

# Good Practice for Installation of Smart Site Safety System (4S) on Tower Cranes and Mobile Plants

This good practice provides a reference guide for installation of danger zone alert system (i.e. 4S) for the following machineries on construction sites. As main Contractor is the party responsible for installation of 4S on its construction sites to enhance its supervision of site safety, the Construction Industry Council (CIC) has assisted to consolidate the requirements of main Contractors by consulting contractor associations including Hong Kong Construction Association (HKCA), Hong Kong General Building Contractors Association (HKGBCA) and Hong Kong Registered Contractors Association (HKRCA), Hong Kong Non-Road Mobile Machinery Association (NRMMA), Hong Kong Professional Hoisting Engineering Association (HKPHEA), Hong Kong Tower Crane Association (HKTCA), Plants Rental Companies and 4S Vendors to prepare this good practice for industry's reference.

## Tower Crane:

## Mobile Plants (11 Types):



推土機  
(Bulldozer)



搬土機  
(Loader)



挖土機  
(Excavator)



龍門架起重機  
(Gantry Crane)



壓實機  
(Compactor)



平土機  
(Grader)



貨車式起重機  
(Truck-mounted Crane)



履帶式起重機  
(Crawler Crane)



傾卸車  
(Dumper)



鏟運機  
(Scraper)







輪胎式液壓伸縮吊臂起重機  
(Wheeled Telescopic Mobile Crane)

# Typical Arrangement of Danger Zone Alert System for Mobile Plants



## Legend:

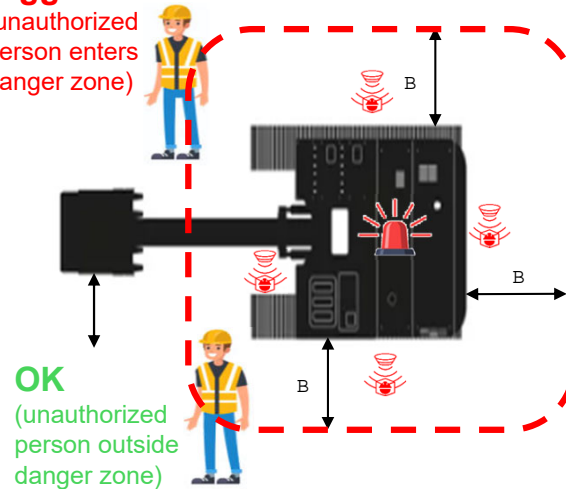
-  **Detection device of the Danger Zone Alert System**  
(It could be in the form of AI camera, proximity sensor, or other technologies that could perform the 360° detection. The positions in the diagrams are indicative only. The product vendor for the device shall determine the number of devices required and the appropriate installation positions on each mobile plant to enable the system to perform the functions as stated in the performance specification below.)
-  **Danger zone to be detected**  
(The danger zone shall be determined by the Safety Officer of the main Contractor according to his risk assessment. Depending on the site condition, the detection extent D of the detection device should be adjustable to 0.6m, 1m or 2m from any part of the mobile plant.)
-  **Warning System for unauthorized person(s) encroaching the danger zone perimeter** (normally a siren speaker with flashlight and buzzer)
-  **Site personnel authorized to work within danger zone**

## Performance Specification of Danger Zone Alert System for Mobile Plants

The system shall be an automated warning system which:

- a) shall detect any unauthorized person(s) encroaching the mobile plant danger zone perimeter, and alert the plant operator and such unauthorized person(s) of the risk of being run over or hit by the plant moving components;
- b) include adequate number of AI cameras, proximity sensors, or other technologies, installed on the mobile plant and its movable superstructures, to ensure full 360° detection coverage around the danger zone perimeter to perform the function in (a) above;
- c) be able to adjust the detection extent of the danger zone to 0.6m, 1m or 2m from any part of the mobile plant (see above diagram) to suit the conditions of different construction sites;
- d) provide the warning alert in (a) above to the plant operator by means of (1) a warning light signal flashing on the plant operating dashboard and (2) an alarming warning message delivered via a speaker or headphone;
- e) provide the warning alert in (a) above to the unauthorized person(s) encroaching the danger zone perimeter by automatically turning on a siren speaker attached to the top of the mobile plant (at a position highly visible to persons near the plant) with flashing red light and buzzer with continuous alarm at a minimum noise level of 70 dB; and
- f) shall automatically turn off all warning signals when the unauthorized person(s) have left the danger zone.

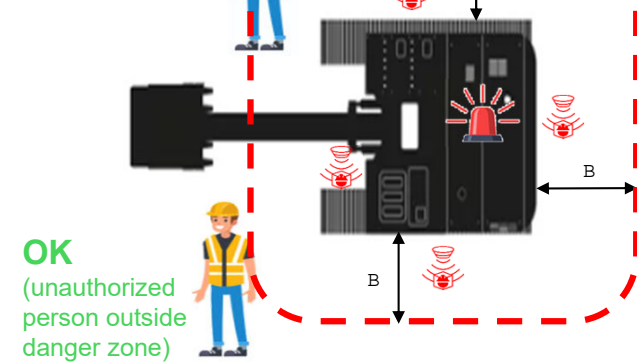
**Alarm triggered**  
(unauthorized person enters danger zone)



**Typical Arrangement for Mobile Plants for which Workers are NOT Required to Work within the Danger Zone (Top View)**

**OK**  
(person authorized to work within danger zone)

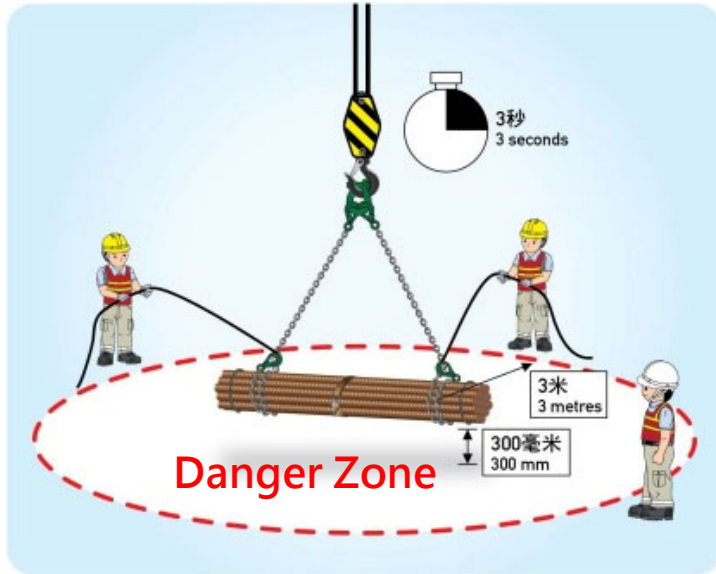
**Alarm triggered**  
(unauthorized person enters danger zone)



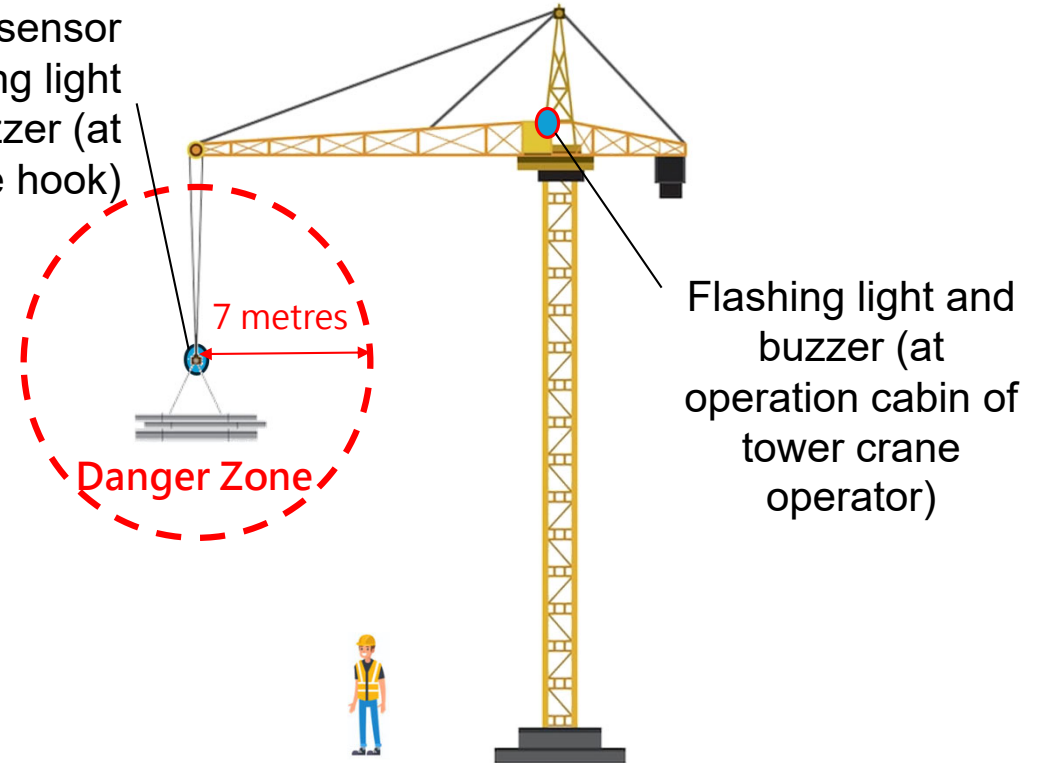
**Typical Arrangement for Mobile Plants for which Specific Workers are Required to Work within the Danger Zone (Top View)**

(Authorization of persons to work within the danger zone could be done by means of different technologies, for example:  
(1) proximity sensor – attaching detection smart tags to the helmets of unauthorized persons only;  
(2) AI camera – using different helmet colours, facial recognition, or other techniques for differentiating authorised and unauthorized persons to facilitate AI detection)

# Typical Arrangement of Danger Zone Alert System for Tower Crane




Detection sensor and flashing light and buzzer (at crane hook)



Legend:

 Danger zone to be detected

 (The danger zone shall be determined by the Safety Officer of the main Contractor according to his risk assessment, but in no case shall the extent of the danger zone be less than 7m radius from the crane hook, or 3m from the cargo being lifted at the loading/unloading area.)

## Typical Arrangement of Danger Zone Alert System for Tower Crane

### Performance Specification of Danger Zone Alert System for Tower Crane

The system shall be an automated warning system which:

- shall detect any unauthorized person(s) encroaching the danger zone perimeters of the tower crane loading/unloading area and lifting area, and alert the tower crane operator and such unauthorized person(s) of the risk of being hit by the moving load under the crane hook;
- include adequate number of AI cameras, proximity sensors, or other technologies, installed on or around the tower crane, to ensure full coverage of all danger zone perimeters of the lifting area and loading/unloading areas at all floor levels involved to perform the function in (a) above;
- provide the warning alert in (a) above to the tower crane operator in the operation cabin by means of (1) a warning light signal flashing on the plant operating dashboard and (2) an alarming warning message delivered via a speaker or headphone;
- provide the warning alert in (a) above to the unauthorized person(s) encroaching the danger zone perimeter by automatically turning on a siren speaker attached to the crane hook (and/or at a position highly visible to persons near the tower crane) with flashing red light and buzzer with continuous alarm at a minimum noise level of 70 dB; and
- shall automatically turn off all warning signals when the unauthorized person(s) have left the danger zone.