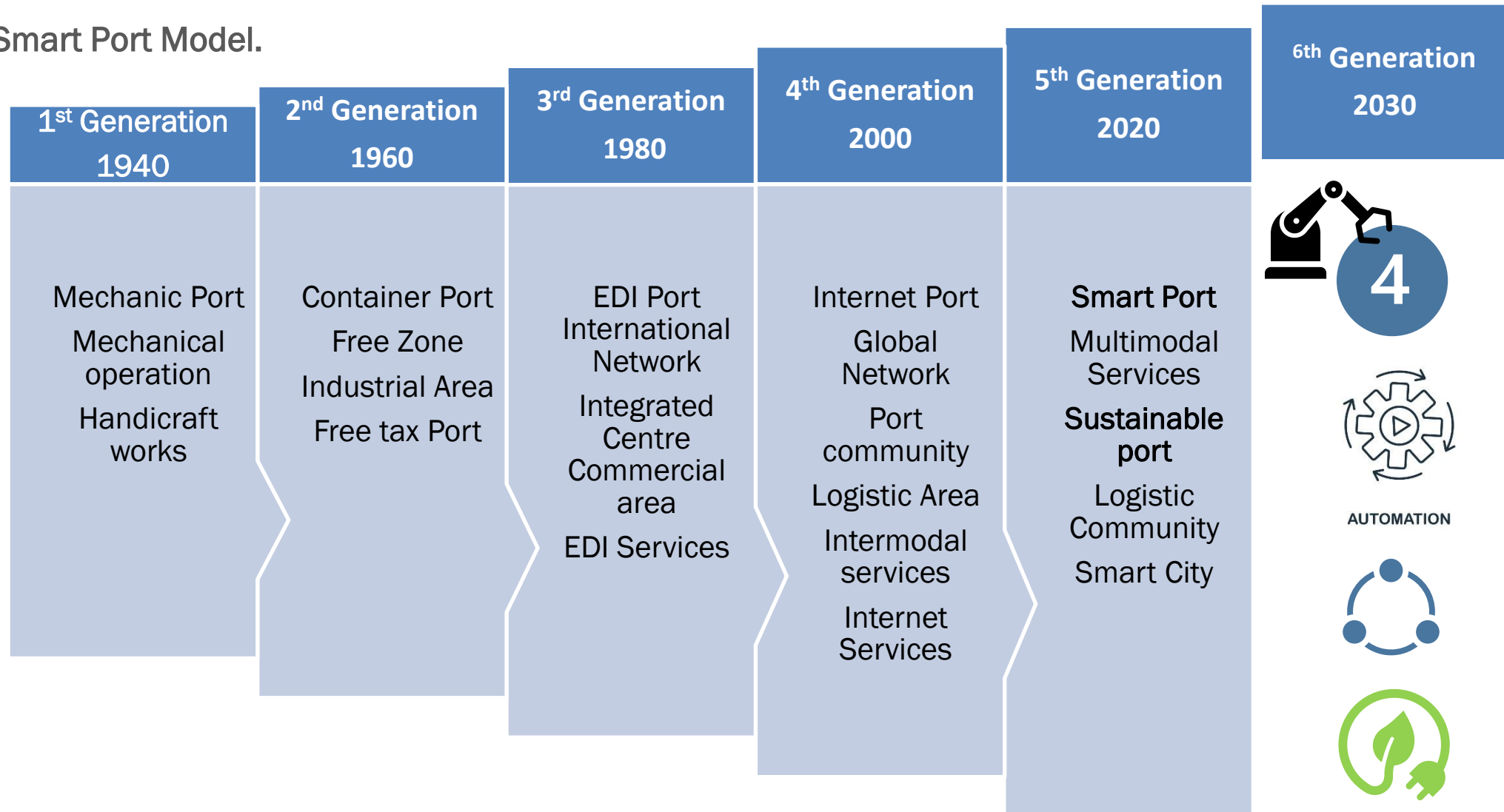


Green Ports: Attaining Energy Efficiency in Forming Green Ports of the Future

THE ZERO EMISSION TERMINAL - HOW TO CONNECT TO THE GREEN FUTURE

**VAHLE - YOUR SYSTEM SUPPLIER FOR INTELLIGENT ENERGY AND
DATA TRANSMISSION, PORT EQUIPMENT ELECTRIFICATION, AND
AUTOMATION SOLUTIONS**

Table 1. UNCTAD Smart Port Model.

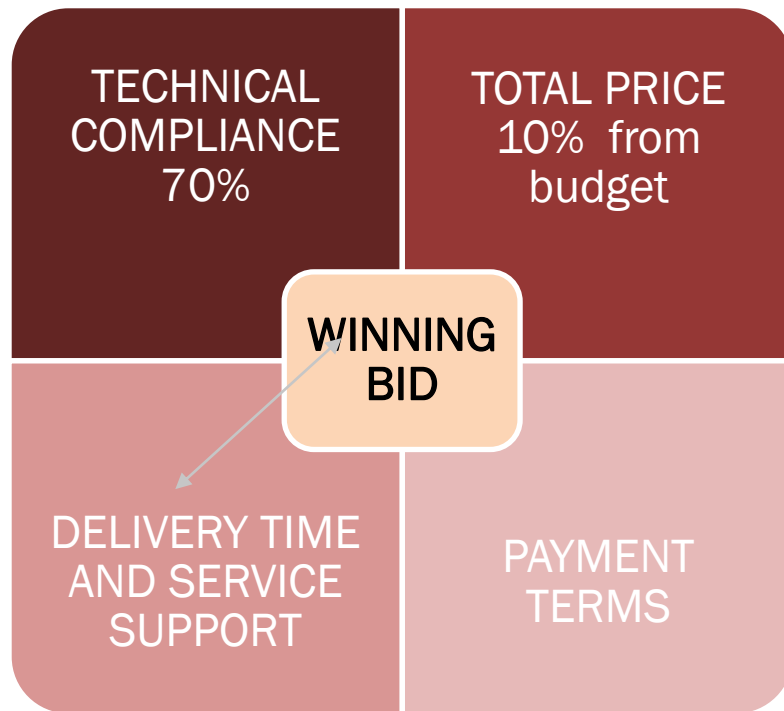


The Implementation of the **SMART** and the **GREEN** Port Concept – a way of thinking: ENVIRONMENTAL, ECONOMIC, SOCIAL

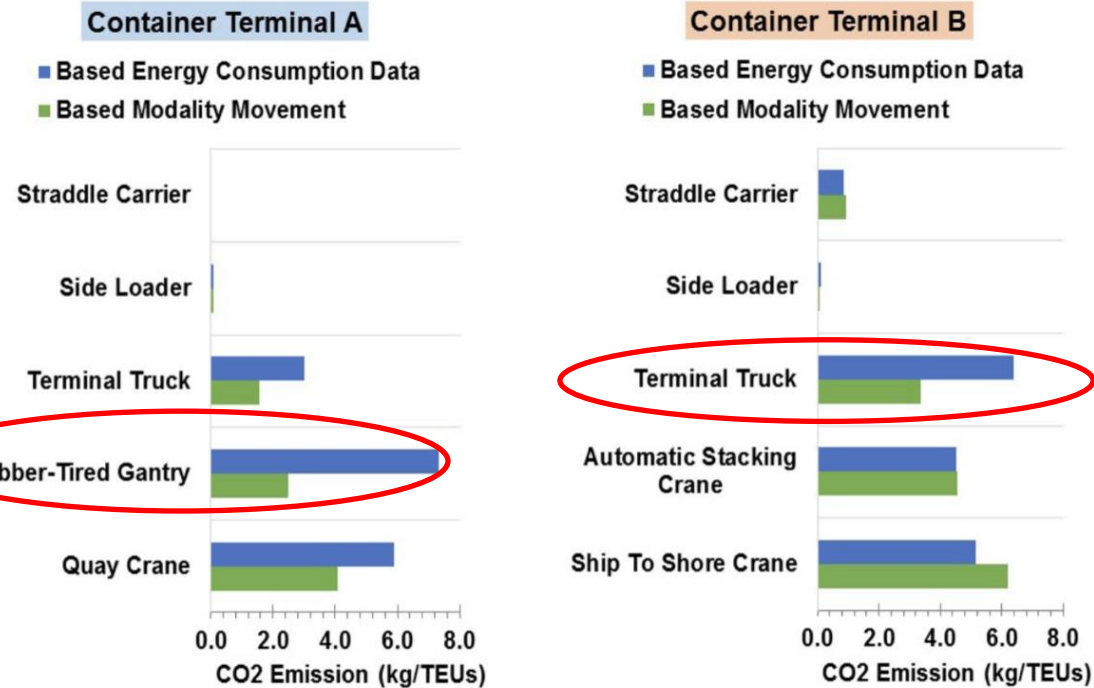


GREEN EVALUATION METHOD

TRADITIONAL EVALUATION METHOD



- RTG is one of the world’s largest machines on tires.



50% of CO2 EMISSIONS



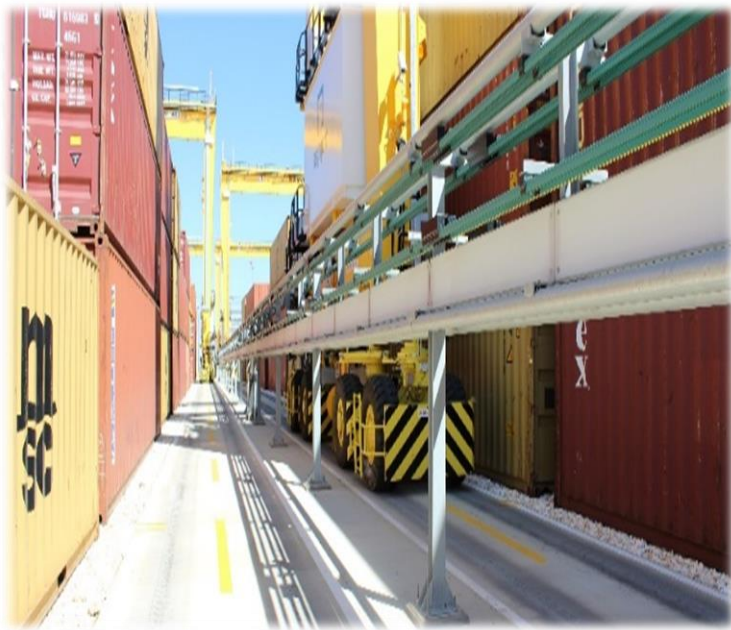
Figure 8. Comparison between CO₂ emissions arising out of container-handling equipment built upon energy use data and those based on movement modality.

Gate to Grave →	diesel	6,017,597.26
	electric	1,462,726.14

GLOBAL WARMING POTENTIAL Kg CO₂. sq

**ELECTRIFICATION OF RTG IS RECOMMENDED TO BE THE FIRST IMPLEMENTATION OF GREEN
PORT CONCEPTS IN PORT OPERATION**

**SOLUTION 1:
eRTG SYSTEMS CONDUCTOR
RAIL – BUSBAR SOLUTION**



**SOLUTIONS 2:
ELECTRIC CONVERSION RTG
USING BATTERIES HYBRID OR
FULL ELECTRIC**



**SOLUTION 3:
ELECTRIFICATION OF RTG BY
CABLE REEL**



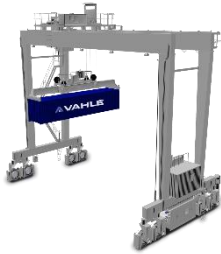
SUCCESS STORY - PORT OF FELIXSTOWE – UNITED KINGDOM

RTG ELECTRIFIED BY VAHLE BUSBAR SOLUTION



2015 – today

Total Savings since
2015:
89.620 tons CO²



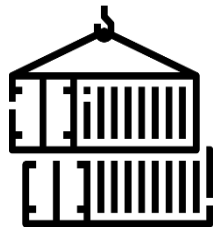
Retrofit

66 ZPMC RTGs

Greenfield

Berth 9: 8 new remote ZPMC
eRTGCs

17 new Konecranes eRTGCs

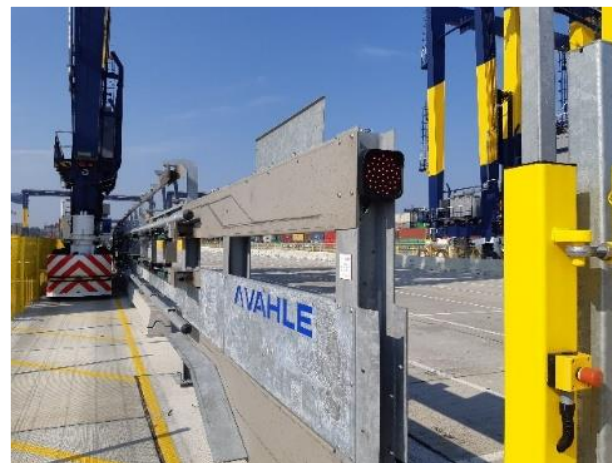


Retrofit

59 Blocks (15,322 m)

Greenfield

Berth 9: 8 container blocks



Automation with **SMGX data communication** and positioning

COMPARISON OF ELECTRIFICATION SOLUTIONS FOR RTG



GREEN CRITERIA COMPLIANCE	SOLUTION 1 eRTG SYSTEMS CONDUCTOR RAIL BUSBAR SOLUTION	SOLUTIONS 2 ELECTRIC CONVERSION RTG USING BATTERIES HYBRID OR FULL ELECTRIC	SOLUTION 3 ELECTRIFICATION OF RTG BY CABLE REEL
EMISSIONS CO2	<ul style="list-style-type: none"> ZERO 	<ul style="list-style-type: none"> Hybrid 50% 	<ul style="list-style-type: none"> ZERO
BATTERY	<ul style="list-style-type: none"> only in block change - compact 	<ul style="list-style-type: none"> Massive size 	<ul style="list-style-type: none"> Massive Cable component
CIRCULARITY	<ul style="list-style-type: none"> Aluminum structure, standard cables, easy to recycle locally. Circular and Sustainable 	<ul style="list-style-type: none"> Difficult to recycle in the local region – not standard and not sustainable. High radio activity 	<ul style="list-style-type: none"> Easy to recycle
MAINTENANCE COST REDUCTION	<ul style="list-style-type: none"> System maintenance free solution 	<ul style="list-style-type: none"> 30% maintenance reduction from diesel 	<ul style="list-style-type: none"> High maintenance
TCO	<ul style="list-style-type: none"> Long Life 20 yrs., Initial investment higher, TCO lowest 	<ul style="list-style-type: none"> Short Life 7 yrs. of batteries, expensive to replace TCO high 	<ul style="list-style-type: none"> TCO high due to maintenance costs
AUTOMATION 4.0 ADAPTABILITY / DATA TRANSFER AND COMMUNICATION	<ul style="list-style-type: none"> Adaptable. Phase 1: electrification Phase 2: Positioning Phase 3: data communication Phase 4: Automation 	<ul style="list-style-type: none"> Not proven 	<ul style="list-style-type: none"> Not adaptable
ADDITIONAL WEIGHT ON RTG, CRANE MODIFICATION, OPERATIONAL PRACTICALITIES, AND MOVABILITY FLEXIBILITY	<ul style="list-style-type: none"> Rail support structure, easy modification. No additional weight. Drive in variant and also plug in. High power grid 	<ul style="list-style-type: none"> Additional weight of battery. No support structure Lower power grid 	<ul style="list-style-type: none"> Cable alignment between RTG and container stack and additional cable protection to avoid damage. Significant additional weight and possibly mechanical modifications on the RTG. No major structural work. The need to unplug and plug in again to change aisles.

HOW THE SYSTEM WORKS: FIRST STEP – SOLUTION 1ERTG SOLUTION CONDUCTOR BUS BAR - ZERO EMISSION AND CIRCULAR SYSTEM: Trimotion 4.0



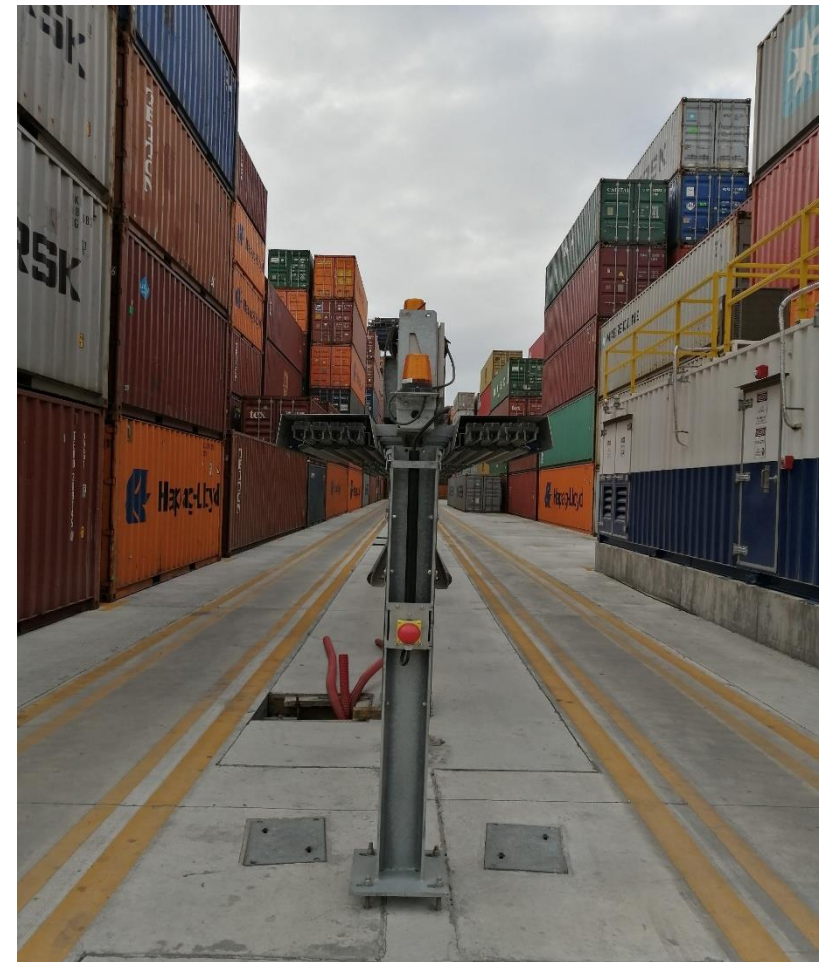
- Understand the block arrangement and workflow pattern of the RTG operation.
- Identify the number of Blocks, the length of each Block, and the Number of RTGs operating in one block.



HOW THE SYSTEM WORKS: FIRST STEP – SOLUTION 1ERTG SOLUTION CONDUCTOR BUS BAR - ZERO EMISSION AND CIRCULAR SYSTEM: Trimotion 4.0



- Check feeding points and electric grid power connections.

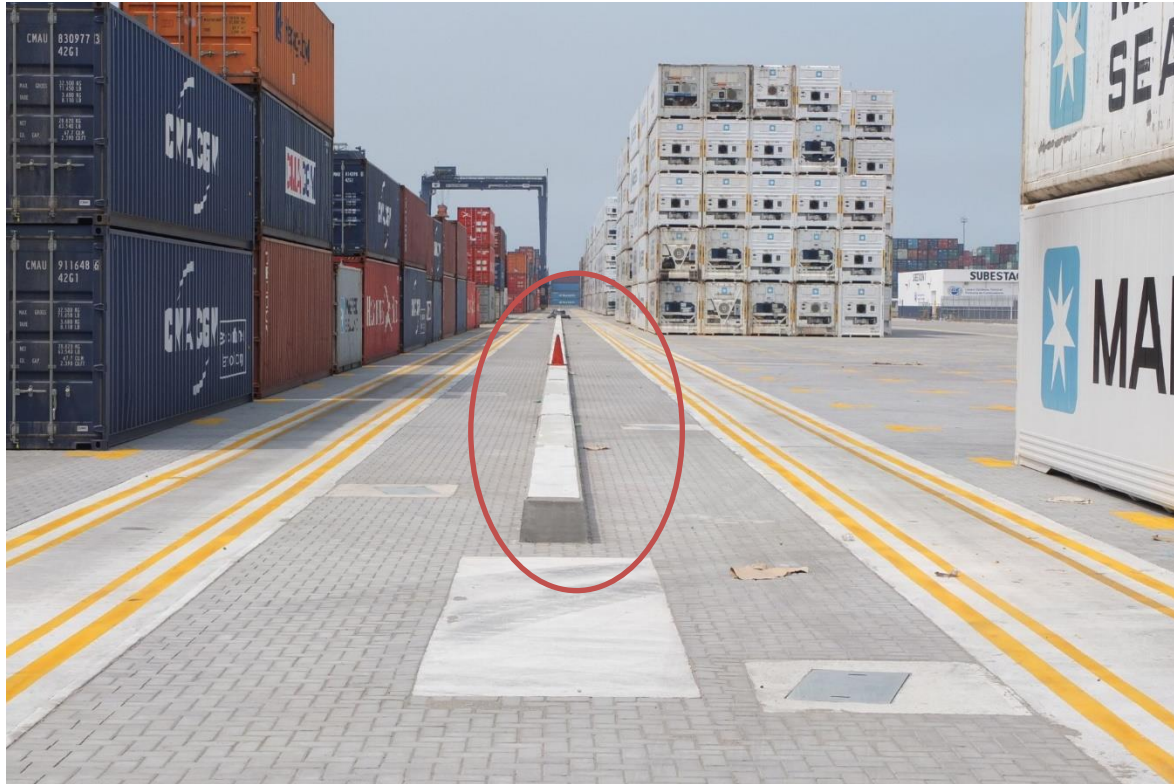


HOW THE SYSTEM WORKS: FIRST STEP – SOLUTION 1

RTG SOLUTION CONDUCTOR BUS BAR - ZERO EMISSION AND CIRCULAR SYSTEM: Trimotion 4.0



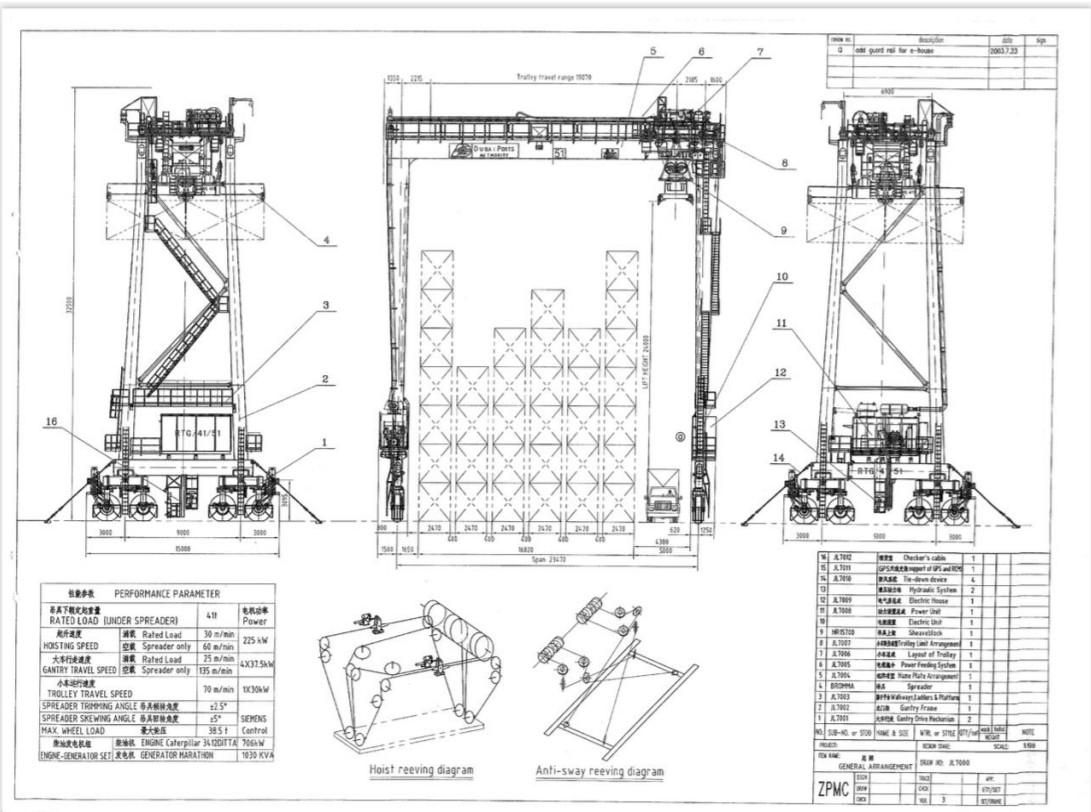
- Identify RTG's Runway paths, truck lanes, and any obstacles.



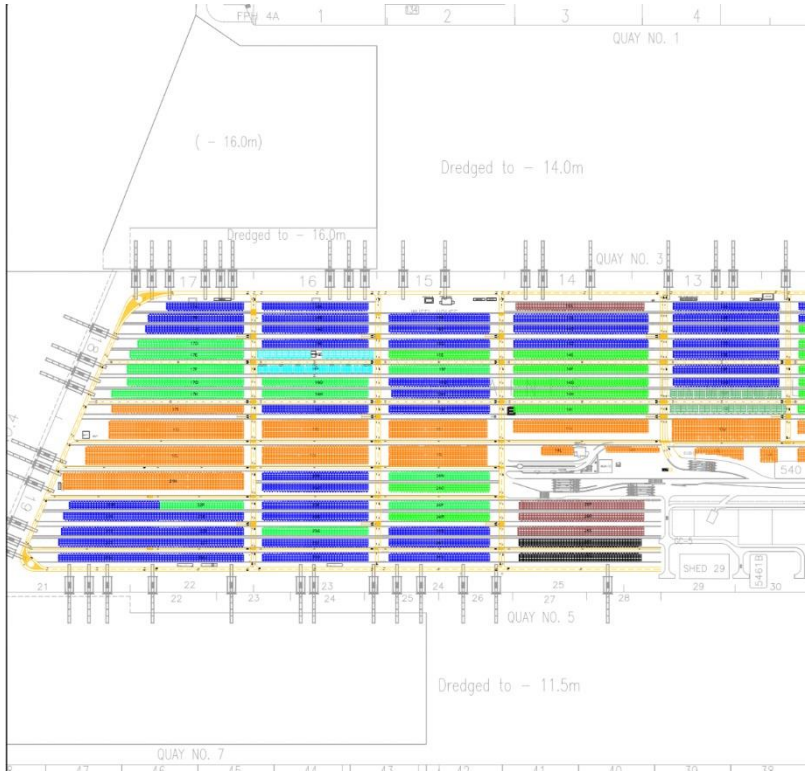
HOW THE SYSTEM WORKS: FIRST STEP – SOLUTION 1ERTG SOLUTION CONDUCTOR BUS BAR - ZERO EMISSION AND CIRCULAR SYSTEM: Trimotion 4.0



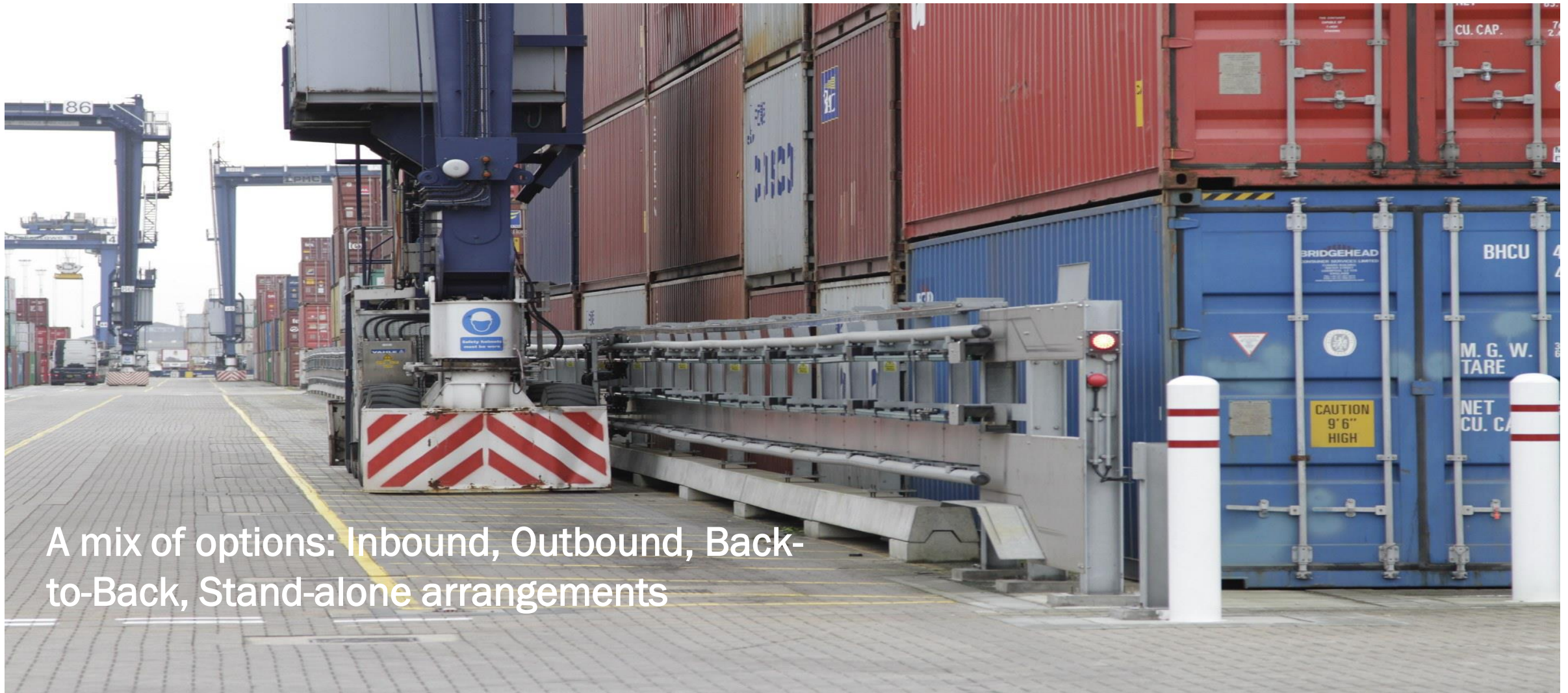
➤ Study the electric diagram and wiring arrangement of the RTG type and genset location on the RTG.



Produce the **NEW** ERTG structure arrangement



HOW THE SYSTEM WORKS: FIRST STEP – SOLUTION 1ERTG SOLUTION CONDUCTOR BUS BAR - ZERO EMISSION AND CIRCULAR SYSTEM: Trimotion 4.0



A mix of options: Inbound, Outbound, Back-to-Back, Stand-alone arrangements

ERTG SOLUTION BY CONDUCTOR BUS BAR FROM VAHLE- ZERO EMISSION AND CIRCULAR SYSTEM: Trimotion 4.0

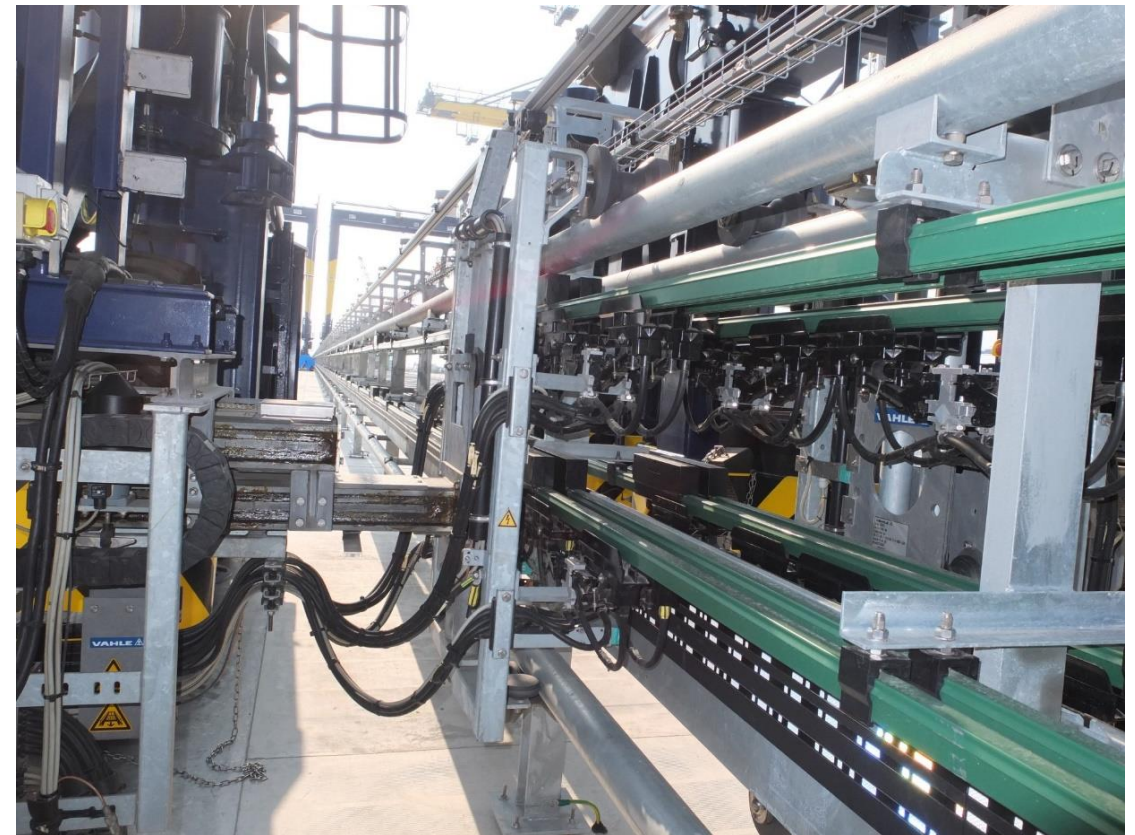


ELECTRIFICATION USING CONDUCTOR BUS BAR SOLUTION – ALUMINIUM STRUCTURE CARRIES CONDUCTOR BARS

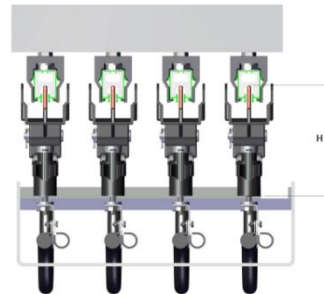
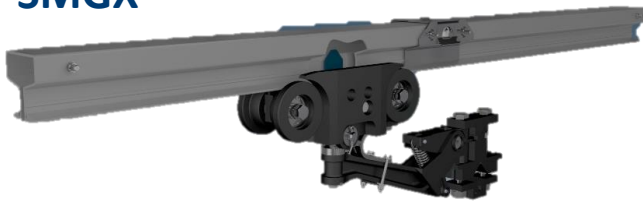


CONDUCTOR BAR SOLUTION WITH A COLLECTOR TROLLEY AND ARM - AUTOMATICALLY ENGAGES AND DISENGAGES.

BRUSHES



SMGX



CONDUCTOR BAR CROSS SECTION

TELESCOPIC ARM

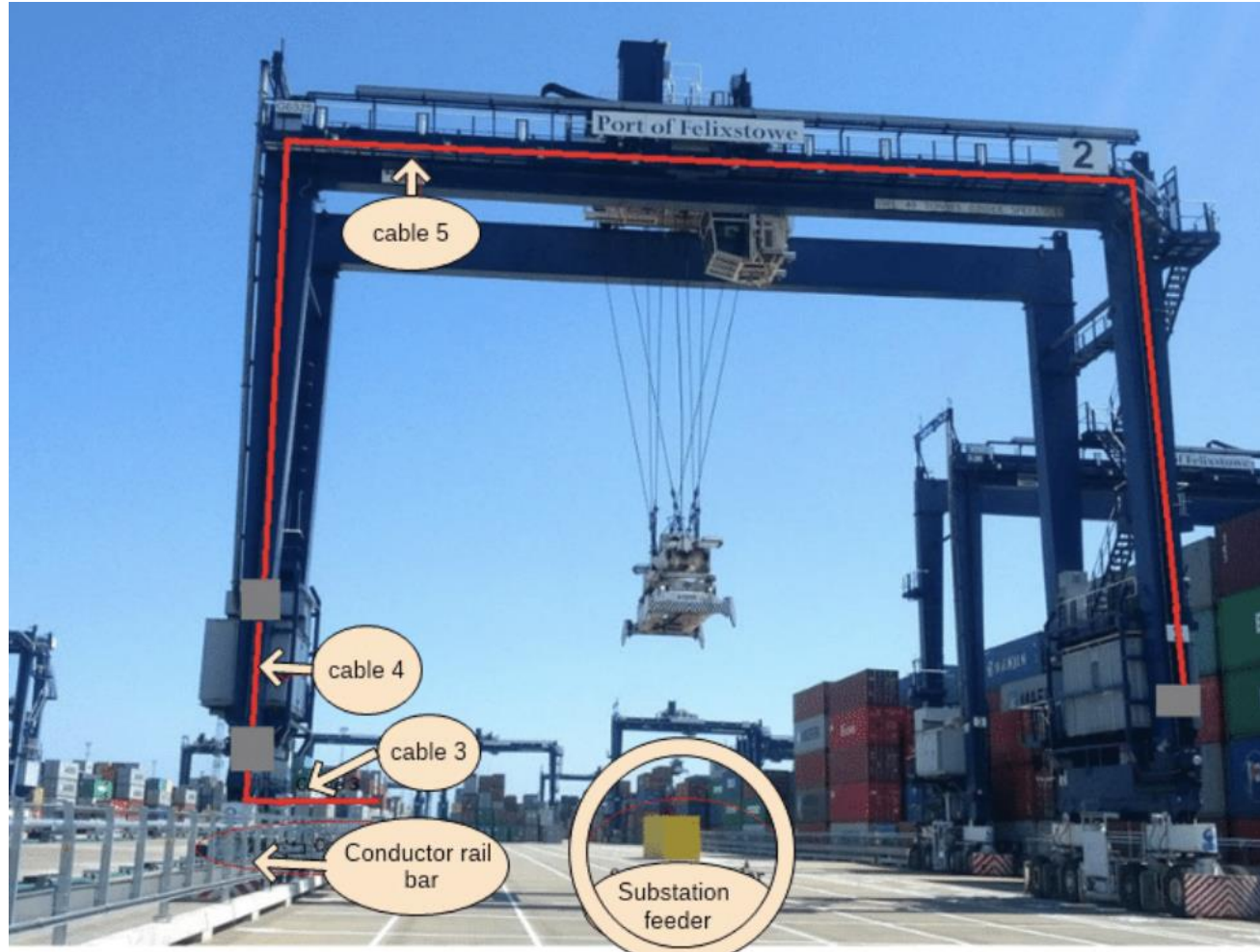
POSITIONING

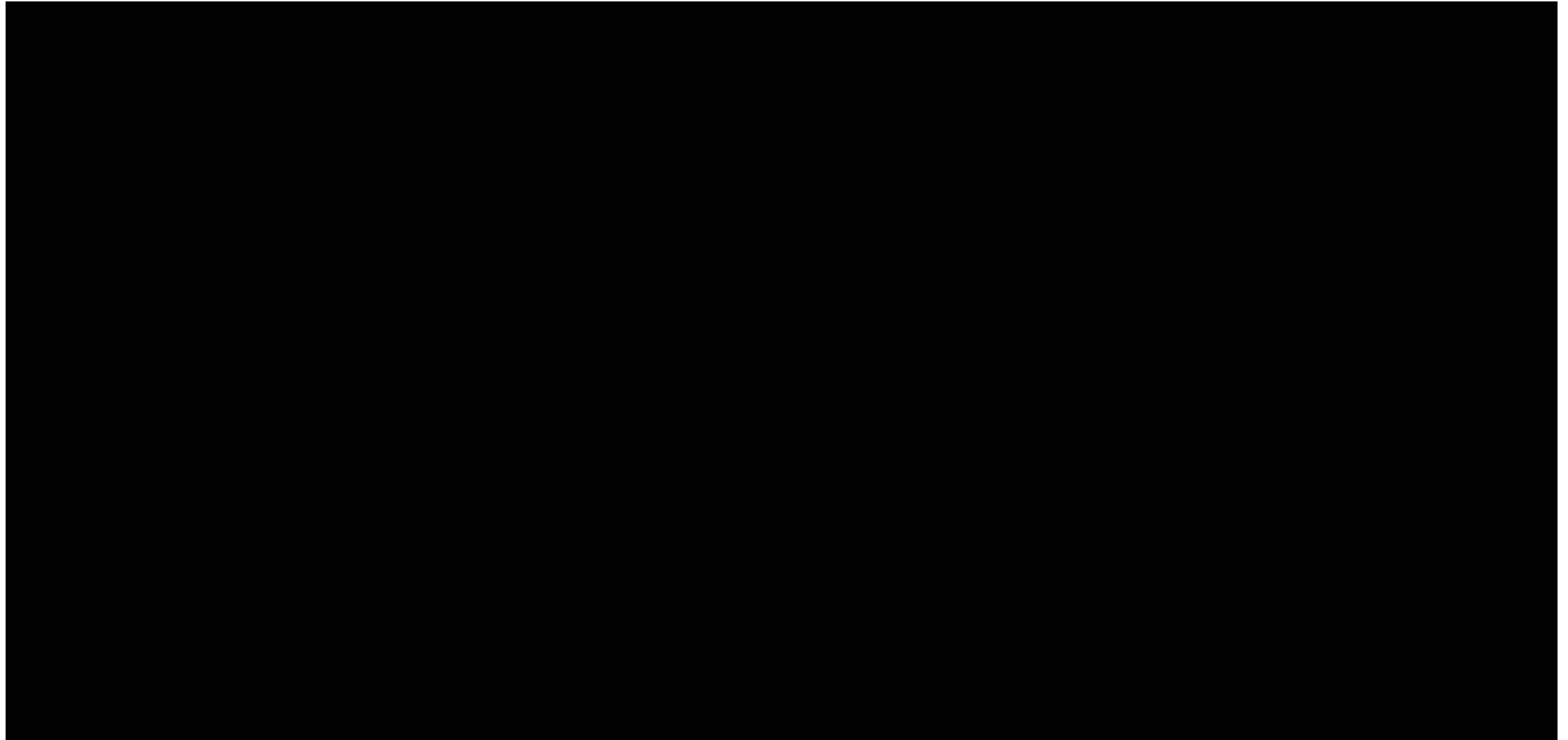


ERTG SOLUTION BY CONDUCTOR BUS BAR FROM VAHLE- ZERO EMISSION AND CIRCULAR SYSTEM: Trimotion 4.0

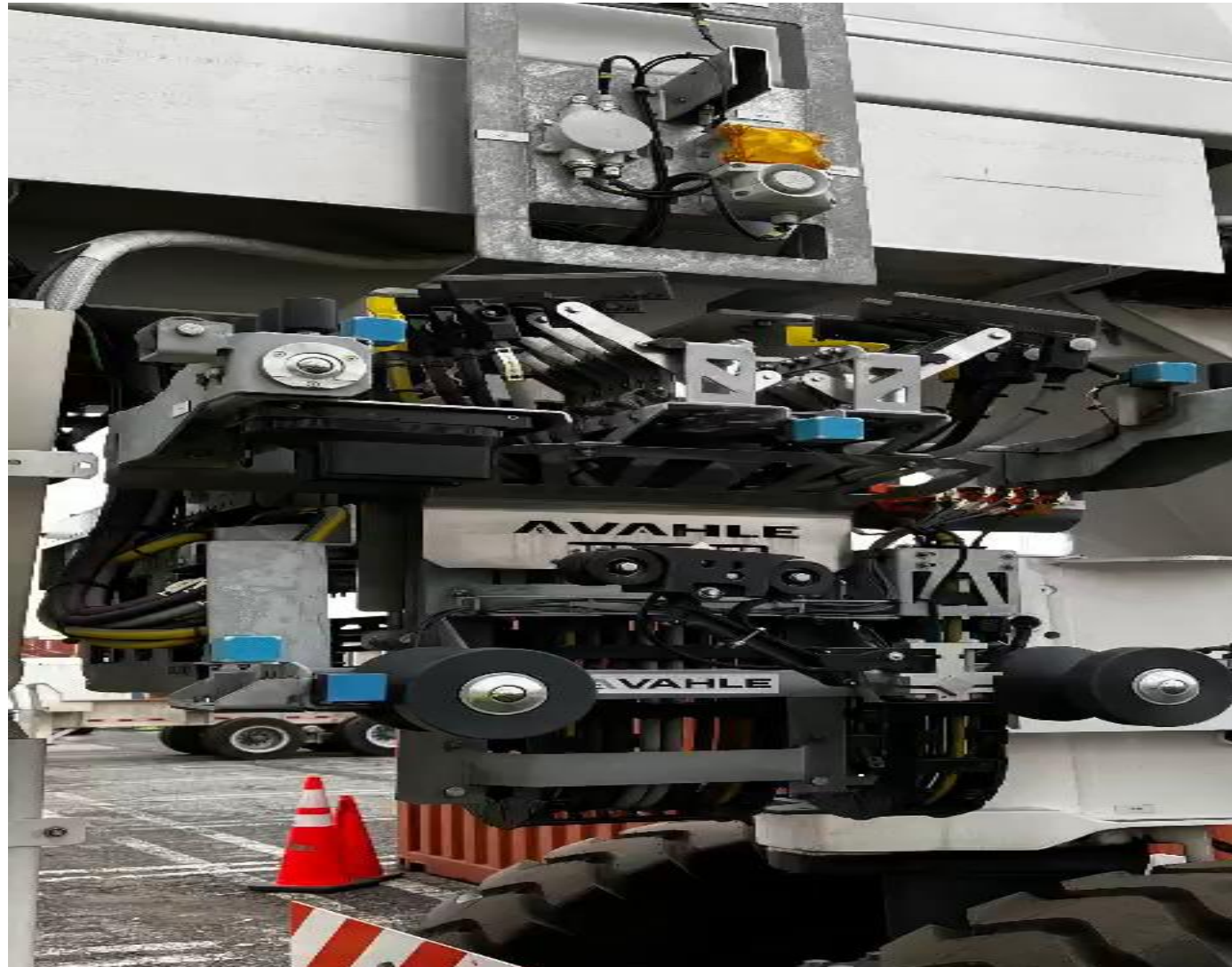


ELECTRIFICATION USING CONDUCTOR BUS BAR SOLUTION – DESIGN AND CONVERSION – Data and Electric Box





ERTG SOLUTION BY CONDUCTOR BUS BAR FROM VAHLE- ZERO EMISSION AND CIRCULAR SYSTEM: Trimotion 4.0 VIDEO – CONNECTION PROCEDURE

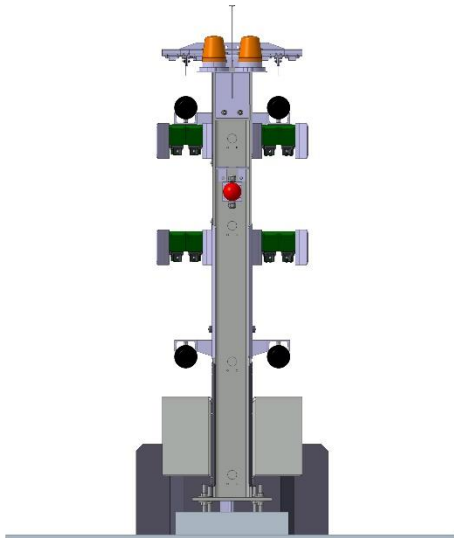
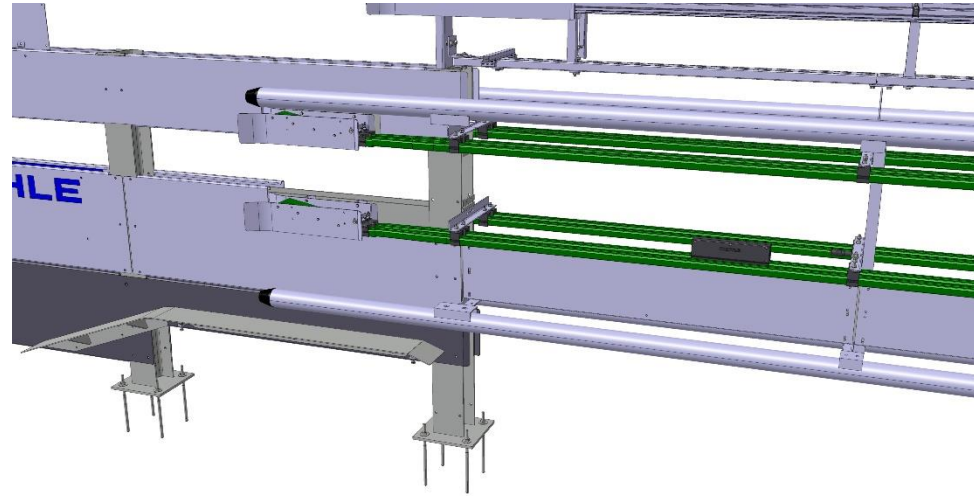
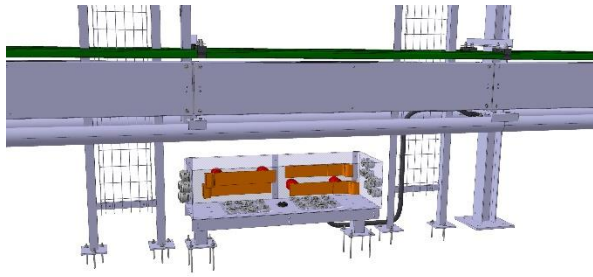


ELECTRIFICATION Of PORT EQUIPMENT – RTG ELECTRIFICATION USING BUSBAR

Increase Efficiency, Decarbonization Zero Emissions, Reduce TCO



eRTG



Operator´s benefits...

- ✓ Flexible yard operation
- ✓ Optimized OPEX by reducing fuel costs and idle time
- ✓ Reduction of CO2 and Noise Pollution
- ✓ Smart / Remote Maintenance
- ✓ Optimized Total Cost of Ownership reduction

Technical benefits

- ✓ Flexible yard operation
- ✓ Automatic connection system
- ✓ Autosteering
- ✓ Seamless synchronization
- ✓ Reduced GenSet maintenance cost

ERTG CONDUCTOR BUS BAR SOLUTION SYSTEM BENEFIT

ELECTRIFICATION TO AUTOMATION



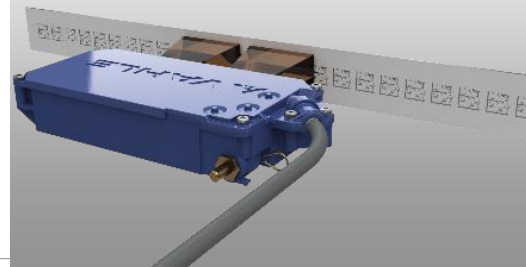
ELECTRIFICATION FLEXIBLE

- Electrification by Conductor Rails
- Automated Power Connection for Block Change
- Automated, seamless switching



POSITIONING ACCURATE

- Absolute Positioning System independent from external influences
- Position accuracy up to ± 1 mm
- PN / PB / Ethernet Interfaces for Plug and Play Integration



DATA COMMUNICATION SAFE

- Highly shielded data communication
- Up to 600 Mbit/s gross rate
- Low latency time
- Interfaces ready for Automation - Ethernet, Profinet & Profinet Safe



CONTROL SYSTEMS SMART

- Autosteering
- Power measurement
- Remote Maintenance
- Energy optimization



1.0 Electrification – Phase 1 Upgrade

Insulated conductor rails 1000V, 1000A with aluminum/stainless steel

2.0 Positioning – Phase 2 Upgrade

Precise positioning feedback with a contactless reading head

3.0 Data Communication – Phase 3 - Upgrade

Interference-free and safe data & video

✓ 2016 – 40 Mbps

✓ 2017 – 80 Mbps

2020- 300 Mbps

2023- 600 Mbps

Competitive Edge

4.0 Automation – Phase 4 Upgrade

Combination of electrification, positioning, and data communication for remote control,



Increase of energy resource **efficiency**



Savings through VAHLE eRTG
since 2011

107,700,830,325

liters of diesel

920,606,093

kilograms of CO₂



About Paul VAHLE GmbH & Co. KG

Paul VAHLE GmbH & Co. KG is a system provider of mobile industrial applications. Since its founding in 1912, the company has delivered individualised energy and data positioning systems for diverse application areas worldwide. It focuses on the crane technology, intralogistics, port technology, automotive, people mover and amusement rides sectors. Among other things, the company is known for Paul Vahle's development of the first copper conductor bar in 1912.

Paul VAHLE GmbH & Co. KG is headquartered in Kamen, Germany, and is part of the VAHLE Group. The value-oriented family business thinks and acts sustainably and stands for quality, innovation and a solution-oriented approach. The Group generates revenue of over €120 million worldwide. Of the more than 750 employees, about 630 work at the German sites in Kamen and Dortmund as well as in twelve national sales offices. VAHLE is active in more than 50 countries worldwide, with twelve subsidiaries and representatives.





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Contact Us: Info@vahle.de