This is a clip from the 10 December 2024 recording of the

Hong Kong Housing Authority

“Site Safety Seminar for Capital Works New Works Contracts”

The speaker on stage is Mr. Timothy LAU

Term Safety Ambassador/1

His topic is “Update of Smart Site Safety System (4S) “

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(00:21)

Thank you all for being here today

Let me introduce myself

I am Safety Ambassador, Mr Timothy LAU

The other speaker is our colleague

Senior Clerk Of Works, Mr. YUEN Ying Yeung

Our presentation will be divided into two parts

I will be responsible for the first part

introducing you to the Housing Authority's work in implementing the Smart Site Safety System(4S)

covering the following aspects

The purpose of the Smart Site Safety System

the contractor's submission of the Smart Site Safety System implementation plan

for the Contract Manager's approval

and the various components that make up the Smart Site Safety System

I will also list some past practical examples

to illustrate how the Smart Site Safety System addresses risks

And my colleague, Mr. YUEN Ying Yeung

will introduce the Smart Site Safety System Labelling Scheme

implemented by the Construction Industry Council and the Development Bureau

Construction sites involve numerous high-risk operations
necessitating measures to control and reduce risks
Smart Site Safety System can help us manage site safety
by monitoring site operations in real-time
identifying hazards
issuing warnings to site personnel, and enabling corrective actions
This system can also collect and analyse data
reveal safety issues
to facilitate contractors in implementing improvement measures
and strengthen site management

In view of this, on December 22, 2023
the Housing Authority launched DCMBI P06/2023
requiring projects with an estimated contract sum exceeding 30 million dollars
to implement Smart Site Safety System
Within the Smart Site Safety System
contractors are required to prepare an implementation plan

Within two weeks after the contract commencement
they must submit the plan to the Contract Manager and obtain approval
The plan must include details on the network, devices, device locations
personnel, software, management plan, response plan
and backup plan information in case of system failure, among other things

Within one month after the Contract Manager approves this plan
the contractor must implement it
The contractor must submit a report on the status of the Smart Site Safety System to the Contract Manager
before the monthly site safety committee meeting

and then discuss the plan within the site safety committee

The Smart Site Safety System must operate continuously until the completion of the project

The contractor must arrange a suitable network

to support the Smart Site Safety System devices

capable of instant message transmission

The accuracy of sensor-triggered alerts must reach 90%

and cameras must continuously transmit

encrypted video feeds to the centralised management platform

for the Contract Manager to watch

Before starting work each day

the contractor must assign personnel to inspect the Smart Site Safety System devices

to ensure they are functioning normally

They must also arrange for personnel to receive training

arranging maintenance service within 24 hours of a system problem occurring

So, what does the Smart Site Safety System include?

Currently, there are a total of 13 facilities in the contract

including a centralised management platform

digitalized system for operator identity verification

dangerous zones access control by electronic lock and key system

tower crane alert system

mobile plant alert system

vehicle height monitoring alert system

safety monitoring system using artificial intelligence

digitalized tracking system for site plant, equipment and personnel

frontline staff monitoring system

confined space monitoring system

digitalized permit-to-work system

virtual reality training

and vehicle handbrake alert system

Let's first talk about the centralised management platform
This platform collects data generated by the Smart Site Safety System devices
and the data is displayed on a dashboard
The platform must operate automatically
and be compatible with the project's (BIM)
to facilitate the display of the locations
of various devices on site within this system
The contractor must arrange
for a manager-level staff to receive training
This person must monitor and operate the platform during office hours
and pay attention to alert signals issued by the platform
to take timely corrective actions
The platform must back up all data and maintain operation
The contractor must design a dashboard
to display data and alert signals
from the Smart Site Safety System devices

The platform must allow no fewer than thirty users to use it simultaneously
and support Artificial Intelligence
and video streaming from the Smart Site Safety System
Based on the large amount of information collected by this management platform
the contractor can use this information for analysis and safety training
Before delivering the management platform
the contractor must submit a data access strategy plan to the Contract Manager
for example, steps on how to manage accounts
The platform must retain data for at least three months

Users should be able to access the platform's server without requiring specific software or licenses

The contractor must provide a firewall for servers installed on site

If the platform is installed in a data centre or on the cloud

its server must comply with international security standards

Details are already specified in the contract specifications

The contractor must submit audit reports to

prove that the platform's server meets international security standards

The contractor must also conduct security audits

to show that the platform's service provider is capable of

fulfilling security and risk management responsibilities

Because it contains a lot of information

such as personal health conditions

this data must not be leaked externally

so security capability is very important

Let's first watch a demonstration video of the centralised management platform

First, we see the site layout plan

It includes statistics on safety issues

and conditions of three tower cranes and buildings

Then it shows fire prevention monitoring

some alert records

tower crane operation status

tower crane operator information

and recent alert records

It also displays information on some machinery and equipment

such as their location

Here are the safety certificates for the tower crane

and information on lifting tools

Safety certificate for the lifting bucket

We also see worker information

the number of site personnel, gender, age

information on new employees

subcontractor employee information, etc

Next, I will use examples of incidents or accidents

to explain how the Smart Site Safety System can help us

In recent years, some accidents have occurred

because site machinery was operated by unauthorized workers

As you can see in the photo

a subcontractor's worker

without training or authorization

operated an aerial platform

and ended up falling into a trench

This is an accident that should not have happened

More recently, there was fatal accidents with an aerial platform

To manage these risks

contractors must use a digitalized system to restrict the operation of these machines

Use a digitalized system to activate elevating platforms, forklifts, loaders, excavators, and mobile cranes

Material hoists must also use Radio Frequency Identification (RFID) technology

or facial recognition technology to allow access

Only when qualified operators are confirmed can they start these machines

In the video on the left

you will see the operator of a crawler crane

needing to unlock a fingerprint lock to use it

This method can prevent unauthorized personnel from starting this machine

The operator is able to open this fingerprint lock

If operator Ho Chun Fai is not at work

the area's foreman, Hau Hang Fai, can open this fingerprint lock

He is also one of the administrators

Apart from these two individuals

no one else can open this fingerprint lock

Now, let's try having someone else open it

The indicator light is red showing that the fingerprint lock cannot be opened

In the past, some accidents have also occurred

related to unauthorized personnel entering restricted zones

or removing covers

This site example is a subcontractor's rest area on the first floor

A worker was asked to clean the area

The worker saw a wooden board on the ground and proceeded to remove it

but underneath the board was actually an opening

The worker was careless

and unfortunately fell from the 6-meter high opening

and died on the spot

Why was that board placed there

without any markings or being fixed to the ground?

This is definitely unreasonable

But with the help of systems and technology

that would be much better

To prevent the risk of accidents

the new contract requires contractors to implement an alert system to monitor the following items

Floor openings larger than 0.5m x 0.5m

Entry into confined spaces

Storage areas for precast concrete and largest steel formwork

Gates of lift shafts

Gates and distribution box doors of material hoists

The system includes electronic locks and electronic keys

When someone opens an electronic lock without authorization

the system will trigger an alert of 70 decibels or more

and a red indicator light will flash simultaneously

The system will send this message as an SMS or via an app

to the mobile devices of site management personnel

and their mobile devices, i.e., their mobile phones, will sound an alert

Site management personnel include the site representative, foreman, safety officer

safety supervisor, and confined space Competent Person

The alert will display the date, time, location

and the identification number of the electronic lock

It will also be recorded on the centralised management platform mentioned earlier

After receiving these alerts, site personnel

can take immediate action to prevent accidents

Lifting operations are a high-risk activity

Objects falling from above can have very serious consequences

Just like the accident in this photo

the hook on the tower crane suddenly detached and fell

hitting the left foot of a worker below who was assisting with the lift

From the photo, one can imagine the weight of the hook

The accident shows that the tower crane lifting area is very dangerous

and requires enhanced management

The safety officer must determine the lifting danger zone based on a risk assessment

The distance between the danger zone boundary and the hook radius must not be less than

7 meters

based on the risk assessment, the safety officer must also

determine that the clearance height between the lifted object and the loading area is not less than 3 meters

This clearance height ensures that the smart system can activate the alert system

When sensors detect someone entering the danger zone

and the height between the lifted object and the loading area

is less than the preset system activation distance

the alarm device on the dashboard in the tower crane control cabin will activate

There will be flashing lights and audible alarm messages

to remind the tower crane operator to stop the lifting operation

And on the hook itself, a red flashing light will continuously blink

and emit an alarm sound

alerting relevant personnel to immediately leave the lifting zone

The system will also send an alert to the mobile devices of site supervisory staff

When the intruder leaves the danger zone

the alert message will stop

The system will record the time and date of intrusion

and video footage from 15 seconds before the intruder entered the danger zone to 10 seconds after they left

will be recorded on the centralised management platform

for management personnel to follow up

Perhaps you have also seen this photo in the newspapers

Several personnel in the industry have been injured or crushed to death by mobile machinery

In this incident

the driver of a dump truck was working behind the truck

It is suspected that an adjacent excavator suddenly slewed

and the driver was caught between the dump truck and the excavator, dying at the scene

If this operating area could be enclosed

with the addition of warning devices

accidents could be reduced

The safety officer determines the danger zone for mobile machinery based on the risk assessment

The distance between this zone and the machine body must not be less than two meters

Sensors are installed on the machine body

The detection range of the sensors must cover the machine's danger zone

Let's watch a short video first

The video shows that when someone enters the danger zone

the red light on the machine body will flash continuously

and a beeper will warn the intruder

At the same time, the system activates a red flashing light and beeper in the cabin

to alert the operator that someone has entered the danger zone

The system simultaneously sends an alert to the mobile devices of site management personnel

Only after the intruder leaves this area

will the alert stop

And the system will display the date and time of the intrusion

and video footage from 15 seconds before the intrusion to 10 seconds after leaving the danger zone

will also be recorded on the centralised management platform

Additionally, it has been noted

that sometimes site vehicles

collide with footbridges on streets

The reason may be that the crane boom was not properly retracted onto the vehicle

Therefore, an alert system is installed on site

The alert system will sound an alarm

when the height of the machinery exceeds the preset site vehicle height

or highway height limits

The alert system will remind the machine operator and security guard to take corrective action

The video on the right also simulates a situation where the machine height exceeds the limit

Contractors have a responsibility to continuously monitor the safe operation of site works

If there is negligence, accidents can easily occur

Before a truck-mounted crane lifts

the outriggers should be fully extended to maintain stability

But in this photo

this practice is seen as very undesirable

Why are the supports not fully extended?

There may be many reasons behind it

but this is undesirable and unsafe

There was once an incident

unrelated to this photo

where the foreman reminded the subcontractor

that the outriggers must be fully extended before starting work

But the foreman is sometimes not present to supervise

so the subcontractor violated the rules

Only one side of the outriggers was extended

After lifting, it overturned

because of a certain weight, the vehicle could not balance

Once it overturns, it's a D.O.

meaning Dangerous Occurrence.

The contractor is responsible for reporting it to the Labour Department within 24 hours

by filling out a report form

These accidents cannot be concealed

Now, with technological advancements

it can help us continuously monitor the site

identify hazards, and trigger alarms

using Artificial Intelligence

The contract requires the contractor to provide an AI system

for real-time monitoring of all open areas, work floors, and external work areas on site

Within two weeks of installing the AI system

they must provide eight hours of training to their colleagues

Within four weeks

the contractor must submit an AI improvement plan to the Contract Manager

AI continuously learns

improving accuracy to meet contract requirements

The system must operate continuously until the project is completed

The average accuracy for all unsafe acts or conditions

must reach 90%

Unsafe acts or conditions include, but are not limited to, the following

Unauthorized entry into restricted areas, danger zones

lifting areas, vehicular access routes, etc

Look at the video on the left

You have entered a dangerous zone, please leave.

The system identifies him as a worker and lets him leave

It's very dangerous for workers to walk in vehicular traffic areas

Other unsafe acts and conditions

such as vehicles or machinery being very close to people

which could lead to collisions

Like the crane outriggers we saw earlier

the outriggers were not fully extended

Workers in the lifting zone not wearing reflective vests and safety helmets

or not wearing safety helmets on site

Exceeding height limits during lifting

Working at height without wearing a safety harness or not being hooked to a lifeline

Not using a work platform

Seeing drivers who are tired or not concentrating

These situations will be displayed in the alert system

This AI system

will allow contractors to demarcate zones themselves

defining areas on the computer based on risk assessment

When AI identifies a hazard

it issues an alert of 100 decibels or more and a flashing signal light

to remind workers of the unsafe act or situation

Alerts will also be sent to the mobile devices of site managers

reminding them to follow up

When sensors detect an unsafe situation

they will issue an alert within one second

One second is very fast

It is actually necessary

because danger might occur one second later

We cannot wait ten seconds for an alert to appear

that would be too late

When the unsafe act or situation is resolved

the alert will stop

The system must completely record the entire process from one minute before the unsafe act occurs

to one minute after it ends

and upload it to the centralised management platform

along with the relevant time, date, response report, and follow-up actions

The system will then submit a report to the Contract Manager

The contractor also needs to conduct a drill every six months

to ensure this system is functioning normally

There are personnel, machinery, facilities, and installations on site

Personnel will receive training

there will be many records

Machinery undergoes inspection and testing

there are also many records

So how should this be managed?

We need the help of technology

Using a digitalized tracking system

through online devices

we can track information about workers, machinery, and equipment at any time

Contractors must regularly update the database in the backend

When management personnel hold a mobile device, such as a mobile phone

and scan the tags on workers' safety helmets

and on machinery or equipment on site

if the information is complete

they will see their details

such as training attended and certificate validity

If it has expired

an alert message will be sent to the management personnel

notifying them that the relevant certificate or training has expired

The centralised management platform will record this information

to facilitate follow-up actions

Here is a short video

The personnel in the video are checking relevant certificates

In the past, many workers

have died on site due to health problems

You have all heard that the age of construction workers is constantly rising

Some workers are over 70 years old and still working on site

Recently, you may have noticed

that a worker in his sixties died on site due to poor health conditions

Workers may not always be aware of their own health

not regularly measuring their blood pressure

so they don't know their blood pressure has exceeded the standard

Fainting in this situation would be very dangerous

So, we need to use technology to help them

Wearable devices can be used to monitor workers' physical condition

Even when they feel unwell, they can use these devices to send a distress signal

which can help them

Contractors must conduct health risk assessments for workers

and provide smart monitoring devices to workers and management personnel in need

For example, workers over 60 years old or those working alone

What is working alone?

One example is machine operators

because there will not be two people operating machinery simultaneously

Or if medical records show a worker has hypertension

more attention should be paid to these individuals

What functions do these smart devices have?

It can show the person's location

So, as mentioned earlier, it needs to be integrated with BIM

to display the worker's location

for prompt rescue

If a worker becomes immobile, has high blood pressure

a rapid heartbeat, or an elevated body temperature

this sensor will send an alert to the centralised management platform

If a worker enters a dangerous zone

the smartwatch and safety helmet worn by the worker

will issue an alert

warning the worker not to enter this area

and to leave as soon as possible

At the same time, this system will send an alert to management personnel

reminding them that someone has entered a dangerous zone

These devices will also flash lights

to remind workers about extreme weather warnings

such as heat stress, heavy rain warnings, and typhoon warnings

After charging, these devices

should be able to operate for 30 hours

meaning they need such a long operational time

They must be able to use wireless networks

such as Wi-Fi, IoT

or Narrowband IoT (NB-IoT) networks

For confined spaces

sometimes you will hear unhappy news in the media

Related accidents often lead to fatalities

Confined spaces may contain toxic gases or be oxygen-deficient

which are extremely dangerous

One can lose consciousness very quickly and an accident can occur

According to the law, if a place meets the definition of a confined space

workers will face risks such as toxic gases and oxygen deficiency during work

The contractor's Competent Person

such as a safety officer or a confined space authorized person

should conduct a risk assessment

They need to consider whether it is necessary to implement a confined space monitoring system

The monitoring system requires installing devices in the confined space

such as monitors with alert functions

to monitor the location and number of workers, and changes in gases within the confined space

including temperature, PM2.5

which means particulate matter of 2.5 micrometres

oxygen, carbon monoxide, carbon dioxide

and flammable gases such as hydrogen sulphide and methane, etc.

The monitors are managed by the centralised management platform

When data exceeds safe levels

or the system detects abnormal conditions in workers

for example, a worker being stationary for a long time

the monitor will issue an alert

The manager of the monitoring platform

will immediately notify frontline personnel to follow up

The monitoring system will record the alert and time

on the centralised management platform for future analysis

Please watch this video; it is a simulated case

It simulates a worker sending a distress signal

It shows the worker's location

Many high-risk operations now require a permit-to-work

We are systematizing and digitalizing these permit systems

to make it convenient for site personnel to

apply for, issue, and track permits online via mobile devices

therefore improving management efficiency

What aspects will the electronic permit system cover?

Confined spaces, lift shafts, mobile cranes, heavy machinery

hot work (welding, cutting)

lifting operations exceeding 2.5 tons or more than 2.5 meters from the crane

electrical work, and using ladders for work off the ground

Try to avoid using ladders for work

If unavoidable, a permit-to-work is required

When a permit expires

the system will send an alert to the mobile devices of site management personnel

providing details of the permit, alert date, and time

The alert record will be placed on the centralised management platform

for site management personnel to follow up

Workers coming to the site will perform many tasks

including some high-risk operations

Unlike in the past when operations could only be done on-site

now with the help of technology, training can be conducted beforehand

allowing workers to familiarize themselves with and understand high-risk operations

before facing them

For example, confined spaces, gondolas, heavy machinery, lifting operations

work at height and electrical work

We require safety training to be provided in site toolbox talks

including virtual reality safety training

The training kit will simulate the site environment and operations

Contractors can use toolkits from the Construction Industry Council, the Construction Merchants Association

similar products on the market

or toolkits developed by the contractors themselves for training

The video in the middle simulates a contractor

providing training for working at height to workers

Accidents when working at height result in falls

Of course, one cannot actually try it

so simulation is used for training

Safety is very important

There have also been accidents on some sites

The driver of this vehicle failed to engage the handbrake when leaving the vehicle

but the vehicle was parked on a slope

Just then, a worker was working with his back to the rear of the vehicle

Because the handbrake was not engaged, the vehicle rolled backward

The rear of the vehicle is extremely heavy

As in the photo on the right, the driver tried to stop it

but was unsuccessful

The vehicle hit the worker, who died on the spot

Is there any way to avoid this type of accident?

Contractors have installed sensors and alarms

on site vehicles that may be parked on slopes

When a driver fails to engage the handbrake

the sensor installed next to the handbrake

will emit an audible signal and a red light will flash within one second

reminding the driver that the handbrake has not been engaged

The driver should engage the handbrake before leaving the vehicle

These alerts will be recorded on the centralised management platform

At this point, I have explained the 13 facilities

Next, I will hand over the time to my colleague, Mr. Yuen Ying Yeung

to explain the Labelling Scheme to everyone

Thank you for watching

(32:59)