

Trends & practices in Tandem 40 Crane Operations



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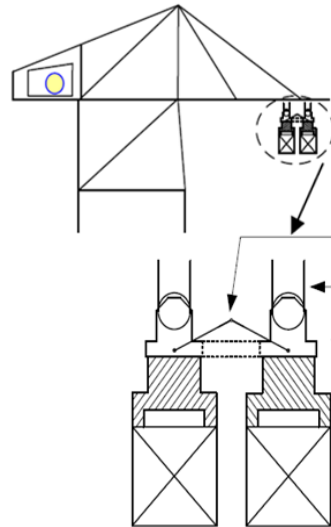
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DUAL HOIST AND SINGLE HOIST COMPARISON

WHAT

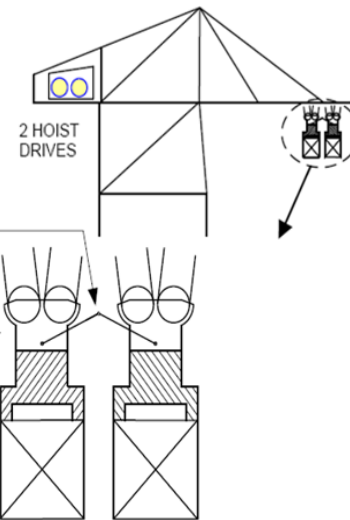
General Arrangement

Single Hoist T-40



1 pair of rope sheave
& 1 set of wire rope

Dual Hoist T-40



2 pairs of rope sheave
& 2 sets of wire rope

DUAL HOIST AND SINGLE HOIST COMPARISON



DUAL HOIST AND SINGLE HOIST COMPARISON

WHY

- **Faster ship operations** ✓
- **Shorter berth stay** ✓
- **More effective use of capital per container** ✓
- **Low energy usage** ✓

INDUSTRY TRENDS

INDUSTRY TRENDS

DELIVERY

Table 4.2: Global STS delivery trend 2005-2015 by lift capacity

Lift capacity (tonnes)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
30-39	1	1	0	4	3	2	3	3	5	3	5
40-49	38	39	32	25	26	18	11	18	7	11	25
50-59	34	32	35	37	34	27	20	41	18	2	10
60-69	118	242	168	149	120	113	94	158	123	186	160
70-79	9	16	16	35	25	16	4	2	8	10	17
80+	31	32	70	80	84	23	2	16	6	21	20
Total	231	362	321	330	292	199	134	238	167	233	237

*“The total number of the order was **277 units** as of the end of 2008” Quote ZPMC*

In 2012 ZPMC published an article by Wang Zhili comparing Dual Hoist and Single Hoist Cranes

In the same year ZPMC sold their first Single Hoist Tandem to Paraguay

港口装卸 2011年第5期(总第199期)

双 40 英尺集装箱吊具上架系统的对比分析

上海振华重工(集团)股份有限公司 王志利 王光辉 徐诚瑜

摘要:为适应船舶大型化对港口装卸效率的高要求,出现了双 40 英尺集装箱吊具上架系统,它给集装箱装卸系统带来了巨大变革。本文对各种双 40 英尺吊具上架系统进行对比分析,为港口购买新设备和对现有设备进行改造提供参考。

关键词:双起升岸桥;单起升双 40 英尺岸桥;双 40 英尺吊具上架

Contrast and analysis on Headblock System in Twin 40' Container Spreader

Shanghai Zhenhua Heavy Industries Co., Ltd. Wang Zhili Wang Guanghui Xu Chengyu

Abstract: In order to meet the higher requirement of large-scale container vessel to port handling efficiency, the headblock system in Twin 40' container spreader is invented and in turn it brings a complete revolution to the container handling system. This article makes a contrast analysis on various headblock systems in twin 40' container spreader, and will be as a reference for port's new equipments purchase or existing equipments modification.

Key words: dual hoist type of quayside container crane; single hoist type of quayside twin 40' container crane; twin 40' spreader's headlock system

岸边集装箱起重机(简称岸桥)自 1965 年诞生以来,经过近半个世纪的演变,已经有了脱胎换骨的改变,目前正面临集装箱船舶大型化和对生产率更高要求的严峻挑战。在油价高昂的今天,大型船舶选择停泊的港口,不仅要有深的航道和好的码头,而且要求能快装快卸,实现最短的在港停留时间。为了满足快装快卸的要求,码头要投入八九台甚至更多的岸桥同时作业,投资大,成本高,经济效益差。

它的诞生立即引起世界港口普遍关注。

ZPMC 的双起升岸桥由两套独立的起升系统组合而成(见图 1),每套起升系统都有单独的起升机



The Article says:

Dual hoist cranes have design & complexity issues:

- *two separate hoisting system*
- *trolley assembly girder width*
- *cart track gauge*
- *size of machine room*
- *hoisting wire rope winding system*
- *overall steel structure design*

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- On the terminal, ordinary gantry cranes can be converted into Tandem gantry cranes according to the existing equipment in order to improve the speed of offloading and unloading.

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INDUSTRY TRENDS

ZPMC ARTICLE

	Overall weight	Trolley weight	Number of lifting system	Machine room size	Girder overall width	Machine price
Comparison of double lifting gantry cranes and conventional gantry cranes	Heavy a lot	More than about 15t	More than one set	About 4m long	About 1m wide	Expensive a lot
Comparison of Tandem gantry cranes and conventional gantry cranes	Slightly heavier	More than about 5t	The same	The same	The same	Slightly more expensive

*They represent the development direction of **new-generation** gantry cranes, and will become new products for upgrading of terminal handling equipment*

This report provides a comparative analysis of the dual hoist STS crane and single hoist double spreader STS crane from an actual operational perspective

SIPG evaluated ZP Dual hoist and also three brands of Single Hoist Tandem system

2016 年 9 月
第 9 期 总第 519 期

水运工程
Port & Waterway Engineering

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自动化码头双 40 ft 桥吊上架形式比选

金 毅, 黎志勇, 田晓峰

(上海国际港务(集团)股份有限公司, 上海 200080)

摘要: 针对自动化码头双 40 ft 桥吊上架形式选择问题, 对目前主流双起升桥吊和单起升双吊具上架桥吊进行研究, 通过双起升桥吊实际使用数据分析 3 种主流双 40 ft 吊具的上架系统结构、性能, 确定洋山四期双 40 ft 桥吊采用单起升双吊具结构形式。

关键词: 双起升桥吊; 单起升双 40 ft 桥吊; 单起升双 40 ft 吊具上架

中图分类号: U 652.7'2

文献标志码: A

文章编号: 1002-4972(2016)09-0107-04

Selection of twin 40 ft spreader's headblock system in automatic container terminal

JIN Yi, LI Zhi-yong, TIAN Xiao-feng

(Shanghai International Port (Group) Co., Ltd., Shanghai 200080, China)

Abstract: Based on the selection of twin 40 ft spreader's headblock system in automatic container terminal, we study the dual hoist and single hoist type of quayside container crane(QC), and analyze the practical data of the usage of dual hoist QC, compare the structure and performance of three main headblock systems in twin 40 ft container spreader. It is preferable to use single hoist dual spreader structure in Yangshan port's twin 40 ft container QC.

Keywords: dual hoist type of quayside container crane; single hoist type of quayside twin 40 ft container crane; single hoist type of twin 40 ft spreader's headblock system

The article says:

- *High price of dual hoist STS crane (higher than the single hoist STS crane by more than 1 million US dollars)*
- *Not in high use due to many factors*
- *High energy consumption and high operating cost*
- *At present new design terminals or terminals under construction have not been selecting dual hoist STS cranes. Instead they opt for the more economic single hoist dual spreader crane*

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Table 1: Dual hoist STS actual operation data

Project	Dual spreader loading / unloading ratio (%)	Energy consumption per container	Maintenance cost	Breakdown rate
Yangshan Phase 2	22.2/18.1	1.13	1.08	1.67
Yangshan Phase 3	13.98/0.59	1.14	1.06	1.63

Note : the maintenance cost, energy consumption and breakdown rate for Single hoist STS crane are define as 1.0.

INDUSTRY TRENDS

SIPG ARTICLE

Table 2: Comparisons of Dual Hoist T40 and Single Hoist T40 with a standard STS crane

QC	Crane total weight	Trolley weight	Hoist system	Electrical Room size	Boom weight	Price
Dual hoist T40	A lot heavier	15T heavier	One additional hoist system	4m longer	1m wider	A lot more expensive
Single hoist T40	Slightly heavier	5T heavier	Same	Same	Same	Slightly higher

INDUSTRY TRENDS

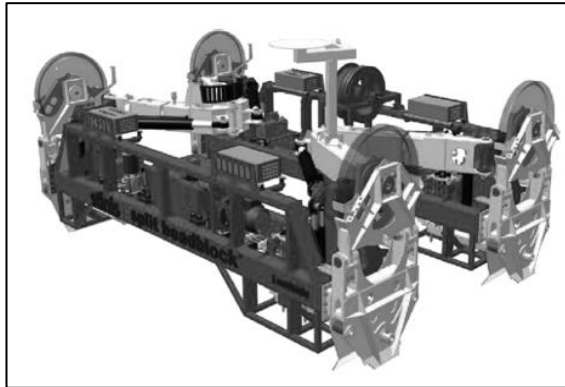
SIPG ARTICLE

The article compared 3 types of single hoist tandem

BROMMA



STINNIS



RAM SPREADERS



INDUSTRY TRENDS

SIPG ARTICLE

Table 3 - Main technical parameter of 3 types of headblock

Headblock	Spreader/HB height	Operation method	Difference in container loads	Gap between spreader	Spreader height difference	Spreader side shift	Spreader/ compatibility with other spreader
Bromma	4.0m	Manual	HB slanted, uneven loading on chain	1.0m	0.7m	0	Non standard/Not compatible
RAM	3.0m	Auto(dedicated docking station)	HB remain leveled	1.5m	1.0m	0.25m	Standard/ compatible
Stinnis	3.6m	Auto (dedicated trailer)	HB remain leveled	1.8m	1.4m	0.9m	Non standard/Not compatible

Conclusions:

- **Lower price** – compared with dual hoist STS cranes, there is **saving of 1 million USD on the cost of acquisition.**
- **Construction is simple and clean** – has the lowest height (at only 3.0m). For the same STS crane height it can achieve a higher lifting height.
- **Lower weight** (50% lighter than a dual hoist crane under twin 40 operation mode) which is a big advantage in energy consumption

Recommendations:

Phase 4 Project have abandoned the selection of dual hoist cranes for their STS cranes along the berth and instead opted for the single hoist cranes with the double spreader head block system

GLOBAL TRENDS

- **Dual hoist cranes delivered and stopped in many locations**

Durban | Saudi | UAE | Germany | Santos Brazil

- **Many terminals selecting Single Hoist Tandem**

Dubai T3 | London Gateway | Antwerp | Mexico | Yangshan | Panama | Rotterdam | Qingdao

- **Dual Hoist achieves <20% tandem**
- **Single Hoist Tandem achieves > 35% tandem**

PLANNING CONSIDERATIONS


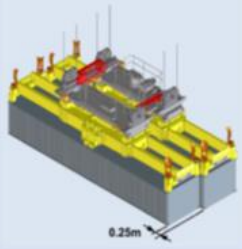
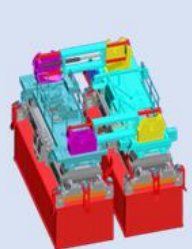

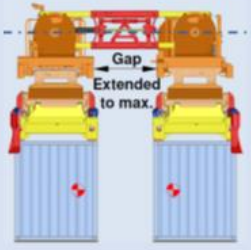
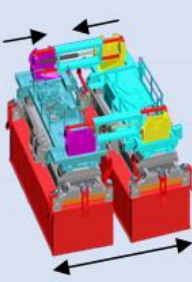

PLANNING CONSIDERATIONS

- **Energy consumption**
- **Design features**
- **Reliability**
- **Proven track record**
- **Flexibility**



PLANNING CONSIDERATIONS

FEATURES AND FUNCTIONS

Gap Adjustment 0-1600mm	Longitudinal Offset $\pm 200\text{mm}$	Skewing Angle ± 5 degrees	Vertical Float $\pm 1000\text{mm}$
			
			

PLANNING CONSIDERATIONS

FLEXIBILITY

- Quick change-over
- Not working all cranes in tandem
- Exceptions can be handled



Single Spreader



Docking Station Change-over

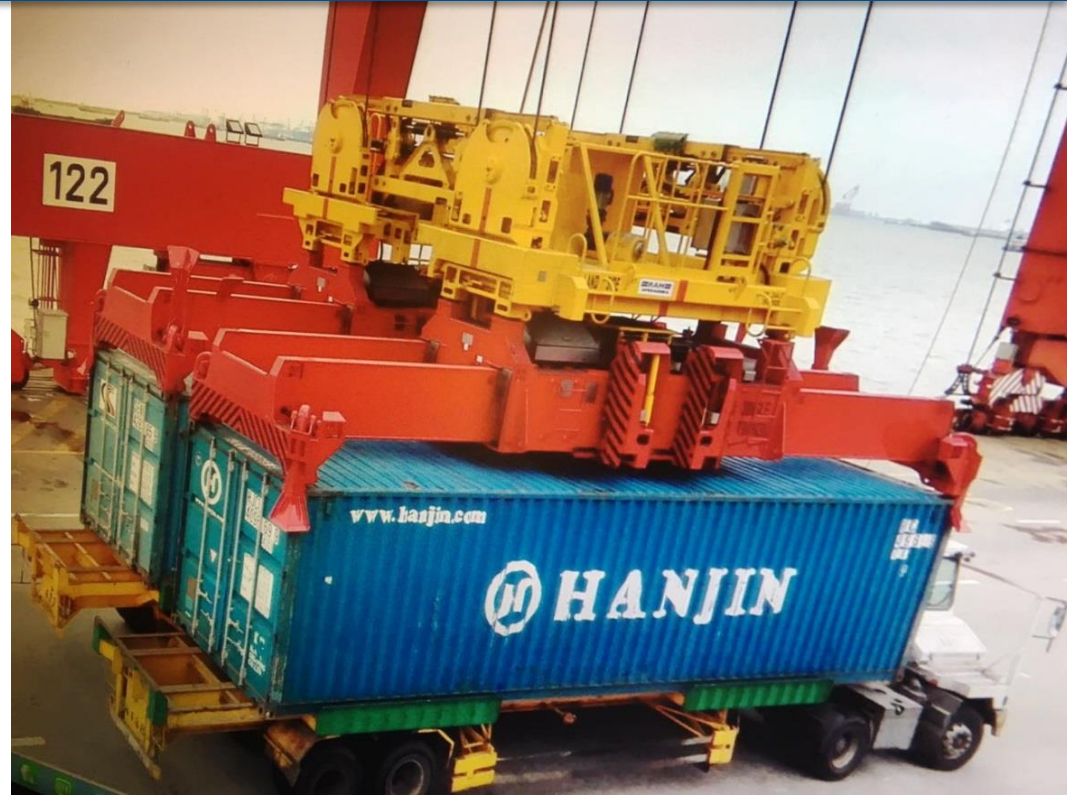


Tandem Lift Spreader

PLANNING CONSIDERATIONS

FLEXIBILITY

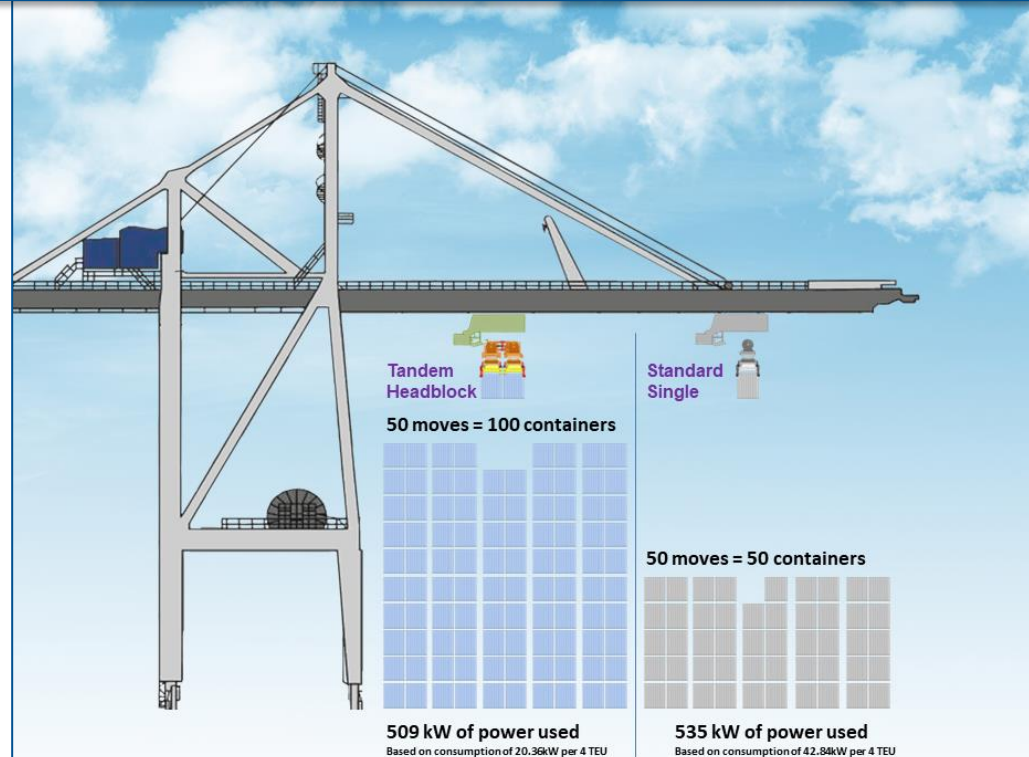
- Ability for headblock to work with existing spreaders



INCREASING LOAD RATES AND SAVING ENERGY

The moving of 100 boxes in 50 moves compared to moving 100 boxes in 100 moves...

“Significantly reduces the total energy consumed per TEU”



PLANNING CONSIDERATIONS

ENERGY

- Crane trolley weighing >100 tons and with the spreader and normal headblock close to 20 tons

The ability to add one more spreader and headblock and do half the journeys, is significant

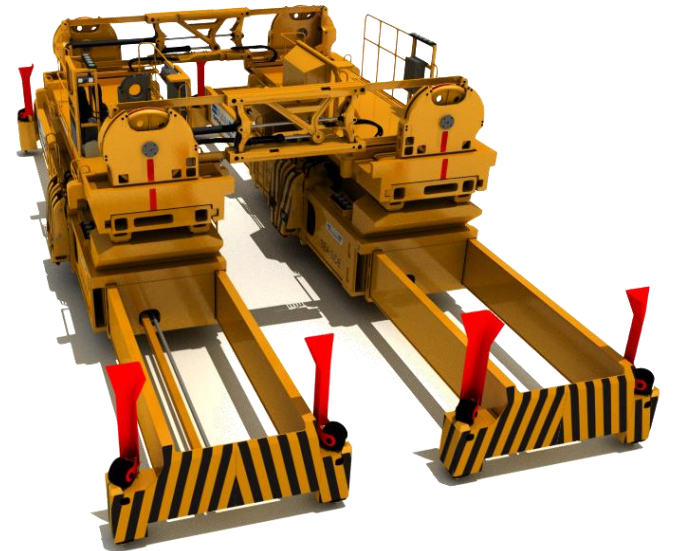


PLANNING CONSIDERATIONS

ENERGY

- Half the journeys for the same boxes reduces energy

A case study shows that energy savings are around 15%



BENEFITS

DUAL vs SINGLE

ENERGY SAVINGS

By lifting 2 containers at once by adding one more spreader and headblock to do have the journeys, energy savings are achieved

WEIGHT

Dual hoist has extra trolley and motors compared with single hoist which adds more than 200 tonnes to the weight of the crane

BENEFITS

DUAL vs SINGLE

MAINTENANCE

Extra trolley and hoisting system on dual hoist means higher maintenance costs over single hoist.

SINGLE HOIST TANDEM COMPANIES

Single Hoist Tandem systems provided by RAM Spreaders:

- Shanghai
- Yangshan
- Qindao
- South East Asia
- North Africa
- United Kingdom
- Dubai
- Antwerp
- Mexico

SINGLE HOIST TANDEM COMPANIES

Single Hoist Tandem systems provided by Stinnis, Bromma and ZPMC:

- Rotterdam
- Tangiers
- Khorforkaan
- Bandar Abbas
- Panama

SINGLE HOIST TANDEM COMPANIES

Representing the biggest leap forward
in container handling productivity
since the introduction of the twinlift spreader

“We are pleased that the single hoist tandem has allowed DP World to work more productively and as such, attract more business ”

**Andrew Bowen, Head of Engineering
London Gateway**

Thank you

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