

## **Productivity Increases by Design Changes in Grab Ship Unloader (GSU)**

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**Summary:** - Substantial reduction in vessel's port turnaround time can be achieved if innovative cargo unloading methods are employed for large bulk carriers. Bulk cargo, nowadays, is transported in large capsize vessels. Such ships can be handled at only a handful of ports. Construction & development of new infrastructure is a costly and long drawn out affair and therefore a great deal of thought should be given during the port facility planning stage. Continuous improvement in cargo handling technology is a must if productivity and efficiencies are to improve any further. In recent years, new cargo unloading systems (GSUs) have been designed. One such design is the offshore unloading system which is not only cost effective but also highly versatile equipment when compared to the traditional cargo unloading systems.

In order to further improve GSU productivity, it is proposed to build an attachment which connects to the hopper of the GSU. It is expected that this attachment will significantly reduce vessel turnaround time as well as reduce the deployment of additional resources by stevedores by reducing the Grab cycle time.

### **BACKGROUND**

In almost all the ports around the world, either shore cranes or vessel cranes are used for unloading activities. In order to achieve high productivity most of the ports have deployed mobile harbor cranes or GSUs (**Gantry dry bulk ship unloader**) for unloading of cargo. Gantry dry Bulk unloader

gives high productivity as compared to the mobile harbor cranes. After closely observing the GSU operation, I am of the opinion that if some modification can be made, the productivity of the GSU can be increased by about 50 to 70 % without incurring any additional cost in modifying the GSU's SWL.

## **PRESENT PRACTICES & CONSTRAINTS**

The productivity per vessel can be improved by the following method

- 1) Increase the number of cranes allocate per vessel
- 2) Increase the capacity of the cranes
- 3) Increase the back-up resources
- 4) Fast evacuation of cargo from storage yard to avoid storage like bottleneck.

However all the above methods results in higher cost. Instead of spending additional money on the above mentioned infrastructure, if it were possible to reduce the cycle time of the GSUs, similar results could be achieved at marginal cost. The reduction in cycle time of the GSU can be achieved with the help of a small innovative idea which will increase the productivity of the GSU without the need for increasing the capacity of the GSU or any major structural modification. There innovation requires a onetime investment for carrying out modification in GSU.

The existing GSUs in use worldwide encounter the following constraints which can be reduced by the proposed innovation.

- Maximum time is spent by the grabs in travelling from the vessel hold to the crane's hopper
- The grab travelling distances is about 30 meters.
- Due to the large distance travelled by the laden grab, the maintenance of the GSU also increases which directly impacts the operational cost
- Due to excessive grab travel time, the berth occupancy and the vessel turnaround time is adversely affected.

Let us, for the moment, consider the Capesize vessels which call Mundra Port, India. These capsize vessels have a DWT of 180000mt.

Most of the GSU's have a designed capacity of 2000 MTs/ hrs. The designed cycle time is 75 seconds. But the average discharge rate per crane achieved is only @ 1000 MTs / hr. If 3 shore cranes are used per vessel then a 180000 MT DWT cape vessel is completed within 2.5 days. However, it is possible to reduce the vessel turnaround time by as much as 40% using the proposed innovation.

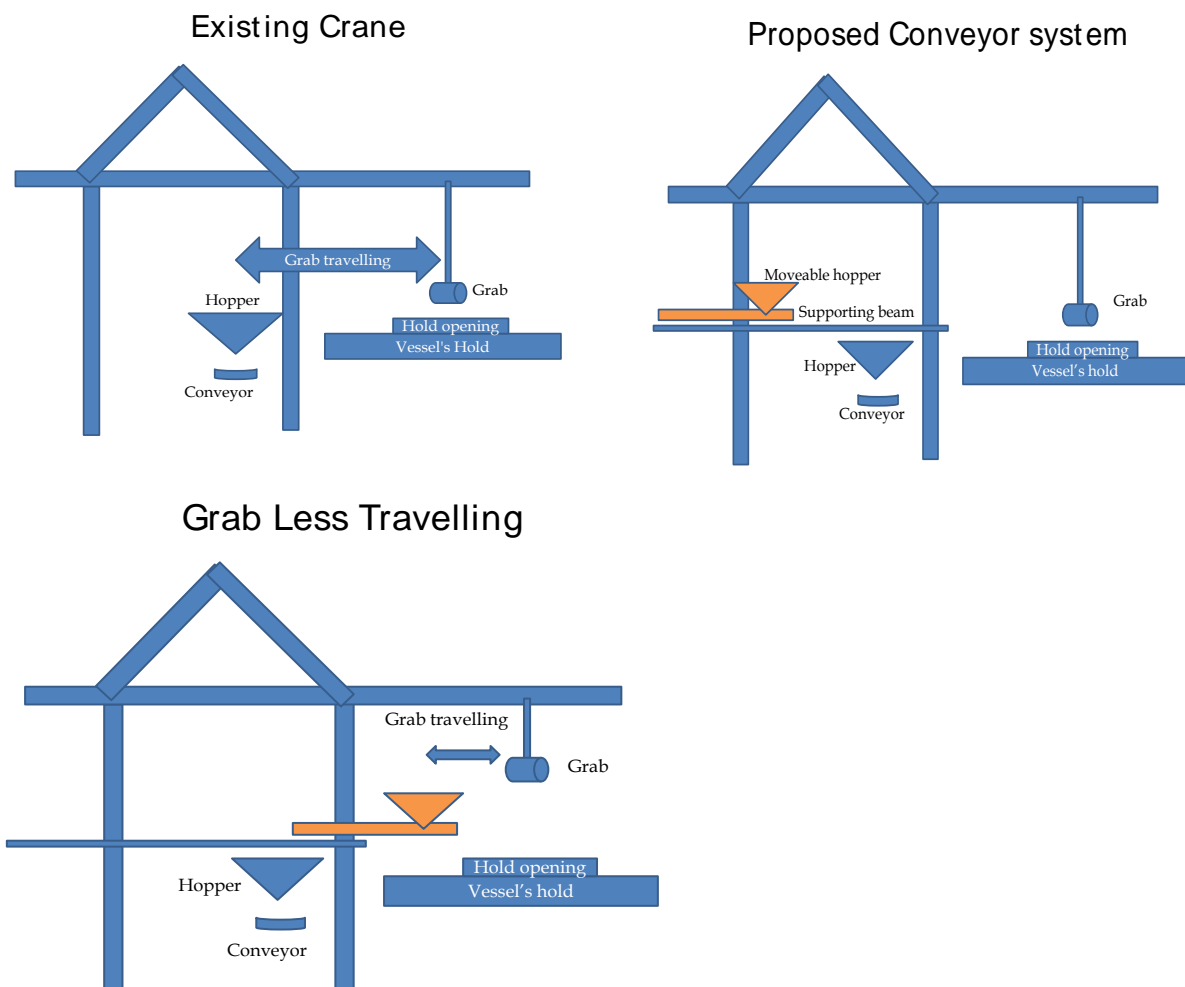
## **HOW TO OVERCOME THE AFORESAID CONSTRAINTS**

In order to overcome the aforementioned constraints, my proposed solution involves modifying the present design by attaching a small moveable conveyor with hopper system just above the main hopper in the crane. The conveyor length would be about 15 meters from the main hopper to the vessel. Using this method the grab would unload the cargo onto the extended hopper and the cargo would be transferred to the main hopper by the conveyor. Every cycle, the grab would be moving 20 mtrs only instead of 50 meters (Calculating for both directions). This will reduce the average cycle time of the crane is reduced by about 50 %. This innovation can help increase cargo handling

productivity by up to 40% without any changes in the GSU capacity. I had approached the largest crane manufacturer of the world, FIGEE in Netherland for their consent. FIGEE showed a lot of interest in my proposed idea and accepted that my idea had the potential to improve the crane productivity. (Mail communication attached for evidence)

***Thank you very much for your request. Your presentation and short animation looks very impressive and requires some calculation. You are indeed a very innovative person.  
Mr. Subbu you are at the right address to make such a modification with Figee.***

**Marc Schinkel**  
**Sales manager**  
**FIGEE**  
**Netherland**



#### Evaluation (before and after modification)

Name	Before	After	Remarks
Grab travelling distance	50 meters	20 meters	
Cycle time (average)	75 seconds	45 mnts	
Max cycles per hrs	48	80*	
Max discharge rate per hrs	1680mt	2800mt*	Average 35 mt/ cycle
Average output per day per crane	24000 mt	40000 mt*	
Vessel Turnaround time (DWT 160000mt & 3 shore cranes)	2.22 days	1.33 days*	
Vessel owner Expense in port stay	USD 22200	USD 13300*	
More cargo handled per day	000000	106800 mt*	
Power consume for 3 cranes	31968 KW	19152 KW*	Per hrs per crane 200 KW. Savings 12816 KW per vessel

\*-90% consider

#### Cost Benefits

By attaching a small conveyor on to the crane, we can reduce the average cycle time from 60 to 45 seconds. So discharge rate can be increased from 1000mt/hr to around 1400 mt/hr. This would reduce the vessel turnaround time by about 40% (considering all delays such as cargo sweeping by labors, Hatch change for vessel stability and stress, onboard equipment change, and back-up stacker change)

Nowadays the demurrage cost for a cape size vessel is approximately 10000 USD per day. If the vessel completes her cargo operations within 48 hrs instead of 72 hrs, the owner / charterer get a benefit of about 10000 USD. In a year if he can save 10 days, an approx additional earning of 100000 USD can be achieved per vessel even using conservative estimates.

At the same time using the proposed innovation a port or a terminal operator can handle higher number of vessels thereby increasing the cargo throughput through such berth. The income of the port / terminal operator is directly related to the volume of cargo handled. The port will be able to handle 50% more cargo without any additional capital investment required for creating an additional 60-70% capacity. If the crane output capacity increases, the ports / terminal operators will require lesser number of shore cranes to handle the same amount of cargo. This is also likely to significantly reduce maintenance cost of the GSU's.

For your reference, I have attached the Quotation received from FIGEE for engineering design.

#### Marine operation benefit

More number of vessels can be handled at the same berth which, in turn, will increase the port revenue by improving berth occupancy & optimal utilization of resources.

#### Pro-Environmental

- Some dry bulk cargoes such as fertilizers & animal feed have high concentrations of organic material and nutrients which have high biological demands. Large spillages of these can cause localized nutrient enrichment & oxygen depletion. This often results in suffocation of the marine life in the vicinity. If the proposed design is considered for GSUs, the spillage of cargo will be greatly reduced at jetty and will ultimately also lead to clean working environment on the jetty and the port.

#### Acknowledgement

I am very much thankful to

Capt. Sansar Chaube- AGM -Marine Dept- Adani Port & SEZL- Mundra

Mr. BG Gandhi- AGM Head, Coal Terminal – Adani Port & SEZL- Mundra

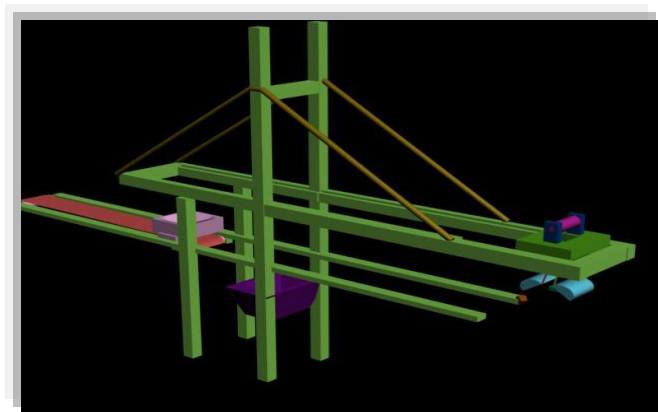
Capt. Unmesh Abhyanka- COO- Adani Port & SEZL- Mundra

who have guided & inspired me to accomplish this project.

Subramanian Nadar

## Budget proposal

### Feasibility study of moveable hopper system



Client : Mundra Port

Figee : 0110207

Revision : 0

Date : December 5<sup>th</sup> 2011



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## **1 Introduction**

### **HARBOUR CRANES**

Figee Crane Services is founded in 1836. The company has earned a worldwide reputation as a leading designer and manufacturer of various types of harbour cranes and general hoisting systems.

Figee started as a manufacturer of machinery and hoisting equipment and bridges. During the years, Figee Crane Services has carefully followed up and anticipated on the expansion and development of loading/unloading in the ports and specialised as a manufacturer of harbour cranes. In the fields of general cargo, bulk- and container handling, Figee Crane Services has build up extended experience and has earned a good reputation as a high-minded and qualified supplier of cranes. In the mean time Figee Crane Services is specialised in rail mounted and floating cranes and is one of the well-known manufacturers of this equipment worldwide.

### **LEMNISCATE ®**

Figee Crane Services is a leader in the design and manufacturing of advanced floating grab cranes. Our very successful range of Lemniscate® floating grab crane is convincing proof of this reputation. Both robust and reliable, Figee Lemniscate® cranes mounted on pontoons provide fast, independent operations, achieving transshipment capacities of up to 25,000 tons/day. Loading and unloading on-stream as well as at sea. Our cranes can handle both ship-to-ship and ship-to-shore operations swiftly and efficiently. Flexibility, reliability and progressive performance under all circumstances make Figee Crane Services' floating cranes stand out from other floating and harbour grab cranes.


### **Delivery program New Build Cranes**

- Pedestal cranes
- floating cranes, including the unique Figee "Lemniscate®" Floating Crane
- single- and double boom cranes for bulk-handling and general cargo
- gantry grab cranes
- ship-to-shore container gantry crane - Rail mounted gantry cranes





#### THE GROUP

Figee Crane Services is a member of the  Group.

**Today, Kenz Figee B.V.** is a crane-building quality centre, serving the global market .

The four individual professional subsidiaries, all with their own characteristics, are specialists in the crane industry with activities worldwide for the Oil & Gas and Harbour industry.

**Figee Crane Services B.V.** has build up extended experience and has earned a good reputation as a high-minded and qualified supplier of harbour cranes. In the mean time Figee Crane Services is specialised in rail mounted and floating cranes and is one of the well-known manufacturers of this equipment worldwide.

**Kenz Cranes B.V.** Kenz Cranes is a long lasting name in cranes and lifting appliances for the offshore industry. The company has provided crane design and manufacturing to the strict specifications of the industry and international standards since 1960.

**Kenz Offshore Services.** An experienced team of multi-skilled maintenance and repair staff, backed up by our headquarters, serves as a 'flying squad' ensuring prompt response on land and offshore, wherever in the world a unit may need assistance. Several well-equipped mobile offshore workshops are on call with tools varying from hydraulic torque equipment to water bags and electronics load cells for on and offshore testing.

**Dutch Crane Engineering B.V.** Our engineering has expertise in hydraulics, electronics and control systems and has the disposal of state-of-the-art technical tools, such as Inventor, Finite Element programs and simulation software. Also, rely on us to comply with the requirements of classification societies, for outstanding project management and meeting the highest of QHSE standards.



## **2 Motivation**

Some time ago we received a request for a study of a moveable conveyor hopper system on a ZPMC crane. Fige Crane Services is an organization, who is an expert in engineering modifications and upgrades on all types of cranes.

With such upgrade Mundra Port will increase their coal turnover with a substantial percentage, due to the fact that the cycle time will be shorter by unloading the cargo direct on the conveyor system. The conveyor system will be connected to the hopper. This ongoing process will improve and guarantees a unique and fast unloading process, which most likely knock out any competition in your area.

Our proposal to you is a feasibility study in order to see if this system can be realized on your ZPMC crane.

## **3 Starting points**

Our proposal is based on the documentation received from Mundra Port

- General arrangement drawing (dr. nr. UL 7400) and PowerPoint document describing the cycle
- Crane, grab and conveyor specification
- The existing ZPMC crane
- The moveable hopper construction, which must be exchangeable with 4 cranes
- Standards are not taken into consideration at this moment
- Work will be done at our engineering department

## **4 Scope of work**

Review and report for the concept of a ZPMC crane with moveable hopper.

The following scope of work will be realized

- Study and review of the delivered documentation
  - General arrangement drawing (dr. nr UL 7400)
  - Power point document describing the cycle
- Feasibility check
  - Interface between QC crane and moveable hopper
  - Structural construction
  - Cycle time
- Best solution check



## **5 Budget feasibility study**

Above scope of work will amount **€ 9.100,-**

Above amount will be given as a discount when Figuee Crane Services receives the full order for production and commissioning of moveable conveyor hopper system.

Amount mentioned is excluding VAT

## **6 Contract conditions**

Payment: 30 days after invoice date

## **7 Validity**

Validity of this budget is 2 weeks and subject to order intake.

## **Appreciation mail from FIGEE - Netherland**

**"Marc Schinkel"**

**<m.schinkel@figee.com>** To <Subramaniam.Nadar@mundraport.com>

10/25/2011 05:37 PM cc "Melvin Veen" <M.Veen@dutchcraneengineering.com>

Subj RE: Enquiry regarding innovative QC bulk crane  
ect

Good afternoon Mr. Subbu,

Thank you very much for your request. Your presentation and short animation looks very impressive and requires some calculation. You are indeed a very innovative person. Mr. Subbu you are at the right address to make such a modification with Figee. We are a specialist in handling bulk. We build and find creative innovative solutions for all of our customers as pure specialist in fast cycle times in hoisting and lifting equipment in combination with conveyor systems.

I will inform you within this week what steps we can take in order to provide you with a suitable solution in order to increase the volume of bulk to be handled per hour.

Kind regards,

Marc Schinkel  
Sales manager