KONECRANES®
Lifting Businesses™

**SPRINGFIELD-CLARK CO SAFETY COUNCIL**

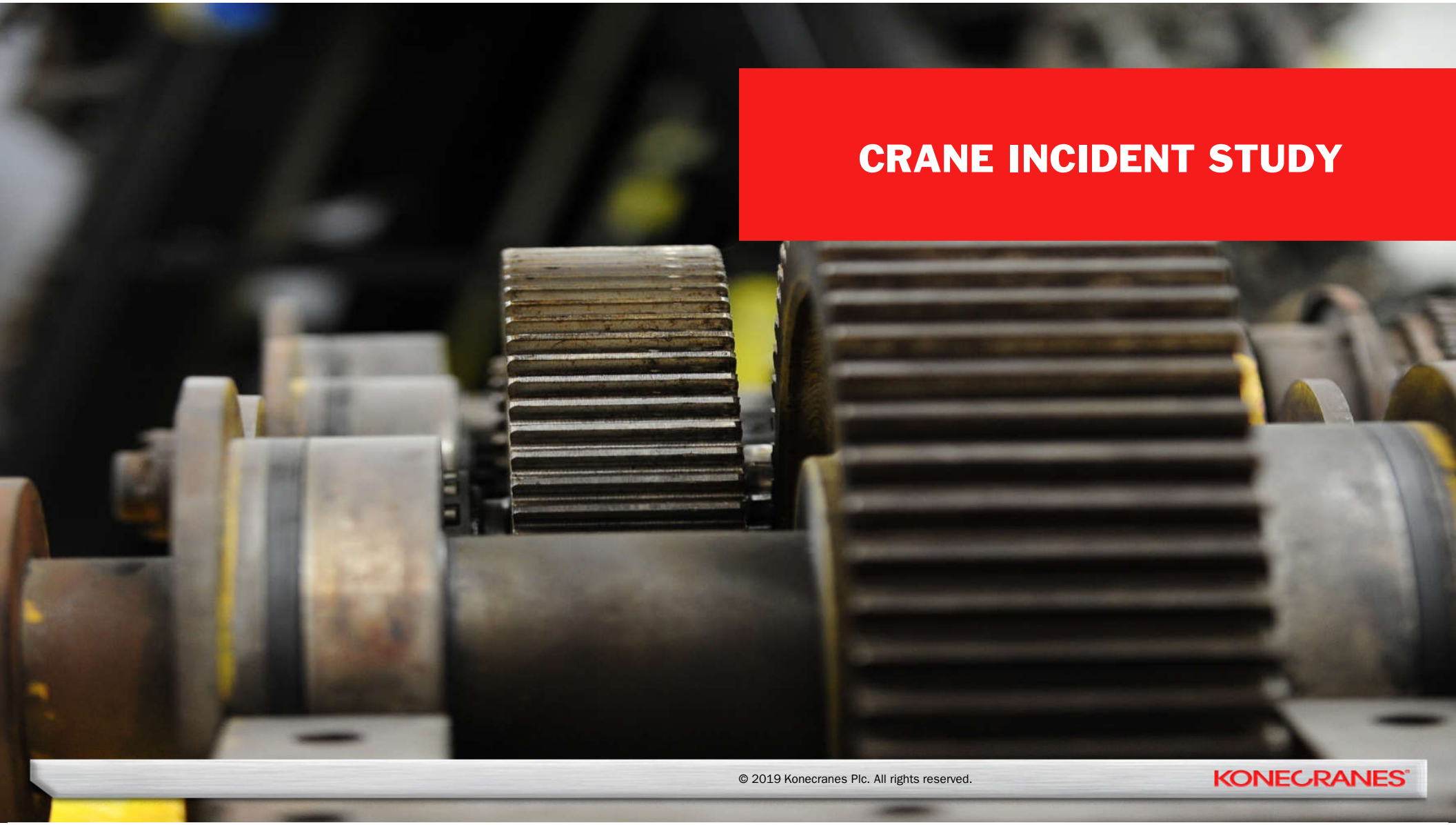
**August 11, 2020**

# Operating Overhead Cranes Safely

THE CHAMBER
Of Greater Springfield

**Joe Otten**
**Director of Learning & Development**
**Konecranes, Inc.**

- In the Overhead Crane Industry for 30 yrs
- Member of Crane Manufacturers Association of America (CMAA)
- Member of CMAA sub committee for Spec 78



# CRANE INCIDENT STUDY



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https://www.youtube.com/watch?v=f-a5bxi_05Q

# OVERHEAD CRANE INCIDENTS:
## IMPACT AND PREVENTION

Experts from the Konecranes Training Institute analyzed 249 OSHA reported crane incidents that occurred over a period of a decade in the U.S. – that's over two per month. Learn the costs, injuries, occupations of the injured, top causes of these incidents and, **most importantly**, ways to **reduce the likelihood** of accidents and injuries involving overhead cranes.

**INCIDENTS INVOLVED**

**838 OSHA VIOLATIONS**

133 INJURIES & 133 FATALITIES

**OVER $2.3 MILLION IN OSHA FINES**

**ESTIMATED ECONOMIC IMPACT:**

OVER **$500 MILLION**

AVERAGE MAJOR INJURY HAS A COST OF OVER: **$200,000**

AVERAGE FATALITY HAS A COST OF OVER: **$4 MILLION**

### DIRECT COSTS

Incident investigation; Doctor and hospital bills; Compensation for the injured person; OSHA fines; Damaged product or equipment; Clean up; Loss of production

### INDIRECT COSTS

Loss of future production; Increased insurance premiums; Attorney fees; Personal impact; Company safety ratings; Potential to lose customers; Missed deliveries

### TOP CAUSES & RESULTS OF THE INCIDENTS

**AREAS OF THE BODY INJURED:**

- head (27%)
- hands and fingers (16%)
- leg(s) (14%)
- foot (10%)
- chest (9%)
- other (24%)

**11%** Injured person crushed/run over by overhead or gantry crane

**93%** of these incidents resulted in a fatality

**12%** Caused by a fall (from heights of 8 ft. to over 100 ft.)

**6%** Improper/absent Lock Out Tag Out (LOTO)

**7%** Other

**37%** Crushed by the load (load swing, load drop or by an unstable load being placed and immediately falling over)

- 33.8% of all fatalities and
- 36.8% of injuries

**27%** Load dropped (most common root causes of load drops: poor rigging practices)

- 50%, poor crane maintenance
- 15%, wire rope breaking

**OCCUPATION OF THOSE INJURED OR WITH FATALITIES**

- 58% - crane operators
- 14% - maintenance employee
- 9% - rigger or signal person
- 5% - production employee
- 4% - millwright
- 10% - other

**70% OF THE INCIDENTS MAY HAVE BEEN PREVENTED BY PROPER TRAINING**

### PREVENTION WAS POSSIBLE

**74%** OF INCIDENTS HAPPENED DURING ROUTINE JOB ACTIVITIES

**9%** OF INCIDENTS MAY HAVE BEEN PREVENTED WITH PROPER CRANE MAINTENANCE

Source: James Lang, Paul Doyle and John Groth. Analysis of Crane Accidents and Fatalities. October 21, 2011. This data is the result of a 2011 study completed by the Konecranes Training Institute in New Berlin, WI. Data was obtained from the U.S. Department of Labor, Occupational Safety & Health Administration. The study analyzed 249 industrial overhead crane incidents that occurred over a 10-year period. The study and the information presented is an analysis and summary of the obtained data and does not take into account the identity of, or attribute liability to, any parties involved in the incidents and in no way states, concludes or infers that Konecranes was involved in any respect in such incidents.





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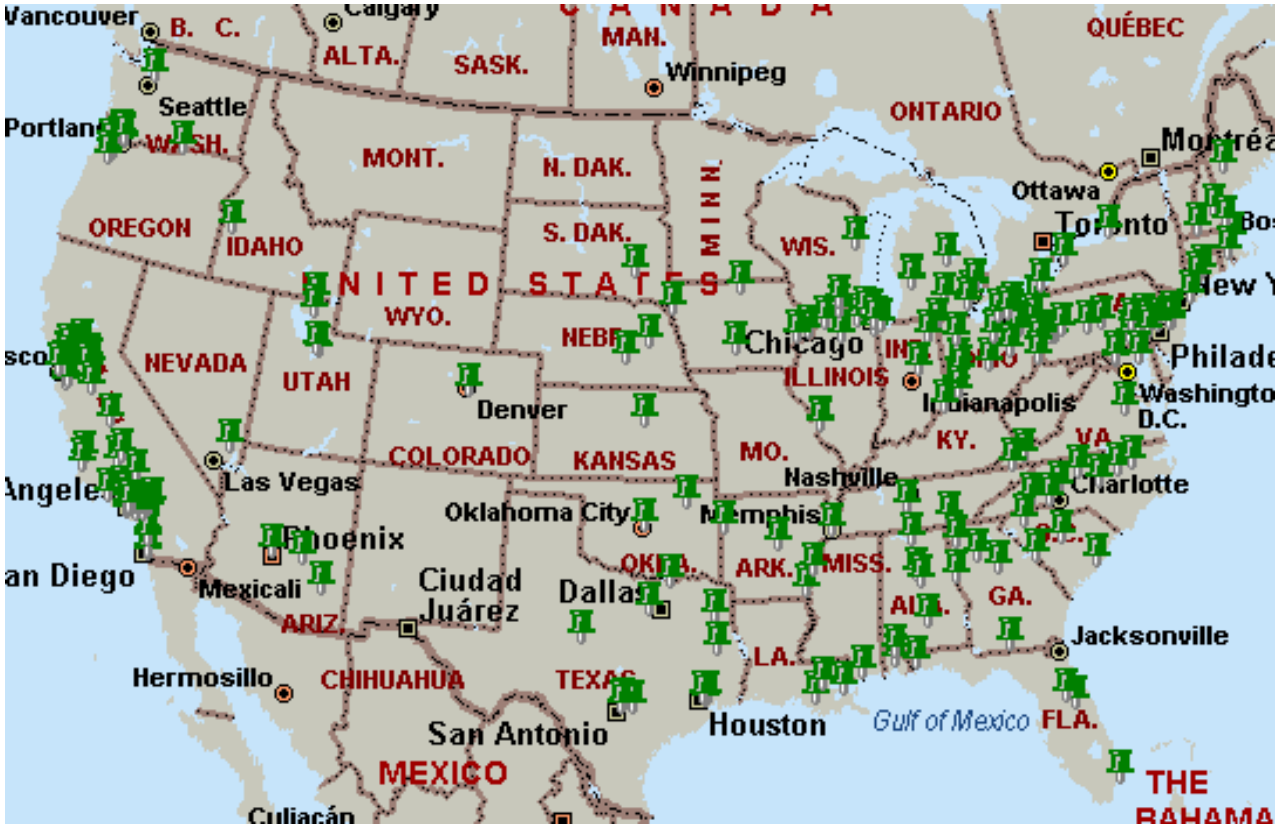
# CRANE INCIDENT STUDY PARAMETERS

- Source:  OSHA Inspection Reports
- Period:  5/1/1997 to 4/30/2007 – Covering 10 years.
- Study completed for **249** crane incidents.
- Full article available at www.cranetrainingu.com.

# MAPPING OF ACCIDENTS IN STUDY



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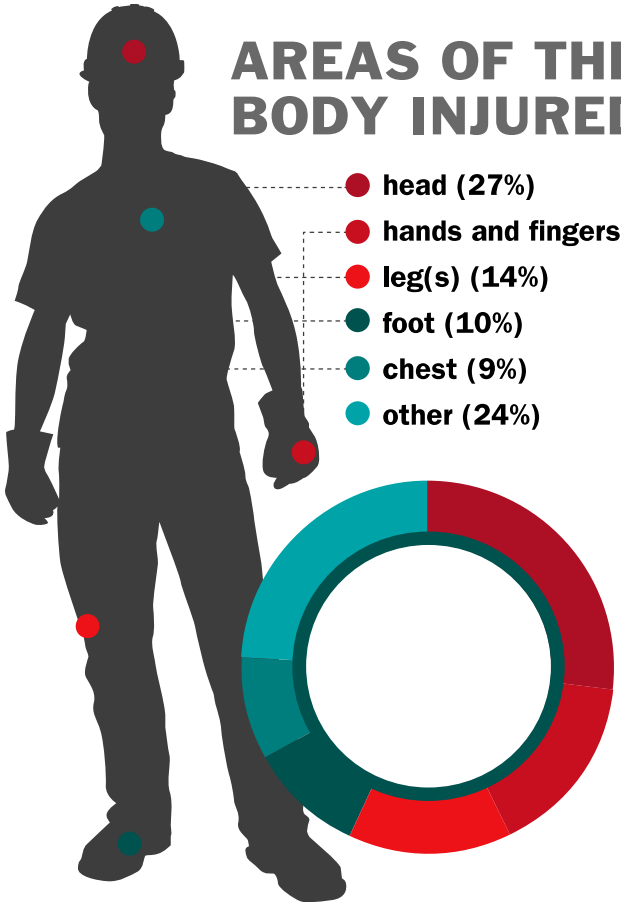
# TYPES OF INJURIES

**64%**
**FRACTURES**

**23%**
**AMPUTATIONS**



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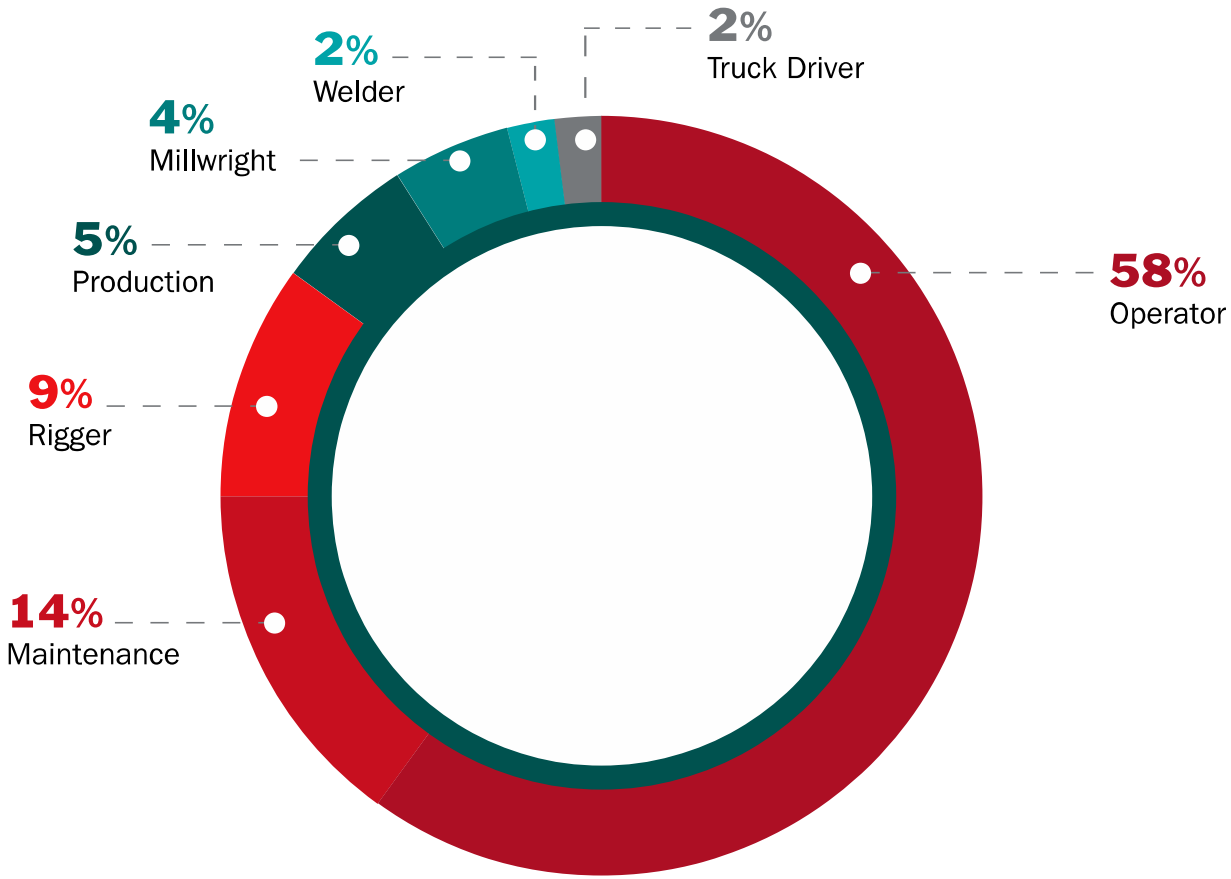
# OCCUPATION OF VICTIM



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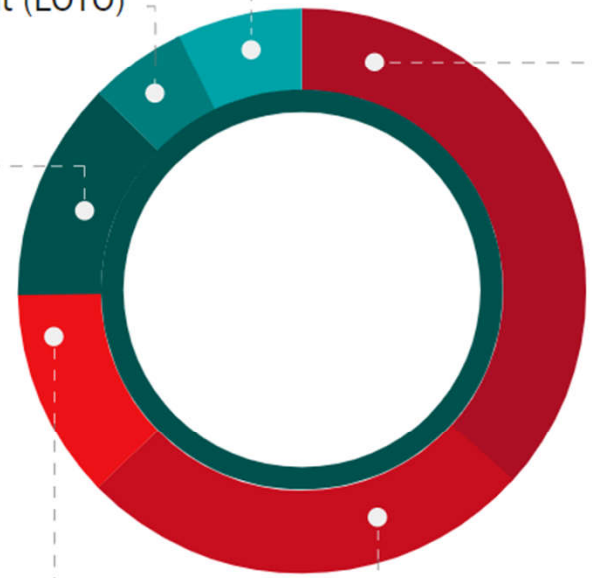
## TOP CAUSES & RESULTS OF THE INCIDENTS



**6%**
Improper/absent Lock Out Tag-Out (LOTO)

**7%**
Other

**37%**
Crushed by the load (load swing, load drop or by an unstable load being placed and immediately falling over)
Crushed by the load resulted in **33.8%** fatalities and **36.8%** injuries

**11%**
Injured person crushed/ run over by overhead or gantry crane

**93%**of these incidents resulted in a fatality

**12%**
Caused by a fall (from heights of 8 ft. to over 100 ft.)

**27%**
Load dropped (most common root causes of load drops: poor rigging practices)



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# CRUSHED BY THE LOAD

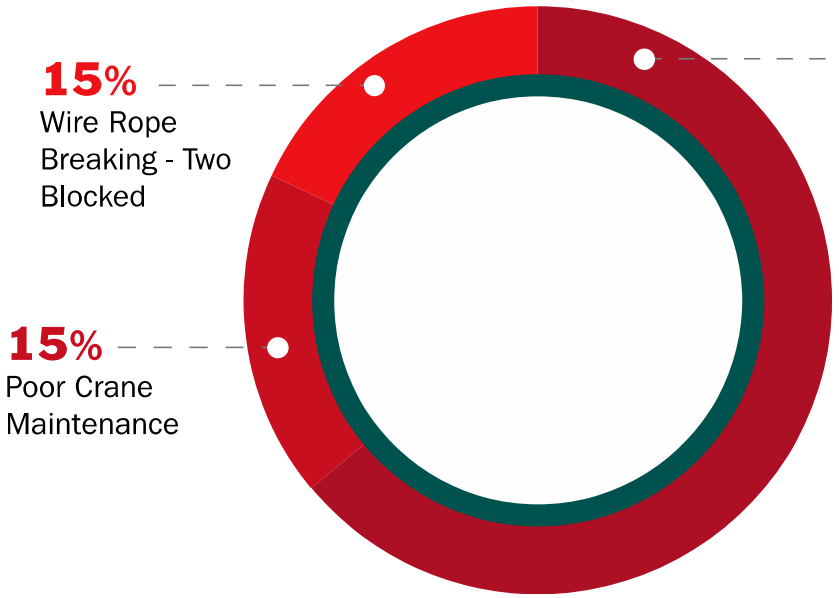
- **37%** of crane incidents involved crushing
  - —**45** Fatalities
  - —**49** Injuries
- **Number One (1)** cause of injury in crane incidents.

# EXAMPLES OF CRUSHED BY THE LOAD

- Employee was operating a 27-ton overhead crane
- Employee was standing in front of a hoisted coil when the coil became hung-up between two stationary coils.
- The coil dislodged and swung free, pinning and crushing the employee against another coil.
- He suffered severe chest and abdomen injuries and was killed.

# LOAD DROPS

## BIGGEST CAUSES OF LOAD DROPS:




**27%**

**OF CRANE INCIDENTS**



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# STRUCK BY THE CRANE INCIDENTS

- **11%** of crane incidents involved:
  - **28** Fatalities – 93% of the time
  - **2** Injuries – 7% of the time
- No. **7** cause of crane incidents.

- Note: OSHA requires only 2” of clearance on the side and 3” above.
- One of the most deadly incidents.

# EXAMPLE OF STRUCK BY THE CRANE

- Employee #1, a maintenance worker, was working with a coworker, adjusting a brake on a hoist trolley
- Crane was not locked out as it **shut down 3 cranes** on the same runway power supply
- Crane operator who was unaware of employees on the crane started to move crane until he heard shouting
- Employee #1 and the coworker were pinned between the gearbox of the crane and the roof beam. Employee #1 was crushed and eventually died.

INCIDENTS INVOLVED

# 838 OSHA VIOLATIONS


133 INJURIES

133 FATALITIES



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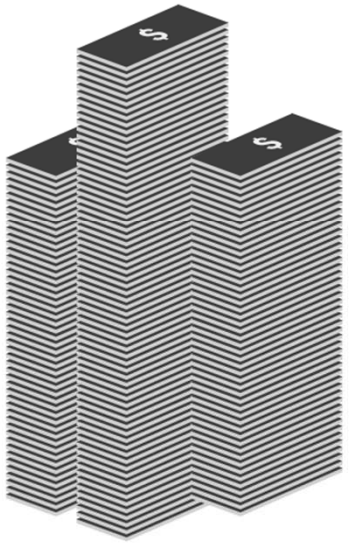

FOLLOWED BY MORE THAN

# $2.3 MILLION

IN OSHA FINES



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AVERAGE MAJOR INJURY HAS A COST OF OVER

**$200,000**

AVERAGE FATALITY HAS A COST OF OVER

**$4.0 MILLION**



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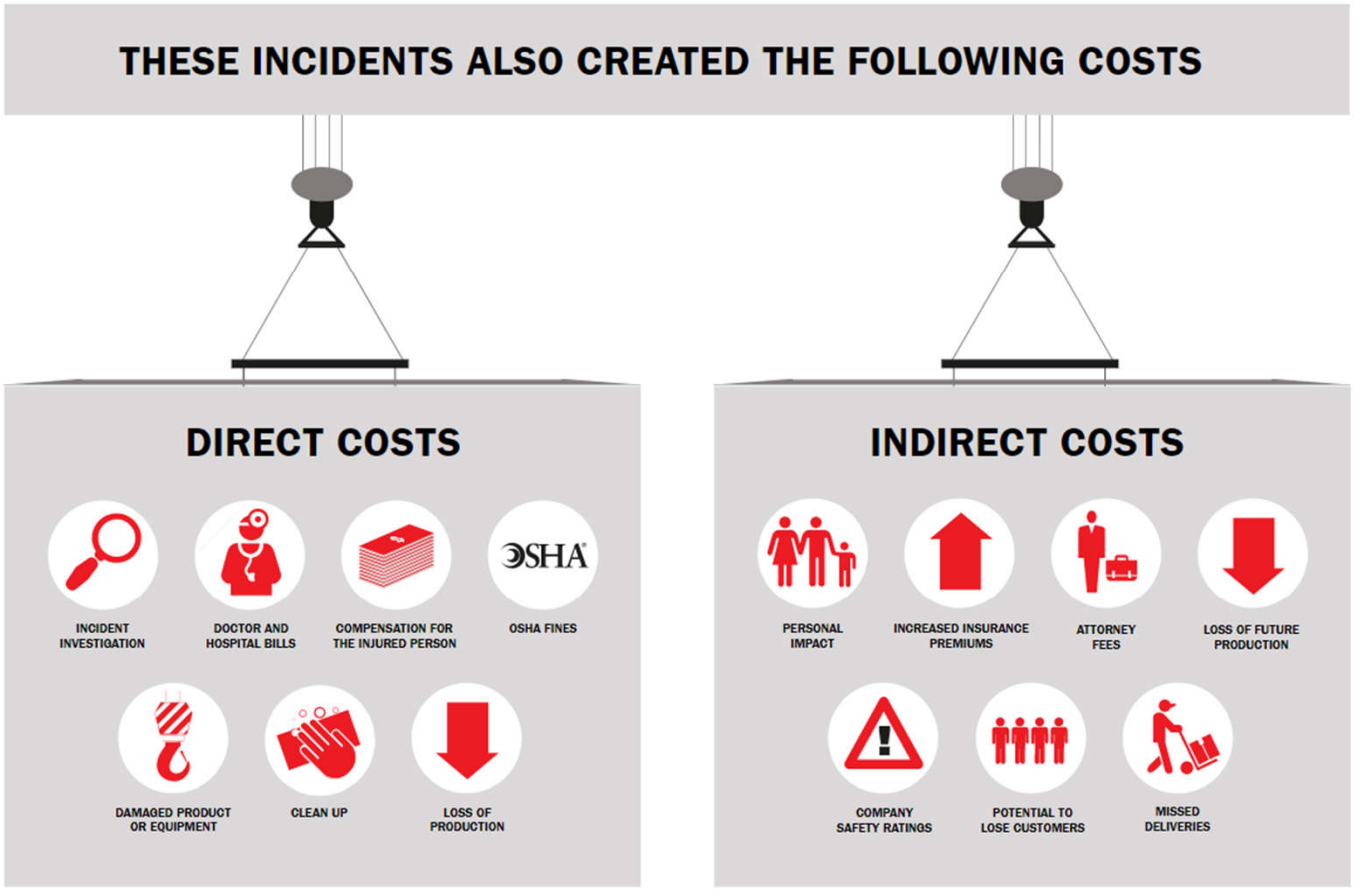




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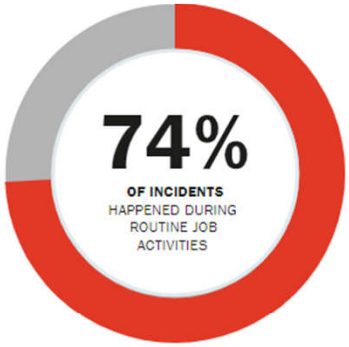
# PREVENTION WAS POSSIBLE

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# PREVENTION

- **70%** of Incidents - Proper training could have prevented the accident.

- **15% + 15% = 30%** of Incidents – Proper Crane Maintenance could have prevented the incident.

# ANSI B30.2

2-3.1.1 Purpose of Crane Operator Training

Crane operator training ***shall*** be provided to promote proficient performance of a crane operator in conformance with the provisions of this Volume.

2-3.2.1 Scope

Other persons, such as, but not limited to, maintenance personnel, test personnel, and crane inspectors, when it is necessary to operate a crane in the performance of their duties, ***shall*** be trained in accordance with the training requirements of this Volume.

# ADULT LEARNING

***”What I hear, I forget;***
***What I see I remember;***
***but what I do***
***I understand.”***
***– Confucius, 451 B.C.***

# ADULT LEARNING TIPS

- People remember 80% of what they learn, IF applied & used immediately
- Retention is greatly increased by involvement of more senses: audible, visual, touch, writing
- Taking notes (even if never re-read) increases retention by 25 - 40%
- Training should include hands on practice and written testing to achieve the best results

# TRAINING BEST PRACTICES

- The trainer should be experienced in the subject matter.
- Hands on training is more effective
- Practical exercises improve retention
- Follow up training supports on-going improvements

# TRAINING BEST PRACTICES

- Crane Operator training should include Introduction to Rigging, Rigging fundamentals and Advanced Rigging
- Hands on training for proper Rigging selection
- Hands on training for proper Rigging inspection

# BEST PRACTICES FOR PROCESS IMPROVEMENT

- All lifting activity should be analyzed and rigging procedures written. Consider having a written Lift Plan.

**SAMPLE LIFTING PROCEDURE** REVIEW DATE May-11

ONLY TRAINED PERSONS ARE TO PERFORM THIS LIFTING OPERATION

| | | | |
|---|---|---|---|
| NAME OF COMPONENT | Alternator | | |
| WEIGHT | XX TON<br>XX TON Properly Rigged | ID No. | 1E XXXX<br>101 |
| LIFTING TASK | LIFT ASSEMBLY IN THE HORIZONTAL POSITION<br>(SEAL AREAS) | | |
| PHOTOGRAPH / DIAGRAM |  | | |
| LIFTING EQUIPMENT TO BE USED | 1 No. Minimum 40 Ton Capacity ELECTRIC OVERHEAD TRAVELING CRANE<br>1 No: 10t LIFTING BEAM<br>2 No. ROUND SLINGS 20 Ft Long - 4 Ton Minimum | | |
| PREPARATION | Before each lift MAKE SURE ALL THE NECESSARY EQUIPMENT IS AVAILABLE AND ALL THE LIFTING EQUIPMENT IS CHECKED TO ENSURE IT IS IN GOOD CONDITION<br>MAKE SURE THAT THE PATH FOR THE LOAD MOVEMENTS ARE CLEAR AND THAT THE RESTING PLACE IS CLEAR AND PREPARED | | |

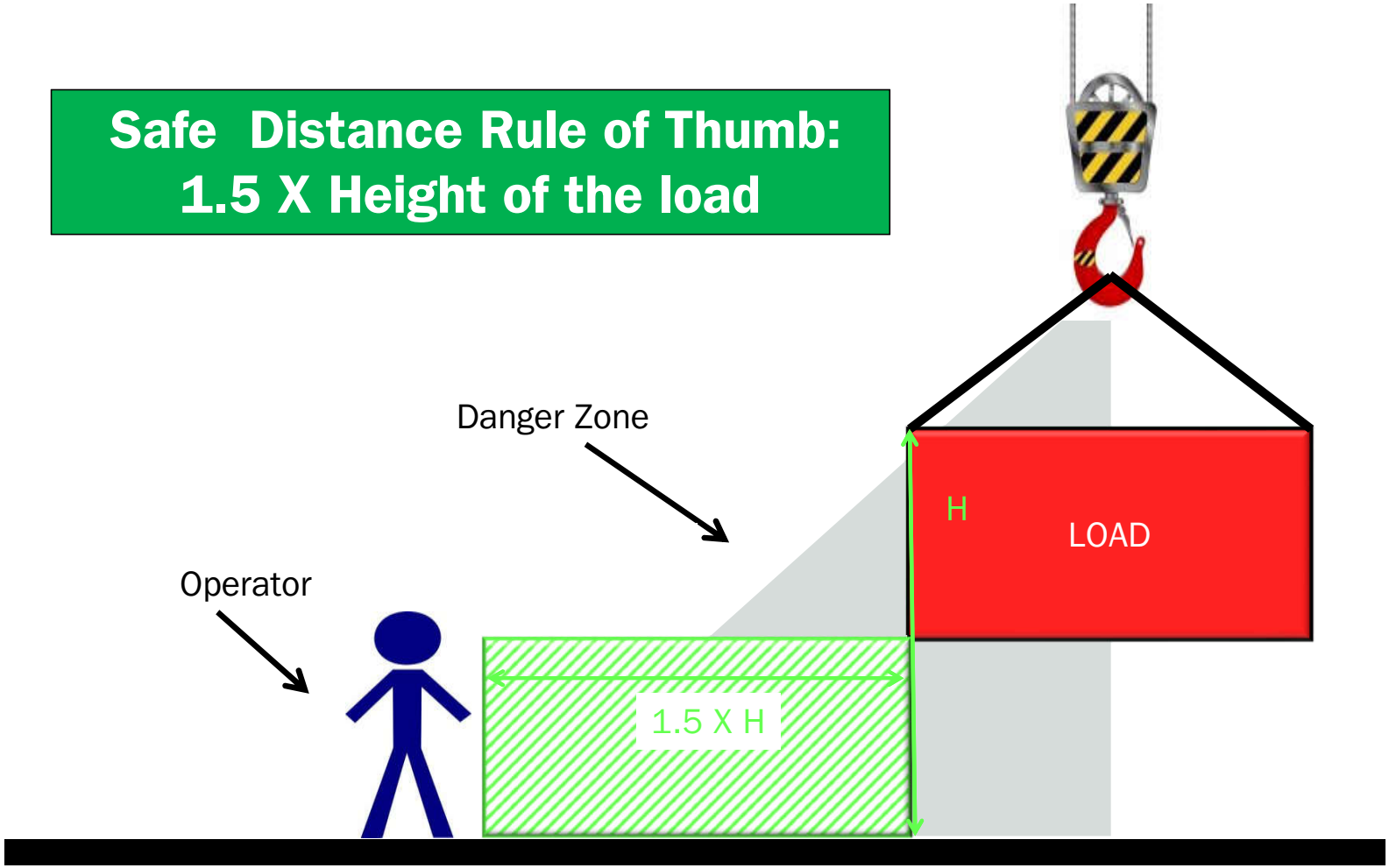
# BEST PRACTICES FOR PROCESS IMPROVEMENT

- Inspect your rigging gear – replace if questionable.

# BEST PRACTICES FOR PROCESS IMPROVEMENT

- People should never be under the load
  - Consider “No Touching” of the Load Policy
  - Be aware of the debris field.

# Safe Distance Rule of Thumb: 1.5 X Height of the load



# TECHNOLOGY

# WHAT CAN I DO TO IMPROVE THE SAFETY OF MY OPERATIONS WHILE MAXIMIZING PRODUCTIVITY?

Konecranes has specifically designed and developed a suite of safety-related features for its overhead cranes. Our safety-related features are designed to reduce the risk of injuries or fatalities while enhancing operational efficiency.


### SWAY CONTROL - SAFER PERFORMANCE, LESS LOAD SWAY

Designed to reduce load swing, improve productivity and safety.

Automatically limit the load swing by controlling the bridge and trolley.

SEE IT IN ACTION


### HOOK CENTERING - ELIMINATES SIDE PULL SITUATIONS AND LOAD SWING

Eliminates side pull during lifting by automatically positioning the bridge and trolley directly over the load.

Faster load cycle times, ease of operation and improved operational safety.

SEE IT IN ACTION


### SNAG PREVENTION - STOPS CRANE MOVEMENT FOR IMPROVED SAFETY

Stops all crane movement if the hook, sling or load accidentally gets caught on something.

Constantly monitors the rope angle to assist in safe crane operations.

SEE IT IN ACTION



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# AVAILABLE SAFE FEATURES

SWAY CONTROL AND ACTIVE SWAY CONTROL

PROTECTED AREAS AND WORKING LIMITS

SLACK ROPE PREVENTION


EXTENDED SPEED RANGE (ESR)

LOAD FLOATING

MICROSPEED

SNAG PREVENTION

HOISTING SYNCHRONIZATION

INCHING

HOOK CENTERING

HOOK LEVELING

TARGET POSITIONING

WORKING LIMITS

SHOCK LOAD PREVENTION

END POSITIONING



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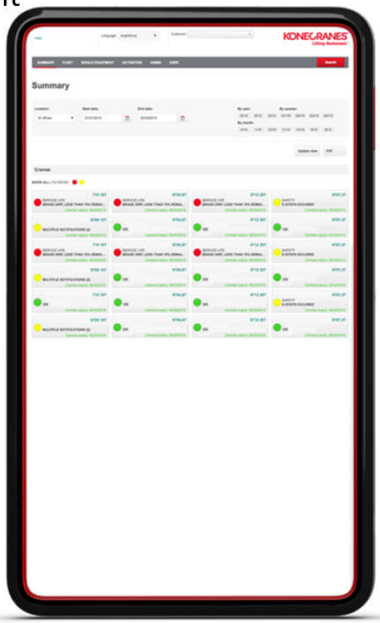
# TRUCONNECT

## TRUCONNECT® REMOTE MONITORING AND REPORTING

TRUCONNECT Data Monitoring and Reporting provides, in addition to the alarms and warnings, the data of the crane performance needed for the periodical maintenance planning. Hoist Safe Working Period (DWP), which is based on the load spectrum and number of hoist cycles, is calculated constantly. Optional service packages will send an email/text alert to you stating the crane has been overloaded. This will allow you to address crane misuse when it happens

- Minimized downtime through component´s lifetime calculations
- Remote troubleshooting can begin remotely already before the technician arrives at site
- Safety issues (i.e. overloads) are captured & clearly brought to your attention so that you can address the problem.



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Hoist

Diagnostic unit

RS232

Every 15-20s (For Alert Data)

2G modem

Every 24hr

Mobile 2G/3G Global Secure Private Network

Secure Encrypted VPN tunnel

Datacenter

Customer Web Portal


Available 24/7

Secure Encrypted access



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# ALERTS E-MAIL & TEXT MESSAGES


**Equipment Status Attention**

reporting@craneportal.konecranes.com

Sent: to 23.8.2012 19:09

To:

| | |
|---|---|
| Customer: | A.C.M.E |
| Equipment: | Project ID: K45822-CXT, Crane name: K45822-CXT |
| Location: | Remote Delivery test |
| Report Date and Time: | 08/23/2012 19:08 |

**The following alerts have occurred:**

Hoist overloaded: "2" at 08/23/2012 19:08, hoist: "A" (load lifted in excess of hoist load capacity)

Contact the nearest Konecranes Service Branch.

**⚠ WARNING**

*Indicates a potentially hazardous situation, which if not avoided,could result in death or serious injury.*

-- This is an automatic message, do not reply to it. --



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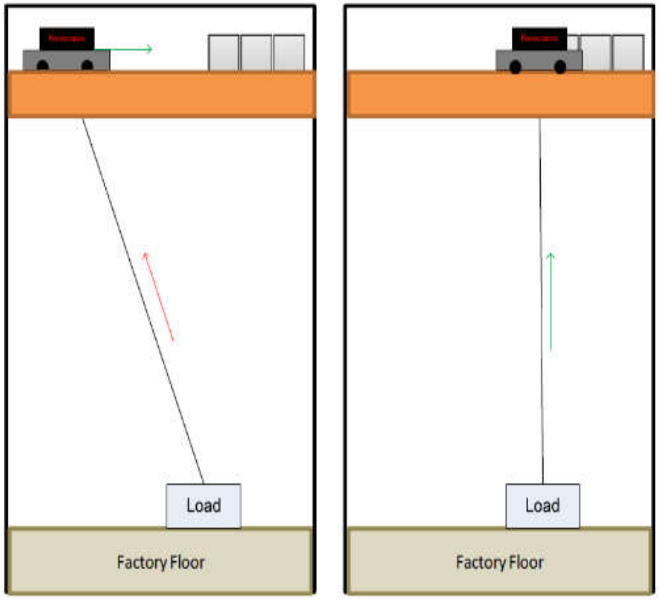
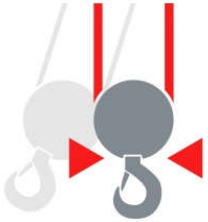



**HOOK CENTERING** is designed to eliminate side pull during lifting by positioning the bridge and trolley automatically directly over the load. This feature reduces the risk of hazardous situations. It also means less wear and tear on crane's components, faster load cycle times and ease of operation.

https://www.youtube.com/watch?v=n8pd9XQrRZs&index=12&list=PL68960FF1587AB6E9

**SNAG PREVENTION** is designed to stop all crane movement if the hook, sling or load accidentally gets caught on something. This safety function reduces the risk of hazardous situations while moving loads and helps to prevent damage to the load, crane and surrounding area.

https://www.youtube.com/watch?v=TVX6FJD6uis&list=PL68960FF1587AB6E9&index=13



**ACTIVE SWAY CONTROL** is designed to dampen the existing load sway and to eliminate load sway. Sway Control allows faster load handling and more precise positioning. This indispensable feature also helps prevent damage to the load, crane and surrounding area.

https://www.youtube.com/watch?v=7zdNnowLZV8&list=PL68960FF1587AB6E9&index=10



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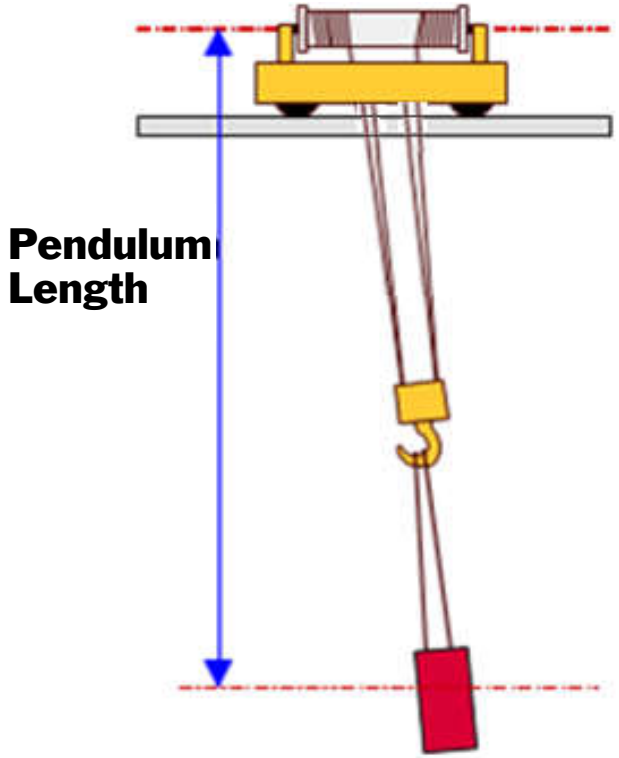
# ACTIVE SWAY CONTROL VS. PASSIVE SWAY CONTROL

| | PASSIVE (open loop) | ACTIVE (closed loop) |
|---|---|---|
| Hoist, Bridge and Trolley motion sway control | **Yes** | **Yes** |
| Prevents sway do to external force (bumped) | **No** | **Yes** |
| Prevents sway from off center pick | **No** | **Yes** |
| Prevents sway from snagged loads | **No** | **Yes** |
| Correct sway following E-stop | **No** | **Yes** |
| Additional hardware required | **Yes** Sling length adjustment switch | **Yes** Hook block location sensor & receiver & cable reel |



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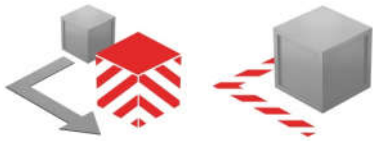
# INCREASED SAFETY



**PROTECTED AREAS** allow to define protected zones such as production machinery or storage areas, where the crane is not allowed to enter.
**WORKING LIMITS** builds temporary ”virtual walls” at which your crane is designed to stop automatically.
**Benefits:**

- Help to prevent collisions between the crane and valuable equipment near the crane
  ➔ Increased safety and lower risk of damages

https://www.youtube.com/watch?v=zlJJisFwvNc&list=PL68960FF1587AB6E9&index=8

# EASIER AND FASTER REPETITIVE WORK CYCLES

**TARGET POSITIONING**
brings the load to a predefined target position, when the work cycle is familiar and repetitive.

**Benefits:**

- Significantly reduced work cycle times
- Make your processes faster and easier
- Reduced need for operator's manual crane operation

**END POSITIONING**
brings the load to the center of a final positioning window, when the work cycle is familiar and repetitive.

**Benefits:**

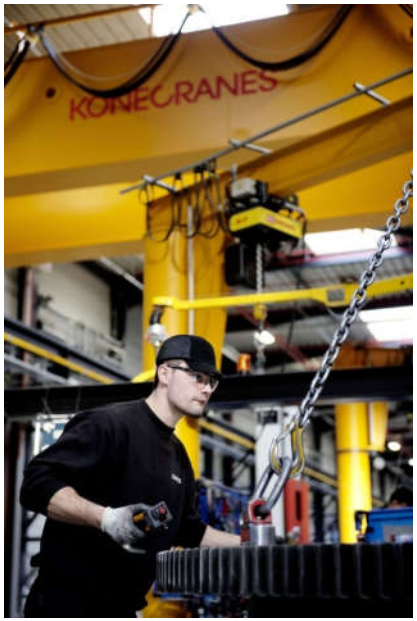
- Significantly reduced work cycle times
- Make your processes faster and easier
- Reduced need for operator's manual crane operation

https://www.youtube.com/watch?v=9Rj0KN7K4Iw&list=PL68960FF1587AB6E9&index=2

# SHOCK LOAD PREVENTION

## DESCRIPTION

The hoist drive monitors load; when quick load change is detected (load snatched), the system slows down speed until load is in air.




## BENEFITS

Shock Load Prevention limits load shocks to the crane, resulting in a longer lifetime for the crane's steel structure. The smooth start protects also the slings, ropes, and load-fixing devices, making the load movements stable and safer.

https://www.youtube.com/watch?v=vdIzpfZQ9mM&list=PL68960FF1587AB6E9&index=4

# MICRO SPEED

## DESCRIPTION

Scales down the operator joystick movements to lower maximum speed, to allow accurate speed control when low speed is needed. When selected by the operator, this feature reduces the speed in all movements.


## BENEFITS

Translates large joystick control movements into very slow and precise crane movements. This on/off feature is selectable from the operator interface (HIM). The speed ratio is selectable from the service display interface.

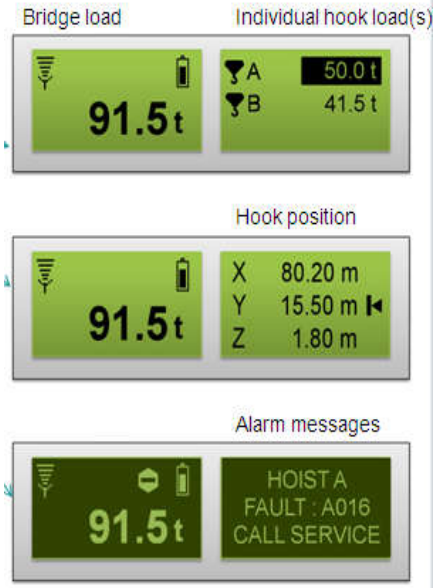
https://www.youtube.com/watch?v=mxHvIhB8HJg&list=PL68960FF1587AB6E9&index=9

x 110.20
y 20.40
z 30.60

# POSITION & WEIGHT DISPLAY

## DESCRIPTION

Crane position is measured and the hook position coordinates (X-Y-Z) are displayed on the operator's information display on the radio control device, HIM (Human Interface to Machine).




## BENEFITS

Helps operator to position the load to defined target and warns of approaching working limits. The display also informs the oparator of the working limit status.



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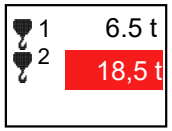
# LOAD DISPLAY

## DESCRIPTION

Load in tons in each hook are shown in load display, either in operator interface (HIM) or in a separate load display on the bridge or trolley.




## BENEFITS

Load indication for single or multiple hooks helps the operator to estimate the weight of the lifted unit and, in one or multiple hooks, handle to balance the load in slings.



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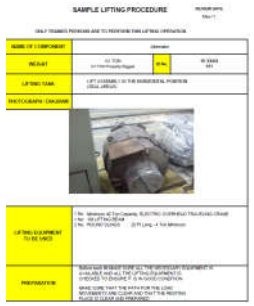
# IMPROVE SAFETY AND PRODUCTIVITY

Have a comprehensive approach to your cranes.


SAMPLE LIFTING PROCEDURE

- Proper inspection and maintenance cycles
- Operator/Maintenance training
- Analyze your lifting operations, have a written Lift Plan
- Inspect your rigging gear – replace if questionable
- Continuously train your crane operators and maintenance personnel
- Use new technology when applicable