

RTG SAFETY ENHANCEMENTS

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RTG SAFETY ENHANCEMENTS

AGENDA

- ACCIDENTS IN RTG OPERATION
 - TYPICAL REASONS
 - TYPICAL ACCIDENTS
- SAFETY ENHANCEMENTS:
 - GANTRY TRAVEL
 - CROSS TRAVEL
 - TROLLEY TRAVEL
 - HOISTING AND LOWERING



ACCIDENTS IN RTG OPERATION



ACCIDENTS IN RTG OPERATION

TYPICAL CAUSES OF RTG ACCIDENTS

CRANE MOTIONS AND LACK OF AWARENESS ARE THE MAJOR CAUSE OF THE ACCIDENTS IN CRANE OPERATIONS

- Operator awareness of the situation
 - Insufficient visibility, blindspots
 - Insufficient lighting
 - Unnoticeable events of others
- Others awareness of the situation
 - Discipline around cranes
 - Warning of the crane motions

ACCIDENTS IN RTG OPERATION

TYPICAL ACCIDENTS IN RTG OPERATION

- GANTRY AND CROSS TRAVEL
 - Collisions to objects in gantry travel direction
 - Collisions to stack
- TROLLEY TRAVEL
 - Collisions with Spreader and/or container to another container
- HOISTING/LOWERING
 - Hoisting a trailer with stuck twistlock
 - Misaligned landing with too high speed

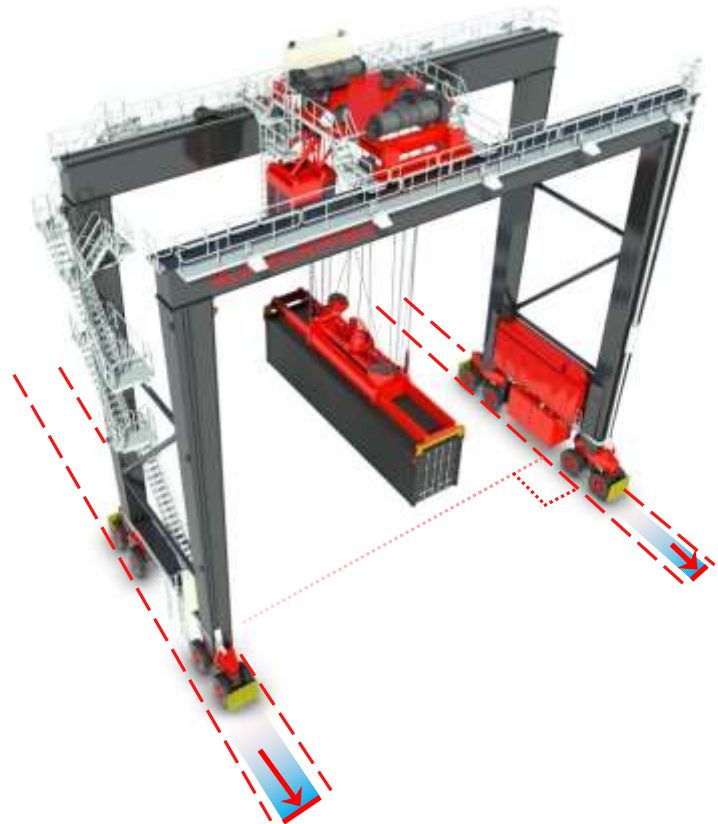


RTG SAFETY ENHANCEMENTS

SAFETY ENHANCEMENTS – GANTRY TRAVEL

AUTO-STEERING

- **Keeps RTG on pre-programmed path**, thus creating “invisible rails”
- **Eliminates the need for corrective crane steering** from the operator by automatic differential steering corrections
- Performs **optimized gantry slow down** at end of block
- Performs **controlled gantry stops** at end of block
- **Works with**
 - **Dual antenna GPS system** on-board providing robust system redundancy and fast signal recovery
 - **Fixed GPS Base Station** located in the terminal high up with a clear view to the RTG(s)



SAFETY ENHANCEMENTS – GANTRY TRAVEL

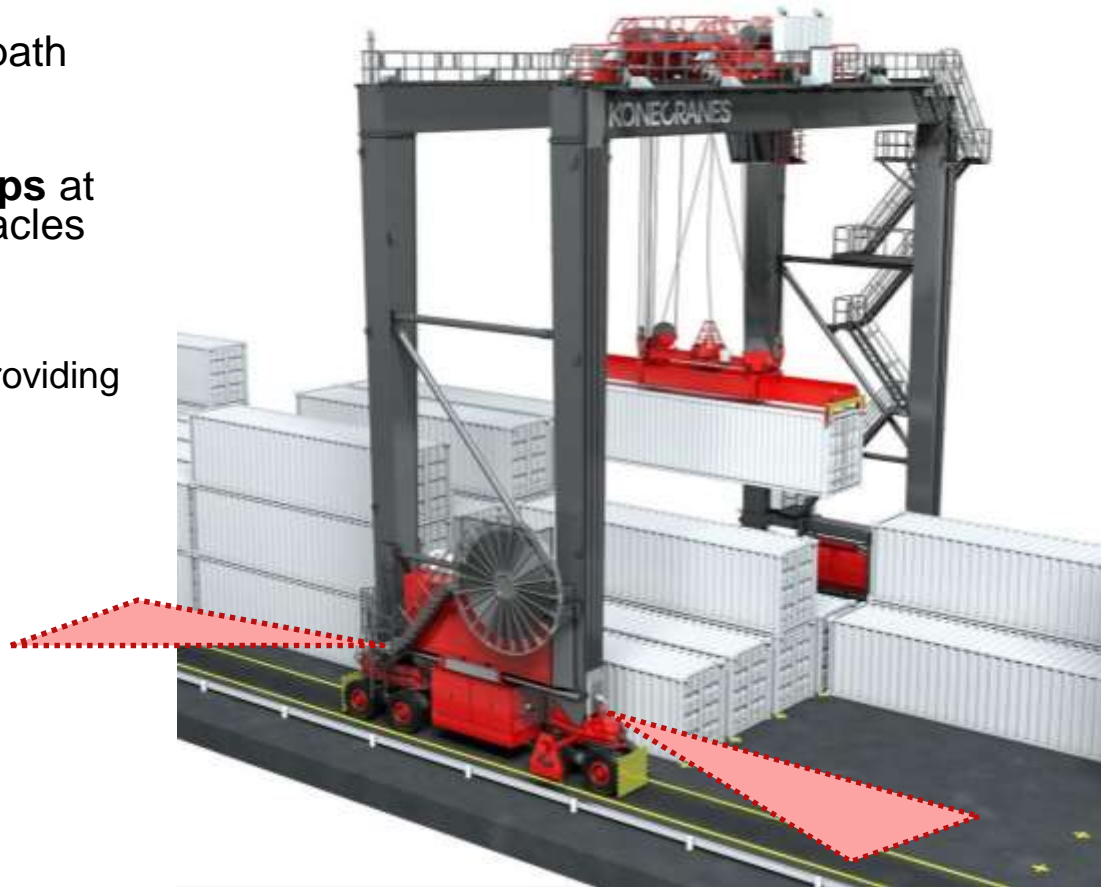
GANTRY ANTI-COLLISION

▶ Always active before gantry motion

- Constantly monitors the driving path with safety zones for clearance
- Performs **controlled gantry stops** at the moment of detection of obstacles

Works with:

- **Lasers** mounted on bogie level providing a safety zone for the gantry travel
- Safety zone can be adjusted



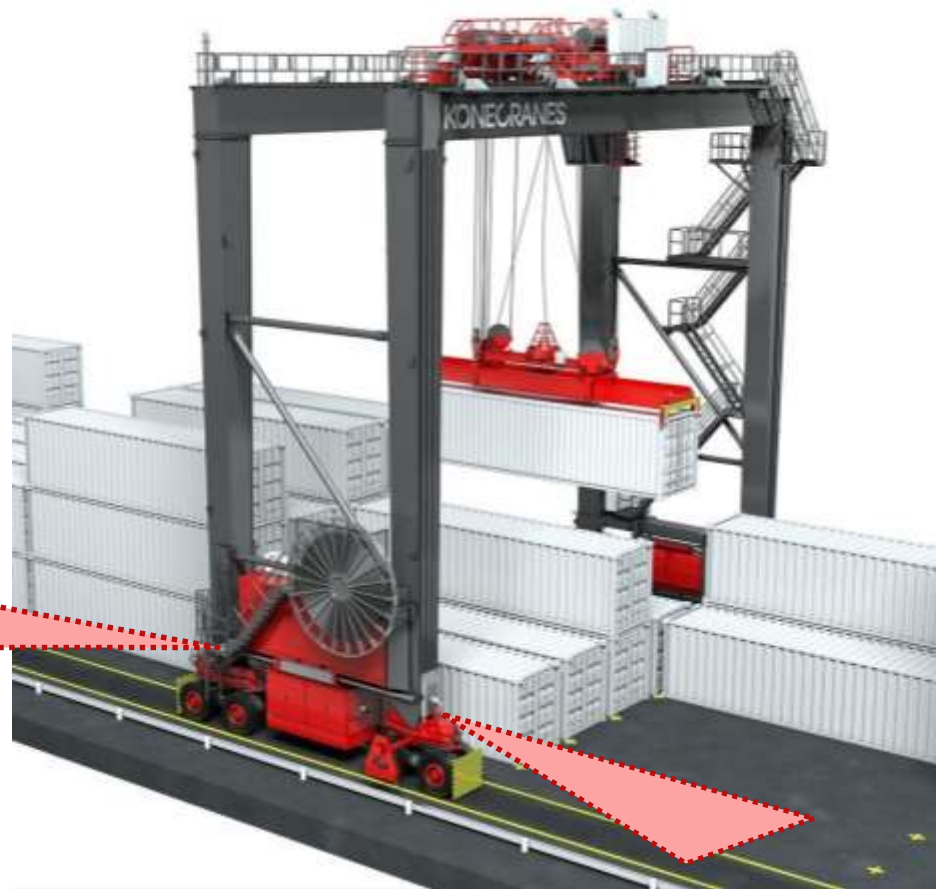
SAFETY ENHANCEMENTS – GANTRY TRAVEL

CAMERA VIEWS FOR OPERATOR

- Camera views can be active all the time or activated from the gantry motion control
- Camera views can be viewed by operator at all times before performing gantry motions
- Operator can detect unsafe events and avoid or stop the gantry motion

Works with:

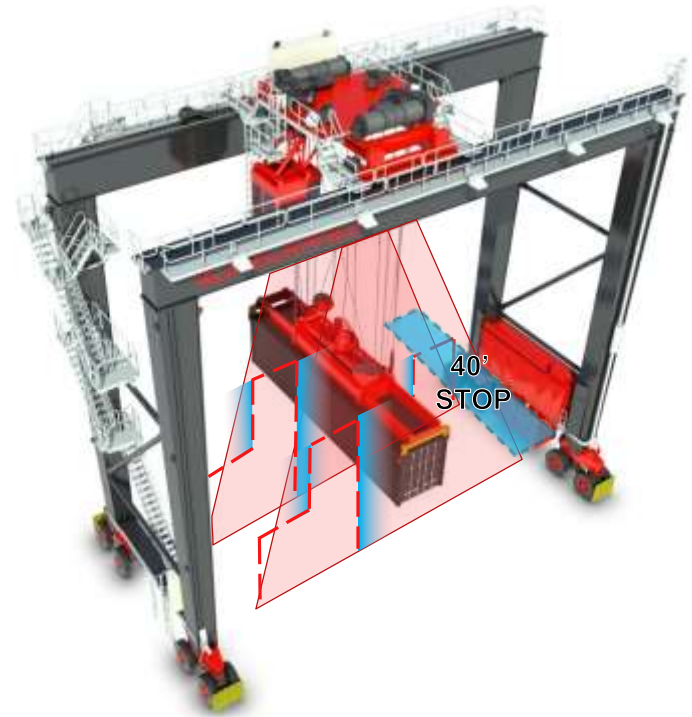
- High definition cameras on the bogie level providing clear view of the gantry travel
- **Monitor** located in the cabin with a clear view to the RTG operator



SAFETY ENHANCEMENTS – TROLLEY TRAVEL

STACK COLLISION PREVENTION

- **Prevents container collisions when RTG trolley moves the load in bay direction**
- **Works with two laser scanned profiles** of the container bay under the RTG. **System redundancy** with dual scanners.
- **Slows down the motion** when handled container is approaching the stack into a very slow approaching speed until impact
- **Prevents unsafe loading in mixed bay slots.** If there is 20' container Slot (x,y) in Tier 1, the system prevents placing a 40' to Tier2.
- **Enables safer manual RTG operation**

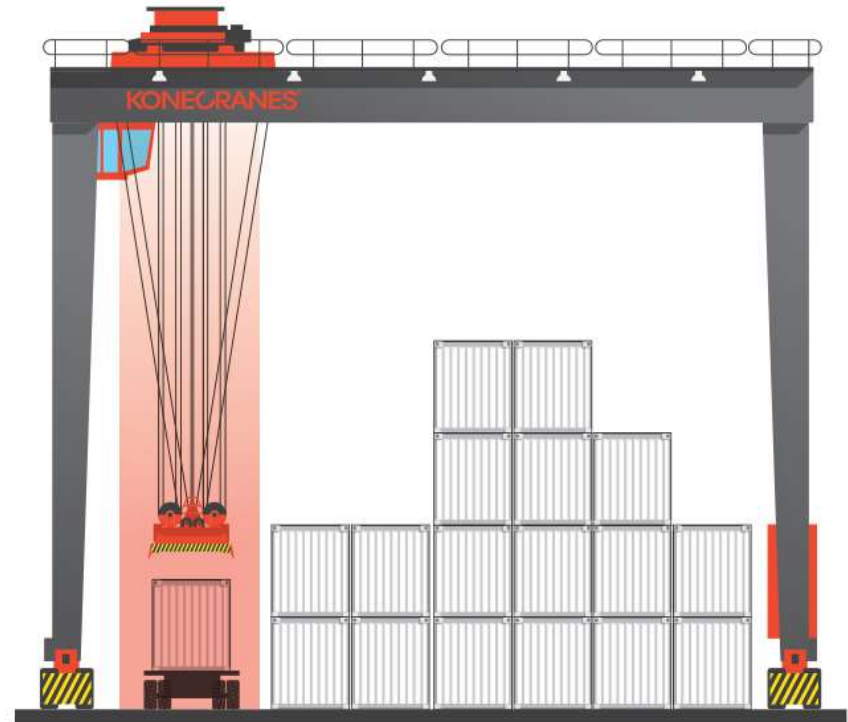


SAFETY ENHANCEMENTS – HOISTING

TRAILER LIFT PREVENTION

- Human error can occur in busy yard operations
- When containers arrive on road trucks, they must be lifted from the trailers carefully
- If all twistlocks are not disengaged, the trailer will be lifted dangerously

Stops lifting if a trailer lift is detected



SAFETY ENHANCEMENTS – LOWERING SMART SLOWDOWN

- When spreader is landed on container or container placed on stack or trailer, hard landings can be avoided with smart slowdown
- Reduces equipment damages
- Reduces damages to containers caused by misaligned hard landings.

Works with:

- **Laser sensors** that constantly measure the relative position of the spreader and the landing height.





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THANK YOU!