswath-Chief Engineer (Civil)
- Mr.Harinath AV-Deputy Chief Engineer (Civil)
- Mr. C P Ravindra=-Executive Engineer (Civil)
- Mr Vikash AC- Asst. Exe. Engineer (Civil)

The Team Leader introduced their team and also presented approach and methodology for the study. During the discussion, Chief engineer emphasised need for cost effective solution and phased development for financially viable development.

Chapter 4:
Data collection and review

4 Data collection and Review

The following section describes the data collected from NMPT in the form of reports and drawings pertaining to Berth No 14.

4.1 Data collected from NMPT

The following inputs have been received from the client

- Borehole No.B14 details for the Vessel Traffic Management System building at the New Mangalore Port done by NITK, Surathkal, Karnataka
- *New Mangalore Port Master Plan updated to 2021-22 Volume-ii: traffic study and forecast* by Indian ports Association.
- *Final report on cargo traffic projections& logistics bottlenecks* by Ministry of Shipping, Indian Ports Association.
- Last Nine years traffic data for the New Mangalore Port by NMPT
- NMP Layout
- *Detailed Engineering Report for Mechanized Iron Ore Handling facility at Berth 14 of NMPT* by Coeus Consultancy.
- Contract Agreement for *Civil works for the construction of deep draft berth at New Mangalore port* by Navayuga Engineering Company Limited, Visakhapatnam.
- Master Plan for New Mangalore Port prepared by AECOM as part of Sagarmala Project.

4.2 Extract of the inputs taken from the data collected from NMPT

4.2.1 Borehole details at the project location

LNTIEL is provided with a report in which borehole data of BH.14 is analysed and Safe Bearing Capacity (SBC) values are recommended for the construction of VTMS building. The analysis is done by Civil Engineering Department NITK, Surathkal on 01-12-2015.

The top 3 m depth is filled up soil underlined by fine to medium sand from 3 m to 13 m depth. From 13.5m to 17.5m depth, layers of sandy silt, clayey silt and clayey sandy silt are found. Soft rock is found from 17.5m to 21.9m underlain by hard rock.

As per the Standard Penetration test, SBC values for shallow foundation (Isolated footing/ combined footing/ Strip footing of width 1.5m to 3m and raft or mat foundation) on

1) Unimproved Ground -170 kN/m^2
2) 0.5m thick well Compacted boulder and sand packing- 200kN/m^2

The Compressive Strength of Hard Rock at 21.9m to 22.9m is obtained as 65 MPa.

Chapter 5:
Existing Facilities

5 Existing Facilities

The New Mangalore Port has currently 15 berths contained in 3 docks:

1. Eastern dock arm- 7 multipurpose berths
2. Western dock arm- 2 berths (Berth No 14 between eastern and western dock arms)
3. Oil dock arm – 5 jetties

Out of these 15 Berths, Berth No 1 to Berth No 7 in the eastern dock arm and Berth No 14 are multipurpose berths. The deep draft multipurpose Berth No 14 exists between eastern dock arm and western dock arm.

Figure 5-1 Locations of three Docks of NMPT

The approximate length of approach channel is about 7.5 km. The depth of outer channel is (-) 15.4 m CD and depth of inner channel is (-) 15.1 m CD. The width of approach channel is 245 m. The diameter of turning circle is 570 m. Depth of harbor basin is (-) 15.1 m CD. The port is protected by two rubble mound breakwaters, one each on north and south, with length of 770 m each with an in between distance of 1,362 m at the root. The breakwaters terminate at a depth of about (-) 6.0 m CD. The Port has a total land area of approximately 822 ha and has Water spread area of 120 ha.

Currently the port is having 2 Mobile Harbour Cranes each having 63T capacity. There are 2 fork lift trucks with 3T capacity and 1 with 10T capacity. In addition to that there are 5 reach stackers of 45T capacity for handling cargo.

At present a new Berth No 12 is being developed in the Western dock arm and mechanization of the berth is being carried out in PPP mode to handle 6.7 MTPA of bulk cargo.

5.1 Berth No 14

The Berth no. 14 is a deep draft multipurpose berth which was intended for handling general & bulk Cargo /container /passenger vessels with available water depth of (-) 15.1 m CD. The berth is having 350 m quay length can accommodate vessels with maximum LOA of 300 m and maximum tonnage of 90,000 DWT. The berth was designed for a capacity of 6.6 MTPA. Presently the berth is being utilised to handle coal, iron ore, fertilisers etc.

Figure 5-2 Berth No 14- location inside port

The Berth No 14 is located in between two docks as shown in the Figure 5-2. The multipurpose berths, Berth No 6and Berth No 7, are located adjacent to Berth No 14 in the eastern side and both are having a dredge depth of 9.5 m CD. The Berth No 15, which is a being developed as captive coal berth for Udupi Power Corporation Limited (UPCL) located on the western side of berth no 14.

NMPT intends to develop the Berth no.14 for handling containers and clean cargo. The general layout and the cross section of the berth are presented in Figure 5-3.

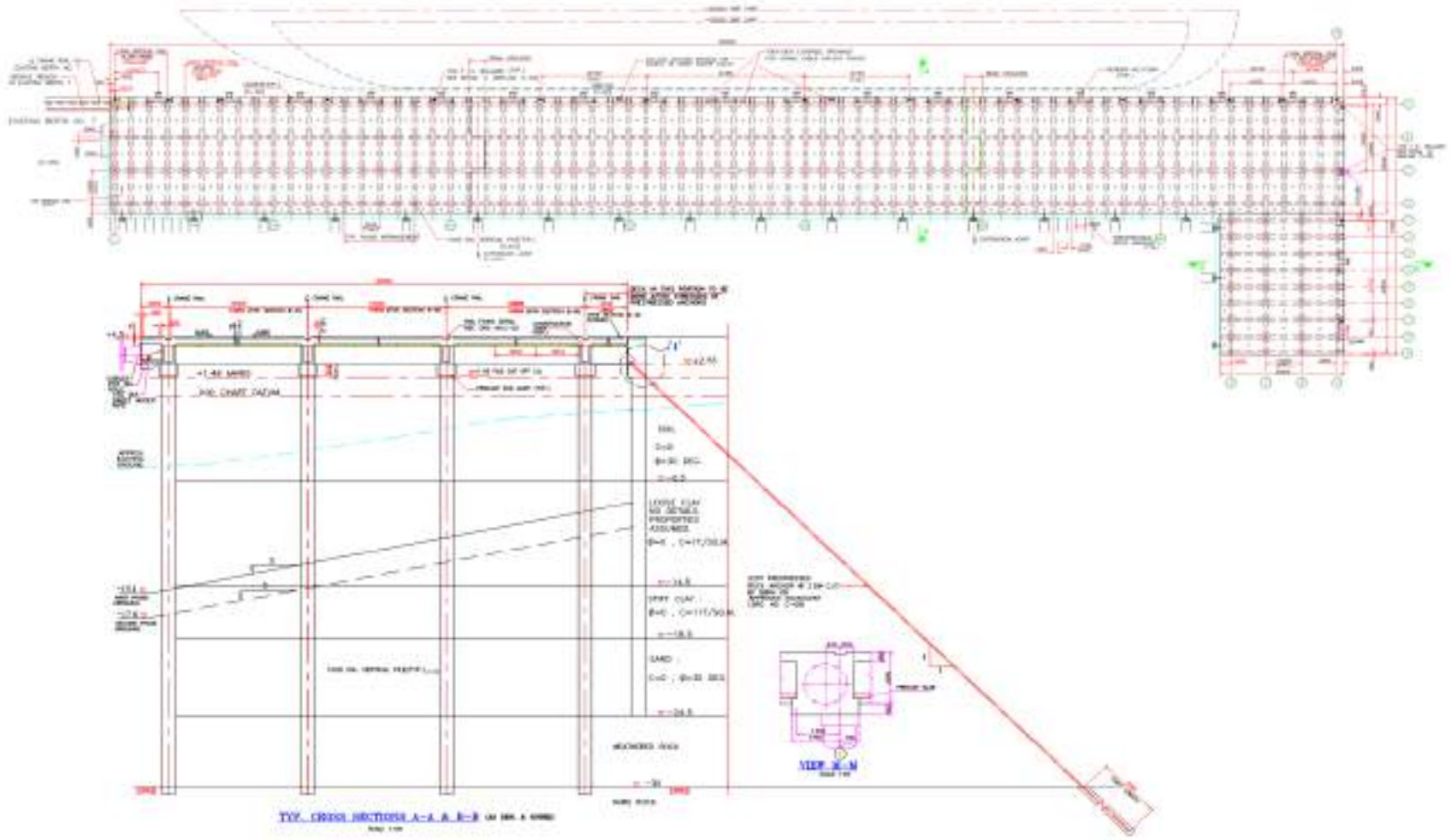


Figure 5-3 Plan and General Cross-section of Berth No 14

5.2 Storage area

There are two existing container storage area and one undeveloped area near railway line considered for planning of container storage. The area located near to the spending beach is about 6.5 Ha. These areas are fully levelled and paved to store containers. The area near railway line is about 1.3 Ha which is planning to be developed for railway yard.

In addition to the above mentioned area, an area of about 7.5 Ha is available for development of storage and allied facilities for storage of containers behind the Beth No. 14. The terrain of the area is very undulating and contains small amount of coal storage. Also some area is covered by bushes and jungle trees. Also a well and some small buildings exist in the area. The width of the area near the berth 95.5 m is increasing to 100 m near the railway line side. The length of the land on the eastern side adjacent to Berth No. 7 is 738 m and the length on the western side is 765 m. A topography survey was undertaken for this area. The summary of the survey is presented below in **Chapter 8 Surveys and Investigations**

The location of the above mentioned storage locations w.r.t the Berth no 14 is presented in Figure 5-4.

Figure 5-4 Location of various storage available for containers

Chapter 6:
Traffic Study

6 Traffic Study

This chapter provides summary of analysis of traffic trend and projection for Berth No. 14 of NMP.

6.1 Container Traffic in Indian Port Scenario

The container traffic in India over the financial years 2012 to 2017 has been studied. The container traffic is observed to be increasing over the observed period of time. India's container traffic has grown at a steady pace at an average CAGR of 6.9% over the past few years and touched 13.5 MTEUs in FY2017. The growth trend followed by the container traffic for the observed period is as shown in Figure 6-1.

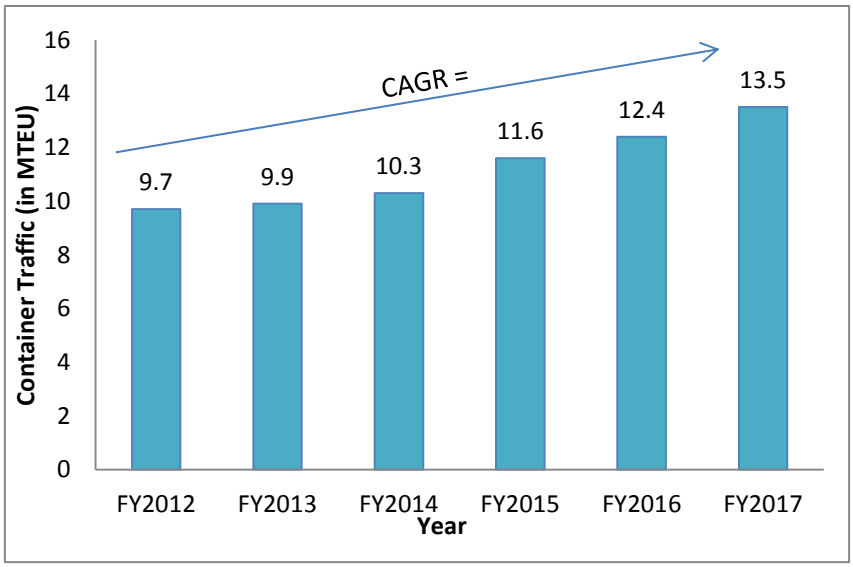


Figure 6-1 Indian container traffic in MTEU

6.1.1 Container Port zones in India

The container port zones in India are broadly classified into three regions which are western zone, southern zone and eastern zone as depicted in Figure 6-2.

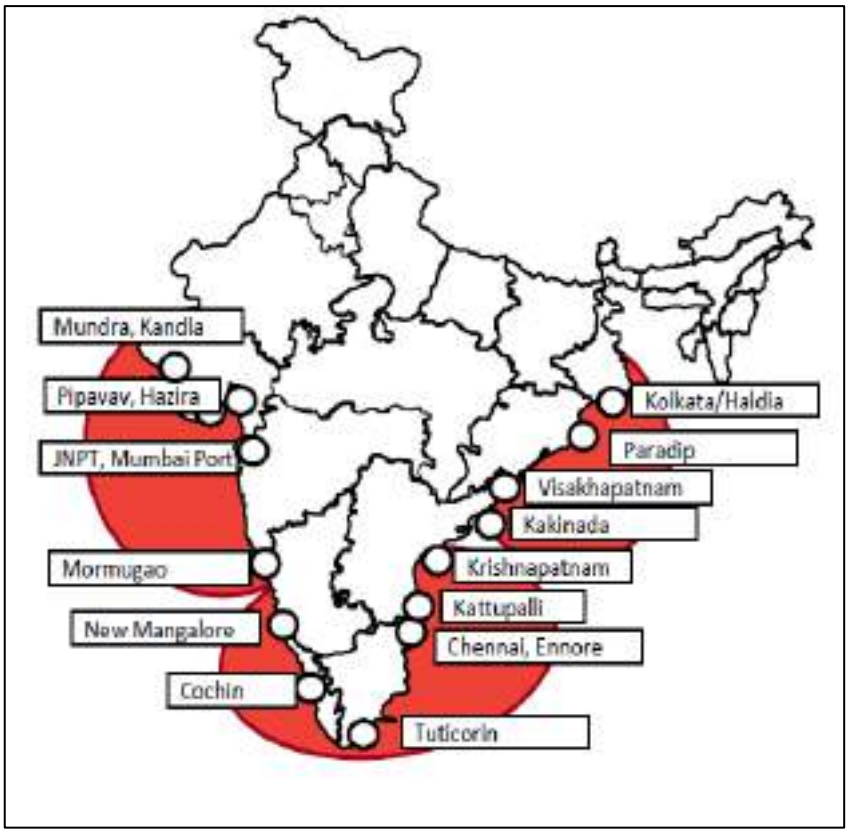


Figure 6-2 Container Port Zones in India

The ports which come under each of the zones are given in Table 6-1.

Table 6-1 Key Region in Container Zones of India

Region	West	South	East
Major Ports	JNPT (JNPCT, NSCIT, GTI), Kandla, Mormugao	Chennai, Ennore, NMPT, Cochin, Tuticorin	Kolkata, Haldia, Paradip, Vizag
Non- Major Ports	Mundra, Pipavav, Hazira	Krishnapatnam, Kattupalli, Kakinada	-

The total container traffic and the percentage of share towards total container traffic for each of these ports for the financial year of 2017 are presented in Table 6-2. NMPT has handled about 95,000 TEUs in FY17.

Table 6-2 Container Throughput in India for FY2017

Port	Throughput (TEUs)	% Share
JNPT	4,500,149	33.20%
Mundra	3,459,685	25.50%

Port	Throughput (TEUs)	% Share
Chennai	1,491,013	11.00%
Pipavav	663,380	4.90%
Tuticorin	643,122	4.70%
Kolkata	635,848	4.70%
Cochin	491,087	3.60%
Hazira	414,945	3.10%
Vizag	366,723	2.70%
Kattupalli	347,956	2.60%
Krishnapatnam	255,436	1.90%
Haldia	135,828	1.00%
NMPT	**94,928**	**0.70%**
Mormugao	19,552	0.10%
Kakinada	13,674	0.10%
Kandla	10,000	0.10%
Total	**135,43,336**	**-**

6.2 New Mangalore Port Traffic

The container traffic in NMPT for the past five years has been studied. Since the mechanization of berth was of the prime importance, the main cargos considered for traffic analysis are container and clean cargo.

6.2.1 Total Traffic Scenario in NMPT

Consultant has reviewed the previous traffic studies collected from the client. The review of traffic studies is given in the following sections. The total cargo traffic at NMPT from 2008 to 2017 is shown in Table 6-3

Table 6-3 Total cargo traffic at NMPT

Year	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Total Traffic (MTPA)	36.73	35.60	31.53	32.94	37.04	39.41	36.57	35.58	39.95	42.06

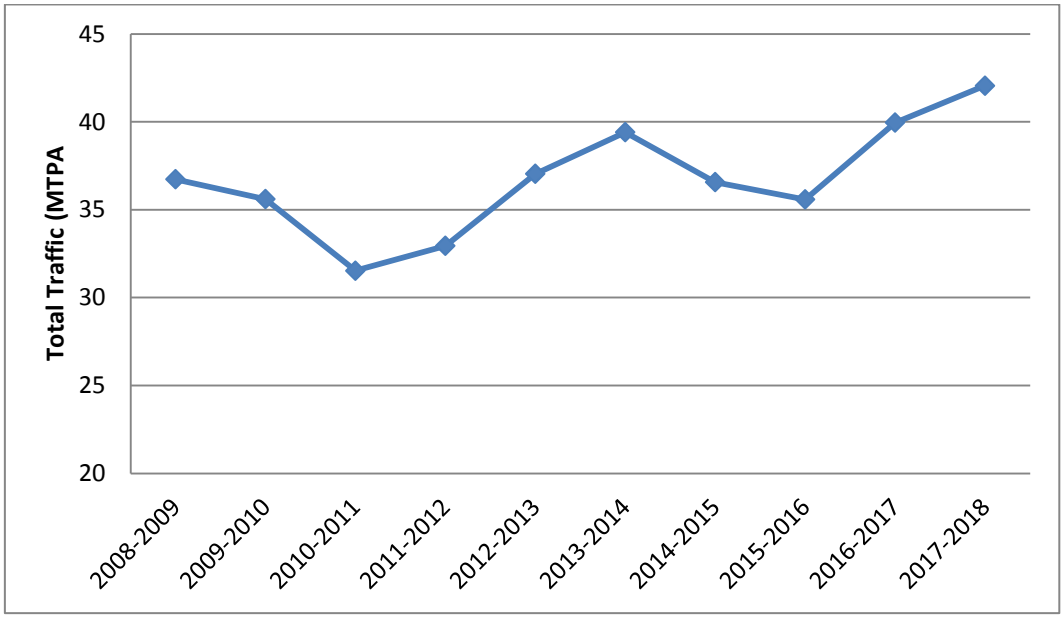


Figure 6-3 Total cargo traffic trend in NMPT

It is evident from the graph that the total traffic is following an irregular growth trend over the years. The traffic shows a decreasing trend from 2008 to 2011, followed by an increase from 2011 to 2014. Then again showing decreasing trend from 2014 to 2016 and is observed to be growing from 2016 onwards.

6.2.2 Container Traffic Scenario in NMPT

The container traffic over the past few years is subjected for analysis to check the trend of container traffic in NMPT. The growth trend followed by container traffic in NMPT is shown in Figure 6-4.

Figure 6-4 Container traffic trend

The container traffic is observed to increase over the observed period of time with an average CAGR of 19%. The split up of total container traffic as loaded and unloaded

containers is shown in Table 6-4. The loaded and unloaded container boxes contribute almost equal to the container traffic as evident from Table 6-4.

Table 6-4 Split of Loaded vs. Unloaded for Total Container Traffic

Year	Volume ('000 TEU)		% Share	
	Loaded	Unloaded	Loaded	Unloaded
FY12	23	22	51%	49%
FY13	24	24	50%	50%
FY14	25	25	50%	50%
FY15	32	31	51%	49%
FY16	38	38	50%	50%
FY17	48	47	51%	49%
FY18	59	57	51%	49%

The detailed split up of export and import container traffic in NMPT for 20' and 40' containers, for empty and laden condition has been studied. The results are presented in Table 6-5.

Table 6-5 Detailed Break-Up by Type for Container Traffic in NMPT

Type	Import			Export			Total		
	Laden	Empty	Total	Laden	Empty	Total	Laden	Empty	Total
20'	27,504	3,113	30,617	18,978	13,846	32,824	47,160	17,068	64,228
40'	10,173	5,725	15,898	8,133	7,456	15,589	18,340	12,360	30,700
TEUs	37,677	8,838	46,515	27,111	21,302	48,413	65,500	29,428	94,928
20' vs. 40'									
20'	73%	44%	67%	70%	65%	68%	72%	58%	68%
40'	27%	56%	33%	30%	35%	32%	28%	42%	32%
Laden vs. Empty									
-	81%	19%		56%	44%		69%	31%	

Compared to 40' containers, 20' containers are observed to contribute the major share in the container traffic volume. Out of the total volume of container traffic for both 20' and 40' containers, laden boxes are observed to contribute the major volume. Raw cashew imports and coffee exports are the principal containerized commodities at NMPT. The commodity wise breakdown of container traffic for import and export is depicted in Table 6-6.

Table 6-6 Container Traffic Breakdown for Different Commodities in NMPT

Imports		Exports	
Raw Cashew	24%	Empty Container	42%
Empty Container	21%	Coffee	27%
Tiles	20%	Reefer Cargo	8%
Chemicals	5%	Fish Meal	4%
Wooden Logs	4%	Cashew Kernels	2%
Others	26%	Others	17%

Raw cashew imports in India are chiefly from Africa with Ivory Coast, Guinea-Bissau and Tanzania together accounting for 60% of the overall imports in India. Rising domestic consumption and presence of large cashew processing cluster in Mangalore has been the driver for raw cashew imports at NMPT. Salt, machinery, coffee, plywood, wax, personal effects, packing materials are some of the containerized imports classified as “Others”.

6.2.3 Clean Cargo Traffic Scenario in NMPT

Non-hazardous and dust-free cargoes are known as clean cargoes. The traffic trend is analysed for clean cargoes also. The clean cargoes used for traffic trend analysis in NMPT are presented below:

- Container
- Timber
- Machinery
- Food Grains
- Steel Plates
- Fertilizer
- Wheat
- Limestone
- Ro-Ro
- Salt
- Gypsum
- Granite
- Maize
- Cattle Feed

Fertilizers and gypsum are the two key clean cargos handled at NMPT. Also volumes of wheat and granite have been on the rise over the past couple of years. The commodity wise traffic for clean cargo for the past five years is shown in Table 6-7.

Table 6-7 Clean Cargo Traffic Trends at NMPT (‘000 T)

Commodity	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	% Share
Container	692	747	921	1,105	1,411	1743	43
Fertilizer	519	454	649	732	409	562	22
Gypsum	153	246	341	330	79	173	9
Timber	247	320	68	5	14	14	4
Wheat	27	-	-	27	248	51	3
Granite	8	13	-	144	116	41	3
Machinery	38	30	14	64	132	122	3
Limestone	26	55	28	-	94	55	2

Commodity	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	% Share
Maize	177	7	-	-	-	-	4
Food Grains	-	117	-	-	-	-	5
Ro-Ro	-	-	-	29	1	-	1
Cattle Feed	-	-	-	10	10	-	0
Steel Plates	-	-	15	-	-	-	1
Granite	-	-	11	-	116	41	2
Salt	1	-	-	-	-	-	0

The growth trend for total clean cargo traffic is observed to be growing in a steady pace with a CAGR of 7.42% as shown in Figure 6-5.

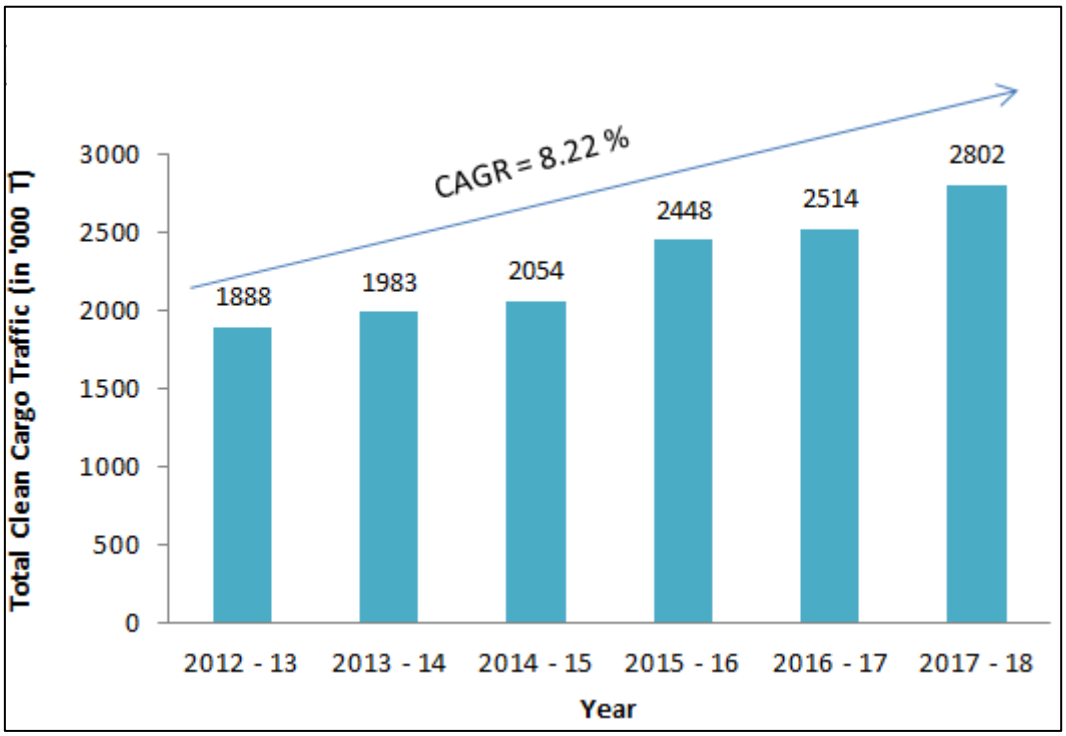


Figure 6-5 Total Clean cargo Traffic Trend in NMPT

6.3 Key Commodity Analysis

The key commodity analysis for export and import cargo at NMPT is described in the following sections

6.3.1 Key Commodities

The key commodities that are handled mainly in NMPT are coffee, raw cashew and fertilizers. The traffic pattern followed by these commodities in Indian scenario from 2013 to 2017 is discussed in this chapter. Coffee contributes the major share in container traffic exports and raw cashew contributes major share in container traffic imports. Fertilizer is the main commodity in total clean cargo traffic. The total quantity of these three commodities in the respective mode of traffic is observed to be increasing over the period of years subjected to study with different CAGR values.

6.3.2 India - Coffee Exports

Being the major commodity that contributes to container export traffic in NMPT, the growth trend followed by coffee in exports in Indian scenario was carried as a part of traffic review. The growth trend followed by coffee in exports in India is shown in Figure 6-6.

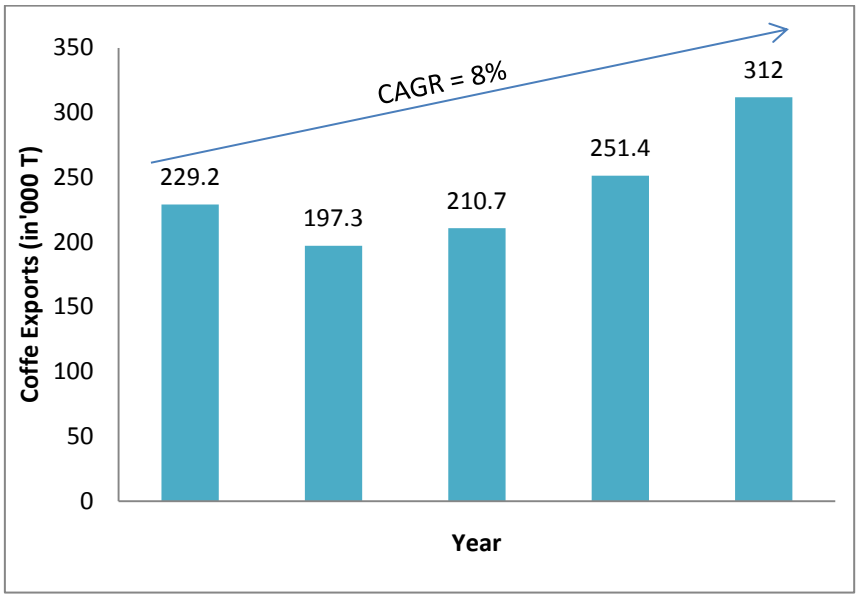


Figure 6-6 Coffee Exports - India for the past five years ('000 T)

Coffee exports from India have grown at a CAGR of 8% over the past 5 years. The hinterland of NMPT accounts for over 70% of India's coffee exports.

6.3.3 India - Raw Cashew Imports

The growth trend followed by raw cashew in imports in Indian scenario was studied as a part of traffic review. The growth trend followed by coffee in exports in India is shown in Figure 6-6.

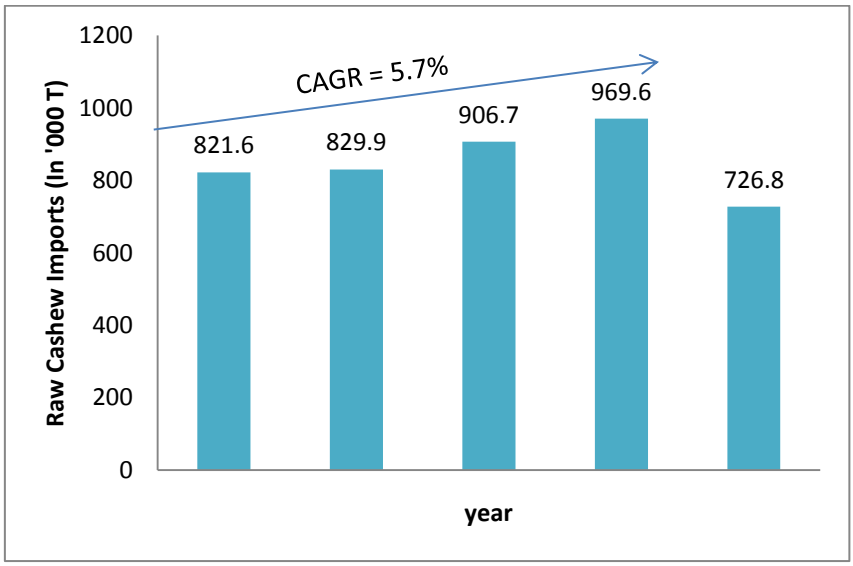


Figure 6-7 Raw Cashew Imports - India for the past five years ('000 T)

Raw cashew imports rose at a CAGR of 5.7% between 2013 and 2016. Although imports fell last year, they are likely to pick up in the future. A rise in global raw cashew prices on account of tight supplies was the major reason for fall in imports in 2017. However, the

situation has improved since then and imports are likely to bounce back. Although India will face competition from Vietnam and Ivory Coast (source of raw cashew), the cashew processing industry is expected to sustain in the long term due to low labour costs and existing hinterland conditions.

6.3.4 India - Fertilizer Imports

Being the major commodity that contributes to clean cargo traffic in NMPT, LNTIEL has analysed the growth trend followed by fertilizer in clean cargo traffic in Indian scenario as a part of traffic review. The growth trend followed by fertilizer in India is shown in Figure 6-8. Fertilizer imports have grown at a CAGR of 1.3% over the past 5 years. Fertilizer imports in India are relatively stable at about 16 MT with the exception of 2016 where there was a sudden spike in imports due to domestic shortfall.

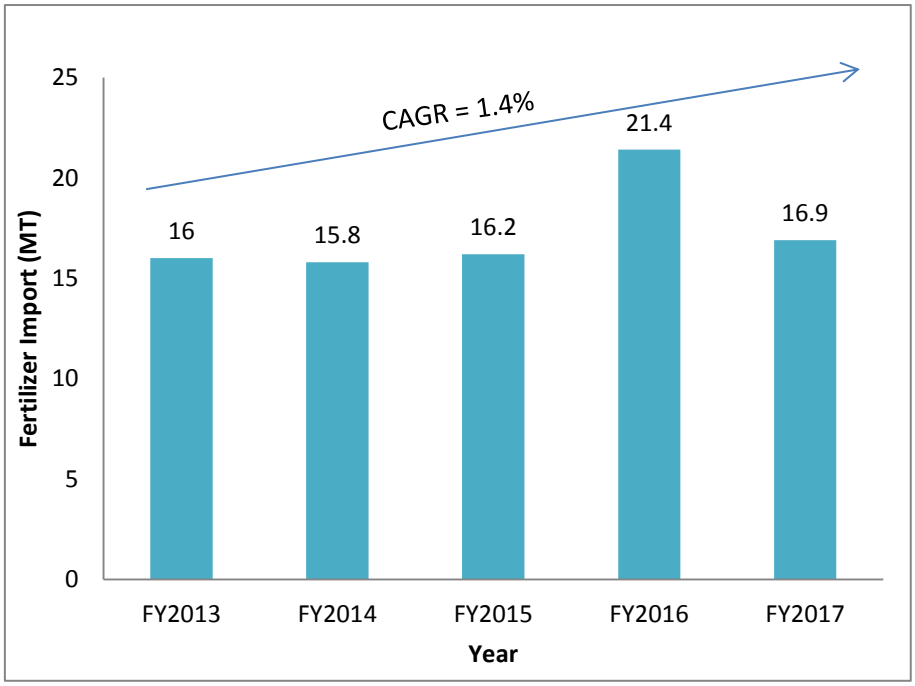


Figure 6-8 India Fertilizer Imports - India for the past five years (MT)

6.4 Traffic Projection

The traffic projection at NMP for key commodities pertaining to Berth No. 14 is given below. The projections have been done by considering base case and optimistic case of traffic scenarios for key commodities.

6.4.1 Traffic Potential

Based on the traffic review for past years, traffic projection has been done for till FY35. Several initiatives are expected to give a lift to container traffic at NMPT. Container traffic at NMPT is set to get a boost with COCNOR acquiring a railway siding at the port. The plan is to set up an ICD at Mangalore and also connect ICDs at Bangalore and Mysore to promote and increase containerized imports and exports of goods. Moreover, CONCOR is also looking to attract cargo from Gujarat and North India which could move coastally from Gujarat ports to New Mangalore port .The initial plan is to run about 10 container trains per month with a load of up to 80 containers per rake. This could boost volumes by about 10,000-12,000 TEUs per annum.

Widening of NH275 would also help NMPT attract cargo from key cargo generating clusters like Mysore and Nanjangudu. Also, frequency of shipping line calls has improved from 1-2 per week to about 4-6 calls per week and this is likely to improve further with companies like Simatech planning to make New Mangalore as a hub for coastal container movement. Large exporters like TVS Tumkur (1,000-1,200 TEUs annually) and JK Tyres Mysore (2,000-2,500 TEUs annually) apart from others could be attracted to NMPT, due to better road connectivity and frequency of shipping line calls. Other major exporters in the hinterland include Nestle in Nanjangudu and Primacy Industries in Baikampady.

Container traffic at NMPT is projected to grow at a CAGR of 12% until FY20. Beyond this in the base case it has been assumed that traffic will grow at a CAGR of 6% until FY25 and 4% until FY35. In the optimistic case, traffic will grow at a CAGR of 8% until FY25 and 6% until FY35.

The optimistic case assumes that volumes will be larger due to increased rakes (services) on the Hassan Mangalore and Mysore Mangalore rail lines. The reduction in growth rate is mainly because the key containerized cargo at NMPT is coffee which cannot grow beyond a certain limit as harvestable land cannot grow much.

In terms of fertilizers, Karnataka has a requirement of about 1.5 MT per annum but production and supply of only 0.3 MT, leading to a deficit of 1.2 MT per annum which can be met through coastal movement in the future provided better handling facilities are available.

The traffic potential for NMPT is presented in Table 6-8.

Table 6-8: Traffic Potential for New Mangalore Port

Cargo	Unit	FY20	FY25		FY35	
			Base	Optimistic	Base	Optimistic
Containers	(MnTEU)	0.14	0.19	0.21	0.29	0.38
	(MnT)	2.17	2.9	3.18	4.29	5.7
Fertilizers	(MnT)	0.9	1.2	1.2	1.4	1.4
Others	(MnT)	0.84	1.18	1.3	1.66	2
Total	(MnT)	3.91	5.28	5.68	7.35	9.1

6.4.2 Traffic projection for Berth No 14

After analysing the existing traffic occupancy of berth, it is understood that the other clean cargo (fertilizer, gypsum, limestone and dolomite) will be handled at other berths in the port. The berth No. 14 is expected to handle only a part of the projected clean cargo.

Hence for further studies, following traffic has been considered for Berth No 14 as shown in Table 6-9.

Table 6-9: Traffic Projection for Berth No.14 in New Mangalore Port

Cargo	Unit	FY20	FY25		FY35	
			Base	Optimistic	Base	Optimistic
Containers	(MnTEU)	0.14	0.19	0.21	0.29	0.38
	(MnT)	2.17	2.9	3.18	4.29	5.7
Fertilizers	(MnT)	0.30	0.40	0.40	0.47	0.47
Gypsum	(MnT)	0.31	0.43	0.48	0.61	0.73
Lime stone	(MnT)	0.02	0.03	0.03	0.04	0.05
Dolomite	(MnT)	0.02	0.03	0.03	0.04	0.05
Total	(MnT)	2.82	3.79	4.12	5.45	7.00

Chapter 7:
Vessel Size Analysis

7 Vessel Size analysis

Selection of optimal vessel size is very vital in planning of port facilities, as it will influence the size of the facilities planned within the port. It is also equally important to identify the right proportion of various probable vessel-sizes that would call at the port along with the maximum vessel size to be handled.

An analysis of the fleet for various cargoes is carried out to get an idea of the vessels on sail around the world. The vessels which are called at the major Indian ports are also reviewed to understand the vessels handled in India. The quantum of traffic to be handled at the proposed port and depth conditions at the site is also significant in deciding the vessel size.

7.1 Review of Worldwide Container Vessels- Existing

The detailed review of existing and on order container vessels available registered in Clarkson register is carried out. Figure 7-1 presents the on existing vessel distribution of container vessel around the world.

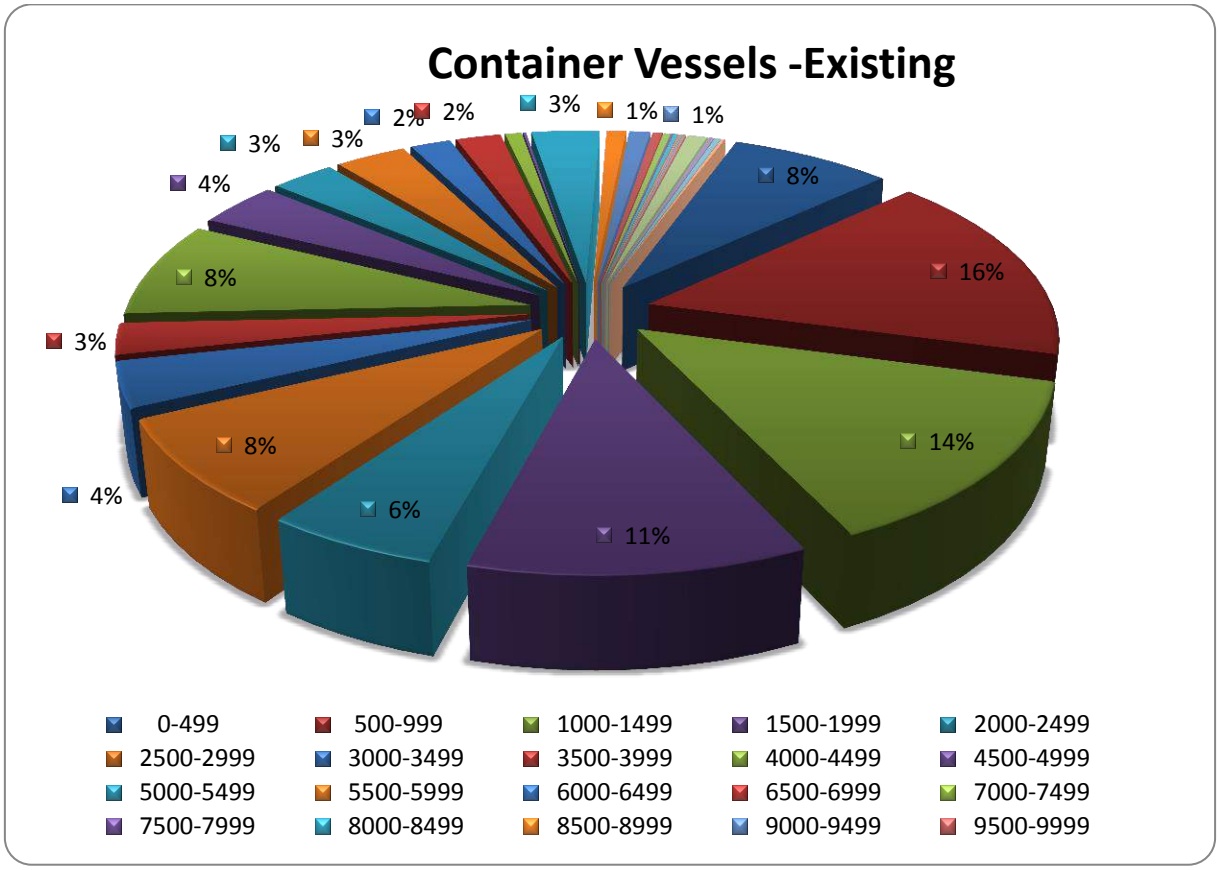


Figure 7-1: Distribution of Worldwide Container Vessels- Existing

From the analysis of the above statistics with the help of **Figure 7-1**, the inferences made are given below:

i. 48.5% of the existing fleet is below 2000 TEUs.

ii. About 20% of vessels have size between 2000 and 4000 TEUs.

iii. Vessels having size range of 4000-6000 TEUs comprises 18% of the total existing container vessels.

iv. Only 5% of the vessels have size between 6000 and 8000 TEUs.

v. Number of vessels above 8000 TEUs is about 8.5%.

7.2 Review of Worldwide Container Vessels- On Order

The detailed analysis of on order container vessels is carried out and distribution of worldwide vessels for containers is presented in **Figure 7-2** drawn from the details taken from Clarkson Register

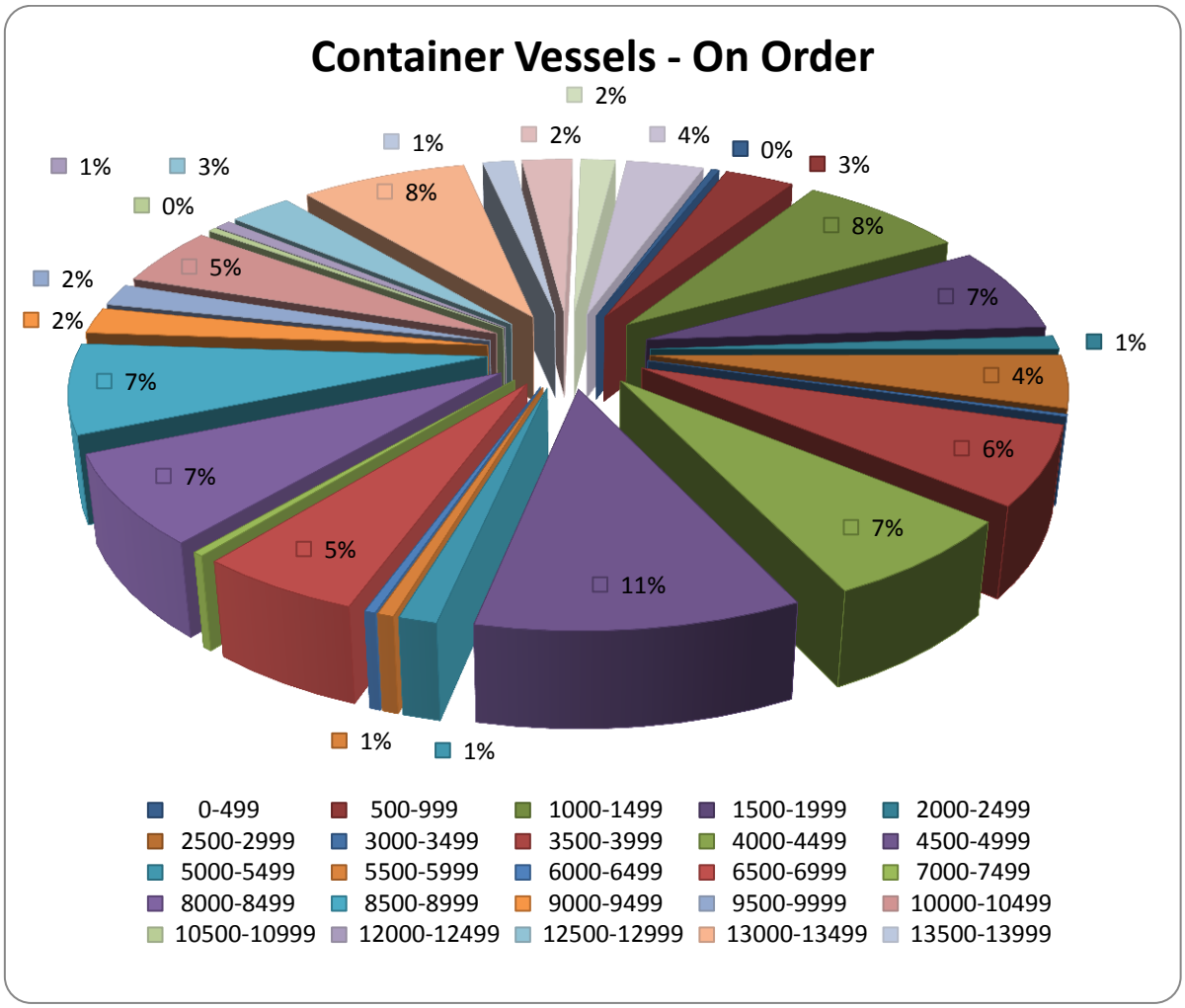


Figure 7-2: Distribution of Worldwide Container Vessels- On Order

From **Figure 7-2** it is understood that,

i. 18% of ordered vessels are below 2000 TEUs.

ii. About 12% lies between 2000 and 4000 TEUs.

iii. Vessels having size range of 4000-6000 TEUs comprises 19% of the total existing container vessels.

iv. Only 6% of the vessels have size between 6000 and 8000 TEUs.

v. 45% of ordered vessels have size greater than 8000 TEUS out of which maximum demand is for vessels in the range of 8000-9000 TEUs.

7.2.1 Review of Container Vessel Traffic at West coast of India

The distribution of the vessel DWT is reviewed for the year 2013-14 and 2015-16 and presented in Figure 7-3. It can be observed that the majority of the vessels which was handled at the major ports of west coast of India are in the range of 10000 T to 30000 T.

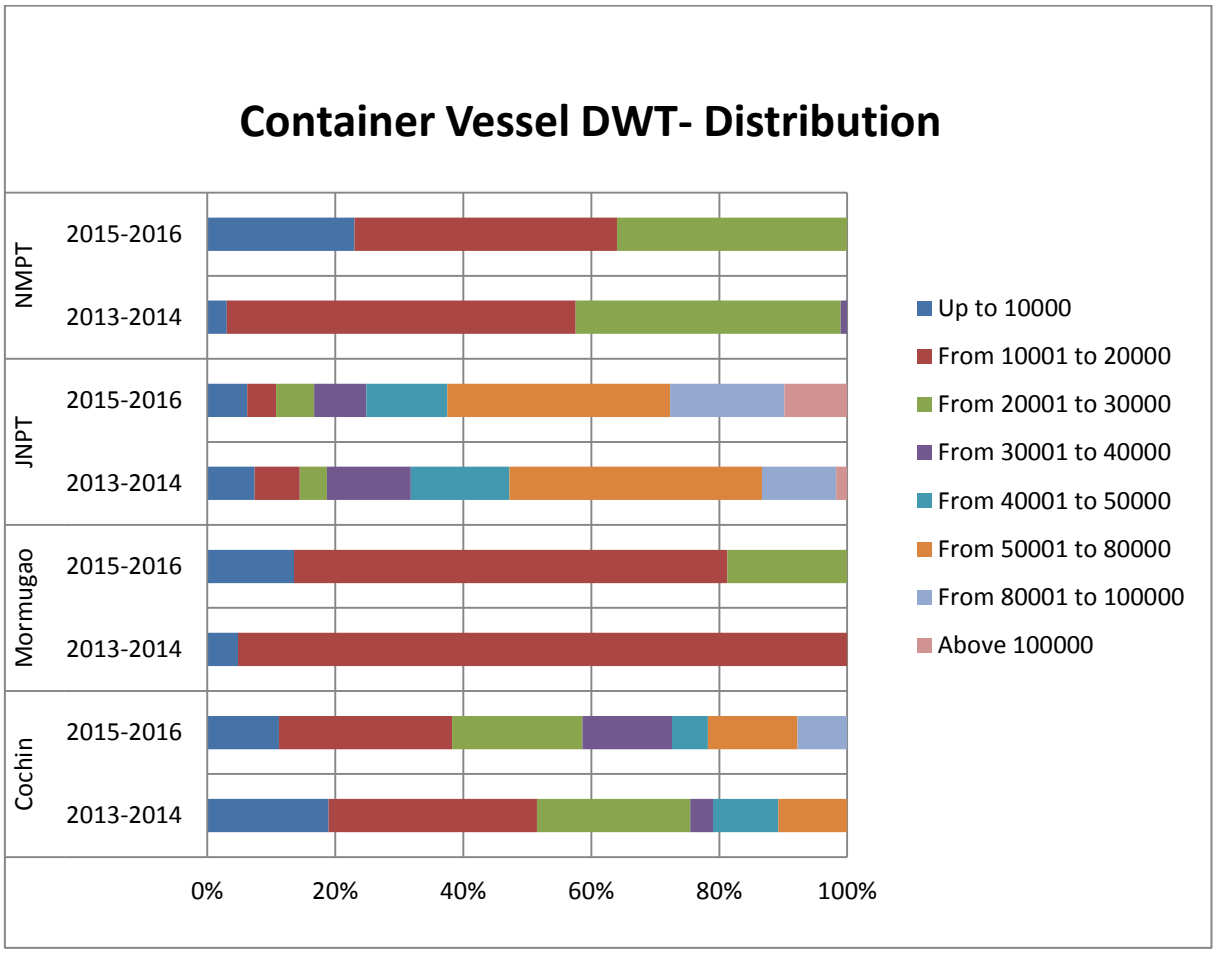


Figure 7-3 Container vessel DWT distribution for the container handling port in west coast of India

7.2.2 Vessel Size for Berth no 14 at NMPT

The Berth No 14, which is to be developed to handle containers, is 350 m long and the water depth available in front of the berth is -15.1 m CD. The berth can handle the vessel upto the length of about 320 m and with draft of around -13.8 m. The berth is designed to handle a vessel with tonnage of 90000 T. The average container vessel size predominant in the ports at the western coast of India is only 20000 DWT, which turns around to 1500 TEUs.

However considering the growth of the container vessel sizes in India and facilities being planned to developed for handling containers, the average vessel size is expected to go up to around 4000 TEUs in near future. Hence facilities on the Berth no 14 can be developed by considering vessel size of around 4000 TEUs initially and growing upto 9000 TEUs (Panamax size) in the future.

7.2.3 Review of Parcel size for container vessel at West coast of India

The distribution of the parcel size in the west coast of India is reviewed for the year 2013-14, 2014-15 and 2015-16 and presented Figure 7-4. It can be observed that the average parcel size excluding JNPT is in range of 400 to 650 TEUs

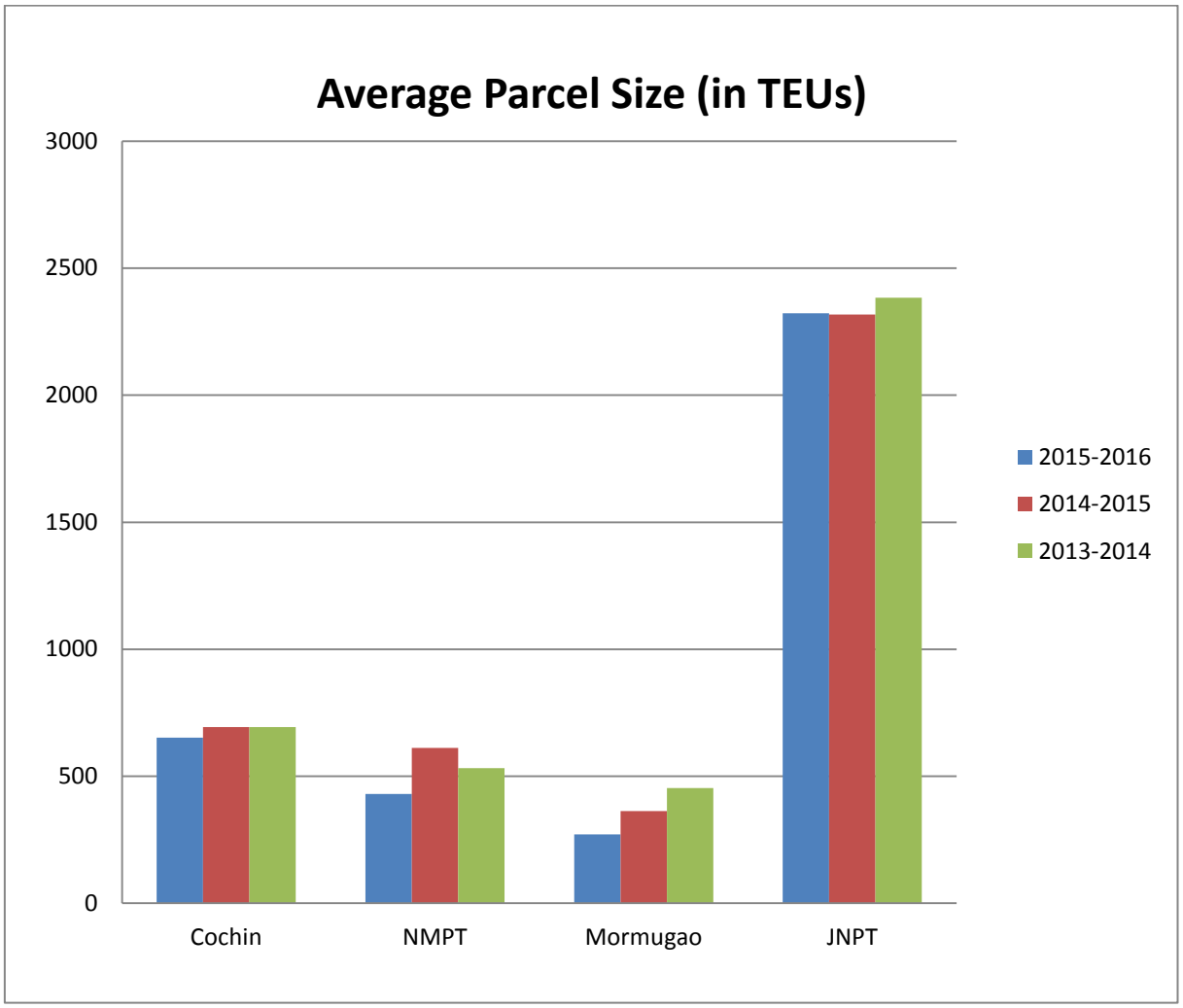


Figure 7-4 Average vessel sizes for container handling ports in West coast of India

7.2.4 Average parcel Size for Berth no 14 at NMPT

The average parcel size for containers for last 5 years at NMPT is given in the table below

Year	Average Parcel Size(TEU)
2016-17	437
2015-16	428
2014-15	614
2013-14	533
2012-13	601

The average parcel size in NMPT is taken 500 TEUs per vessel. Considering the growth of container traffic and the vessel parcel trend it is expected that the average parcel size will grow to 800 TEUs by 2025 and to 1000 TEUs by 2030.

For handling other cargo, which includes Fertilisers, Gypsum, Dolomite, Limestone, the vessel size is taken 50000 DWT and average parcel size is taken as 45000 DWT.

Chapter 8:
Surveys and Investigations

8 Surveys and Investigations

Topography survey has been carried out to fix exact boundary and to understand contour along with existing features in the area allocated for this project. The topography survey details are given in the following sections:

8.1.1 Topography survey

Topographic survey has been done in 3 blocks. Block 1, block 2 and block 3. Block 1 is the immediate area behind the berth No. 14. Block 2 is intended for container storage and lies almost perpendicular to the block 1, towards the eastern side. Block 3 is proposed if there is a need for additional container storage area.

Block 1

Block 1 is the rectangular area which lies in East-West direction and the southern side of the area includes the berth No.14. Block 1 has an area of around 6 acres. Two buildings, each of 3.5 m high are located in block 1, one at (+) 4.0 m CD and another at (+) 3.5 CD. Two drains are there inside Block 1. Another drain, coming from the backup area of UPCL berth runs along the northern side of block 1 and continues along the eastern side of block 2. There is a culvert at the end of second drain in Block 1. The ground level varies from (+) 4.0 m CD to (+) 5.8 m CD in block 1.

Block 2

Block 2 lies North-South with an area of about 7.68 Ha. It is a 751 m long, 97 m wide rectangular area. There are two buildings in block 2, one 3 m high and another 4 m high. At about 310 m from Block 1, there is a road across the block 2. There is a second road at 166 m from northern side of block 2 which pass across the block 2. At 254 m from block one 1, at a ground level of (+) 6.13 m CD, there is a CCTV tower. About 170 m from northern end of block 2, a well is located at a ground level of (+) 4.4 m CD. One road runs along the eastern side of block 2 and another starts at about 331 m from block 1 and runs along the western block side, northwards. The eastern side of block 2 is lined intermittently by jungle trees. Currently coal is stored in heaps in block 2. The drain from block 1 runs along the eastern side of block 2 till the top left corner.

An area of about 3.6 Ha is covered with trees and bushes on the Northern side of block 2

Block 3

The block 3 has area of about 4 acres. There is a transformer at eastern side of block 3. Block 3 is connected by a road of 7 m width at its topmost right corner.

The detailed topography of the area is presented in **Figure FD0801**

Chapter 9:
Planning Considerations

9 Planning Considerations

NMPT intends to handle container and clean cargo at Berth No 14 and also to develop handling facilities and storage facilities for container at existing stackyard near the spending beach. The location of Berth no 14 and the backup area available for development is presented in Figure 9-1

Figure 9-1 Proposed area of development for Berth No.14

For NMP, the facilities for the latest development have to be planned in a logical method by avoiding/limiting conflicts with the existing established infrastructure. When looking into the planning considerations, it has to be remembered that the cargo forecasts are simply estimates and the real cargo development will diverge from these estimates. It is important

that the planning considerations described in the following sections allow for these variations, particularly in the later phases.

The object of the study is to set a framework within which the port can exploit commercial opportunities for development of handling facilities for containers and other clean cargo. Within this general aim, the team uses a set of planning criteria to decide what facilities are to be provided and the location for those facilities. The main criteria considered for planning process will include:

- Provide facilities with sufficient capacity to handle the anticipated traffic safely and economically
- Provide a road and rail network that allows cargo to be transported in and out of the port efficiently
- Provide a layout includes security arrangements to fit the generally acceptable regulations
- Minimise the damage to the terrestrial and marine environment during the construction and operation of the facilities
- Comply with national regulations on the separation of industrial installations from housing. These goals will be achieved by careful consideration of:
    - Traffic and Phasing of development
    - Design vessel size
    - Storage area requirements
    - Road and rail layouts
    - Environmental factors

9.1 Development options

Container stackyard is the space for stacking containers inside the port. The stackyard is divided into rectangular regions, called blocks. Each block area is divided along their length into 20 foot sections called slots and the containers are stacked on top of one another in each slot. A typical arrangement of containers behind the berth is shown in Figure 9-2

Figure 9-2 Typical arrangement of containers behind the berth

In this chapter various development options for the Berth and the storage has been discussed. The Development options have been divided into two groups

1. Development option for the Berth
2. Development option for the Storageyard.

The development plan include the analysing various equipments, utilisation of the available back up area for storage, the road rail connectivity. Etc.

9.1.1 Development options for berth

The Berth no 14 is 350 m in length. The berth was designed for handling a vessel of 90000 T. The berth is presently utilised for the handling of coal, iron ore and other bulk. The cargo presently is being handled by Mobile harbour crane and in some cases by ship cranes.

The substructure of the Berth no 14 constitutes of 4 rows of 1000 mm diameter piles and diaphragm wall of 1100 mm thick. The piles are socketed in hard rock below 30 m CD and the diaphragm wall is also anchored in hard rock below 30 m CD. The super structure of the Berth no 14 consists of network of longitudinal and cross beams and a deck slab above. Provision for 4 crane rails is provided on all the longitudinal beams at every 10 m. The deck level of the berth is 4.575 m CD. Typical cross section of the existing berth is presented in Figure 9-3.

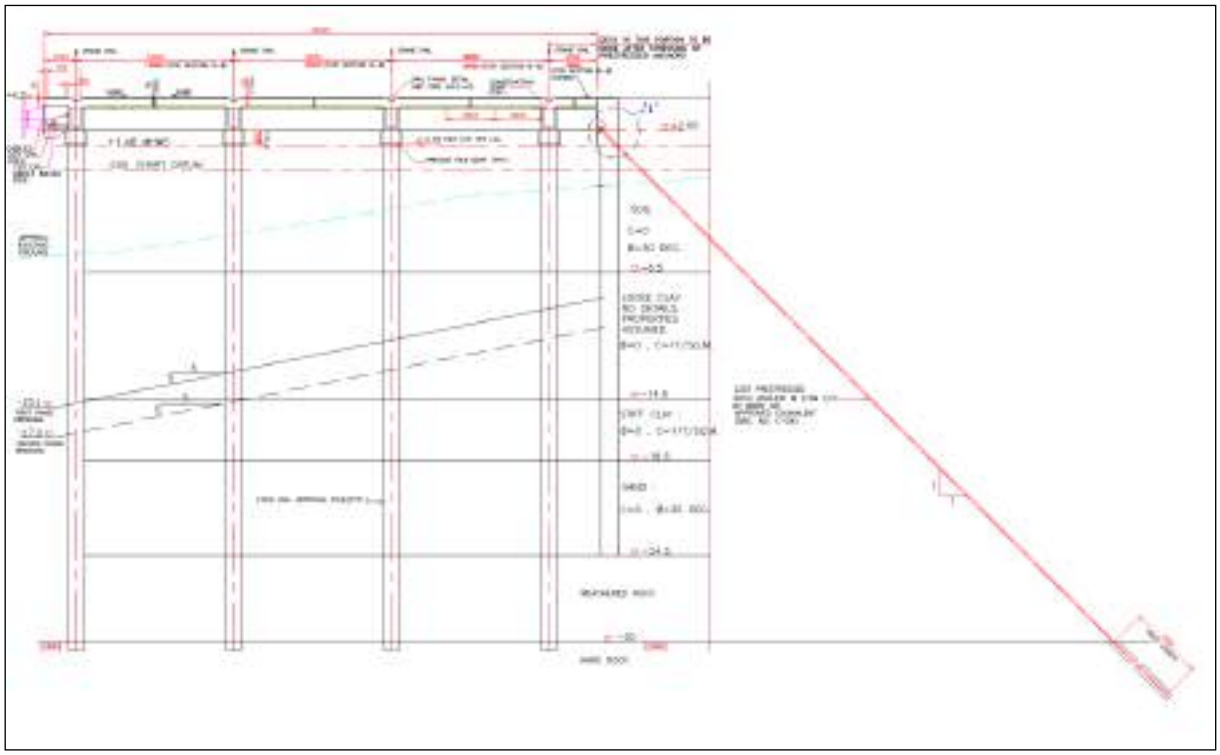


Figure 9-3 Typical cross section of the Berth No 14

Selection of equipment for transfer of containers from ship to shore depends on the cargo throughput to be handled, the available space at the berth and the required handling rate. The following options are studied for mechanising the Berth No 14.

- Using Rail Mounted Quay Cranes(RMQC)
- Using Mobile Harbour Cranes(MHC)
- Using a combination of Rail Mounted Quay Cranes and Mobile Harbour Cranes

9.1.1.1 Using Rail mounted quay cranes

Modern container operations are based on large Rail Mounted Gantry Cranes that can average more than 30 productive lifts per hour. In addition to these productive lifts, the cranes carry out hatch moves and occasional re-stows. Although modern cranes are very fast, the productivity is actually determined by the efficiency with which the containers are delivered to and removed from the crane. This is determined by the yard equipment and in particular by the implementation of a sophisticated Terminal Operating System that ensures that the crane has a plentiful supply of containers in the right sequence for loading.

Rail Mounted Quay Cranes shown in Figure 9-4 is travelling on rails, with a telescopic spreader attachment. They are generally used for ship to shore transfer of containers especially when higher cargo handling rates and throughputs are involved.

Figure 9-4 Rail mounted quay cranes

Given an efficient yard system, the number of containers transferred on and off a ship depends on the number of cranes that can be deployed on that ship. This is in turn a function of the size of the ship and the stowage pattern within the holds. Because of the geometry of the cranes, they can only address alternate holds at any given time. The target for handling containers on a large main line ship is to deploy five or six cranes for the whole time the ship is alongside. For the smaller feeder ships, up to three cranes can be deployed depending on the size of the vessel. In practice, most container terminals are equipped with one crane for every 85-100m of quay length.

Hence considering the length of Berth No 14, and considering the traffic growth, consultant suggests providing 3 cranes for handling containers to handle the ultimate traffic.

However in case of the quay crane, generally RMQC is not preferred to handle other cargo as these cranes are specifically built for handling containers and also will not be efficient in handling other bulk cargo. Additional equipments like MHC have to be installed on the berth to handle other cargo such as fertilizers, dolomite, gypsum, limestone.

9.1.1.1.1 Berth Occupancy Vs Traffic

The berth occupancy is calculated considering the following assumptions

- Working days per year : 365 days
- Working hours per day : 20 hours
- Average handling rate per RMQC : 25
- Additional time required for peripheral activities: 4 hours

The berth occupancy calculation for this alternative is presented in Table 9-1**.** In case of RMQC, it is assumed that no clean cargo shall be handled at the berth.

Table 9-1 Berth occupancy using RMQC

Description	Units	2020	2025, base	2025, optimistic	2035, base	2035, optimistic
		Container	Container	Container	Container	Container
Traffic	Mn TEU OR MTPA	0.14	0.19	0.21	0.29	0.38
Parcel size	TEU OR TONNES	500	800	800	1000	1000
Number of vessel/yr	No.s	280	238	263	290	380
Handling rate	moves/hr OR TPH	25	25	25	25	25
Number of cranes	No.s	2	2	2	2	2
Service time per vesse;	Hrs	10.0	16.0	16.0	20.0	20.0
Time for peripheral activities	Hrs	4	4	4	4	4
Total time required per vessel	Days	0.58	0.83	0.83	1.00	1.00
Total time required for all vessels in one year	Days	163	198	219	290	380
No: of berths provided	Nos	1	1	1	1	1
No:of berth days required	Days	163	198	219	290	380
Total Berth days required	Days/year	163	198	219	290	380
No: of Berth Days Available per year	Days/year	365	365	365	365	365
Berth Occupancy	%	**44.75**	**54.34**	**60.05**	**79.45**	**104.11**

From the above table it is clear that the berth cannot handle the container traffic projected beyond 2035 by only 2 numbers of RMQC. To handle the cargo projected beyond 2035, an additional RMQC has to be installed. The Berth occupancy for the increased number of RMQC is presented in Table 9-2

Table 9-2 Berth occupancy for increased RMQC

Traffic year	No of RMQC	BO %
2035, base	3	57.38
2035, optimistic	3	75.19

9.1.1.2 Using Mobile harbour Cranes

The mobile harbour cranes are used for ship to shore transfer of containers when the cargo throughput is very less and have to utilise the berth for other cargo. Also such types of cranes are usually used to handle heterogeneous cargoes. **Figure 9-5** shows a typical mobile harbour crane used for handling containers.

Figure 9-5 : Mobile Harbour Crane

The advantages of Mobile Harbour cranes are:

- Flexibility to handle a wide range of cargo
- High degree of flexibility for conversion to handle the above type of cargo.
- Safe and efficient for relatively exposed berths where tranquillity conditions are not favourable.

The disadvantages are:

- Low handling rates
- Very poor dust control
- High risk of damage to the berth pavement
- Inability to lift the last of the cargo leaving contamination risks

Hence considering the length of Berth No 14, 3 Mobile harbour cranes are ideal for a mix of container operation and other cargo.

9.1.1.2.1 Handling Clean cargo

The Berth no 14 however is envisaged to handle other clean cargo. The MHC can be used for handling the cargo by changing the spreaders to hooks or grab.

9.1.1.2.2 Berth Occupancy Vs Traffic

The berth occupancy is calculated considering the following assumptions

- Working days per year : 365 days
- Working hours per day : 20 hours
- Average handling rate per MHC : 20 moves/hr or 600 TPH
- Additional time required for peripheral activities: 4 hours

The berth occupancy calculation for this alternative is presented in Table 9-3

Table 9-3 Berth occupancy – MHC

Description	Units	2020		2025,base		2025,optimistic		2035,base		2035,optimistic	
		Container	Clean Cargo	Container	Clean Cargo	Container	Clean Cargo	Container	Clean Cargo	Container	Clean Cargo
Traffic	Mn TEU OR MTPA	0.14	0.650	0.19	0.89	0.21	0.94	0.29	1.16	0.38	1.30
Parcel size	TEU OR TONNES	500	45000	800	45000	800	45000	1000	45000	1000	45000
Number of vessel/yr	No.s	280	15	238	20	263	21	290	26	380	29
Handling rate	moves/hr OR TPH	20	600	20	600	20	600	20	600	20	600
Number of cranes	No.s	2	2	2	2	2	2	2	2	2	2
TEU s OR TPH	TEU s OR TPH	40	1200	40	1200	40	1200	40	1200	40	1200
Service time per vessel;	Hrs	12.50	37.50	20.00	37.50	20.00	37.50	25.00	37.50	25.00	37.50
time for peripheral activities	Hrs	4	4	4	4	4	4	4	4	4	4
Total time required per vessel	Days	0.69	1.73	1.00	1.73	1.00	1.73	1.21	1.73	1.21	1.73
No:of berth days required	Days	193	26	238	35	263	37	351	45	460	51
Total Berth days required	Days/year	219		273		300		396		511	
No: of Berth Days Available per year	Days/year	365		365		365		365		365	
Berth Occupancy	%	**60.00**		**74.79**		**82.19**		**108.49**		**140.00**	

From 2025, an additional MHC shall be installed to maintain the Berth occupancy in the acceptable levels.

The berth occupancy and traffic handled at the berth has to be optimal to achieve the optimal throughput. It is suggested that the clean cargo from 2028 shall be reduced gradually so that by 2032 only container will be handled at Berth No14.

The cargo handled at berth no 14 and the Berth occupancy levels using MHC are shown in Figure 9-6

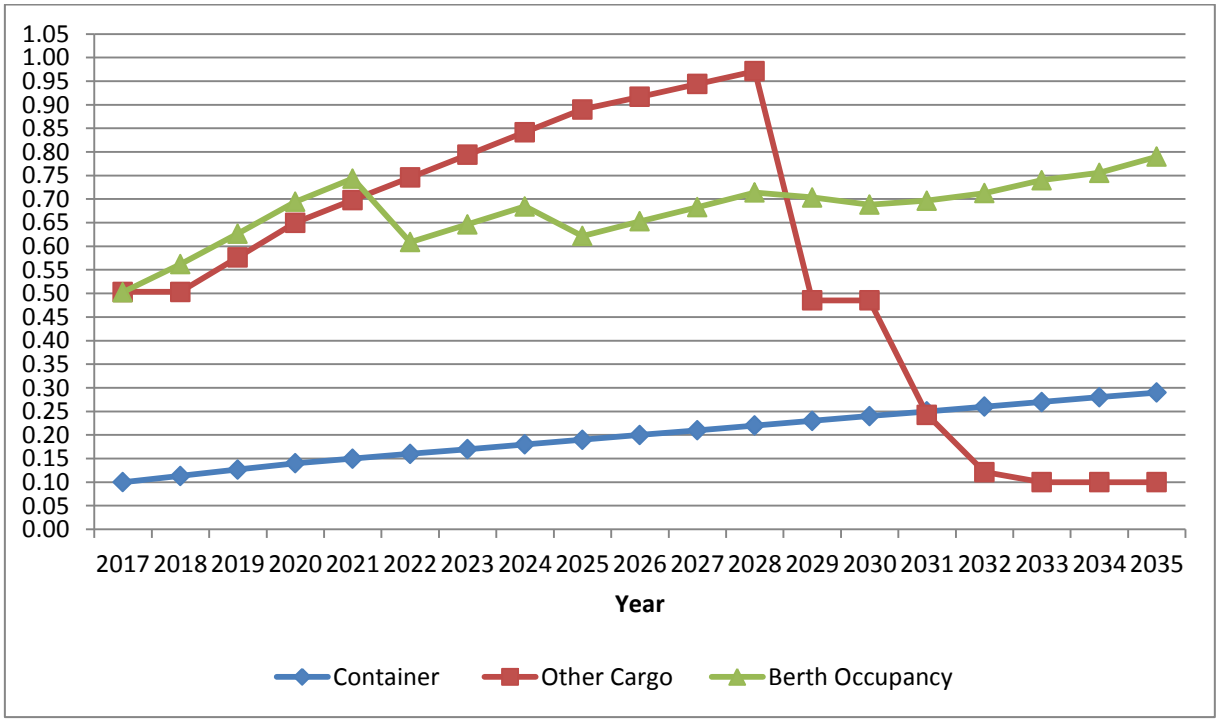


Figure 9-6 Berth occupancy vs cargo handled at Berth No 14 for MHC

Berth occupancy after installing 3 MHC beyond 2025 for base case traffic scenario is given below

	2025	2030	2035
Berth Occupancy (%)	53.7	64.2	77.0

9.1.2 Using a Combination of Rail mounted quay cranes and Mobile harbour cranes

In this option, 2 numbers of RMQC is assumed to handle the containers and 1 MHC to handle the other clean cargo.

The capacity calculation for handling cargo on the Berth no 14 using both RMQC and MHC is presented in Table 9-4. It is assumed that 60% of time containers shall be handled and 40% of time other clean cargo will be handled.

Table 9-4 Capacity of Berth no 14 for handling containers- RMQC and MHC

Description	Units	Value
Number of RMQCs	Nos	2
Average moves/ hour	Nos/hr	25
Number of boxes moved per hour	Nos	50
Average handling hours per day	hrs	20
Containers moved per day	nos	1000
Number of working days in year		198
Number of boxes which can be moved in year	nos	198000
Assuming that 70% of 20 ft and 30 % of 40 ft		
Capacity of berth with RMQCs	TEUs	257400
Description	**Units**	**Value**
Number of MHCs	Nos	1
Average Handling rate per crane	TPH	600
Cargo handled per hour	TPH	600
Average handling hours per day	hrs	20
Cargo handle per day	T	12000
Number of working days in year	Nos	132
Cargo which can be handled per annum	T	1584000

Assuming that 60% of time containers shall be handled and 40% of time other clean cargo will be handled, the capacity of the berth will be around 5.5 MTPA (assuming 15 T per containers). With this combination Berth no 14 can handle traffic projected upto 2025 in optimistic case.

9.2 Container Ground slots required

The number of ground slots required for container is estimated based on projected traffic and considering different dwell time's combinations. The dwell time combination makes separate dwell time for full container and empty container.

The ground slots are calculated separately for each type of yard equipment i.e. reaches stacker and RTG. For arriving at the ground slots, for traffic upto 2020, only reach stacker operations is considered. For traffic beyond 2025, comparison of ground slots requirement for both reach stackers and RTGs have been made

Following are the assumptions made for the arriving at the number of ground slots.

- Ratio between Dry and Reefer containers : 95:5
- Ratio between 20' and 40' containers : 80:20

- Ratio between full and empty containers : 70:30
- Average stack height- RTG- 4 high for full, 5 high for empty
- Reach stackers- 2 high for filled and 4 high for empty
- Reefers- 2 high for full and 3 high for empty
- Peak factor : 25 %

Dwell time is the time container spent inside the port. The following combinations of dwell time are considered for full and empty containers for calculating ground slots required.

- Combination 1: 7 days (Full container) + 20 days (Empty container)
- Combination 2: 4 days(Full container)+ 10 days (Empty container)
- Combination 3: 4 days (Full container)+ 4 days (Empty container)

9.2.1 Ground slots required for dwell time combination 1- 7 days (Full container) + 20 days (Empty Container)

The ground slots required for reach stacker operation is given in the following Table 9-5

Table 9-5 Ground slots required for Reach Stacker operation

Stackyard Equipments	Reach Stacker				
Year	2020	2025	2025	2035	2035
Traffic Scenario	Base	Base	Optimistic	Base	Optimistic
Dry Full Container	1117	1515	1675	2313	3030
Reefer full Container	59	80	89	123	160
Dry Empty	684	928	1025	1417	1855
Reefer Empty	49	67	73	100	132
Total Container Slots	1909	2590	2862	3953	5177

The ground slots required for RTG operation is given in the following Table 9-6

Table 9-6 Ground slots required for RTG operation

Stackyard Equipments	Rubber Tyre Gantry			
Year	2025	2025	2035	2035
Traffic Scenario	Base	Optimistic	Base	Optimistic
Dry Full Container	758	838	1157	1515
Reefer full Container	80	89	123	160
Dry Empty	743	820	1133	1484
Reefer Empty	67	73	100	132

Total Container Slots	1648	1820	2513	3291

9.2.2 Ground slots required for dwell time combination 2-4 days(Full container)+ 10 days (Empty container)

The ground slots required for reach stacker operation is given in the following Table 9-7

Table 9-7 Ground slots required for reach stacker operation

Stackyard Equipments	Reach Stacker				
Year	2020	2025	2025	2035	2035
Traffic Scenario	Base	Base	Optimistic	Base	Optimistic
Dry Full Container	639	866	957	1322	1732
Reefer full Container	35	46	52	70	92
Dry Empty	343	465	513	709	929
Reefer Empty	25	33	37	50	66
Total Container Slots	1042	1410	1559	2151	2819

The ground slots required for RTG operation is given in the following Table 9-8

Table 9-8 Ground slots required for RTG operation

Stackyard Equipments	Rubber Tyre Gantry			
Year	2025	2025	2035	2035
Traffic Scenario	Base	Optimistic	Base	Optimistic
Dry Full Container	434	479	662	867
Reefer full Container	47	52	70	92
Dry Empty	372	410	567	743
Reefer Empty	34	37	50	67
Total Container Slots	887	978	1349	1769

9.2.3 Ground slots required for dwell time combination 3-4 days (Full container)+ 4 days (Empty container)

The ground slots required for reach stacker operation is given in the following Table 9-9

Table 9-9 Ground slots required for reach stacker operation

Stackyard Equipments	Reach Stacker				
Year	2020	2025	2025	2035	2035
Traffic Scenario	Base	Base	Optimistic	Base	Optimistic
Dry Full Container	639	867	958	1322	1732
Reefer full Container	34	47	52	70	92
Dry Empty	138	187	205	284	372
Reefer Empty	10	14	15	20	27
Total Container Slots	**821**	**1115**	**1230**	**1696**	**2223**

The ground slots required for RTG operation is given in the following Table 9-10

Table 9-10 Ground slots required for RTG operation

Stackyard Equipments	Rubber Tyre Gantry			
Year	2025	2025	2035	2035
Traffic Scenario	Base	Optimistic	Base	Optimistic
Dry Full Container	434	479	662	867
Reefer full Container	47	52	70	92
Dry Empty	149	165	228	298
Reefer Empty	14	15	20	27
Total Container Slots	**644**	**711**	**980**	**1284**

9.2.4 Summary of Ground slots required

The required ground slots for Reach stackers and RTGs are summarized below in Table 9-11

Table 9-11 Summary of Ground slots required for Reach Stacker (RS) operation

Total Ground Slots Required	2020	2025		2035	
		Base	Optimistic	Base	Optimistic
7 days(Full)+ 20 days (Empty)Dwell time	1909	2590	2862	3953	5177

4 days(Full)+ 10 days (Empty)Dwell time	1041	1412	1560	2151	2819
4 days(Full)+ 4 days (Empty)Dwell time	821	1115	1230	1696	2223

For RTG operations, which is considered only beyond 2025 traffic, the number of ground slots required is estimated as given in Table 9-12

Table 9-12 Summary of Ground slots required for RTG operation

Total Ground Slots Required	2025		2035	
	Base	Optimistic	Base	Optimistic
7 days(Full)+ 20 days (Empty)Dwell time	1648	1820	2513	3291
4 days(Full)+ 10 days (Empty)Dwell time	887	978	1349	1769
4 days(Full)+ 4 days (Empty)Dwell time	644	711	980	1284

9.2.5 Conclusions and recommendations

From analysing all the options, the best alternative is to install MHC on the berth, so that there is flexibility for handling both containers and clean cargo. However post 2028, the clean cargo shall be moved gradually out of the Berth no 14, so that it will handle only containers by the end of 2032. To start with the berth will be equipped with 2 MHC and further in 2025 an additional MHC shall be provided to handle the growing cargo. In 2032, an additional MHC may be installed to keep the berth occupancy within the accepted level.

Chapter 10:
Development Options

10 Development Plan

This chapter describes different options of development and selection of best option.

10.1 Development options for container stackyard

Container terminals generally can use a range of yard handling systems such as Rubber Tyre Gantry Cranes, Reach Stackers, Forks lifts trucks, Straddle carriers, Automated Stack Cranes and tractor trailer units. The main advantages and disadvantages of each are described below:-

1. Rubber tyre gantry cranes with tractor trailer units – This is the most common system in container terminals and it achieves a high density of stacking. The system is flexible for different amounts of transhipment but it has the highest manning levels of all the systems.
2. Reach stackers or Forks lifts trucks with tractor trailer units – These require very large storage areas and are not applicable to high volume terminals. Reach stackers are very useful for handling unusual cargo items. They commonly used to supplement RTGs for handling leaking containers/empty containers.
3. Straddle carriers – Although very efficient this system only achieves an intermediate level of storage density (requires approximately 30% more area than RTG storage) and very high skill levels are required for individual drivers.
4. Automated Stack Cranes perpendicular to the quay – This gives the highest stack density and the lowest manning costs. It does not work well with high transhipment percentages due to congestion at the ship end of the stack.

For Berth no 14, as the traffic excepted at the berth will be around 0.4 MTEUs, it is suggested to study the following systems of the equipments

- Rubber tyre gantry cranes with tractor trailer units
- Reach stackers or Forks lifts trucks with tractor trailer units

10.1.1 Rubber tyre gantry cranes with tractor trailer units

A Rubber Tyre Gantry crane (RTG) shown in Figure 10-1**,** is a mobile gantry crane used for stacking intermodal containers within the stacking areas of a container terminal. RTGs are used at container terminals and container storage yards to straddle multiple lanes of rail/road and container storage, or when maximum storage density in the container stack is desired.

Normally 6+1 wide containers are used in India, even though there are 7+1 wide RTGs which are widely used in transhipment terminals around the globe. RTGs are able to handle containers of 5 or 6 high. While stacking the containers higher looks superficially attractive, the higher the stack the greater the number of housekeeping moves required to sequence the containers.

Hence for NMPT, it is suggested to utilise 6+1 wide containers capable of stacking 1 over 5 high.

Figure 10-1 Typical Rubber Tyre Gantry

It is a common practice to provide 2.5 and 3 RTGs per each quay crane. Over the years these numbers have increased slightly so it is likely that NMPT will need 3 RTGs for each quay crane / MHC.

10.1.2 Reach stackers with tractor trailer units

A reach stacker shown in Figure 10-2 is a vehicle used for handling intermodal cargo containers in small terminals or medium-sized ports. Reach stackers are able to transport a container short distances very quickly and pile them in various rows depending on its access. Reach stackers have gained ground in container handling in most markets because of their flexibility and higher stacking and storage capacity when compared to forklift trucks. Using reach stackers, container blocks can be kept 4-deep due to second row access.

In India, most commonly used Reach stackers are capable of handling 45 tons in the first row up to 5 high and 31 tons in the second Row and 16 tons in the third row.

Figure 10-2 Reach Stacker

10.1.3 Other Container equipments required in a stackyard

10.1.3.1 Empty Container Stacking

Major portion of the total container traffic is estimated to be empty containers. Although some are likely to be placed under the RTGs, it is much more efficient in terms of space and cost to block stack them using a dedicated empties handler. Empty containers do not need random access as with full containers so they can be stacked by type, size and ownership. Block stacking can be up to 8 high.

Typically a terminal has one empty handler Figure 10-3 for each 3 quay cranes but the high percentage of empties forecast may require more than that.

Figure 10-3 Empty container handler

10.1.3.2 Fork Lifts

A forklift truck shown in Figure 10-4 is a powered industrial truck used to lift and transport materials. The forklift has since become an indispensable piece of equipment in manufacturing and warehousing operations. It can be used for transferring of containers within the stockyard.

Figure 10-4 Fork Lifts

10.1.3.3 Tractors/Trailers

A trailer truck is an articulated vehicle consisting of a tractor and a trailer that carries the freight. A semi-trailer does not trail completely behind the towing vehicle, but is attached at a point that is just forward of the rear-most axle of the towing unit, so that some fraction of the weight of the trailer is carried by the prime mover, with most of that at the rear axle(s) and a small amount at the front axle(s) of the prime mover. This arrangement requires both tractor and semi-trailer to be distinct in design from a rigid truck and trailer.

Figure 10-5 Tractor trailer

10.2 Alternate layouts for development of stackyard

The existing 6.5 ha along with 1.3 ha of land near railway line is proposed to be utilised initially. Once the existing stackyard is saturated, 7.5ha of the land behind the berth will be developed. The whole back up area available behind the berth shall be levelled to level of (+) 4.575 m CD (as same as berth) with appropriate slope for drainage. From the topographic survey undertaken, it is known that the area has an undulating terrain. Hence levelling exercise has to be done for achieving the finished level. Also there are some existing buildings and trees which has to be demolished/cut for development of the stackyard.

To achieve the level of 4.575 m CD, about 35000 cum earth has to be excavated and 6500 cum earth has to be filled. Additional material available will be used for filling other areas.

Figure 10-6 Area for the proposed development of container terminal

The development of stackyard is envisaged in following locations

- Existing container storage of 6.5 Ha near the spending beach
- Area of 1.3 Ha near railway line
- Area of 7.5 Ha behind the Berth no 14

Considering the above mentioned locations, the following alternate options have been developed for mechanisation of Berth no 14

- Development of stackyard for Reach stacker operations
- Development of stackyard for RTG operations

The ground slots provided in the alternative layouts are given in the following sections. It is assumed that for RTG operations the containers shall be stacked 6+1 truck wide whereas for reach stackers operations the containers shall be stacked 4+1 truck wide.

10.2.1 Development of stackyard for RTG operations

In this alternative, RTG operations are considered in the stackyard. It is suggested to utilise 6+1 wide containers capable of stacking 1 over 5 high. Considering the same, a layout has been prepared in the storage locations available as option 1 and is shown in Figure 10-7. The layout option 1 is also presented in detail in Figure No: **FD1001**.

The following are the features of layout.

- 7 number of continuous rows of RTGs for the existing storage amounting to 816 ground slots
- 3 numbers of continuous rows of RTGs for the storage behind the Berth no 14 amounting to 1724 ground slots
- The Total number of ground slots is 2540

Figure 10-7 Layout Option 1- Development of Stackyard for RTG

The capacity of the stackyard for RTG operations as in layout option 1 is presented in Table 10-1

Table 10-1 Stackyard Capacity for Layout Option 1

Description	Units	Value
Existing storage		
Average stack height	no of containers	4
Number of ground slots	nos	816
Stackyard capacity	nos	3264
Storage area behind the berth		
Average stack height	no of containers	4
Number of ground slots	nos	1724
Stackyard capacity	nos	6896
Total	nos	10160
Average Dwell time	nos	6
Stackyard capacity per annum	TEUs	618067
	MTEUs	0.62

10.2.2 Development of stackyard for Reach stacker operations

In this alternative, reach stacker operations are considered in the stackyard. It is suggested to utilise reach stacker to stack up to 5 high containers. Considering the same 2 numbers of alternative layouts has been prepared in the storage locations available and presented in Figure 10-8 Layout option 2 and Figure 10-9 Layout Option 3.

The layout option 2 and layout option 3 are presented in Figure No: **FD1002** and Figure No: **FD1003**.

The following are the features of layout option 2. In this layout the container in the existing storage is planned that it will be stacked perpendicular to the entrance of the stackyard.

- The number of ground slots available in the existing storage is 1151
- The number of ground slots available behind the berth is 1574
- Total number of ground slots is 2725

Figure 10-8 Layout Option 2- Development of stackyard for Reach Stacker

The capacity of the stackyard is presented in the Table 10-2

Table 10-2 Stackyard Capacity for Layout Option 2

Description	Units	Value
Existing storage		
Average stack height	no of containers	3
Number of ground slots	nos	1151
Stackyard capacity	nos	3453
Storage area behind the berth		
Average stack height	no of containers	3
Number of ground slots	nos	1574
Stackyard capacity	nos	4722
Total	nos	8175

Description	Units	Value
Average Dwell time	nos	6
Stackyard capacity per annum	TEUs	497312
	MTEUs	0.49

The following are the features of layout option 3 as shown in Figure 10-9. In this layout the container in the existing storage is planned that it will be stacked parallel to the entrance of the stackyard.

- The number of ground slots available in the existing storage is 1171
- The number of ground slots available behind the berth is 1574
- Total number of ground slots is 2745

Figure 10-9 Layout Option 3 Development of stackyard for Reach Stacker

The capacity of the stackyard for layout option 3 is presented in the Table 10-3

Table 10-3 Stackyard Capacity Layout Option 3

Description	Units	Value
Existing storage		
Average stack height	no of containers	3
Number of ground slots	nos	1163
Stackyard capacity	nos	3489
Storage area behind the berth		
Average stack height	no of containers	3
Number of ground slots	nos	1574
Stackyard capacity	nos	4722
Total	nos	8211
Average Dwell time	nos	6
Stackyard capacity per annum	TEUs	499502
	MTEUs	0.5

10.2.3 Summary of the capacities of different options worked out

The above mentioned stackyard capacities are assumed 6 hours of average dwell time in all options. However, the capacity can be varied by fixing different dwell time for containers in the stackyard. In addition to 6 days of average dwell time, the annual stackyard capacity is estimated for average dwell time of 4 days and 13 days.

The summary of ground slots provided and annual stackyard capacity for different layout options are given in below in Table 10-4

Table 10-4 Summary of Ground slots and stackyard capacity in Alternative options

Description	Option 1 FD1001	Option 2 FD1002	Option 3 FD1003
1.Existing Stackyard- Ground slots	RTG	RS	RS
	816	1151	1163
Stack Height	4	3	3
Stackyard capacity per day	3264	3453	3489

Description	Option 1 FD1001	Option 2 FD1002	Option 3 FD1003
2.Behind Berth- Ground slots	RTG	RS	RS
	1724	1574	1574
Stack Height	4	3	3
Stackyard capacity per day (TEUs)	6896	4722	4722
3. Total Capacity per day (TEUs)	10160	8175	8211
Avg. Dwell time 4 days	0.93	0.74	0.75
Avg. Dwell time 6 days	0.62	0.49	0.5
Avg. Dwell time 13 days	0.29	0.22	0.23

10.3 Proposed Stackyard for development

After comparing the alternative layouts, layout option 2 i.e. reach stacker operation is found best in the initial phase compared to other options and provides following aspects for the development of stackyard.

- Flexibility of Container handling operations
- Area for development for other cargo
- Future development for RTG operations

The layout option 2 provides reach stacker operation in the stackyard. Average stacking height is considered as 3 containers. However it can stack up to 4 containers high. The containers are stacked in 4 wide configurations. This will provide flexibility in handling and will avoid multi-handling of containers.

Also the existing 150 ground slots of the reefer points are considered to be utilised for the stacking of reefer containers. It is assumed that the reefer containers will be stacked one high

The existing stackyard area will be developed for reach stacker operation. The containers will be stacked in 4 wide configurations. The reach stacker can stack upto 5 high with achieving an average of 3 high. The arrangement of container in the stackyard is shown in Figure 10-10.

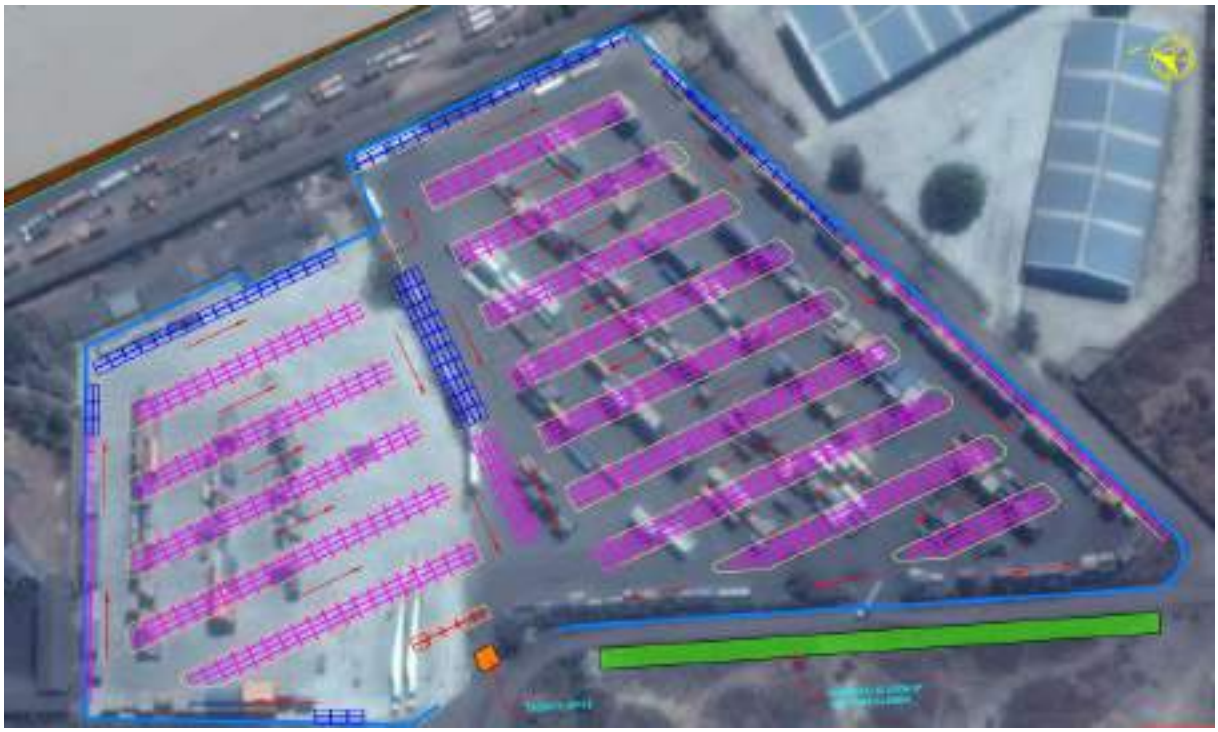


Figure 10-10 Proposed Stackyard layout- Existing Stackyard

The capacity of the existing container stackyard is given in the following **Table 10-5**

The layout of existing stackyard is given in Figure FD1004.**Table 10-5 Capacity in the existing stackyard**

Container	Ground slots (Nos)	Stack height (Nos)	Capacity (TEUs)
Dry	1054	3	3162
Reefer	150	1.5	225

The stackyard with above mentioned capacity are analysed for the following combinations of dwell times.

- Combination 1: 7 days (Full container) + 20 days (Empty container)
- Combination 2: 4 days(Full container)+ 10 days (Empty container)
- Combination 3: 4 days (Full container)+ 4 days (Empty container)
- Combination 4: 6 days (Full container)+ 10 days (Empty container)

Table 10-6 gives capacity of the stackyard for various dwell times and the year in which the traffic handled at stackyard crosses the projected traffic.

Table 10-6 Capacity of the existing stackyard

Sl No	Dwell time	Stackyard Capacity (MTEUs)	Year which the projected traffic matches the capacity
1	Combination 1: 7 days (Full container) + 20 days (Empty container) (Average 14 days)	0.09	2018
2	Combination 2: 4 days(Full container)+ 10 days (Empty container) (Average 7 days)	0.18	2024
3	Combination 3: 4 days (Full container)+ 4 days (Empty container) (Average 4 days)	0.31	2035
4	Combination 4: 6 days (Full container)+ 10days (Empty container) (Average 8 days)	0.15	2021

From the Table 10-6 , it is clear that the existing storage of 6.5 Ha will attain the capacity by 2024. However by stacking one more high the stackyard can accommodate the traffic upto 2026 Hence further to that 7.5 Ha of stackyard behind the berth shall be utilised for the storage of cargo.

It is to be note that, consultant has also studied provision for special type of container cargo such as hazardous containers, containers above 40’ length, transhipment containers and over dimensional Containers in the existing stackyard.

The assumptions taken for classification of container cargo including special type of containers are given below

- Normal and Reefer containers : 96%
- Hazardous containers : 2%
- Containers above 40’ length : 1.4%
- Transhipment containers : 0.1 %
- Over Dimensional Containers : 0.5 %

As per the above assumption, the number of ground slots and capacity are estimated as given in Table 10-7

Table 10-7 Capacity of existing stackyard with Non-conventional containers

Container	Ground slots (Nos)	Stacking Height (Nos)	Capacity (TEUs)
Dry	1030	3	3089
Reefer	108	1.5	163
Hazardous containers	68	1	68
Containers above 40’ length	47	1	47
Transhipment containers	3	1	3
Over Dimensional Containers	17	1	17

The Table 10-7 presents the required storage space for special type containers such as reefer, hazardous, above 40’ length, and over dimensional containers other than dry, however other than the hazardous cargo the space of the dry containers in the proposed stackyard can be utilized by the operator as such special types of container arrive.

The proposed layout of stackyard behind the berth is presented in Figure 10-11

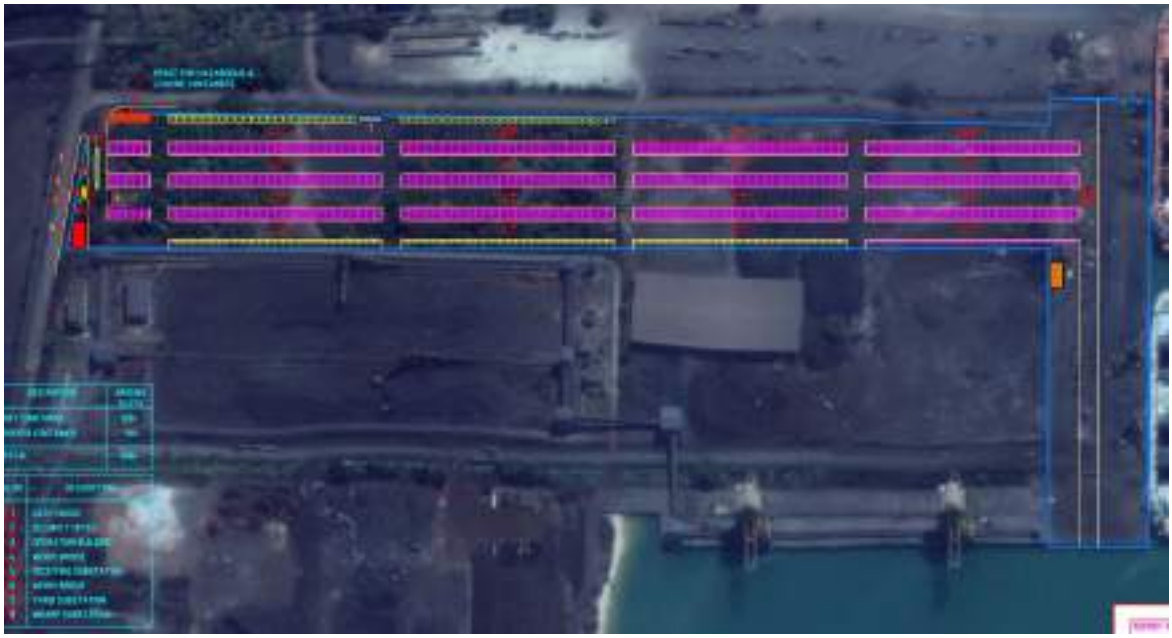


Figure 10-11 Proposed Stackyard layout- Behind Berth

The stackyard provide space for dry containers only. The reefer containers shall be stored in the existing stackyard. There are 1484 ground slots provided for dry containers. Also an area of around 0.02 ha has been earmarked for leaking/hazardous containers.

The layout of stackyard behind the berth is given in **Figure FD1005**

The Capacity of stackyard is given in the following Table 10-8

Table 10-8 Capacity of the stackyard

Sl No	Dwell time	Stackyard Capacity (MTEUs)
1	Combination 1: 7 days (Full container) + 20 days (Empty container)	0.12
2	Combination 2: 4 days(Full container)+ 10 days (Empty container)	0.23
3	Combination 3: 4 days (Full container)+ 4 days (Empty container)	0.41
4	Combination 4: 6 days (Full container)+ 10days (Empty container)	0.2

The total stackyard capacity, including both existing container yard stackyard and stackyard behind berth, is calculated for different dwell times and is given in Table 10-9

Table 10-9 Total stackyard capacity of selected layout option

Sl No	Dwell time	Total Stackyard Capacity (MTEUs)
1	Combination 1: 7 days (Full container) + 20 days (Empty container)	0.21
2	Combination 2: 4 days(Full container)+ 10 days (Empty container)	0.41
3	Combination 3: 4 days (Full container)+ 4 days (Empty container)	0.72
4	Combination 4: 6 days (Full container)+ 10days (Empty container)	0.35

10.3.1 Conclusions and recommendations

Comparing the capacity of the stackyard available and the ground slots required as per the traffic projections, the following can be concluded

- The existing container yard can accommodate 1204 ground slots for reach stacker operations which can handle about 0.18 MTEUs/year. By improving the dwell time the capacity can go upto 0.41 MTEus/year
- The area behind the Berth no 14, which can accommodate maximum of 1484 ground slots for reach stacker operations, can handle about 0.23 MTEUs/year.

Hence for the traffic projected for the Berth no 14, it is recommended that the stackyard to be equipped as follows

- The existing stackyard shall also be utilised till the container traffic grows upto to 0.18 TEUs/Year
- Further to the above, the area behind the Berth no 14 shall be utilised for stackyard with reach stacker operation
- In addition to reach stackers, empty container handlers, forklifts shall be utilised to increase the stackyard storage capacity

For the proposed Berth no 14, the Annual throughput is 5.45 MT PA (FY 35) including container and bulk cargo. In that the bulk cargo throughput is comparatively less and comes around 1.16 MTPA. It is clear that for handling the bulk cargo of aforesaid throughput, 140T capacity crane is not appropriate and such crane is required only for project cargo.

Normally 144 T lifting capacity will be operating at an outreach up to 20 m (approx). In such cases the heavy cargo always will be placed at the center of the vessel and hence normal operating radius will depend on the type of the vessel. For a Panamax vessel it will be minimum 27 m or so. (say 32 m beam size; So 16 m to vessel center, 2 m fender, 2 m safe distance from berth edge + 7 m crane center)

Looking at the less bulk throughout, the consultant discourages to go for bigger capacity crane which not only increases CAPEX, OPEX and will make under-utilization of the cranes. Also 1TEU container unit generally will have weight ranging from 15T to 20T and a grab of 14m3 capacity for handling bulk cargo, the weight of one grab with 100 % fill will be 39 T. Therefore the MHC with around 100T capacity will suffice for Berth no 14.

A report on equipments for the mechanization of Berth no 14 is given in **Annexure 1**

Brochures and details of the equipments are given in **Annexure 2**

The available land for storage and operation is given in the following Table 10-10

Table 10-10 Available land for storage and operation

Location	Area (sqm)	Description	Phases
Berth Area (350mx35m))	12,250	1.225 Ha Berth area	Phase 1
Area behind the Berth	15,133	1.51 Ha for connectivity, truck queuing area, immediate storage	Phase 1
Existing stackyard near spending beach	65,000	6.50 Ha for Container Storage	Phase 1
Proposed stackyard behind the berth	75,000	7.50 Ha for Container Storage	Phase 2
Total Phase I area	9.24 Ha		
Total Phase II area	7.50 Ha		
Total area	16.74 Ha		
Railway Stackyard area on common user basis	1.30 Ha		

10.4 Quay capacity

The optimal quay capacity is calculated as per the norms provided by Tariff Authority for Major Ports (TAMP).

Table 10-11 Quay capacity

Quay Capacity	Unit	Phase 1	Phase 2
Number of cranes on berth	Nos	2	3
Number of working hours of cranes per year	hrs	8760	8760
Average number of moves per cranes	Nos	20	20
TEU ratio		1.3	1.3
Quay Capacity	MTEU	0.32	0.48
Quay Capacity	MTPA	4.78	7.17
Handling rate of cargo		10000	10000
Optimal capacity	MTPA	2.55	2.55
Total Quay capacity	MTPA	4.22	6.01

10.5 Development of Railway yard

The development of railway yard is proposed further north of the stackyard behind the berth near the existing railway line. The area for railway yard is estimated about 1.3 Ha. 110 container slots have been provided in the railway yard.

The proposed railway yard is presented in **Figure FD1006**

The railway yard is proposed outside the stackyard area between the gate complex and railway line.

Figure 10-12Layout of railway yard

10.6 Container Freight Station

Container Freight Station (CFS) is a place where containers are stuffed de-stuffed and aggregation/segregation of export import cargo will take place.

An area measuring about 1.84 Ha is earmarked outside security compound wall north of RCWH quarters near Baikambady Industrial area for setting up of CFS.

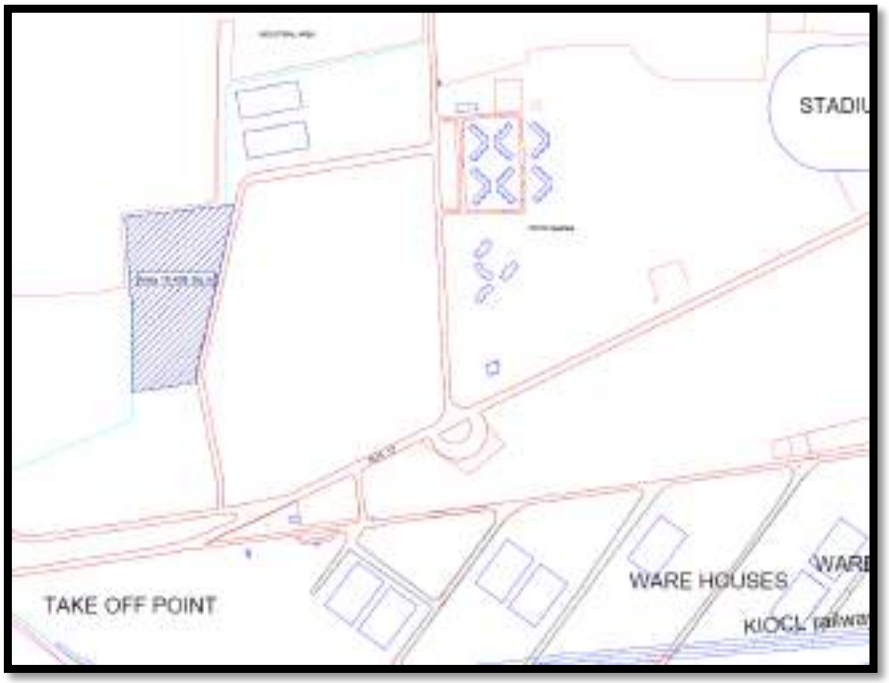


Figure 10-13 Container Freight Station location

The traffic volume for container Freight Station (CFS) is taken as 0.076 MTEUs assuming 20% of the traffic to come to CFS. The average transit time is assumed as 3 Days.

Assuming the cubic capacity of an ISO Container of IC type is 33.3 m3 and all containers are full, the required area for the CFS is obtained as 1.82 Ha.

The CFS area calculations are given in Table 10-12

Table 10-12 Storage area calculation Container Freight Station

Container Freight Station	UNIT	Value	
Traffic Volume at CFS	MTEUs	0.076	
Container movements per year	TEUs	76000	
		20ft	40 ft
		53200	22800
Average Transit Time	days	3	3
No of Working days in an year	days	350	350
Holding Capacity Required	TEUs	456.0	195.4
Cubic Capacity of Container	m3	33.3	66.6
Average stacking height of cargo	m2	2	2
CFS Stacking area	m2	7592.4	6507.8
Assume Access factor	%	15	15
CFS average storage area	m2	8731.3	7483.9
Assume Reserve Capacity Safety Factor	%	12	
CFS design storage area	m2	18161.02	
	Ha	**1.82**	

10.7 Truck parking area

The truck parking area shall provide parking for trucks that

- Arrive too early and need to wait
- Arrive too late and need to rebook
- Are affected by congestion/problems at the in-gate
- Are affected by the traffic movement restrictions and need to wait

- Require maintenance (by drivers or breakdown services)

The Truck parking area is calculated assuming 10 hours of parking time. The area required for truck parking will vary initially from 0.5 Ha to 2.5 Ha. The parking area will provide space for around 90 trucks initially to 330 trucks. The provision of parking area is required to prevent the trucks parking upon the hard shoulders of the port authority roads.

It is proposed to develop a truck parking area on the north side of NMPT estate near Industrial Area Baikampady.

10.8 Movement of container from Berth to stackyard

The existing storage is located at about 2.6 km from the berth. The container from the vessel will be loaded onto the trailer of the truck on the berth and the truck will carry the container to the stackyard and vice versa. The total travel distance for the truck is estimated at about 5.3 Km.. The number of trucks per hour is estimated and presented in Table 10-13.

Table 10-13 Number of trucks- containers

Sl. No	Description	Unit	Value
1	Distance from berth to existing stackyard	km	2.75
2	Distance from existing stackyard to berth	km	2.51
3	Handling rate /MHC Crane	Moves/Hr	20
4	Handling rate /reach stacker	Moves/Hr	7
5	Number of MHC Crane	Nos	2
6	Inter departure time between trucks	minutes	3
7	Distance between berth and Storage area and back	km	5.26
8	Average traveling speed of the trailer	Km/hr	15
9	Time for truck to travel from berth to storage and back	minutes	21.04
10	Time for loading in berth	minutes	1.5
11	Time for unloading in storage	Minutes	4.5
12	Total Cycle time for trucks	minutes	27
13	Truck movement per hour per crane	Nos	10
14	Add 10% for operation and maintenance issues	Nos	2
15	Total truck requirement for 2 cranes/hr	Nos	22

For the crane of 20 Moves per hour, minimum of 20 trucks movement will happen per hour which accounts to 800 truck movements per day for two cranes for 20 hour working day.

10.9 Gate complex

The function of gate complex is to control entry and exit of all vehicles and personnel using the terminals. The gate complex will include gate office, in and out gate house booths, entry and exit gates and lanes for wide loads. The gate house is located at the entry and exit way of the stackyard.

The gate office will include control rooms for gate functions, space suitable for gate operations, administration and maintenance staffs, customs, police and security staffs.

The gate complex will also be equipped with RFID reader and also each of the containers will be provided with RFID tag. Using RFID tag, containers can be tracked and traced through different RFID readers. This will provide the visibility and transparency of the EXIM container movement starting from the Port and covering the entire movement through rail or road till the ICDs and CFSs.

In addition to the gate complex, NMPT is proposing to develop container scanner units near the existing stackyard. All the containers which have to be scanned as per the customs requirement shall be taken to the scanner location.

10.10 Clean Cargo

The clean cargo which includes fertilizers, gypsum, limestone and dolomite will be handled from ship by means of MHC. The MHC will transfer the cargo to the trucks and the trucks will carry the cargo to the warehouse. The storage for the clean cargo will be located by the end users either in the warehouse owned by port or private party within 5 km from the berth. Trucks will carry the cargo from the berth to the storage yard. Mobile hoppers are proposed for loading of the cargo onto to the trucks from the vessel. The number of trucks required for the for transfer of cargo is presented in Table 10-14

Table 10-14 Number of trucks for clean cargo

Particulars	Unit	Value
Average time required for loading truck including queuing time	sec	60
Average distance from Berth to storage yard	m	5000
Speed of truck	m/s	5.56
Average time required for travelling to storage yard	sec	900
Average time required for dumping into yard	sec	30
Average time required for travelling back to stockyard	sec	900
Additional time for stoppages, traffic signals, gates etc	sec	300
Average total time for operations	min	36.5
Number of trips per truck per hour	trips	1.64

Particulars	Unit	Value
Average capacity of load carried by truck	tonnes	16
Material handled per truck per hour	TPH	26.30
Material to be handled per hour at Berth 9	TPH	600
Number of trucks required per hour to evacuate from berth	Nos	23
Add 10 % for operation and maintenance issues		
Number of trucks required per hour to storage yard	Nos	26

10.11 Electrical System

The following basic Electrical Data viz., desired/available voltage levels, frequency and other such details shall be followed for this project and accordingly the equipments for the port will be designed.

Table 10-15 Basic Electrical Data

Description	Data	Remarks
Incoming Voltage From Grid	33KV, 3 Phase, 3 Wire	SC Rating 26KA
Frequency	50 Hz	-
Primary Distribution Voltage	11KV	SC Rating 26KA
Secondary Distribution/Utilization Voltage	415V	SC Rating 50KA
Low Voltage system	415V	SC Rating 50KA
Low Voltage (LV) Distribution	415 V, 3 Phase, 3 Wires	4 Wire for Lighting
Control supply for HV and LV switchgear	110 V DC	-
MCC Contactor coils	220V AC	-
Switchgear & Protection circuit voltage	110 V DC	-
Solenoid valve voltage level	220 V AC	-
Digital inputs and outputs	220V AC	-

Lighting	400V/230V	-
Power Supply Arrangement to Ship in Port	Max. output voltage – 440 V, 3 Phase, Frequency – 60 Hz	-

These specifications shall be used for all the electrical equipments such as Cranes, Motors of conveyors etc. so that a multiple voltages can be avoided in the port.

10.11.1 Codes and Standards

The whole electrical installation will be in compliance with the Indian Standards (BIS) and Indian Electricity Act/Rules.

For areas, which are not regulated by the Indian Codes and Standards, the design shall be in accordance with the Codes and Standards of the International Electro Technical Commission (IEC).

10.11.2 Information on Electrical Installations

The port consists of the following Electrical Installations.

- Main Receiving Station
- Main Power Distribution system.
- Sub-stations in the Quay area.
- Sub-stations in the yard area.
- Power supply to Port illumination system.
- Power distribution for Air conditioning and ventilation system.
- Power supply to reefer containers.
- Power supply arrangement to Ships in Port.
- Installation of Emergency Power Generator.
- Power supply to Utilities (Water & Air system, lifts, mobile hopper etc).

10.11.3 Energy Management System

The total power requirement for the Port operation at the end of the Master Plan Development will be approximately 1.2 MW. Power receiving and distribution system shall maintain the power system in the best condition for uninterrupted availability of power for the port operations. In order to achieve this, an Energy Management System will be installed.

The energy management system shall consist of the required measuring and controlling devices, computer system and appropriate software. Operation of the power system can be done from a single control room. The system shall have facilities for its operation under various conditions in an efficient manner.

10.11.4 Power Requirement

The Terminal shall receive 33KV power from the State grid (as of now available). The system will be designed with

- One 33 KV incoming feeder from the state Grid.
- One 33 KV / 11 KV power transformer to step down the voltage from 33 KV to 11 KV (Primary supply voltage) to the system
- Two Nos. 11 KV outgoing feeders shall be selected to feed power to sub-stations at yard and sub-stations at quay to meet the power requirement of the project.

Provision will be kept for future expansion of the MRS and also for the outgoing feeders to meet any increase in power demand in future. Selection of equipment shall be done in such a way to suit the immediate power requirement of the Port as well as the future requirement considering various phases of expansion.

10.11.4.1 Estimation of Power

The power required for the operation of the port is estimated considering all the electrical equipments to be used for handling of Containers, lighting for terminal, fire fighting system, power supply arrangement to ship in port and other facilities. The estimation of electrical power required for various equipments with their respective rated capacity is given in Table 10-16 and Table 10-17.

Table 10-16 Power Requirement- Phase 1

Sl. No.	Equipment Description	Load (KVA)		
		Nos.	Unit Load	Connected Load
1.	Illumination by high mast (30 mts) at Berth Area and yard elimination	12	8	96
4.	Water pumping system	1 set	40	40
5.	Fire Fight Equipment	1 set	50	50
6.	Substation Lighting	1 set	10	10
7.	Port operating building such as Gate House, Security, Mobile hoppers etc.	100 m^2	0.02	2
8.	Mobile Hoppers	2 nos	3	6
9.	Reefer plug and socket arrangement (considering 60% utilization factor)	150	7.5	675
	Total- Phase 1			**879**

Table 10-17 Power Requirement- Phase 2

Sl. No.	Equipment Description	Load (KVA)		
		Nos.	Unit Load	Connected Load
1.	Illumination by high mast (30 mts) at Berth Area and yard elimination	9	8	96
3.	Security lighting along boundary	60	0.2	12
4.	Water pumping system	1 set	40	40
5.	Fire Fight Equipment	1 set	50	50
6.	Substation Lighting	1 set	10	10
7.	Port operating building such as Gate House, Security, etc.	100 m^2	0.02	2
	Total- Phase 2			**210**

Total Power = 1089 KVA

As a green initiative, as an option port may take up the work “Extending Power Supply to Ship through Distribution Service Unit (DSU)” of each 80 KW capacity and shall be provided on the berth in the interval of 100 mts.

The approx. power load to DSU = 80 x 3 = 240 KW / 0.8 = 300 KVA

During the Phase 1 the existing facilities available will be utilised. The existing reefer points are assumed to be utilised for both the phases.

Single line diagram (SLD), a diagrammatic representation of electrical network indicates power flow rather than circuit diagram, making them easier to comprehend and allows to add more details of components and other necessary details. SLD for the facilities at the stackyard proposed behind the Berth No. 14 at New Mangalore Port Trust is shown in **Figure FD1007.**

10.11.4.2 Power Factor Correction

Power factor is an important aspect to be maintained in the power system. The power factor without the correction system will be normally in the order of 0.8 to 0.84. It is proposed to correct this to a value of 0.95 or better.

Power factor correction has the following benefits.

- The maximum demand in KVA will be reduced and accordingly the max demand charges.
- Higher power factor results in reduced current in the system and corresponding loses in the cables and transformer is reduced.
- Voltage drop in the system is reduced and this helps in stable operation of the equipment.
- Most Power companies charge a power factor penalty if the power factor goes below certain value. This can be avoided.

To achieve this PF following arrangements shall be considered.

- For the large capacity motors capacitors of appropriate rating shall be connected across the motor terminals to obtain a power-factor of 0.95. Care will be taken to avoid self-excitation of these motors.
- For each LT section, an automatic PF correction panel will be provided. This will use switched capacitors and maintain a PF of about 0.97.

10.11.4.3 Sources of Power and Distribution

Mangalore Electricity Supply Company Limited will be approached to meet the power requirement of this project. Generally, power is received from the nearest Sub-station Grid.

The main receiving station shall be located anywhere near the north boundary of the project site. The 33 KV power at MRS is distributed to the following sub-stations.

- Yard Sub-Station
- Quay Sub-Station

10.11.4.3.1 Main Receiving Station

The 33 KV / 11 KV Switchyard located in the MRS will be designed to meet the power requirement and the same can be designed in such a way that it can be expanded to meet future requirement without any major modifications. MRS shall consist of 33 KV incomer feeder from grid, one number power transformer 33 KV / 11 KV and two numbers 11 KV outgoing feeders for Quay and Yard Sub-stations.

Vacuum Circuit Breaker (VCB) shall be used for the incomer and outgoing feeders. Necessary, Potential Transformers, Current Transformers, lightning arrestors, and other accessories shall be installed in the MRS as per the standards. From the main 11 KV switch board, power to individual Sub-stations is provided via 11 KV cables.

10.11.4.3.2 Yard Sub-station

The Indoor sub-station will be located near the container reefer socket arrangement area at container yard. It receives 11 KV supply from the main receiving station and stepped down to 415 V for feeding LT supply to office buildings, yard lighting, security lighting and reefer containers.

10.11.4.3.3 Quay Sub-station

The Indoor sub-station will be located in the middle of the quay area. It receives 11 KV supply from the main receiving station and stepped down to 415 V for feeding LT supply to office buildings, Wharf lighting, security lighting and power distribution board. Separate dry type
11 KV / 415 V transformer and static frequency converter (SFC) shall be planned for providing Shore Power Supply to ship.

10.11.4.3.4 Standby Power Generation

It is proposed to install a Diesel Generator (DG) of appropriate capacity to feed power to all equipments requiring emergency power. The DG will be located in each sub-station.

10.11.4.3.5 Illumination

Considering 24 hours operation of the port, an efficient and reliable lighting system shall be designed. Illumination level at different working areas shall be maintained according to the relevant Indian Standards such as IS: 10947.

The total lighting system shall be designed to provide the different levels of illumination, as mentioned in Table 10-18

Table 10-18 Lux level for Illumination

Area	Lux level
Berths	50
Sub stations, .Pump House	200
External illumination (Street Lighting)	20
Stock pile area	50
Conveyor galleries	50
Transfer Towers,(if any)	100
Central Control Room (CCR)	300

Office area	500

The lighting system shall be divided into two groups,

- 24 Hour system
- 12 Hour system

All indoor areas, offices, and enclosed plant area shall require power all the 24 Hrs. These areas shall be fed from 24 hour circuits. In the port area, the open buildings and uncovered areas shall require power only during night hours and will be fed from 12 hrs circuits. Outdoor illumination of the storage and material handling area including all roads with suitable street lighting fittings are also fed from 12 hrs circuit.

Automatic Control shall be used for all outdoor lighting and all 12 hour circuits. Power supply to convenient sockets shall be connected to independent circuits and areas requiring emergency lighting shall have a separate circuit fed from UPS.

Lighting masts with a height of about 30m will be used for yard lighting, entrance area lighting and wharf illumination with appropriate number of luminary are installed for outdoor illumination. LED lamps shall be used for the lighting masts and these lamps are controlled by a control panel located near the high mast towers which will have facility for remote operation and automatic operation.

All the fixtures and panels will have an enclosure category of IP65. The high mast towers will be of galvanised steel suitable for corrosive atmosphere. All high mast towers will be provided with an Aviation warning lamp and lightning conductor.

The lamp fittings in the high masts will be grouped as follows.

- 20% of the lamps will be operating always irrespective of the operations. This will provide general illumination in the respective area. This part will be controlled by lighting sensor/timer.
- Balance 80% of the lamps will be switched “ON” based on requirement whenever there is operations/activities in the area. Earthing and Lightning Protection

The neutral of power transformer and lighting transformers shall be earthed solidly.

The plant earthing grid shall be designed to maintain a very low earth resistance for the safety of personnel and equipment. This shall be achieved by installing required earthing electrodes all over the plant and interconnecting them. GI strip of appropriate sizes shall be used for forming the earth grid. MS conductor can be used in embedded concrete and for earth mats.

Lightning protection system shall be designed for the protection of all buildings and structures following relevant IS/IEC specifications.

The layout of port electrical facilities are given in **Figure FD1008**

10.12 Water Supply and Fire Fighting System

The following Sections describes the water supply and fire fighting system for the project

10.12.1 Water Requirement

Water supply facilities at the port site are planned for the following activities:

- Supply to port staff and Port users
- Supply to ships

- Fire fighting purposes

The water requirement estimated es are presented in Table 10-19

Table 10-19 Water requirement for the proposed development

Sl.No	Activity	Water Requirement (KLD)
1	Supply to staff and users for buildings	14
2	Supply to ships	200
3	Fire fighting purposes	180
	TOTAL	**394**

Fresh water or raw water is used for both drinking purpose and domestic usage. The quality of water required to be supplied at the port site are given in Table 10-20

Table 10-20 Characteristic Quality of Raw water required as per IS 10500 (2012)

Sl. No	**Parameters**	**Spec value. (Max)**
1	Turbidity	5 NTU
2	Total dissolved salts	500
3	Total suspended solids	10
4	Ca hardness as $CaCO_3$ mg/l	75
5	Mg hardness as $MgCO_3$ mg/l	30
6	Total hardness as $CaCO_3$ mg/l	300
7	Chlorides as Cl, mg/l	250
8	pH	6.5 to 8.5
9	Sulphates as SO_4	200
10	Total iron, mg/lit	0.3
11	M – Alkalinity, mg/lit	200

Raw water received from source provided by the NMPT will be collected in Underground Tank which will be located near operational Building. Raw water is distributed from the U/G sump through pump to 2 days storage overhead tank to the buildings and other utility points.

10.13 Fire Fighting System

The system envisaged for fire fighting purpose at terminal is a Single Hydrant service system. This system comprises of a network of above-ground piping throughout the area. Taping shall be considered in the hydrant header line for Sprinkler system. In order to meet the sprinkler system pressure requirement, booster pumps shall be considered near the gate house building. Hand Appliances selection basis and quantity shall be as per relevant TAC recommendation/ NBC codes.

For the proposed area to be developed behind the berth no 14, for the fire protection system, it is considered as ordinary Hazard with simple system of Hydrants at equal intervals of 45m and assuming that Mobile Fire Tenders (Tankers on Truck) will cater for peak demand. Capacity and number of Fire Protection System (FPS) Pump shall be decided w.r.t number of equivalent Single Hydrants and Water Monitors. Normally above Ground water storage is preferable with positive suction for FPS Pumps. But if U/G sumps are provided, then it is preferred to install the Pumps in Cellar with Positive suction.

10.14 Estimation of capacity

10.14.1 Container Cargo

10.14.1.1 Quay Capacity

The optimal quay capacity is 70% of the maximum number of TEUs that can be handled across the quay over a period of one year.

- Optimum Quay Capacity=A×B×C×D×E TEUs

Where,

- A = Number of gantry cranes deployed for work in an year
- B = Number of working hours of gantry cranes in an year
- C = Average number of moves per gantry crane
- D = TEU ratio
- E = 70%

Details	Phase 1	Phase 2
A = Number of harbour mobile cranes deployed for work in an year	2 nos.	3 nos.
B = Number of working hours of harbour mobile cranes in an year	8,760hrs (24 hrs x 365 days)	8,760hrs (24 hrs x 365 days)
C = Average number of moves per harbour mobile crane	20 nos.	20 nos.
D = TEU ratio	1.3	1.3
E = 70%	70%	70%
Share of Container Cargo	75%	75%
Thus, Optimal Quay Capacity = (A * B * C * D * E)*75%	**2,39,148 TEUs**	**3,58,722 TEUs**

10.14.1.2 Yard Capacity

The Optimal Yard Capacity is 70% of the maximum number of Containers (in TEUs) that could pass through the yard in a year.

- Optimal Yard capacity=0.7×(G×H×P)/(S ×D) TEUs

Where,

- G = Total ground slot in TEUs
- H = Average Stack height
- P = Period in No. of days
- S = Surge factor
- D = Average Dwell Time (measured as the time in days from the time a container is placed in the yard until it leaves it irrespective of the free time allowed in the Scale of Rates)

Details	*Units*	Phase 1	Phase 2
Total Area	*Ha*	6.5	14
G = Total ground slot*	*TEUs per Ha*	360	360
H = Average Stack height	*ratio*	2.5	2.5
P = Period in No. of days	*days*	365	365
S = Surge factor	*ratio*	1.3	1.3
D = Average Dwell Time#	*days*	7	7
Thus, Optimal Yard Capacity = 0.7 * (G * H * P) / (S * D)	***TEUs***	**1,64,250**	**3,53,769**

**Ground slots per hectare taken as 360 which is practically possible.*
#Average of 4 days for full containers & 10 days for empty containers.

10.14.2 Other Cargo

The optimal quay capacity is 70% of the maximum or possible quantity of cargo that could be loaded (in the case of loading terminal) or unloaded (in the case of unloading terminal) on to or from the ship in a period of one year expressed in tonnes.

As per the TAMP Norms for Multipurpose Cargo the handling rate is 10000 TPD for vessels of more than 30000 tons parcel size.

- The parcel size as per DPR is 45000 Tonnes.
- Share of Cargo = 25%
- P1 = Handling rate per day of vessel =10000 TPD
- S1 = Percentage Share of Cargo =100%
- Optimum Quay Capacity = 0.7 * (S1/100) * P1 * 365*25%= 0.64 MTPA

10.14.3 Optimal Terminal Capacity

As per the Guidelines of 2008, optimal terminal capacity is the lower value of the optimal quay capacity or optimal yard capacity. According to the calculations undertaken in the earlier sections, optimal capacity is determined as below

10.14.3.1 Phase 1

Parameters	Container Cargo		Other Cargo
Quay Capacity	2,39,148TEUs	3.59 MTPA	0.64 MTPA
Yard Capacity	1,64,250 TEUs	2.46 MTPA	*NA*
Optimal Capacity	**1,64,250 TEUs**	**2.46 MTPA**	**0.64 MTPA**

Total Capacity : 3.1 MTPA

10.14.3.2 Phase 2

Parameters	Container Cargo		Other Cargo	Total
Quay Capacity	3,58,722 TEUs	5.38 MTPA	0.64 MTPA	
Yard Capacity	3,53,769 TEUs	5.31 MTPA	*NA*	
Optimal Capacity	**3,53,769 TEUs**	**5.31 MTPA**	**0.64 MTPA**	**5.95 MTPA**

Total Capacity : 5.95 MTPA

Chapter 11:
Structural Adequacy of Berth no 14

11 Structural Adequacy of Berth No 14

NMPT intends to handle container and clean cargo at Berth No 14 and also develop handling facilities and storage facilities for container New Mangalore Port Trust requested L&T-Infrastructure Engineering Limited (LNTIEL) to carry out the adequacy check for Piles, Beam and Deck Slab for the proposed mobile harbour crane loads. The same has been presented in the report. The design capacity is arrived based on the drawings received from NMPT.

11.1 Input Data

The following are the documents received from NMPT:

- 369C-09-R3 – Typical reinf. details of Pile and Pile muffs
- Bollard position – Position of Bollard and Fender
- C-03 – Typical detail of Expansion Joint
- C-04 – Typical Reinf. detail of Beam
- C-10 – Elevation of Diaphragm wall and rock anchoring
- C-11 – Typical Reinf. detail of Diaphragm wall for Zone- L1
- C-12 – Typical Reinf. detail of Diaphragm wall for Zone- L2
- C-14 sheet 1of 2 – General Arrangements and RC Detail of Precast slabs
- C-14 sheet 2of 2 – General Arrangements and RC Detail of Precast slabs
- C-023 – Reinforcement Detail of Longitudinal Beam Cantilever End
- C-26 – Detail of 150 Tonne Cast Iron Bollard
- C27(1) – Reinforcement Detail of Precast Cover
- C28(1) – Detail of Ramp between Deep Draft Multipurpose Berth & Behind Old Berth
- I-369-C01-R4 – General arrangements
- 17066-TT-01-0 – G HMK 4406 B Mobile Harbour Crane
- 17066-DC-01-0 – G HMK 4406 B Mobile Harbour Crane
- 17066-QS-01-0 – G HMK 4406 B Mobile Harbour Crane
- 17066-TB-01-0 – G HMK 4406 B Mobile Harbour Crane
- 17066-TD-01-0 – G HMK 4406 B Mobile Harbour Crane

11.2 Assumption

- The berth structure has already been designed for 5 T/m^2
- IS 4651-1989: Part-IV has been considered for the design checks
- Steel reinforcement of Grade Fe415 has been considered
- Reduced concrete grade of M35 has been considered in view of ageing

- Hogging reinforcement for deck slab is considered same as that of sagging reinforcement drawing (as suggest by NMPT vide meeting dated 17/1/2018 at Mangalore).

11.3 Adequacy Check

The Structural system is checked for the following proposed mobile harbour cranes:

1. Gottwald Crane G HMK 4406 B- Lifting Capacity-100T
2. LHM 550-Lifting capacity-144 T

Out of the above mentioned loads it is found that LHM 550 is governing. Analysis and result for the same is presented in sections below.

11.3.1 Piles (Axial Capacity):

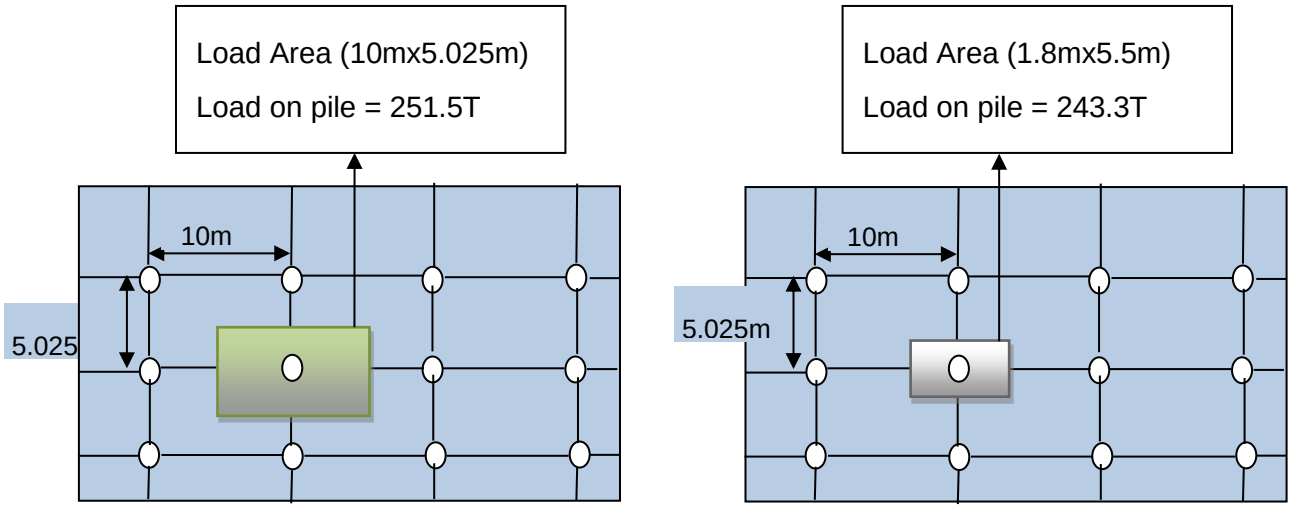


Figure 11-1: Axial Load on piles due to Surcharge and LHM 550

Only axial capacity has been checked for piles since there are no lateral loads due to LHM 550, reinforcement of pile checking is not done for piles. It is observed that the axial load on Pile due to stacking of 5T/sq. m is 251.5T, whereas axial load on pile due to LHM 550 is 243.3T which is more than that of 5T/sq.m stacking, hence axial capacity of existing piles are found to be safe for LHM 550.

11.3.2 Cross Beam

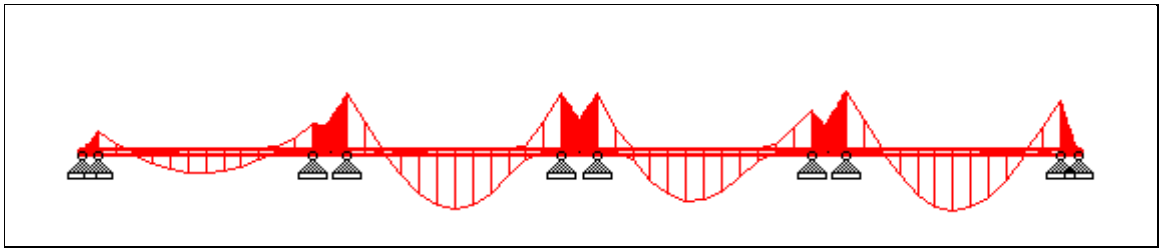


Figure 11-2: Bending Moment Diagram of Cross Beam

Load Condition	Section Width m x Depth m	Rft As per Drawing	Moment Capacity kN.m	Ultimate Moment or shear kN.m or kN	Service Moment kN.m	Crack width mm	Conclusion
Sagging	1.2 x 2	12C32	8242	2806	1871	0.045	Safe
Hogging	1.2 x 2	12C32	6349	3100	2065	0.068	Safe
Shear	1.2 x 2	3C12+ 1C8@ 100mm	-	2715	-	-	Safe

11.3.3 Long Beam

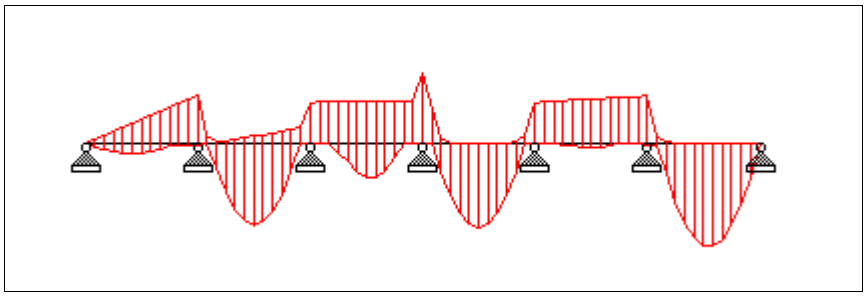


Figure 11-3: Bending Moment Diagram of Crane Beam

Load Condition	Section Width m x Depth m	Rft in Drawing	Moment Capacity kN.m	Ultimate Moment or shear kN.m	Service Moment kN.m	Crack width mm	Conclusion
Sagging	1 x 2	12C32	7130	1085	722	-0.02	Safe
Hogging	1 x 2	12C32	5220	780	520	-0.04	Safe
Shear	1 x 2	3C12+ 1C8@ 100mm	-	1570	-	-	Safe

11.3.4 Deck slab

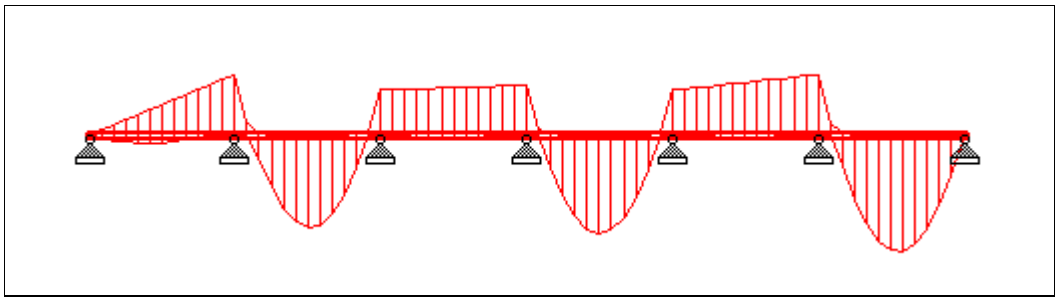


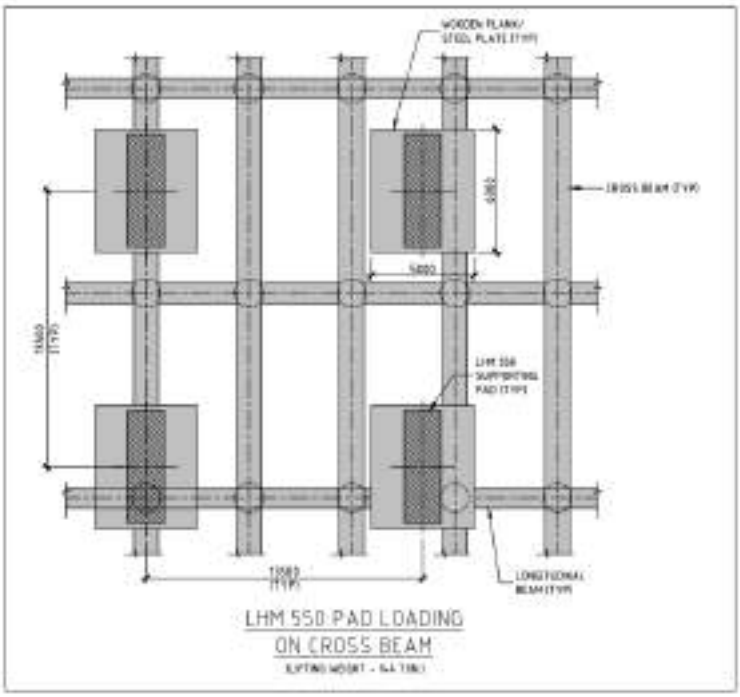
Figure 11-4: Bending Moment Diagram of Deck Slab

Load Condition	Section Width m x Depth m	Rft in Drawing	Moment Capacity kN.m	Ultimate Moment kN.m	Service Moment kN.m	Crack width mm	Conclusion
Sagging	3.03 x 0.6	21C25	1522	1050	700	0.157	Safe
Hogging	3.03 x 0.6	21C25	1522	900	602	0.125	Safe
Shear	3.03 x 0.6	5C12@ 150mm	-	1567	-	-	Safe

11.4 Summary

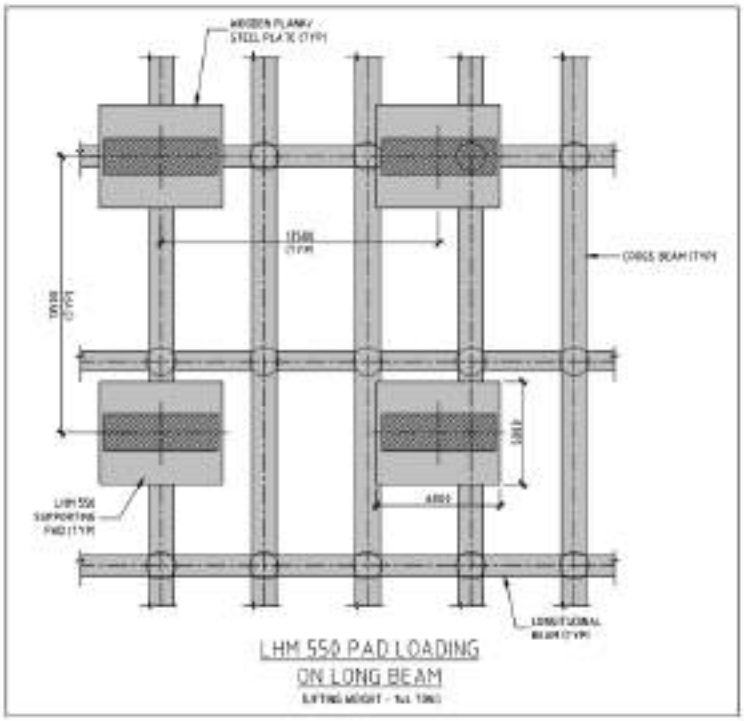
Upon reviewing the results, it is found that both Gottwald Crane G HMK 4406 B and LHM 550 cranes are found to be safe for operation with following arrangements.

11.4.1 LHM550 on Cross Beam



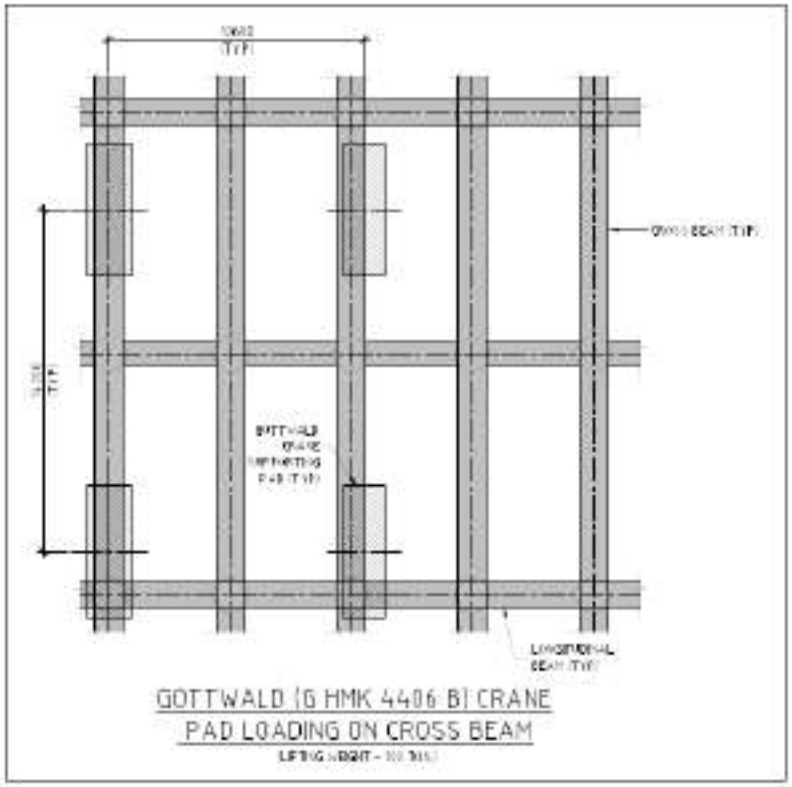
- Outrigger pads shall be positioned in such a way that the loads from the same are transferred to the beams and not over the slabs.
- Wooden Planks/ steel plates of size 5mx6m shall be placed under the outrigger pads of LHM 550 during operation.

11.4.2 LHM550 on Long Beam



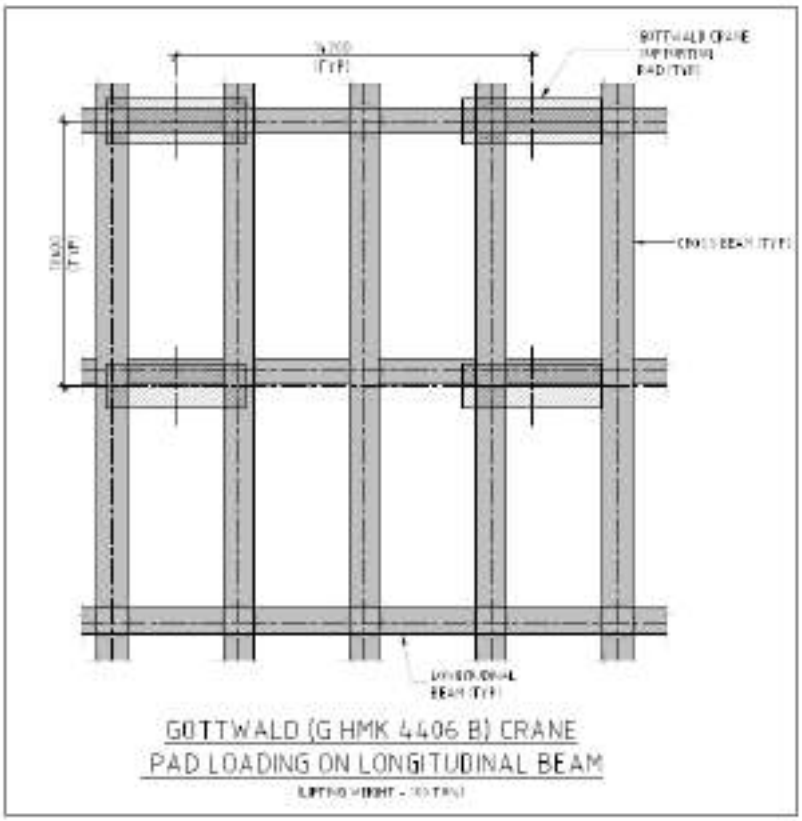
- Outrigger pads shall be positioned in such a way that the loads from the same are transferred to the beams and not over the slabs.
- Wooden Planks/ steel plates of size 5mx6m shall be place under the outrigger pads of LHM 550 during operation.

11.4.3 GOTTWALD Crane on Cross Beam



- Outrigger pads shall be positioned in such a way that the loads from the same are transferred to the beams and not over the slabs.

11.4.4 GOTTWALD Crane on Long Beam



- Outrigger pads shall be positioned in such a way that the loads from the same are transferred to the beams and not over the slabs.

11.5 Conclusion

- Both Gottwald Crane G HMK 4406 B and LHM 550 cranes are found to be safe for operation
- Outrigger pads for both cranes shall be positioned in such a way that the loads from the same are transferred to the beams and not over the slabs
- Wooden Planks/ steel plates of size 5mx6m shall be place under the outrigger pads of LHM 550 during operation

Chapter 12:
Initial Environment Examination

12 Initial Environment Examination

As discussed the previous chapters the traffic at NMPT is increasing and the port need to handle new age traffic that is container traffic. As a part of the scope of work Initial Environment Examination (IEE) has been prepared to suggest Environment protection and identify the measures to reduce /eliminate the adverse impact during the construction and operation of the proposed project facility.

12.1 Objective of IEE

The broad objectives of IEE study are:

- Study the existing environmental status around the project area
- Study the likely potential environmental and social impacts of the project during construction and operational phases
- Suggesting mitigation measures to minimize the environment and social impacts
- Preparation of broad environmental management and monitoring plan
- Green Initiatives
- Conclusions

12.2 Policy and Administrative Framework

The Existing CRZ/ Environmental Clearance was obtained vide letter no. January 16, 2003 is to handle Multi-Purpose Cargo. The following rules and regulations are applicable to this development is given in **Table 12-1.**

Table 12-1 Applicable Environmental Regulation

Applicable GoI Policies & Regulations	Year	Objective	Reason for Applicability
Environmental (Protection) Act	1986	To protect and improve overall environment	Environment in general
Environmental Impact Assessment Notification (as amended)	2006	EIA notification for a more effective Environmental clearance process	Direct
Coastal Regulation Zone Notification	2011	To protect the Coastal ecological resources and to prevent coastal pollution.	Direct
Air (prevention and control of pollution) Act	1981	To control air pollution by controlling emissions according to prescribed standards	Control of Air pollution
Noise Pollution (Regulation and Control) (Amendment) rules	2000 & 2010	Noise pollution regulation and controls.	Control of Noise pollution
Water (Prevention and Control of Pollution) Act	1974	To control water pollution by controlling emission & Water pollutants as per the prescribed standards.	Control of Water pollution
Water (Prevention and Control of Pollution) Cess Act	1977	Levy and Collection of Cess on water consumed, with a view to augment the resources of the Central and the State Boards for the prevention and control of water pollution constituted under the Water (Prevention and Control of Pollution) Act, 1974.	Water Usage
Solid Waste Management Rules	2016	Management of Solid Waste.	Appropriate handling of Solid Waste
Hazardous and other Wastes (Management and Trans-boundary Movement) Rules	2016	To store/handle hazardous waste and materials as per the provisions of the manufacturer, storage and import of Hazardous Chemical Rules, Hazardous Wastes (Management and Handling)	Appropriate handling of Hazardous and Other Waste.

		Rules and Amendments.	
E-Waste (Management) Rules	2016	Consumer or bulk consumer of electrical and electronic equipments listed in Schedule I shall ensure that e-waste generated by them is channelized to authorized collection centre (s) or registered dismantler (s) or recycler or is returned back to the pick up or take back services provided by the producers.	Involvement of information technology and telecommunication equipment, electrical and electronics.
Batteries (Management and Handling) Rules	2001 (amended in 2010)	Consumer to ensure that used batteries are not disposed off in any manner other than depositing with the dealer, manufacturer, importer, assembler, registered recycler, reconditioner or at the designated collection centres.	Appropriate handling of used batteries.
Construction and Demolition Waste Management Rules	2016	Generator shall prima-facie be responsible for collection, segregation of concrete, soil and others and storage of construction and demolition waste generated, as directed or notified by the concerned local authority in consonance with these rules. The generator shall ensure that other waste (such as solid waste) does not get mixed with this waste and is stored and disposed separately.	Appropriate handling of Construction and Demolition waste.
Bio-Medical Waste Management Rules	2016	Generator to take all necessary steps to ensure that bio-medical waste is handled without any adverse effect to human health and the environment.	Appropriate handling of Bio-Medical Waste.

12.3 Baseline Environment Status

The baseline status has been established from the Environmental Monitoring Reports for the month of May, 2017 for NMPT obtained from NMPT website. The baseline status is given in Table 12-2.

Table 12-2: Baseline Environment Status

S. No.	Environment Attribute	Baseline Environment Status
1.	Ambient Air Quality	• $PM_{2.5}$ was observed between 18 – 34 µg/m^3 • PM_{10} was observed in the range of 46 – 60 µg/m^3 • SO_2 concentration was observed in the range of 17 - 22 µg/m^3 • NO_2, CO, O_3, NH_3, Pb, As, Ni, C_6H_6 and B(α)P were BDL
2.	Stack Emissions	• SPM was observed between 23 – 46 mg/Nm^3 • SO_2 concentration was observed in the range of 21 - 37 mg/Nm^3 • NO_x concentration was observed in the range of 54 - 77 mg/Nm^3
3.	Noise level	• Day time: 63.5 to 72.5 dB(A) • Night time: 54.1 to 63.7 dB(A)
4.	Drinking Water	• pH range was observed between 6.65 – 7.66 • Turbidity was found <1 NTU • Total hardness was observed between 57 – 86 mg/l • TDS was observed between 85 – 166 mg/l • Chlorides was observed between 20 – 46 mg/l • Sulphates was observed between 8 – 19 mg/l • Bacterial count and Coliforms were not present in the samples • On the basis of test results it is summarized that water quality is as per IS: 10500 – 2012

5.	Marine Water	• Marine water quality analysis showed no abnormality. The analysis results for TDS, TSS, Na, K, Mg, Ca, P, TS SO_4, pH, DO, coliforms etc., were as expected as typically for sea water.
6.	Sensitive Ecosystem	• No ecologically sensitive area like national park, wildlife sanctuary, biosphere reserve, forests, wetland are present in the 10-km radius of project site.

Source: Environmental Monitoring Reports for the month of May, 2017 for NMPT

12.4 Identification of Impacts and Mitigation Measures

12.4.1 Construction Phase

The development activities such as berth modernization/mechanisation, back up area development close to water front etc., will impact marine environment. Site development, civil construction, mechanical erection of infrastructure and backup area development is likely to cause impacts on the terrestrial environment. Most of impacts during construction are short-term in nature and will cease on completion of construction activities.

Summary of possible construction phase impacts and mitigation measures are discussed below.

12.4.1.1 Impacts due to Berth Modernization/Mechanisation Disposal

Possible Impacts:

Change in marine water quality/Ecology; Increase in noise levels; Disturbance to benthic communities; Changes in species diversity and density and Impacts on mangroves if any.

Mitigation Measures:

Though the harbour area is already experiencing vessel movements & Cargo handling and the marine bio diversity is already acclimatised to such activities, the following are the measures proposed:

- Discharge of waste into sea shall be prohibited; Adoption of Good construction methods with containment system; Slop tanks shall be provided to barges/ workboats for collection of liquid/ solid waste; Discharge of toxic/hazardous materials during the port construction would not be allowed.

12.4.1.2 Material Transport and Construction Activities such as Site Improvement

Possible Impacts:

Exhaust emission and noise from vehicles; Windblown and fugitive emission during material movement and unloading; Emission and noise from DG sets; Emission and noise from construction activities; Disturbance to natural drainage pattern and strain on existing infrastructure and traffic addition.

Mitigation Measures:

Necessary measures such as Emission control norms; Periodic checking and washing of vehicles & construction machinery; Adequately sized construction yard; Enclosures on all sides of construction site; Non-peak hour movement and onsite speed control; Water sprinkling; Provide adequate vibration damping/vibration isolation techniques; Maintenance of construction equipment; Scheduling of High noise generating activities at daytime (6.00 am to 10 pm); Personal protective equipment's etc will be followed/adhered.

The deck level of the Berth no 14 is (+) 4.575 m CD. Hence the whole back up area available behind the berth shall be levelled to level of (+) 4.575 m CD with appropriate slope for drainage. Drainage & Sewerage System with Underground Drainage System and Heavy Duty Grattings under Container Stackyard has been planned.

The Port is connected with three National Highways i.e. NH-66, NH-75 and NH-50 which shall be utilised for transportation of raw materials during construction phase.

12.4.1.3 Marine Side Construction Activities and Fishing

However, it may be noted that fishing activities are not being carried out in the areas (in fact restricted area) of the proposed construction activities as such no impacts to the fishing community are envisaged. Fish landing and harbour area is far away (> 5.0 Km) from NMPT and access route to sea will also be separated and not envisaged to be impacted.

12.4.1.4 Solid Waste Management including Handling of Hazardous Waste

Possible Impacts:

Impact on soil quality due to disposal on ground; Fire accidents and Impact on terrestrial and marine environment

Mitigation Measures:

Solid Waste Management Rules, 2016 and Construction & Demolition Waste Management Rules, 2016 shall be followed for environmental sound management of respective waste; Construction waste will be utilized for level raising of Berth no:14 back up area or filling low lying areas within NMPT if possible; Hazardous and other waste Management Rules, 2016 shall be followed for environmental sound management of hazardous waste; OSHA standards shall be adopted; Hazardous wastes shall be disposed through approved KSPCB/CPCB vendors.

12.4.1.5 Water Resource

Water Requirement shall be met from NMPT's existing source. Hence, no impact envisaged.

12.4.1.6 Impact on Flora and Fauna

Since this is an existing port, faunal species are not observed at the proposed development. However, clearance of minimal vegetation/ felling of trees will be required as per the proposed development. Necessary clearance for felling of trees if required shall be taken.

12.4.2 Operation Phase

Some of the operation phase impacts and appropriate mitigation measures during the operation phase are discussed below.

12.4.2.1 Cargo Handling/Inland Cargo Movement/Storage/Equipments Operation

Possible Impacts:

Impact due to cargo handling and storage is not envisaged as the proposed development is for handling of container and clean cargo. The proposed operation/activity is less pollution intensive as compared to other typically port activities (dry bulk cargo handling and storage).

Emission and Noise due to DG Sets, DG sets of Cargo Handling Equipment's, vehicles; Traffic addition due to cargo from/to port; Fugitive emissions from the activities in the vicinity such as handling of coal and other bulk cargos.

Mitigation Measures:

- Regularization of truck movement; Greenbelt Development; Speed regulations for vehicles engaged in transportation; Feasibility of cold ironing shall be explored
- Acoustic Barriers and Enclosures and Personal Protective Equipment (PPE) shall be provided.
- Good internal road connectivity and also connectivity to the NH network through NH-66, NH-75 and NH-50 is already available which shall provide good traffic movement and help reduce vehicular emissions
- Also, it may be noted that most of the cargo movement will takes place by rail for which railway yard will be developed by extending separate branch of railway line towards the existing storage yard. This will provide free cargo transfer from the rakes without causing any disturbances to the existing railway line
- The container and clean cargo storage areas shall be isolated from the fugitive dust emission areas such as coal stockyard by providing wind screen (of suitable material) which shall be 2-3 m over and above the coal stacking height (~15.0 m height) for the required length.

12.4.2.2 Aqueous Discharges including Accidental Spills

Possible Impacts:

Impact on marine water quality and ecology due to discharge ship wastes (sullage), sewage, bilge water and Ballast Water (Ballast water is water held on a ship to maintain balance and stability while sailing. Water is typically taken up in one location and emptied in another, resulting in the release of marine organisms into a new environment. This causes non-native species and pathogens to be introduced, which can be harmful to the environment and human health).

Mitigation Measures:

- Ships coming to NMPT shall comply with the MARPOL regulation
- Existing Oil spill contingency plan prepared by NMPT shall be executed in case any oil spill.
- As stipulated in the EC letter dated January 16, 2003, the berth shall be provided with in-built oil leakage detection and warning system. Adequate measures for monitoring pressure in excess of those of those for which the berth is designed shall be ensured to prevent the leakage
- Hazardous and liquid containers shall be earmarked
- Ballast water management guidelines are applicable for ships and there are no guidelines for ports and harbours. The guidelines to ships issued by DG Shipping vide Merchant Shipping Notification No. 13/2001 requires the ships to follow guidelines promulgated through International Maritime Organisation (IMO). The same shall be ensured or the NMPT current practises shall be followed on this aspect.

12.4.2.3 Maintenance Dredging

Maintenance dredging shall be carried out for NMPT as a whole.

12.4.2.4 Water Resource

The additional water requirement is envisaged to be 394 KLD and shall be sourced from NMPT source. Raw water received from source provided by the NMPT will be collected in Underground Tank which will be located near operational Building. Raw water will be

distributed from the U/G sump through pump to two days storage overhead tank to the buildings and other utility points. Hence impacts on existing water resources/competing users are not significant.

12.4.2.5 Wastewater Generation

Wastewater will be generated in the form of sewage, wash water from the workshops etc., and storm water. Necessary mitigation shall be followed as below:

- Sewage and wash water from the workshop areas shall be treated in the existing treatment system of NMPT and sludge generated shall be utilised for greenbelt development. Existing Treatment systems of NMPT shall be utilised based on its capacity availability or by extending the same in a modular manner.
- Adequate storm water drainage system shall be developed

12.4.2.6 Solid Waste Management including Handling of Hazardous Waste

Possible Impacts:

Impact on groundwater and soil quality due to disposal on ground; Fire accidents and Impact on terrestrial and marine environment

Mitigation Measures:

- 5 R (Reduce /Reuse/Recover/Recycle and Re Process) principle shall be explored
- Solid Waste Management Rules, 2016 and Hazardous waste Management Rules, 2016 shall be followed for environmental sound management of respective waste
- OSHA standards shall be adopted
- Hazardous wastes shall be disposed through approved KSPCB/CPCB vendors.

12.5 Environment Management Plan

The main objectives of Environmental Management are to:

- Identify key environmental issues envisaged to be encountered during construction and operation phases of the proposed project
- Provide guidelines for appropriate mitigation measures
- Establish systems and procedures for implementing mitigation measures
- Ensure the mitigation measures are being implemented
- Monitor the effectiveness of mitigation measures
- Develop an institutional framework which shall include/address the responsibilities for environment management/implementation of environmental measures
- Take necessary prompt action when unforeseen impacts occur

The summary of various project activities associated environmental impacts and proposed mitigation measures are summarised in Table 12.3**.**

Table 12-3 Project Activities, Associated Impacts and Mitigation Measures

S. No.	Activity	Relevant Environmental Components likely to be Impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
			Construction Phase		
1.	Berth modernization/ mechanisation/ Back up area development close to water front/Discharges	Marine water quality/ecology	• Change in marine water quality/Ecology • Disturbance to benthic communities	• Though the harbour area is already experiencing vessel movements & Cargo handling and the marine bio diversity is acclimatised to such activities • Discharge of waste into sea shall be prohibited • Adoption of Good construction methods with containment system • Slop tanks are provided to barges/ workboats for collection of liquid/ solid waste • Discharge of toxic/hazardous materials during the port construction would not be allowed	Construction Contractor/ NMPT
2.	Site levelling /Material transport and construction activities	Air Quality	• Exhaust emissions from vehicles, barges, etc. • Windblown dust during material movement • Fugitive dust during material unloading • Dust suspension during site preparation, construction • Emissions from DG sets • Health Issues, Airway Irritation and Allergies from	• To reduce impacts from exhausts, emission control norms will be enforced/adhered • All the vehicles and construction machinery will be periodically checked to ensure compliance to emission standards • Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt • Providing adequately sized construction yard for storage of construction materials, equipment tools, earthmoving equipment, etc.	Construction Contractor/ NMPT

S. No.	Activity	Relevant Environmental Components likely to be Impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
			Diesel Exhaust	• Provide enclosures on all sides of construction site • Movement of material will be mostly during non-peak hours • On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic • PUC certified vehicles will be used for the transportation of material and equipment's, etc. • Water sprinkling will be carried out to suppress fugitive dust • Environmental awareness program will be provided to the personnel involved in developmental works • Use of tarpaulin covers and speed regulations for vehicles engaged in transportation • Coarse gravel or crushed stone shall be placed over construction sand/sand remains • Ambient air quality shall be monitored at regular intervals	
3.		Noise	Noise from following activities • Vehicles transporting construction material • Diesel run engines of construction machinery • Drilling/Pile driving	• Noise levels shall be maintained below threshold levels stipulated by CPCB • Procurement of machinery/construction equipment in accordance with specifications conforming to source noise levels less than 85 dB (A)	Construction Contractor/ NMPT

S. No.	Activity	Relevant Environmental Components likely to be Impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
			activities during repair/construction of structures	• Well-maintained construction equipment, which meets the regulatory standards for source noise levels, shall be used • Any equipment emitting high noise, wherever possible, shall be oriented so that the noise is directed away from sensitive receptors • Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers • High noise generating activities such as piling and drilling shall be scheduled in day time • Exercise of route selection as well as measures such as traffic regulation, timings of transportation etc will be followed to avoid congested built up areas, as much as possible • Personnel exposed to noise levels beyond threshold limits shall be provided with PPE • Ambient noise levels shall be monitored at regular intervals	
4.		Disturbance to Natural Drainage pattern	• Impact to natural flow of runoff due to blockage and change of drainage course	• Drainage system will be provided at construction yard. Measures will be taken to prevent silting of natural drainage due to runoff from construction areas • Dust control reduces the surface and air transport of dust, which minimizes	Construction Contractor/ NMPT

S. No.	Activity	Relevant Environmental Components likely to be Impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
				pollutants from infiltrating into the storm water drains • Adequate storm water drainage system shall be provided	
5.		Existing Traffic	• Traffic addition	• The Port is connected with 3 National Highways i.e. NH-66, NH-75 and NH-50 and transportation of construction materials will be carried out during non-peak hours • Regularization of truck movement • Other modes of transportation of construction material such as using barges shall be explored which will further reduce the traffic on existing roads	Construction Contractor/ NMPT
6.	Demolition Works/Vegetation Clearance/Felling of Trees	Air Quality	• Visibility issues • Airway Irritation and Allergies due to toxic dust	• Ensuring sufficient ventilation • Pre-demolition checks has to be conducted to find signs of used toxic materials • Appropriate respirators should be used for dust and chemicals • All workers onsite should wear visibility vests, shirts, jackets to increase visibility of the worker	Construction Contractor/ NMPT
7.		Noise	• Hearing loss/Injury	• Suitable silencers should be used for the equipment's • Procurement of machinery/construction equipment in accordance with specifications conforming to source noise levels less than 85 dB(A)	Construction Contractor/ NMPT
8.		Soil and Surface water	• Impacts due to disposal of demolition waste on	• Demolition waste/debris which can be reused shall be used to maximum possible	Construction Contractor/ NMPT

S. No.	Activity	Relevant Environmental Components likely to be Impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
			ground • Corroded steel bars and leachate	extent for the new construction activities (like site filling, etc.) • Unusable waste shall be accumulated properly and disposed off appropriately as per prescribed Rules/Guidelines	
9.		Flora and Fauna	• Loss of species	• Since this is an existing port, faunal species are not observed at the proposed development. • Clearance of vegetation/ felling of trees will be required as per the proposed development. Necessary clearance for felling of trees if required shall be taken.	Construction Contractor/ NMPT
10.	Solid Waste Management	Soil quality and Water quality (surface & ground)	• Impacts due to disposal of solid waste on ground without treatment	• Solid waste shall be managed as per the Solid Waste Management Rules, 2016 • As much as possible, construction waste shall be used within project site for filling of low lying areas • Local authorised waste recycler shall be employed to remove general refuse from the site, separately from construction waste and hazardous wastes • Recyclable wastes will be disposed through approved KSPCB vendors • Excavated soil shall be stockpiled in a corner of the site in bunded area to avoid run off with storm water • General refuse generated on-site shall be collected in waste skips and separated from construction waste	Construction Contractor/ NMPT

S. No.	Activity	Relevant Environmental Components likely to be Impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
				• Burning of refuse at construction sites shall be prohibited	
11.	Handling of hazardous materials	Human safety and property loss	• Fire accidents due to hazardous material handling • Health Issues	• Hazardous waste shall be managed as per Hazardous and Other Waste (Management and Transboundary Movement) Rules, 2016 • Adequate safety measures as per OSHA standards will be adopted • Construction site will be secured by fencing with controlled/limited entry points • Hazardous materials such as lubricants, paints, compressed gases, and varnishes, etc. will be stored and handled as per the prescribed/approved safety norms • Medical facilities including first aid will be available for attending to injured workers • Positive isolation procedures will be adhered. • Handling and storage as per MSIHC rules, MoEF guidelines with fire protection system • Hazardous wastes, if any, shall be disposed through approved KSPCB/CPCB vendors	Construction Contractor/ NMPT
12.	Water Supply	Water scarcity/Pollution	• Impacts to the surface water body	• Water Requirement shall be met from NMPT source • Care should be taken to prevent the runoff from the construction site to the nearby natural streams • Optimized utilization of the water	NMPT/ Construction Contractor

S. No.	Activity	Relevant Environmental Components likely to be Impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
13.	Fishing	Fishermen and fishing villages	• Impact on fishing due to Construction	• It may be noted that fishing activities are not being carried out in the areas of the proposed focussed area construction activities as such minimal impacts to the fishing community are envisaged • Fishing landing and harbour area is far away (> 5.0 Km) from NMPT and access route to sea will also be separated and not envisaged to be impacted	NMPT/Dredging Contractor
Operation Phase					
1.	Cargo Handling/Inland Cargo movement and storage areas	Air Quality	• Emissions from unloading equipments, DG sets, vehicular dust emissions from storage areas • Fugitive emissions from the activities on the vicinity such as handling of coal and other bulk cargos	• Regularization of truck movement • Greenbelt Development • Speed regulations for vehicles engaged in transportation • Feasibility of cold ironing shall be explored wherein oceangoing vessels and tugboats shall be provided with electrical power at berths so as to reduce use of diesel fuel • It shall be recommended that the ships run on fuel with the lowest sulphur content possible • Equipment more than ten years old should be replaced with either alternative-fuel engines • The container and clean cargo storage areas shall be isolated from the fugitive dust emission areas such as coal stockyard by providing wind screen (of suitable material) which shall be 2-3 m over and	NMPT to provide regulations to vessel operators

S. No.	Activity	Relevant Environmental Components likely to be Impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
				above the coal stacking height (~15.0 m height) for the required length	
2.			• Vehicular emissions	• Good internal road connectivity and also connectivity to the NH network through NH-66, NH-75 and NH-50 is already available which shall provide good traffic movement and help reduce vehicular emissions. • Speed regulations for vehicles engaged in transportation of dry cargo. • Also, it may be noted that most of the cargo movement will takes place by rail for which railway yard will be developed by extending separate branch of railway line towards the existing storage yard. This will provide free cargo transfer from the rakes without causing any disturbances to the existing railway line	
3.	Aqueous discharges in harbour basin	Marine water quality and ecology	• Change in marine water quality/ecology due to discharge ship wastes (silage), sewage, bilge water, solid waste etc.	• Ships are prohibited from discharging wastewater, bilge, oil wastes, etc. into the near-shore as well as harbour waters as per the International Convention for the Prevention of Pollution from Ships (MARPOL) 1974/1978, Consolidated Edition, IMO, 1991, including 1992 amendments to Annex 1 and 2002 amendments • Existing Oil spill contingency plan prepared by NMPT shall be executed in case any oil spill	NMPT to provide regulations to vessel operators

S. No.	Activity	Relevant Environmental Components likely to be Impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
				• Provision of waste reception facility for bilge water and waste oil shall be explored • Ballast water management guidelines by DG Shipping vide Merchant Shipping shall be followed	
4.	Cargo and Oil spills	Marine water quality and ecology	• Change in marine water quality	• Existing Oil spill contingency plan prepared by NMPT shall be executed in case any oil spill • Response time for shutting down the fuelling, containment and recovery will be quicker	NMPT
5.	Maintenance dredging	Marine water quality Marine Ecology	• Increase in turbidity • Due to decrease in DO levels potential effect on marine ecology and disturbance to benthic communities.	• Maintenance dredging shall be carried out for NMPT as a whole.	Dredging Contractor/ NMPT
6.	Cargo handling	Noise	• Increased noise levels due to equipment handling and vehicular movement	• Acoustic Barriers and Enclosures • Transportation vehicles, machinery will be periodically checked to ensure minimal noise generation to comply OHSAS and ambient noise standards in the surrounding area • The Ships and other vessels shall comply with IMO Code on Noise Levels on Board Ships, A 468 – XII, MSC.337(91) • Use of Personal Protecting Equipment (PPE) • Greenbelt Development	Construction Contractor/ NMPT

S. No.	Activity	Relevant Environmental Components likely to be Impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
				• Counselling and traffic regulation	
7.	Operation of generators and other machineries	Vibration in Land and Air Environment	• Temporary perplexity • Health implication on working continuously in vibrating environment	• Machine and equipments likely to generate vibration shall be fixed based on the detail designing of foundation • Machinery equipped with latest vibration-reduction technology shall minimise the vibrations • Vibration dampers shall be provided around the source of generation	NMPT
8.	Water Supply	Water resources	• Impact on existing water resources	• The water requirement is envisaged to be 394 KLD and shall be sourced from NMPT source; Raw water received from source provided by the NMPT will be collected in Underground Tank which will be located near operational Building. Raw water is distributed from the U/G sump through pump to 2 days storage overhead tank to the buildings and other utility points. Hence impacts on existing water resources are not significant.	NMPT
9.	Wastewater Discharge	Water Quality	• Impact due to disposal of untreated sewage	• Sewage and wash water from the workshop areas shall be treated in the existing treatment system of NMPT and sludge generated shall be utilised for greenbelt development. Existing Treatment systems of NMPT shall be utilised based on its capacity availability or by extending the same in a modular manner. • Adequate storm water drainage system	NMPT

S. No.	Activity	Relevant Environmental Components likely to be Impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
				shall be developed • Treated wastewater will be used for irrigating the greenbelt • Ships calling at the Port will have their on-board treatment facilities as per regulatory requirements	
10.	Solid waste management	Groundwater and Soil quality	• Impact due to disposal of solid waste on ground without treatment	• Solid waste shall be managed as per the Solid Waste Management Rules, 2016 • Other recyclable wastes will be sold to approved vendors • Non compostable and non-recyclable waste will be sent to municipal/engineered landfill	NMPT
11.	Handling of hazardous wastes	Fire accidents due to products handling	• Human life and loss of property	• Hazardous waste shall be managed as per Hazardous and Other Waste (Management and Transboundary Movement) Rules, 2016 • Hazardous materials will be stored as per the prescribed/approved safety norms • Hazardous materials such as lubricants, paints, compressed gases, and varnishes etc., will be disposed at nearest Treatment, Storage and Disposal Facility (TSDF) through approved KSPCB vendors • Medical facilities including first aid will be available for attending to injured workers • Emergency alarms, provision of fire hydrant system and fire station • Existing Disaster Management Plan (DMP) prepared by NMPT shall be executed in	NMPT

S. No.	Activity	Relevant Environmental Components likely to be Impacted	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
				case any emergency • Recovery of spills to the extent possible	
12.	Operation of the Berth after proposed changes	Fishermen livelihood	• Impact on fishing due to vessel movement	• It may be noted that fishing activities are not being carried out in the areas of the proposed construction activities as such minimal impacts to the fishing community are envisaged • Fishing landing and harbour area is far away (> 5.0 Km) from NMPT and access route to sea will also be separated and not envisaged to be impacted	NMPT

12.6 Environment Monitoring Programme

An integral part of environmental management of the project is the continuous monitoring of the conditions of the receiving environment. This is to determine if any undesirable changes are occurring as a result of the proposed development project. The project authority especially the Environmental Management Cell (EMC) shall follow a rational approach with regards to environmental monitoring. This includes judicious decision making in consultation with institutional stake holders e.g. Karnataka State Pollution Control Board (KSPCB) or reputed environmental consultants for appropriate changes in the monitoring strategy as and when required, i.e., changes in the sampling frequency, sampling location, monitoring parameters and any new/additional requirements.

In addition to the existing annual environmental monitoring plan of entire NMPT the following additional number of locations and parameters proposed to be monitored (if not covered in the existing monitoring plan) and given in **Table 12-4.** The tentative cost per annum for the environmental monitoring will be ~INR 15.0 Lakhs (Rupees Fifteen Lakhs Only). It is important to monitor marine water quality, sediment quality and benthos in and around the project development site.

Table 12-4: Monitoring Plan for Operation Phase

Environmental Attributes	Parameters to be monitored	No. of Sampling Locations	Frequency of Monitoring
Air Quality	Parameters as per national ambient air quality standards (NAAQS)	One Location	Twice in a week
Noise Levels	Day and night noise levels	Two Locations	Once in a month of the year
Soil Quality	Soil texture, type, electrical conductivity, pH, infiltration, porosity, etc.,	Two Locations	Once a year
Marine Water Quality	Physical, Chemical and Biological	Two Locations	Once in a quarter of the Year
Plankton and Benthic Communities	Phytoplankton, Zooplankton and Benthic Communities	Two Locations	Once in a quarter of the Year
Sediment Quality	Physical, Chemical and Biological	Two Locations	Once in a quarter of the Year
Stack Monitoring	PM, SO_2, NO_2 , NMHC (as C) and CO and CO	At all DGs	Once in a year

12.6.1 Reporting

As a part of environmental monitoring programme, half yearly compliance report shall be submitted to KSPCB and Regional Office of MoEF&CC on 1st June and 1st December of each calendar year.

12.7 Green Initiatives

India has in place (since 2008) a ***National Action Plan on Climate Change (NAPCC)*** aimed to mitigate and adapt to climate change. The NAPCC outlines a number of steps to simultaneously advance India's development and climate change-related objectives. The NAPCC encompasses a range of measures. **Table 12-5** discusses the NAPCC recommended measures and corresponding measures may be considered by NMPT as contribution towards meeting the national objectives of NAPCC.

Table 12-5: Green Initiatives as per NAPCC

S. No.	NAPCC Measure	Proposed Initiatives
1.	National Solar Mission – promote development and use of solar energy for power generation and other uses	Installation of rooftop solar power projects, Solar Street Lights, etc. shall be explored
2.	National Mission for Enhanced Energy Efficiency – energy consumption decreases	The proposed project is for the mechanisation of Berth No. 14 of NMPT for handling of containers and clean cargo. Efficient approach such as minimise idling time of equipment's improvement in efficiency in terms of port physical performance indicators such as Average Turn-Round Time, Average Pre Berthing Detention Time, Average Output Per Ship Berth-day, Dwell Time of Cargo etc. Also, methods and ways have to be looked for Swachh Bharat Mission such as fulfilment of all the latest applicable rules; 5 R (Reduce /Reuse/Recover/Recycle and Re Process) principles shall be explored etc.,
3.	National Mission on Sustainable Habitat – promoting energy efficiency; also emphasizes on waste management and recycling	
4.	National Water Mission – improvement in water use efficiency	Optimization and Reuse of treated wastewater
5.	Green India Mission – aims at afforestation of Six million hectares of degraded forest lands and expanding forest cover from 23 to 33% of India's territory	Greenbelt shall be developed
6.	Renewable energy – central and the state electricity regulatory commissions must purchase a certain percentage of grid-based power from renewable sources	Exploring the opportunities of installing solar and wind based power systems by NMPT
7.	Energy efficiency – large energy-consuming industries are required to undertake energy audits and have an energy-labelling program for appliances	Same as Point 2 and 3.

12.8 Conclusions

a. The Existing CRZ/ Environmental Clearance was obtained vide letter no. January 16, 2003 is to handle Multi-Purpose Cargo.
b. The EIA and CRZ clearances obtained for the project are as per the older 1994 EIA notification and 1991 CRZ notifications.

Container receipt, handling, storage and evacuation are less polluting compared to the other dry bulk cargo handling at port. Activities and potential impacts associated with the project

development have been identified and presented in IEE. The identified impacts will typically be localized and can be mitigated with minor to negligible residual impacts.

Chapter 13:
Cost Estimate

13 Cost Estimate

In this chapter, an estimate of the Capital Cost and Annual Operation and Maintenance Cost for the various facilities identified has been prepared. The annual operation and maintenance cost of facilities that would be incurred annually for the various phases is also presented.

13.1 Basis of Cost Estimates

The cost arrived are based on the budgetary quotes and the In-house database available on cost estimates. The rates for various items of work have been prepared on the basis of current rates for various items of work prevailing in the region.

The item rates and costs have been arrived at broadly on the following:

- Rates taken from current works of similar nature
- Updated rates of works of similar nature completed in the recent past
- Consultant's in-house data bank of cost estimates and budgetary quotations.

13.2 Phases of development

The projects will be developed in two phases.

- Phase 1 : 2020
- Phase 2 : 2027

13.3 Mechanical cost

The cost under this head is worked out and is presented in Table 13-1. The budgetary quotations received for various equipments is presented in ***Annexure 2***

Table 13-1 Summary of mechanical cost

Description	Phase 1				Phase 2			
	Unit	Qty	Rate/Unit (in Rs)	Amt (Rs. crore)	Unit	Qty	Rate/Unit (in Rs)	Amt (Rs. crore)
Mobile harbour cranes of 100 T capacity	No.	2	360000000	72	No.	1	360000000	36
Reach Stackers	No.	6	35000000	21	No.	3	35000000	10.5
Empty container handlers	No.	1	26000000	2.6	No.	1	26000000	2.6
Mobile hoppers	No.	2	5000000	1	No.	0	5000000	0
Total in crores				**96.6**				**49.1**

It is proposed that the tractor trailers and payloaders shall be taken on lease. The same has been considered in operation cost.

The estimate of capital cost for Civil and utilities is made and presented in **Table 13-2**

Table 13-2 Cost Estimate- Civil & Utilities

Sl. No	Description	unit	Phase 1			Phase 2		
			Quantity	Rate/ Unit	Amount (RS crores)	Quantity	Rate/ Unit	Amount (RS crores)
1	Land Preparation for the desired level including cutting, filling, removal of buildings, trees, coal heaps, bushes and all other debris	sq.m	15133	200	0.30	75000	700	5.25
2	Stack yard area development including pavement for service roads and container stacking area	sq.m	15133	4000	6.05	75000	4000	30.00
3	Terminal Gate complex and buildings							
	Weigh Bridge	NOS				2	1500000	0.30
	Civil works including Canopy,Security Booth,Road Furnitures, compound wall etc	LS						3.00
	Road lighting, marking etc	LS						1.00
	Control buildings, operational, customs, canteen, first aid etc	LS			1			5.00
4	Drainage & Sewerage System- With Underground Drainage System and Heavy Duty Grattings under Container Stackyard, Hea	LS						5.00
5	Electrical, firefighting and water supply	LS			1			6.00
7	Environment Protection and monitoring system	LS						5.00
	Total Civil				**7.36**			**49.25**
	Total utilities				**1**			**11.30**
	TOTAL (Rs. Crores)				**8.36**			**60.55**

13.4 Combined Cost

The combined cost is presented in Table 13-3

Table 13-3 Combined capital cost

Cost Head	Unit	Phase1 (Rs crores)	Phase 2 (Rs crores)
Civil Cost	Rs Cr	7.36	49.25
Utilities	Rs Cr	1.00	11.30
Mechanical cost	Rs. Cr	96.60	49.10
Communication and IT Infrastructure - Including Terminal Operating System and Track and trace for containers	2% of Civil and mech	2.10	2.19
Sub total	**Rs. Cr**	**107.05**	**111.84**
Add contingency (5%)	Rs. Cr	5.35	5.59
PMC & Misc. (5% of total cost)	RS Cr	5.35	5.59
Total	**Rs. Cr**	**117.8**	**123.0**

Chapter 14: Conclusions

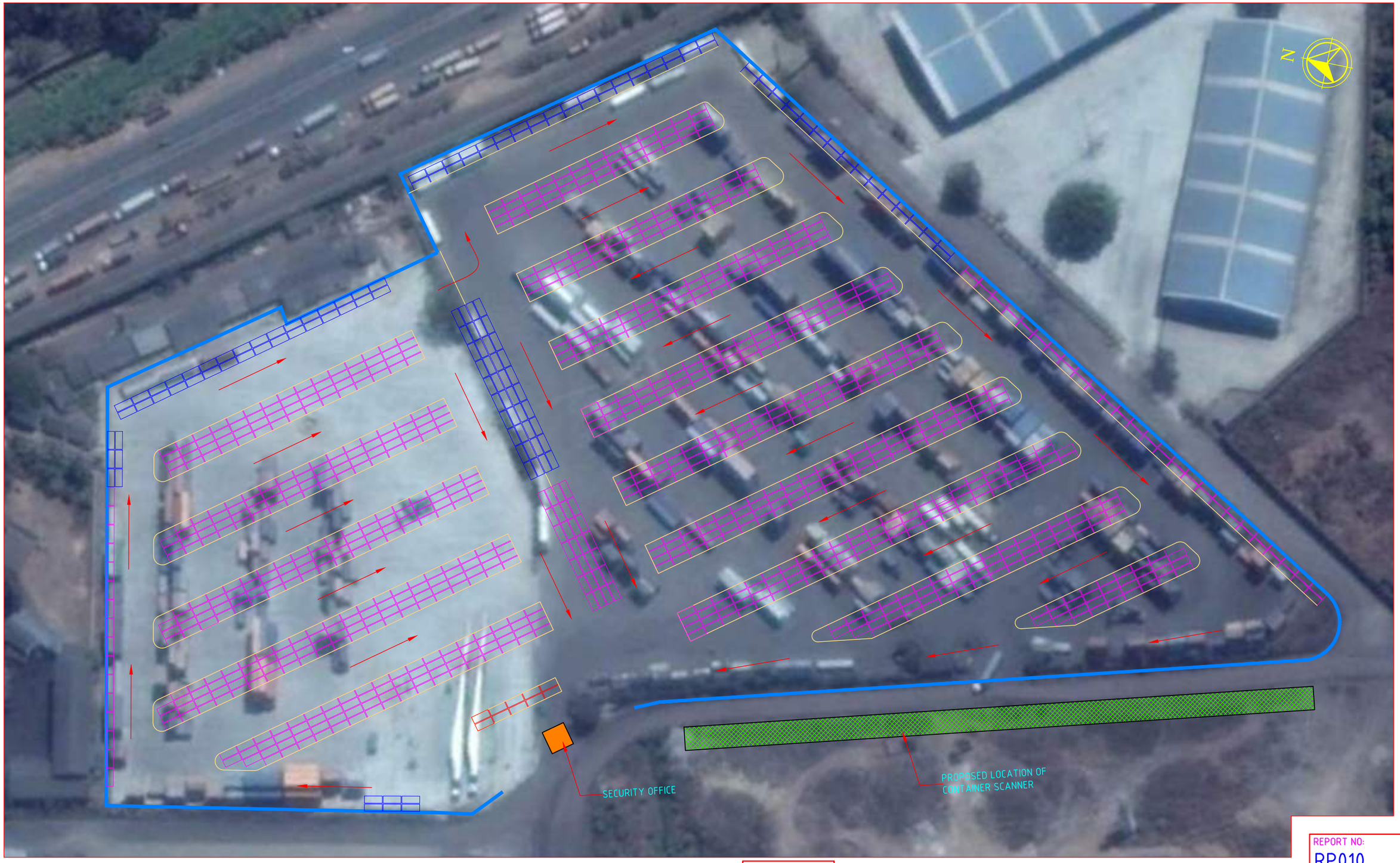
14 Conclusions

- Followed by kick-off meeting and finalizing the project objectives, consultant carried out topographic survey of the area and map prepared
- Consultant carried out analysis of traffic trend and projection at NMPT for the cargo handling at Berth No. 14.Traffic forecast has done and it projected container traffic 0.14MTEU in year 2020, 0.19 MTEU in year 2025 and 0.29MTEU in year 2035 for base case. The same is expected to increase to 0.21 MTEU in year 2025 and 0.38MTEU in year 2035 for optimistic case.

  The clean cargo handled at berth no 14 includes Fertilizer, Gypsum, Limestone and dolomite. Clean cargo traffic projects 0.65 MTPA in year 2020, 0.89 MTPA in year 2025, 1.16 MTPA in year 2035. For optimistic case, the traffic expected to reach 0.94 MTPA in year 2025 and 1.3 MTPA in year 2035.
- The Vessel size analysis reveals that the average parcel size in NMPT is 500 TEU for containers. It is expected to grow 800 TEUs by 2025 and to 1000 TEUs by 2030.The average parcel size is taken as 45000 DWT for clean cargo.
- The total area demarcated for development is about 18 Ha. The total area for the development comprises of 10.4 Ha of land including the Berth and backup area (7.5 Ha), 6.5 ha of land in the existing container stackyard near the spending beach, and 1.3Ha of land near the railway line.
- It is recommended to install MHC on the berth, so that there is flexibility for handling both containers and clean cargo. To start with the berth will be equipped with 2 MHC and further in 2025 an additional MHC shall be provided to handle the growing cargo.
- In the Phase 1, the existing storage of 6.5 Ha shall be utilised which can accommodate 1204 ground slots and once the capacity is achieved the area of 7.5 Ha behind the berth will be developed. This area can accommodate 1484 ground slots
- The total cost of the project is estimated as follows

Cost (Rs. Crores)	Phase 1	Phase 2
Capital Cost	117.8	123.0

Figures



NOTES

1. ALL DIMENSIONS ARE IN METRES.
2. ALL LEVELS ARE IN METRES AND ARE WITH RESPECT TO CHART DATUM (CD).
3. ALL COORDINATES ARE GIVEN IN METRES REFERRED TO UNIVERSAL TRANSVERSE MERCATOR (UTM) PROJECTION, SPHEROID (WGS 1984), ZONE 43.

LEGEND

	DESCRIPTION	GROUND SLOTS
	DRY CONTAINER	1044
	REEFER CONTAINER	150
	HAZARDOUS CARGO	10

SCALE: 1:1250

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PROJECT: FR & DPR FOR MECHANIZATION OF BERTH NO.14, NEW MANGALORE PORT

TITLE: STORAGE LAYOUT (EXISTING STOCKYARD)

L&T Infra Engineering

L&T Infrastructure Engineering Ltd.

REPORT NO: RP010

PROJECT NO: C1171105

DATE: 21/11/18

MADE: AST

FIGURE NO: FD0001

REV: B

AUTO PATH: L:\PORTS\2017\C1171105 - FR AND DPR FOR B14 NMPT\WORKING\DRAWINGS\RP010-RB-FINAL DPR_21NOV18\FD0001 & FD0002-RB-AST-STORAGE LAYOUT (OPTION-2).DWG

TBA

DESCRIPTION	GROUND SLOTS
DRY CONTAINER	1484

SL.NO	DESCRIPTION
1	GATE HOUSE
2	SECURITY OFFICE
3	OPERATION BUILDING
4	WEIGH BRIDGE
5	RECEIVING SUBSTATION
6	WEIGH BRIDGE
7	YARD SUBSTATION
8	WHARF SUBSTATION

NOTES

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PROJECT: FR & DPR FOR MECHANIZATION OF BERTH NO.14, NEW MANGALORE PORT

TITLE: STORAGE LAYOUT (BEHIND BERTH)

L&T Infra Engineering

L&T Infrastructure Engineering Ltd.

REPORT NO: RP010

PROJECT NO: C1171105

DATE: 21/11/18

MADE: AST

FIGURE NO: FD0002

REV: B

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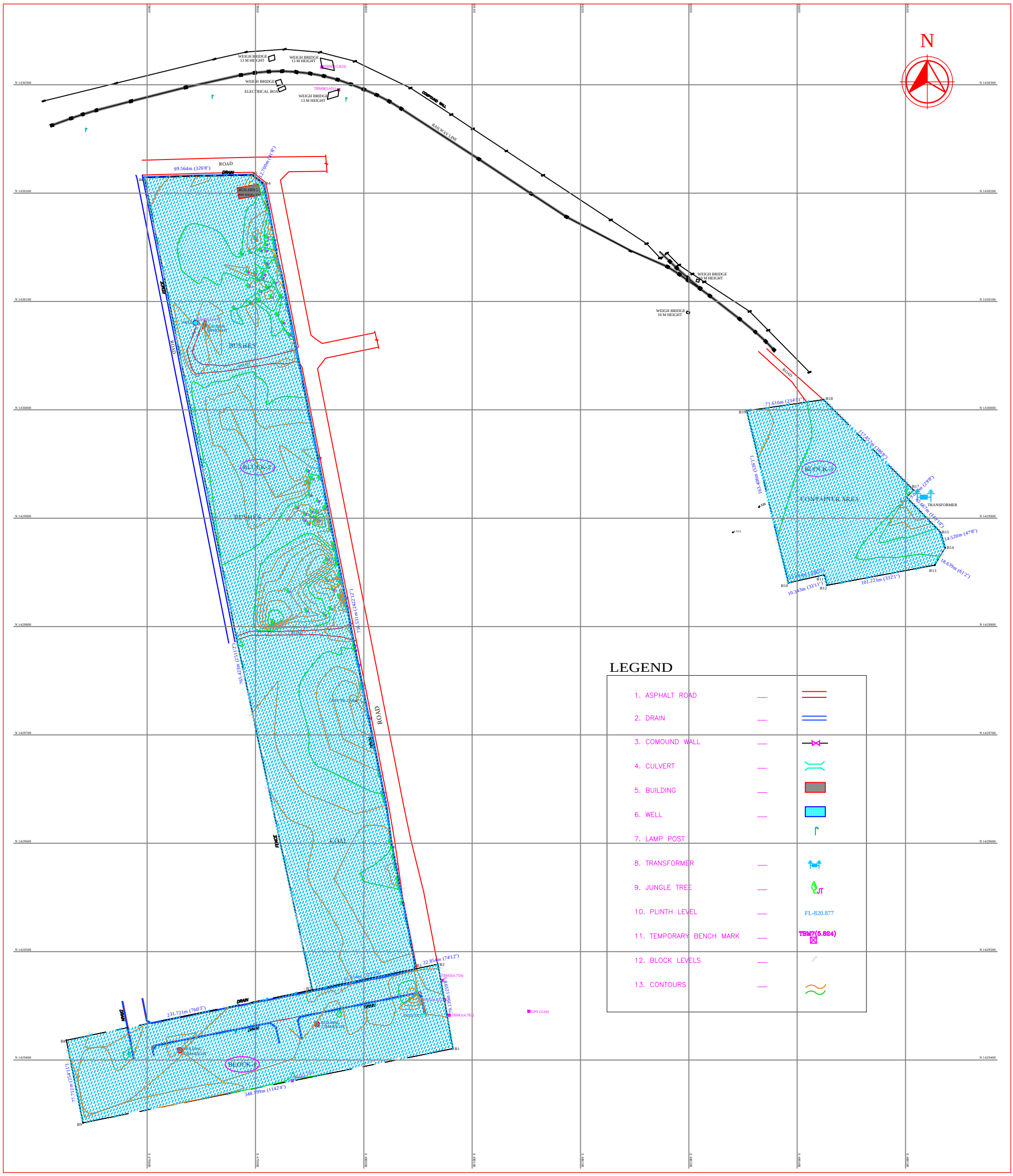
TBA



LEGEND

1. ASPHALT ROAD	
2. DRAIN	
3. COMOUND WALL	
4. CULVERT	
5. BUILDING	
6. WELL	
7. LAMP POST	
8. TRANSFORMER	
9. JUNGLE TREE	JT
10. PLINTH LEVEL	FL-820.877
11. TEMPORARY BENCH MARK	TBM7(5.824)
12. BLOCK LEVELS	
13. CONTOURS	

NOTES

1. THE BENCHMARK (GPS 3.64m CD) AND ITS LEVEL WAS PROVIDED BY NMPT.
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PROJECT: FR & DPR FOR MECHANIZATION OF BERTH NO.14, NEW MANGALORE PORT

TITLE: TOPO SURVEY

L&T Infra Engineering

L&T Infrastructure Engineering Ltd.

REPORT NO: RP010

PROJECT NO: C1171105

DATE: 21/11/18

MADE: AST

FIGURE NO: FD0801

REV: B

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LEGEND

TOTAL NO. OF GROUND SLOTS = 2540

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PROJECT: FR & DPR FOR MECHANIZATION OF BERTH NO.14, NEW MANGALORE PORT

TITLE: STORAGE LAYOUT (OPTION-1)

L&T Infra Engineering

L&T Infrastructure Engineering Ltd.

REPORT NO:	RP010
PROJECT NO:	C1171105
DATE:	21/11/18
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REV:	B

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LEGEND

TOTAL NO. OF GROUND SLOTS = 2635

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PROJECT: FR & DPR FOR MECHANIZATION OF BERTH NO.14, NEW MANGALORE PORT

TITLE: STORAGE LAYOUT (OPTION-2)

L&T Infra Engineering

L&T Infrastructure Engineering Ltd.

REPORT NO:	RP010
PROJECT NO:	C1171105
DATE:	21/11/18
MADE:	AST
FIGURE NO:	FD1002
REV:	B

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TBA

NOTES

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2. ALL LEVELS ARE IN METRES AND ARE WITH RESPECT TO CHART DATUM (CD).
3. ALL COORDINATES ARE GIVEN IN METRES REFERRED TO UNIVERSAL TRANSVERSE MERCATOR (UTM) PROJECTION, SPHEROID (WGS 1984), ZONE 43.

LEGEND

TOTAL NO. OF GROUND SLOTS = 2737

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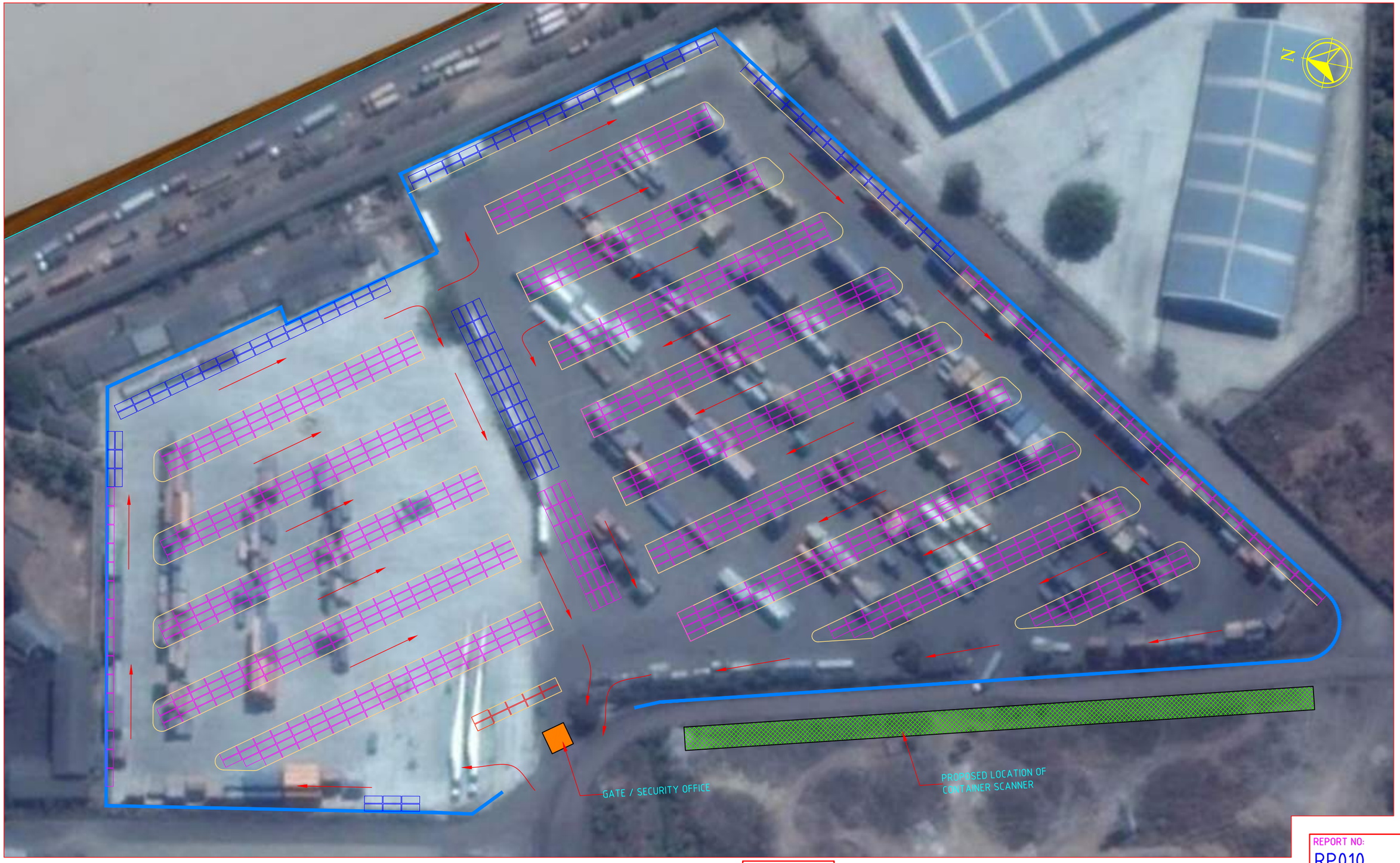
PROJECT: FR & DPR FOR MECHANIZATION OF BERTH NO.14, NEW MANGALORE PORT	PROJECT NO: C1171105
TITLE: STORAGE LAYOUT (OPTION-3)	DATE: 21/11/18
	MADE: AST
L&T Infra Engineering / L&T Infrastructure Engineering Ltd.	FIGURE NO: FD1003 / REV: B

REPORT NO: RP010

AUTO PATH: L:\PORTS\2017\C1171105 - FR AND DPR FOR B14 NMPT\WORKING\DRAWINGS\RP010-RB-FINAL DPR_21NOV18\FD1003-RB-AST-STORAGE LAYOUT (OPTION-3).DWG

TBA



NOTES

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2. ALL LEVELS ARE IN METRES AND ARE WITH RESPECT TO CHART DATUM (CD).
3. ALL COORDINATES ARE GIVEN IN METRES REFERRED TO UNIVERSAL TRANSVERSE MERCATOR (UTM) PROJECTION, SPHEROID (WGS 1984), ZONE 43.

LEGEND

	DESCRIPTION	GROUND SLOTS
	DRY CONTAINER	1044
	REEFER CONTAINER	150
	HAZARDOUS CARGO	10

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SCALE: 1:1250

PATH: REFER BOTTOM LEFT CORNER OF THE DRAWING

PROJECT: FR & DPR FOR MECHANIZATION OF BERTH NO.14, NEW MANGALORE PORT

TITLE: STORAGE LAYOUT (EXISTING STOCKYARD) (Sheet 1 of 2)

L&T Infra Engineering

L&T Infrastructure Engineering Ltd.

REPORT NO: RP010

PROJECT NO: C1171105

DATE: 21/11/18

MADE: AST

FIGURE NO: FD1004

REV: B

AUTO PATH: L:\PORTS\2017\C1171105 - FR AND DPR FOR B14 NMPT\WORKING\DRAWINGS\RP010-RB-FINAL DPR_21NOV18\FD1004 & FD1005-RB-AST-STORAGE LAYOUT (OPTION-2)_SHEET1 & 2.DWG

TBA

DESCRIPTION	GROUND SLOTS
DRY CONTAINER	1484

SL.NO	DESCRIPTION
1	GATE HOUSE
2	SECURITY OFFICE
3	OPERATION / WORKSHOP
4	WEIGH BRIDGE
5	RECEIVING SUBSTATION
6	WEIGH BRIDGE
7	YARD SUBSTATION
8	WHARF SUBSTATION

NOTES

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SCALE: 1:2500

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PROJECT: FR & DPR FOR MECHANIZATION OF BERTH NO.14, NEW MANGALORE PORT

TITLE: STORAGE LAYOUT (BEHIND BERTH) (Sheet 2 of 2)

L&T Infra Engineering

L&T Infrastructure Engineering Ltd.

REPORT NO: RP010

PROJECT NO: C1171105

DATE: 21/11/18

MADE: AST

FIGURE NO: FD1005

REV: B

AUTO PATH: L:\PORTS\2017\C1171105 - FR AND DPR FOR B14 NMPT\WORKING\DRAWINGS\RP010-RB-FINAL DPR_2\NOV18\FD100a & FD1005-RB-AST-STORAGE LAYOUT (OPTION-2)_SHEET1 & 2.DWG

TBA

NOTES

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LEGEND

- RAIL

SCALE: 1:4500

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PROJECT: FR & DPR FOR MECHANIZATION OF BERTH NO.14, NEW MANGALORE PORT

TITLE: LAYOUT OF RAILWAY YARD

L&T Infra Engineering

L&T Infrastructure Engineering Ltd.

REPORT NO: RP010

PROJECT NO: C1171105

DATE: 21/11/18

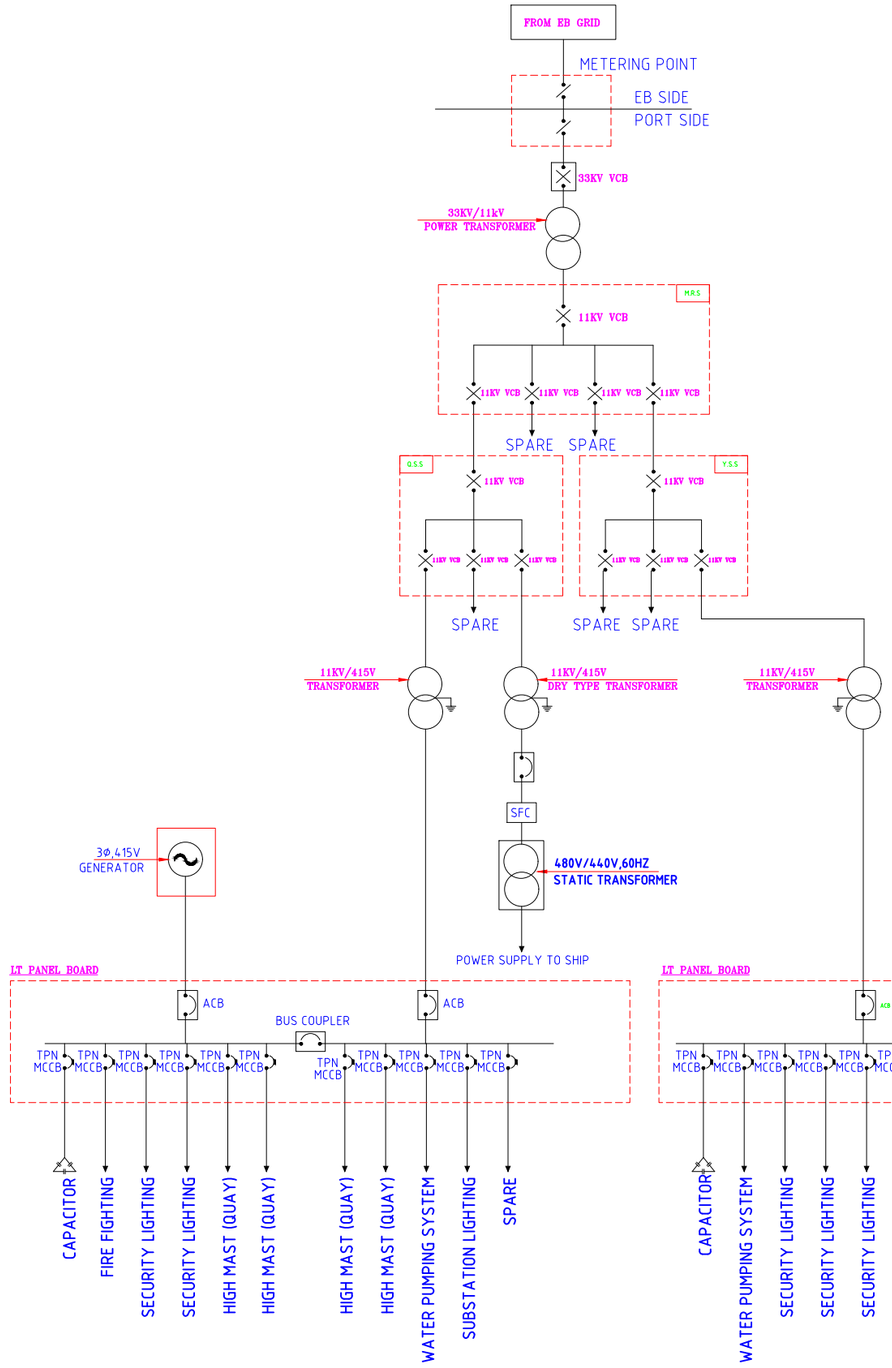
MADE: AST

FIGURE NO: FD1006

REV: B

AUTO PATH: L:\PORTS\2017\C1171105 - FR AND DPR FOR B14 NMPT\WORKING\DRAWINGS\RP010-RB-FINAL DPR_21NOV18\FD1006-RB-AST-LAYOUT OF RAILWAY YARD.DWG

TBA



LEGEND

MRS	–	MAIN RECEIVING STATION
	–	DOUBLE BREAK SWITCH
	–	VACCUM CIRCUIT BREAKER
	–	AIR CIRCUIT BREAKER
	–	MOULDEDCASE CIRCUIT BREAKER
	–	POWER TRANSFORMER
Q.S.S.	–	QUAY SUBSTATION
Y.S.S	–	YARD SUBSTATION
SFC	–	STATIC FREQUENCY CONVERTER

AUTO PATH: L:\PORTS\2017\C1171105 - FR AND DPR FOR B14, NHPT\WORKING\DRAWINGS\RP010-RB-FINAL DPR_2\NOV18\FD1007-RB-AST-ELECTRICAL SCHEMATIC DIAGRAM (STOCKYARD - PHASE2).DWG

TBA

SCALE: XXX

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REPORT NO: RP010

PROJECT: FR & DPR FOR MECHANIZATION OF BERTH NO.14, NEW MANGALORE PORT

PROJECT NO: C1171105

TITLE: ELECTRICAL SCHEMATIC DIAGRAM (STOCKYARD - PHASE 2)

DATE: 21/11/18

MADE: AST

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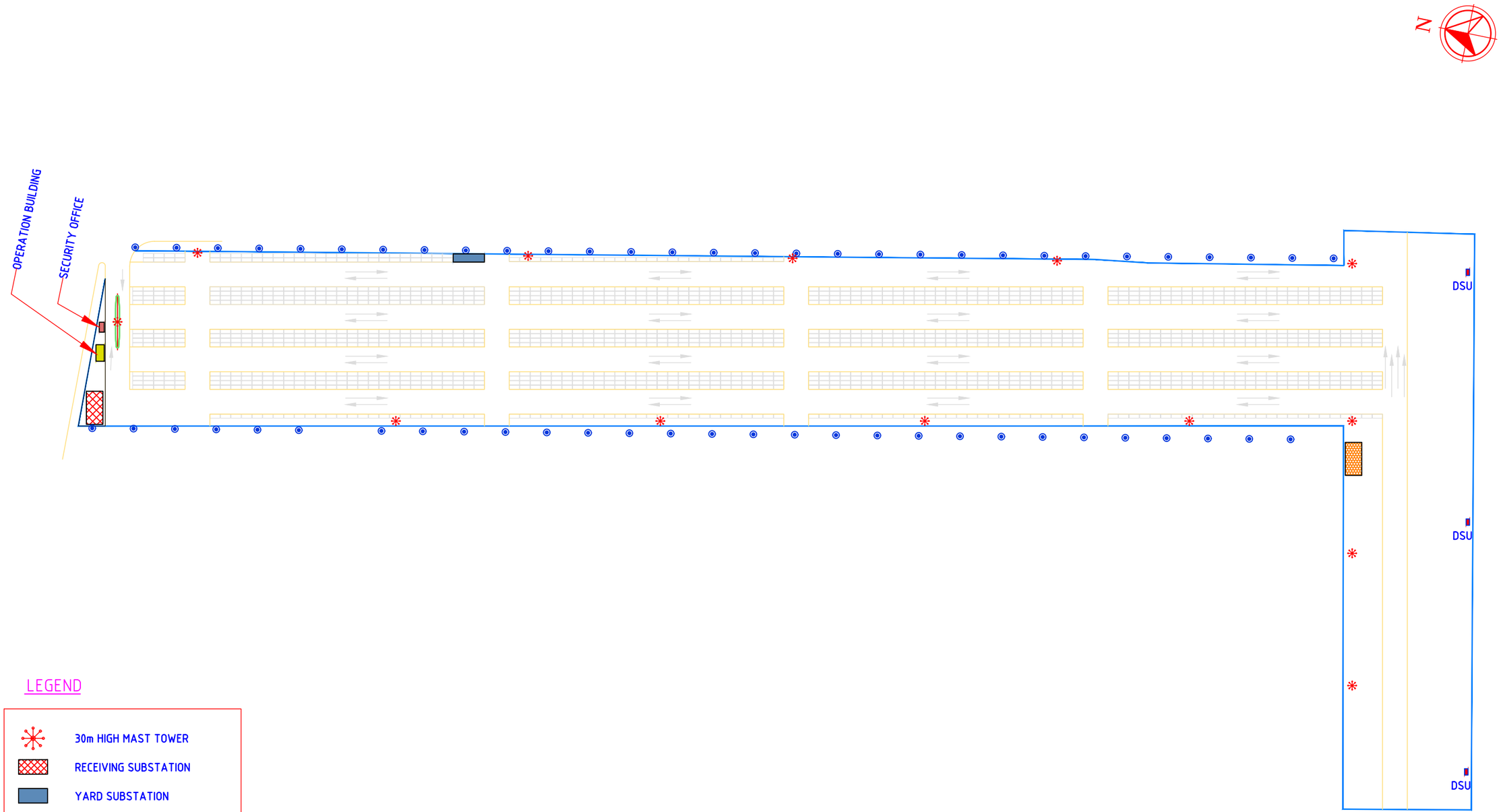
FIGURE NO: FD1007

REV: B



LEGEND

- 30m HIGH MAST TOWER
- RECEIVING SUBSTATION
- YARD SUBSTATION
- WHARF SUBSTATION
- SECURITY LIGHT
- DISTRIBUTION SERVICE UNIT

NOTES

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SCALE: 1:2500

PATH: REFER BOTTOM LEFT CORNER OF THE DRAWING

PROJECT: FR & DPR FOR MECHANIZATION OF BERTH NO.14, NEW MANGALORE PORT

TITLE: ELECTRICAL FACILITIES

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REPORT NO: RP010

PROJECT NO: C1171105

DATE: 21/11/18

MADE: AST

FIGURE NO: FD1008

REV: B

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TBA

Annexure

Annexure 1:
Report on Mechanization of Berth no 14

1.1 Mechanization of Berth no 14

Mechanization of Berth No 14 is envisaged in order to improve efficiency of the berth in handling container cargo. The mechanization is achieved by providing equipments like Rubber Tyre Gantry, Mobile Harbour Cranes, Reach Stackers, Empty Container Handler, Fork Lifts, and Tractor Trailer units.

In view of this, MHC's on the berth and Reach stackers in stacking area is selected for the mechanization of Berth No 14

In order to compare the feasibility of above options, the consultant has approached well-known Original Equipment Manufacturers (OEMs) for container handling equipments in the global market. The consultant has found out most effective technical specifications and budgetary offers from the following OEMs for container handling equipments.

- Konecranes Private Limited
- Liebherr India Private Limited

The details and specifications of the equipments are given in the below sections

1.2 Berth: Loading and unloading of container and clean cargo at berth

The berth No 14 is envisaged to provide installation of mobile harbour crane at the berth.

1.2.1 Mobile harbour Crane

The following section compares mobile harbour cranes for berth no 14 at NMPT. The comparison is made between Liebherr LHM 425 Litronic model and Konecranes G HMK 4406 model. The Liebherr MHC is used for operating on Post-Panamax range vessels and Konecranes MHC is used for Panamax vessel.

Typical diagram Liebherr LHM 425 crane is shown in Figure 1

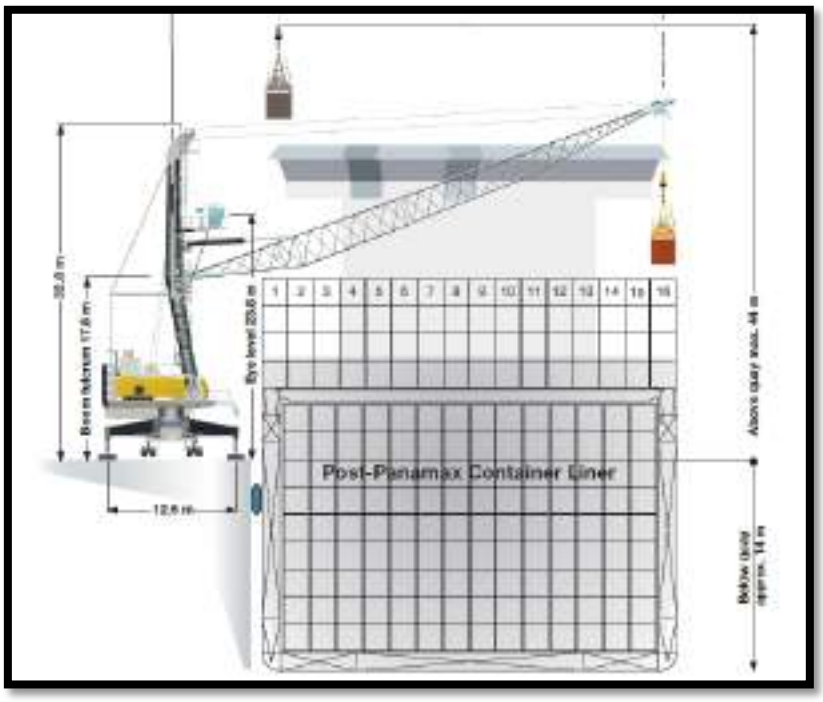

Figure-1 Typical diagram of Liebherr LHM 425

Typical diagram Konecrane G HMK 4406 crane is shown in Figure 2

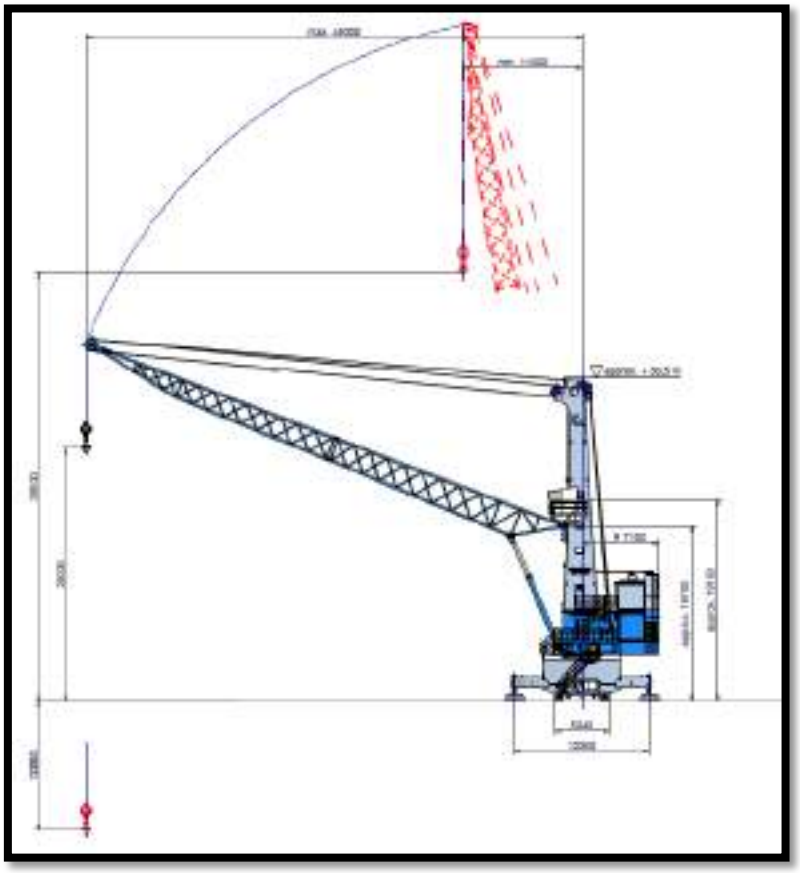

Figure -2 Typical diagram of Konecrane G HMK 4406

The following Table -1 gives technical data comparison of Konecranes G HMK 4406 B and Liebherr LHM 425.

Table -1 Comparison of Mobile Harbour Crane

Sl No	Details	Value	
		Liebherr	Konecranes
1	Model	LHM 425	G HMK 4406 B
2	Capacity		
2.1	Maximum capacity	84 T	100 T
2.2	Lifting Capacity (on hook)	30.4T at 46 m outreach 54.4 T at 30 m outreach 81.5 T at 15 m outreach	37.6 T at 46 m outreach 68T at 30 m outreach 100T at 15 m outreach
3	Total Weight of Crane	338 T	360 T

4	Main Dimension		
4.1	Maximum Outreach	48.0 m	46.0 m
4.2	Minimum Outreach	10.5 m	11 m
4.3	Overall height	32.8 m	30.8
4.4	Length of boom	48.6 m	47.0 m
4.5	Overall length of undercarriage	20.0 m	14.2 m
4.6	Overall width of undercarriage	14.3 m	10.6 m
4.7	C/C Distance between loading pads	12.5 m	12.5 m
5	Hoisting Height		
5.1	Above quay at minimum radius	44 m	39 m
5.2	Above quay at maximum radius	29 m	24m
5.3	Below quay level	14 m	12 m
6	Working Speeds		
6.1	Hoisting/Lowering	23-90 m/min	28-85 m/min
6.2	Slewing	0 - 1.6 rpm	0 - 2 rpm
6.3	Luffing	55 m/ min	64 m/min
6.4	Travelling	0 - 5 kmph	0 – 4.8 kmph
7	Propping Arrangements		
7.1	Standard supporting base	12.5 m x 12.5 m	13.0 m x 12.5 m
7.2	Standard pad dimension	4 x 5.5 m x 1.8 m	2X 2 x 4.5 m
8	Quay load Arrangements		
8.1	Uniformly distributed load	1.3 t/m^2	2.39 t/m^2
8.2	Max Load per tyre	5.3 T	15 T

9	Environmental Conditions		
9.1	Max wind speed in operation	24 m/s	24 m/s
9.2	Max wind speed out of operation	42 m/s	46 m/s
9.3	Max wind speed during travelling	20 m/s	24 m/s
10	Drive System		
10.1	Prime mover	Diesel Engine	Diesel- Electric Engine
10.2	Number of cylinder	12	12
10.3	Cooling System	Water	Water
10.4	Output on drive shaft	750 kW at 1700 rpm	809 kW at 1800 rpm
10.5	Fuel Tank capacity	13000 L	7850 L
10.6	Fuel Consumption	198 g/KWh (at average load)	211 g/KWh (at full load)

In addition to above, higher version MHC namely Liebherr LHM550 is also studied and details are given in the following section.

Liebherr LHM 550 MHC has a maximum capacity of 144 T under hook operation on ropes for heavy lift. This model of the crane is optimized for operating on New Panamax container vessels which will typically be having 18 rows of containers in the vessel. The handling rate is given as 32 moves per hour for containers and 1500 TPH for bulk handling.

Typical diagram Konecrane G HMK 4406 crane is shown in Figure 2

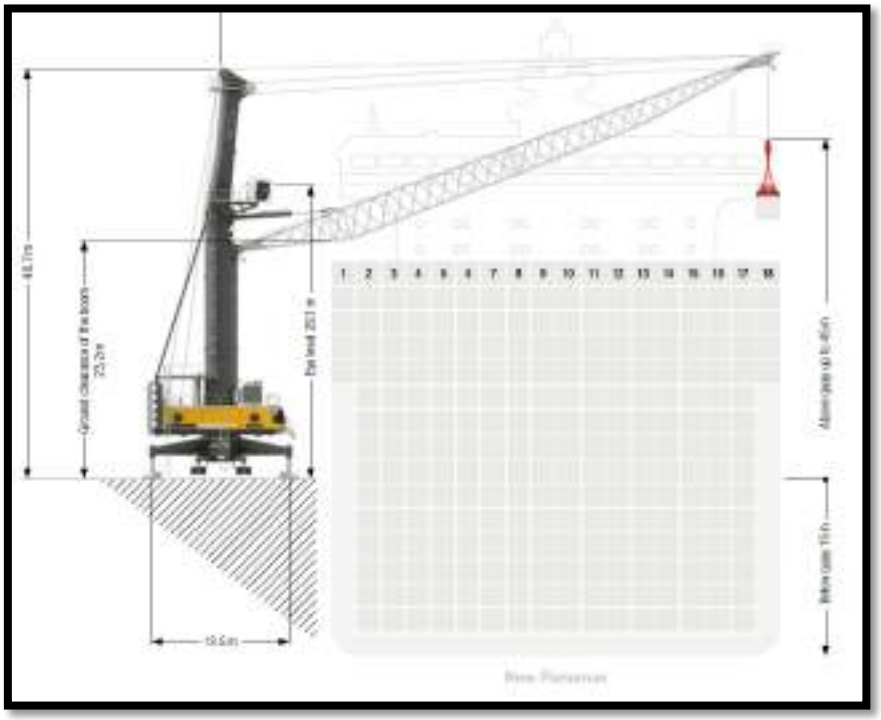

Figure -3 Typical diagram of Liebherr LHM 550

The technical details of the MHC is given in Table-2 below

Table-2 Details of Liebherr LHM 550

Sl No	Details	Value
1.	Model	LHM 550
2.	Capacity	
2.1	Maximum capacity	144 T
2.2	Lifting Capacity (on hook)	40.9 T at 54m outreach 89.2 T at 30 m outreach 144 T at 15 m outreach
3	Total Weight of Crane	454T
4	Main Dimension	
4.1	Maximum Outreach	54 m
4.2	Minimum Outreach	11 m
4.3	Overall height	40.7 m

4.4	Overall length of undercarriage	20.7 m``
4.5	Overall width of undercarriage	6 m
4.6	C/C Distance between loading pads	13.5 m
5	Hoisting Height	
5.1	Above quay at minimum radius	45 m
5.2	Above quay at maximum radius	36.3
5.3	Below quay level	15 m
6	Working Speeds	
6.1	Hoisting/Lowering	0-120 m/min
6.2	Slewing	0 - 1.6 rpm
6.3	Luffing	0-85 m/ min
6.4	Travelling	0 - 5 kmph
7	Propping Arrangements	
7.1	Standard supporting base	13.5 m x 13.5 m
7.2	Standard pad dimension	4 x 5.5 m x 1.8 m
8	Quay load Arrangements	
8.1	Uniformly distributed load	1.6 t/m^2
8.2	Max Load per tyre	5.8 T

The following graph in Figure -4 is showing Lifting capacity against outreach for the cranes. The Load capacity is given for spreader operation under single lift for the

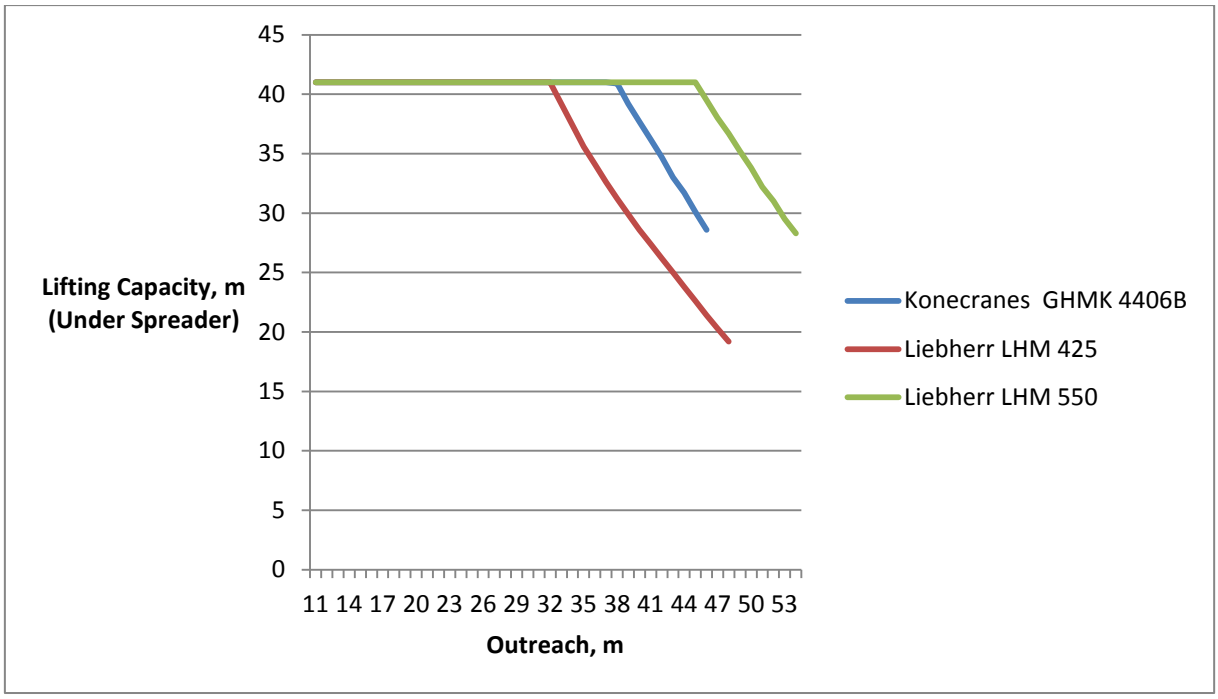

Figure -4 Spreader operation- Lifting Capacity vs Outreach

The following graph in Figure 5 is showing Lifting capacity vs outreach for heavy lift on hook for the cranes.

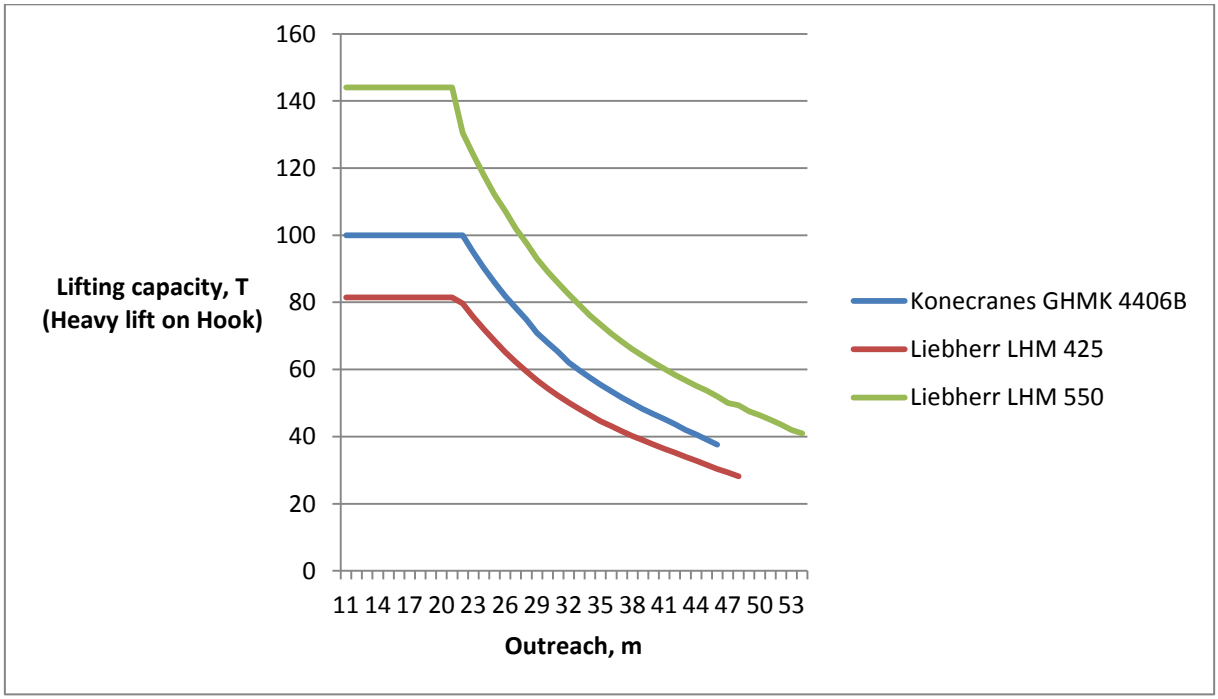

Figure -5 Heavy lift under hook- Lifting Capacity vs Outreach

1.3 Stackyard: Loading and stacking of container at the stackyard

The stackyard will be equipped with reach stackers, Empty container Handler, fork lifts. The tractor trailer units will be plying to and fro between these two areas to transfer the container.

A comparison of RS is given in the following sections

1.3.1 Reach Stacker

The Reach stacker including Liebherr LRS 545 and Konecranes SMV 4531 are compared in this section. The Reach Stacker details are given in Table -3

Table -3 Comparison of Reach Stacker

Sl No	Details	Value	
		Liebherr	Konecranes
1	Model	LRS 545	SMV 4531 TC5
2	Dimensions		
2.1	Overall length	8.5 m	8.3 m
2.2	Overall length with spreader	11.8 m	11.5
2.3	Overall width	6.0 m	6.0m
2.4	Boom height maximum	17.8 m	18.2 m
2.5	Boom angle	0-60.3°	0-62°
3	Lift height		
3.1	First row	14.6 m	15.3 m
3.2	Second row	12.8 m	13.4 m
3.3	Third row	10.0	10.5
4	Working Load		
4.1	Rated Load	40.5 T	45 T
4.2	For maximum hosting height at First row	40.5 T	45 T
4.3	For maximum hosting height at Second row	29.5 T	31 T
4.4	For maximum hosting height at Third row	16.5 T	16 T
5	Load centres (distance from Centre of front wheel)		
5.1	First row	2.2 m	2.15 m

5.2	Second row	4.7 m	4.65 m
5.3	Third row	7.2 m	7.15 m
6	Lifting Speed		
6.1	Unloaded	0.40 m/s	0.38 m/s
6.2	Rated load	0.25 m/s	0.23 m/s
7	Lowering Speed		
7.1	Unloaded	0.40 m/s	0.35 m/s
7.2	Rated load	0.40 m/s	0.40 m/s
8	Driving Speed		
8.1	Unloaded	25 kmph	24 kmph
8.2	Rated load	20 kmph	21 kmph
8.3	Unloaded (reverse)	25 kmph	18 kmph
8.4	Rated load (reverse)	20 kmph	17 kmph
9	Wheel		
9.1	Tyre Type	Pneumatic	Pneumatic
9.2	Wheel base	6.5 m	6.4 m
9.3	Number of wheels, front + rear	4+2	4+2
9.4	Track width, Front / Rear	3.34/2.43 m	4.16/2.91
10	Driving System		
10.1	Engine model	Liebherr D944	Volvo TAD-1141-VE
10.2	Power	230 KW at 1700 rpm	265 kW at 2100 rpm
10.3	Fuel Consumption	12-14 L/hr	15-18 L/hr
10.4	Tank Volume	Diesel tank volume- 1100 L Hydraulic tank Volume- 500 L	Diesel tank volume- 65 L Hydraulic tank Volume- 850 L

Annexure 2:

Brochures and Details of Equipments

OEM- Konecranes

Konecranes

Mobile Harbor Crane

KONECRANES®
Lifting Businesses™

TECHNICAL DESCRIPTION

G HMK 4406 B MOBILE HARBOR CRANE

TABLE OF CONTENTS

KONECRANES® | GOTTWALD

KONECRANES®
Lifting Businesses™

1 MOBILE HARBOR CRANES

Konecranes Gottwald Mobile Harbor Cranes are slewing boom cranes. They were introduced to the market in 1956 and have been developed continually since then. With maximum lifting capacities of up to 200 tonnes and working radii of up to 61 metres, Mobile Harbor Cranes are used to serve ships of all types and sizes.

Because their lifting gear can be changed quickly, Mobile Harbor Cranes are suitable for flexible handling of all types of cargo, including containers, general cargo, bulk materials and project cargo.

Konecranes Gottwald Mobile Harbor Cranes are equipped with rubber-tyred chassis and are highly mobile within the port and terminal areas. They travel to the ships that are to be loaded and unloaded, and they can be used throughout virtually the entire terminal.

The environmentally-friendly drive concept of Konecranes Gottwald Mobile Cranes with its low diesel fuel consumption and low noise emissions is highly efficient.

A Mobile Harbor Crane comprises four main assembly groups:

- chassis
- superstructure
- tower
- boom.

The tower cab is the crane operator's ergonomically designed workplace and affords an excellent view of the work area. All the crane functions can be controlled from the tower cab. In addition, the crane is fitted with radio remote control.

Konecranes Gottwald Mobile Harbor Cranes are designed, developed and manufactured to international standards and guidelines and in accordance with the state of the art technology. This, together with Konecranes' long experience of crane manufacture, provides the basis for many years of reliable, high-performance crane operation.

2 CHASSIS

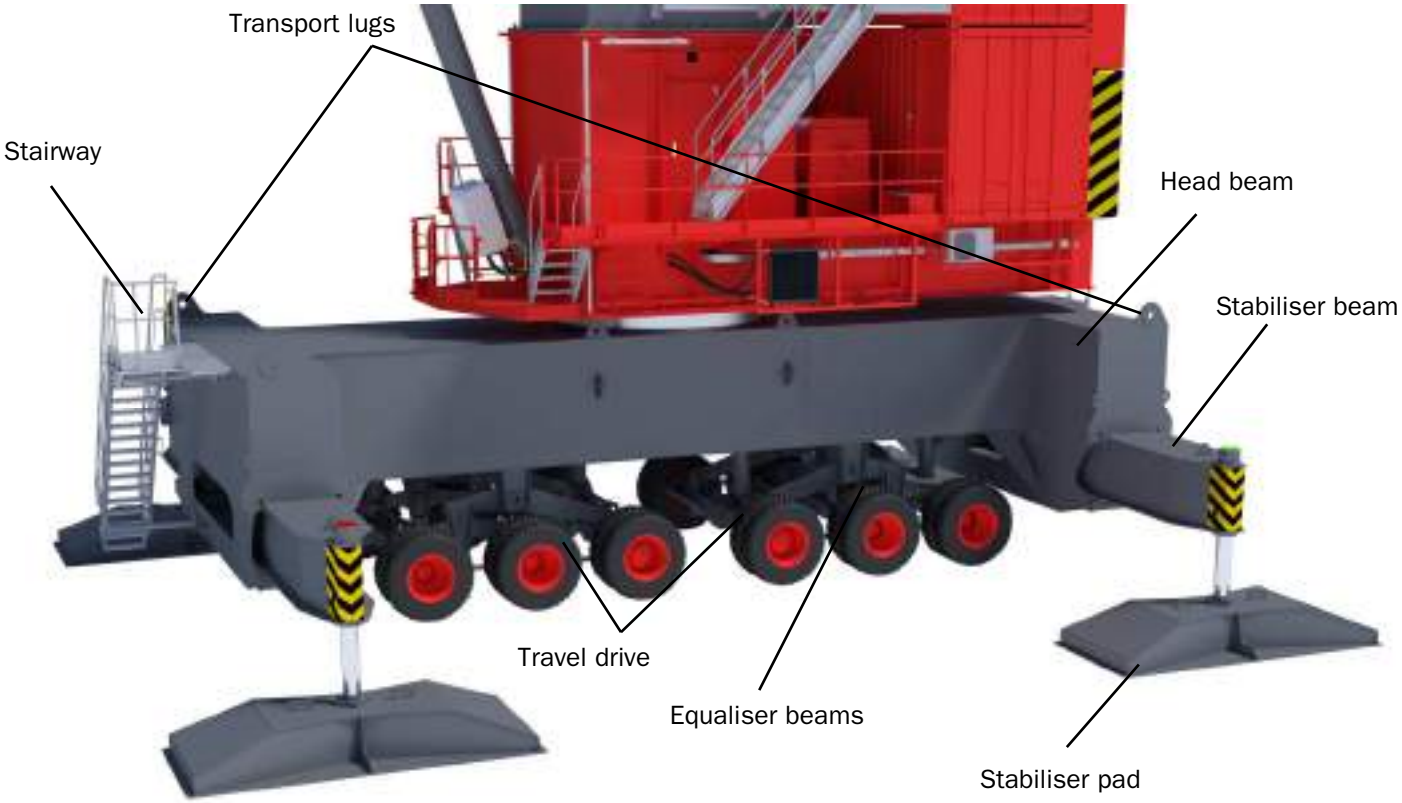

Figure 1: Schematic representation of the chassis

2.1 STEEL STRUCTURE

The chassis is constructed as a welded steel structure in a torsionally stiff box design. The structure is designed to carry the forces and moments occurring in crane and travel operation.

2.1.1 TRANSPORT LUGS

Four fixed lifting points for lifting the fully mounted crane are integrated in the steel structure of the chassis.

With these lugs, time can be saved when the crane is transported, e.g. by means of a floating crane.

2.1.2 ACCESS TO THE SUPERSTRUCTURE

Easy access from the quay to the chassis is provided by a stairway mounted at the front end of the chassis. The bottom step of the stairway is flexibly mounted to prevent it from being damaged.

The superstructure platform is accessed via safety doors. These doors and the additional emergency descent ways enable the crane operator to safely leave the crane whatever position the superstructure is in.

2.2 PROPPING SYSTEM

The steel structure of the chassis is fitted with two head beams. Each head beam accommodates two stabiliser beams. The stabiliser beams are extended and retracted by means of hydraulic cylinders that are

also located in the head beams. The position of the stabiliser beams is monitored by induction limit switches. By means of hydraulic cylinders located in the stabiliser beams, the stabiliser pads are raised or lowered to prop the crane. The extension and jack cylinders can be extended and retracted either all together in automatic mode or individually in manual mode.

The stabilisers are operated from the tower cab by means of pushbutton switches below the screen of the Visumatic® (Crane Management System) near the crane operator seat, or via the radio remote control (RRC). In the tower cab, the horizontal position of the crane is indicated by an electronic level on the Visumatic® screen.

2.2.1 STABILISER PADS

The stabiliser pads are mounted on gimbals on the jack cylinders. The stabiliser pads can be removed easily when the crane is to travel through narrow passages.

2.3 TRAVEL GEAR

2.3.1 TRAVEL DRIVE

In travel operation, the crane is driven by one hydraulic motor per driven axle. The hydraulically controlled torque distribution over the axles ensures uniform torque delivery. The same maximum speed is attained in both travel directions.

2.3.2 AXLES

Only two axle types are used; both have twin tyres. The driven axles are additionally braked and steered. They each have a differential in the middle of the axle and planetary gears in the wheel hubs. The other axles are steered axles.

The small number of axle types reduces the number of spare parts that need to be stocked and simplifies maintenance work.

2.3.3 AXLE SUSPENSION

The axle suspension with robust, low-maintenance equaliser beams guarantees uniform distribution of the total weight over all the axles. At the same time, the equaliser beams permit independent vertical motion of the axles.

Obstacles such as rails and dips can be travelled over or through without difficulty.

2.3.4 STEERING

All the axles are steered by means of hydraulic cylinders. The steering angles are synchronised with the aid of electronic linear encoders integrated in the steering cylinders.

The steering concept provides precise steering with the minimum possible tyre wear, and it allows crab steering for the best possible manoeuvrability of the crane.

2.3.5 CRAB STEERING

In crab steering mode, the crane can travel sideways with a translational motion; to achieve this, all axles are steered with the same steering angle. The sideways travel of the crane facilitates manoeuvring in confined harbors and provides a high level of mobility.

2.3.6 BRAKES

Crane travel is braked with the hydraulic service brake by means of brake valves. A low-maintenance, oil-immersed multi-disc brake assists the hydraulic service brake and facilitates starting on ramps. The spring-loaded parking brake is applied automatically after crane travel has been brought to a halt. All the brake systems act on the driven axles.

2.3.7 TRAVEL GEAR CONTROL

The travel motion of the crane is controlled from the tower cab, the optional driver cab or with the radio remote control (RRC). This control covers driving, steering, braking, lowering of the crane from the propped position onto the wheels, and propping for crane operation. The crane can accelerate smoothly from standstill all the way up to maximum speed in both directions.

2.3.8 WARNING SIGNALS DURING CRANE TRAVEL

Visual and acoustic warning signals are safety features provided for crane travel.

2.4 SUPPLY OF PRESSURISED OIL TO THE CHASSIS

Pressurised oil for the hydraulic stabiliser, steering, travel gear and brake systems is provided by the pressure oil unit in the superstructure.

3 SUPERSTRUCTURE

The superstructure is a torsionally stiff welded steel load-bearing structure designed to carry all the forces and moments occurring in crane operation. The superstructure is based on a supporting superstructure platform which houses the drive units and all key assemblies in a compact arrangement.

The crane control including the electrical control and monitoring systems are housed in a separate electrics container on the rear of the superstructure platform. Situated above this container, there is a diesel-generator container which houses the diesel-electric system. These two containers shield the crane control system and the diesel-electric system from environmental influences; the diesel-generator container also protects the environment from noise emissions.

The slewing gear drive units and hydraulic oil system are arranged inside the tower base. The hoists are located in the central area of the superstructure platform.

A platform at the front of the superstructure provides safe access from the chassis to the superstructure. Access to the drive units, other assemblies and to the tower cab is by means of lockable doors and stairways & platforms.

The superstructure is illuminated with fluorescent lamps, some of which are also for emergency lighting.

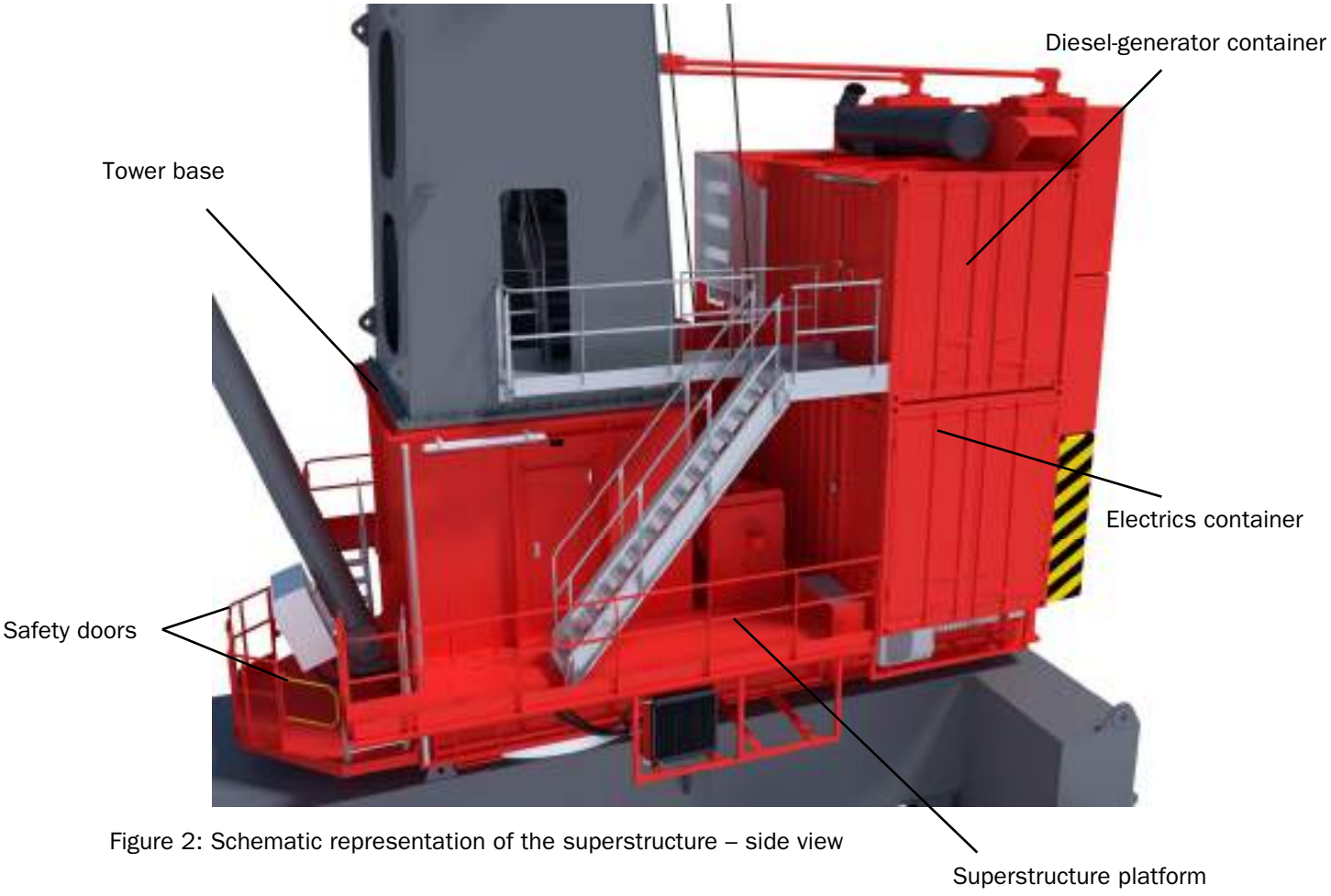

Figure 2: Schematic representation of the superstructure – side view

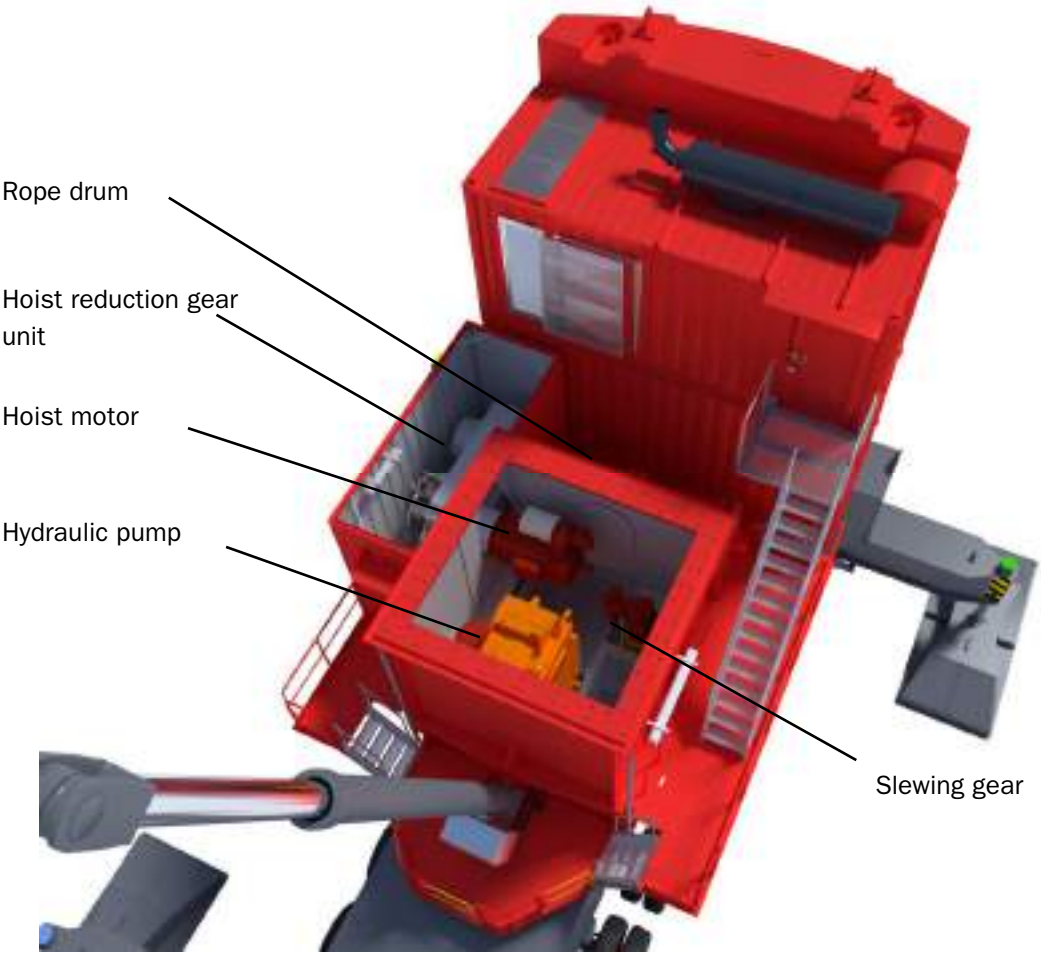

Figure 3: Schematic representation of the superstructure

3.1 COMMUNICATION SYSTEM

The Mobile Harbor Crane is equipped with a communication system consisting of headphones and microphones. This equipment can be plugged into the following areas:

- diesel generator container
- electrics container
- tower base
- tower cab.

The system is supplemented with external loudspeakers and an amplifier with microphone in the tower cab.

3.2 DIESEL-ELECTRIC SYSTEM

The electric power for the crane drives is generated by a diesel-electric system consisting of a diesel engine and a three-phase generator. The diesel-electric system has been sized to provide enough power for all the crane functions to be carried out simultaneously and independently of each other.

The diesel engine drives the generator at a constant speed. The diesel-electric system is mounted on a sliding frame to facilitate quick replacement of the assembly groups that can be extracted at the side of the diesel-generator container using standard port equipment. To gain easier access, this container can be raised from the superstructure and set down on the quay or may remain on the superstructure.

The control unit for the diesel engine is installed on the engine and equipped with start and stop buttons, key-operated ignition and a digital display for:

- engine oil pressure
- coolant temperature
- rev counter
- operating hours counter
- battery voltmeter

The starter batteries with the crane main switch are also located in the diesel-generator container.

3.2.1 MAIN FUEL TANK

The main fuel tank is integrated in the steel structure of the superstructure platform. Its capacity is sufficient for intensive multi-shift crane operation. The intermediate tank is supplied automatically from the main fuel tank. The filler neck for filling the main fuel tank is located in the chassis. To save time, the main fuel tank can be refilled during crane operation. It is important that the relevant provisions applicable in the country of operation be observed.

3.2.2 INTERMEDIATE TANK

The diesel engine runs on fuel from the intermediate tank, which is located in the diesel-generator container. The intermediate tank is automatically supplied with fuel from the main fuel tank in the superstructure platform.

The automatic filling is controlled with the aid of a number of sensors in the intermediate tank.

3.3 HOIST FOR FOUR-ROPE GRAB

The hoist assembly comprises two modular hoists. One hoists acts as a holding gear, the other opens and closes the four-rope grab. Each hoist comprises:

- DC motor
- spring-loaded disc brake
- completely enclosed reduction gear unit
- milled rope drum.

The components are arranged in such a manner that all the maintenance points are easily accessible. The weather-resistant rope drums are located behind the tower. All the other components are installed in weather-proof housings.

The ropes are coiled in one layer on the rope drums in order to keep wear low. Two ropes are coiled on each drum. The rope ends are connected directly to the grab or the hook rotator, i.e. the hoist speed of the grab or hook is the same as the rope speed.

A horizontal load path during luffing is achieved by triple reeving of the ropes between tower and boom head.

3.3.1 HOIST LUBRICATION

The hoist reduction gear units are oil-immersed. The oil level is monitored.

3.3.2 HOIST BRAKE

The hoist is braked electrically by the hoist motors. When the hoisting speed is near zero, the spring-loaded hydraulically released disc brakes are applied automatically. These brakes also act as emergency brakes in the event of a power supply failure.

3.3.3 HOIST CONTROL

The electric motor is a separately excited DC shunt motor. The hoist motor is controlled by means of thyristors connected in an inverse-parallel arrangement. The DC drive system provides smooth acceleration and deceleration of the hoisting motion. It thus protects the mechanical components and the steel structure from fatigue. The maximum possible hoisting speed is automatically increased with reduced load.

In crane operation with the hook rotator, both hoists are electronically synchronised.

3.4 SLEWING GEAR

With the slewing gear, the superstructure can be slewed infinitely. The slewing gear has a modular design and comprises:

- DC motor,
- an elastic coupling,
- disc brake,
- three-row roller bearing slew ring,
- fully enclosed planetary reduction gear unit.

The drive pinion of the planetary gear unit engages with the internal toothing of the slew ring.

3.4.1 SLEWING GEAR LUBRICATION

The slewing reduction gear unit is oil-immersed. The roller bearing slew ring and the toothing are lubricated by means of a central lubrication system.

3.4.2 SLEWING GEAR BRAKE

The slewing motion is braked electrically. When the slewing gear has been brought to a standstill, the spring-loaded hydraulically released disc brake is applied automatically. This brake also acts as an emergency brake in the event of a power supply failure.

3.4.3 SLEWING GEAR CONTROL

The electric motor is a separately excited DC shunt motor. The slewing gear motor is controlled by means of thyristors connected in an inverse-parallel arrangement. The DC drive system provides smooth acceleration and deceleration of the slewing motion. The maximum slewing speed depends on the boom position and is controlled automatically.

3.5 LUFFING GEAR

The boom is luffed in and out by means of a hydraulic differential luffing cylinder that holds the boom in position. The cylinder is mounted below the boom. Brake valves control the cylinder movement. For safety reasons, pipe-break valves are fitted.

The boom head can be lowered to a convenient working height for maintenance purposes.

For maintenance work, the valve block on the luffing cylinder can be accessed easily from a platform on the superstructure.

3.5.1 LUFFING GEAR DRIVE

The pressure oil unit on the superstructure platform supplies the hydraulic oil for operating the luffing cylinder.

3.5.2 LUFFING GEAR CONTROL

Acceleration and deceleration of the luffing motion are controlled smoothly and in an infinitely variable fashion by means of valves and by alteration of the volumetric flow rate of the oil.

3.6 PRESSURE OIL UNIT

The pressure oil unit supplies pressurised oil to the luffing gear on the superstructure and to the propping, steering, travel gear and brake systems on the chassis. It comprises:

- a three-phase squirrel-cage motor,
- an elastic coupling,
- an axial piston pump.

The axial piston pump has an adjustable oil displacement. The displacement is adapted as necessary during crane operation.

3.7 CENTRAL LUBRICATION SYSTEM

The automatic central lubrication system supplies the following lubrication points on the crane:

- boom root bearing
- upper and lower pivot point of the luffing cylinder
- roller bearing slew ring

The central lubrication system is installed at an easily accessible point and has an integrated lubricant reservoir. The points to be lubricated are supplied automatically and regularly with a sufficient quantity of lubricant via a pipework and lubricant distributors.

A second automatic lubrication system supplies the internal toothing of the roller bearing slew ring with lubricant by means of a lubricating pinion.

3.8 COUNTERWEIGHT

The counterweight is mounted in a positive lock construction at the rear of the superstructure.

4 TOWER/BOOM SYSTEM

The high boom pivot point on the tower allows the crane to be positioned very close alongside the ship without risk to ship freight, ship superstructure or crane components.

The elevated position of the tower cab offers an excellent view of the entire work area and into the ship's hold.

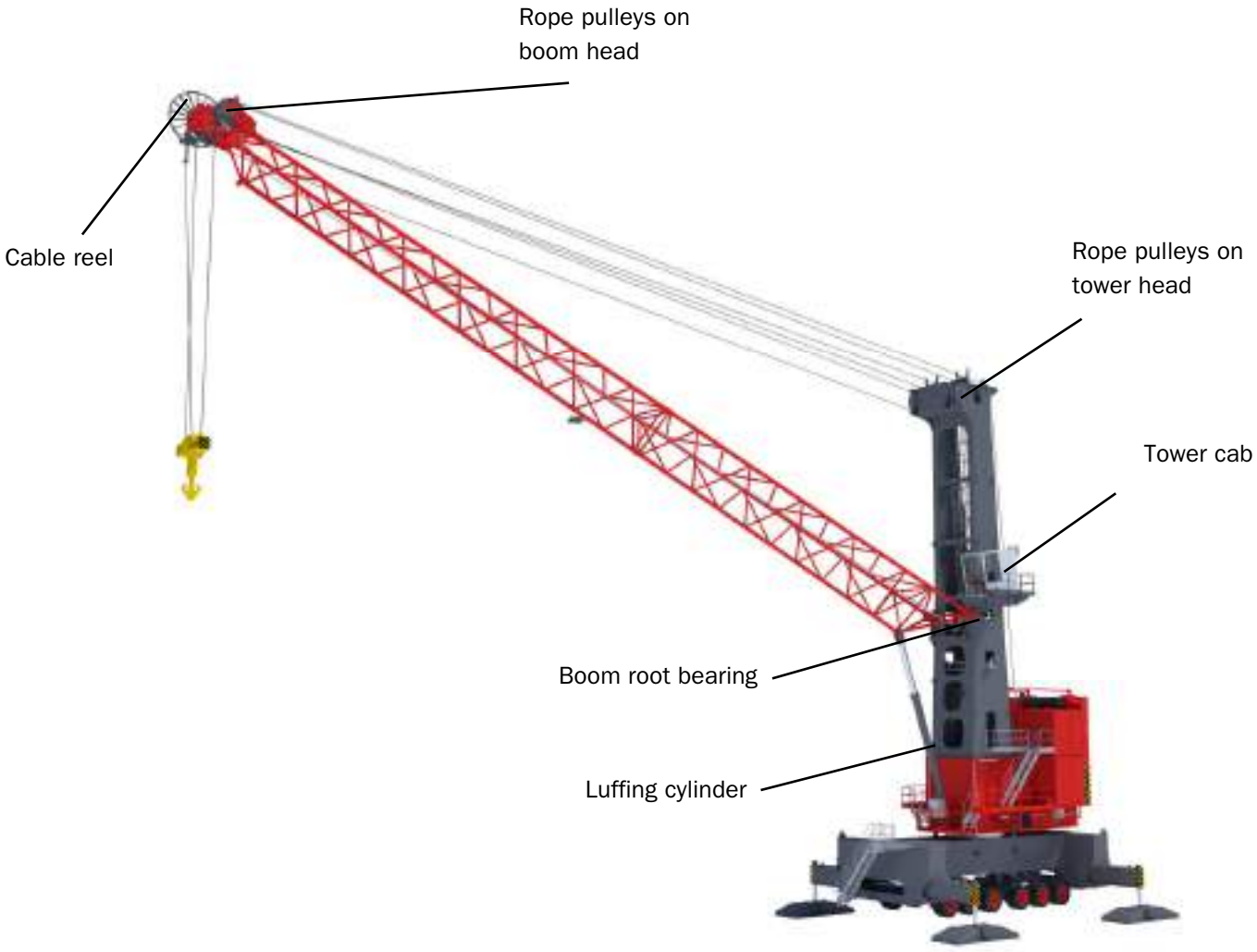

Figure 4: Schematic representation of the tower/boom system

4.1 TOWER

The tower is a torsionally stiff, welded steel box-girder structure. The transmission of forces and moments to the superstructure takes place in a uniformly distributed manner over the entire circumference of the tower.

4.1.1 ROPE PULLEYS

A rope pulley set is provided on the tower head. Rope guides prevent the hoist ropes jumping out of the pulleys. The rope pulleys run in anti-friction bearings and are of a low-maintenance design. Grease nipples are, however, provided for lubricating the bearings.

The rope pulleys can be accessed easily via ladders and platforms.

4.2 LUFFING BOOM

The luffing boom is constructed as a torsionally stiff, welded tubular-lattice structure with two upper chords and one lower chord. The boom comprises the boom root and the boom head, which are connected together by a flange connection that remains immovable even in the long term.

4.2.1 BOOM ROOT BEARING

The boom root is mounted in plain bearings on the tower. A maintenance platform provides easy, safe access to the boom root bearing.

4.2.2 ROPE PULLEYS

A rope pulley set is provided on the boom head. The design of the rope pulley set is the same as that of the rope pulley set on the tower head. The distance between the rope pulleys is selected such that load is stabilised below the boom.

4.3 ACCESS TO TOWER CAB

Access to the tower cab is via stairways and platforms. The tower cab can be reached easily via wide, safe stairways which are at an angle of 50°. Spacious platforms facilitate maintenance work.

5 TOWER CAB

The crane operator controls all the functions of the crane from a spacious, ergonomically designed tower cab. Large windows and the cab position high on the tower provide an excellent view of the work area and the ship's holds.

The tower cab is made of steel plates and sections which are protected against corrosion in a salt-laden, marine environment by a tried-and-tested paint finish. The tower cab is fitted with safety glass windows. The windows are arranged in such a manner that they are easy to clean from inside and outside. The near-silent ventilation system with its air outlets on the windscreen and side windows and in the footwell ensure the windows do not mist up.

The non-glased surfaces in the cab are panelled with a material which is heat and sound insulating. The dark, carefully matched colour scheme inside the cab minimises reflections from the windscreen. A number of practical and ergonomic features make the tower cab a pleasant place to work:

- windows of tinted safety glass
- a front window with infinitely variable opening
- sound and heat insulating interior panelling
- upholstered operator seat, which is adjustable in the vertical and horizontal directions
- controls and indicators
- air outlets for the windscreen and side windows and the footwell
- infinitely adjustable sun blinds on the side windows, rooflight and windscreen, and on the door
- air conditioner
- near-silent ventilation system with electric heater
- wiper/washer system for the front and roof windows
- interior lighting
- electric socket
- electric horn
- internal and external communication system
- ashtray
- CD radio.

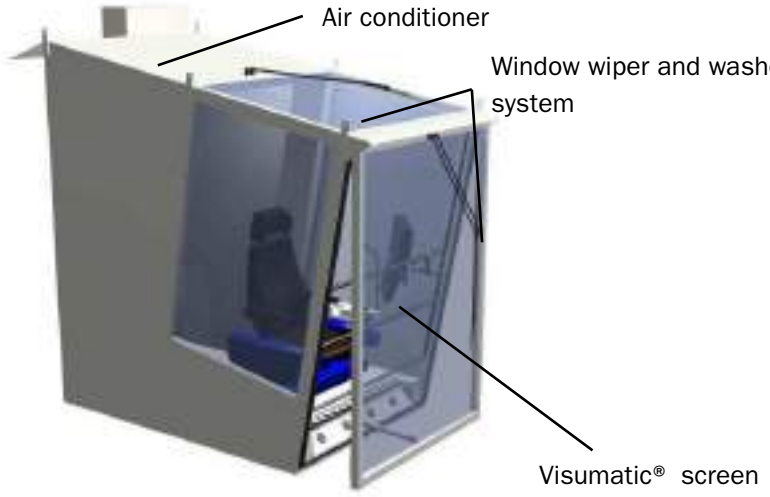

Figure 5: Schematic representation of the tower cab

5.1 CONTROLS AND INDICATORS

The controls and indicators for all crane functions are located in control panels on both sides of the operator seat and below the Visumatic® screen.

The controls comprise light switches and control levers and switches for all main and auxiliary crane functions.

5.2 VISUMATIC® – CRANE MANAGEMENT SYSTEM

Konecranes Gottwald Visumatic, Konecranes crane management system, displays all the crane functions in a structured, easy-to-understand form on a screen near the crane operator seat. The individual functions are indicated by coloured pictograms and are selected with function keys on the screen.

All the data required for operating and monitoring the crane are shown on the Visumatic® screen. These data include:

- check list with status indicator for crane, travel and propping operations
- actual and limit values for load, radius and hoisting height
- wind speed
- fuel level
- operating mode (hook, spreader or grab operation)
- diagnostic messages
- support for fault finding and remedying
- indication of remaining operating hours until end of maintenance interval
- diesel engine diagnostic system
- statistics for diagnostic messages and performance data.

6 HOOK ROTATOR

The lifting gear comprises a beam from which a ramshorn hook equipped with safety catches is suspended by means of a universal joint. The hook is manually rotatable on a roller bearing.

7 SAFETY EQUIPMENT

The safety devices installed comply with currently applicable EU Directives for mobile cranes. Additional safety equipment further enhances operational safety.

7.1 SAFE LOAD INDICATOR

The crane is equipped with an automatic safe load indicator that ensures its safe operation.

The system indicates the actual load on the hook and the actual radius of the boom. As soon as the permissible load is reached, motions that would increase the load moment are disabled and an audible alarm is sounded in the tower cab.

7.2 SECURING FOR CRANE TRAVEL

Before crane travel, the superstructure and chassis must be locked together mechanically and the boom must be in the travel position. When these conditions are satisfied, the slewing gear is switched off and the travel drive enabled.

7.3 STABILISER MONITORING

The propping status is monitored. If the crane is correctly propped, the superstructure/chassis locking device can be unlocked and the crane drives can be operated.

Before the stabiliser pads can be raised into the travel position, the superstructure and chassis must be locked.

7.4 LIMIT SWITCHES

The hoisting and lowering motions of the crane are limited by electronic limit switches. In the pre-limit switch range, the speed of the hoisting motion is reduced. When the switch-off point is reached, the hoisting motion is stopped.

For the electronic limit switch of the hoist, the lifting height is detected by two redundant systems. The two values detected are verified in two computers. When the deactivation criterion is reached, the hoist is deactivated through two channels.

The limit switching of the luffing gear functions in the same manner as that of the hoist.

7.5 SAFETY VALVES

The jack and luffing cylinders are equipped with pipe-break valves that hold the cylinders in position should a leak occur.

Pressure limiting valves protect the hydraulic circuits from excessive pressure.

7.6 ANEMOMETER

An anemometer is located on the tower head. The wind speed is shown on the Visumatic® screen. If the allowed wind speed is exceeded, an audible alarm will be sounded in the tower cab.

7.7 EMERGENCY STOP

In case of danger to staff in the work area or to the crane itself, the motions of the crane can be stopped immediately by actuating an emergency stop switch.

Emergency stop switches are mounted in the tower cab, in the tower base, in the diesel-generator container and in the electrics container. When one of these switches is actuated, all crane motions are stopped immediately.

Further emergency stop switches are mounted at the front and rear of the chassis. When one of these emergency stop switches is actuated, all crane travel motions are stopped immediately.

7.8 DEADMAN SWITCH

There are deadman switches in the joysticks to the right and left of the crane operator seat. For safety reasons, the crane drives can only be activated when both deadman switches are actuated simultaneously.

8 ELECTRICAL EQUIPMENT

The main drives of the crane are driven by means of electric motors. This drive concept, which is the most wide-spread and commonly used drive concept in port technology applications, offers the following advantages:

- low operating and maintenance costs,
- reliable operation even in continuous, multi-shift operation,
- reliable operation under extreme climatic conditions,
- long machine-unit service lives with unvarying high efficiency,
- easy service and maintenance.

The required electric power is generated independently of external power sources by a diesel-generator system in the crane. As an alternative, with the external power supply option, the crane can be connected to the shore power supply.

Thyristor converter units convert the alternating current generated by the diesel-generator system to direct current for the hoist and slewing gear drives. The DC drive system provides smooth acceleration and deceleration of the crane motions.

8.1 ELECTRICS CONTAINER

The separate, lockable electrics container is located on the superstructure platform. Accommodated in this container are the crane control system and the electric control equipment.

The electric control equipment is arranged by function groups. All cables, plugs and terminal strips are clearly marked so that maintenance work can be performed easily.

The electrics room is air conditioned and can be heated, so that moisture problems can be prevented and it is possible to carry out maintenance work safely and reliably in all weather conditions.

8.2 CENTRAL COMPUTER

The programmable logic controller of the crane is installed in the electrics room. It detects and monitors all electric signals and diagnostic messages via a bus system. In addition, data is exchanged between the controller, the crane drives and the tower cab via a high-speed bus system.

8.3 LIGHTING

The tower cab, all the areas of the superstructure, and the stairways and platforms are illuminated by fluorescent lamps. Some of these fluorescent lamps also serve as emergency lighting. Thanks to the installed lighting, it is possible to walk safely on and in the crane, and to perform maintenance work without difficulty, when it is dark outside.

Floodlighting is provided for illumination of the work area in night operation of the crane. Lights are mounted on the boom head, below the boom, on the front of the tower and on the rear of the tower.

8.4 OPERATING HOURS COUNTER

The operating hours counters record the operating hours of the various crane drives.

8.5 VIDEO CAMERA ASSISTANCE

The crane is equipped with a camera system that assists the crane operator during loading and unloading of cargo. A video camera on the boom head continually supplies images to the screen in the tower cab. The screen is mounted in a clearly visible position close to the operator seat.

8.6 RADIO REMOTE CONTROL

All the crane functions can be controlled by the radio remote control unit. The control unit is portable, robust and weatherproof. The radio remote control is equipped with displays that show, among other things, the operating mode, radius and lifting capacity. The individual functions are indicated with the same symbols and pictograms as are used on the screen in the tower cab. With the radio remote control, the crane can be travelled and positioned easily from the ground. Miscommunication between the crane operator and ground staff during repair and maintenance work can thus be avoided.

8.7 DYNAMIC BRAKE RESISTORS

For brake processes of the hoist and slewing gear, electrical energy is recovered and made available to other consumers connected to the crane mains supply if these consumers have a simultaneous energy requirement. Whatever electrical energy is not used by other consumers is dissipated in brake resistors. The brake resistors are not activated in stages as is customary but continuously triggered by an optimised control and use of a converter. As a result of this precise coordination, considerably less energy is dissipated, whereby the energy balance of the crane is considerably improved and – depending on the application and operation mode – significant fuel savings can be made.

9 SURFACE PROTECTION

All load-bearing parts are sandblasted and painted using proven methods. These methods meet the requirements of a salt-laden, marine environment.

10 OPTIONAL EQUIPMENT

The selected options complement the standard equipment and enable the cranes to be adapted to the special requirements of customers.

10.1.1 ADDITIONAL EQUIPMENT FOR TEMPERATURE ZONE 3

This additional equipment increases the range of the permissible ambient temperature upward. The increased range is achieved by additional cooling. The hoist reduction gear units are equipped with a recirculating oil lubrication system with cooling.

10.2.1 SECOND STAIRWAY ON CHASSIS

There is a second stairway installed at the rear of the chassis. The stairways at the two ends of the chassis are of identical design.

10.2.2 AUTOMATIC LUBRICATION ON THE CHASSIS

The crane is equipped with an additional automatic central lubrication system, which supplies the lubrication points of the axles.

10.5.2 EMERGENCY DESCENDER DEVICE

If the stairway in the tower cannot be used, descent is possible using the emergency descender device, which is located on the tower cab platform. Alternatively, descent from the tower cab platform is possible along the tower or directly from the front window of the cab.

10.5.4.4 CONTROL OPTION: HOISTING HEIGHT LIMITING

Hoisting height limiting assists the crane operator when he is operating the hoist manually. If a previously defined upper hoisting height is achieved during a hoisting motion, the system automatically stops the hoisting motion. Hoisting can then be resumed at creep speed. In the same way, during lowering, the lowering motion of the hoist is automatically stopped when the lowest hoisting height is reached.

10.5.4.6 CONTROL OPTION: LANDSIDE LOWERING LIMITATION ("SOFT LANDING")

This control option helps the crane operator to avoid unintentional lowering of the load on the quay surface with excessive speed by automatically braking the hoist from a previously defined height when lowering on the landside.

10.8.3 SPREADER CONTROL

The crane is equipped for controlling single lift and twin lift spreaders from the tower cab.

Subject to change.

KONECRANES® Lifting Businesses™

TECHNICAL DATA

G HMK 4406 B MOBILE HARBOR CRANE

TABLE OF CONTENT PAGE

KONECRANES® | GOTTWALD

1.0 MAIN DIMENSIONS

Length of chassis without stabiliser pads	approx.	16.6 m
Width of chassis without stabiliser pads *	approx.	9.0 m
Size of stabiliser pads *		2.0 m x 4.5 m
Propping base (length, width)		13.0 m x 12.5 m
Tail radius		7.15 m
Height of boom pivot point	approx.	16.7 m
Crane operator viewing height	approx.	19.1 m
Boom length		47.0 m
Maximum radius		46.0 m
Minimum radius		11.0 m
Hoisting height on hook above quay *	11 m to 36 m radius	39.0 m
	46 m radius	24.0 m
Hoisting height on hook below quay		12.0 m

2.0 WEIGHTS

Counterweight		87.5 t
Total weight of operational crane***	approx.	360.0 t

3.0 MAIN DRIVE

Type of drive system	Diesel – electric

3.1 DIESEL ENGINE

Manufacturer	Cummins
Model	QST 30-G2 NR1
Engine type	Diesel
Cooling	Water
Nominal output (PRP, ISO 8528)	809 kW at 1800 rpm
Number of cylinders	12
Fuel consumption (at full load)	max. 211 g/kWh

3.2 FUEL TANK

Volume of main fuel tank	approx.	7850 l
Possible operating time without refueling (depending on operating mode and intensity)		up to 170 h

4.0 HOIST

Number of rope drums		2
Number of ropes		4
Hoisting speeds:		
	to 33.0 t	85.0 m/min
	34.0 t	82.0 m/min
	40.0 t	72.0 m/min
	45.0 t	64.0 m/min
	63.0 t	46.0 m/min
	80.0 t	37.0 m/min
	100.0 t	28.0 m/min

5.0 SLEWING GEAR

Number of slewing gear drive units		2
Slewing speeds:		
	without load	to 2.0 rpm
	to 63.0 t	to 1.7 rpm
	to 100.0 t	to 0.6 rpm
Maximum peripheral speeds at boom head:	without load	to 350 m/min
Grab operation, with load	to 40.0 t	to 300 m/min
Normal-load operation, with load	to 63.0 t	to 200 m/min
Heavy-load operation, with load	to 100.0 t	to 80 m/min

6.0 LUFFING GEAR

Maximum luffing speeds:		80 m/min
Average luffing speeds:	to 63.0 t	64 m/min
	to 100.0 t	27 m/min

7.0 TRAVEL GEAR

Travel speed	up to	80.0 m/min
Total number of axles		6
Number of steered axles		6
Number of driven axles		2
Number of wheels		24
Tyre size		14.00-24
Climbing ability		6.0 %
Vertical axle compensation		+250 mm / -250 mm
Minimum inner curve radius	approx.	4.3 m
Minimum outer curve radius	approx.	13.5 m
Maximum crab steering angle	approx.	25°

8.0 AMBIENT CONDITIONS

Permissible wind speeds:

Crane in operation	to	24 m/s
Crane in travel operation	to	24 m/s
Crane out of service	to	46 m/s

At wind speeds above 46 m/s, the boom head should be lowered and secured.

Permissible ambient temperatures: **	minimum	-20° C
	maximum	+45° C

9.0 STABILITY REQUIREMENT (PERCENTAGE OF TIPPING LOAD)

Normal-load operation / heavy-load operation	≤ 75 %
Four-rope grab operation	≤ 60 %

10.0 CLASSIFICATION OF CRANE AND MECHANISMS

Classification in accordance with: FEM 1.001, 3rd edition, 1998

10.1 CRANE CLASSIFICATION

Container operation (single lift)		A7
Four-rope grab operation	34.0 t	A8
Four-rope grab operation	40.0 t	A7
Normal-load operation	63.0 t	A5
Heavy-load operation	100.0 t	A3

10.2 CLASSIFICATION OF MECHANISMS

Hoist:

Container operation (single lift)		M7
Four-rope grab operation	34.0 t	M8
Normal-load operation	63.0 t	M6
Heavy-load operation	100.0 t	M3

Slewing gear:

Container operation (single lift)		M8
Four-rope grab operation	40.0 t	M8
Normal-load operation	63.0 t	M8
Heavy-load operation	100.0 t	M8

Luffing gear:

Container operation (single lift)		M7
Four-rope grab operation	40.0 t	M7
Normal-load operation	63.0 t	M7
Heavy-load operation	100.0 t	M7

Travel gear: M4

11.0 LIGHTING

Boom head *	Metal vapour lamp	1 x 2000 W
Bottom of boom *	Metal vapour lamp	1 x 2000 W
Front of tower *	Metal vapour lamp	2 x 400 W
Rear of tower *	Metal vapour lamp	1 x 400 W

12.0 SURFACE TREATMENT*

The primary steel structure of the crane is coated in accordance with the following specification:

Surface treatment of the steel structure:		EN ISO 12944
Surface preparation:		SA 2½ (ISO 8501-1)
Edge protection:	Two-component epoxy resin with micaceous iron ore	
Primer coat:	Two-component epoxy resin	≥ 60 µm
Intermediate coat:	Two-component epoxy resin	≥ 60 µm
Top coat:	Two-component acrylic-polyurethane	≥ 50 µm
Total nominal coating thickness:		≥ 170 µm

12.1 COLOUR SCHEME

Boom	RAL 5015-Sky blue
Front section, boom head including rope pulleys	RAL 5015-Sky blue
Tower, rope pulleys and diesel engine container	RAL 7001-Silver grey
Superstructure/engine house, electrics container	RAL 5015-Sky blue
Luffing cylinder	RAL 5015-Sky blue
Chassis	RAL 7001-Silver grey
Counterweight below/above	RAL 5015-Sky blue
	RAL 7001-Silver grey
Tower cab, cab platform and chassis cab	RAL 1013-Oyster white
Stabiliser pads	RAL 7001-Silver grey
Wheel rims, axles, equalisers	RAL 7024-Graphite grey

Other colour schemes on request.

Key:

* Data for basic equipment. Alternative special equipment available
** Data for special equipment
***Depending on the configuration selected

Subject to technical modification without prior notice.

QUAY LOADINGS

G HMK 4406 B MOBILE HARBOR CRANE

MAIN CRANE DATA:

Total crane weight:	360,0 t
Maximum load:	100,0 t
Maximum load on operation:	460,0 t
Number of axles:	6
Propping base:	13,0 m x 12,5 m
Stabilizer pad size:**	2,0 m x 4,5 m
Stabilizer pads per corner:	1

**other sizes on request

CRANE IN TRAVELLING MODE:

UNIFORMLY DISTRIBUTED LOAD DURING TRAVELLING:

Area covered (14,2 m x 10,6 m)	150,38 m²
Uniformly distributed load (360,0 t / 150,4 m²)	2,39 t/m²

PRESSURE UNDER WHEELS:

Axle Load:	60 t
Wheels / Axle:	4
Load / Wheel:	15,00 t
Supporting Area / Wheel:	1690 cm²
Pressure under Wheel:	8,88 kg/cm²

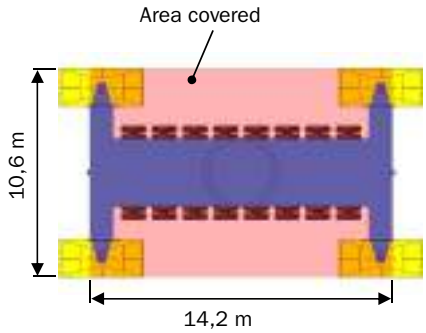

Figure 1: Area covered by the crane in travelling mode *

CRANE IN OPERATION:

MAXIMUM PROPPING FORCES [Heavy load - 75%]

BOOM POSITION	I	II	III
Load:	100,0 t	100,0 t	100,0 t
Radius:	22 m	22 m	22 m
Stabilizer pad loading:	196,2 t	230,1 t	199,2 t
Pad(s) on which load is exerted:	A, D	A	A, B
Stabilizer Pad Area:	9,00 m²	9,00 m²	9,00 m²
Ground Pressure :	2,18 kg/cm²	2,56 kg/cm²	2,21 kg/cm²

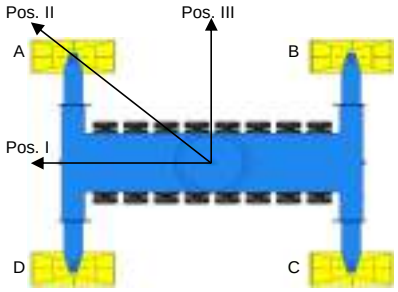

Figure 2: Determination of boom and pad position *

* Images are exemplary and may vary from configured crane

KONECRANES Lifting Businesses

LIFTING CAPACITIES

G HMK 4406 B MOBILE HARBOR CRANE

RADIUS [m]	CAPACITIES [t]		
	Heavy Lift on hook (75%)*	**Grab on ropes** (60%)*	**General cargo on hook** (75%)*
11	100,0	40,0	63,0
12	100,0	40,0	63,0
13	100,0	40,0	63,0
14	100,0	40,0	63,0
15	100,0	40,0	63,0
16	100,0	40,0	63,0
17	100,0	40,0	63,0
18	100,0	40,0	63,0
19	100,0	40,0	63,0
20	100,0	40,0	63,0
21	100,0	40,0	63,0
22	100,0	40,0	63,0
23	94,9	40,0	63,0
24	90,2	40,0	63,0
25	85,9	40,0	63,0
26	81,9	40,0	63,0
27	78,3	40,0	63,0
28	74,9	40,0	63,0
29	70,9	40,0	63,0
30	68,0	40,0	63,0
31	65,3	40,0	63,0
32	62,0	40,0	62,0
33	59,7	39,1	59,7
34	57,5	37,5	57,5
35	55,4	35,7	55,4
36	53,5	34,3	53,5
37	51,6	32,7	51,6
38	49,9	31,2	49,9
39	48,2	30,0	48,2
40	46,7	29,0	46,7
41	45,2	27,9	45,2
42	43,7	26,9	43,7
43	42,0	26,0	42,0
44	40,7	25,1	40,7
45	39,1	24,2	39,1
46	37,6	23,4	37,6

Deadweight of hook swivel gear : 2,0 t

* Indicates the percentual utilization of the tipping load

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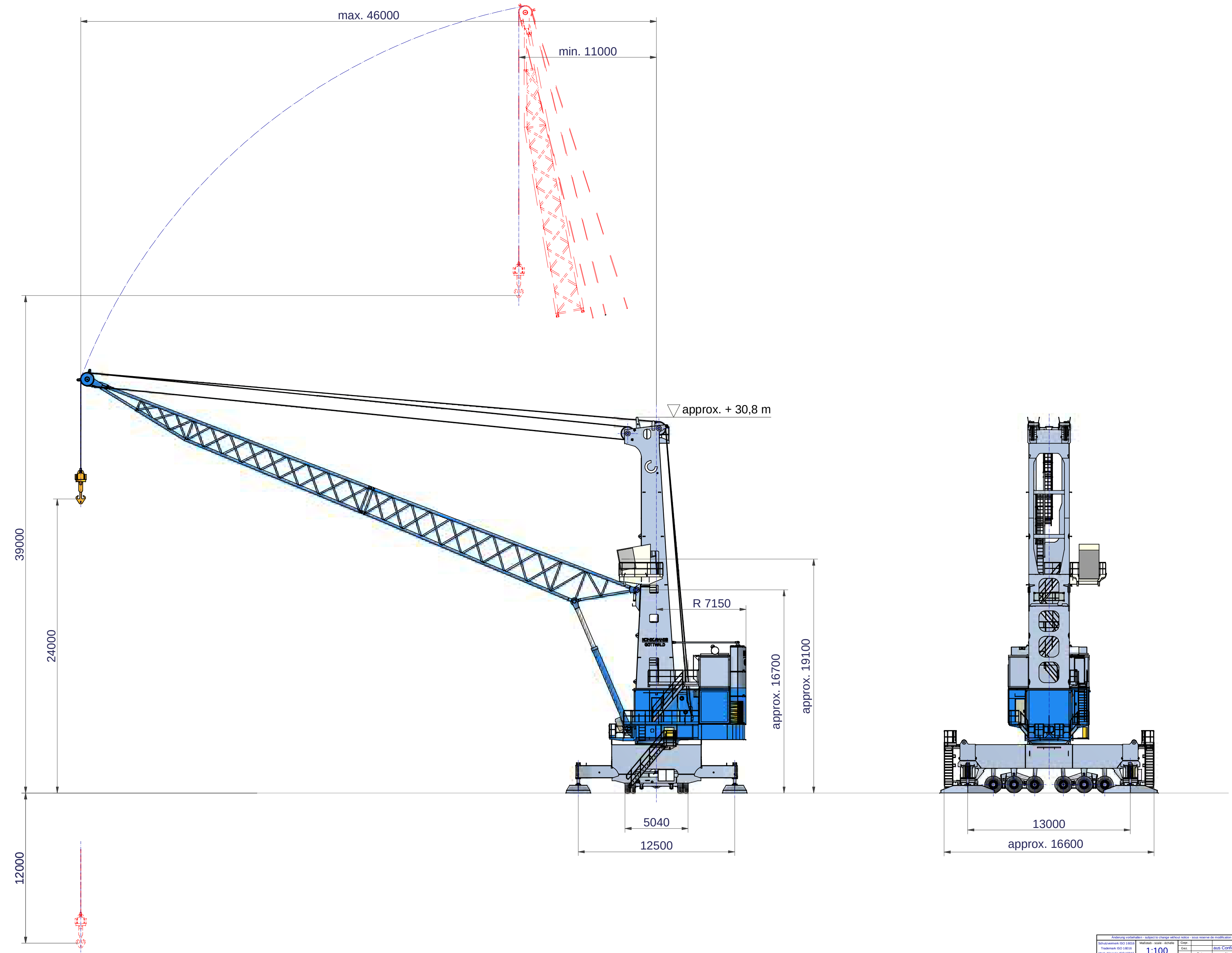


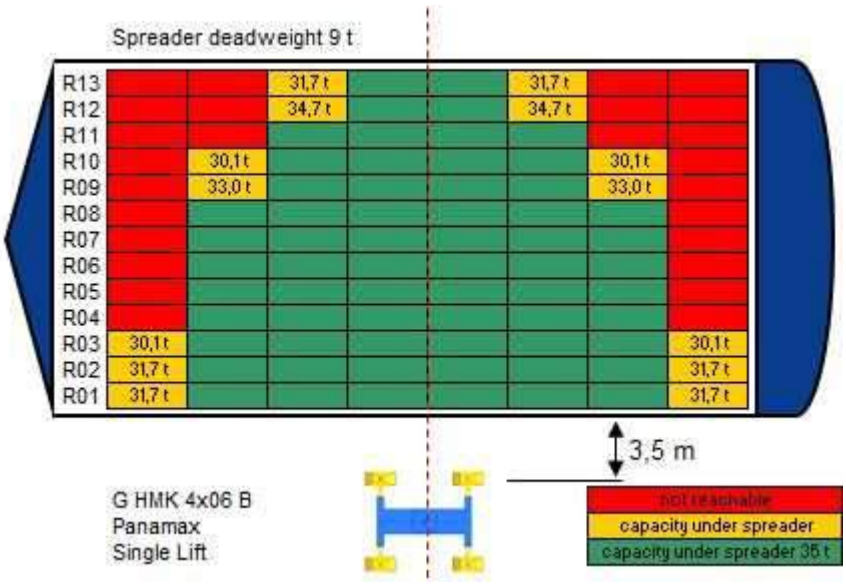
Änderung vorbehalten - subject to change without notice - sous reserve de modification			
Schutzvermerk ISO 16016 Trademark ISO 16016 Mark déposée ISO 16016	Maßstab - scale - échelle 1:100	Gepr. / Gez. / Datum / Name: aus Configurator	Ind. / Änd.- Nr. / Anzahl / Datum / Name / Gepr.
KONECRANES Lifting Businesses	Benennung - designation - désignation GHMK4406B Terex Port Solutions		Zeichnungsnummer - drawing number - no de dessin 17066-DC-01-0 entstand aus:

KONECRANES®
Lifting Businesses™

SERVICE RANGE

G HMK 4x06 B MOBILE HARBOR CRANE

RANGE FOR CONTAINER OPERATION



Red Area : Area not reachable
Yellow Area : Capacity under spreader [t]
Green Area : max. capacity under spreader
Spreader : Single lift

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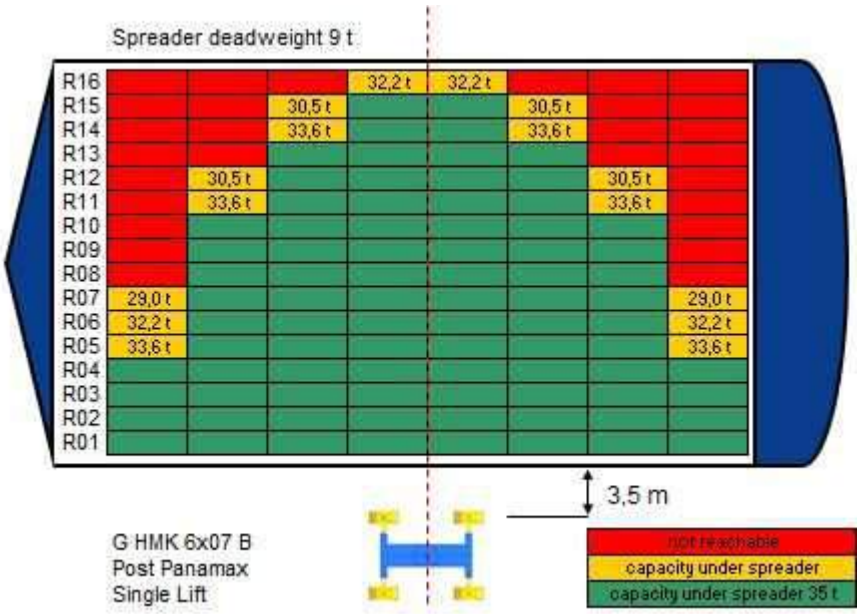
SERVICE RANGE

G HMK 6x07 B MOBILE HARBOR CRANE

RANGE FOR CONTAINER OPERATION



Red Area : Area not reachable
Yellow Area : Capacity under spreader [t]
Green Area : max. capacity under spreader
Spreader : Single lift

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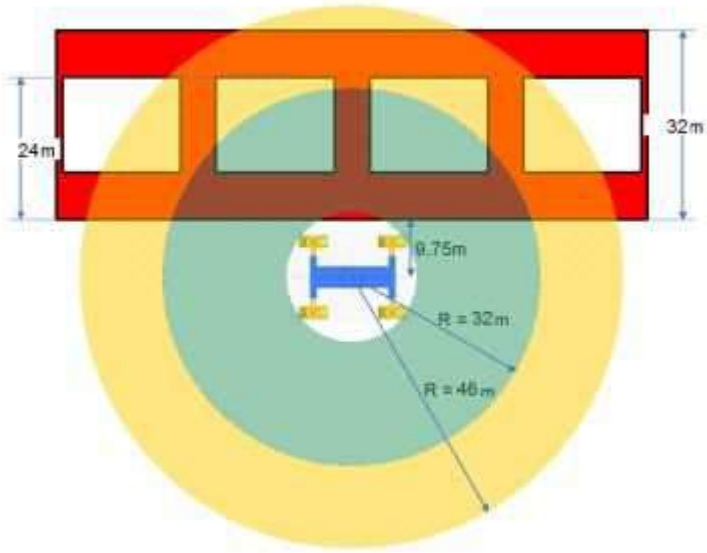
SERVICE RANGE

G HMK 4X06 B MOBILE HARBOR CRANE

RANGE FOR BULK OPERATION

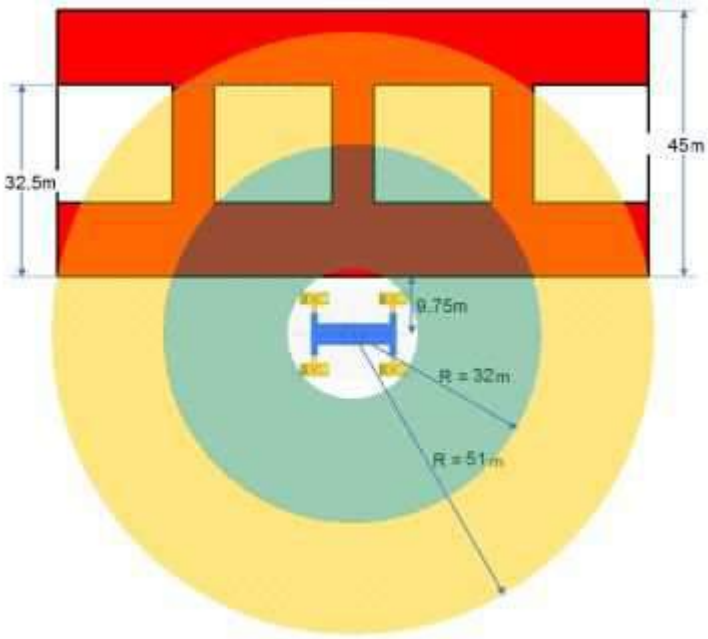


Vessel	:	Panamax
Classification	:	A7 / 40 t under ropes
Green Area	:	capacity under ropes 40 t
Yellow Area	:	reduced capacity under ropes. see lifting capacity chart

SERVICE RANGE

G HMK 6X07 B MOBILE HARBOR CRANE

RANGE FOR BULK OPERATION



Vessel	:	Capesize
Classification	:	A7 / 50 t under ropes
Green Area	:	capacity under ropes 50 t
Yellow Area	:	reduced capacity under ropes. see lifting capacity chart

Konecranes

Reach Stacker

Quote number: QUO000001412/ 0
Date: 2017-12-14

OFFER

KONECRANES®

L&T Infrastructure Engineering Ltd.
Triton Square 4th Floor (SKCL Buiding), No. C3-C7, Thiru Vi Ka Industrial Estate, Guindy,
Chennai – 600 032
India

We thank you for your inquiry and submit our quotation as follows:

POS	QTY	PRODUCT	DESCRIPTION	PRICE
1	1	Reach Stacker	SMV 4531 TC5	351 000€

We do hope you will find our quotation of interest and are looking forward hearing from you.

With kind regards,
Tobias Nilsson / **Corporate ("Konecranes")**

Direct phone: +46 433 733 84
Mobile: +46 70 372 44 90
Email: tobias.nilsson@konecranes.com

Customer	Handled by	Offer number	Offer date
Ennore Cargo Container Terminal	Tobias Nilsson	QUO0000002490	2017-08-07T01:40:21

COMMERCIAL TERMS

1. DELIVERY SCHEDULE

Normal delivery time is 18 to 20 weeks

2. DELIVERY TERMS

Seller shall deliver the Equipment on the delivery terms:

- CIF New Mangalore Port (INCOTERMS 2010)

3. PAYMENT TERMS

Customer shall pay the price as follows:

- I - Against Letter of Credit.

4. GENERAL TERMS AND CONDITIONS

This offer shall be subject to Seller's General Terms and Conditions attached hereto and available upon request and incorporated as if fully rewritten herein:

General Terms and Conditions of Sale (KC LT 30 November 2012).

5. VALIDITY OF OFFER

This offer is valid until 31-Jan-2018

6. WARRANTY

- Warranty 12 months / 2000 hours (whichever comes first)

7. CURRENCY CLAUSE

Prices are based on a fixed currency (USD/EUR). If the currency exchange rate is changed more than 2%, we reserve the right to adjust the prices.

APPENDICES FOR THE QUOTATION

- Technical Data Sheet
- Terms and conditions
- Drawing

Konecranes Lifttrucks AB
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SE-28523 MARKARYD
SWEDEN.

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Fax
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SE556142496001

SMV 4531 TC5 - Reach stacker – TopLift

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KONECRANES®
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Standard equipment

Description
Box type chassis, bolted tanks, mud guards, 2+2 lift eyes
Access steps and handles up to cabin on both sides
Manual moveable cabin (1800 mm), 2 high mirrors (back of mudguard)
Kessler drive axle D102 (W=4160 mm)
Engine air filter std. 2-stage with element, insert & indicator
DANA Automatic Transmission TE-30
Load-sensing hydraulic system (variable piston pumps), return filter (10 µm)
Hydraulic functions for lifting & spreader, 1 joystick
Separated hydraulic tanks for brake oil & working hydraulics
El. system 24V, monitoring, CanBus, 7" colour display MD4
LED Lamps (position-brake-blinkers) & LED Working Lamps (2 mudguard, 4 boom, 2 reverse)
EMC Master incl. MD4-controller with 7" color touch display (A)
EMC 106 Full Monitoring (engine, transmission, hydraulics, levers/joystick & service)
EMC 114 Electronic servo joystick (incl. Auto accelerator/power control)
EMC 123 ECO Drive module (fuel measure functions & settings)
EMC 124 Driver login module (max 20 logins)
EMC 125 Data logger module (alarms + errors)
EMC 129 Productivity hour counter (Idle-neutral-driving)
EMC 130 Transport mode for boom/spreader (drive speed limitation)
Cabin Optima (L x W x H = 1605 x 1480 x 1620 mm)
Moveable cabin, 1 joystick, ventilation, 3 wipers
Sliding window (left & right), inside rear mirror (right)
Seat BeGe 9200 Mechanical spring (4 settings, high back)
Safety belt, 2-point, waist model
El. connection 24V / 7.5A / 12.5mm plug front of dashboard right side
Clothes hangers (2x) on rear cabin pillar (left + right side)
Duplex lift boom for 5-high stacking (5 x 9'6" / 5 x 8'6")
817 Toplift, 20-40ft, sideshift ±800 mm, MPS ±2,0 d (C=45 T/W=9,0 T)
Drive & steer (4 + 2) 18.00x25"/PR40 Diagonal
Lightgrey, Cab & engine hood, RAL 7035
Black, Lift equipment & axles. RAL 7021
Seagreen, Chassis, tanks, mudguards, CW, NCS S2555 B30G
Doc set - Instruction Books & Operator's Manual
Doc set - Spare Parts Catalogue

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Optional equipment

Description
Cummins QSM-11-C335 (272 kW, 1674 Nm, 10,8 L, 2100 rpm, EU 3a/EPA 3)
Extra Oil cooler for working hydraulics
Acoustic signal when reversing (reverse alarm)
Warning beacon LED (adjustable on bar/rear on boom)
EMC 107 Electronic weight scale (resolution 0,1 tons)
Automatic Climate Control (stepless and pollen filter)
Sun blind adjustable / long / roof & front window

00. General Information, Standards & Norms:

All our reach stackers are designed and built in accordance with the current legislations and norms, which are described below:

2006 / 42 / EC ..... Machine Directive in Europe
ISO 13562 ..... Stability for Container Handling Trucks
EN 1459:1998 ..... Safety for industrial Trucks
ISO 3046 ..... Engine power, torque, fuel & emission norm
EN 12895 ..... Electro Magnetic Compatibility approvals (EMC)
EN 13564 ..... Visibility norm for driver
EN 13059 ..... Vibration norm for driver
EN 12053 ..... Noise level norm (DIN 45635 inside cab)

10. Chassis “Box-Type”

The chassis is made with long life time, low concentration of stress, and a high torsion strength in mind. This is possible through the high-strength rectangular design that is built from 2 longitudinal welded box sections with powerful cross members. There is also one extra cross member in the rear upper tower section, where the boom is fixed to the chassis.

The front end of the chassis is made even stronger by reinforcements with thick steel plates, support plates and brackets. All fixation points for vital main components, including drive axle, steer axle and lift boom, have very powerful fixation points which together with the design gives a durable and rigid chassis.

20-30. Drive Line (Engine, Transmission, Drive and Steer axles):

3.1 All engines are certified low-emission CanBus diesels, with turbo charger, air-to-air intercooler, fuel injection, common rails technology with high capacity cooling systems.

The automatic transmissions are bolted directly to the engines and connected via flexible steel plates. Automatic gear shifting with hydraulic operation and electronic controls, the softshift type gives safe and smooth driving performance.

3.2 The Kessler axles have a two-stage reductions and integral “Wet Disc Brakes”. The two-stage reduction reduces stresses in the axle transmission system. The “Wet Disc Brakes” system for service brakes are mounted in each hub with multiple brake discs.

3.3 Strong welded steer axle of sandwich design in wide version, mounted in two (2) long life bushings between chassis and axle. Mechanical side stops between axle and chassis for best side stability. Hydrostatic power steering with double acting single cylinder.

Engine model	Power (kW/rpm)	Torque (Nm/rpm)	Volume (l)	EU /EPA
Volvo TAD-1141-VE	265 at 2100	1785 at 1200	11	EU 2 / EPA 2

Transmission model	Gears (fwd/rev)	Automatic / Manual shifting
Dana TE-30	5 / 3	Yes / Yes

40. Load Sensing Hydraulic System (low-energy):

Low energy consumption is reached with the “power-on-demand” function that builds up Konecranes load sensing hydraulic system. The system is designed to work together as one unit and we use the same components in all our trucks and stackers. This means that all of them includes powerful and silent running variable piston pumps, accurate proportional valves, efficient valve regulators and electronic controls.

These very efficient and proven hydraulic systems are the most powerful on the market, with the main features being lowest power and fuel consumption, extended service intervals, reduced wear on components and oil, lower heat generation, fingertip precision and safety for the driver.

45. Electrical System:

The 24V electrical system is designed and EMC-approved according to EN 12895.

<u>Standard LED road lighting configuration:</u>

- 2 x head lights on front mudguards
- 2 x position lights on front mudguards
- 2 x working / reverse lights
- 2 x tail lights
- 2 x brakes lights
- 4 x direction blinkers
- 4 x working lights on boom (at the lift cylinder ends)
- 2 x working lights on the spreader at the twistlocks (20ft/40ft position)
- 2 x inside cabin lamp
- 1 x electric horn
- 1 x main power switch

49. Electronic Overload, Control & Monitoring System (EMC):

All the trucks are equipped with electronic control & monitoring system to optimize performance and efficiency of the trucks. This gives the operator a unique possibility to control and monitor the performance of his truck or truck fleet.

- MD4 controller with 4 CanBus interfaces (engine, transmission and truck). Full color touch display (7”).
- EMC 106; Full monitoring of engine, transmission, hydraulics, levers and service.
- EMC 114; Electronic joystick (incl. auto accelerator/power control)
- EMC 123; ECO Drive module (fuel measure & monitoring incl. settings.
- EMC 124; Driver login module (Max. 20 logins)
- EMC 125; Data logger module (alarms + errors).
- EMC 129; Productivity hour counter.
- EMC 130; Transport mode for boom/spreader (drive speed limitation)

50. OPTIMA – Drivers Cabin:

Remarkable visibility

Visibility is very difficult to measure objectively: you just know it when you see it. When you sit down in OPTIMA, you will see what visibility from a lift truck really means.

- The remarkable visibility is made possible by very large, lowered windows with no corner posts, thin but very strong roof cross member, and curved panes.
- New EMC Master with MD4 7” touch screen enables a more spacious cabin with its integrated solutions. There is also more space for operating the foot pedals.
- The positioning of the instrumentation improves operating ergonomics. Instrumentation has been moved from the driver’s left side to his right, above his seat, where it is conveniently accessible.
- OPTIMA is customizable for your exact operational needs. You can select levers or joystick, mini-wheel steering, the driver’s seat and precisely the instrumentation you need.

60. Lift Boom “Box-Type”:

The Konecranes lifting boom of 2-stage design, with inner boom and outer boom, are made of rectangular box-type design that are built up with 4 welded steel plates. Boom front & rear end pivot points are mounted in long life bronze bushings and lifting cylinders with re-generative lift function for higher lift speeds.

75. Container and Trailer Spreader:

Top lift spreader ELME, for loaded ISO containers.

85. Wheels (Tires & Rims):

Drive rims:	13.00 x 25"	(4x)
Drive tires:	18.00 x 25" (PR 40)	(4x)
Steer rims:	13.00 x 25"	(2x)
Steer tires:	18.00 x 25" (PR 40)	(2x)

90. Colour & Painting:

Lightgrey, Cab & engine hood, RAL 7035

Black, Lift equipment & axles. RAL 7021

Seagreen, Chassis, tanks, mudguards, CW, NCS S2555 B30G

95. Documentation:

The standard package includes the following: Operator's Manual, Maintenance Manual, Spare Parts Catalogue, Machine Card, Warranty/Start-up Protocol, Engine Operator's Manual.

100. Warranty:

Warranty according to Konecranes standard or extended warranty conditions. For further information see warranty documentation.

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KONECRANES®
Lifting Businesses™

WARRANTY REGULATIONS FOR NEW KONECRANES LIFTTRUCKS MACHINES (LIFTTRUCKS)

1 SCOPE

These warranty conditions apply to the machine (Machine) named in this warranty certificate and/or specified as agreed in the purchasing agreement. The original warranty period applies for the original Buyer and for later owners.

The warranty does not cover tyre equipment, batteries, fuses, light bulbs or led's or other wear parts of the machine. It does neither cover fluids, filters and unspecified material such as grease, oil, cleaning material.

2 WARRANTY PERIOD

Warranty time is 12 months or 2.000 running hours from date of signing the "Warranty start up report", or as latest 15 months from KLFT invoice date, whichever comes first

The warranty period for replaced or repaired parts during the warranty period is limited to the machine warranty.

3 WARRANTY OBLIGATIONS

Should defects occur during the period of this warranty, LIFTTRUCKS or its authorized dealer will, at its option, either repair the defects or supply the correct parts free of charge. The defective parts of the Machine shall on request of LIFTTRUCKS be sent to LIFTTRUCKS together with a claim report according to clause 4 below. In case the parts are not defective, the Buyer will cover all the costs including, but not limited to, repair, replacement and/or shipping costs.

4 CLAIMS

Claims must be reported in writing or via Konecranes Warranty OnLIne (WOL) system to LIFTTRUCKS within 45 days of discovery of the alleged fault. Claims must always include information concerning the machine's serial number, type designation, and date of delivery and total hours of operation. In addition, a complete description of the nature of the fault must be given.

5 FAULTS

This warranty is given on the condition that the Machine is in all respects operated, handled, serviced and maintained properly, in accordance with LIFTTRUCKS instructions and under specified operating conditions.

Excluded from the warranty are those parts including spare parts, to which repair or replacement becomes necessary due to:

a. Normal wear, tear and corrosion, tyre equipment, batteries, fuses, light bulbs or led's or other wear parts of the machine. It does neither cover fluids, filters and unspecified material such as grease, oil, cleaning material.
b. Overloading of the Machine
c. Which are used for purposes other than for those intended by LIFTTRUCKS and has not otherwise been used in an appropriate manner,
d. Which are exhaustible items, including but not limited to such items as bulbs and fuses;
e. Which are not approved by LIFTTRUCKS
f. On which repairs, alterations or adjustments have been performed or begun by the Buyer or any third party without LIFTTRUCKS previous consent
g. Which failures are not promptly reported to LIFTTRUCKS within the warranty period above
h. Which failures or damage are due to negligence other than that of LIFTTRUCKS, including but not limited to accident, abuse, improper installation (other than installation by LIFTTRUCKS), improper operation, or abnormal conditions of temperature, moisture, dirt, corrosive matter, dust or other similar type of reason;
i. Which have been damaged otherwise without the fault of LIFTTRUCKS.

Further, this warranty is given on the condition that,

The delivery inspection, warranty service and other in Service manual specified services have been carried out by LIFTTRUCKS or by a LIFTTRUCKS authorised dealer or service workshop

6 LIMITATION OF LIABILITY

This is the sole and exclusive warranty given by LIFTTRUCKS to the Buyer with respect to the equipment and is in lieu of and excludes all other warranties, express or implied, arising by operation of law or otherwise, including but not limited to, any implied warranties of merchantability or fitness for particular purpose.

7 SPARE PARTS WARRANTY

LIFTTRUCKS provides a warranty on genuine spare parts for 6 months or 1.000 running hours whichever occurs first, counted from the date of delivery. LIFTTRUCKS does not reimburse labour costs or other costs incurred by the replacement or repair of a defective spare part.

Otherwise, the same warranty conditions apply to applicable parts as for new machines.

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TECHNICAL DATA : SMV 4531 TC5

KONECRANES®
Lifting Businesses™

LIFTING DATA		
Lift capacities (at load center LC1 / LC2 / LC3)	kg	45 000 / 31 000 / 16 000
Lift capacities (at load center LC1 / LC2 / LC3 at max lifting height)	kg	45 000 / 31 000 / 16 000
Load centers (LC1 / LC2 / LC3)	mm	2 000 / 3 850 / 6 350
Lifting speed, unloaded / at 40 % load / at rated load	m/s	0,38 / 0,35 / 0,23
Lowering speed, unloaded / at rated load	m/s	0,35 / 0,4
DRIVING DATA		
Drive speed forward, unloaded / at rated load	km/h	24 / 21
Drive speed reverse, unloaded / at rated load	km/h	18 / 17
Incline (driving ability) at rated load at 0 km/h/at 2 km/h	%	34 / 21
Towing (power ability) at rated load at 0 km/h/at 2 km/h	kN	397 / 266
SERVICE WEIGHT / AXLE PRESSURE		
Service weight	kg	71 800
Axle pressure front at load center LC1, unloaded / at rated load	kg	37 500 / 102 200
Axle pressure front at load center LC2, unloaded / at rated load	kg	42 000 / 95 500
Axle pressure rear at load center LC1, unloaded / at rated load	kg	34 300 / 14 600
Axle pressure rear at load center LC2, unloaded / at rated load	kg	29 800 / 7 300
Axle pressure in driving position, front/rear (at rated load)	kg	93 100 / 23 700
ENGINE (electronic controlled)		
Engine make / model name		Volvo TAD-1141-VE
Emission approval EU / US		Stage 2 / Tier 2
Monitoring / emission controlled / CanBus		Yes / yes / yes
Fuel / type of engine / intercooler		Diesel/4-stroke/ yes
Power ISO 3046 / max speed	kW / rpm	265 / 2 100
Torque ISO 3046 / at speed	Nm / rpm	1 785 / 1 260
Displacement / No. of cylinders / type	L	10,8 / 6 / Inline
Fuel consumption, normal driving	L/h	15 – 18
Alternator, type/power / capacity	/ W / Amp	AC / 3 080 / 110
Starting battery, voltage/capacity	V / Ah	2 x 12 / 140
TRANSMISSION (electronic controlled)		
Transmission make / model / amount of gears (forward /reverse)		Dana TE-30 / 5 + 3 gears
Monitoring / reverse protection / CanBus / Clutch, type		Yes / yes / yes / Torque converter
Transmission type / type of shift gear		Softshift – Powershift / Automatic
DRIVE AXLE & BRAKE SYSTEM		
Drive axle make / model name		Kessler D102
Drive axle type / drive axle width	/ mm	Differential + hub reduction / 4 160
Driving brake system, type / affected wheels		Oil cooled Wet Disc Brakes / drive wheels
Parking brake system, type / affected wheels		Dry disc brake / spring release / drive wheels
STEER AXLE & STEER SYSTEM		
Steer axle type / steering system		Double acting cylinder / hydraulic servo assisted
WHEELS		
Number of wheels, front + rear / type (*driven)		4*+2 / pneumatic
Tire pressure front / rear	MPa	1,0 / 1,0
Tire dimensions (Ply rating) front / rear	Inch (No)	18.00 x 25" (PR 40) / 18.00 x 25" (PR 40)
Rim dimension front / rear	Inch	13.00 x 25" / 13.00 x 25"
HYDRAULIC SYSTEM		
Hydraulic pump make / model name		Parker & Hannifin / P2-series
Hydraulic system / pump type		Load sensing system / variable piston pump
Power-on-demand / Low energy / Separate oil tanks		Yes / yes / hydraulics & brakes
Hydraulic oil pressure mast / spreader	MPa / MPa	24 / 15
TANK VOLUMES		
Diesel tank volume	L	650
Hydraulic tank volume	L	850
LIFT EQUIPMENT & SPREADER		
Spreader make / type		ELME 817-MPS / Toplift (container)
Spreader functions		20-40 ft containers
Spreader locking containers / lifting eyes		4 x top twist locks / 4 x in corners
Sideshift stroke / rotation / pile slope type (pile slope stroke)	mm / deg /	± 800 / +195 : -105 / Manual MPS / (± 2,0)
OTHERS		
Safety, Monitoring & overload system / programmable / colour		Electronic system EMC / yes / yes
Manual sliding cabin / stroke	/ mm	Yes / 1 800
Noise level (inside Cab / Lm) DIN 45635	dB(A)	66
Noise level (inside Cab/ LpAZ) EN 12053	dB(A)	75
Noise level (outside at 7 m/ Lwa) 2005/88/EC	dB(A)	111
NORMS & STANDARDS		
Machine Directive in Europe 2006 / 42 / EC		Yes
Stability of Container Handling Trucks ISO 13562		Yes
Safety of Industrial trucks EN 1459:1998		Yes

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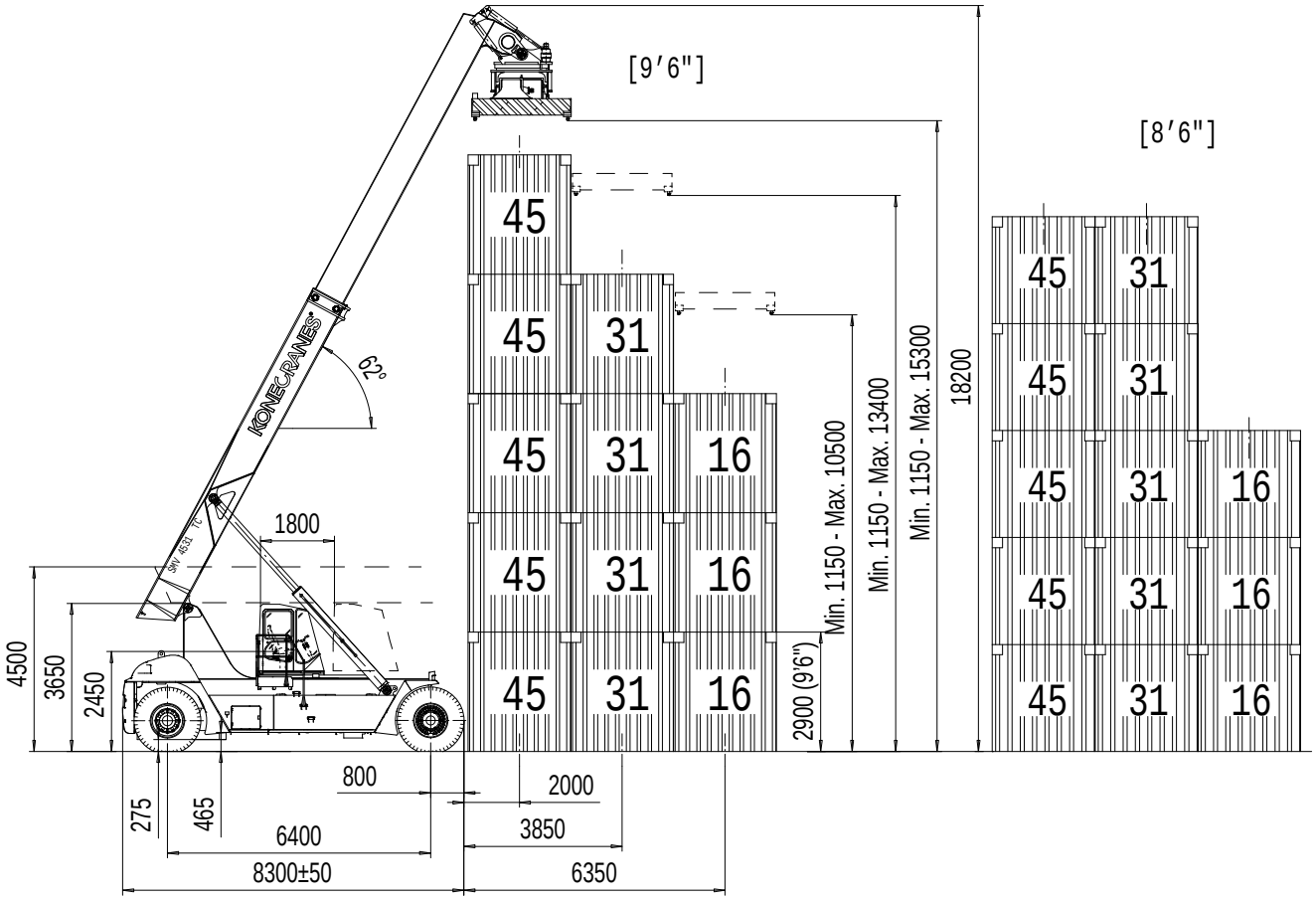
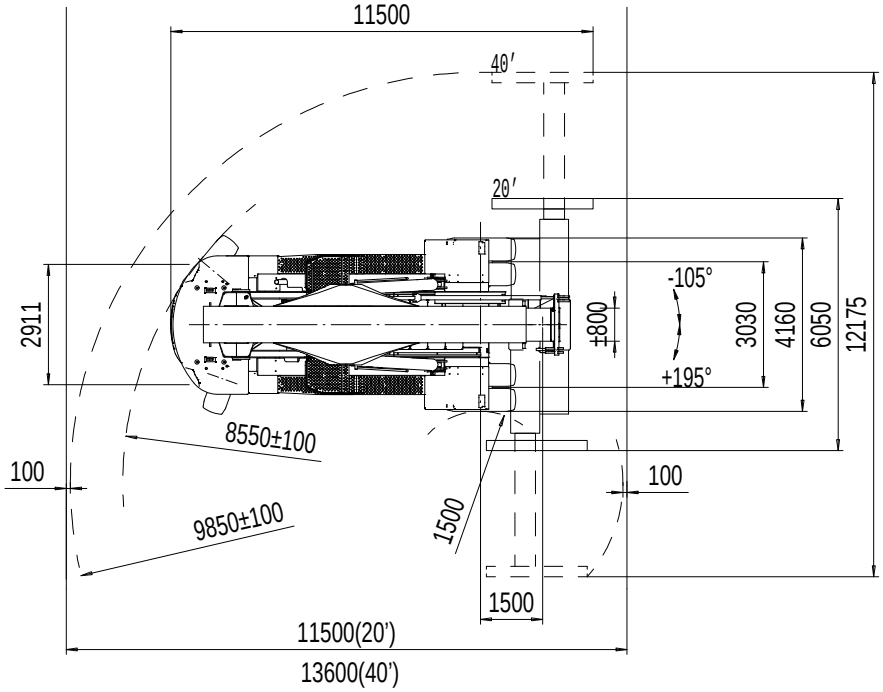
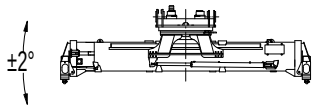
Phone: +46-433-733 00 / Fax: +46-433-733 10
Konecranes Lifttrucks reserve the right to alter design and specification without prior notice







KONECRANES LIFTTRUCKS AB
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www.kclifttrucks.com
Mail: info.lifttrucks@konecranes.com

Konecranes Lifttrucks reserve the right to alter design and specification without prior notice

Konecranes

Empty Container Handler

QUOTE

QUOTE NUMBER:	QUO0000003604
MODEL:	SMV 5/6 ECC 90
CUSTOMER:	L&T Infrastructure Engineering Ltd.
DATE:	2017-12-14

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Dear Mr. Sanish.A,

We trust you will find this quotation of interest and we look forward to hear from you. For further information, do not hesitate to contact us.

With kind regards,

Tobias Nilsson
Konecranes Lifttrucks AB

Date of quote	2017-12-14
Company name	L&T Infrastructure Engineering Ltd.
Address	Triton Square 4th Floor (SKCL Buiding), No. C3-C7, Thiru Vi Ka Industrial Estate, Guindy, Chennai -600 032. India
Attention	Mr. Sanish. A
Email	asa@lntiel.com
Phone	
Konecranes Lift Trucks contact	Tobias Nilsson
Email	tobias.nilsson@konecranes.com
Phone	+46 433 733 84
Address	Konecranes Lifttrucks AB

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5 REASONS TO CHOOSE KONECRANES

1 Global footprint

Operations at over 600 locations. in more than 120 countries worldwide and served by a broad distributor network.

2 Optima – The best cabin on the market

Every detail has been carefully designed for comfort and safety. Controls, displays, ventilation and seating work to boost driver productivity. Excellent visibility in all directions.

3 Smart Connected Lift Trucks

Remote monitoring is a key toward a more productive, efficient and safe workplace. With TRUCONNECT you get more out of your lift trucks.

4 Smarter where it matters

Years of experience has proven that the combination of high quality components and cutting edge technology together with low running costs results in a lower total cost of ownership.

5 Your uptime, our focus

The Konecranes group has the largest service organization in the world. A global and local network of maintenance professionals ensures that your machines have the optimal uptime. 24/7 spare parts supply from distribution centers worldwide.

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SMV 5/6 ECC 90 – Empty Container Handler

Standard features:

- Box type chassis, bolted tanks, mud guards, 2+2 lift eyes
- Access steps on both sides, steps & hand rails on cabin left side
- Kessler drive axle D81 (W=4060 mm)
- Engine air filter std. 2-stage with element, insert & indicator
- DANA Automatic Transmission TE-17300
- Load-sensing hydraulic system (variable piston pumps), return filter (10 µm)
- Hydraulic functions for lifting & spreader, 1 joystick
- Accumulator for lift mast 1 pressure (shock absorbing)
- El. system 24V, monitoring, CanBus, 7" colour display MD4
- LED Lamps (position-brake-blinkers) & LED Working Lamps (2 mudguard, 2 mast, 2 reverse)
- EMC Master incl. MD4-controller with 7" color touch display (A)
- EMC 106 Full Monitoring (engine, transmission, hydraulics, levers/joystick & service)
- EMC 114 Electronic servo joystick (incl. Auto accelerator/power control)
- EMC 123 ECO Drive module (fuel measure functions & settings)
- EMC 124 Driver login module (max 20 logins)
- EMC 125 Data logger module (alarms + errors)
- EMC 129 Productivity hour counter (Idle-neutral-driving)
- Cabin Optima (L x W x H = 1605 x 1480 x 1620 mm)
- Fixed cabin , 1 joystick, ventilation, 3 wipers
- Sliding window (left & right), inside rear mirror (right)
- Seat BeGe 9200 Mechanical spring (4 settings, high back)
- Safety belt, 2-point, waist model
- El. connection 24V / 7.5A / 12.5mm plug front of dashboard right side
- Clothes hangers (2x) on rear cabin pillar (left + right side)
- Duplex 5/6, LH min-max=2245-16325, BH min-max=9130-16645 mm
- Sidelift, sideshift, MPS mechanic pile slope 0-200 mm
- 588TB Sidelift single stacker, 20-40ft, top twistl, sideshift
- Drive & steer (4 + 2) 12.00x24"/PR20 Diagonal
- Lightgrey, Cab & engine hood, RAL 7035
- Black, Lift equipment & axles. RAL 7021
- Seagreen, Chassis, tanks, mudguards, CW, NCS S2555 B30G
- Doc set - Instruction Books & Operator's Manual
- Doc set - Spare Parts Catalogue

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Optional features:

	Quantity
• Cummins QSB-6.7-C260 (201 kW, 990 Nm, 6.7 L, EU 3a/EPA 3)	1
• Engine air filter Turbo II	1
• Acoustic signal when reversing (reverse alarm)	1
• Warning beacon LED (fixed mounting - on cab roof)	1
• Automatic Climate Control (stepless and pollen filter)	1

Local options

	Quantity

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00. General Information, Standards & Norms:

The empty container handler is designed and built in accordance with the current legislations and norms, which are described below:

2006 / 42 / EC..... Machine Directive in Europe
ISO 10525..... Stability for Container Handling Trucks
EN ISO 3691-1 ..... Safety for Industrial Trucks
ISO 3046..... Engine power, torque, fuel & emission norm
EN 12895..... Electro Magnetic Compatibility approvals (EMC)
EN 13564..... Visibility norm for driver
EN 13059..... Vibration norm for driver
EN 12053..... Noise level norm (DIN 45635 inside cab)

10. Chassis. Heavy Duty "Box-Type"

The chassis is made with long life time, low concentration of stress, and a high torsion strength in mind. This is possible through the high-strength rectangular design that is built from 2 longitudinal welded box sections with powerful cross members. The front end of the chassis is made even stronger by reinforcements with thick steel plates, support plates and brackets, and the container lift truck gets additional safety and strength from reinforced tilt cylinder fixations. All fixation points for vital main components, including drive axle, steer axle and lift mast, have very powerful fixation points which together with the design gives a durable and rigid chassis.

20-30. Drive Line (Engine, Transmission, Drive and Steer axles):

3.1 The engine is certified low-emission CanBus diesel, with turbo charger, air-to-air intercooler, fuel injection, common rails technology with high capacity cooling system.
The automatic transmission is bolted directly to the engine and connected via flexible steel plates. Automatic gear shifting with hydraulic operation and electronic control, the softshift type gives safe and smooth driving performance.
3.2 The Kessler axle has a two-stage reductions and integral "Wet Disc Brakes". The two-stage reduction reduces stresses in the axle transmission system. The "Wet Disc Brakes" system for service brakes are mounted in each hub with multiple brake discs.
3.3 Strong welded steer axle of sandwich design in wide version, mounted in two (2) long life bushings between chassis and axle. Mechanical side stops between axle and chassis for best side stability.
Hydrostatic power steering with double acting single cylinder.

Engine model	**Power (kW/rpm)**	**Torque (Nm/rpm)**	**Volume (l)**	**EU /EPA**
Cummins QSB-6.7-C260	194 at 2400	987 at 1500	7	Stage 3a / Tier 3

Transmission model:	**Gears (fwd/rev):**	**Automatic / Manual shifting:**
Dana TE-17300	3 / 3	Yes / Yes

40. Smart Load Sensing Hydraulic System (low-energy):

Low energy consumption is reached with the "power-on-demand" function that builds up Konecranes load sensing hydraulic system. The system is based on the latest technology from Parker & Hannifin and is designed to work together as one unit. We use the same components in all our trucks and stackers which means that all of them includes powerful and silent running variable piston pumps, accurate proportional valves, efficient valve regulators and electronic controls.

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45. Electrical System:
The 24V electrical system is designed and EMC-approved according to EN 12895.

Standard LED road lighting configuration:

- 2 x head lights on front mudguards
- 2 x position lights on front mudguards
- 2 x working/reverse lights
- 2 x tail lights
- 2 x brakes lights
- 4 x direction blinkers
- 2 x working lights in the mast
- 4 x working lights on the spreader at the twistlocks (20ft/40ft position)
- 2 x inside cabin lamp
- 1 x electric horn
- 1 x main power switch

49. Electronic Control & Monitoring System (EMC):
To optimize performance and efficiency in the truck it come equipped with an electronic control and monitoring system that gives the operator a unique possibility to control and monitor the performance of the lift truck or fleet.

EMC functions included in the basic package:

- MD4 controller with 4 CanBus interfaces (engine, transmission and truck). Full colour touch display (7”).
- EMC 106; Full monitoring of engine, transmission, hydraulics, levers and service.
- EMC 114; Electronic joystick (incl. auto accelerator/power control)
- EMC 123; ECO Drive module (fuel measure & monitoring incl. settings.
- EMC 124; Driver login module (Max. 20 logins)
- EMC 125; Data logger module (alarms + errors).
- EMC 129; Productivity hour counter.

50. OPTIMA – Drivers Cabin:

Remarkable visibility

Visibility is very difficult to measure objectively: you just know it when you see it. When you sit down in OPTIMA, you will see what visibility from a lift truck really means.

- The remarkable visibility is made possible by very large, lowered windows with no corner posts, thin but very strong roof cross member, and curved panes.
- New EMC Master with MD4 7” touch screen enables a more spacious cabin with its integrated solutions. There is also more space for operating the foot pedals.
- The positioning of the instrumentation improves operating ergonomics; the instrumentation has been moved from the driver’s left side to his right, above his seat, where it is conveniently accessible.
- OPTIMA is customizable for your exact operational needs. You can select levers or joystick, mini-wheel steering, the driver’s seat and precisely the instrumentation you need.

60. Lift Mast (wide – high stability):
The Konecranes lift mast is designed for maximum strength and stability. The heavy-duty lift masts are of 2-stage design and the structures welded in high quality steel, with large cross section areas and strong profiles. Cross members of thick profiles and support plates sits between the mast channels, and strong roller bearings and side roller bearings are located between the outer and inner mast, and between the inner mast and the carriage.

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75. Container Spreader:
Side lift spreader ELME, for empty ISO containers.

85. Wheels (Tires & Rims):

Drive tires:	12.00 x 24" (PR 20)	(4x)
Drive rims:	10.00 x 24"/HD	(4x)
Steer tires:	12.00 x 24" (PR 20)	(2x)
Steer rims:	10.00 x 24"/HD	(2x)

90. Colour & Painting:

Lightgrey, Cab & engine hood, RAL 7035
Black, Lift equipment & axles. RAL 7021
Seagreen, Chassis, tanks, mudguards, CW, NCS S2555 B30G

95. Documentation:
The standard package includes the following: Operator's Manual, Maintenance Manual, Spare Parts Catalogue, Machine Card, Warranty/Start-up Protocol, Engine Operator's Manual.

100. Warranty:
Warranty according to Konecranes standard or extended warranty conditions. For further information, see warranty documentation.

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1. DELIVERY SCHEDULE
Approx. 18-20 weeks Ex. works after fully clarified order.
Lead time can possible be improved at the time of order

2. DELIVERY TERMS
Seller shall deliver the Equipment on the delivery terms:
CIF New Mangalore Port (INCOTERMS 2010)

3. PAYMENT TERMS
Customer shall pay the price as follows:
I - Against Letter of Credit

4. GENERAL TERMS AND CONDITIONS
This offer shall be subject to Seller's General Terms and Conditions attached hereto and available upon request and incorporated as if fully rewritten herein:
General Terms and Conditions of Sale (KC LT October 2016).

5. VALIDITY OF OFFER
This offer is valid until 2018-01-31.

6. WARRANTY
Warranty 12 months / 2000 hours (whichever comes first)

7. CURRENCY CLAUSE
Prices are based on a fixed currency (USD/EUR). If the currency exchange rate is changed more than 2%, we reserve the right to adjust the prices.

Price

EUR 250,000.

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GENERAL TERMS AND CONDITIONS OF SALE-LIFTRUCKS

1. APPLICATION OF THESE TERMS

These Terms and Conditions of Sale ("Terms") shall apply to any tender and any contract of sale ("Agreement"), unless the parties agree otherwise in writing. Modifications of or amendments to these Terms must be agreed in writing. We object to any other or different terms and conditions than these even if we have not made an expressly objection. In the event of any inconsistency between the Agreement and these Terms, the Agreement shall govern.

2. SCOPE OF DELIVERY

2.1 The delivery of the equipment ("Equipment") includes all components, materials and services expressly specified in the Agreement.
2.2 The delivery includes Seller's standard technical documents, such as spare part lists, operating manuals, erection instructions (if the erection is not included in the scope of delivery) and main dimension drawings in English. Seller shall not be obliged to provide manufacturing drawings for the Equipment or spare parts.
2.3 Design, work at site, erection, supervision of erection, training services, start-up assistance and materials are included to the extent they are expressly specified in the Agreement.

3. DOCUMENTATION

3.1 The Seller shall have all rights, title and interest including ownership right, copyright and other intellectual and industrial property rights to documents, drawings, software, reports, technical information, definitions, descriptions, manuals and any other intellectual property that the Seller has or creates.
3.2 Documents, drawings, software, reports, technical information, definitions, descriptions, manuals and any other intellectual property received by the Buyer shall not, without the consent of the Seller, be used for any other purpose than for the erection, commissioning, operation or maintenance of the Equipment. They may not otherwise be used or copied, reproduced, transmitted or communicated to a third party. The Seller may, however transmit the documents or software to a third party that the Seller sells the Equipment to.

4. PACKING AND MARKING

The Equipment shall be packed in accordance with Seller's standard packing procedures as required for transportation under normal transport conditions. The Equipment shall be clearly marked and carry the necessary information concerning Buyer's identification and place of destination.

5. PRICE

5.1 In addition to the price set forth on the Agreement, Buyer shall be responsible for additional charges as set forth in these Terms.
5.2 If any part of the delivery of the Equipment is delayed due to reasons caused by Buyer or any third party under the control of Buyer, Buyer shall compensate any additional expenses incurred by Seller due to the late delivery.
5.3 Prices do not include any stamp duty, turnover or value-added tax, bank charges or any other similar taxes, duties or charges payable in the country into which the Equipment is to be imported and where the installation is to be carried out. In the event Seller is required to pay any such tax or charge, the tax or charge will be added to the invoice as a separate charge and Buyer shall reimburse Seller for the payment.

6. TERMS OF PAYMENT

6.1 The payments shall be made in accordance with the payment schedule specified in the Agreement.
6.2 Whenever any part of the payment is to be made by means of a Documentary Credit, Section 23. shall apply.
6.3 If Buyer delays making any payment or in the establishment of the Documentary Credit or if it becomes evident that the Buyer will not fulfil his contractual obligations, Seller may postpone the fulfilment of its obligations until such a payment is made or the Documentary Credit is established.
6.4 Seller shall be entitled to charge interest from Buyer if payment to Seller is past due. The rate of the interest is the highest rate permissible under the applicable law. The interest shall be counted from the due date until the actual date of the payment. Buyer shall pay such interest within thirty (30) days from the date of the respective invoice.
6.5 If Buyer has not paid the amount due within three months Seller shall be entitled to terminate the Agreement by notice in writing to Buyer and to claim compensation for the loss it has incurred.

7. STANDARDS OF MANUFACTURING AND DESIGN

The Equipment supplied and the work carried out shall be in accordance with the technical standards commonly used in Seller's country. If the Equipment shall be operated outside of Seller`s country, the scope of the work agreed in the Agreement shall prevail. The Seller shall not take into consideration laws and regulations prevailing at the place of operation, if they are not agreed in the Agreement. Buyer shall inform Seller of the applicable safety regulations. Any costs in excess of the costs of compliance with European standards resulting from mandatory local laws and regulations shall be added to the price and paid by Buyer.

8. INSPECTIONS DURING MANUFACTURING

Buyer has the right at its own expense, subject to agreement with the Seller as to the time and place, to inspect the progress of manufacture and the quality of the Equipment. The inspections of the Equipment shall be carried out at Seller's works or at the place of manufacturing. Inspection carried out by Buyer is not a precondition to the delivery of the Equipment.

9. DELIVERY TERM AND PASSING OF THE RISK

9.1 Any agreed delivery term shall be construed in accordance with INCOTERMS 2010. If no delivery term is specifically agreed, the delivery term shall be Ex works Seller's manufacturing plant (EXW).
9.2 The risk of loss of or damage to the Equipment shall pass from Seller to Buyer in accordance with the agreed delivery term. If no delivery term is set forth in the Agreement, the risk of loss shall pass to Buyer Ex Works Seller's manufacturing plant.

10. DELIVERY TIME

10.1 The delivery time shall start to run on the latest to occur of
(a) the date of execution of the Agreement by Seller;
(b) the date of receipt by Seller of the agreed down payment as set forth in the Agreement; or;
(c) the date of receipt by Seller of all agreed information and approval by Buyer of the general arrangement drawings.

10.2 Seller shall be entitled to a reasonable extension of the delivery time (which shall not be less than the length of the delay) if the delivery is delayed due to Buyer's actions or actions by a third party under the control of Buyer, such as modifications requested by Buyer, delay in the approval of the relevant drawings, delay in the preparing work at the erection site and delay in payments, or it becomes evident that the Buyer will not fulfil his contractual obligations.

11. TRANSFER OF PROPERTY

11.1 Notwithstanding Section 9.1, the Equipment shall remain Seller's property until the total purchase price has been paid. In the event the applicable laws do not permit Seller to retain title, Seller shall be entitled to a security interest or charge in the property. Buyer shall give Seller every assistance in securing an interest in the property or taking any measure required to protect Seller's title or such other rights. The retention of title, security interest or charge shall not affect the passing of risk of loss under Section 9.
11.2 Seller shall retain title to any software and documentation.

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To the extent that such software and documentation are included in the scope of delivery, then Buyer shall receive a royalty-free, non-exclusive and non-transferable license to use such software and documentation only in connection with the Equipment and for no other purpose whatsoever.

12. ACCEPTANCE TESTS

12.1 Should the Agreement require separate acceptance tests, the tests shall be carried out in accordance with the Agreement. If the Agreement does not specify the requirements, the tests shall be carried out in accordance with general practice in the industry in the country of manufacture.

12.2 Seller shall notify Buyer of the tests on sufficient time to permit the Buyer to be represented. If Buyer is not represented, the test report shall be sent to Buyer and shall be deemed accepted as accurate.

12.3 If the tests show the Equipment not to be in accordance with the Agreement, the Seller shall without delay remedy any deficiencies in order to ensure that the Equipment complies with the Agreement. New tests shall then be carried out at Buyer's request, unless the deficiency was insignificant.

12.4 Seller shall bear its own costs for tests carried out at the place of manufacture. Buyer shall bear all its own costs, including but not limited to travelling and living expenses for Buyer's representatives in connection with such tests.

13. FINAL ACCEPTANCE

13.1 Should the Agreement require separate acceptance, the Equipment is deemed to be finally accepted when acceptance tests have been carried out and the Equipment is found to be in accordance with the Agreement. Minor defects do not prevent the acceptance of the Equipment. Such defects shall be listed and Seller shall remedy any listed deficiencies without delay. If acceptance tests are not to be carried out, the Equipment is deemed to be delivered and taken over when delivered in accordance with the delivery term specified in Section 9.

13.2 If the acceptance has been agreed, the acceptance is to be made without delay after the notification of readiness for acceptance. If the acceptance is not carried out in due time or completely, the Equipment is deemed to be finally accepted seven (7) days after the notification of readiness for acceptance.

13.3 Buyer is not entitled to take the Equipment into use before final acceptance. If Buyer takes the Equipment into use before final acceptance without Seller's consent, the Equipment is deemed to be finally accepted.

13.4 In the cases specified in Section 13.2 and 13.3 the Seller is entitled to invoice the Equipment from the Buyer and the period of warranty shall start to run.

14. WARRANTY

14.1 Seller warrants that to the best of its knowledge the Equipment is free from defects caused by faulty design, materials or workmanship, which would prevent the electrical or mechanical functioning of the Equipment. The cost of disassembling and installing a repaired or replaced part furnished under this warranty is excluded.

14.2 These warranty conditions apply to the Equipment named in this Agreement. The warranty applies for the original Buyer and for later owners who have acquired the Equipment within 6 months from the delivery date to Buyer.

14.3 The period of the warranty for any part of the Equipment is the earliest of

(i) twelve (12) months from the date of the delivery of the Equipment in accordance with applicable delivery term or

(ii) 2000 operating hours whichever expires earlier.

14.4 The warranty period for replaced or repaired parts is twelve (12) months from the date of repair or replacement. However, no warranty for any parts shall apply after twenty-four (24) months from the delivery of the Equipment.

14.5 Seller provides a warranty on genuine spare parts for 6 months counted from the date of delivery. The Seller does not reimburse labor costs or other costs referable to the replacement or repair of a defected spare part. Otherwise, the same warranty conditions apply in applicable parts as for new Equipments.

14.6 Should defects occur during the period of this warranty, The Seller or its authorized dealer will, at its option, either repair the defects or supply the correct parts free of charge. The defected parts of the Equipment shall on request of Seller be sent to Seller together with a claim report according to Section 13.7 below. In case the parts have not been defected, Buyer will cover all the costs including, but not limited to repair, replacement and/or sending costs.

14.7 Claims must be reported in writing to the Seller within 45 days after the alleged fault has been discovered. Claims must always include information concerning the Equipmnent's serial number, type designation, and date of delivery and total hours of operation. In addition, a complete description of the nature of the fault must be given.

14.8 This warranty is given on the condition that the Equipment is in all respects operated, handled, serviced and maintained properly, in accordance with the Seller's instructions and under specified operating conditions. Excluded from the warranty are those parts including spare parts

a) To which repair or replacement becomes necessary due to normal wear, tear and corrosion;
b) To which repair of replacement becomes necessary due to the overloading of the Equipment
c) Which are used for purposes other than for those intended by Seller and has not otherwise been used in an inappropriate manner,
d) Which are exhaustible items, including but not limited to such items as bulbs and fuses;
e) Which are not approved by Seller
f) On which repairs, alterations or adjustments have been performed or begun by Buyer or any third party without Seller's previous consent;
g) Which failures are not promptly reported to Seller within the warranty period above;
h) Which failures or damage are due to negligence other than that of Seller, included but not limited to accident, abuse, improper installation (other than installations made by the Seller), improper operation, or abnormal conditions of temperature, moisture, dirt, corrosive matter, dust or other similar type of reason;
i) Which have been damaged otherwise without the fault of Seller.

14.9 The delivery inspection, warranty service and other services specified in the service manual have been carried out by Seller or by a dealer or service workshop authorized by the Seller.

If the Buyer and Seller have agreed on a longer warranty period (called also extended warranty) such an extended warranty is subject to these Terms and additionally:

(i) The extended warranty covers only the main components including engine, transmission, drive axle, hydraulic pumps, valves and cylinders, electric control units and structural parts

(ii) It is to be noted that the extended warranty does not cover

On bolded items, for example, turbo alternator, starter, water pump, sensors, hydraulic hoses, connections, seals, solenoids, electrical cabling, plugs, switches, fan and wiper motors.

(iii) The warranty period for replaced or repaired parts during the warranty period is limited to the machine warranty.

14.10 THIS IS THE SOLE AND EXCLUSIVE WARRANTY GIVEN BY SELLER TO BUYER WITH RESPECT TO THE EQUIPMENT AND IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESS OR IMPLIED ARISING BY OPERATION OF LAW OR OTHERWISE, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

15. FORCE MAJEURE

Either party shall be entitled to suspend performance of its obligations under the Agreement to the extent that such performance is impeded by circumstances beyond the control of the party, including but not limited to war (whether declared or not), revolution, strikes, failure of supplies of power, fuel,

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transport, equipment or other goods or services, natural disasters, unacceptable weather conditions, acts of government, traffic accidents, export or import prohibitions, fire, explosions, floods, accidents, sabotage, civil commotions, riots, and breakage or loss during transportation or storage as well as delays of deliveries by the subcontractors (when caused by Force Majeure as herein defined).

16. LIQUIDATED DAMAGES OF DELAY OF SELLER

Buyer is entitled to liquidated damages for delay from the date on which the delivery should have taken place in case the delivery is delayed due to Seller's fault. The liquidated damages shall be 0,5 per cent of the price of the delayed portion of the Equipment for each complete week of delay. In no event shall the liquidated damages for delay exceed 5 % of the price of the delayed portion of the Equipment. The Buyer shall forfeit his right to liquidated damages if he fails to claim liquidated damages by written notice within one (1) month after the date when the delivery took place. The Liquidated damages referenced in this Article shall be the sole and exclusive remedy for such delay. The parties agree that such liquidated damages are a reasonable estimate of the damages Buyer is likely to incur as a result of such delay.

17. LIQUIDATED DAMAGES OF DELAY OF BUYER

If any part of the delivery or the acceptance of the Equipment is delayed due to reasons not caused by Seller, the risk of loss passes to Buyer and he pays the liquidated damages in the amount of 0.5% of price of the delayed portion of Equipment for each complete week of delay, starting 14 days after notification of the readiness for shipment or acceptance, where the liquidated damages are limited to 5% of the price of the delayed portion of Equipment, unless higher costs or damages can be proven by Seller. The Buyer shall compensate any additional expenses incurred by Seller due to delay.

18. REPORTING

18.1 If separately agreed the Seller shall deliver reporting services by collecting data on the Equipment and its operation through remote data connection. The Buyer has the right to prohibit such collection of data at any time. Despite of such prohibition the Buyer is obliged to pay the agreed charges till the end of contract period.

18.2 The Seller reserves the right to use and develop data generated for reporting services for its general research and development of equipment and for delivering services to the Buyer.

18.3 The Seller shall not monitor, inspect or otherwise follow any Equipment, equipment usage data, report including equipment usage data or other information that is generated by using a separate unit, data connection and/or otherwise. Any such equipment usage data, report and/or other data shall be created and provided to the Buyer on “as is” and as available basis and without warranties of any kind either express or implied made in relation to the correctness, accuracy or reliability of such equipment usage data, report and/or other data.

19. LIMITATION OF LIABILITY

SELLER'S LIABILITY UNDER THE AGREEMENT SHALL BE LIMITED TO THE AMOUNT OF THE ACTUAL DIRECT DAMAGES INCURRED BY BUYER OR TO THE PRICE PAID BY BUYER TO SELLER FOR THE EQUIPMENT OR TO THE REPLACEMENT OF THE EQUIPMENT, WHICHEVER IS THE LOWEST. BUYER SHALL BE ENTITLED TO NO OTHER REMEDY REGARDLESS OF THE FORM OF CLAIM OR CAUSE OF ACTION, WHETHER BASED IN AGREEMENT, NEGLIGENCE, STRICT LIABILITY OR OTHERWISE.

IN NO EVENT SHALL SELLER BE LIABLE FOR ANY SPECIAL, PUNITIVE, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO, LOSS OF PRODUCTION, LOSS OF PROFIT, LOSS OF USE, OR LOSS OF AGREEMENTS.

20. EXPORT LAWS AND REGULATIONS

20.1 The Buyer will comply with all applicable international, country specific, federal, state and local export, re-export and trade laws, rules and regulations in relation to the Equipment (Trade Laws and Regulations). Besides the other applicable laws and regulations, the Trade Laws and Regulations of the United Nations, European Union and the United States of America are always applicable.

20.2 For the avoidance of doubt, the Equipment also includes all related software.

20.3 Prior to any transfer of the Equipment to a third party or use of the Equipment provided by the Seller, the Buyer shall in particular check and guarantee by appropriate measures that:

a) The Buyer shall not infringe any applicable Trade Laws and Regulations, also considering the prohibitions of by-passing those embargos;
b) The Equipment is not intended for use in connection with armaments, nuclear technology or weapons, if and to the extent such use is subject to prohibition or authorization, unless required authorization is provided;
c) If required to enable authorities to conduct export checks, the Buyer, upon request by the authorities, shall promptly provide the authorities with necessary information required by mandatory law or regulations.

20.4 The Buyer shall maintain all documentation required under the Trade Laws and Regulations and shall provide the same to the Seller without delay at Seller’s reasonable request. This recordkeeping obligation of the Buyer shall continue for five (5) years from the Final Acceptance of the Equipment.

20.5 The Buyer understands that the requirements and restrictions of the Trade Laws and Regulations vary depending on the product, software, documentation and technical data provided under this Agreement and may change over time and that the Buyer is obliged to know about and comply with such changes.

20.6 The Buyer shall defend, indemnify and hold the Seller harmless from all fines, penalties and all associated expenses arising out of or resulting from any violation by the Buyer of any of its obligations in this paragraph 20.

21. APPLICABLE LAW AND SETTLEMENT OF DISPUTES

21.1 The Agreement shall be governed by and construed in accordance with the laws of Seller's place of incorporation.

21.2 All disputes arising out of or in connection with the present contract shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce by one or more arbitrators appointed in accordance with the said Rules.

21.3 The arbitration shall take place in in Stockholm, Sweden. The language of the arbitration proceedings shall be English.

21.4 Notwithstanding the above, Seller shall be entitled to take action for collecting its receivables from Buyer at the courts of the Buyer's place of domicile.

22. LANGUAGE

All documents and correspondence between Seller and Buyer shall be in English.

23. LETTER OF CREDIT (DOCUMENTARY CREDIT)

23.1 Documentary Credit shall be irrevocable and transferable, it shall allow partial shipments, loading on deck, charter party Bill of Lading and transhipments.

23.2 Documentary Credit shall be established in a form acceptable to Seller not later than 30 days from the date on which the Agreement is executed by Seller and it shall remain valid for a period of at least 30 days after the date of last shipment.

23.3 Documentary Credit shall be issued and confirmed by a first class international bank acceptable to Seller and it shall be payable at sight at the counters of a bank nominated by Seller against presentation of appropriate transport documents and a commercial invoice and/or other documents specified in the Agreement.

23.4 Regardless of any other paragraph of these Terms, if any, If Seller is unable to ship the goods due to any reason outside of its control, the Documentary Credit shall be payable against the forwarding agent's receipt, or, should Buyer fail to name the forwarding agent, against the warehouse receipt.

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23.5 The Documentary Credit shall provide that the rules in the "Uniform Customs and Practice for Documentary Credits (2007 Revision) ICC Publication No. 600" are applicable to the Documentary Credit.
23.6 All charges and expenses, related to the fulfilment of this Contract of Buyer's Bank including opening and extension of Documentary Credit and confirmation commission of the same in the Seller's Bank shall be borne by Buyer. The charges and expenses of Seller's bank, except the confirmation commissioning of Documentary Credit, shall be borne by Seller.

24. NO WAIVER

No course of dealing between either party, ~~and~~ no failure or delay on the part of either party in exercising any right or remedy under the Agreement or no single or partial exercise of any other right or remedy of either party shall operate as a waiver of any such right or remedy.

25. SEPARABILITY; REFORMATION AND AMENDMENTS

25.1 The invalidity or enforceability of any provisions of the Agreement shall not impair the validity or enforceability of any other provisions; provided, however, that the Agreement shall be reformed to the maximum extent permitted by law to carry out the parties' original intention.
25.2 The Agreement may be amended only in writing signed by both parties.

LT 27 Oct 2016

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KONECRANES®
Lifting Businesses™

WARRANTY REGULATIONS FOR NEW KONECRANES LIFTTRUCKS MACHINES (LIFTTRUCKS)

1 SCOPE

These warranty conditions apply to the machine (Machine) named in this warranty certificate and/or specified as agreed in the purchasing agreement. The original warranty period applies for the original Buyer and for later owners.
The warranty does not cover tyre equipment, batteries, fuses, light bulbs or led's or other wear parts of the machine. It does neither cover fluids, filters and unspecified material such as grease, oil, cleaning material.

2 WARRANTY PERIOD

Warranty time is 12 months or 2.000 running hours from date of signing the "Warranty start up report", or as latest 15 months from KLFT invoice date, whichever comes first

The warranty period for replaced or repaired parts during the warranty period is limited to the machine warranty.

3 WARRANTY OBLIGATIONS

Should defects occur during the period of this warranty, LIFTTRUCKS or its authorized dealer will, at its option, either repair the defects or supply the correct parts free of charge. The defective parts of the Machine shall on request of LIFTTRUCKS be sent to LIFTTRUCKS together with a claim report according to clause 4 below. In case the parts are not defective, the Buyer will cover all the costs including, but not limited to, repair, replacement and/or shipping costs.

4 CLAIMS

Claims must be reported in writing or via Konecranes Warranty OnLIne (WOL) system to LIFTTRUCKS within 45 days of discovery of the alleged fault. Claims must always include information concerning the machine's serial number, type designation, and date of delivery and total hours of operation. In addition, a complete description of the nature of the fault must be given.

5 FAULTS

This warranty is given on the condition that the Machine is in all respects operated, handled, serviced and maintained properly, in accordance with LIFTTRUCKS instructions and under specified operating conditions.
Excluded from the warranty are those parts including spare parts, to which repair or replacement becomes necessary due to:

a. Normal wear, tear and corrosion, tyre equipment, batteries, fuses, light bulbs or led's or other wear parts of the machine. It does neither cover fluids, filters and unspecified material such as grease, oil, cleaning material.
b. Overloading of the Machine
c. Which are used for purposes other than for those intended by LIFTTRUCKS and has not otherwise been used in an appropriate manner,
d. Which are exhaustible items, including but not limited to such items as bulbs and fuses;
e. Which are not approved by LIFTTRUCKS
f. On which repairs, alterations or adjustments have been performed or begun by the Buyer or any third party without LIFTTRUCKS previous consent
g. Which failures are not promptly reported to LIFTTRUCKS within the warranty period above
h. Which failures or damage are due to negligence other than that of LIFTTRUCKS, including but not limited to accident, abuse, improper installation (other than installation by LIFTTRUCKS), improper operation, or abnormal conditions of temperature, moisture, dirt, corrosive matter, dust or other similar type of reason;
i. Which have been damaged otherwise without the fault of LIFTTRUCKS.

Further, this warranty is given on the condition that,
The delivery inspection, warranty service and other in Service manual specified services have been carried out by LIFTTRUCKS or by a LIFTTRUCKS authorised dealer or service workshop

6 LIMITATION OF LIABILITY

This is the sole and exclusive warranty given by LIFTTRUCKS to the Buyer with respect to the equipment and is in lieu of and excludes all other warranties, express or implied, arising by operation of law or otherwise, including but not limited to, any implied warranties of merchantability or fitness for particular purpose.

7 SPARE PARTS WARRANTY

LIFTTRUCKS provides a warranty on genuine spare parts for 6 months or 1.000 running hours whichever occurs first, counted from the date of delivery. LIFTTRUCKS does not reimburse labour costs or other costs incurred by the replacement or repair of a defective spare part.

Otherwise, the same warranty conditions apply to applicable parts as for new machines.

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TECHNICAL DATA : SMV 5/6 ECC 90

KONECRANES®
Lifting Businesses™

LIFTING DATA			
Lift capacity / Load center		kg / mm	9 000 / 1 220
Stacking height (of 9'6" / 8'6" containers)			5 / 6
Lifting speed, unloaded / at rated load		m/s	0,68 / 0,61
Lowering speed, unloaded / at rated load		m/s	0,6 / 0,6
DRIVING DATA			
Drive speed forward, unloaded / at rated load		km/h	25 / 25
Drive speed reverse, unloaded / at rated load		km/h	25 / 25
Incline (driving ability) at rated load at 0 km/h/at 2 km/h		%	38 / 29
Towing (power ability) at rated load at 0 km/h/at 2 km/h		kN	168 / 133
SERVICE WEIGHT / AXLE PRESSURE			
Service weight		kg	34 100
Axle pressure front, unloaded / at rated load		kg	21 800 / 35 600
Axle pressure rear, unloaded / at rated load		kg	12 700 / 8 000
ENGINE (electronic controlled)			
Engine make / model name			Cummins QSB-6.7-C260
Emission approval EU / US			Stage 3a / Tier 3
Monitoring / emission controlled / CanBus			Yes / yes / yes
Fuel/type of engine/intercooler			Diesel / 4-stroke / yes
Power ISO 3046 / max speed		kW / rpm	201 / 2 300
Torque ISO 3046 / at speed		Nm / rpm	990 / 1 500
Displacement / No. of cylinders / Type		L / /	6,7 / 6 / Inline
Fuel consumption, normal drive		L/h	10 – 12
Alternator, type/power / capacity		/ W / Amp	AC / 1 960 / 70
Starting battery, voltage/capacity		V / Ah	2 x 12 / 88
TRANSMISSION (electronic controlled)			
Transmission make / model name			DANA TE-17
Monitoring / reverse protection / CanBus			Yes / yes / yes
Clutch, type			Torque converter
Transmission type / type of shift gear			Softshift – Powershift / Automatic
No. of gears, forward/reverse			3 / 3
DRIVE AXLE & BRAKE SYSTEM			
Drive axle make / model name			Kessler D81
Drive axle type / drive axle width		/ mm	Differential + hub reduction / 4 060
Service brake system, type / affected wheels			Oil cooled Wet Disc Brakes / drive wheels
Parking brake system, type / affected wheels			Dry disc brake / spring release / drive wheels
STEER AXLE & STEER SYSTEM			
Steer axle type / steering system			Double acting cylinder / hydraulic servo assisted
WHEELS			
Number of wheels, front + rear / type (*driven)			4*+2/pneumatic
Tire pressure front / rear		MPa	0,9 / 0,9
Tire dimensions (Ply rating) front / rear		Inch (No)	12.00 x 24" (PR 20) / 12.00 x 24" (PR 20)
Rim dimension front / rear		Inch	10.00 x 24"/HD / 10.00 x 24"/HD
HYDRAULIC SYSTEM			
Hydraulic pump make / model name			Parker & Hannifin / P2-series
Hydraulic system / pump type			Load sensing system / variable piston pump
Power-on-demand / Low energy			Yes / yes
Hydraulic oil pressure mast / spreader		MPa / MPa	18 / 15
TANK VOLUMES			
Diesel tank volume		L	400
Hydraulic tank volume		L	430
LIFT EQUIPMENT & SPREADER			
Lift mast model / mast type / design			Duplex standard / 2-stage / free visibility
Spreader make / model name			ELME 588TB
Spreader type / capacity			Sidelift telescopic / 20-40 ft containers
Spreader locking type / No. of containers			2 x top twist locks / 1
Sideshift stroke		mm	± 300
Pile Slope type / pile slope stroke (side tilt)		/ mm	Mechanical MPS / 0 - 200)
OTHERS			
Noise level (inside Cab / Lm)	DIN 45635	dB(A)	68
Noise level (inside Cab/ LpAZ)	EN 12053	dB(A)	75
Noise level (outside at 7 m/ Lwa)	2005/88/EC	dB(A)	110
NORMS & STANDARDS			
Machine Directive in Europe	2006 / 42 / EC		Yes
Stability of Industrial Trucks	ISO 1074		Yes
Safety of Industrial trucks	EN ISO 3691-1		Yes

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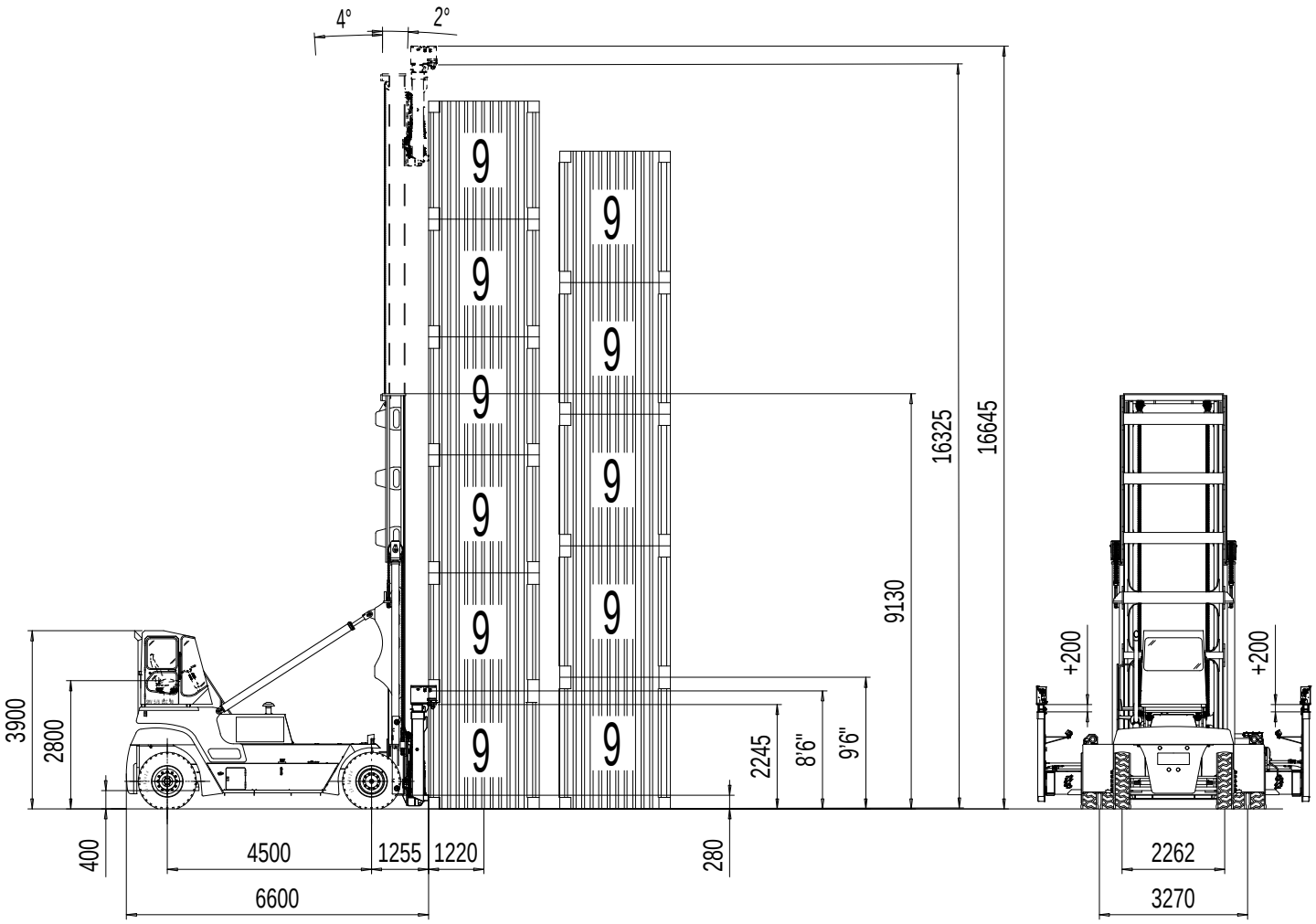

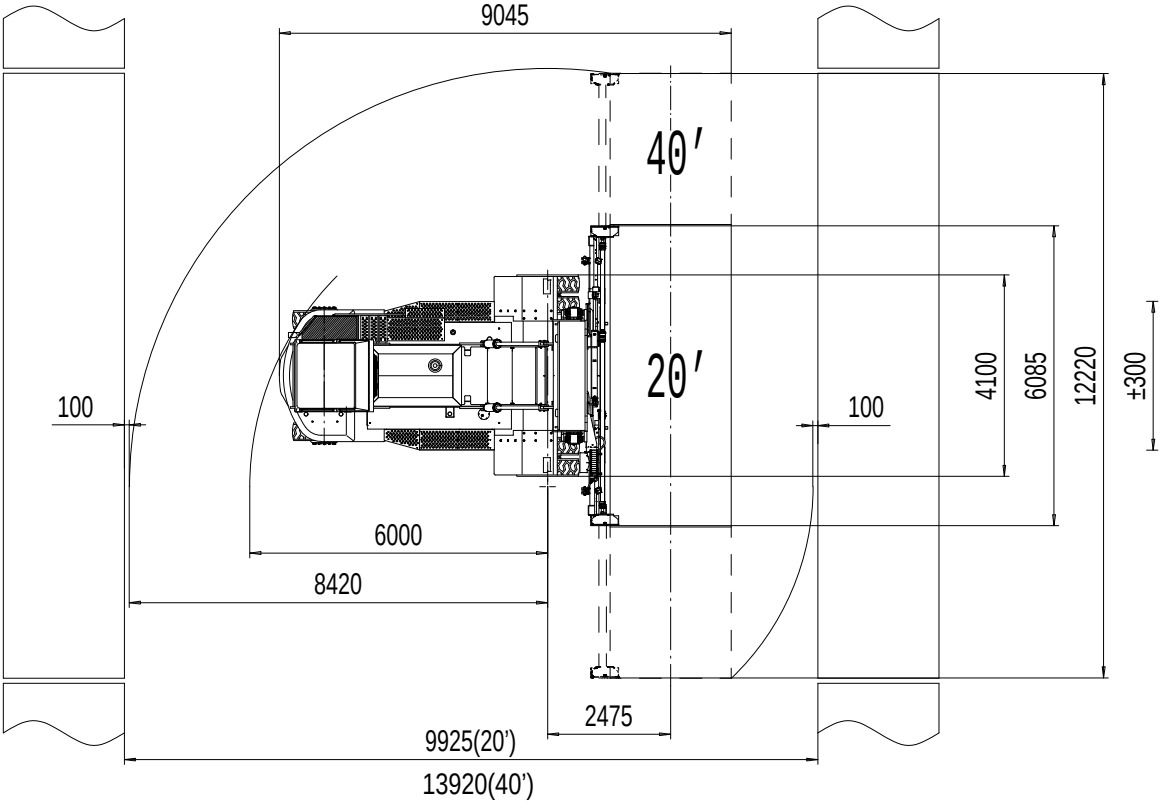

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QUOTE

QUOTE NUMBER:	QUO0000003605
MODEL:	SMV 7/8 ECC 90
CUSTOMER:	L&T Infrastructure Engineering Ltd.
DATE:	2017-12-14

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Dear Mr. Sanish.A.

We trust you will find this quotation of interest and we look forward to hear from you. For further information, do not hesitate to contact us.

With kind regards,

Tobias Nilsson
Konecranes Lifttrucks AB

Date of quote	2017-12-14
Company name	L&T Infrastructure Engineering Ltd.
Address	Triton Square 4th Floor (SKCL Buiding), No. C3-C7, Thiru Vi Ka Industrial Estate, Guindy, Chennai -600 032 India
Attention	Mr. Sanish. A
Email	asa@lntiel.com
Phone	
Konecranes Lift Trucks contact	Tobias Nilsson
Email	tobias.nilsson@konecranes.com
Phone	+46 433 733 84
Address	Konecranes Lifttrucks AB

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5 REASONS TO CHOOSE KONECRANES

1 Global footprint

Operations at over 600 locations. in more than 120 countries worldwide and served by a broad distributor network.

2 Optima – The best cabin on the market

Every detail has been carefully designed for comfort and safety. Controls, displays, ventilation and seating work to boost driver productivity. Excellent visibility in all directions.

3 Smart Connected Lift Trucks

Remote monitoring is a key toward a more productive, efficient and safe workplace. With TRUCONNECT you get more out of your lift trucks.

4 Smarter where it matters

Years of experience has proven that the combination of high quality components and cutting edge technology together with low running costs results in a lower total cost of ownership.

5 Your uptime, our focus

The Konecranes group has the largest service organization in the world. A global and local network of maintenance professionals ensures that your machines have the optimal uptime. 24/7 spare parts supply from distribution centers worldwide.

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SMV 7/8 ECC 90 – Empty Container Handler

Standard features:

- Box type chassis, bolted tanks, mud guards, 2+2 lift eyes
- Access steps on both sides, steps & hand rails on cabin left side
- Kessler drive axle D81 (W=4060 mm)
- Engine air filter std. 2-stage with element, insert & indicator
- DANA Automatic Transmission TE-17300
- Load-sensing hydraulic system (variable piston pumps), return filter (10 µm)
- Hydraulic functions for lifting & spreader, 1 joystick
- Accumulator for lift mast 1 pressure (shock absorbing)
- El. system 24V, monitoring, CanBus, 7" colour display MD4
- LED Lamps (position-brake-blinkers) & LED Working Lamps (2 mudguard, 2 mast, 2 reverse)
- EMC Master incl. MD4-controller with 7" color touch display (A)
- EMC 106 Full Monitoring (engine, transmission, hydraulics, levers/joystick & service)
- EMC 114 Electronic servo joystick (incl. Auto accelerator/power control)
- EMC 123 ECO Drive module (fuel measure functions & settings)
- EMC 124 Driver login module (max 20 logins)
- EMC 125 Data logger module (alarms + errors)
- EMC 129 Productivity hour counter (Idle-neutral-driving)
- Cabin Optima (L x W x H = 1605 x 1480 x 1620 mm)
- Fixed cabin , 1 joystick, ventilation, 3 wipers
- Sliding window (left & right), inside rear mirror (right)
- Seat BeGe 9200 Mechanical spring (4 settings, high back)
- Safety belt, 2-point, waist model
- El. connection 24V / 7.5A / 12.5mm plug front of dashboard right side
- Clothes hangers (2x) on rear cabin pillar (left + right side)
- Duplex 7/8, LH min-max=2245-21525, BH min-max=11730-21845 mm
- Sidelift, sideshift, MPS mechanic pile slope 0-200 mm
- 588TB Sidelift single stacker, 20-40ft, top twistl, sideshift
- Drive & steer (4 + 2) 12.00x24"/PR20 Diagonal
- Lightgrey, Cab & engine hood, RAL 7035
- Black, Lift equipment & axles. RAL 7021
- Seagreen, Chassis, tanks, mudguards, CW, NCS S2555 B30G
- Doc set - Instruction Books & Operator's Manual
- Doc set - Spare Parts Catalogue

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Optional features:

	Quantity
• Cummins QSB-6.7-C260 (201 kW, 990 Nm, 6.7 L, EU 3a/EPA 3)	1
• Engine air filter Turbo II	1
• Acoustic signal when reversing (reverse alarm)	1
• Warning beacon LED (fixed mounting - on cab roof)	1
• Automatic Climate Control (stepless and pollen filter)	1

Local options

	Quantity

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00. General Information, Standards & Norms:

The empty container handler is designed and built in accordance with the current legislations and norms, which are described below:

2006 / 42 / EC..... Machine Directive in Europe
ISO 10525..... Stability for Container Handling Trucks
EN ISO 3691-1 ..... Safety for Industrial Trucks
ISO 3046..... Engine power, torque, fuel & emission norm
EN 12895..... Electro Magnetic Compatibility approvals (EMC)
EN 13564..... Visibility norm for driver
EN 13059..... Vibration norm for driver
EN 12053..... Noise level norm (DIN 45635 inside cab)

10. Chassis. Heavy Duty "Box-Type"

The chassis is made with long life time, low concentration of stress, and a high torsion strength in mind. This is possible through the high-strength rectangular design that is built from 2 longitudinal welded box sections with powerful cross members. The front end of the chassis is made even stronger by reinforcements with thick steel plates, support plates and brackets, and the container lift truck gets additional safety and strength from reinforced tilt cylinder fixations. All fixation points for vital main components, including drive axle, steer axle and lift mast, have very powerful fixation points which together with the design gives a durable and rigid chassis.

20-30. Drive Line (Engine, Transmission, Drive and Steer axles):

3.1 The engine is certified low-emission CanBus diesel, with turbo charger, air-to-air intercooler, fuel injection, common rails technology with high capacity cooling system.
The automatic transmission is bolted directly to the engine and connected via flexible steel plates. Automatic gear shifting with hydraulic operation and electronic control, the softshift type gives safe and smooth driving performance.
3.2 The Kessler axle has a two-stage reductions and integral "Wet Disc Brakes". The two-stage reduction reduces stresses in the axle transmission system. The "Wet Disc Brakes" system for service brakes are mounted in each hub with multiple brake discs.
3.3 Strong welded steer axle of sandwich design in wide version, mounted in two (2) long life bushings between chassis and axle. Mechanical side stops between axle and chassis for best side stability.
Hydrostatic power steering with double acting single cylinder.

Engine model	**Power (kW/rpm)**	**Torque (Nm/rpm)**	**Volume (l)**	**EU /EPA**
Cummins QSB-6.7-C260	194 at 2400	987 at 1500	7	Stage 3a / Tier 3

Transmission model:	**Gears (fwd/rev):**	**Automatic / Manual shifting:**
Dana TE-17300	3 / 3	Yes / Yes

40. Smart Load Sensing Hydraulic System (low-energy):

Low energy consumption is reached with the "power-on-demand" function that builds up Konecranes load sensing hydraulic system. The system is based on the latest technology from Parker & Hannifin and is designed to work together as one unit. We use the same components in all our trucks and stackers which means that all of them includes powerful and silent running variable piston pumps, accurate proportional valves, efficient valve regulators and electronic controls.

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45. Electrical System:
The 24V electrical system is designed and EMC-approved according to EN 12895.

Standard LED road lighting configuration:

- 2 x head lights on front mudguards
- 2 x position lights on front mudguards
- 2 x working/reverse lights
- 2 x tail lights
- 2 x brakes lights
- 4 x direction blinkers
- 2 x working lights in the mast
- 4 x working lights on the spreader at the twistlocks (20ft/40ft position)
- 2 x inside cabin lamp
- 1 x electric horn
- 1 x main power switch

49. Electronic Control & Monitoring System (EMC):
To optimize performance and efficiency in the truck it come equipped with an electronic control and monitoring system that gives the operator a unique possibility to control and monitor the performance of the lift truck or fleet.

EMC functions included in the basic package:

- MD4 controller with 4 CanBus interfaces (engine, transmission and truck). Full colour touch display (7”).
- EMC 106; Full monitoring of engine, transmission, hydraulics, levers and service.
- EMC 114; Electronic joystick (incl. auto accelerator/power control)
- EMC 123; ECO Drive module (fuel measure & monitoring incl. settings.
- EMC 124; Driver login module (Max. 20 logins)
- EMC 125; Data logger module (alarms + errors).
- EMC 129; Productivity hour counter.

50. OPTIMA – Drivers Cabin:

Remarkable visibility

Visibility is very difficult to measure objectively: you just know it when you see it. When you sit down in OPTIMA, you will see what visibility from a lift truck really means.

- The remarkable visibility is made possible by very large, lowered windows with no corner posts, thin but very strong roof cross member, and curved panes.
- New EMC Master with MD4 7” touch screen enables a more spacious cabin with its integrated solutions. There is also more space for operating the foot pedals.
- The positioning of the instrumentation improves operating ergonomics; the instrumentation has been moved from the driver’s left side to his right, above his seat, where it is conveniently accessible.
- OPTIMA is customizable for your exact operational needs. You can select levers or joystick, mini-wheel steering, the driver’s seat and precisely the instrumentation you need.

60. Lift Mast (wide – high stability):
The Konecranes lift mast is designed for maximum strength and stability. The heavy-duty lift masts are of 2-stage design and the structures welded in high quality steel, with large cross section areas and strong profiles. Cross members of thick profiles and support plates sits between the mast channels, and strong roller bearings and side roller bearings are located between the outer and inner mast, and between the inner mast and the carriage.

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75. Container Spreader:
Side lift spreader ELME, for empty ISO containers.

85. Wheels (Tires & Rims):

Drive tires:	12.00 x 24" (PR 20)	(4x)
Drive rims:	10.00 x 24"/HD	(4x)
Steer tires:	12.00 x 24" (PR 20)	(2x)
Steer rims:	10.00 x 24"/HD	(2x)

90. Colour & Painting:

Lightgrey, Cab & engine hood, RAL 7035
Black, Lift equipment & axles. RAL 7021
Seagreen, Chassis, tanks, mudguards, CW, NCS S2555 B30G

95. Documentation:
The standard package includes the following: Operator's Manual, Maintenance Manual, Spare Parts Catalogue, Machine Card, Warranty/Start-up Protocol, Engine Operator's Manual.

100. Warranty:
Warranty according to Konecranes standard or extended warranty conditions. For further information, see warranty documentation.

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SWEDEN.

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info.lifttrucks@konecranes.com
Web
www.kclifttrucks.com

VAT
SE556142496001

1. DELIVERY SCHEDULE
Approx. 18-20 weeks Ex. works after fully clarified order.
Lead time can possible be improved at the time of order

2. DELIVERY TERMS
Seller shall deliver the Equipment on the delivery terms:
CIF Cost Insurance and Freight (INCOTERMS 2010)

3. PAYMENT TERMS
Customer shall pay the price as follows:
I - Against Letter of Credit

4. GENERAL TERMS AND CONDITIONS
This offer shall be subject to Seller's General Terms and Conditions attached hereto and available upon request and incorporated as if fully rewritten herein:
General Terms and Conditions of Sale (KC LT October 2016).

5. VALIDITY OF OFFER
This offer is valid until 2018-01-31.

6. WARRANTY
Warranty 12 months / 2000 hours (whichever comes first)

7. CURRENCY CLAUSE
Prices are based on a fixed currency (USD/EUR). If the currency exchange rate is changed more than 2%, we reserve the right to adjust the prices.

OTHER SERVICES

Price

EUR 260,000

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GENERAL TERMS AND CONDITIONS OF SALE-LIFTRUCKS

1. APPLICATION OF THESE TERMS

These Terms and Conditions of Sale ("Terms") shall apply to any tender and any contract of sale ("Agreement"), unless the parties agree otherwise in writing. Modifications of or amendments to these Terms must be agreed in writing. We object to any other or different terms and conditions than these even if we have not made an expressly objection. In the event of any inconsistency between the Agreement and these Terms, the Agreement shall govern.

2. SCOPE OF DELIVERY

2.1 The delivery of the equipment ("Equipment") includes all components, materials and services expressly specified in the Agreement.
2.2 The delivery includes Seller's standard technical documents, such as spare part lists, operating manuals, erection instructions (if the erection is not included in the scope of delivery) and main dimension drawings in English. Seller shall not be obliged to provide manufacturing drawings for the Equipment or spare parts.
2.3 Design, work at site, erection, supervision of erection, training services, start-up assistance and materials are included to the extent they are expressly specified in the Agreement.

3. DOCUMENTATION

3.1 The Seller shall have all rights, title and interest including ownership right, copyright and other intellectual and industrial property rights to documents, drawings, software, reports, technical information, definitions, descriptions, manuals and any other intellectual property that the Seller has or creates.
3.2 Documents, drawings, software, reports, technical information, definitions, descriptions, manuals and any other intellectual property received by the Buyer shall not, without the consent of the Seller, be used for any other purpose than for the erection, commissioning, operation or maintenance of the Equipment. They may not otherwise be used or copied, reproduced, transmitted or communicated to a third party. The Seller may, however transmit the documents or software to a third party that the Seller sells the Equipment to.

4. PACKING AND MARKING

The Equipment shall be packed in accordance with Seller's standard packing procedures as required for transportation under normal transport conditions. The Equipment shall be clearly marked and carry the necessary information concerning Buyer's identification and place of destination.

5. PRICE

5.1 In addition to the price set forth on the Agreement, Buyer shall be responsible for additional charges as set forth in these Terms.
5.2 If any part of the delivery of the Equipment is delayed due to reasons caused by Buyer or any third party under the control of Buyer, Buyer shall compensate any additional expenses incurred by Seller due to the late delivery.
5.3 Prices do not include any stamp duty, turnover or value-added tax, bank charges or any other similar taxes, duties or charges payable in the country into which the Equipment is to be imported and where the installation is to be carried out. In the event Seller is required to pay any such tax or charge, the tax or charge will be added to the invoice as a separate charge and Buyer shall reimburse Seller for the payment.

6. TERMS OF PAYMENT

6.1 The payments shall be made in accordance with the payment schedule specified in the Agreement.
6.2 Whenever any part of the payment is to be made by means of a Documentary Credit, Section 23. shall apply.
6.3 If Buyer delays making any payment or in the establishment of the Documentary Credit or if it becomes evident that the Buyer will not fulfil his contractual obligations, Seller may postpone the fulfilment of its obligations until such a payment is made or the Documentary Credit is established.
6.4 Seller shall be entitled to charge interest from Buyer if payment to Seller is past due. The rate of the interest is the highest rate permissible under the applicable law. The interest shall be counted from the due date until the actual date of the payment. Buyer shall pay such interest within thirty (30) days from the date of the respective invoice.
6.5 If Buyer has not paid the amount due within three months Seller shall be entitled to terminate the Agreement by notice in writing to Buyer and to claim compensation for the loss it has incurred.

7. STANDARDS OF MANUFACTURING AND DESIGN

The Equipment supplied and the work carried out shall be in accordance with the technical standards commonly used in Seller's country. If the Equipment shall be operated outside of Seller`s country, the scope of the work agreed in the Agreement shall prevail. The Seller shall not take into consideration laws and regulations prevailing at the place of operation, if they are not agreed in the Agreement. Buyer shall inform Seller of the applicable safety regulations. Any costs in excess of the costs of compliance with European standards resulting from mandatory local laws and regulations shall be added to the price and paid by Buyer.

8. INSPECTIONS DURING MANUFACTURING

Buyer has the right at its own expense, subject to agreement with the Seller as to the time and place, to inspect the progress of manufacture and the quality of the Equipment. The inspections of the Equipment shall be carried out at Seller's works or at the place of manufacturing. Inspection carried out by Buyer is not a precondition to the delivery of the Equipment.

9. DELIVERY TERM AND PASSING OF THE RISK

9.1 Any agreed delivery term shall be construed in accordance with INCOTERMS 2010. If no delivery term is specifically agreed, the delivery term shall be Ex works Seller's manufacturing plant (EXW).
9.2 The risk of loss of or damage to the Equipment shall pass from Seller to Buyer in accordance with the agreed delivery term. If no delivery term is set forth in the Agreement, the risk of loss shall pass to Buyer Ex Works Seller's manufacturing plant.

10. DELIVERY TIME

10.1 The delivery time shall start to run on the latest to occur of
(a) the date of execution of the Agreement by Seller;
(b) the date of receipt by Seller of the agreed down payment as set forth in the Agreement; or;
(c) the date of receipt by Seller of all agreed information and approval by Buyer of the general arrangement drawings.

10.2 Seller shall be entitled to a reasonable extension of the delivery time (which shall not be less than the length of the delay) if the delivery is delayed due to Buyer's actions or actions by a third party under the control of Buyer, such as modifications requested by Buyer, delay in the approval of the relevant drawings, delay in the preparing work at the erection site and delay in payments, or it becomes evident that the Buyer will not fulfil his contractual obligations.

11. TRANSFER OF PROPERTY

11.1 Notwithstanding Section 9.1, the Equipment shall remain Seller's property until the total purchase price has been paid. In the event the applicable laws do not permit Seller to retain title, Seller shall be entitled to a security interest or charge in the property. Buyer shall give Seller every assistance in securing an interest in the property or taking any measure required to protect Seller's title or such other rights. The retention of title, security interest or charge shall not affect the passing of risk of loss under Section 9.
11.2 Seller shall retain title to any software and documentation.

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To the extent that such software and documentation are included in the scope of delivery, then Buyer shall receive a royalty-free, non-exclusive and non-transferable license to use such software and documentation only in connection with the Equipment and for no other purpose whatsoever.

12. ACCEPTANCE TESTS

12.1 Should the Agreement require separate acceptance tests, the tests shall be carried out in accordance with the Agreement. If the Agreement does not specify the requirements, the tests shall be carried out in accordance with general practice in the industry in the country of manufacture.

12.2 Seller shall notify Buyer of the tests on sufficient time to permit the Buyer to be represented. If Buyer is not represented, the test report shall be sent to Buyer and shall be deemed accepted as accurate.

12.3 If the tests show the Equipment not to be in accordance with the Agreement, the Seller shall without delay remedy any deficiencies in order to ensure that the Equipment complies with the Agreement. New tests shall then be carried out at Buyer's request, unless the deficiency was insignificant.

12.4 Seller shall bear its own costs for tests carried out at the place of manufacture. Buyer shall bear all its own costs, including but not limited to travelling and living expenses for Buyer's representatives in connection with such tests.

13. FINAL ACCEPTANCE

13.1 Should the Agreement require separate acceptance, the Equipment is deemed to be finally accepted when acceptance tests have been carried out and the Equipment is found to be in accordance with the Agreement. Minor defects do not prevent the acceptance of the Equipment. Such defects shall be listed and Seller shall remedy any listed deficiencies without delay. If acceptance tests are not to be carried out, the Equipment is deemed to be delivered and taken over when delivered in accordance with the delivery term specified in Section 9.

13.2 If the acceptance has been agreed, the acceptance is to be made without delay after the notification of readiness for acceptance. If the acceptance is not carried out in due time or completely, the Equipment is deemed to be finally accepted seven (7) days after the notification of readiness for acceptance.

13.3 Buyer is not entitled to take the Equipment into use before final acceptance. If Buyer takes the Equipment into use before final acceptance without Seller's consent, the Equipment is deemed to be finally accepted.

13.4 In the cases specified in Section 13.2 and 13.3 the Seller is entitled to invoice the Equipment from the Buyer and the period of warranty shall start to run.

14. WARRANTY

14.1 Seller warrants that to the best of its knowledge the Equipment is free from defects caused by faulty design, materials or workmanship, which would prevent the electrical or mechanical functioning of the Equipment. The cost of disassembling and installing a repaired or replaced part furnished under this warranty is excluded.

14.2 These warranty conditions apply to the Equipment named in this Agreement. The warranty applies for the original Buyer and for later owners who have acquired the Equipment within 6 months from the delivery date to Buyer.

14.3 The period of the warranty for any part of the Equipment is the earliest of

(i) twelve (12) months from the date of the delivery of the Equipment in accordance with applicable delivery term or

(ii) 2000 operating hours whichever expires earlier.

14.4 The warranty period for replaced or repaired parts is twelve (12) months from the date of repair or replacement. However, no warranty for any parts shall apply after twenty-four (24) months from the delivery of the Equipment.

14.5 Seller provides a warranty on genuine spare parts for 6 months counted from the date of delivery. The Seller does not reimburse labor costs or other costs referable to the replacement or repair of a defected spare part. Otherwise, the same warranty conditions apply in applicable parts as for new Equipments.

14.6 Should defects occur during the period of this warranty, The Seller or its authorized dealer will, at its option, either repair the defects or supply the correct parts free of charge. The defected parts of the Equipment shall on request of Seller be sent to Seller together with a claim report according to Section 13.7 below. In case the parts have not been defected, Buyer will cover all the costs including, but not limited to repair, replacement and/or sending costs.

14.7 Claims must be reported in writing to the Seller within 45 days after the alleged fault has been discovered. Claims must always include information concerning the Equipmnent's serial number, type designation, and date of delivery and total hours of operation. In addition, a complete description of the nature of the fault must be given.

14.8 This warranty is given on the condition that the Equipment is in all respects operated, handled, serviced and maintained properly, in accordance with the Seller's instructions and under specified operating conditions. Excluded from the warranty are those parts including spare parts

a) To which repair or replacement becomes necessary due to normal wear, tear and corrosion;
b) To which repair of replacement becomes necessary due to the overloading of the Equipment
c) Which are used for purposes other than for those intended by Seller and has not otherwise been used in an inappropriate manner,
d) Which are exhaustible items, including but not limited to such items as bulbs and fuses;
e) Which are not approved by Seller
f) On which repairs, alterations or adjustments have been performed or begun by Buyer or any third party without Seller's previous consent;
g) Which failures are not promptly reported to Seller within the warranty period above;
h) Which failures or damage are due to negligence other than that of Seller, included but not limited to accident, abuse, improper installation (other than installations made by the Seller), improper operation, or abnormal conditions of temperature, moisture, dirt, corrosive matter, dust or other similar type of reason;
i) Which have been damaged otherwise without the fault of Seller.

14.9 The delivery inspection, warranty service and other services specified in the service manual have been carried out by Seller or by a dealer or service workshop authorized by the Seller.

If the Buyer and Seller have agreed on a longer warranty period (called also extended warranty) such an extended warranty is subject to these Terms and additionally:

(i) The extended warranty covers only the main components including engine, transmission, drive axle, hydraulic pumps, valves and cylinders, electric control units and structural parts

(ii) It is to be noted that the extended warranty does not cover

On bolded items, for example, turbo alternator, starter, water pump, sensors, hydraulic hoses, connections, seals, solenoids, electrical cabling, plugs, switches, fan and wiper motors.

(iii) The warranty period for replaced or repaired parts during the warranty period is limited to the machine warranty.

14.10 THIS IS THE SOLE AND EXCLUSIVE WARRANTY GIVEN BY SELLER TO BUYER WITH RESPECT TO THE EQUIPMENT AND IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESS OR IMPLIED ARISING BY OPERATION OF LAW OR OTHERWISE, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

15. FORCE MAJEURE

Either party shall be entitled to suspend performance of its obligations under the Agreement to the extent that such performance is impeded by circumstances beyond the control of the party, including but not limited to war (whether declared or not), revolution, strikes, failure of supplies of power, fuel,

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transport, equipment or other goods or services, natural disasters, unacceptable weather conditions, acts of government, traffic accidents, export or import prohibitions, fire, explosions, floods, accidents, sabotage, civil commotions, riots, and breakage or loss during transportation or storage as well as delays of deliveries by the subcontractors (when caused by Force Majeure as herein defined).

16. LIQUIDATED DAMAGES OF DELAY OF SELLER

Buyer is entitled to liquidated damages for delay from the date on which the delivery should have taken place in case the delivery is delayed due to Seller's fault. The liquidated damages shall be 0,5 per cent of the price of the delayed portion of the Equipment for each complete week of delay. In no event shall the liquidated damages for delay exceed 5 % of the price of the delayed portion of the Equipment. The Buyer shall forfeit his right to liquidated damages if he fails to claim liquidated damages by written notice within one (1) month after the date when the delivery took place. The Liquidated damages referenced in this Article shall be the sole and exclusive remedy for such delay. The parties agree that such liquidated damages are a reasonable estimate of the damages Buyer is likely to incur as a result of such delay.

17. LIQUIDATED DAMAGES OF DELAY OF BUYER

If any part of the delivery or the acceptance of the Equipment is delayed due to reasons not caused by Seller, the risk of loss passes to Buyer and he pays the liquidated damages in the amount of 0.5% of price of the delayed portion of Equipment for each complete week of delay, starting 14 days after notification of the readiness for shipment or acceptance, where the liquidated damages are limited to 5% of the price of the delayed portion of Equipment, unless higher costs or damages can be proven by Seller. The Buyer shall compensate any additional expenses incurred by Seller due to delay.

18. REPORTING

18.1 If separately agreed the Seller shall deliver reporting services by collecting data on the Equipment and its operation through remote data connection. The Buyer has the right to prohibit such collection of data at any time. Despite of such prohibition the Buyer is obliged to pay the agreed charges till the end of contract period.

18.2 The Seller reserves the right to use and develop data generated for reporting services for its general research and development of equipment and for delivering services to the Buyer.

18.3 The Seller shall not monitor, inspect or otherwise follow any Equipment, equipment usage data, report including equipment usage data or other information that is generated by using a separate unit, data connection and/or otherwise. Any such equipment usage data, report and/or other data shall be created and provided to the Buyer on “as is” and as available basis and without warranties of any kind either express or implied made in relation to the correctness, accuracy or reliability of such equipment usage data, report and/or other data.

19. LIMITATION OF LIABILITY

SELLER'S LIABILITY UNDER THE AGREEMENT SHALL BE LIMITED TO THE AMOUNT OF THE ACTUAL DIRECT DAMAGES INCURRED BY BUYER OR TO THE PRICE PAID BY BUYER TO SELLER FOR THE EQUIPMENT OR TO THE REPLACEMENT OF THE EQUIPMENT, WHICHEVER IS THE LOWEST. BUYER SHALL BE ENTITLED TO NO OTHER REMEDY REGARDLESS OF THE FORM OF CLAIM OR CAUSE OF ACTION, WHETHER BASED IN AGREEMENT, NEGLIGENCE, STRICT LIABILITY OR OTHERWISE.

IN NO EVENT SHALL SELLER BE LIABLE FOR ANY SPECIAL, PUNITIVE, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO, LOSS OF PRODUCTION, LOSS OF PROFIT, LOSS OF USE, OR LOSS OF AGREEMENTS.

20. EXPORT LAWS AND REGULATIONS

20.1 The Buyer will comply with all applicable international, country specific, federal, state and local export, re-export and trade laws, rules and regulations in relation to the Equipment (Trade Laws and Regulations). Besides the other applicable laws and regulations, the Trade Laws and Regulations of the United Nations, European Union and the United States of America are always applicable.

20.2 For the avoidance of doubt, the Equipment also includes all related software.

20.3 Prior to any transfer of the Equipment to a third party or use of the Equipment provided by the Seller, the Buyer shall in particular check and guarantee by appropriate measures that:

a) The Buyer shall not infringe any applicable Trade Laws and Regulations, also considering the prohibitions of by-passing those embargos;
b) The Equipment is not intended for use in connection with armaments, nuclear technology or weapons, if and to the extent such use is subject to prohibition or authorization, unless required authorization is provided;
c) If required to enable authorities to conduct export checks, the Buyer, upon request by the authorities, shall promptly provide the authorities with necessary information required by mandatory law or regulations.

20.4 The Buyer shall maintain all documentation required under the Trade Laws and Regulations and shall provide the same to the Seller without delay at Seller’s reasonable request. This recordkeeping obligation of the Buyer shall continue for five (5) years from the Final Acceptance of the Equipment.

20.5 The Buyer understands that the requirements and restrictions of the Trade Laws and Regulations vary depending on the product, software, documentation and technical data provided under this Agreement and may change over time and that the Buyer is obliged to know about and comply with such changes.

20.6 The Buyer shall defend, indemnify and hold the Seller harmless from all fines, penalties and all associated expenses arising out of or resulting from any violation by the Buyer of any of its obligations in this paragraph 20.

21. APPLICABLE LAW AND SETTLEMENT OF DISPUTES

21.1 The Agreement shall be governed by and construed in accordance with the laws of Seller's place of incorporation.

21.2 All disputes arising out of or in connection with the present contract shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce by one or more arbitrators appointed in accordance with the said Rules.

21.3 The arbitration shall take place in in Stockholm, Sweden. The language of the arbitration proceedings shall be English.

21.4 Notwithstanding the above, Seller shall be entitled to take action for collecting its receivables from Buyer at the courts of the Buyer's place of domicile.

22. LANGUAGE

All documents and correspondence between Seller and Buyer shall be in English.

23. LETTER OF CREDIT (DOCUMENTARY CREDIT)

23.1 Documentary Credit shall be irrevocable and transferable, it shall allow partial shipments, loading on deck, charter party Bill of Lading and transhipments.

23.2 Documentary Credit shall be established in a form acceptable to Seller not later than 30 days from the date on which the Agreement is executed by Seller and it shall remain valid for a period of at least 30 days after the date of last shipment.

23.3 Documentary Credit shall be issued and confirmed by a first class international bank acceptable to Seller and it shall be payable at sight at the counters of a bank nominated by Seller against presentation of appropriate transport documents and a commercial invoice and/or other documents specified in the Agreement.

23.4 Regardless of any other paragraph of these Terms, if any, If Seller is unable to ship the goods due to any reason outside of its control, the Documentary Credit shall be payable against the forwarding agent's receipt, or, should Buyer fail to name the forwarding agent, against the warehouse receipt.

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23.5 The Documentary Credit shall provide that the rules in the "Uniform Customs and Practice for Documentary Credits (2007 Revision) ICC Publication No. 600" are applicable to the Documentary Credit.
23.6 All charges and expenses, related to the fulfilment of this Contract of Buyer's Bank including opening and extension of Documentary Credit and confirmation commission of the same in the Seller's Bank shall be borne by Buyer. The charges and expenses of Seller's bank, except the confirmation commissioning of Documentary Credit, shall be borne by Seller.

24. NO WAIVER

No course of dealing between either party, ~~and~~ no failure or delay on the part of either party in exercising any right or remedy under the Agreement or no single or partial exercise of any other right or remedy of either party shall operate as a waiver of any such right or remedy.

25. SEPARABILITY; REFORMATION AND AMENDMENTS

25.1 The invalidity or enforceability of any provisions of the Agreement shall not impair the validity or enforceability of any other provisions; provided, however, that the Agreement shall be reformed to the maximum extent permitted by law to carry out the parties' original intention.
25.2 The Agreement may be amended only in writing signed by both parties.

LT 27 Oct 2016

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KONECRANES®
Lifting Businesses™

WARRANTY REGULATIONS FOR NEW KONECRANES LIFTTRUCKS MACHINES (LIFTTRUCKS)

1 SCOPE

These warranty conditions apply to the machine (Machine) named in this warranty certificate and/or specified as agreed in the purchasing agreement. The original warranty period applies for the original Buyer and for later owners.
The warranty does not cover tyre equipment, batteries, fuses, light bulbs or led's or other wear parts of the machine. It does neither cover fluids, filters and unspecified material such as grease, oil, cleaning material.

2 WARRANTY PERIOD

Warranty time is 12 months or 2.000 running hours from date of signing the "Warranty start up report", or as latest 15 months from KLFT invoice date, whichever comes first

The warranty period for replaced or repaired parts during the warranty period is limited to the machine warranty.

3 WARRANTY OBLIGATIONS

Should defects occur during the period of this warranty, LIFTTRUCKS or its authorized dealer will, at its option, either repair the defects or supply the correct parts free of charge. The defective parts of the Machine shall on request of LIFTTRUCKS be sent to LIFTTRUCKS together with a claim report according to clause 4 below. In case the parts are not defective, the Buyer will cover all the costs including, but not limited to, repair, replacement and/or shipping costs.

4 CLAIMS

Claims must be reported in writing or via Konecranes Warranty OnLIne (WOL) system to LIFTTRUCKS within 45 days of discovery of the alleged fault. Claims must always include information concerning the machine's serial number, type designation, and date of delivery and total hours of operation. In addition, a complete description of the nature of the fault must be given.

5 FAULTS

This warranty is given on the condition that the Machine is in all respects operated, handled, serviced and maintained properly, in accordance with LIFTTRUCKS instructions and under specified operating conditions.
Excluded from the warranty are those parts including spare parts, to which repair or replacement becomes necessary due to:

a. Normal wear, tear and corrosion, tyre equipment, batteries, fuses, light bulbs or led's or other wear parts of the machine. It does neither cover fluids, filters and unspecified material such as grease, oil, cleaning material.
b. Overloading of the Machine
c. Which are used for purposes other than for those intended by LIFTTRUCKS and has not otherwise been used in an appropriate manner,
d. Which are exhaustible items, including but not limited to such items as bulbs and fuses;
e. Which are not approved by LIFTTRUCKS
f. On which repairs, alterations or adjustments have been performed or begun by the Buyer or any third party without LIFTTRUCKS previous consent
g. Which failures are not promptly reported to LIFTTRUCKS within the warranty period above
h. Which failures or damage are due to negligence other than that of LIFTTRUCKS, including but not limited to accident, abuse, improper installation (other than installation by LIFTTRUCKS), improper operation, or abnormal conditions of temperature, moisture, dirt, corrosive matter, dust or other similar type of reason;
i. Which have been damaged otherwise without the fault of LIFTTRUCKS.

Further, this warranty is given on the condition that,
The delivery inspection, warranty service and other in Service manual specified services have been carried out by LIFTTRUCKS or by a LIFTTRUCKS authorised dealer or service workshop

6 LIMITATION OF LIABILITY

This is the sole and exclusive warranty given by LIFTTRUCKS to the Buyer with respect to the equipment and is in lieu of and excludes all other warranties, express or implied, arising by operation of law or otherwise, including but not limited to, any implied warranties of merchantability or fitness for particular purpose.

7 SPARE PARTS WARRANTY

LIFTTRUCKS provides a warranty on genuine spare parts for 6 months or 1.000 running hours whichever occurs first, counted from the date of delivery. LIFTTRUCKS does not reimburse labour costs or other costs incurred by the replacement or repair of a defective spare part.

Otherwise, the same warranty conditions apply to applicable parts as for new machines.

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TECHNICAL DATA : SMV 7/8 ECC 90

KONECRANES®
Lifting Businesses™

LIFTING DATA			
Lift capacity / Load center		kg / mm	9 000 / 1 220
Stacking height (of 9'6" / 8'6" containers)			7 / 8
Lifting speed, unloaded / at rated load		m/s	0,68 / 0,61
Lowering speed, unloaded / at rated load		m/s	0,6 / 0,6
DRIVING DATA			
Drive speed forward, unloaded / at rated load		km/h	25 / 25
Drive speed reverse, unloaded / at rated load		km/h	25 / 25
Incline (driving ability) at rated load at 0 km/h/at 2 km/h		%	37 / 28
Towing (power ability) at rated load at 0 km/h/at 2 km/h		kN	168 / 133
SERVICE WEIGHT / AXLE PRESSURE			
Service weight		kg	38 400
Axle pressure front, unloaded / at rated load		kg	24 500 / 38 300
Axle pressure rear, unloaded / at rated load		kg	13 900 / 9 100
ENGINE (electronic controlled)			
Engine make / model name			Cummins QSB-6.7-C260
Emission approval EU / US			Stage 3a / Tier 3
Monitoring / emission controlled / CanBus			Yes / yes / yes
Fuel/type of engine/intercooler			Diesel / 4-stroke / yes
Power ISO 3046 / max speed		kW / rpm	201 / 2 300
Torque ISO 3046 / at speed		Nm / rpm	990 / 1 500
Displacement / No. of cylinders / Type		L / /	6,7 / 6 / Inline
Fuel consumption, normal drive		L/h	10 – 12
Alternator, type/power / capacity		/ W / Amp	AC / 1 960 / 70
Starting battery, voltage/capacity		V / Ah	2 x 12 / 88
TRANSMISSION (electronic controlled)			
Transmission make / model name			Dana TE-17300
Monitoring / reverse protection / CanBus			Yes / yes / yes
Clutch, type			Torque converter
Transmission type / type of shift gear			Softshift – Powershift / Automatic
No. of gears, forward/reverse			3 / 3
DRIVE AXLE & BRAKE SYSTEM			
Drive axle make / model name			Kessler D81
Drive axle type / drive axle width		/ mm	Differential + hub reduction / 4 060
Service brake system, type / affected wheels			Oil cooled Wet Disc Brakes / drive wheels
Parking brake system, type / affected wheels			Dry disc brake / spring release / drive wheels
STEER AXLE & STEER SYSTEM			
Steer axle type / steering system			Double acting cylinder / hydraulic servo assisted
WHEELS			
Number of wheels, front + rear / type (*driven)			4*+2/pneumatic
Tire pressure front / rear		MPa	0,9 / 0,9
Tire dimensions (Ply rating) front / rear		Inch (No)	12.00 x 24" (PR 20) / 12.00 x 24" (PR 20)
Rim dimension front / rear		Inch	10.00 x 24"/HD / 10.00 x 24"/HD
HYDRAULIC SYSTEM			
Hydraulic pump make / model name			Parker & Hannifin / P2-series
Hydraulic system / pump type			Load sensing system / variable piston pump
Power-on-demand / Low energy			Yes / yes
Hydraulic oil pressure mast / spreader		MPa / MPa	18 / 15
TANK VOLUMES			
Diesel tank volume		L	400
Hydraulic tank volume		L	430
LIFT EQUIPMENT & SPREADER			
Lift mast model / mast type / design			Duplex standard / 2-stage / free visibility
Spreader make / model name			ELME 817-MPS
Spreader type / capacity			Sidelift telescopic / 20-40 ft containers
Spreader locking type / No. of containers			4 x top twist locks / 1
Sideshift stroke		mm	± 800
Pile Slope type / pile slope stroke (side tilt)		/ mm	Mechanical MPS / 0 - 225)
OTHERS			
Noise level (inside Cab / Lm)	DIN 45635	dB(A)	70
Noise level (inside Cab/ LpAZ)	EN 12053	dB(A)	75
Noise level (outside at 7 m/ Lwa)	2000/14/E	dB(A)	110
NORMS & STANDARDS			
Machine Directive in Europe	2006 / 42 / EC		Yes
Stability of Industrial Trucks	ISO 10525		Yes
Safety of Industrial trucks	EN ISO 3691-1		Yes

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www.konecraneslifttrucks.se
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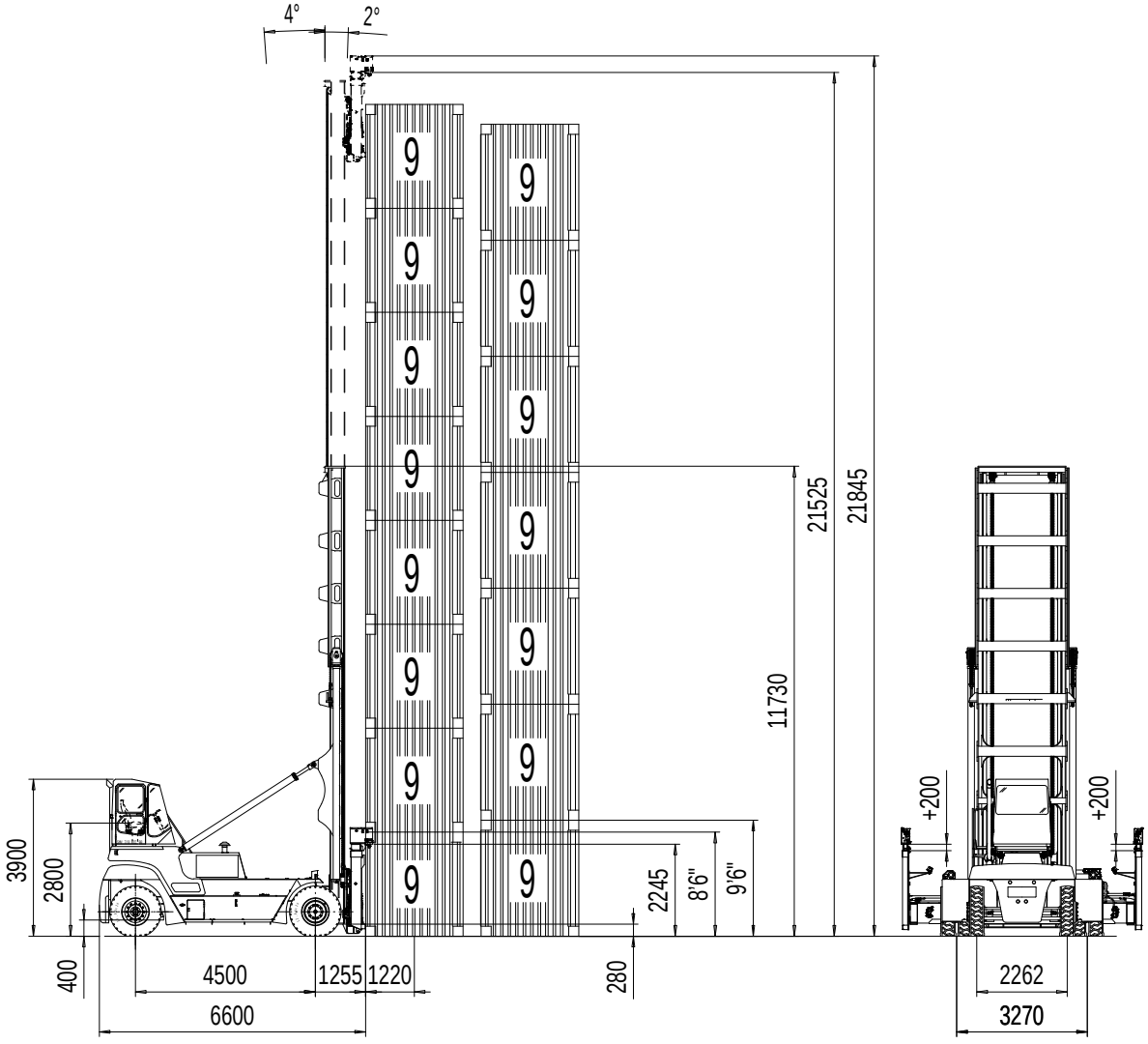

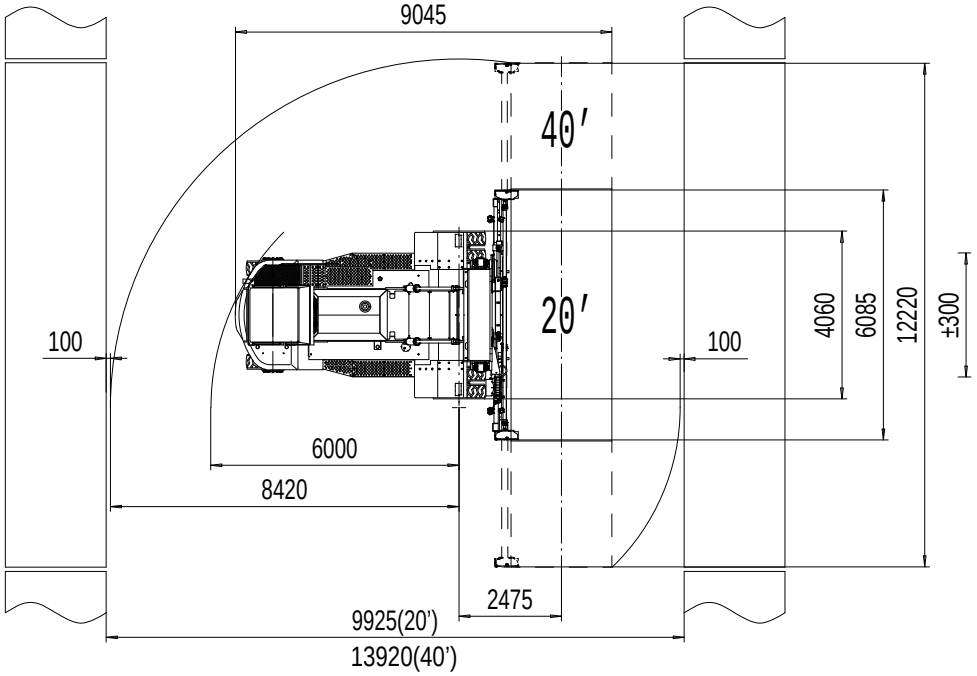

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Konecranes

Fork Lift

QUOTE

QUOTE NUMBER:	QUO0000003606
MODEL:	SMV 18-1200 C
CUSTOMER:	L&T Infrastructure Engineering Ltd.
DATE:	2017-12-14

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Dear Mr. Sanish. A,

We trust you will find this quotation of interest and we look forward to hear from you. For further information, do not hesitate to contact us.

With kind regards,

Tobias Nilsson
Konecranes Lifttrucks AB

Date of quote	2017-12-14
Company name	L&T Infrastructure Engineering Ltd.
Address	Triton Square 4th Floor (SKCL Buiding), No. C3-C7, Thiru Vi Ka Industrial Estate, Guindy, Chennai – 600 032. India
Attention	Mr. Sanish.A
Email	asa@lntiel.com
Phone	
Konecranes Lift Trucks contact	Tobias Nilsson
Email	tobias.nilsson@konecranes.com
Phone	+46 433 733 84
Address	Konecranes Lifttrucks AB

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5 REASONS TO CHOOSE KONECRANES

1 Global footprint

Operations at over 600 locations. in more than 120 countries worldwide and served by a broad distributor network.

2 Optima – The best cabin on the market

Every detail has been carefully designed for comfort and safety. Controls, displays, ventilation and seating work to boost driver productivity. Excellent visibility in all directions.

3 Smart Connected Lift Trucks

Remote monitoring is a key toward a more productive, efficient and safe workplace. With TRUCONNECT you get more out of your lift trucks.

4 Smarter where it matters

Years of experience has proven that the combination of high quality components and cutting edge technology together with low running costs results in a lower total cost of ownership.

5 Your uptime, our focus

The Konecranes group has the largest service organization in the world. A global and local network of maintenance professionals ensures that your machines have the optimal uptime. 24/7 spare parts supply from distribution centers worldwide.

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SMV 18-1200 C - Forklift truck

Standard features:

- Box type chassis, bolted tanks, mud guards, 2+2 lift eyes
- Access steps and hand rails up to cabin on both sides
- Kessler drive axle D91 (W=3000 mm)
- Engine air filter std. 2-stage with element, insert & indicator
- DANA Automatic Transmission TE-17300
- Load-sensing hydraulic system (variable piston pumps), return filter (10 µm)
- 4 hyd functions (lift-tilt-sideshift-fork pos), 4 lift levers
- El. system 24V, monitoring, CanBus, 7" colour display MD4
- LED Lamps (position-brake-blinkers) & LED Working Lamps (2 mudguard, 2 mast, 2 reverse)
- EMC Master incl. MD4-controller with 7" color touch display (A)
- EMC 106 Full Monitoring (engine, transmission, hydraulics, levers/joystick & service)
- EMC 114 Electronic servo levers (incl. Auto accelerator/power control)
- EMC 123 ECO Drive module (fuel measure functions & settings)
- EMC 124 Driver login module (max 20 logins)
- EMC 125 Data logger module (alarms + errors)
- EMC 129 Productivity hour counter (Idle-neutral-driving)
- Cabin Optima (L x W x H = 1605 x 1480 x 1620 mm)
- Tiltable cabin , 4 levers, ventilation, 3 wipers
- Sliding window (left & right), inside rear mirror (right)
- Seat BeGe 9200 Mechanical spring (4 settings, high back)
- Safety belt, 2-point, waist model
- El. connection 24V / 7.5A / 12.5mm plug front of dashboard right side
- Clothes hangers (2x) on rear cabin pillar (left + right side)
- Duplex Standard, LH max=4000, BH min-max=3810-5755, FH=0 mm
- Tilt angle 10° rear / 5° front (total 15°)
- Sideshift & Fork pos. STD (W=3000/FP=650-2550)
- Fork dimension 2400 x 200 x 110 mm
- Taper STD (full thickness: 0-600, taper: 600 to tip / tip 25 mm)
- Drive & steer (4 + 2) 14.00x24"/PR24 Diagonal
- Lightgrey, Cab & engine hood, RAL 7035
- Black, Lift equipment & axles. RAL 7021
- Seagreen, Chassis, tanks, mudguards, CW, NCS S2555 B30G
- Doc set - Instruction Books & Operator's Manual
- Doc set - Spare Parts Catalogue

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Optional features:

	Quantity
• Cummins QSB-6.7-C260 (201 kW, 990 Nm, 6.7 L, EU 3a/EPA 3)	1
• Engine air filter Turbo II	1
• Acoustic signal when reversing (reverse alarm)	1
• Warning beacon LED (fixed mounting - on cab roof)	1
• Automatic Climate Control (stepless and pollen filter)	1

Local options

	Quantity

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00. General Information, Standard & Norms:

The fork lift truck is designed and built in accordance with the current legislations and norms, which are described below:

2006 / 42 / EC ..... Machine Directive in Europe
ISO 22915-2 ..... Stability for Industrial Trucks
EN ISO 3691-1 ..... Safety for Industrial Trucks
ISO 3046 ..... Engine power, torque, fuel & emission norm
EN 12895 ..... Electro Magnetic Compatibility approvals (EMC)
EN 13564 ..... Visibility norm for driver
EN 13059 ..... Vibration norm for driver
EN 12053 ..... Noise level norm (DIN 45635 inside cab)

10. Chassis "Box-Type"

The chassis is made with long life time, low concentration of stress, and a high torsion strength in mind. This is possible through the high-strength rectangular design that is built from 2 longitudinal welded box sections with powerful cross members. The front end of the chassis is made even stronger by reinforcements with thick steel plates, support plates and brackets, and the fork lift trucks gets additional safety and strength from reinforced tilt cylinder fixations. All fixation points for vital main components, including drive axle, steer axle and lift mast, have very powerful fixation points which together with the design gives a durable and rigid chassis.

20-30. Drive Line (Engine, Transmission, Drive and Steer axles):

The engine is certified low-emission CanBus diesel, with turbo charger, air-to-air intercooler, fuel injection, common rails technology with high capacity cooling system.

The automatic transmission is bolted directly to the engines and connected via flexible steel plates. Automatic gear shifting with hydraulic operation and electronic controls, the softshift type gives safe and smooth driving performance.

The Kessler axle has a two-stage reductions and integral "Wet Disc Brakes". The two-stage reduction reduces stresses in the axle transmission system. The "Wet Disc Brakes" system for service brakes are mounted in each hub with multiple brake discs.

Strong welded steer axle of sandwich design in wide version, mounted in two (2) long life bushings between chassis and axle. Mechanical side stops between axle and chassis for best side stability. Hydrostatic powersteering with double acting single cylinder.

Engine model	**Power (kW/rpm)**	**Torque (Nm/rpm)**	**Volume (l)**	**EU /EPA**
Cummins QSB-6.7-C260	194 at 2400	987 at 1500	7	Stage 3a / Tier 3

Transmission model:	**Gears (fwd/rev):**	**Automatic / Manual shifting:**
Dana TE-17300	3 / 3	Yes / Yes

40. Load Sensing Hydraulic System (low-energy):

Low energy consumption is reached with the "power-on-demand" function that builds up Konecranes load sensing hydraulic system. The system is based on the latest technology from Parker & Hannifin and is designed to work together as one unit. We use the same components in all our trucks and stackers which means that all of them includes powerful and silent running variable piston pumps, accurate proportional valves, efficient valve regulators and electronic controls.

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45. Electrical System:

The 24V electrical system is designed and EMC-approved according to EN 12895.

Standard LED road lighting configuration:

- 2 x head lights on front mudguards
- 2 x position lights on front mudguards
- 2 x working / reverse lights
- 2 x tail lights
- 2 x brakes lights
- 4 x direction blinkers
- 2 x working lights in the mast
- 2 x inside cabin lamp
- 1 x electric horn
- 1 x main power switch

49. Electronic Control & Monitoring System (EMC):

To optimize performance and efficiency in the truck it come equipped with an electronic control and monitoring system that gives the operator a unique possibility to control and monitor the performance of the lift truck or fleet.

EMC functions included in the basic package:

- MD4 controller with 4 CanBus interfaces (engine, transmission and truck). Full colour touch display (7”).
- EMC 106; Full monitoring of engine, transmission, hydraulics, levers and service.
- EMC 114; Electronic servo levers (incl. auto accelerator/power control)
- EMC 123; ECO Drive module (fuel measure & monitoring incl. settings.
- EMC 124; Driver login module (Max. 20 logins)
- EMC 125; Data logger module (alarms + errors).
- EMC 129; Productivity hour counter.

50. OPTIMA – Drivers Cabin:

Remarkable visibility

Visibility is very difficult to measure objectively: you just know it when you see it. When you sit down in OPTIMA, you will see what visibility from a lift truck really means.

- The remarkable visibility is made possible by very large, lowered windows with no corner posts, thin but very strong roof cross member, and curved panes.
- New EMC Master with MD4 7” touch screen enables a more spacious cabin with its integrated solutions. There is also more space for operating the foot pedals.
- The positioning of the instrumentation improves operating ergonomics. Instrumentation has been moved from the driver’s left side to his right, above his seat, where it is conveniently accessible.
- OPTIMA is customizable for your exact operational needs. You can select levers or joystick, mini-wheel steering, the driver’s seat and precisely the instrumentation you need.

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60. Lift Mast, Carriage and Forks:

The Konecranes lift mast is designed for maximum strength and stability. The heavy-duty lift mast is of 2-stage design and the structures welded in high quality steel, with large cross section areas and strong profiles.
Cross members of thick profiles and support plates sits between the mast channels, and strong roller bearings and side roller bearings are located between the outer and inner mast, and between the inner mast and the carriage.
The fork carriage is designed for high strength, durability and good visibility, and is made of high quality steel with large cross section areas. The carriage has hydraulic powered sideshift and fork positioning of the two (2) integral forks, by means of 2 hydraulic cylinders.

85. Wheels (Tires & Rims):

Drive tires:	14.00 x 24" (PR 24)	(4x)
Drive rims:	10.00 x 24"/HD	(4x)
Steer tires:	14.00 x 24" (PR 24)	(2x)
Steer rims:	10.00 x 24"/HD	(2x)

90. Colour & Painting:

Lightgrey, Cab & engine hood, RAL 7035
Black, Lift equipment & axles. RAL 7021
Seagreen, Chassis, tanks, mudguards, CW, NCS S2555 B30G

95. Documentation:

The standard package includes the following: Operator's Manual, Maintenance Manual, Spare Parts Catalogue, Machine Card, Warranty/Start-up Protocol, Engine Operator's Manual.

100. Warranty:

Warranty according to Konecranes standard or extended warranty conditions. For further information, see warranty documentation.

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1. DELIVERY SCHEDULE
Approx. 18-20 weeks Ex. works after fully clarified order.

2. DELIVERY TERMS
Seller shall deliver the Equipment on the delivery terms:
CIF New Mangalore Port (INCOTERMS 2010)

3. PAYMENT TERMS
Customer shall pay the price as follows:
I - Against Letter of Credit

4. GENERAL TERMS AND CONDITIONS
This offer shall be subject to Seller's General Terms and Conditions attached hereto and available upon request and incorporated as if fully rewritten herein:
General Terms and Conditions of Sale (KC LT October 2016).

5. VALIDITY OF OFFER
This offer is valid until 2018-01-31.

6. WARRANTY
Warranty 12 months / 2000 hours (whichever comes first)

7. CURRENCY CLAUSE
Prices are based on a fixed currency (USD/EUR). If the currency exchange rate is changed more than 2%, we reserve the right to adjust the prices.

OTHER SERVICES

INSTALLATION (Cranes/Forklift etc are to be provided by you)
TRAINING

Price

EUR 217,000

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GENERAL TERMS AND CONDITIONS OF SALE-LIFTRUCKS

1. APPLICATION OF THESE TERMS

These Terms and Conditions of Sale ("Terms") shall apply to any tender and any contract of sale ("Agreement"), unless the parties agree otherwise in writing. Modifications of or amendments to these Terms must be agreed in writing. We object to any other or different terms and conditions than these even if we have not made an expressly objection. In the event of any inconsistency between the Agreement and these Terms, the Agreement shall govern.

2. SCOPE OF DELIVERY

2.1 The delivery of the equipment ("Equipment") includes all components, materials and services expressly specified in the Agreement.
2.2 The delivery includes Seller's standard technical documents, such as spare part lists, operating manuals, erection instructions (if the erection is not included in the scope of delivery) and main dimension drawings in English. Seller shall not be obliged to provide manufacturing drawings for the Equipment or spare parts.
2.3 Design, work at site, erection, supervision of erection, training services, start-up assistance and materials are included to the extent they are expressly specified in the Agreement.

3. DOCUMENTATION

3.1 The Seller shall have all rights, title and interest including ownership right, copyright and other intellectual and industrial property rights to documents, drawings, software, reports, technical information, definitions, descriptions, manuals and any other intellectual property that the Seller has or creates.
3.2 Documents, drawings, software, reports, technical information, definitions, descriptions, manuals and any other intellectual property received by the Buyer shall not, without the consent of the Seller, be used for any other purpose than for the erection, commissioning, operation or maintenance of the Equipment. They may not otherwise be used or copied, reproduced, transmitted or communicated to a third party. The Seller may, however transmit the documents or software to a third party that the Seller sells the Equipment to.

4. PACKING AND MARKING

The Equipment shall be packed in accordance with Seller's standard packing procedures as required for transportation under normal transport conditions. The Equipment shall be clearly marked and carry the necessary information concerning Buyer's identification and place of destination.

5. PRICE

5.1 In addition to the price set forth on the Agreement, Buyer shall be responsible for additional charges as set forth in these Terms.
5.2 If any part of the delivery of the Equipment is delayed due to reasons caused by Buyer or any third party under the control of Buyer, Buyer shall compensate any additional expenses incurred by Seller due to the late delivery.
5.3 Prices do not include any stamp duty, turnover or value-added tax, bank charges or any other similar taxes, duties or charges payable in the country into which the Equipment is to be imported and where the installation is to be carried out. In the event Seller is required to pay any such tax or charge, the tax or charge will be added to the invoice as a separate charge and Buyer shall reimburse Seller for the payment.

6. TERMS OF PAYMENT

6.1 The payments shall be made in accordance with the payment schedule specified in the Agreement.
6.2 Whenever any part of the payment is to be made by means of a Documentary Credit, Section 23. shall apply.
6.3 If Buyer delays making any payment or in the establishment of the Documentary Credit or if it becomes evident that the Buyer will not fulfil his contractual obligations, Seller may postpone the fulfilment of its obligations until such a payment is made or the Documentary Credit is established.
6.4 Seller shall be entitled to charge interest from Buyer if payment to Seller is past due. The rate of the interest is the highest rate permissible under the applicable law. The interest shall be counted from the due date until the actual date of the payment. Buyer shall pay such interest within thirty (30) days from the date of the respective invoice.
6.5 If Buyer has not paid the amount due within three months Seller shall be entitled to terminate the Agreement by notice in writing to Buyer and to claim compensation for the loss it has incurred.

7. STANDARDS OF MANUFACTURING AND DESIGN

The Equipment supplied and the work carried out shall be in accordance with the technical standards commonly used in Seller's country. If the Equipment shall be operated outside of Seller`s country, the scope of the work agreed in the Agreement shall prevail. The Seller shall not take into consideration laws and regulations prevailing at the place of operation, if they are not agreed in the Agreement. Buyer shall inform Seller of the applicable safety regulations. Any costs in excess of the costs of compliance with European standards resulting from mandatory local laws and regulations shall be added to the price and paid by Buyer.

8. INSPECTIONS DURING MANUFACTURING

Buyer has the right at its own expense, subject to agreement with the Seller as to the time and place, to inspect the progress of manufacture and the quality of the Equipment. The inspections of the Equipment shall be carried out at Seller's works or at the place of manufacturing. Inspection carried out by Buyer is not a precondition to the delivery of the Equipment.

9. DELIVERY TERM AND PASSING OF THE RISK

9.1 Any agreed delivery term shall be construed in accordance with INCOTERMS 2010. If no delivery term is specifically agreed, the delivery term shall be Ex works Seller's manufacturing plant (EXW).
9.2 The risk of loss of or damage to the Equipment shall pass from Seller to Buyer in accordance with the agreed delivery term. If no delivery term is set forth in the Agreement, the risk of loss shall pass to Buyer Ex Works Seller's manufacturing plant.

10. DELIVERY TIME

10.1 The delivery time shall start to run on the latest to occur of
(a) the date of execution of the Agreement by Seller;
(b) the date of receipt by Seller of the agreed down payment as set forth in the Agreement; or;
(c) the date of receipt by Seller of all agreed information and approval by Buyer of the general arrangement drawings.

10.2 Seller shall be entitled to a reasonable extension of the delivery time (which shall not be less than the length of the delay) if the delivery is delayed due to Buyer's actions or actions by a third party under the control of Buyer, such as modifications requested by Buyer, delay in the approval of the relevant drawings, delay in the preparing work at the erection site and delay in payments, or it becomes evident that the Buyer will not fulfil his contractual obligations.

11. TRANSFER OF PROPERTY

11.1 Notwithstanding Section 9.1, the Equipment shall remain Seller's property until the total purchase price has been paid. In the event the applicable laws do not permit Seller to retain title, Seller shall be entitled to a security interest or charge in the property. Buyer shall give Seller every assistance in securing an interest in the property or taking any measure required to protect Seller's title or such other rights. The retention of title, security

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interest or charge shall not affect the passing of risk of loss under Section 9.
11.2 Seller shall retain title to any software and documentation. To the extent that such software and documentation are included in the scope of delivery, then Buyer shall receive a royalty-free, non-exclusive and non-transferable license to use such software and documentation only in connection with the Equipment and for no other purpose whatsoever.

12. ACCEPTANCE TESTS

12.1 Should the Agreement require separate acceptance tests, the tests shall be carried out in accordance with the Agreement. If the Agreement does not specify the requirements, the tests shall be carried out in accordance with general practice in the industry in the country of manufacture.
12.2 Seller shall notify Buyer of the tests on sufficient time to permit the Buyer to be represented. If Buyer is not represented, the test report shall be sent to Buyer and shall be deemed accepted as accurate.
12.3 If the tests show the Equipment not to be in accordance with the Agreement, the Seller shall without delay remedy any deficiencies in order to ensure that the Equipment complies with the Agreement. New tests shall then be carried out at Buyer's request, unless the deficiency was insignificant.
12.4 Seller shall bear its own costs for tests carried out at the place of manufacture. Buyer shall bear all its own costs, including but not limited to travelling and living expenses for Buyer's representatives in connection with such tests.

13. FINAL ACCEPTANCE

13.1 Should the Agreement require separate acceptance, the Equipment is deemed to be finally accepted when acceptance tests have been carried out and the Equipment is found to be in accordance with the Agreement. Minor defects do not prevent the acceptance of the Equipment. Such defects shall be listed and Seller shall remedy any listed deficiencies without delay. If acceptance tests are not to be carried out, the Equipment is deemed to be delivered and taken over when delivered in accordance with the delivery term specified in Section 9.
13.2 If the acceptance has been agreed, the acceptance is to be made without delay after the notification of readiness for acceptance. If the acceptance is not carried out in due time or completely, the Equipment is deemed to be finally accepted seven (7) days after the notification of readiness for acceptance.
13.3 Buyer is not entitled to take the Equipment into use before final acceptance. If Buyer takes the Equipment into use before final acceptance without Seller's consent, the Equipment is deemed to be finally accepted.
13.4 In the cases specified in Section 13.2 and 13.3 the Seller is entitled to invoice the Equipment from the Buyer and the period of warranty shall start to run.

14. WARRANTY

14.1 Seller warrants that to the best of its knowledge the Equipment is free from defects caused by faulty design, materials or workmanship, which would prevent the electrical or mechanical functioning of the Equipment. The cost of disassembling and installing a repaired or replaced part furnished under this warranty is excluded.
14.2 These warranty conditions apply to the Equipment named in this Agreement. The warranty applies for the original Buyer and for later owners who have acquired the Equipment within 6 months from the delivery date to Buyer.
14.3 The period of the warranty for any part of the Equipment is the earliest of

(i) twelve (12) months from the date of the delivery of the Equipment in accordance with applicable delivery term or
(ii) 2000 operating hours whichever expires earlier.

14.4 The warranty period for replaced or repaired parts is twelve (12) months from the date of repair or replacement. However, no warranty for any parts shall apply after twenty-four (24) months from the delivery of the Equipment.
14.5 Seller provides a warranty on genuine spare parts for 6 months counted from the date of delivery. The Seller does not reimburse labor costs or other costs referable to the replacement or repair of a defected spare part. Otherwise, the same warranty conditions apply in applicable parts as for new Equipments.
14.6 Should defects occur during the period of this warranty, The Seller or its authorized dealer will, at its option, either repair the defects or supply the correct parts free of charge. The defected parts of the Equipment shall on request of Seller be sent to Seller together with a claim report according to Section 13.7 below. In case the parts have not been defected, Buyer will cover all the costs including, but not limited to repair, replacement and/or sending costs.
14.7 Claims must be reported in writing to the Seller within 45 days after the alleged fault has been discovered. Claims must always include information concerning the Equipmnent's serial number, type designation, and date of delivery and total hours of operation. In addition, a complete description of the nature of the fault must be given.
14.8 This warranty is given on the condition that the Equipment is in all respects operated, handled, serviced and maintained properly, in accordance with the Seller's instructions and under specified operating conditions. Excluded from the warranty are those parts including spare parts

a) To which repair or replacement becomes necessary due to normal wear, tear and corrosion;
b) To which repair of replacement becomes necessary due to the overloading of the Equipment
c) Which are used for purposes other than for those intended by Seller and has not otherwise been used in an inappropriate manner,
d) Which are exhaustible items, including but not limited to such items as bulbs and fuses;
e) Which are not approved by Seller
f) On which repairs, alterations or adjustments have been performed or begun by Buyer or any third party without Seller's previous consent;
g) Which failures are not promptly reported to Seller within the warranty period above;
h) Which failures or damage are due to negligence other than that of Seller, included but not limited to accident, abuse, improper installation (other than installations made by the Seller), improper operation, or abnormal conditions of temperature, moisture, dirt, corrosive matter, dust or other similar type of reason;
i) Which have been damaged otherwise without the fault of Seller.

14.9 The delivery inspection, warranty service and other services specified in the service manual have been carried out by Seller or by a dealer or service workshop authorized by the Seller.
If the Buyer and Seller have agreed on a longer warranty period (called also extended warranty) such an extended warranty is subject to these Terms and additionally:
(i) The extended warranty covers only the main components including engine, transmission, drive axle, hydraulic pumps, valves and cylinders, electric control units and structural parts
(ii) It is to be noted that the extended warranty does not cover
On bolded items, for example, turbo alternator, starter, water pump, sensors, hydraulic hoses, connections, seals, solenoids, electrical cabling, plugs, switches, fan and wiper motors.
(iii) The warranty period for replaced or repaired parts during the warranty period is limited to the machine warranty.
14.10 THIS IS THE SOLE AND EXCLUSIVE WARRANTY GIVEN BY SELLER TO BUYER WITH RESPECT TO THE EQUIPMENT AND IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESS OR IMPLIED ARISING BY OPERATION OF LAW OR OTHERWISE, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

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SE-28523 MARKARYD
SWEDEN.

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15. FORCE MAJEURE

Either party shall be entitled to suspend performance of its obligations under the Agreement to the extent that such performance is impeded by circumstances beyond the control of the party, including but not limited to war (whether declared or not), revolution, strikes, failure of supplies of power, fuel, transport, equipment or other goods or services, natural disasters, unacceptable weather conditions, acts of government, traffic accidents, export or import prohibitions, fire, explosions, floods, accidents, sabotage, civil commotions, riots, and breakage or loss during transportation or storage as well as delays of deliveries by the subcontractors (when caused by Force Majeure as herein defined).

16. LIQUIDATED DAMAGES OF DELAY OF SELLER

Buyer is entitled to liquidated damages for delay from the date on which the delivery should have taken place in case the delivery is delayed due to Seller's fault. The liquidated damages shall be 0,5 per cent of the price of the delayed portion of the Equipment for each complete week of delay. In no event shall the liquidated damages for delay exceed 5 % of the price of the delayed portion of the Equipment. The Buyer shall forfeit his right to liquidated damages if he fails to claim liquidated damages by written notice within one (1) month after the date when the delivery took place. The Liquidated damages referenced in this Article shall be the sole and exclusive remedy for such delay. The parties agree that such liquidated damages are a reasonable estimate of the damages Buyer is likely to incur as a result of such delay.

17. LIQUIDATED DAMAGES OF DELAY OF BUYER

If any part of the delivery or the acceptance of the Equipment is delayed due to reasons not caused by Seller, the risk of loss passes to Buyer and he pays the liquidated damages in the amount of 0.5% of price of the delayed portion of Equipment for each complete week of delay, starting 14 days after notification of the readiness for shipment or acceptance, where the liquidated damages are limited to 5% of the price of the delayed portion of Equipment, unless higher costs or damages can be proven by Seller. The Buyer shall compensate any additional expenses incurred by Seller due to delay.

18. REPORTING

18.1 If separately agreed the Seller shall deliver reporting services by collecting data on the Equipment and its operation through remote data connection. The Buyer has the right to prohibit such collection of data at any time. Despite of such prohibition the Buyer is obliged to pay the agreed charges till the end of contract period.

18.2 The Seller reserves the right to use and develop data generated for reporting services for its general research and development of equipment and for delivering services to the Buyer.

18.3 The Seller shall not monitor, inspect or otherwise follow any Equipment, equipment usage data, report including equipment usage data or other information that is generated by using a separate unit, data connection and/or otherwise. Any such equipment usage data, report and/or other data shall be created and provided to the Buyer on “as is” and as available basis and without warranties of any kind either express or implied made in relation to the correctness, accuracy or reliability of such equipment usage data, report and/or other data.

19. LIMITATION OF LIABILITY

SELLER'S LIABILITY UNDER THE AGREEMENT SHALL BE LIMITED TO THE AMOUNT OF THE ACTUAL DIRECT DAMAGES INCURRED BY BUYER OR TO THE PRICE PAID BY BUYER TO SELLER FOR THE EQUIPMENT OR TO THE REPLACEMENT OF THE EQUIPMENT, WHICHEVER IS THE LOWEST. BUYER SHALL BE ENTITLED TO NO OTHER REMEDY REGARDLESS OF THE FORM OF CLAIM OR CAUSE OF ACTION, WHETHER BASED IN AGREEMENT, NEGLIGENCE, STRICT LIABILITY OR OTHERWISE.

IN NO EVENT SHALL SELLER BE LIABLE FOR ANY SPECIAL, PUNITIVE, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO, LOSS OF PRODUCTION, LOSS OF PROFIT, LOSS OF USE, OR LOSS OF AGREEMENTS.

20. EXPORT LAWS AND REGULATIONS

20.1 The Buyer will comply with all applicable international, country specific, federal, state and local export, re-export and trade laws, rules and regulations in relation to the Equipment (Trade Laws and Regulations). Besides the other applicable laws and regulations, the Trade Laws and Regulations of the United Nations, European Union and the United States of America are always applicable.

20.2 For the avoidance of doubt, the Equipment also includes all related software.

20.3 Prior to any transfer of the Equipment to a third party or use of the Equipment provided by the Seller, the Buyer shall in particular check and guarantee by appropriate measures that:

a) The Buyer shall not infringe any applicable Trade Laws and Regulations, also considering the prohibitions of by-passing those embargos;
b) The Equipment is not intended for use in connection with armaments, nuclear technology or weapons, if and to the extent such use is subject to prohibition or authorization, unless required authorization is provided;
c) If required to enable authorities to conduct export checks, the Buyer, upon request by the authorities, shall promptly provide the authorities with necessary information required by mandatory law or regulations.

20.4 The Buyer shall maintain all documentation required under the Trade Laws and Regulations and shall provide the same to the Seller without delay at Seller’s reasonable request. This recordkeeping obligation of the Buyer shall continue for five (5) years from the Final Acceptance of the Equipment.

20.5 The Buyer understands that the requirements and restrictions of the Trade Laws and Regulations vary depending on the product, software, documentation and technical data provided under this Agreement and may change over time and that the Buyer is obliged to know about and comply with such changes.

20.6 The Buyer shall defend, indemnify and hold the Seller harmless from all fines, penalties and all associated expenses arising out of or resulting from any violation by the Buyer of any of its obligations in this paragraph 20.

21. APPLICABLE LAW AND SETTLEMENT OF DISPUTES

21.1 The Agreement shall be governed by and construed in accordance with the laws of Seller's place of incorporation.

21.2 All disputes arising out of or in connection with the present contract shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce by one or more arbitrators appointed in accordance with the said Rules.

21.3 The arbitration shall take place in in Stockholm, Sweden. The language of the arbitration proceedings shall be English.

21.4 Notwithstanding the above, Seller shall be entitled to take action for collecting its receivables from Buyer at the courts of the Buyer's place of domicile.

22. LANGUAGE

All documents and correspondence between Seller and Buyer shall be in English.

23. LETTER OF CREDIT (DOCUMENTARY CREDIT)

23.1 Documentary Credit shall be irrevocable and transferable, it shall allow partial shipments, loading on deck, charter party Bill of Lading and transhipments.

23.2 Documentary Credit shall be established in a form acceptable to Seller not later than 30 days from the date on which the Agreement is executed by Seller and it shall remain valid for a period of at least 30 days after the date of last shipment.

23.3 Documentary Credit shall be issued and confirmed by a first class international bank acceptable to Seller and it shall be

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payable at sight at the counters of a bank nominated by Seller against presentation of appropriate transport documents and a commercial invoice and/or other documents specified in the Agreement.
23.4 Regardless of any other paragraph of these Terms, if any, If Seller is unable to ship the goods due to any reason outside of its control, the Documentary Credit shall be payable against the forwarding agent's receipt, or, should Buyer fail to name the forwarding agent, against the warehouse receipt.
23.5 The Documentary Credit shall provide that the rules in the "Uniform Customs and Practice for Documentary Credits (2007 Revision) ICC Publication No. 600" are applicable to the Documentary Credit.
23.6 All charges and expenses, related to the fulfilment of this Contract of Buyer's Bank including opening and extension of Documentary Credit and confirmation commission of the same in the Seller's Bank shall be borne by Buyer. The charges and expenses of Seller's bank, except the confirmation commissioning of Documentary Credit, shall be borne by Seller.

24. NO WAIVER
No course of dealing between either party, ~~and~~ no failure or delay on the part of either party in exercising any right or remedy under the Agreement or no single or partial exercise of any other right or remedy of either party shall operate as a waiver of any such right or remedy.

25. SEPARABILITY; REFORMATION AND AMENDMENTS
25.1 The invalidity or enforceability of any provisions of the Agreement shall not impair the validity or enforceability of any other provisions; provided, however, that the Agreement shall be reformed to the maximum extent permitted by law to carry out the parties' original intention.
25.2 The Agreement may be amended only in writing signed by both parties.

LT 27 Oct 2016

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KONECRANES®
Lifting Businesses™

WARRANTY REGULATIONS FOR NEW KONECRANES LIFTTRUCKS MACHINES (LIFTTRUCKS)

1 SCOPE

These warranty conditions apply to the machine (Machine) named in this warranty certificate and/or specified as agreed in the purchasing agreement. The original warranty period applies for the original Buyer and for later owners.
The warranty does not cover tyre equipment, batteries, fuses, light bulbs or led's or other wear parts of the machine. It does neither cover fluids, filters and unspecified material such as grease, oil, cleaning material.

2 WARRANTY PERIOD

Warranty time is 12 months or 2.000 running hours from date of signing the "Warranty start up report", or as latest 15 months from KLFT invoice date, whichever comes first

The warranty period for replaced or repaired parts during the warranty period is limited to the machine warranty.

3 WARRANTY OBLIGATIONS

Should defects occur during the period of this warranty, LIFTTRUCKS or its authorized dealer will, at its option, either repair the defects or supply the correct parts free of charge. The defective parts of the Machine shall on request of LIFTTRUCKS be sent to LIFTTRUCKS together with a claim report according to clause 4 below. In case the parts are not defective, the Buyer will cover all the costs including, but not limited to, repair, replacement and/or shipping costs.

4 CLAIMS

Claims must be reported in writing or via Konecranes Warranty OnLIne (WOL) system to LIFTTRUCKS within 45 days of discovery of the alleged fault. Claims must always include information concerning the machine's serial number, type designation, and date of delivery and total hours of operation. In addition, a complete description of the nature of the fault must be given.

5 FAULTS

This warranty is given on the condition that the Machine is in all respects operated, handled, serviced and maintained properly, in accordance with LIFTTRUCKS instructions and under specified operating conditions.
Excluded from the warranty are those parts including spare parts, to which repair or replacement becomes necessary due to:

a. Normal wear, tear and corrosion, tyre equipment, batteries, fuses, light bulbs or led's or other wear parts of the machine. It does neither cover fluids, filters and unspecified material such as grease, oil, cleaning material.
b. Overloading of the Machine
c. Which are used for purposes other than for those intended by LIFTTRUCKS and has not otherwise been used in an appropriate manner,
d. Which are exhaustible items, including but not limited to such items as bulbs and fuses;
e. Which are not approved by LIFTTRUCKS
f. On which repairs, alterations or adjustments have been performed or begun by the Buyer or any third party without LIFTTRUCKS previous consent
g. Which failures are not promptly reported to LIFTTRUCKS within the warranty period above
h. Which failures or damage are due to negligence other than that of LIFTTRUCKS, including but not limited to accident, abuse, improper installation (other than installation by LIFTTRUCKS), improper operation, or abnormal conditions of temperature, moisture, dirt, corrosive matter, dust or other similar type of reason;
i. Which have been damaged otherwise without the fault of LIFTTRUCKS.

Further, this warranty is given on the condition that,
The delivery inspection, warranty service and other in Service manual specified services have been carried out by LIFTTRUCKS or by a LIFTTRUCKS authorised dealer or service workshop

6 LIMITATION OF LIABILITY

This is the sole and exclusive warranty given by LIFTTRUCKS to the Buyer with respect to the equipment and is in lieu of and excludes all other warranties, express or implied, arising by operation of law or otherwise, including but not limited to, any implied warranties of merchantability or fitness for particular purpose.

7 SPARE PARTS WARRANTY

LIFTTRUCKS provides a warranty on genuine spare parts for 6 months or 1.000 running hours whichever occurs first, counted from the date of delivery. LIFTTRUCKS does not reimburse labour costs or other costs incurred by the replacement or repair of a defective spare part.

Otherwise, the same warranty conditions apply to applicable parts as for new machines.

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Dear Mr. Satish,

Thanx for the clarifications and we would like to propose Konecranes Gottwald Model G HMK 4406B to suit the application.

Please find attached all the technical data along with propping base and pressure under pads. Pl chk the suitability and revert for any clarifications.

Looking at the volumes of 1.2 M MT PA, ONE MHC is more than enough unless same crane will be used for containers.

A budget price for such 1 x G HMK 4406B (four Rope) can be considered as 3.6 Mio Euro CIF including One Grab.

E MAILS to add kvl, sha are not going through.

Best Regards,

Shyam Pathak
+91 97 64 00 86 85

From: Sanish. A [mailto:asa@lntiel.com]
Sent: Tuesday, January 02, 2018 5:10 PM
To: Shyam Pathak
Cc: 'kvl'; sha@lntiel.com; 'Immanuel Anderson. H'; Santosh Pradhan
Subject: RE: Budgetary offer for container handling equipments

Dear Sir,
Our point wise replies is given in red below

Regards,

Sanish A
Associate Project Consultant, Ports & Environment

L&T Infrastructure Engineering Ltd.
(Formerly known as L&T Rambøll Consulting Engineers Limited)
Triton Square 4th Floor (SKCL Buiding), No. C3-C7, Thiru Vi Ka Industrial Estate, Guindy,
Chennai – 600 032, Tamilnadu, India.
*Phone: 044 2250 9**677** | Fax: 044 2250 9600 | Mobile: +91 94453 92007 | Website: www.lntiel.com*

Shyam Pathak
Sales Director - South Asia

Konecranes Port Solutions

Direct : + 91 20 6719 1504
Mobile : +91 97 64 00 86 85
www.konecranes.com

Compnay Address :
Konecranes Pvt. Ltd.
C/o Aker Powergas Ltd. Level 3, Survey No. 75/2/3
Baner, Pune. 411 045, Maharashtra, India

From: Santosh Pradhan
Sent: Friday, December 22, 2017 9:58 AM
To: Sanish. A
Cc: 'kvl'; sha@lntiel.com; 'Immanuel Anderson. H'; Shyam Pathak
Subject: RE: Budgetary offer for container handling equipments

Hi Sanish,

Apologize for the delay.
The budget pricing is as follows.

1. STS - Euro 12 Mio per STS.
2. RTG – Euro 1.6 Mio per RTG.

You will get pricing of Reach Stacker, Empty Handler and Forklift from our dealer Portrucks. We shall ask him to send you prices.
We shall send you pricing of MHC by tomorrow.

Trust this suffice the purpose.

With Best Regards,

Santosh Pradhan.
Manager – Port Cranes.

Konecranes Port Solutions

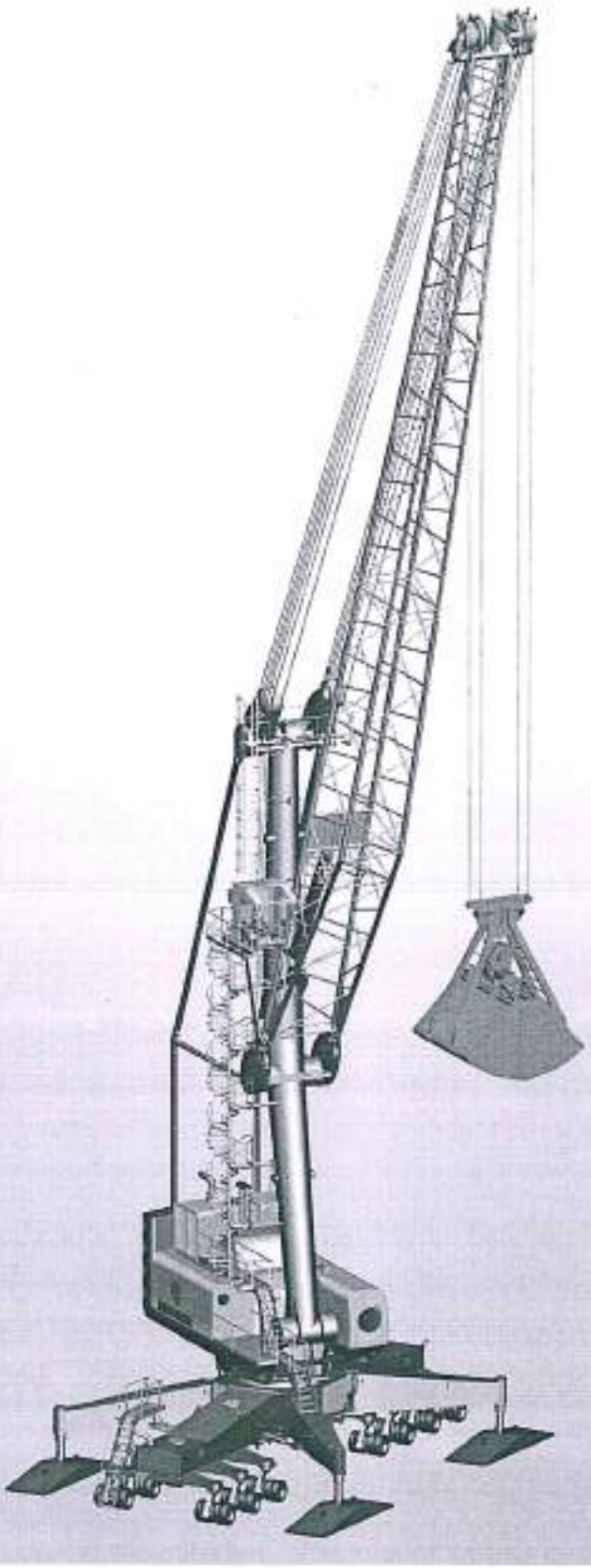
Land Line: +91 20 6719 1527 (D)

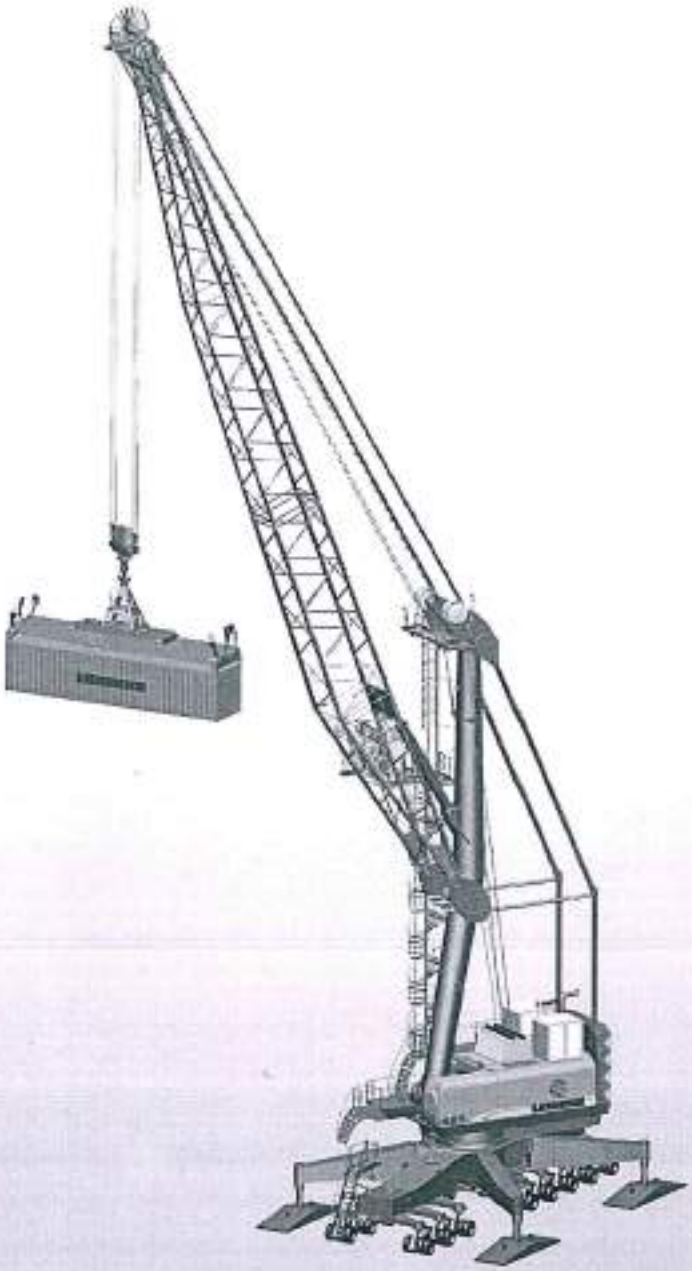
OEM- Liebherr

Liebherr

Mobile Harbor Crane

Mobile Harbour Crane LHM 425

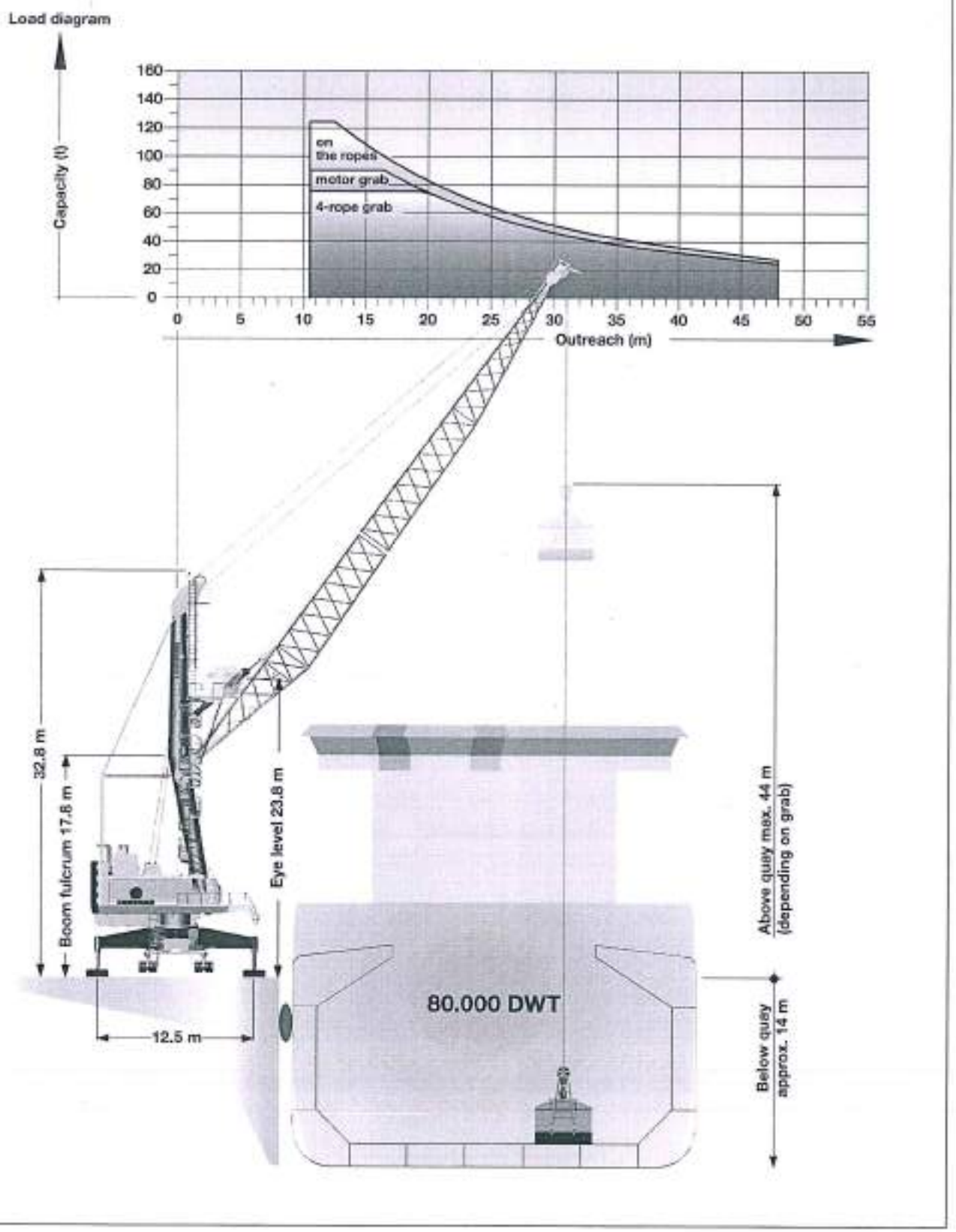




LIEBHERR

Main dimensions

Bulk operation



Bulk operation

Maximum crane capacity 124 t			
	Hook operation	Grab operation	
Outreach	on the ropes	4-rope grab	motor grab
(m)	(t)	(t)	(t)
10.5	124.0	75.0	90.0
11	124.0	75.0	90.0
12	124.0	75.0	90.0
13	117.6	75.0	90.0
14	111.5	75.0	90.0
15	105.6	75.0	90.0
16	100.1	75.0	90.0
18	90.0	75.0	81.0
19	85.3	75.0	76.8
20	81.0	72.9	72.9
22	73.1	65.8	65.8
24	66.2	59.6	59.6
26	60.2	54.2	54.2
28	55.1	49.5	49.5
30	50.6	45.5	45.5
31	48.6	43.7	43.7
34	43.4	39.1	39.1
36	40.5	36.5	36.5
38	38.0	34.2	34.2
40	35.7	32.1	32.1
42	33.5	30.2	30.2
44	31.4	28.3	28.3
46	29.3	26.3	26.3
48	27.3	24.5	24.5

Weight ramshorn hook 3.8 t
Weight rotator 3.0 t

Maximum crane capacity 84 t			
	Hook operation	Grab operation	
Outreach	on the ropes	4-rope grab	motor grab
(m)	(t)	(t)	(t)
10.5	84.0	45.0	52.0
11	84.0	45.0	52.0
12	84.0	45.0	52.0
13	84.0	45.0	52.0
14	84.0	45.0	52.0
15	84.0	45.0	52.0
16	84.0	45.0	52.0
18	84.0	45.0	52.0
19	84.0	45.0	52.0
20	81.0	45.0	52.0
22	73.1	45.0	52.0
24	66.2	45.0	52.0
26	60.2	45.0	52.0
28	55.1	45.0	49.5
30	50.6	45.0	45.5
31	48.6	43.7	43.7
34	43.4	39.1	39.1
36	40.5	36.5	36.5
38	38.0	34.2	34.2
40	35.7	32.1	32.1
42	33.5	30.2	30.2
44	31.4	28.3	28.3
46	29.3	26.3	26.3
48	27.3	24.5	24.5

Weight ramshorn hook 2.2 t
Weight rotator 2.2 t

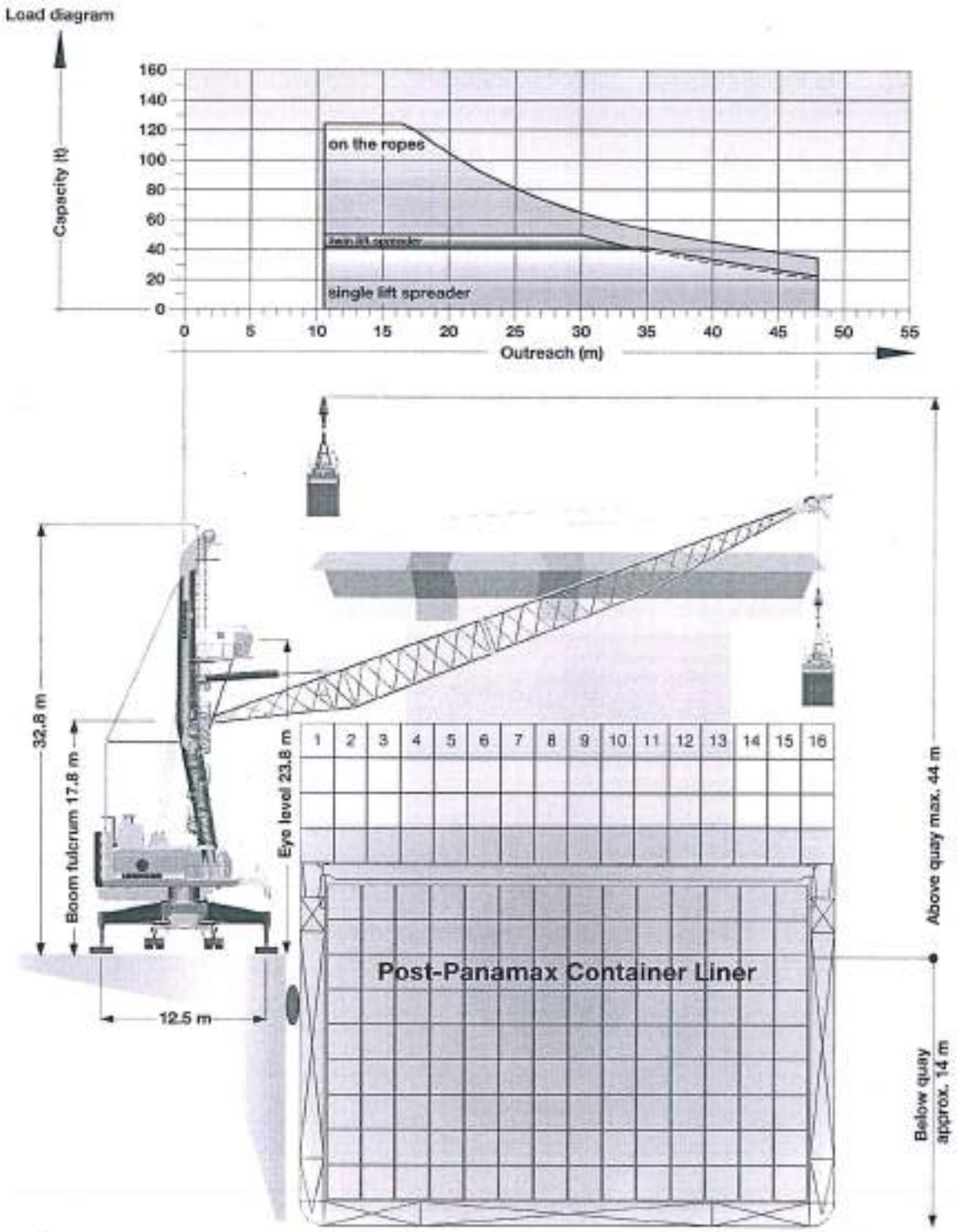
Standard configuration — Turnover up to 1500 t per hour
Pactronic® — Turnover up to 2000 t per hour

The powerful hydrostatic transmission and advanced Liebherr electronics ensure short, productive working cycles during bulk handling.

- During grab operation, hoisting, slewing, and luffing are driven simultaneously at maximized speed to achieve the highest (possible) turnover.
- During grab filling, features such as automatic lowering and hoisting guarantee the optimum filling level of the grab.
- The slack rope monitoring system ensures extended lifetime of the ropes and increases operational safety.
- Reverse power is returned to the drive process through closed loop hydraulics which results in reduced fuel consumption.
- The Cycoptronic® anti-sway system automatically compensates for all rotational swing, transverse and longitudinal sway of the load at maximum speeds.
- To provide safe and stress-free working conditions for the operator, Liebherr offers the Cycoptronic® including Teach-In® feature, a semi-automatic system, which pilots the crane from the vessel hatch to the quay without any sway. Especially for bulk operation into hoppers, the Teach-In® system increases turnover and ensures consistent turnover rates during the entire ship unloading.
- Liebherr technology is absolutely resistant to all types of dust and dirt due to the closed hydraulic system and an electronic system which is military proven and tested.
- The airflow needed for cooling hydraulic and engine systems is routed external from the main machinery house. This helps keep the engine room clean and free of debris.

Main dimensions

Container operation



Container operation

Maximum crane capacity 124 t*

Outreach	Spreader operation under		Hook operation on the ropes
	Single lift	Twin lift	Heavy lift
(m)	(t)	(t)	(t)
10.5	41.0	50.0	124.0
11	41.0	50.0	124.0
12	41.0	50.0	124.0
13	41.0	50.0	124.0
14	41.0	50.0	124.0
16	41.0	50.0	124.0
18	41.0	50.0	113.9
20	41.0	50.0	102.5
22	41.0	50.0	92.5
24	41.0	50.0	83.8
26	41.0	50.0	76.2
28	41.0	50.0	69.2
30	41.0	50.0	64.1
32	41.0	45.5	59.2
33	41.0	43.3	57.0
34	41.0	41.3	55.0
35	41.0	39.3	53.0
38	36.1	34.4	48.1
40	33.2	31.5	45.2
42	30.5	28.8	42.5
44	27.8	26.1	39.8
46	25.1	23.4	37.1
48	22.5	20.8	34.5

Weight rotator 3.0 t
Weight fully automatic (telescopic) spreader 9 t
Weight twin lift spreader 10.7 t
*) also available in 4-rope configuration

Maximum crane capacity 84 t*

Outreach	Spreader operation under		Hook operation on the ropes
	Single lift	Twin lift	Heavy lift
(m)	(t)	(t)	(t)
10.5	41.0	50.0	84.0
11	41.0	50.0	84.0
12	41.0	50.0	84.0
13	41.0	50.0	84.0
14	41.0	50.0	84.0
16	41.0	50.0	84.0
18	41.0	50.0	84.0
20	41.0	50.0	84.0
23	41.0	50.0	84.0
24	41.0	50.0	83.8
26	41.0	50.0	76.2
28	41.0	50.0	69.7
30	41.0	50.0	64.1
32	41.0	46.3	59.2
33	41.0	44.1	57.0
34	41.0	42.1	55.0
35	41.0	40.1	53.0
38	36.9	35.2	48.1
40	34.0	32.3	45.2
42	31.3	29.6	42.5
44	28.6	26.9	39.8
46	25.9	24.2	37.1
48	23.3	21.6	34.5

Weight rotator 2.2 t
Weight fully automatic (telescopic) spreader 9 t
Weight twin lift spreader 10.7 t
*) also available in 4-rope configuration

Standard configuration — **Turnover up to 32 cycles per hour**
Pactronic® — **Turnover up to 38 cycles per hour**

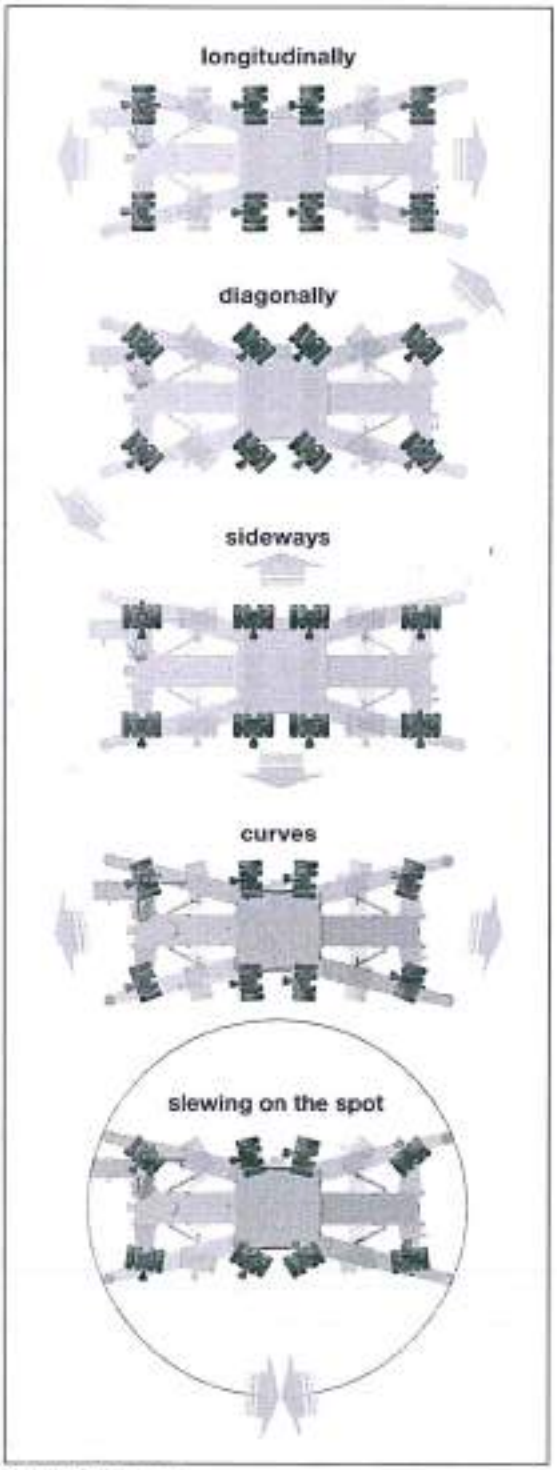
Precision to perfection: With incredibly short acceleration times for all crane motions, Liebherr is the top performer in container handling.

- The crane can be fitted with various types of spreaders (fixed or telescopic) connected to the rotator. Manual, semi or fully automatic telescopic spreaders are available for various container sizes.
- Liebherr Cycoptronic® is an accurate, sway-free load motion control system that uses in-house designed software. Cycoptronic® allows for direct load positioning and aids the crane driver in mastering his task. With Cycoptronic® turnover, safety and the confidence of the operator will be improved.
- Safety: The luffing cylinder is positioned above the lattice boom. This eliminates the possibility of any damage to the cylinder through swinging loads or highly stowed rows of containers on board the vessel.
- The Liebherr hydrostatic drive is the most reliable and highest performing drive system for mobile harbour cranes. Independent closed loop hydraulic systems utilize the minimum number of components to guarantee highly responsive, smooth and precise operation while maximizing operational safety.

Undercarriage

Mobility

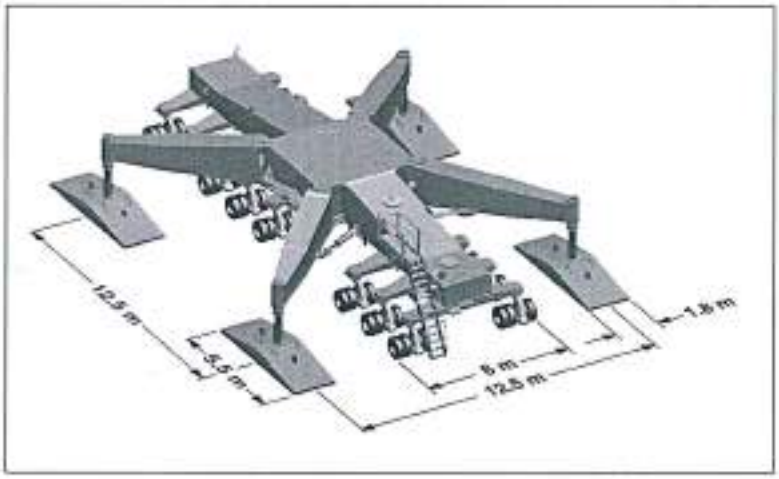
- Outstanding mobility and manoeuvrability
- Curves at any possible radii and even slewing on the spot



Schematic diagram

Modular propping system

- Minimised stress and strain of undercarriage due to cruciform support base which directs the load path from boom tip to quay
- Modular system allows further reduction of quay loads by installing additional axle sets
- Easy adaptation to various sizes of support pads and bases



Hydraulic load distribution

- Hydraulic suspension avoids overloading of individual wheel sets
- Standard trailer tyres making requisition of spares economical and time-saving
- Increased lifetime of tyres due to individually steerable wheel sets

Optimum pressure distribution and adaption of wheel sets on uneven surfaces

Technical data

Capacity and Classification

	Capacity	Classification
Grab operation	< 52 t	A8
Standard operation	< 70 t	A6
Container	< 57 t	A7
Heavy lift	< 124 t	A3

Main dimensions

Min. to max. outreach	10.5—48 m
Height of boom fulcrum	17.8 m
Tower cabin height (eye level)	23.8 m
Overall height (top of tower)	32.8 m
Overall length of undercarriage	20.0 m
Overall width of undercarriage	6.5 m

	Bulk	Container
Number of axle sets (standard)	14	16
Number of axle sets (optional)	24	24

Working speeds

Hoisting / lowering	0 — 120	m/min
Slewing	0 — 1.6	rpm
Luffing	0 — 85	m/min
Travelling	0 — 5	km/h

Propping arrangements

Standard supporting base	12.5 m x 12.5 m
Standard pad dimension	4 x 5.5 m x 1.8 m
Standard supporting area of pads	9.9 m²

Optional size of supporting pads and bases on request

Quay load arrangements

	Bulk	Container
Uniformly distributed load	1.3 t/m²	1.4 t/m²
Max. load per tyre	6.1 t	5.8 t

Due to a unique undercarriage design the quay loads specified above can even be reduced. Pad sizes, supporting base and the number of axle sets can easily be adapted to comply with the most stringent quay load restrictions.

Weight

	Bulk	Container
Total weight of crane (approx.)	342 t	371 t

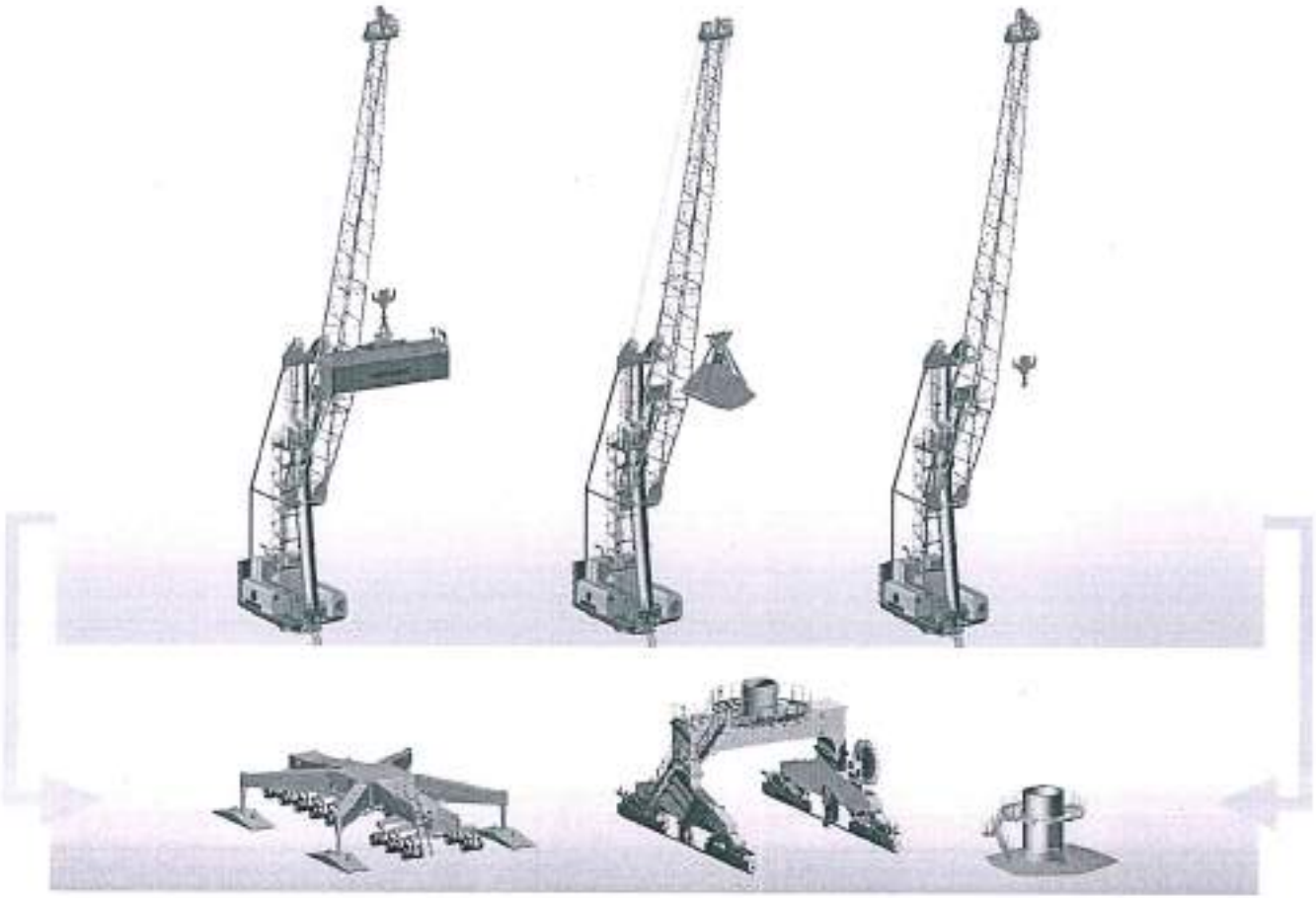
Hoisting heights

Above quay at minimum radius	44 m
Above quay at maximum radius	29 m
Below quay level (approx.)	14 m

Optional equipment

1. Pactronic® - power by Accumulator and Electronics
2. Cycoptronic® - anti-sway system
3. Teach-In® - semi-automatic point to point system
4. Vertical Line Finder® - diagonal pull preventing system
5. Sycratronic® - synchronizing crane control system
6. SCULI® - crane analyzer with various features
7. Dynamic anti-collision system
8. Economy software - for optimised fuel consumption
9. Modem for data transfer and telediagnosis
10. Data recorder
11. Machine data recording
12. Video monitoring system
13. Radio remote control
14. Autopropping undercarriage
15. Cyclone air-intake system for the engine
16. Low temperature package
17. Tropical temperature package
18. Customer-specific painting & logo
19. Additional (driven) axle sets
20. Axle sets equipped with foamed tyres
21. Different supporting bases and pad sizes
22. And many more as per customers requirements

Practical solutions



Liebherr develops and produces special designs and solutions to meet customer-specific requirements

- The Liebherr Portal Crane, LPS, is an efficient combination of a space-saving portal (mounted on rails) and the proven mobile harbour crane concept. Particularly on narrow quays, individual portal solutions permit (railway) trains and (road) trucks to travel below the portal.
- Liebherr Fixed Slewing Cranes (LFS) are an efficient combination of a mobile harbour crane upper carriage and a fixed pedestal. LFS cranes provide an economical and space-saving solution for the installation on quaysides and jetties, especially where room for manoeuvring is limited and low ground pressure is essential.

LHM 420 – 105xxxxx – 02/2012 – Subject to change without notice.

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LIEBHERR

MOBILE HARBOUR CRANE

TYPE

LHM 425 Litronic®
(2 rope, 84t, L - version)

TECHNICAL DATA

MCR
12-02-18

Rev. 2017/06

TECHNICAL DATA

TABLE OF CONTENTS

1 MAIN DATA

1.1 Load Table

Dead weight rotator = 2.5 t
Dead weight spreader = 9.0 t
SWL spreader = 41.0 t

1.1.1 Load Capacity Chart

Radius (m)	Hook Operation Utilisation of Tipping 75% on Rope (t)	Hook Operation Utilisation of Tipping 75% on Hook (t)	Spreader Operation under Spreader (t)	Motor Grab or/and Electro Magnet Operation on Rope (t)
11	84.0	81.5	41.0	52.0
12	84.0	81.5	41.0	52.0
13	84.0	81.5	41.0	52.0
14	84.0	81.5	41.0	52.0
15	84.0	81.5	41.0	52.0
16	84.0	81.5	41.0	52.0
17	84.0	81.5	41.0	52.0
18	84.0	81.5	41.0	52.0
19	84.0	81.5	41.0	52.0
20	84.0	81.5	41.0	52.0
21	84.0	81.5	41.0	52.0
22	82.2	79.7	41.0	52.0
23	78.2	75.7	41.0	52.0
24	74.5	72.0	41.0	52.0
25	71.0	68.5	41.0	52.0
26	67.7	65.2	41.0	52.0
27	64.7	62.2	41.0	51.8
28	61.9	59.4	41.0	49.5
29	59.3	56.8	41.0	47.5
30	56.9	54.4	41.0	45.5
31	54.7	52.2	41.0	43.7
32	52.6	50.1	41.0	42.1
33	50.7	48.2	39.2	40.5
34	48.9	46.4	37.4	39.1
35	47.1	44.6	35.6	37.7
36	45.6	43.1	34.1	36.5
37	44.1	41.6	32.6	35.3
38	42.7	40.2	31.2	34.2
39	41.4	38.9	29.9	33.1
40	40.1	37.6	28.6	32.1
41	38.9	36.4	27.4	31.1
42	37.7	35.2	26.2	30.2
43	36.5	34.0	25.0	29.2
44	35.3	32.8	23.8	28.3
45	34.1	31.6	22.6	27.3
46	32.9	30.4	21.4	26.3
47	31.8	29.3	20.3	25.4
48	30.7	28.2	19.2	24.5

1.1.2 Travelling Window

For travelling the boom of crane must be positioned either over front part (slew angle = 0°) or over rear part of undercarriag e (slew angle = 180°).

The maximum load on ropes during travelling is (travelling in both directions) 25t / 25t.

1.2 Operating Speeds

* 100 percent infinitely variable speed control from zero to maximum speed
* electronic-controlled acceleration/deceleration, to avoid shocks to crane and load and to enable smoother speed control
* automatic power output regulators
* slewing, luffing, hoisting can be operated simultaneously

	ac- / deceleration time			
Hoisting / Lowering	appr. 1 sec	23.0	m/min with	84 t
		28.0	m/min with	70 t
		40.0	m/min with	50 t
		65.0	m/min with	30 t
	appr. 3 sec	90.0	m/min with	empty hook
Slewing	appr. 5-6 sec	0 - 1.6	rpm	
		280	m/min	max speed boom head
		360	°	unlimited slewing range
Luffing	appr. 2 sec	41	sec	with full load from max. to min working radius (theoretical without ac- and deceleration)
		55	m/min	average horizontal speed
Travelling	appr. 6 sec	0 - 5	km/h	without load

Max. inclination in transverse direction	2%	without load, during travelling
Max. inclination in longitudinal direction	5%	without load, during travelling

(Steeper gradients can be negotiated with additional driven axle sets)

1.3 Weights

Total weight of crane	appr.	338	t

1.4 Dimensions

Support base	12.5 m x 12.5 m		
Size of supporting pads	5.5 m x 1.8 m		
Supporting area of pads	9.9	m²	
Optional size of supporting pads	on request		
Overall width without supporting pads	6.0	m	
Overall width with supporting pads and swung in outriggers	10.2	m	
Overall width in traveling position and deployed outriggers	14.3	m	
Overall length of undercarriage	20.0	m	
Length of boom (centre sheaves)	48.6	m	
Overall height (top of tower)	32.8	m	
Height of boom fulcrum	17.8	m	
Cab height (eye level)	24.0	m	
Turning radius	0.0	m	inner
incl. supporting pads	13.0	m	outer
Tail swing radius	7.0	m	
Max. hoisting height (measured at crane rope socket)			(not valid for 4-rope grab)
above quay at minimum radius	44.0	m	
above quay at maximum radius	29.0	m	
below quay	12.0	m	
Winchconfiguration	1x84t		
Number of winches	1	(2 ropes per winch)	
Diameter of hoisting rope	44	mm	
Diameter of sheaves at boom head	1044	mm	
Ratio between diameter of hoisting rope to sheaves	1 : 23.7		
Diameter of rope drum	1000	mm	
Ratio between diameter of rope to drum	1 : 22.7		
Number of axle sets	16		
Number of axle sets (optional)	24		
Axle sets driven	5		
Axle sets steerable	all		
No. of tyres	4	per axle set	
Tyres	285/70 R 19.5	make Continental	
Tyre pressure	10	bar max	

1.5 Environmental Conditions

Ambient temperature	-20°C to +45 °C
Humidity (relative)	97 %
Max. wind speed in operation	24 m/s
Max. wind speed out of operation	42 m/s
Max. wind speed during travelling	20 m/s

1.6 Requirements on Quay

During crane operation and driving, the following pressures are relevant (calculations based on standard size supporting plates).

Assumed Conditions:

Normal	=	all static loads are included
Extreme	=	all static loads and dynamic factors are included

Max. axle set loading: (2 axle sets = 1 axle line)	Normal	appr.	21.1 t
	Extreme	appr.	25.9 t

Max. Corner Loading:

		75%	**Grab**
Normal (static excl. wind)	boom 45°	212.5 t	183.0 t
	boom 90°	170.8 t	156.9 t
Normal (static incl. wind)	boom 45°	228.0 t	193.5 t
	boom 90°	177.8 t	167.7 t
Extreme (dynamic incl. wind)	boom 45°	250.4 t	216.5 t
	boom 90°	191.9 t	179.3 t

Max. Area Pressure:

		75%	**Grab**
Normal (static excl. wind)	boom 45°	21.5 t/m²	18.5 t/m²
	boom 90°	17.3 t/m²	15.8 t/m²
Normal (static incl. wind)	boom 45°	23.0 t/m²	19.5 t/m²
	boom 90°	18.0 t/m²	16.9 t/m²
Extreme (dynamic incl. wind)	boom 45°	25.3 t/m²	21.9 t/m²
	boom 90°	19.4 t/m²	18.1 t/m²

1.7 Drive System

Prime mover	Diesel Engine	
Make	LIEBHERR	
Type	D 9512 A7	
Combustion system	Diesel	
Emission standard	none	
Number of cylinder	12	
Cooling system	Water	
Max. torque	4750 Nm	at 1500 rpm
Output on the drive shaft	750 kW	at 1700 rpm acc. ISO 9249
Average consumption	198	g/KWh
Fuel tank capacity	13000	l
Starter	Bosch QB	
Output	9	kW
Dynamo	Bosch	
Nominal current	140	Amp
Voltage	24	V

1.8 Hydraulic Oil

Oil	See table of lubricants
Oil cooling	The hydraulic driven oil cooler is located outside the machinery room, protected via cover, cooling medium is fresh air

1.9 Lighting

Appropriate illumination is fitted in	- machinery room - switch cabinet room - cabs - access to the crane
Floodlight type	- LED
Position	- two on the boom - one on the tower
Rating (per floodlight)	- 450 W

Steps from the tower cabin are provided with battery-buffered 24 VDC emergency lights.
Two warning lights (on undercarriage) and a ringing bell when travelling are standard

1.10 Heating

- Heating of driver's cabin (6 kW)
- Heating of switch cabinet room (1 x 2 kW)
- Standstill heating of slipring collector, switch cabinet
- Total installed heating capacity approx. 12 kW.

1.11 Group Classification of Crane and Components

Authorities, Regulations EN, FEM, DIN, VDE, VDI, IEC, ISO

Classification of crane as a whole in appliance groups

		Crane group at operation with	
		75%	**Grab**
Hook operation	SWL < 84t	A5	
Hook operation	SWL < 70t	A6	
Spreader Operation	SWL < 57t	A7	
Motor Grab Operation	SWL < 52t		A8

Classification of individual mechanisms

	Mechanism group			
	Hook operation	**Hook operation**	**spreader**	**motor grab**
Winch gear	M6 (70t)	M5 (84t)	M8 (52t)	M8 (52t)
Luffing gear	M7	M7	M7	M8
Slewing gear	M7	M8	M7	M8
Travelling gear	M4	M4	M4	M4

1.12 Documentation

Standard scope of delivery includes

- 3 operation/maintenance manuals
- 3 spare parts books
- 3 works certificates

1.13 Protective Coat/Painting

I GENERAL

- Liebherr LH N°983593014
- Cleaning and Substrate Preparation
- Solvent Cleaning/Degreasing
- Shot Blasting SA 2.5 (ISO 8501-1)
- Surface Profile: Comparator Type "G"
- Segment 2-3 (ISO 8503-1)

II CRANE - INTERNAL SURFACES

		Film thickness	
1.0	**Priming Coat** 2-Pack Zinc Rich Epoxy Primer Interzinc 315 HS	75 (+30/-20)	microns
3.0	**Finish Coat** 2-Pack Epoxy Amerlock 400C	110 (+15/-15)	microns
Total Min. Dry Film Thickness		**185**	**microns**

III CRANE - EXTERNAL SURFACES

		Film thickness	
1.0	**Priming Coat** 2-Pack Zinc Rich Epoxy Primer Interzinc 315 HS	75 (+30/-20)	microns
2.0	**Intermediate Coat** 2-Pack Epoxy Amerlock 400 C or Interseal 670 HS	100 (+25/-15)	microns
3.0	**Finish Coat** 2-Pack Polyurethane Finish Interfine 979 or PSX 700	75 (+15/-15)	microns
Total Min. Dry Film Thickness		**250**	**microns**

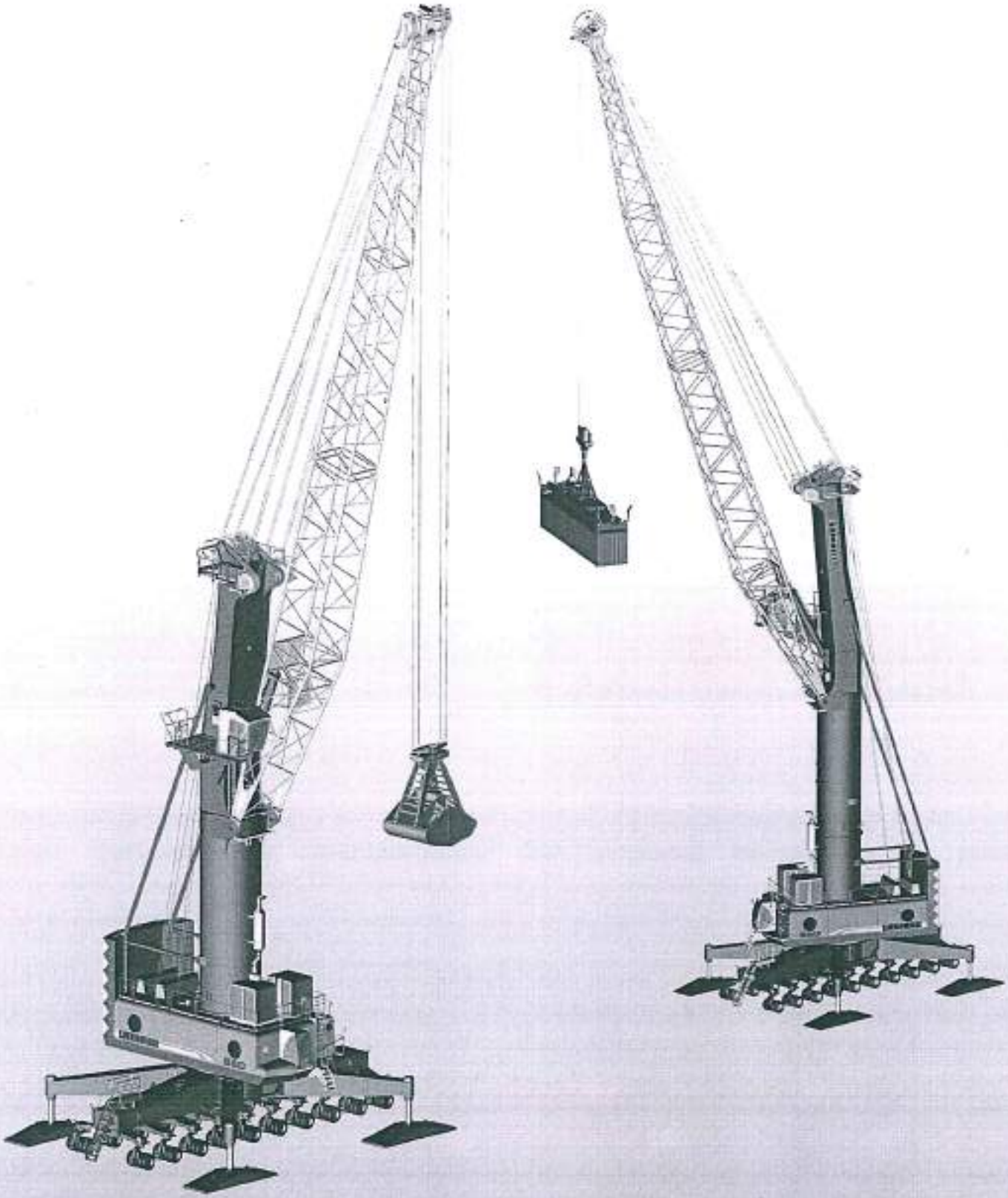
Note:
Above values are related to primary structure.

The final colour shade for undercarriage, slewing platform steel construction, counter weights and tower is RAL 7043.
The colour shade for the slewing platform is Liebherr yellow (RAL 1006-1007), jib and housing of the cooling devices are in RAL 7047.
The cabin is in RAL 9002.

All ladders, stairs, walkways, etc. are hot dip galvanised.

Mobile Harbour Crane

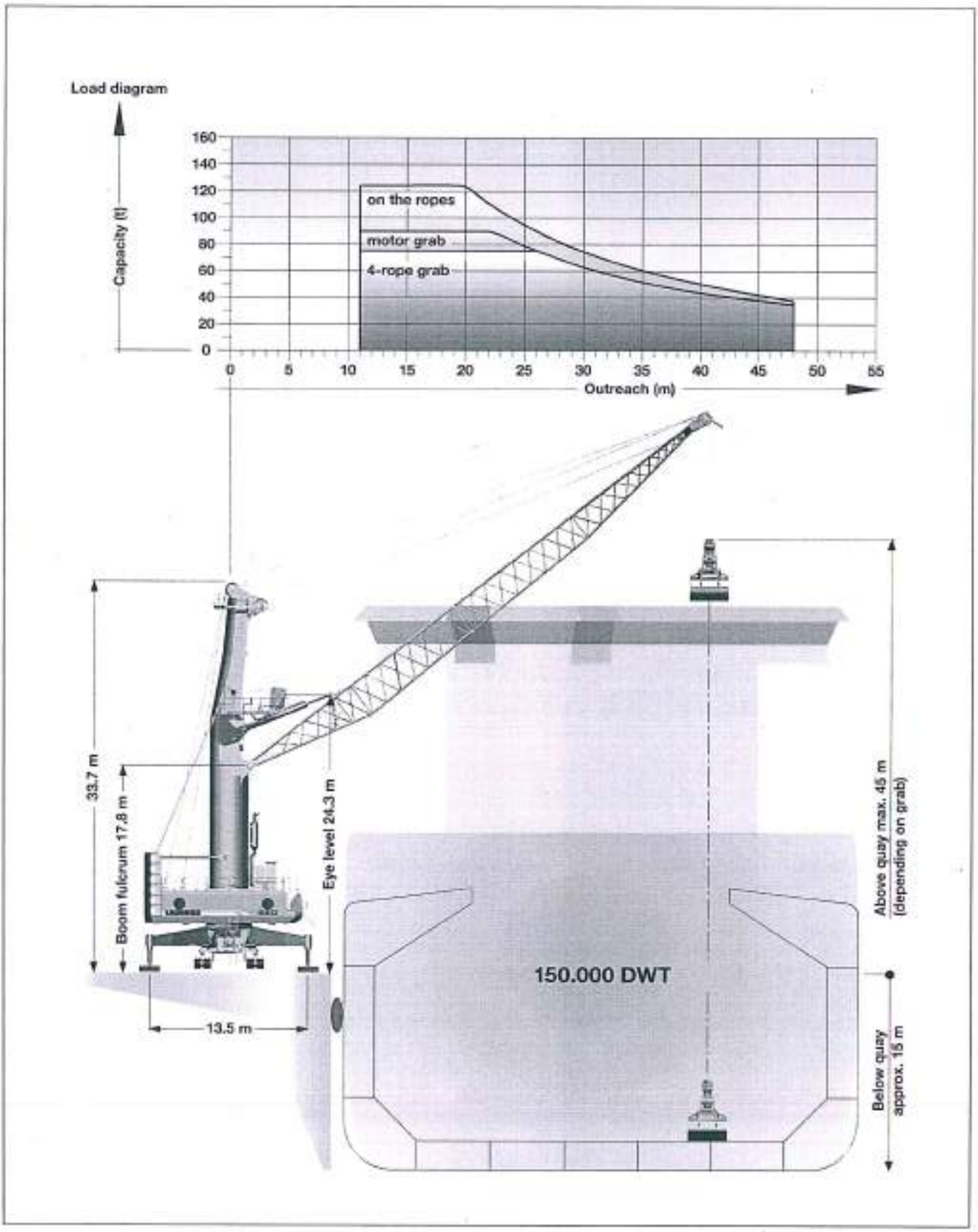
LHM 550



LIEBHERR

Main dimensions

Bulk operation



Bulk operation

Maximum crane capacity 124 t			
	Hook operation	Grab operation	
Outreach	on the ropes	4-rope grab	motor grab
(m)	(t)	(t)	(t)
11	124.0	75.0	90.0
16	124.0	75.0	90.0
18	124.0	75.0	90.0
20	114.5	75.0	90.0
22	103.1	75.0	90.0
23	97.9	75.0	88.1
24	93.1	75.0	83.8
25	88.7	75.0	79.9
26	84.7	75.0	76.2
27	81.0	72.9	72.9
28	77.2	69.5	69.5
29	73.7	66.3	66.3
30	70.5	63.4	63.4
31	67.6	60.9	60.9
32	65.0	58.5	58.5
33	62.5	56.2	56.2
34	60.1	54.1	54.1
36	55.8	50.3	50.3
38	52.2	47.0	47.0
40	49.0	44.1	44.1
42	46.2	41.5	41.5
44	43.6	39.3	39.3
46	41.2	37.1	37.1
48	38.9	35.0	35.0

Weight ramshorn hook 3.8 t
Weight rotator 3.6 t

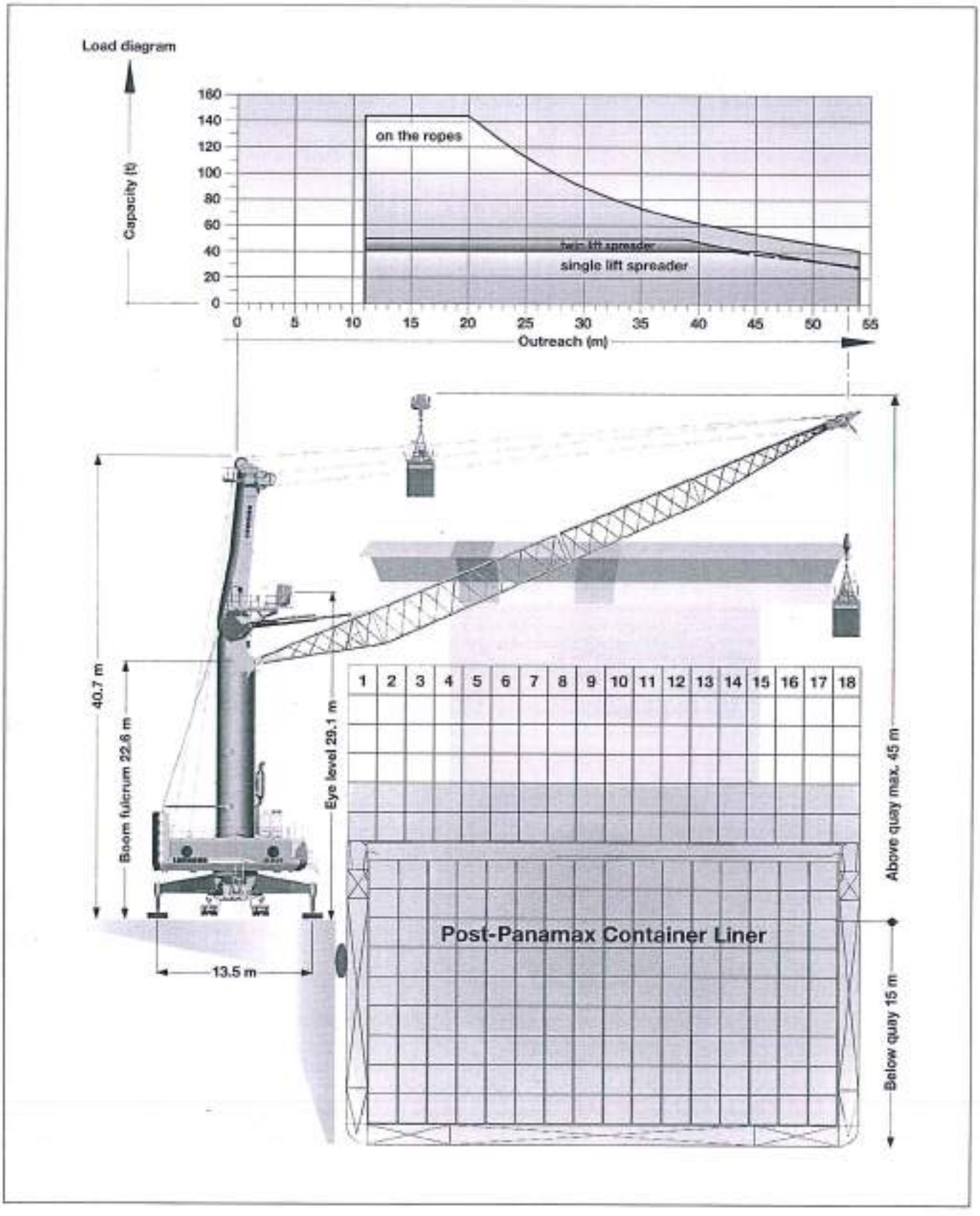
Standard configuration — Turnover up to 1500 t per hour
Pactronic® — Turnover up to 2000 t per hour

The powerful hydrostatic transmission and advanced Liebherr electronics ensure short, productive working cycles during bulk handling.

- During grab operation, hoisting, slewing, and luffing are driven simultaneously at maximized speed to achieve the highest (possible) turnover.
- During grab filling, features such as automatic lowering and hoisting guarantee the optimum filling level of the grab.
- The slack rope monitoring system ensures extended lifetime of the ropes and increases operational safety.
- Reverse power is returned to the drive process through closed loop hydraulics which results in reduced fuel consumption.
- The Cycoptronic® anti-sway system automatically compensates for all rotational swing, transverse and longitudinal sway of the load at maximum speeds.
- To provide safe and stress-free working conditions for the operator, Liebherr offers the Cycoptronic® including Teach-In® feature, a semi-automatic system, which pilots the crane from the vessel hatch to the quay without any sway. Especially for bulk operation into hoppers, the Teach-In® system increases turnover and ensures consistent turnover rates during the entire ship unloading.
- Liebherr technology is absolutely resistant to all types of dust and dirt due to the closed hydraulic system and an electronic system which is military proven and tested.
- The airflow needed for cooling hydraulic and engine systems is routed external from the main machinery house. This helps keep the engine room clean and free of debris.

Main dimensions

Container operation



Container operation

Maximum crane capacity 104 t*			
	Spreader operation under		Hook operation on the ropes
Outreach	Single lift	Twin lift	Heavy lift
(m)	(t)	(t)	(t)
11	41.0	50.0	104.0
12	41.0	50.0	104.0
13	41.0	50.0	104.0
14	41.0	50.0	104.0
16	41.0	50.0	104.0
18	41.0	50.0	104.0
20	41.0	50.0	104.0
22	41.0	50.0	104.0
24	41.0	50.0	104.0
26	41.0	50.0	104.0
28	41.0	50.0	97.7
30	41.0	50.0	89.2
32	41.0	50.0	82.3
34	41.0	50.0	76.0
36	41.0	50.0	70.7
39	41.0	50.0	63.9
40	41.0	48.3	62.0
42	41.0	44.7	58.4
44	41.0	41.5	55.2
45	41.0	40.0	53.7
48	37.3	35.6	49.3
50	34.4	32.7	46.4
52	31.6	29.9	43.6
54	28.9	27.2	40.9

Weight rotator 3.0 t
Weight fully automatic (telescopic) spreader 9 t
Weight twin lift spreader 10.7 t
*) also available in 4-rope configuration

Maximum crane capacity 144 t*			
	Spreader operation under		Hook operation on the ropes
Outreach	Single lift	Twin lift	Heavy lift
(m)	(t)	(t)	(t)
11	41.0	50.0	144.0
12	41.0	50.0	144.0
13	41.0	50.0	144.0
14	41.0	50.0	144.0
16	41.0	50.0	144.0
18	41.0	50.0	144.0
20	41.0	50.0	144.0
22	41.0	50.0	130.5
24	41.0	50.0	117.9
26	41.0	50.0	107.2
28	41.0	50.0	97.7
30	41.0	50.0	89.2
32	41.0	50.0	82.3
34	41.0	50.0	76.0
36	41.0	50.0	70.7
38	41.0	50.0	66.0
40	41.0	47.7	62.0
42	41.0	44.1	58.4
44	41.0	40.9	55.2
45	41.0	39.4	53.7
48	36.7	35.0	49.3
50	33.8	32.1	46.4
52	31.0	29.3	43.6
54	28.3	26.6	40.9

Weight rotator 3.6 t
Weight fully automatic (telescopic) spreader 9 t
Weight twin lift spreader 10.7 t
*) also available in 4-rope configuration

Standard configuration — **Turnover up to 32 cycles per hour**
Pactronic® — **Turnover up to 38 cycles per hour**

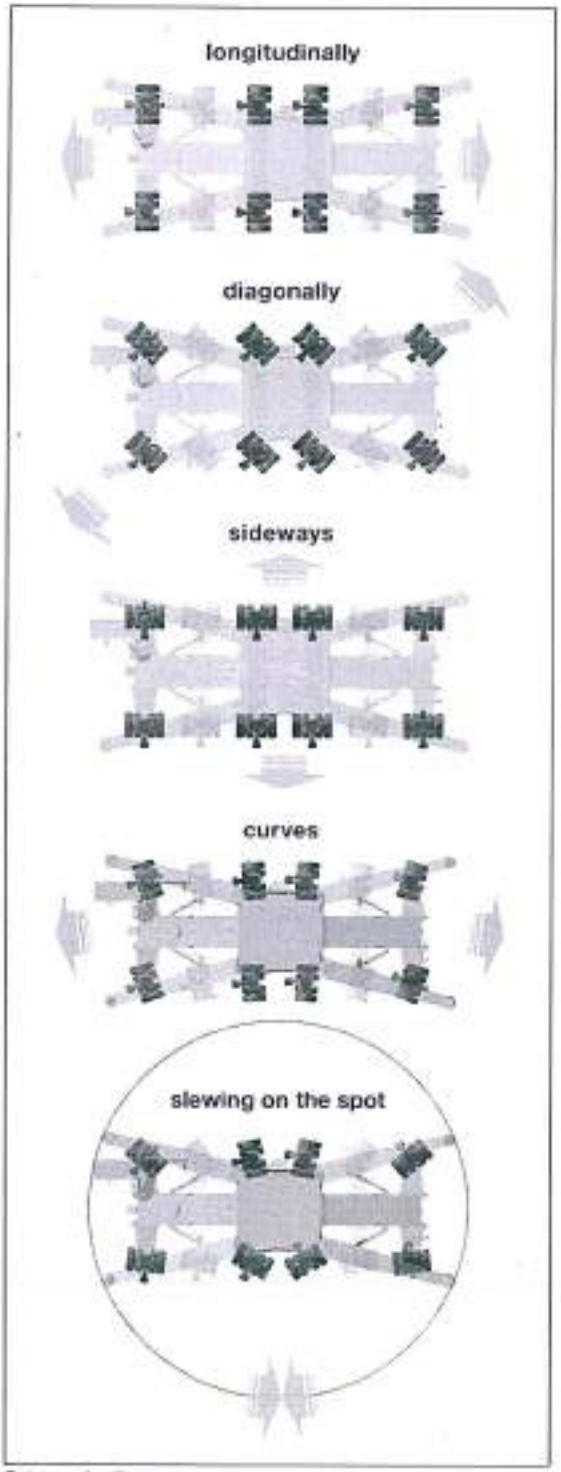
Precision to perfection: With incredibly short acceleration times for all crane motions, Liebherr is the top performer in container handling.

- The crane can be fitted with various types of spreaders (fixed or telescopic) connected to the rotator. Manual, semi or fully automatic telescopic spreaders are available for various container sizes.
- Liebherr Cycoptronic® is an accurate, sway-free load motion control system that uses in-house designed software. Cycoptronic® allows for direct load positioning and aids the crane driver in mastering his task. With Cycoptronic® turnover, safety and the confidence of the operator will be improved.
- Safety: The luffing cylinder is positioned above the lattice boom. This eliminates the possibility of any damage to the cylinder through swinging loads or highly stowed rows of containers on board the vessel.
- The Liebherr hydrostatic drive is the most reliable and highest performing drive system for mobile harbour cranes. Independent closed loop hydraulic systems utilize the minimum number of components to guarantee highly responsive, smooth and precise operation while maximizing operational safety.

Undercarriage

Mobility

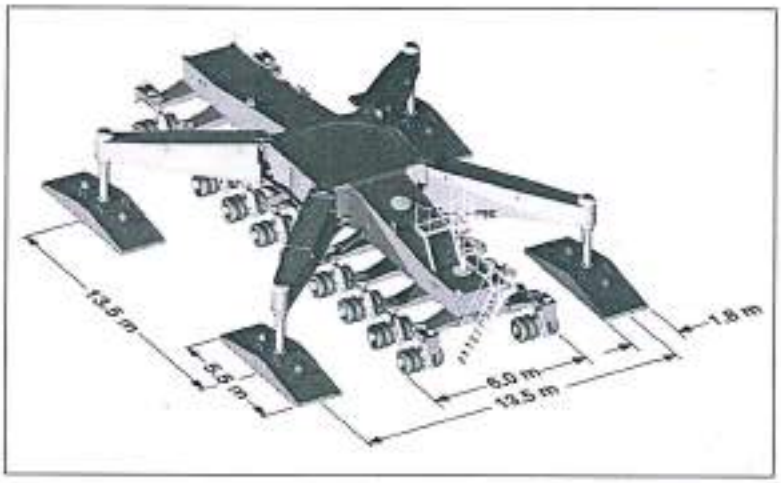
- Outstanding mobility and manoeuvrability
- Curves at any possible radii and even slewing on the spot



Schematic diagram

Modular propping system

- Minimised stress and strain of undercarriage due to cruciform support base which directs the load path from boom tip to quay
- Modular system allows further reduction of quay loads by installing additional axle sets
- Easy adaptation to various sizes of support pads and bases



Hydraulic load distribution

- Hydraulic suspension avoids overloading of individual wheel sets
- Standard trailer tyres making requisition of spares economical and time-saving
- Increased lifetime of tyres due to individually steerable wheel sets

Optimum pressure distribution and adaption of wheel sets on uneven surfaces

Technical data

Capacity and Classification

	Capacity	Classification
Grab operation	< 52 t	A8
Standard operation	< 77 t	A6
Container	< 63 t	A7
Heavy lift	< 144 t	A3

Main dimensions

	Bulk	Container*
Min. to max. outreach	11–48 m	11–54 m
Height of boom fulcrum	17.8 m	22.6 m
Tower cabin height (eye level)	24.3 m	29.1 m
Overall height (top of tower)	33.7 m	40.7 m
Overall length of undercarriage	20.7 m	20.7 m
Overall width of undercarriage	6.0 m	6.0 m
Number of axle sets (standard)	18	20
Number of axle sets (optional)	24	24

Working speeds

Hoisting / lowering	0 – 120	m/min
Slewing	0 – 1.6	rpm
Luffing	0 – 85	m/min
Travelling	0 – 5	km/h

*) Crane with tower extension (4.8 m) and 54 m boom.

Propping arrangements

Standard supporting base	13.5 m x 13.5 m
Standard pad dimension	4 x 5.5 m x 1.8 m
Standard supporting area of pads	9.9 m²

Optional size of supporting pads and bases on request

Quay load arrangements

	Bulk	Container*
Uniformly distributed load	1.4 t/m²	1.6 t/m²
Max. load per tyre	5.6 t	5.8 t

Due to a unique undercarriage design the quay loads specified above can even be reduced. Pad sizes, supporting base and the number of axle sets can easily be adapted to comply with the most stringent quay load restrictions.

Weight

Total weight of crane Bulk version with 48 m boom	approx. 406 t
Total weight of crane Container version with 54 m boom and tower extension 4.8 m	approx. 439 t

Hoisting heights

	Bulk	Container*
Above quay at minimum radius	45.0 m	45.0 m
Above quay at maximum radius	29.3 m	36.3 m
Below quay level	15.0 m	15.0 m

Optional equipment

1. Pactronic® - power by accumulator and electronics
2. Cycoptronic® - anti-sway system
3. Teach-In - semi-automatic point to point system
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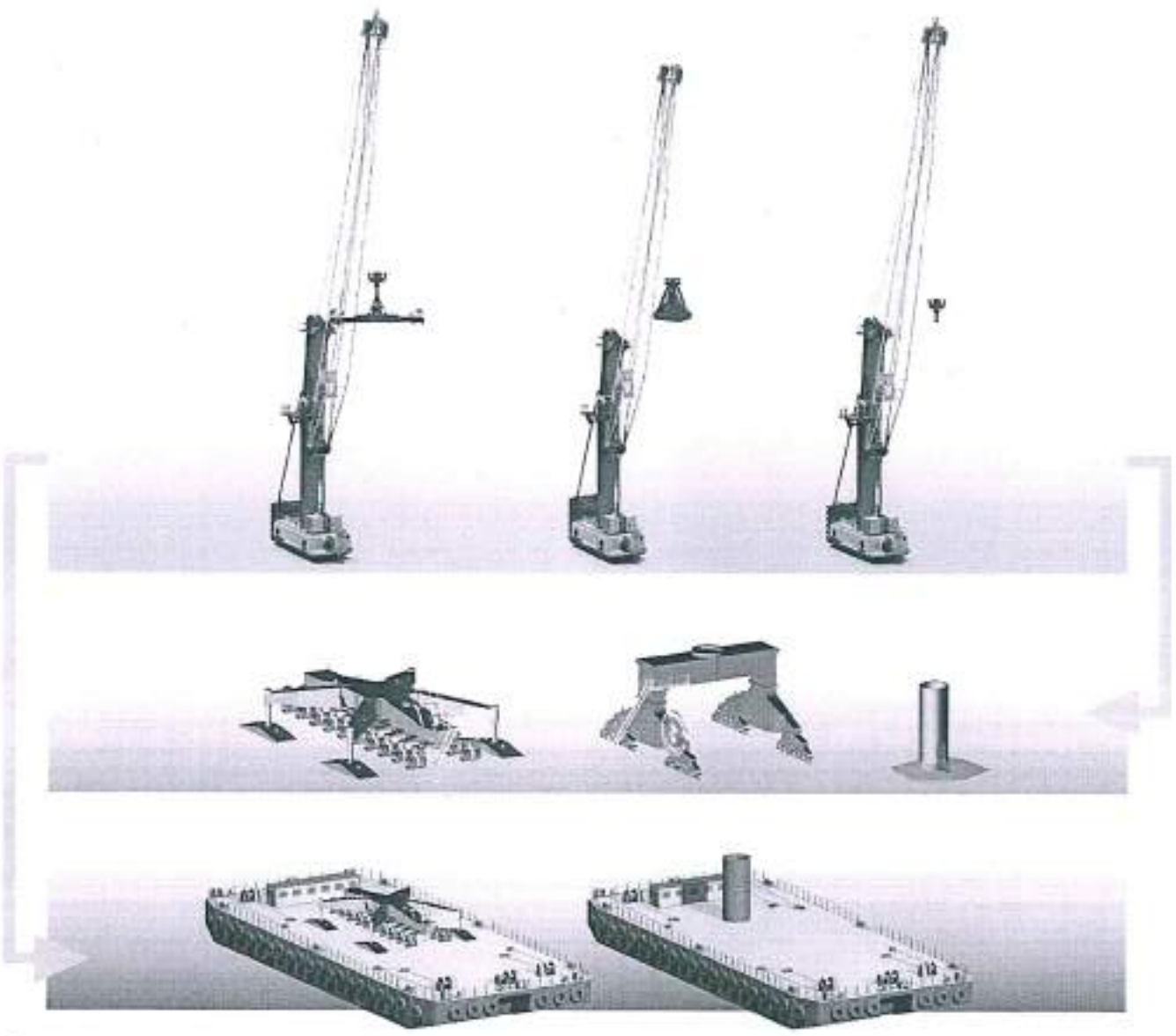
Practical solutions



Liebherr develops and produces special designs and solutions to meet customer-specific requirements

- The Liebherr Portal Crane, LPS, is an efficient combination of a space-saving portal (mounted on rails) and the proven mobile harbour crane concept. Particularly on narrow quays, individual portal solutions permit (railway) trains and (road) trucks to travel below the portal.
- Liebherr floating cranes, LBS, can be used for transhipment and midstream operation between ocean-going vessels and river barges on different types of waterways, including those having no or few quays. In addition, the LBS solution allows direct cargo transfer from ship to shore – especially when quays reach capacity limits.
- Depending on customer specifications, the LBS range may have varying lifting capacities due to tailor-made design solutions.
- Liebherr Fixed Slewing Cranes (LFS) are an efficient combination of a mobile harbour crane upper carriage and a fixed pedestal. LFS cranes provide an economical and space-saving solution for the installation on quaysides and jetties, especially where room for manoeuvring is limited and low ground pressure is essential. Additionally LFS solutions are also ideally suited for the installation on crane barges.

LHM 550 – 10341098 – 09/2012 – Subject to change without notice.

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mobile.harbour.crane@liebherr.com
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Liebherr

Reach Stacker

Reachstacker

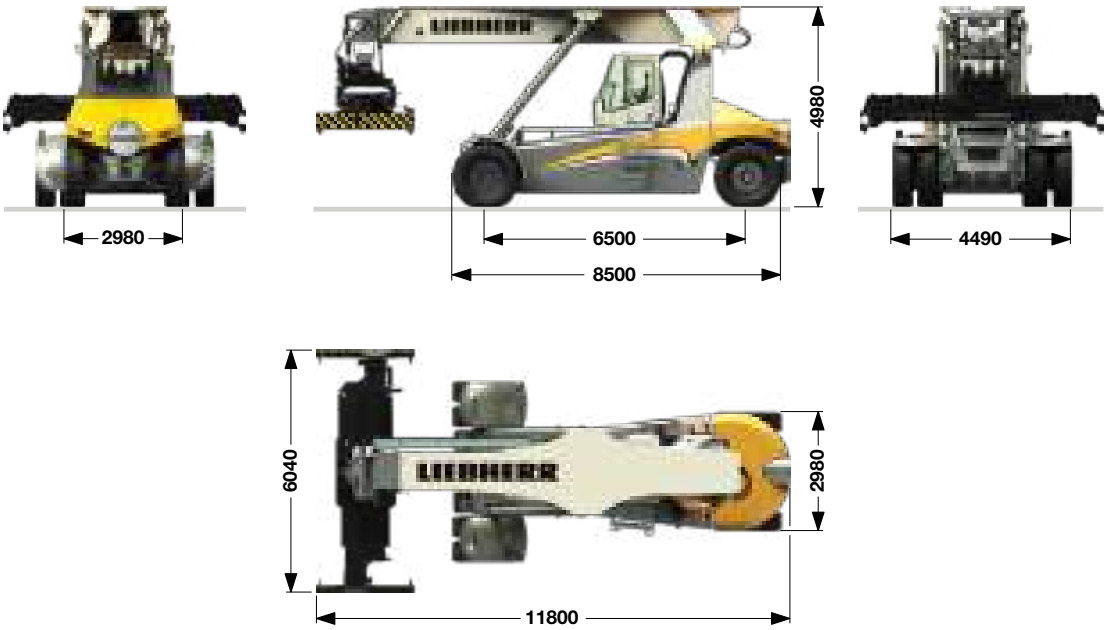
LRS 545 Intermodal

Similar to illustration, may contain special equipment

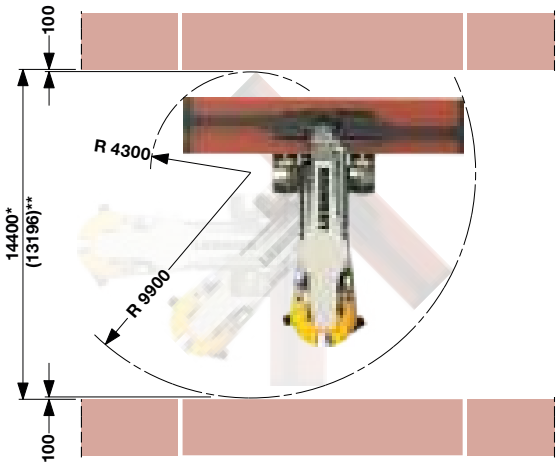
LIEBHERR

Dimensions

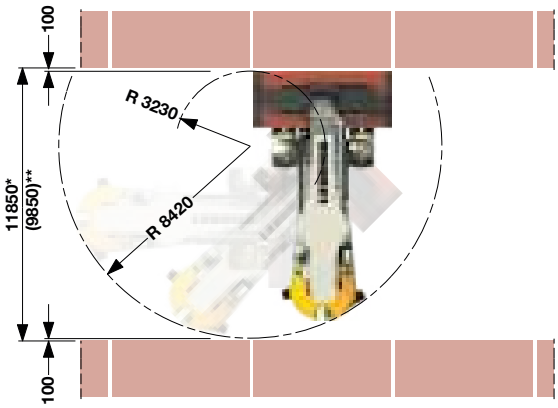
LRS 545 Intermodal



40´ Container



20´ Container



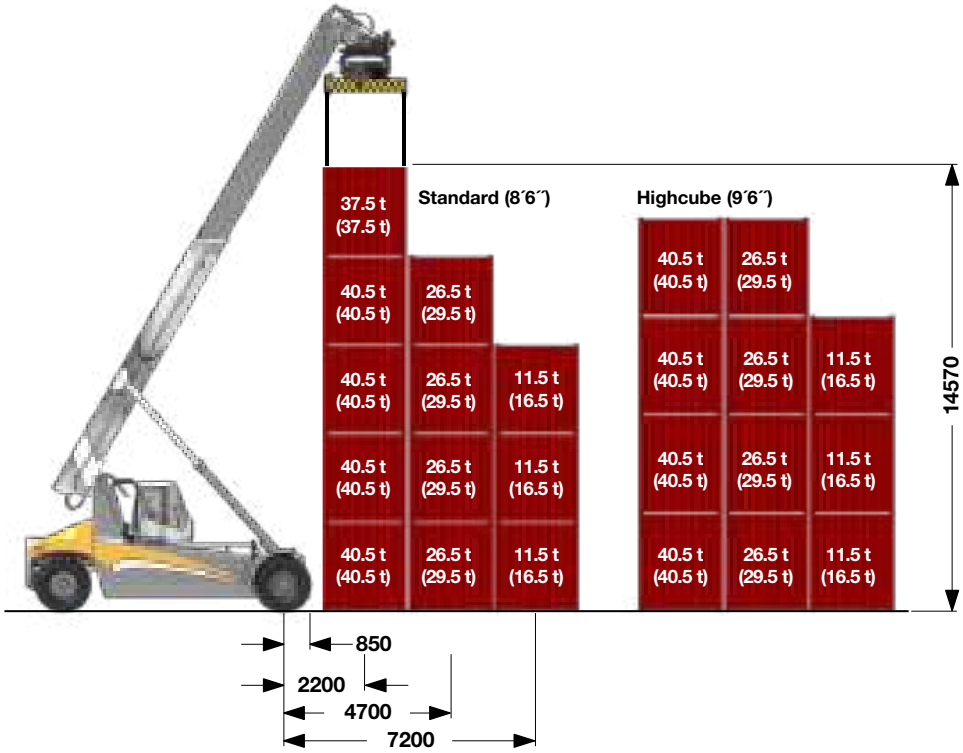
* Distance center of front axle to center of spreader = 2000 mm
** Distance center of front axle to center of spreader = 0 mm

Dimensions

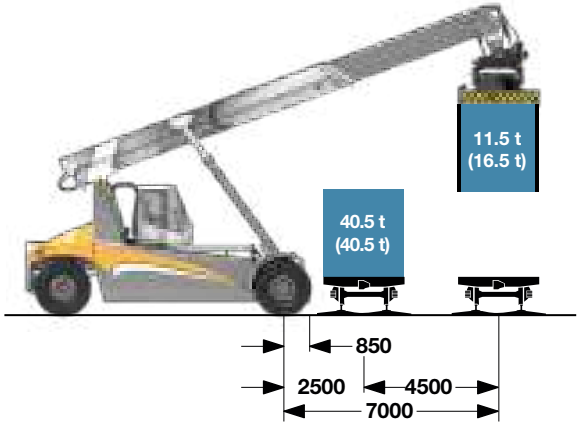
	Unit	LRS 545-31 I
Overall length of machine	mm	8500
Overall length incl. spreader	mm	11800
Width incl. front wheels	mm	4490
Min. ground clearance	mm	300
Wheelbase	mm	6500
Boom angle (min./max.)	°	0/60.3
Max. lifting height under twistlock (row 1/2)	mm	14570/12820
Min. distance ground to spreader	mm	1385
Seat height	mm	2600
Boom height (min./max.)	mm	4980/17800
Total weight (unladen/laden)	t	72.5/113

Load chart

LRS 545 Intermodal



Optional: support plate



Values in brackets only with support plate

Load Data

	Unit	**LRS 545-31 I** (row 1/2/3)
Capacity	t	40.5/26.5/11.5
Capacity with supporting plate	t	40.5/29.5/16.5
Distance from centre of tyres to container	mm	2200/4700/7200
Face of tyres to container	mm	1350/3850/6350
Stacking height – 8‘6“ container		5/4/3
Stacking height – 9‘6“ container		4/4/3

Technical Data

LRS 545 Intermodal

Driveline

	Unit	LRS 545-31 I
Engine manufacturer/type		Liebherr D944
Emission standard		Stage IV/Tier 4 final
Power		230 kW at 1700 rpm
Torque		1440 Nm at 1350 rpm
Displacement/number of cylinder	cm^3	7964/4
Fuel consumption	l/h	12 - 14
Tank volume (hydraulic/diesel/AdBlue)	l	1100/500/46
Noise level (inside)	dBa	71
Transmission		stepless/hydrostatic
Operation brake		hydraulic/wet disc brake
Parking brake		wet disc brake

Performance

	Unit	LRS 545-31 I
Drive speed* (unladen/laden)	km/h	25/20
Lifting speed (unladen/laden)	m/s	0.40/0.25
Lowering speed (unladen/laden)	m/s	0.40/0.40
Gradeability (unladen/laden)	%	18/10

*forward and backward

Wheels

	Unit	LRS 545-31 I
Tyre type		pneumatic
Tyre dimension		18.00 x 25/40PR
Rim dimension		13.00 x 25
Tyre pressure	bar	10
Number of wheels (front/rear)		4/2
Track width (front/rear)	mm	3345/2435

Lifting Attachments

	Unit	LRS 545-31 I
Spreader type		Intermodal
Spreader width (min./max.)	mm	6050/12175
Spreader side shift	mm	+/- 800
Spreader rotation	°	-105/+195
Mechanical pile slope (mechanical levelling)	°	+/- 3
Power pile slope	°	+/- 6
Power damping (forward/backward)	°	standard

LRS 545 Intermodal – 1502.03 – 04/2016 Subject to change without notice.

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kvl

From: Sanish. A <asa@lntiel.com>
Sent: Friday, March 09, 2018 4:37 PM
To: 'kvl'; sha@lntiel.com
Subject: FW: India - L&T - NMPT - existing Berth No. 14 - Consultancy for developing container terminal
Attachments: liebherr-lhm-550-mobile-harbour-crane-datasheet-english.pdf

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From: Vaghela Vijaysinh (LID) [mailto:Vijaysinh.Vaghela@liebherr.com]
Sent: Friday, March 09, 2018 4:32 PM
To: Sanish. A
Cc: Kalra Sunil (LID); Khunt Sanjay (LID); Kravina Carlo (MCR); 'kvl'
Subject: RE: India - L&T - NMPT - existing Berth No. 14 - Consultancy for developing container terminal

Dear Mr. Sanish,

This has further reference to our telephonic discussion

As discussed, the budgetary offer for LHM 550 would be 3.55ml Euro FOB North European seaport, accordingly please find attached herewith the datasheet for the same (kindly refer page no.4 for container handling load chart)

Should you need any further information, please do let us know.

Hope to have been of assistance to you.

Thanks & Best Regards,

Vijaysinh Vaghela
Sales Manager – Liebherr Maritime Cranes
LIEBHERR INDIA PRIVATE LIMITED
GSM : +91 91674 99954

From: Vaghela Vijaysinh (LID)
Sent: Monday, February 12, 2018 4:42 PM
To: 'Sanish. A'

Cc: Kalra Sunil (LID); Khunt Sanjay (LID); Kravina Carlo (MCR); 'kvl'
Subject: RE: India - L&T - NMPT - existing Berth No. 14 - Consultancy for developing container terminal

Dear Mr. Sanish,

This has further reference to mail below

For MHC, since maximum cargo to be handled would be container and having 12 -13 containers across vessel, we would propose our model LHM 425 (2 rope, 84t) accordingly please find attached herewith the technical datasheet of LHM 425

The budgetary offer for LHM 425 would be 3.1 Ml EURO FOB North European seaport, the delivery period would be 6 to 7 months ex. works after receipt of LC, subject to goods remaining unsold

For RTG's, please find attached herewith the datasheet for your reference

The budgetary offer for RTG's would be 1.6 Ml EURO FOB and depending on final scope of supply, the delivery period would be 10 to 11 months ex. works after receipt of LC, subject to goods remaining unsold

The offer price for above cranes excludes all customs duties and whatsoever charges applicable in India

Trust the above is inline with your expectation, we now look forward for your favorable response

Should you need any further information, please do let us know

Hope to have been of assistance to you.

Thanks & Best Regards,

Vijaysinh Vaghela
Sales Manager – Liebherr Maritime Cranes

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Liebherr construction on Facebook | Liebherr maritime on Facebook | Liebherr on Xing | Liebherr on LinkedIn

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From: Sanish. A [mailto:asa@lntiel.com]
Sent: Friday, February 09, 2018 12:17 PM
To: Vaghela Vijaysinh (LID)