Overhead Crane No-Fly Zones Minimize Collisions With Machinery and Structures When Operators Are Distracted

Hazards are ever-present in the steel plant environment, and a heightened awareness and emphasis on safety is a necessary priority for our industry. This monthly column, coordinated by members of the AIST Safety & Health Technology Committee, focuses on procedures and practices to promote a safe working environment for everyone.

Author

Steve Lubeck
President, Laser-View Technologies Inc., Chester Springs, Pa., USA

Jeanine Lubeck
Channel Manager, Laser-View Technologies Inc., Chester Springs, Pa., USA

Comments are welcome. If you have questions about this topic or other safety issues, please contact safetyfirst@aist.org. Please include your full name, company name, mailing address and email in all correspondence.

Overhead cranes can be equipped with no-fly-zone capability to keep the hoist out of areas it is prohibited to travel over, such as furnaces, stamping presses, roll lines and in-plant structures. As a crane operator in a busy mill environment, it is possible to become distracted or miscalculate how close an obstacle is. Systems that perform safety zoning add to a steel producer's safety program by minimizing the possibility of such collisions.

Throughout the years, overhead cranes have also been referred to as electrified overhead traveling (EOT) cranes. These cranes come in different configurations, but what is common is that each crane commonly has one or more trolley hoists mounted. The hoist can interfere with structures or equipment on the mill floor under the crane runway.

No-Fly Zone

A no-fly zone is an area in which overhead crane movement is prohibited. This area can be designated in several ways:

- Prohibit movement of trolley hoist.
- Prohibit hoist downward movement.
- Force slow speed for safer operation.

What kind of obstacles can be considered no-fly zones?

- Buildings/structures within the crane runway.
- Equipment, such as furnaces, tandem mills, flame cutting machines, stamping presses, CNC machine centers.
- Areas with high material handling traffic below, such as main forklift aisles.
- Other crane systems, such as modular self-standing cranes under the main runway.
- Jib cranes for machine tending or inspection operations.

Distractions and Crane Safety

As crane controls have migrated from pendant to wireless radio–type controls, the frequency and probability of collisions between a crane and obstacles have increased. This is because the crane operator no longer must walk with the crane. In some cases, operators can mistakenly operate a different crane than intended. Too often, they realize this after it is too late.

Even the most experienced operator can easily become distracted during a crucial part of a lift and miscalculate the position of the crane. If complacency kicks in and an operator does not feel the need to operate slowly around an obstacle, a lift can go wrong once the load shifts unexpectedly.

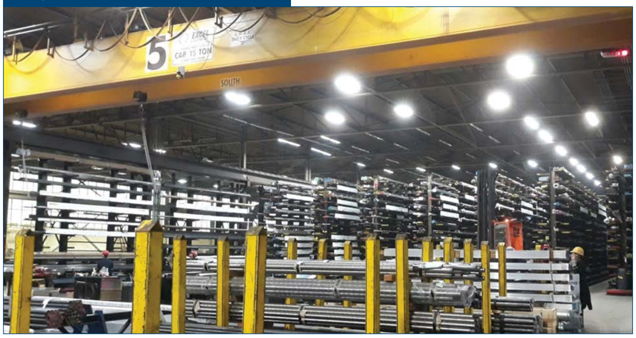
Accidental interference can lead to several problems:

- Injury to personnel.
- Damage to structure.
- Damage to tooling or materials being transported.
- Downtime to evaluate the incident.

Methods of Restricting Overhead Crane Movement in No-Fly Zones

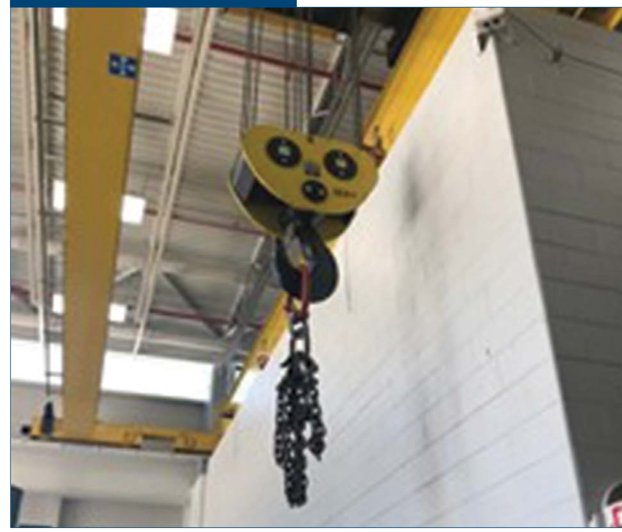
Traditionally, no-fly zones have been handled using mechanical limit switches. These switches, often

Figure 1



Electrified overhead traveling (EOT) cranes in action.

Figure 2



Crane Sentry® Zone Manager provides a system for keep EOT cranes from interfering with structures under a crane runway.

referred to as "windmill" switches, are mounted to the bridge or trolley and fixed levers flip the positions.

The limit switches must be tied into a common controller to provide the relay logic for the forward, reverse and speed signals to the bridge and trolley drives. Adjustment is not easy since any position adjustment must be made mechanically by remounting and repositioning the trip arm. In addition, two switches are needed to obtain slow and stop conditions on each of the four sides of the zone.

Non-contact methods using modern laser distance sensors is a preferred technique for no-fly zones. This technique, when integrated properly, provides almost infinite adjustment, and can easily be configured.

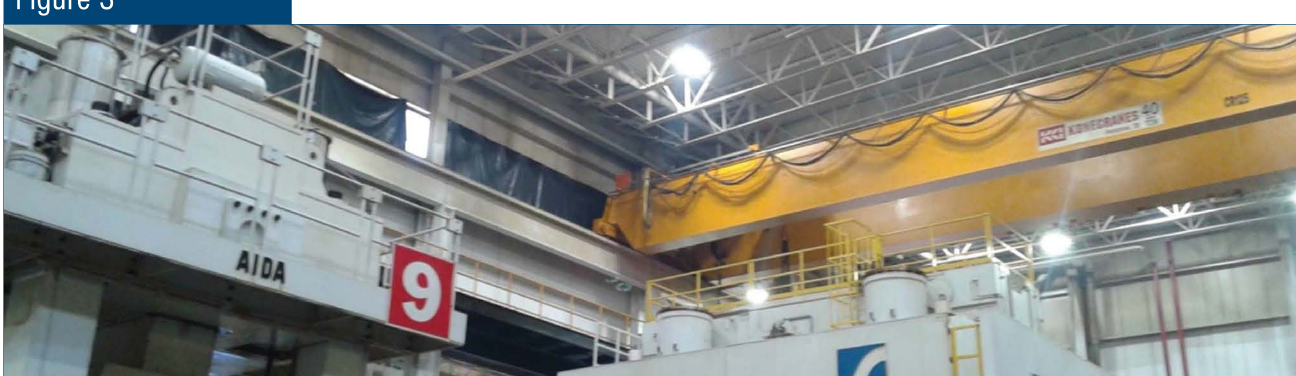
Implementation of such a system requires monitoring the position of the bridge relative to the runway end stop or a wall and the trolley relative to the end of the bridge. It is imperative that one never lose position during operation.

Long-range laser distance sensors with absolute monitoring capability are ideal. When implemented properly, and even if the laser signal is blocked or moves on/off its target plate for a brief moment, the position sensors will pick up its absolute position right away. It is often believed that laser distance sensors cannot operate in the harsh environment of a steel mill. This is not true when the proper sensor and protective hardware is selected for the job. High-performing laser sensors can see though more dust and debris than one might think possible.

Considerations

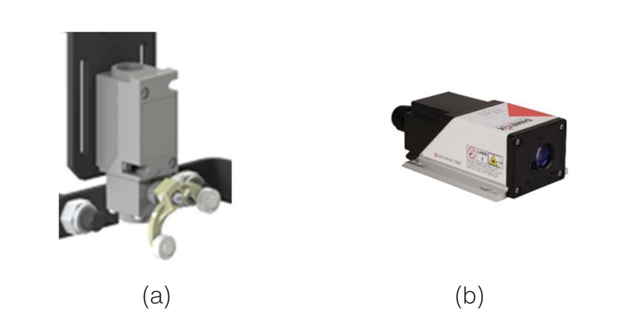
Design and Implementation Considerations for No-Fly Zone Systems — When considering a restricted zoning system for an overhead crane, it is important to understand how the crane is utilized and to identify if the goal is personnel protection only or a combination of

Figure 3



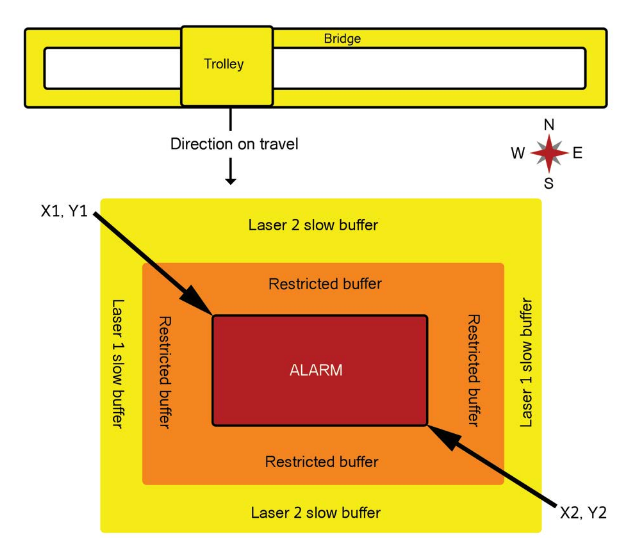
Overhead crane over a stamping press, which usually is made into a no-fly zone.

Figure 4



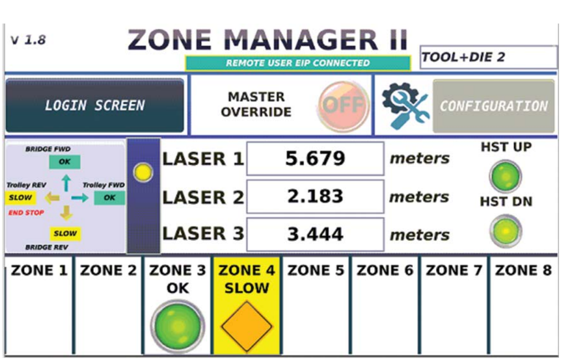
The two key tools of restricting overhead crane movement in no-fly zones are: a mechanical limit switch, also known as a "windmill switch" (a) and modern laser distance sensor (b).

Figure 5



Rendering of crane safety zones.

Figure 6



Example of a no-fly zone controller.

safety and equipment reliability. Some questions to consider are:

- In what areas is the hoist prohibited?
- Is the no-fly zone(s) permanent or is access needed to this area at times for activity, such as machine maintenance?
- Are there obstacles that interfere with the crane's hoist or bridge intermittently that need protection, like a robotic arm, or a mast from a CNC machine?
- Is an override capability needed over the restricted areas?
- Are there areas of the facility that the crane must always enter in which a slow zone is needed instead of a no-fly zone?
- How many restricted zones are needed?

Other parameters that are crucial to the project are:

- Runway length and span.
- Type of crane drive (contactor, VFD, 250 VDC controls).
- The number of independent trolley hosts on each crane.
- Radio controls or pendant controls.

Important Key Characteristics to Consider While Evaluating No-Fly Zone Solutions

To maintain safe operation of hoists, it is important that a no-fly zone system have key characteristics that will promote safety and reliability:

- Absolute positioning sensors that never lose track of the crane and never require re-zeroing.
- Configuration of zones and related slow buffers: simple configuration of restricted zones and the related parameters. It is imperative that a slow and stop zone be configurable.
- User alarm configuration: The ability to set alarm limits is crucial.
- Interface with machines in the facility: the ability to override a no-fly zone or alert a machine that the crane is in its area.
- Override capability: overrides are often needed for maintenance access with the crane.
- Real measurement system: See the position values and eliminate the need to have to teach positions like a proximity system.

Conclusions

As production demands increase, fast and efficient movement of materials via overhead cranes is important. Handling materials around structures and equipment in a facility poses an inherent risk to navigate the obstacles. Experienced operators typically can navigate around the building or stamping press in the middle of the runway, but it takes only the smallest distraction for an accident to occur. Any accident involving collision between a crane and a structure or machine can cause a reportable safety event, combined with serious machine or load damage.

Utilizing no-fly or slow zones in facilities can have great benefits:

- Safety: Minimize collision minded safety concerns.
- Reliability: Reduce probability of damage to crane and production equipment.
- Productivity: Better defined movement paths promote productivity.

Investing in reliable and simple to implement technology can help in the quest to provide a safer interface with cranes that also minimizes unplanned downtime. ✦