

# **Workplace Safety, Health and Environmental Good Practices Handbook**

# Foreword

Land Transport Authority (LTA) places great emphasis on the importance of safety, as well as minimizing the impacts caused to the environment arising from our construction activities.

This Handbook is a compilation of exemplary safety and environmental site practices implemented by LTA's contractors who have gone the extra mile to achieve safety and environmental excellence.

The good practices comprise of innovative solutions to challenges faced on most sites, as well as improved work procedures that enhance safety and environmental performance. While every site is unique, there are common issues that may be faced by most contractors. Hence, these good practices are shared with all to encourage continual learning and improvement.

Contractors are recommended to adopt good practices that may be applicable to their worksites, but should also exercise discretion in adopting the practices according to the needs of their sites.

# Disclaimer

All illustrations shared in this Handbook are meant for learning purposes only. The learning points for each illustration are not exhaustive and should not be taken to encapsulate all the responsibilities and obligations of the user of this Handbook under the law. LTA and its authorised agents do not accept any liability or responsibility to any party for any losses or damage arising from following this Handbook.

Compliance with this Handbook does not of itself confer immunity from legal obligations.

As a guide, this Handbook has no legal standing.

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Enquiries can be directed to LTA Construction Safety & Environmental Protection Division

# Acknowledgement

LTA would like to thank the staff for their invaluable contribution and continuous support in producing this Workplace Safety, Health and Environmental Good Practices Handbook.

LTA would like to acknowledge the contractors who have contributed in the making of the Handbook.

Lastly, a big thank you to all our contractors for their continuous support and efforts in maintaining a safe, healthy and environmentally friendly site.



**LET'S GET THE WORKFORCE TO TAKE THE  
SAFETY PLEDGE DAILY TO REMIND OURSELVES  
ON OUR SAFETY COMMITMENT TO STRIVE FOR  
A ZERO-ACCIDENT WORKPLACE!**



## **SAFETY PLEDGE**

- 1 PUT SAFETY AND HEALTH OF MY COLLEAGUES AND MYSELF FIRST.**
- 2 REPORT UNSAFE CONDITIONS OR PRACTICES.**
- 3 DO NOT TAKE SHORTCUTS AND ASK WHEN UNSURE.**
- 4 RETURN HOME SAFELY FOR MY FAMILY.**

**START SAFELY   WORK SAFELY   HOME SAFELY  
EVERYDAY**

**The Safety Pledge is also available in:**



**Bengali**



**Burmese**



**English**



**Malay**



**Mandarin**



**Tamil**



**Thai**



**Vietnamese**

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# Safety





# Application of Technology





# Application of Technology



## Robotic Traffic Marshal

Deploy robotic traffic marshal to guide traffic.

- Eliminates risk of traffic accidents.
- Ensures that a traffic controller is available at all times of the day to alert motorists of the temporary road works ahead.

# Application of Technology



## Aqua Cutter

Employ the use of aqua cutter for rebar exposure.

- Increases work efficiency for rebar exposure process.
- Eliminates hazards associated with conventional methods such as excavator hacker machine.



# Application of Technology

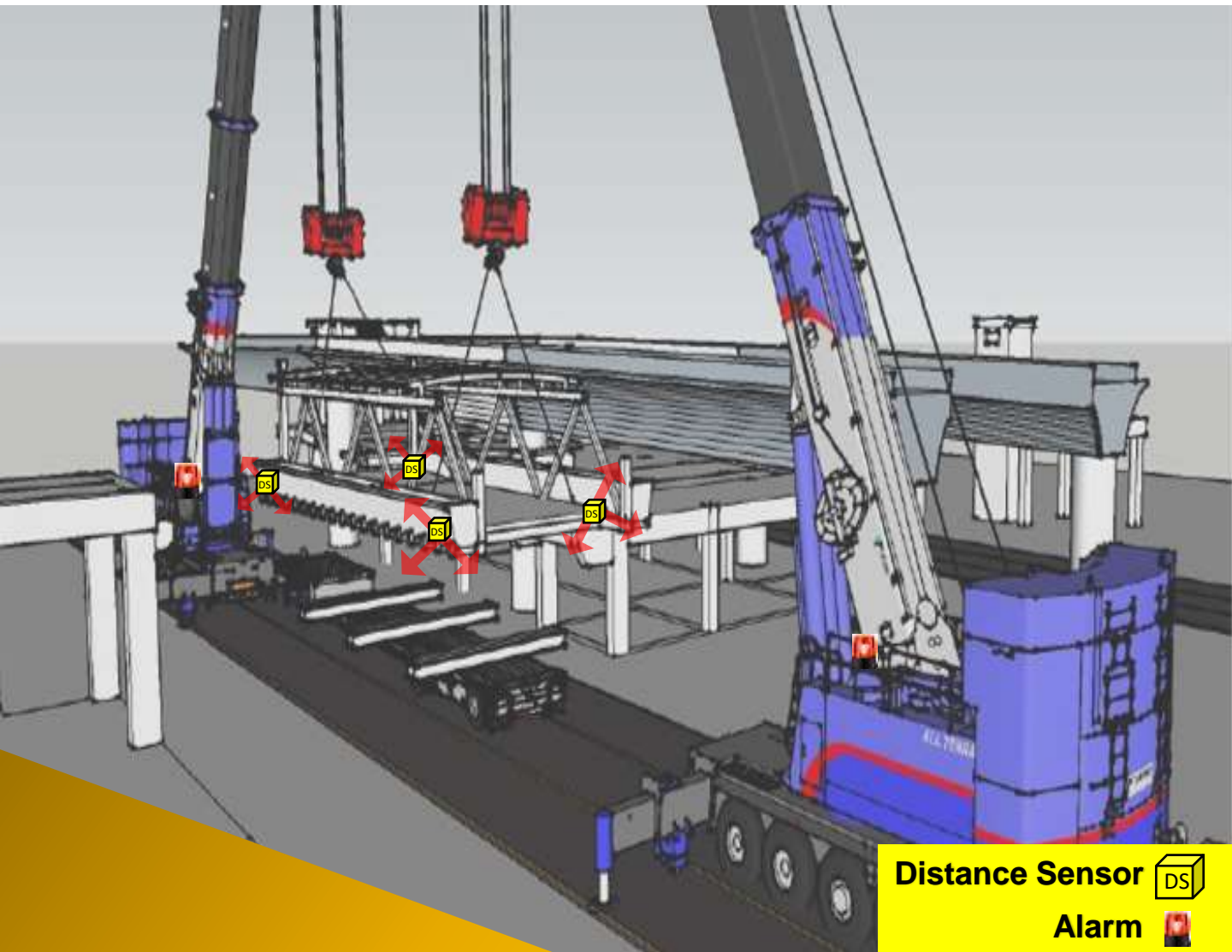


## Virtual Training

Incorporate virtual reality (VR) technology for workers' training.

- Allows workers to have a more realistic safety training experience.
- Enhances workers' learning and understanding of safe work processes.

# Application of Technology



## Wireless Anti-Collision Sensory Protection Device

Install sensor and alarm system before lifting operation commences.

- Reduces risk of collision with nearby structures.
- Enhances safety of lifting operations.



# Application of Technology



## Portable Lightning Detector

Provide portable lightning detector for workers.

- Provides pre-lightning warnings.
- Improves safety on site.

# Application of Technology



## CCTV Monitoring

Provide close monitoring on concrete casting process.

- Provides a comprehensive monitoring system with recording function.
- Allows for a clearer view of the work area through the rotation and zoom functions.



# Application of Technology



## Mast Climbing Platforms

Provide mast climbing platforms for safe access to work areas at height.

- Eliminates hazards associated with conventional scaffolding.
- Minimises obstruction to other works in the vicinity due to its smaller footprint.

# Application of Technology



## Load Indicator Panel on Gantry Crane

Provide load indicator during lifting operations.

- Provides accurate judgment on the weight of load.
- Enhances safety of lifting operations.



# Application of Technology



## Automatic Lightning Warning System

Provide real time lightning warning alert.

- Provides real-time monitoring of weather.
- Improves efficiency of alerting workers as the warning system is automatically activated when lightning is detected.

# Application of Technology



## Vehicular Speed Detector

Provide speed detector along vehicular access.

- Reminds drivers to be wary of their vehicle's speed.
- Reduces tendency of speeding.

# Application of Technology



## Heavy Duty Decking

Provide alternative decking to traditional steel plates.

- Reduces tripping hazard as decking panels are interlocking.
- Reduces slipping hazard.



# Application of Technology



## Kerb Laying Machine

Provide machinery assistance in laying of kerb.

- Reduces hand or finger injuries.
- Reduces fatigue.



# Application of Technology



## Photo Beam Sensors

Provide sensors along the worksite hoardings.

- Prevents lifting operations from exceeding site boundaries.
- Improves safety during lifting operations.

# Application of Technology



## Segment Hoist Synchronization Sensor

Provide synchronization sensor to align movement of hoist.

- Prevents asynchronous operations of hoist.
- Reduces risk of segment dropping.



# Application of Technology



## LED Balloon Light

Provide better illumination on work area.

- Provide additional lighting at work areas on the road.
- Increases visibility for workers.



# Application of Technology



## Wireless LED Lamp

Provide wireless LED lamp for better illumination.

- Reduces tripping hazard due to absence of electrical cables.

# Application of Technology



## Visual Analytic Behavioural Detection Device

Provide detection system that monitors operators' alertness and behaviour.

- Detects unsafe behaviour and alerts operators.
- Creates a log of operators' behaviour on site.



# Application of Technology



## Excavator with Electro Magnetic Attachment

Use of excavator with electro magnetic attachment to shift steel plates on site.

- Safer operation during shifting and laying of steel plates.
- Lesser manpower needed.

# Application of Technology



270 degrees camera system factory-fitted on excavator.

- Safer operation as a visual aid of blind-spots to operator so as to prevent hitting of nearby personnel and obstructions.

**Excavator  
with Field  
View Monitor**



# Application of Technology



## Demolition with Remote Robot

Use of remote robot for demolition works.

- Improves work safety as operator is positioned away from danger.
- Shorten time spent for demolition with high production rate and versatility.

# Application of Technology



## Use Anti-entrapment System for MEWP

Innovative secondary guarding to minimise risk of crushing and entrapment.

- Using Light Detection and Ranging (LiDAR) scanning technology to track operator's movement and positioning.
- Cut off the MEWP on detection of sudden shift in operator's posture and position.



# Application of Technology



## AI Camera Blind Spot Detection System on Heavy Machinery

The system is able to detect humans within Area of Risk and blind-spots around the machine.

- Reduce false alarms by differentiating human and physical object detection.
- Alert operator on presence of personnel as well as triggers alarm to warn personnel at risk.

# Application of Technology



## Roborigger for Safe Lifting

Adopt Roborigger (remote-controlled robotic device) for safer lifting operations.

- Controls load's orientation without the risk of workers being in the vicinity of the lifting zone.
- Rotates and holds loads in a desired orientation regardless of wind without using taglines.



# Competency





# Competency



## Safety Training School

Set up a safety training school to train workers on workplace safety and health.

- Enhances workers' learning experiences.

# Competency



## Buddy System

Assign one experienced worker to guide each new worker on site.

- Helps new workers to better adapt to work practices on site.



# Competency



## Personnel Competency Stickers

Provide stickers to identify competent users.

- Allows for quick identification of workers' competency.
- Reduces occurrences of unsafe usage of tools and equipment by untrained workers.

# Competency

## STOMP -ING AWAY

THE STOMP HAZARDS ON-SITE



NEW

**Slipping and Tripping hazards:** Uneven surfaces, protruding objects / trailing cables, poor housekeeping, wet or slippery surfaces etc.



**Opening hazards:** Unguarded edges and unsecured covers on floor openings, barricades / covers made from unsound material etc.

**Machinery hazards:** Entanglement of loose items, unguarded cutting elements, impact from moving machinery, contact with faulty wires, excessive noise etc.



**Pinch point hazards:** Areas where body parts can get caught in-between moving machinery, rotating/moving parts, moving loads

## STOMP Acronym for Hazard Identification

Use of STOMP acronym to easily recall and identify the commonly found STOMP hazards on-site.

STOMP hazards refer to:

- Slips
- Machinery
- Trips
- Pinch Points
- Openings



# Competency

NEW

**FIRST '3'**

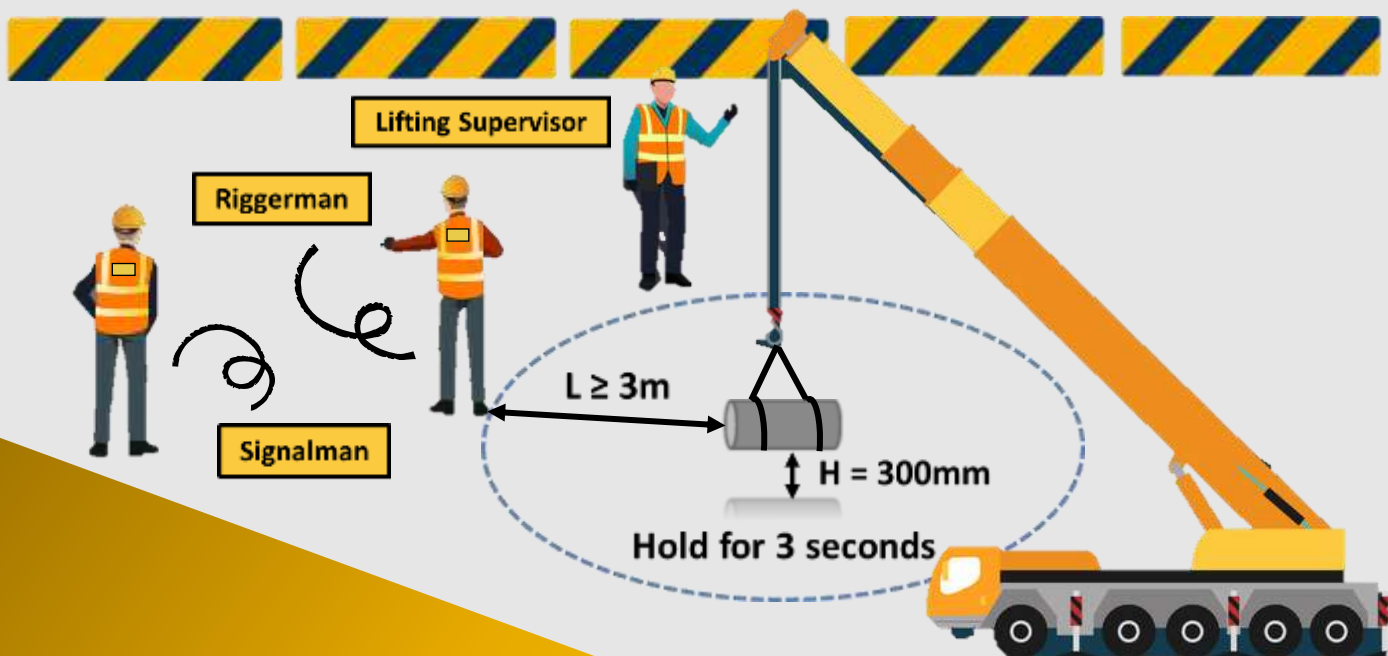
Keep a safe distance of **3m** away from the lifted load.

**SECOND '3'**

Lift the load **300mm** above ground.

**THIRD '3'**

Hold the load in position for **3 seconds** to check for load stability.



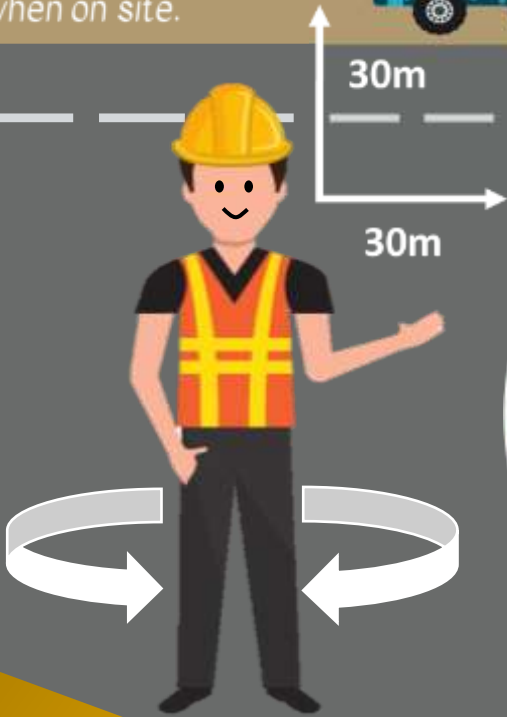
## 3-3-3 Lifting Technique

Apply 3-3-3 lifting technique for safe lifting works.

- Ensures load stability during lifting operations.
- Avoids overloading and load from hitting onto structures and people in the surrounding.

# Competency

Apply the **30-30-30** observation technique at all times when on site.



## 30-30-30 Observation Technique

Develop situational awareness through the 30-30-30 observation technique.

- Enhances workers' attention to look out for potential surrounding hazards.



# Construction Methods





# Construction Methods



## System Formwork

Employ the use of system formwork for casting of large structures.

- Improves structural integrity of temporary works.
- Avoids potential hazards arising from using incompatible materials from different systems.



# Construction Methods



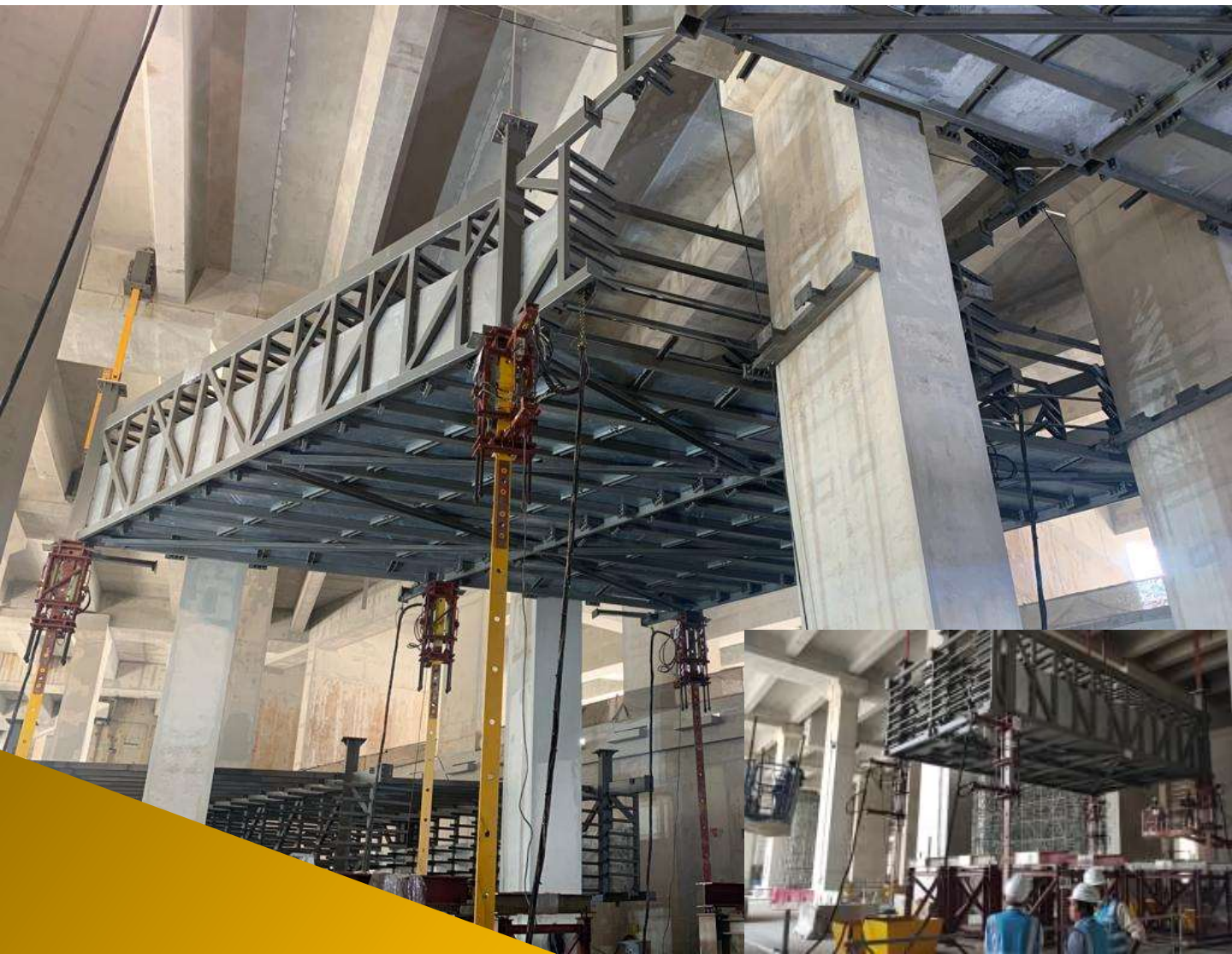
## Modular Scaffold Access

Provide modular scaffolds for safe access to deep excavations.

- Eliminates risk of falling from height.
- Eliminates risk of falling objects.



# Construction Methods



## Hydraulic Jacking System

Provide hydraulic jacking system for heavy modules.

- Improves safety of lifting operations within congested spaces.
- Eliminates risks associated with working at height.



# Construction Methods



## Soil Compactor with Machine Drive Power (MDP)

Soil Compactor equipped with MDP.

- Time saving, less manpower and more accurate data compared to Non Destructive Testing (NDT).
- Operator has real-time information of compaction levels, allowing for improved and even compaction.

# Construction Methods



## Steel Caisson for Canal Works

Steel caisson acts as cofferdam to allow workers to work in a dry and safe environment.

- Reduces time taken to do traffic diversion.
- Safer due to work process reduction.
- Enhance productivity.



# Construction Methods

Precast RC Shell Installation

NEW



## Precast (PC) Shell for Construction of Pilecap over Waterbody

Use of PC shell instead of sheetpile to create a cofferdam for pilecap construction.

- Reduces all hazards associated with sheetpile construction and excavation.
- Enhance productivity.

# Construction Methods

NEW



## Fast, Easy & Safe (FES) Block

FES blocks used for earth retaining system.

- Considerably much shorter duration to implement as compared to conventional temporary retaining system.
- Easy to install due to the interlocking mechanism built in on the blocks.
- Each FES block comes with a built-in lifting points.



NEW



## Portable Anchorage Tool

Portable anchorage tool for work-at-height.

- PE-designed anchorage tool can be mounted on structures such as parapet wall.
- Eliminate the need for installation of the lifeline system.

# Construction Methods



NEW

Portable and lightweight cage for drain opening.

- Prevent personnel from falling into the drain opening.
- Prevent drain cover or grating from slamming down onto personnel.

## Portable Cage for Drain Opening



# Engagement



# Engagement



## Stakeholders Engagement

Carry out regular stakeholders engagements and assist to address their concerns.

- Helps to build a good relationship with stakeholders.



# Engagement



## Care for Community Spaces

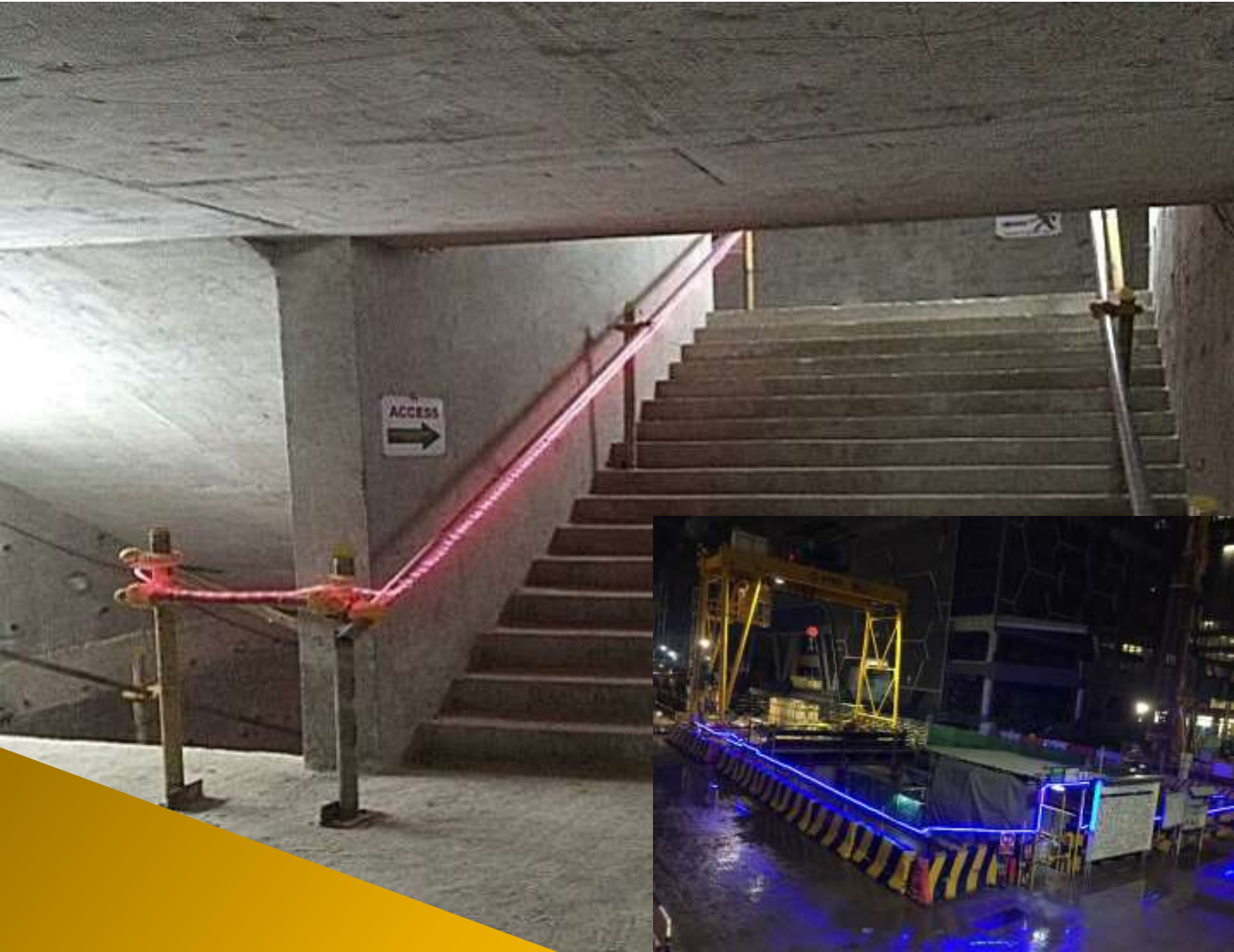
Carry out housekeeping and oiling at areas outside site boundaries.

- Helps to build a good relationship with stakeholders.

# Innovation







## LED Lights

Provide Light-Emitting Diode (LED) lights to highlight safe access and egress in work areas.

- Illuminates access and egress under low light conditions.



## Delineated Wire Mesh Access

Provide proper and durable wire mesh overlay across rebar surface.

- Eliminates risk of workers tripping on rebar gaps.

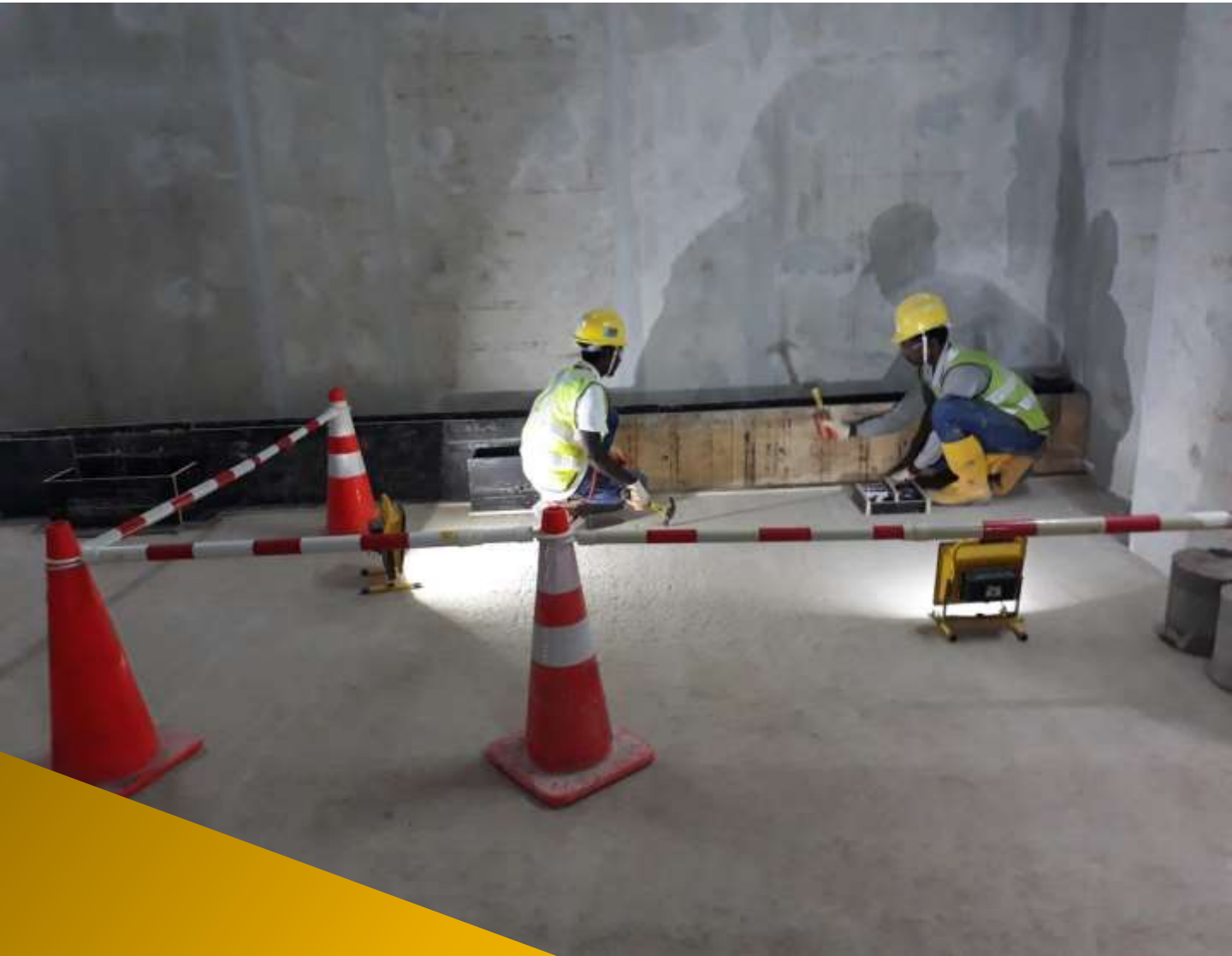




## Mobile Ladder Platform

Provide mobile ladder platform to access rebar works.

- Provides a proper safe platform to access work area.
- Reduces risk of falling from height.



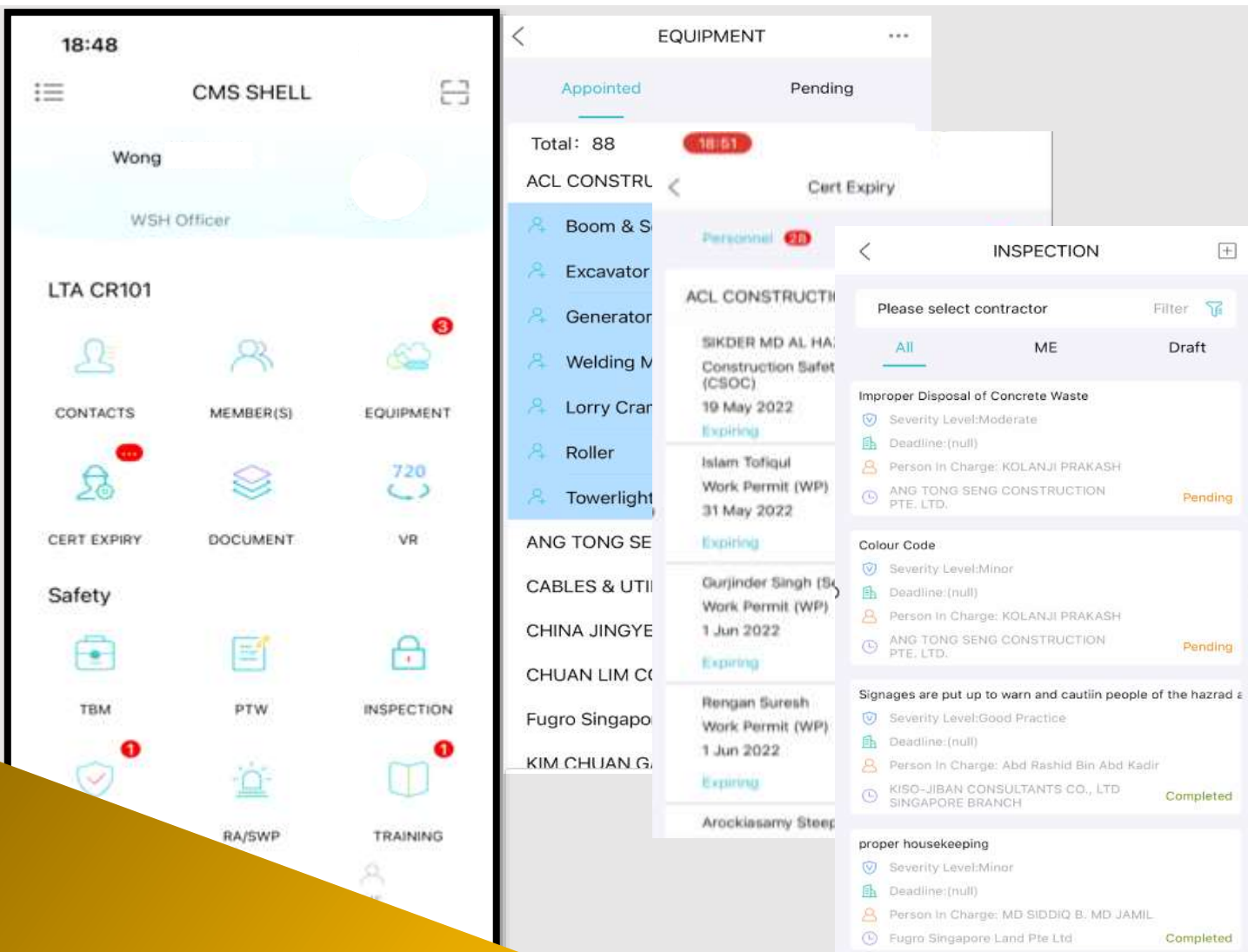
## Portable LED Flood Lights

Provide portable LED flood lights at work areas with poor lighting.

- Improves illumination.
- Reduces risk of tripping without the use of electrical cables.



# Innovation



## Electronic Safety, Health and Environmental Management System (e-SHEMS)

Implement e-SHEMS for worksite.

- Allow ease of access.
- Receive notifications/ prompts.
- Maintain confidentiality of data through restricted access.
- Digital SHE records for ease of tracking and retrieval.



## Additional Gantry Height Warning System

Provide additional height warning system.

- Restricts height of vehicles.
- Prevents damages to site gate and vehicles over the height limit.





## Lifting Brackets

Provide lifting brackets to secure loads.

- Prevents webbing sling from slipping outwards.
- Improves lifting operation safety.



## Height Alert System

Provide height alert system for machineries to prevent overreaching.

- Warns workers of maximum reachable height to prevent collision.

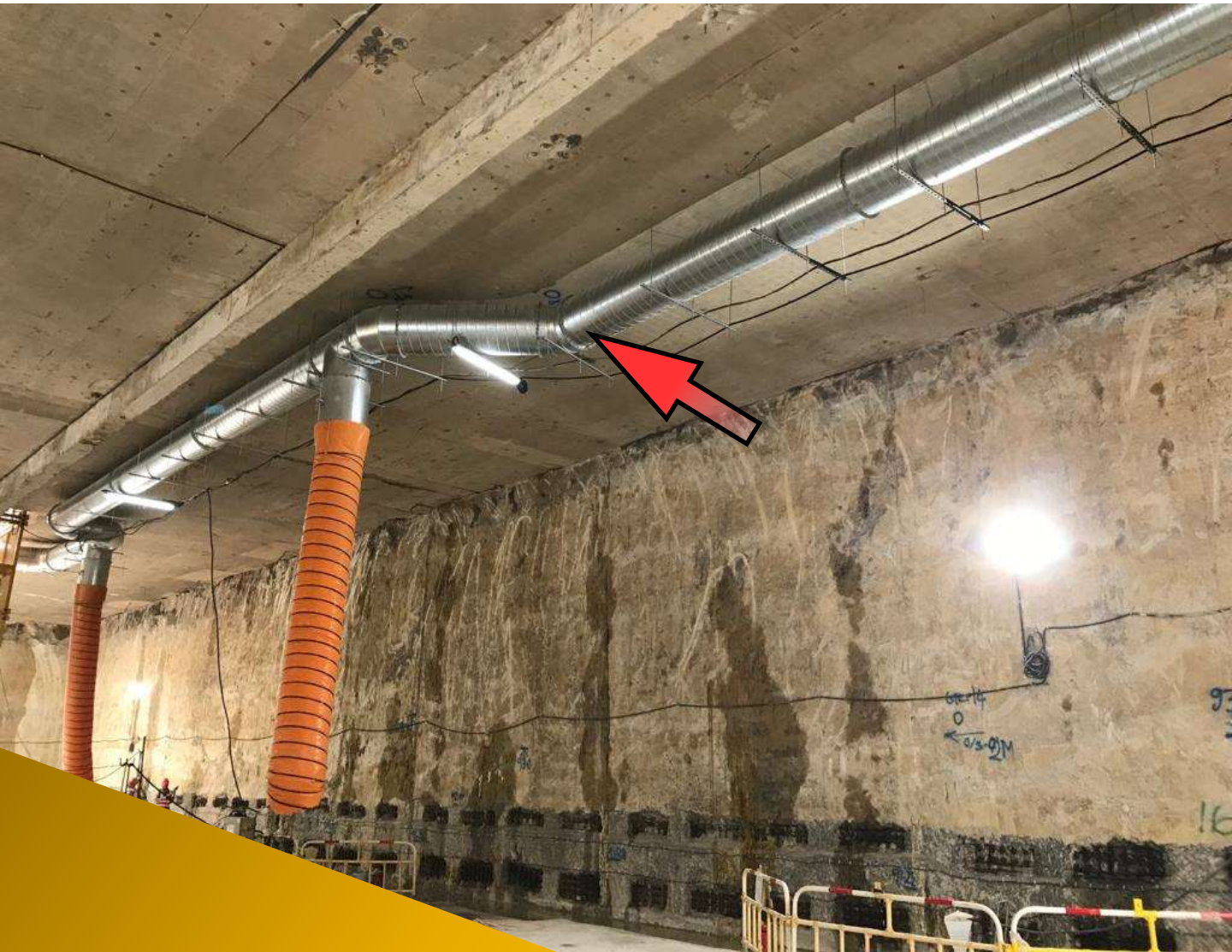




## Portable Lifting Siren

Provide siren for lifting operations.

- Provides warning for others nearby when lifting operation is in process.
- Enhances safety of lifting operation.



## Supply Air Ducts

Provide air ducts for confined space works.

- Improves ventilation in confined spaces.
- Enhances durability of ventilation ducts.





## Steel Guide Wall

Provide steel guide wall for excavation.

- Reduces time taken to erect shoring.
- Improves stability of shoring.

Note: Height of guide wall must be equal to surrounding excavation depth.



## Proprietary Fall Protection System

Provide fall prevention barricades.

- Reduces manpower required for installation.
- Fall prevention implementation at platform level.





## Stairs Climber

Mechanised trolley to facilitate transportation of materials.

- Ability to maintain load at flat level while moving up or down staircase.
- Reduces manual handling injuries.
- Fully battery operated.



## Ground Guard

Provide alternative decking material for vehicular access.

- Reduces muscle strains caused by carrying heavy conventional decking materials.
- Reduces manpower required for installation.





## Elevated Cabin Excavator

Provide excavators with cabins that can be elevated.

- Provides better vision for the operator with a top-down view.
- Improves handling of the controls.



## Local Exhaust Ventilation

Provide local exhaust ventilation at work areas.

- Controls dust at source.
- Improves ventilation for workers.





## Precast Lifting System

Provide remote release system for RC elements.

- Improves ease of mounting and removing precast concrete elements during lifting operations.
- Eliminates working-at-height hazard.



## Fall Protection For Gantry Crane

Provide fall protection device that eliminates fall from height risks during use of gantry crane access ladder.

- Provides safe access on to gantry crane.
- Reduces fall from height hazards.

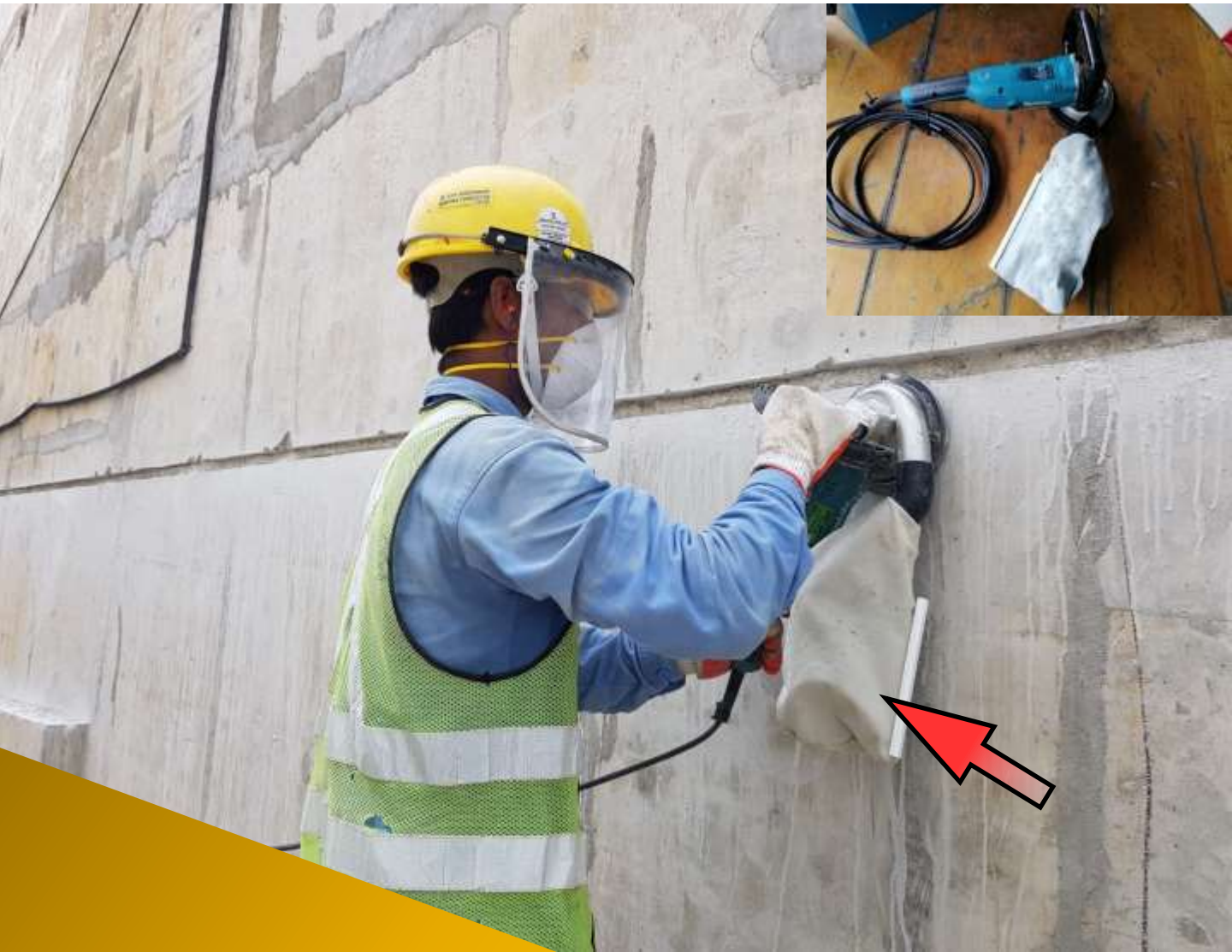




## Lightning Dissipation System for Gantry Crane

Provide lightning dissipation system for gantry crane.

- Reduces probability of lightning strike on gantry crane.
- Provides additional protection for gantry crane operators.



## Dust Collector

Provide proper dust collector for hand tools.

- Bag attachment collects dust generated during work activities.
- Improves dust control on site.





## Fire Extinguishing Ball

Provide an alternate method of extinguishing fire on site.

- Requires less steps for deployment as compared to conventional fire extinguishers.
- Reduces storage space required.

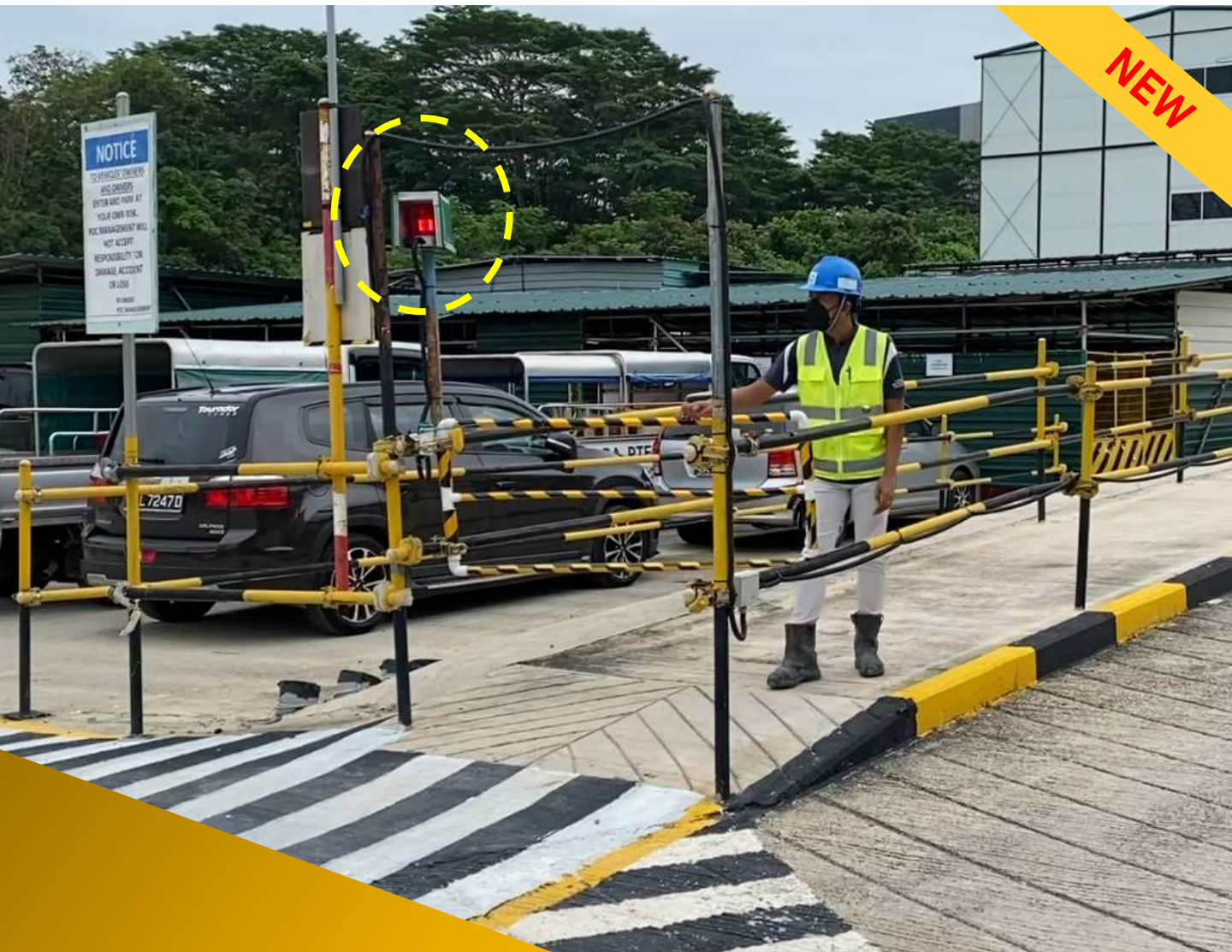


## Pedal Trolley for Pipe Jacking

Customised trolley for transportation of personnel in pipe jacking works.

- Eliminates the risk of slip, trip and fall while walking in the pipe.
- Foot pedal can move both forward and reverse directions. Trolley fitted with magnetic headlights, rear blinker light and gas monitoring meter.
- Worker can sit on platform to carry out works.





## Pedestrian Crossing Alert System

Pedestrian crossing alert system with warning blinker lights and sound when the barrier is open.

- Alert personnel before stepping onto vehicular traffic crossing.
- Alert oncoming traffic of pedestrian crossing ahead.



NEW



## Magnetic Sweeper

Magnetic sweeper installed with 24-inch magnet can collect up to 2.5kg of metal debris.

- Improved ergonomics for workers doing housekeeping.
- Higher efficiency for clearing sharp metallic objects.



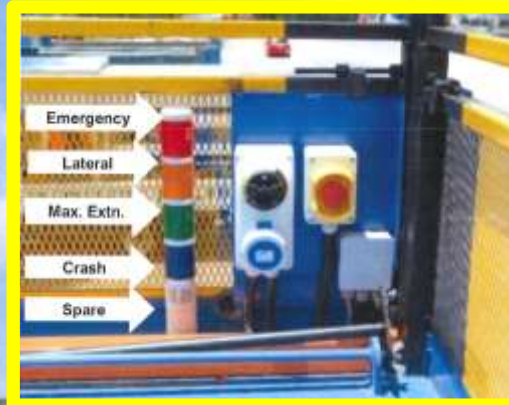


## Rail Removal Frame

Mechanical aid to eliminate manual handling during lifting of rail.

- Reduce pinch point hazard.
- Require lesser manpower.
- Speed up work progress.

NEW



## Truck Mounted Working Platform

Hydraulic working platform mounted on truck.

- Eliminate the erection of scaffold inside tunnel.
- Ability to transport heavy items for installation.
- Safer and better mobility compared to the use of scaffold.





## Trolley System for Battery Transportation

Use of mechanical aid  
(PE designed trolley system)  
for battery transportation into  
station.

- Enhance productivity.
- Eliminate manual handling injuries.



## Electric Material Mobility Device

Use of Electric Mobility Device to transport material on site.

- Increase productivity by enabling the use of mechanical means and minimises the reliance on human labour.
- The device is battery powered hence does not emit toxic gases such as carbon monoxide. Safe for use in a confined space environment.
- Minimise the risk of workers being affected with musculoskeletal injuries.





## Cable Pulling Machine

Cable pulling machine used for cable pulling.

- Eliminate risk of finger injury.
- Require lesser manpower.
- Improve productivity.



## Steel Plate Connector

Installation of steel plate connectors to interlock steel plates on access.

- Minimise accidental movement of steel plates during machinery/vehicular movement.
- Prevents tripping hazards from uneven steel plate placement.





# Material Storage





# Material Storage



## Racks for Rebar Storage

Provide racks at material storage areas to hold rebar in place.

- Provides proper access for workers to retrieve materials.
- Reduces risk of tripping.



# Material Storage



Provide racks and containers for storage of loose materials.

- Prevents tripping.
- Improves general housekeeping.

## Material Storage Racks



# Welfare





# Welfare



## Double Storey Rest Area

Install double storey workers' rest area.

- Occupies less space on site.
- Houses more workers.

# Welfare



**NEW**

## LABOUR DAY MOVIE NIGHT

30 April 2019

பாபு கருணா பரதீசு

KALANTRI NARAN  
"SUPER STAR" RAJINIKANTH  
**CU:1**  
KARTHIKA SUBRAMAN

Time:  
7-9 pm

Venue:  
KTCCE Training Centre

Drinks and refreshments will be served!

All are welcomed!

Organized by 

## Events for Site Workforce

Organise outing or events for the workforce on site.

- To promote mental health and well-being of the workforce.
- To promote team-bonding.



# Personal Protective Equipment





# Personal Protective Equipment



## Reflective Safety Vest with LED Lights

Provide traffic controller with reflective safety vest fitted with LED lights.

- Increases visibility of traffic controller.
- Enhances safety of motorists and traffic controller.



# Personal Protective Equipment



## Removable Foot Steel Plate

Provide removable steel plate for foot protection.

- Increases foot protection coverage during hacking works.
- Reduces likelihood of foot injuries.

# Personal Protective Equipment



## Anti-Vibration Gloves

Provide anti-vibration gloves for workers doing hacking works.

- Reduces vibration experienced during hacking works.
- Minimises joint and muscle pain.



# Health





# General



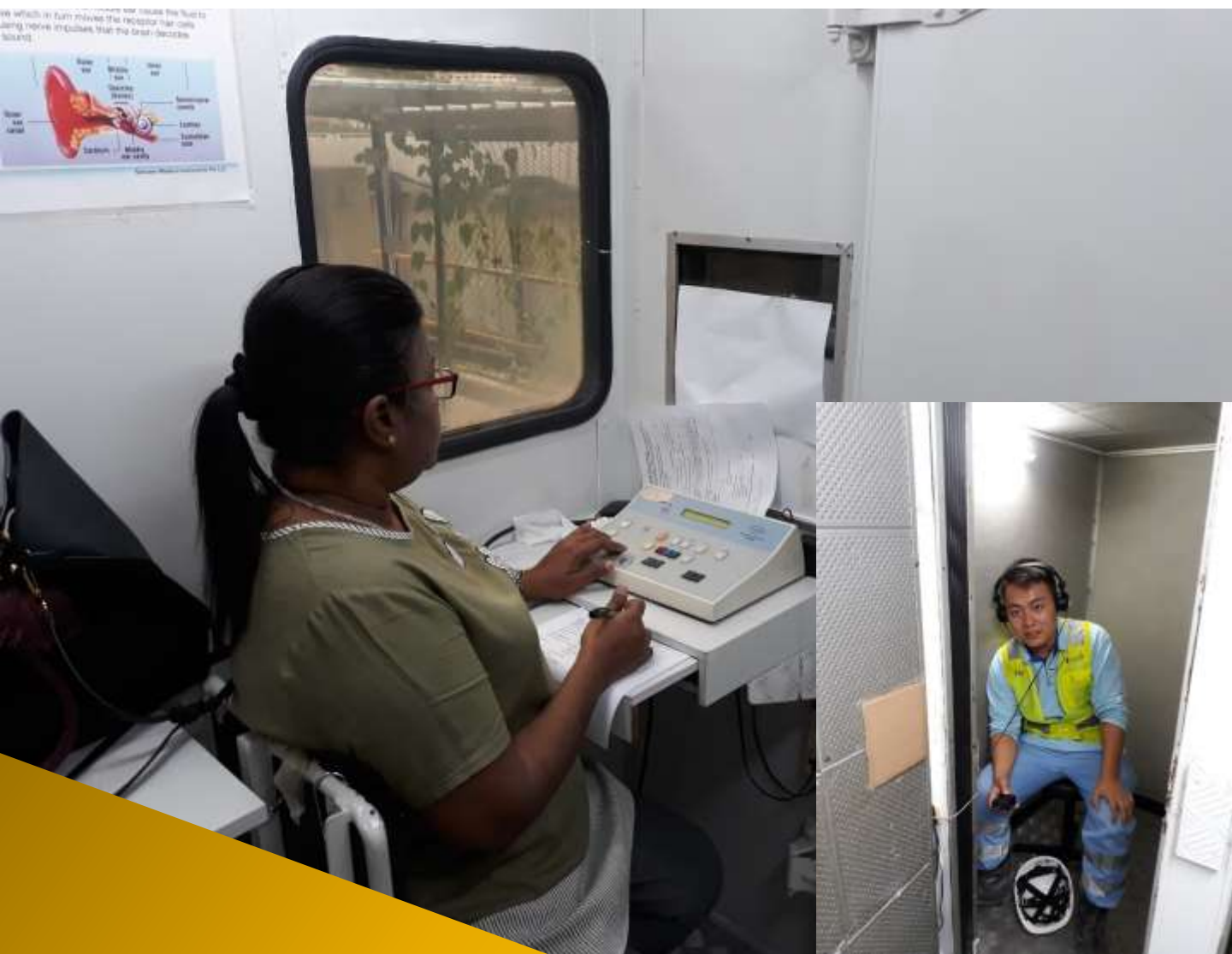
## Health Checks

Conduct regular health checks for all workers.

- Ensures that workers are in good health before work starts.



# General



## Annual Audiometric Test

Provide audiometric examination for workers at worksites.

- Allows for early detection of Noise-Induced Deafness (NID).
- Reduces likelihood of incidents resulting from hearing loss.

# General



## Healthier Dining Options

Provides healthier eating options for the workforce.

- Improves the health of the workers.
- Improves productivity of the workforce.





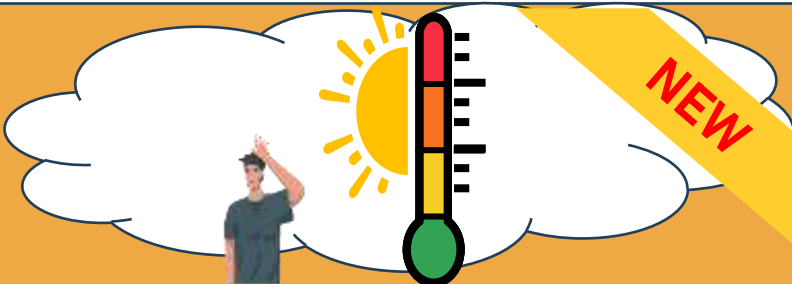
## Sports Event


Conduct periodical sports events for staff and workers.

- Improves the health of the workers.
- Improves general well-being of the workforce.

# General

## ENHANCED HEAT STRESS MEASURES for outdoor work



WET BULB GLOBE TEMPERATURE	 <b>Low</b> ≤31°C	 <b>Moderate</b> 31°C – 31.9°C	 <b>High</b> 32°C – 32.9°C	 <b>Very High</b> ≥ 33°C
<b>WBGT Temperature measurement</b>	Hourly	Hourly	Hourly	Hourly
<b>Wear cool clothing</b>	✓	✓	✓	✓
<b>Ensure adequate hydration</b>	✓	✓	✓	✓
<b>Rest breaks</b>			At least 10-minutes break at 1-hour intervals	At least 15-minutes break at 1-hour intervals
<b>Close supervision and monitoring to identify anyone with heat stress (with buddy system)</b>	✓	✓	✓	✓
<b>Re-schedule heavy manual work to cooler part of the day, e.g. earlier parts of morning or late afternoon</b>	-	-	✓	✓
<b>Train and educate workforce on heat stress symptoms and effects<sup>2</sup></b>	✓	✓	✓	✓
<b>Provide clean drinking water facilities and shaded rest areas with fans</b>	✓	✓	✓	✓
			Increase rest areas to minimise travel distance during breaks	Increase rest areas to minimise travel distance during breaks

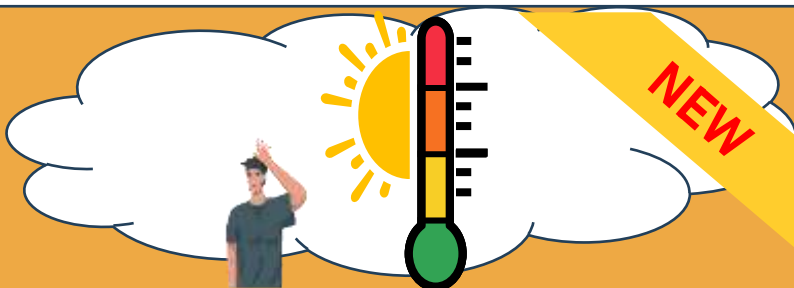
Notes :

- ❖ Provide cool or cold drinking water supply near work areas
- ❖ Rehydrate at least hourly and drink a recommended intake of 300ml per hour or more depending on the rate of water loss based on work intensity.
- ❖ Emergency response and first-aid procedures on standby at all times.



# General

## ENHANCED HEAT STRESS MEASURES for outdoor work



### WET BULB GLOBE TEMPERATURE



**Low**  
**<31°C**



**Moderate**  
**31°C – 31.9°C**



**High**  
**32°C – 32.9°C**



**Very High**  
**≥ 33°C**

1. All workplaces are to monitor the WBGT on a hourly basis to determine the risk of heat stress to the workforce.
- ✓ WBGT is available on myENV application, which will display the WBGT from the sensor closest the user’s location.
  - ✓ MOM requires workplaces with outdoor work<sup>1</sup>, including larger construction projects that are valued at \$5 million and above<sup>2</sup>, to monitor the actual WBGT on-site. This can be done using portable WBGT meters or handheld units.

<sup>1</sup> Outdoor work refers to work under the sun

<sup>2</sup> MOM will take reference to the letter of award

### Work-Rest cycle

MOM introduced a new work-rest cycle based on the work activity with recommended rest duration to ensure that workers get adequate rest under shade during hot weather.

WBGT	32 ≤ WBGT (°C) < 33		WBGT(°C) ≥ 33	
Work Activity	Light physical activity <sup>4</sup>	Heavy physical activity <sup>5</sup>	Light physical activity	Heavy physical activity
Frequency, Rest Duration	Hourly, 5 to 10mins	Hourly, 10 mins rest	Hourly, 10 mins rest	Hourly, 15 mins rest

<sup>4</sup>Examples of light physical activities include light to moderate manual hand, arm, trunk or leg work; pushing and pulling light loads, and normal walking

<sup>5</sup>Examples of heavy physical activities include intense arm and trunk work, carrying, shovelling, manual sawing; pushing and pulling heavy loads; and walking at fast pace

# Safe Management Measures for Infectious Disease



TOTAL COUNT:4    SAFE COUNT:0    LOW RISK COUNT:2    HIGH RISK COUNT:2

## S-DISTANCE SYSTEM

### Artificial Intelligence Monitoring for Safe Distancing

Use artificial intelligence to monitor safe distancing compliance on site.

- Ensures that safe distancing measures are complied with.
- Reduces risk of disease transmission due to close contact on site.



# Safe Management Measures for Infectious Disease



## Sanitization of Common Areas

Provide sanitizing agents to clean common areas.

- Eliminates risk of virus transmission via contact with surfaces.
- Improves hygiene standards.

# Safe Management Measures for Infectious Disease



## Virtual Meeting

Provide alternative means of communication when necessary.

- Eliminates risks of transmission through close contacts during meetings.
- Facilitates regular meetings.



# Safe Management Measures for Infectious Disease



## Hands-free Hand Sanitiser Dispenser

Provide hand sanitiser dispensers at multiple locations.

- Promotes good personal hygiene.
- Eliminates contact through hands-free dispensing.

# Safe Management Measures for Infectious Disease



## Table Screen Divider

Provide dividers for tables at workers' rest area.

- Minimises risk of transmission by providing additional protection.



# Safe Management Measures for Infectious Disease



## Use of UV-C Light for Disinfection

UV-C lighting in toilets for disinfection of surfaces.

- Minimises risk of transmission by providing additional protection.
- UV-C disinfection uses light to break down the chemical compounds in micro-organisms like bacteria, spores and viruses so they cannot multiply.



# Environmental



# Air Pollution Control



## Sprinkler System

Install automatic water sprinkler systems to wet vehicular access.

- Reduces dust on site.

# Air Pollution Control



## Vacuum Machine with Water Sprayer

Provide a vacuum machine with water sprayer to wet vehicular access.

- Reduces dust on site.



# Air Pollution Control



## Misting Machine for Dust Control

Deploy a misting machine to suppress dust generated by construction works.

- Provides dust control for large outdoor areas.

# Air Pollution Control



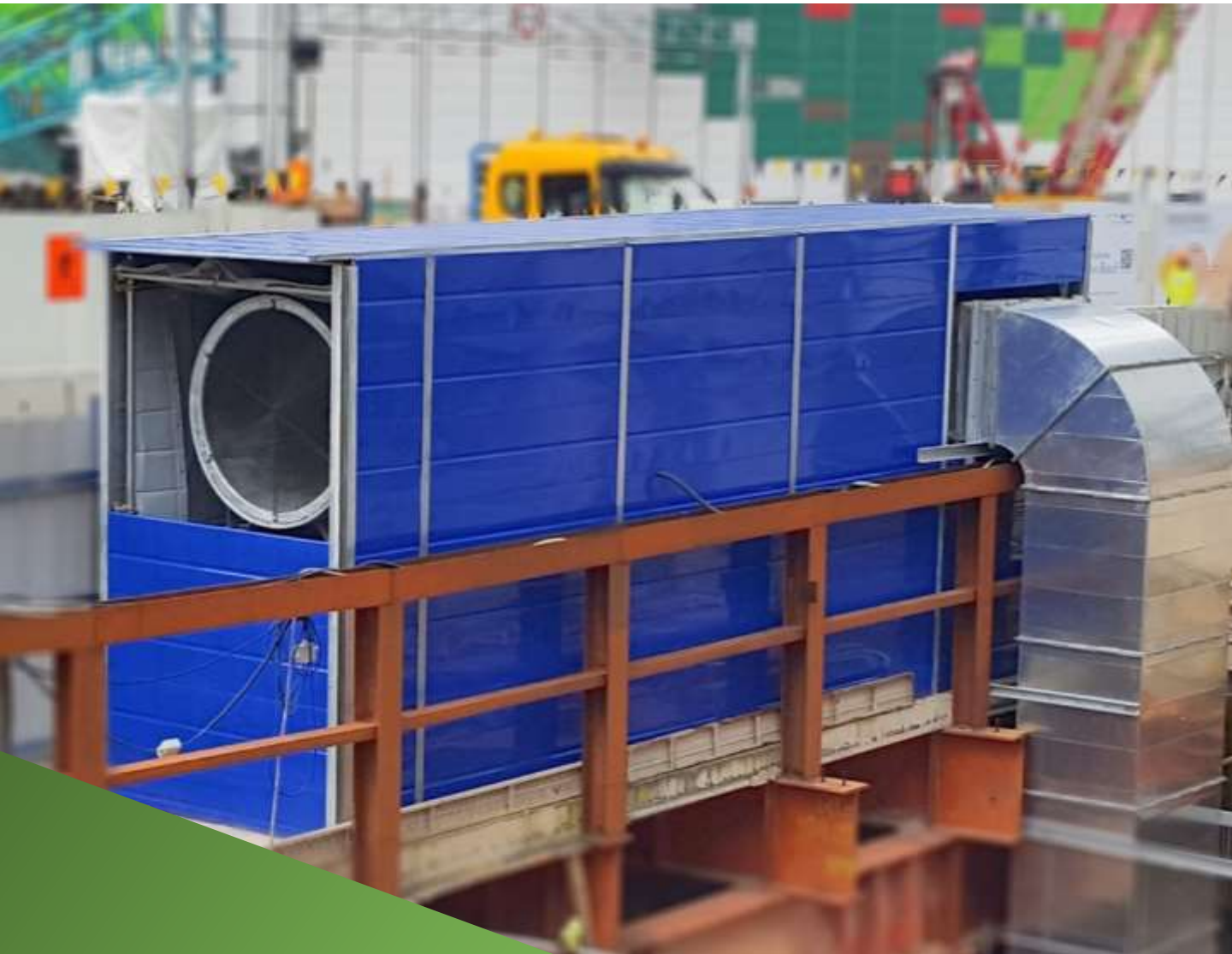
## Dust Collection System

Provide a dust collection system to arrest dust.

- Eliminates the use of water and provides effective dust control for indoor areas.



# Noise Control



## Noise Enclosure for Ventilation Fan

Provide noise enclosure for ventilation fan.

- Reduces noise emission from ventilation fan.

# Noise Control



## Retractable Noise Enclosure

Install retractable noise enclosure over the opening of launch shaft.

- Reduces noise emission from tunneling activities.
- Allows for multiple launches of TBM and ease of moving materials.



# Noise Control



## Acoustic Shed for Noisy Works

Provide acoustic shed for noisy works e.g. hacking.

- Reduces noise emission from noisy works such as hacking.

# Noise Control



## Localised Noise Enclosure

Provide localised noise enclosure for night works at live station or track.

- Reduces noise emission from noisy works such as hacking and drilling.



# Noise Control

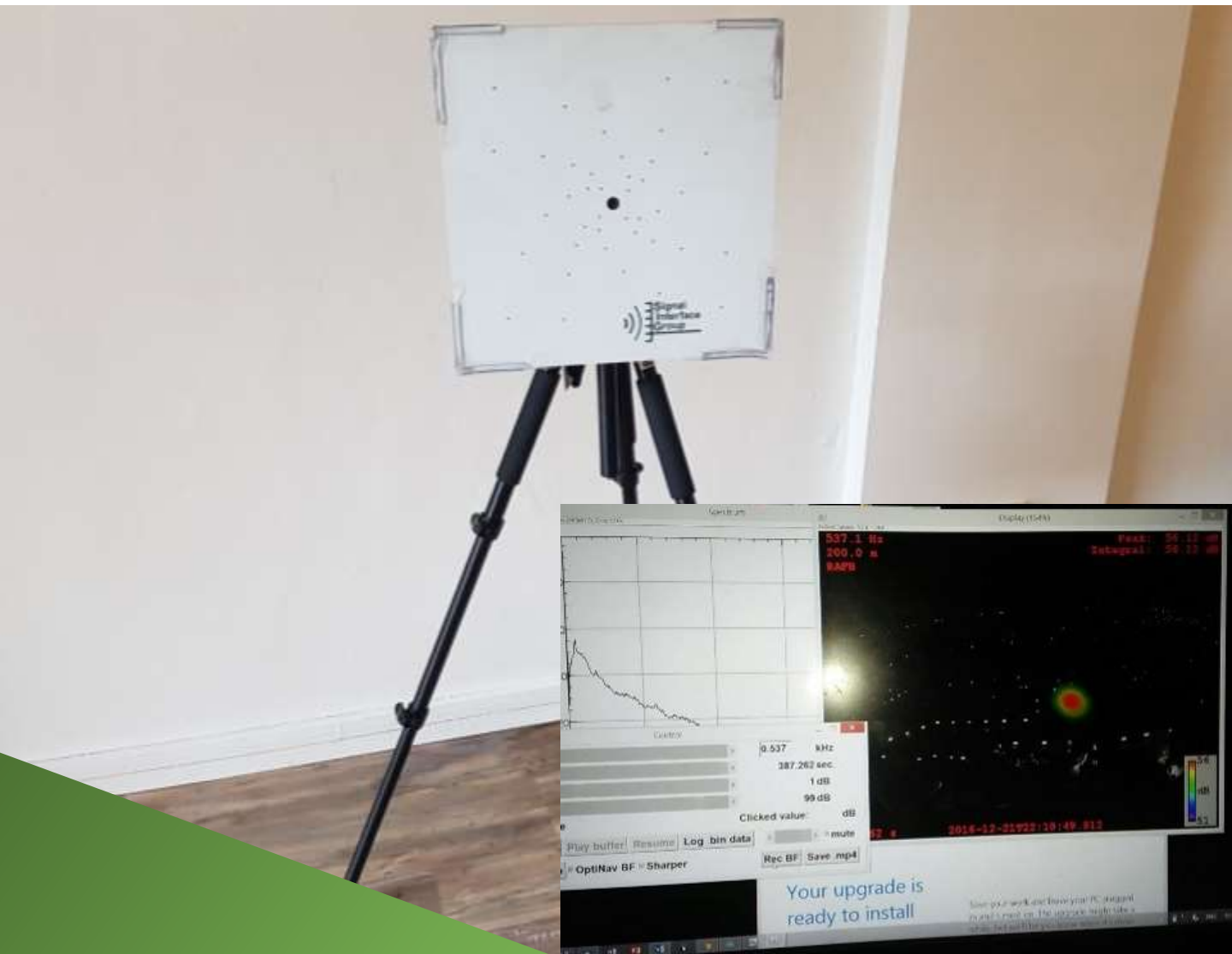


## Rubber Mat

Provide rubber mat on work surfaces.

- Reduces noise emission when workers are handling materials.

# Noise Control



## Acoustic Spectrum Camera

Use an acoustic spectrum camera to identify noise sources on site.

- Enables site personnel to pinpoint noise source that requires enhanced mitigation efforts.



# Noise Control



## Innovative Lightweight Noise Barriers

Lightweight noise barriers for space-constraint locations.

- Only requires small base.
- Easy to set up with minimal use of machineries.
- Patented wind load relief mechanism to withstand strong winds.

# Noise Control



## Noise Meter App

Real-time noise readings accessible on mobile app.

- Alerts user on noise limit exceedance.
- Easy to use and convenient to check.



# Resource Conservation



## High Pressure Jet Boot Wash

Provide high pressure jets for washing of boots.

- Uses less water for washing boots.



## Reusable Protective Floor Mat

Use of reusable protective floor mat for temporary footpath construction.

- Easy to install without the use of machineries.
- Eliminates the need to demolish concrete and reduces concrete consumption.





## Solar Panels for Site Office

Extensive use of solar panels for site offices, where possible.

- Adopts clean and renewable energy that is emission-free.
- Reduces monthly electricity bills.
- Contributes to Singapore's energy security.

# Resource Conservation



## Independent Air Conditioning (AC) System

Independent AC system keeps crane cabin cool while engine is switched off.

- Reduces diesel usage and servicing required.
- Generates less noise than leaving the engine on.



# Vector Control



## Mosquito Suction Trap

Provide mosquito suction trap at workers' rest areas to supplement vector control efforts.

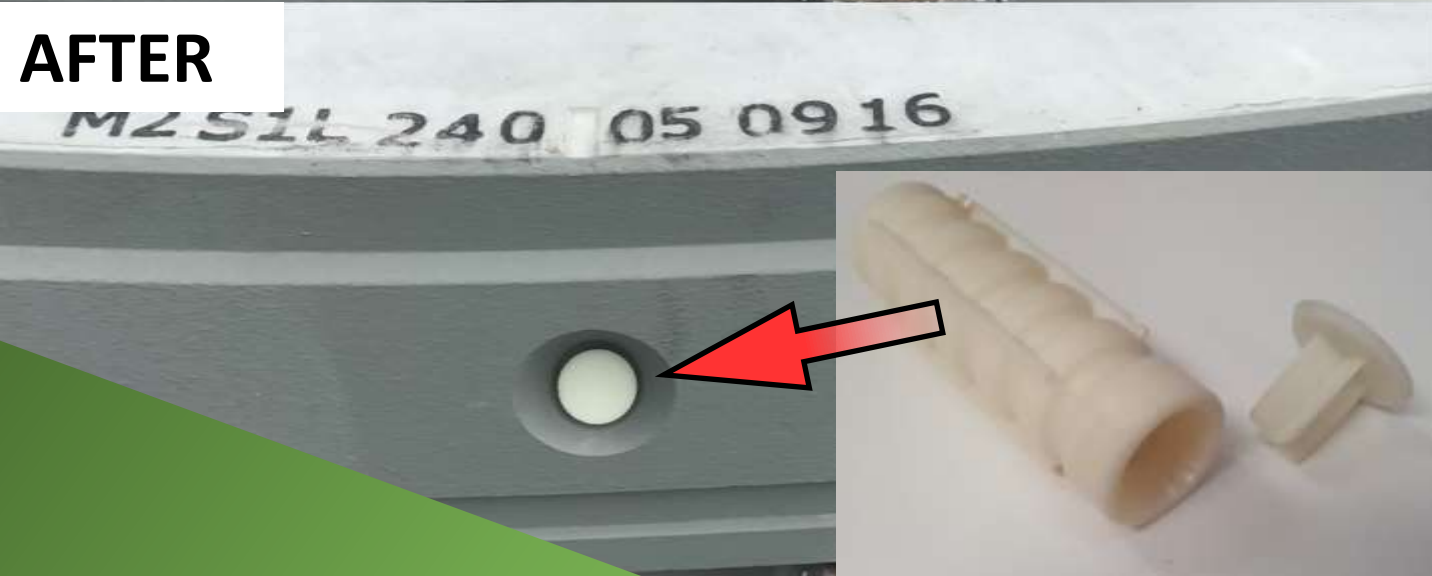
- Lures and eliminates adult mosquitoes from site.

# Vector Control

**BEFORE**



**AFTER**



Install end cap for bolt socket of tunnel segment rings.

- Prevents water ponding in bolt sockets.
- Eliminates potential mosquito breeding.

## End Cap for Bolt Socket





## Movable Roof for Shaft

Provide movable roof over shaft to prevent rainwater ingress.

- Reduces stagnation of water in excavated areas.
- Movable roof allows for ease of moving materials.

# Vector Control



## Anti-mosquito Nets

Provide anti-mosquito nets with repellent properties to cover the top of ECM treatment plants.

- Prevents mosquito breeding, especially for treatment plants that are not in use.



# Vector Control



## Food Cabinet

Provide dedicated cabinets for food storage.

- Prevents food contamination and vectors infestation.

# Vector Control



## Mosquito-repellent Resin Net

Provide netting with slow-release insecticide for protection against mosquitoes.

- Long lasting (up to 30days).
- Odourless.
- Safe to use (low toxicity to humans).





## Channelling Rainwater in Station Box

Erect a canopy at areas with openings to channel rainwater into scupper drains.

- Reduces stagnation of water in station box.
- Prevents mosquito breeding.

# Vector Control



## QR Code for Documentation of Insect Repellent Application

Display QR code on site for workers to document the application of insect repellent.

- Digital records for easier tracking and retrieval.



# Waste Management



## Upcycling

Upcycle waste materials for other uses e.g. reuse wooden crates to create furniture.

- Reduces amount of waste generated.
- Encourages workers to be environmentally friendly.

# Waste Management



Recycle food waste (e.g. fruits and vegetables) into fertilizer.

- Reduces amount of food waste generated from site (i.e. canteen).

## Food Waste Composter



# Water Pollution Control



Before dewatering

After dewatering

## Geotextile Bag

Provide geotextile bag to filter silt particles before channeling to ECM treatment plant.

- Reduces silt content effectively.

# Water Pollution Control



## Sand Bags for Contingency

Provide a dedicated storage area for sand bags on standby.

- Allows for more efficient containment in the event of silty water discharge.



# Water Pollution Control

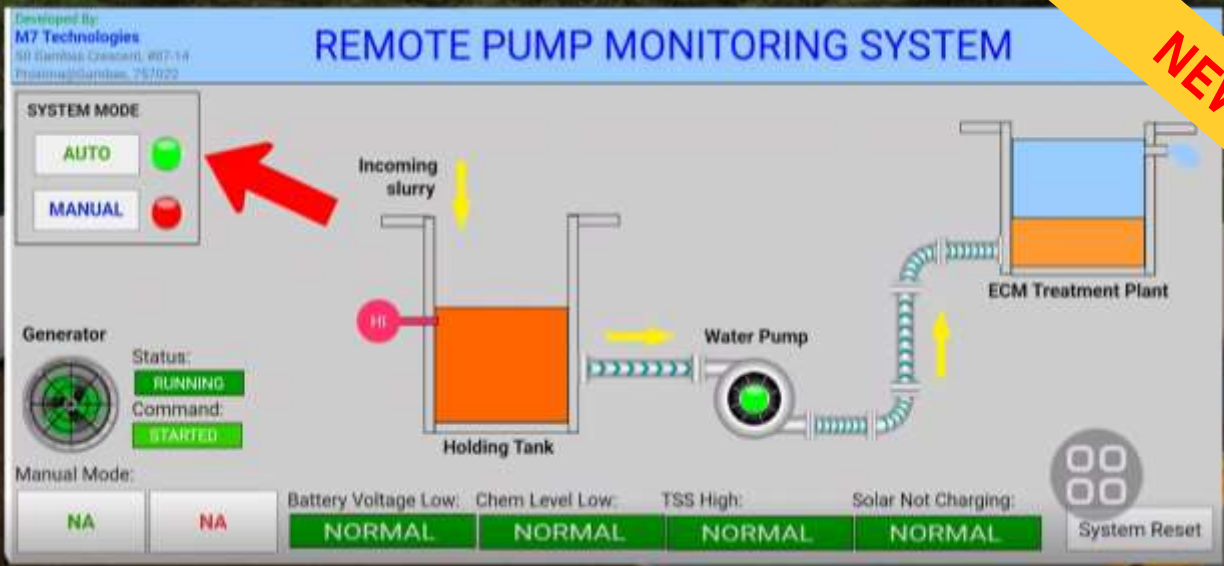


## ECM Plant Maintenance Guide

Display maintenance guide at ECM treatment plants for ease of reference.

- Strengthen the competency of ECM plant operators.

# Water Pollution Control



NEW



## Automated ECM System

Leverage technology to automate or remote control the start and stop of ECM system, monitor chemical levels and redirect silty discharge.

- Reduces reliance on manpower.
- Prevents silty discharge.



# LTA's SHE Guidebooks

Apart from the Handbook, contractors can also refer to other SHE guidebooks and guidance published by LTA for reference. The publications can be found in the links below.

1

Construction Safety Handbook



2

Guidebook for Best Environmental Practices:  
Water Resource Management at LTA sites



3

Guidebook for Best Environmental Practices:  
Vector Control at LTA sites



4

Guidebook for Best Environmental Practices:  
Construction Waste Management at LTA sites



5

Guidebook for Best Environmental Practices:  
Noise Control at LTA sites



6

Noise Guidance: Developing a Noise  
Management Plan in LTA Projects



7

Guidebook for Sustainable  
Practices at LTA Sites

