



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 authorized agents do not accept any liability or responsibility to any party for any losses or damage arising from following this Handbook.

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As a guide, this Handbook has no legal standing.

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

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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.

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Application of Technology



Application of Technology



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

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

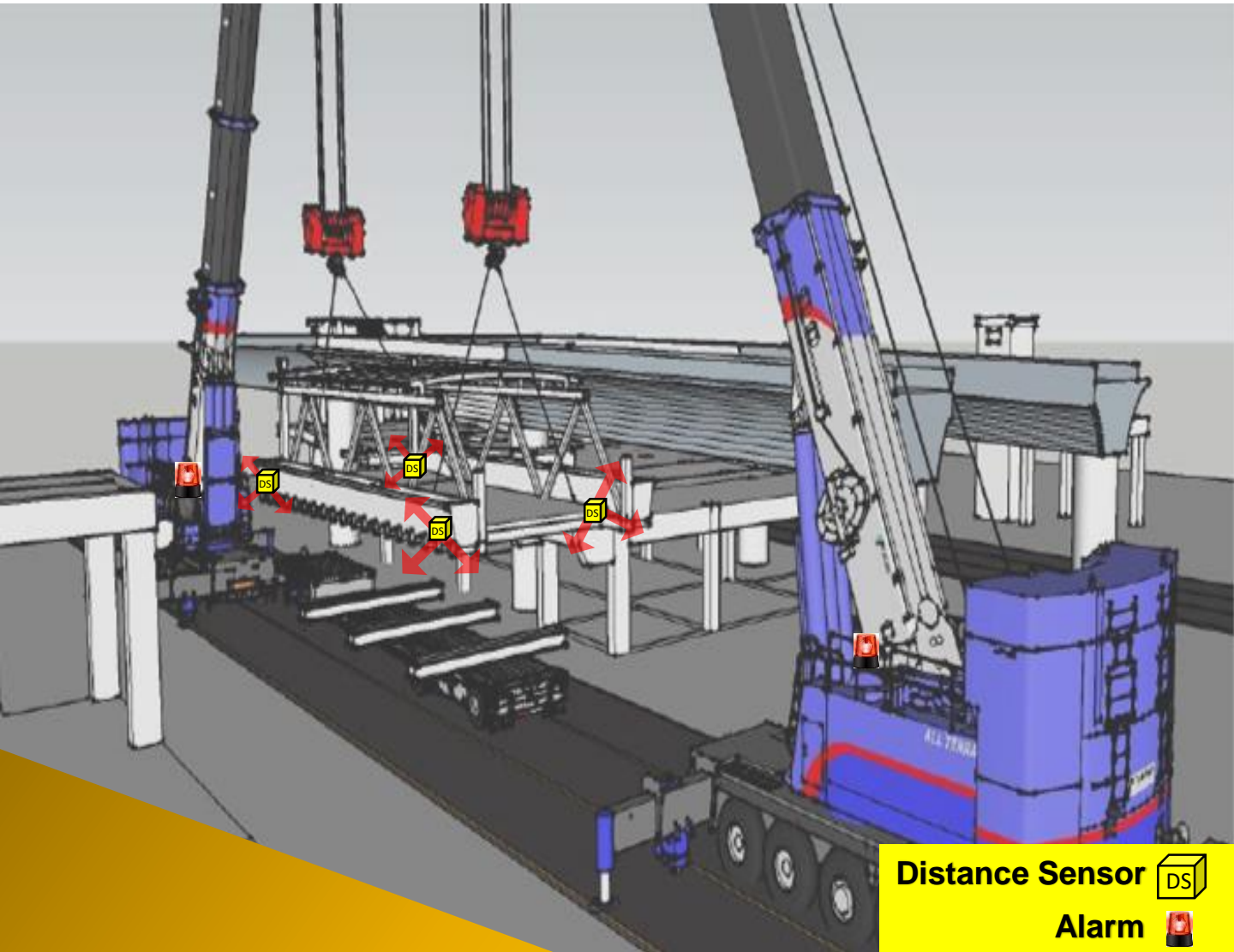


Virtual Training

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

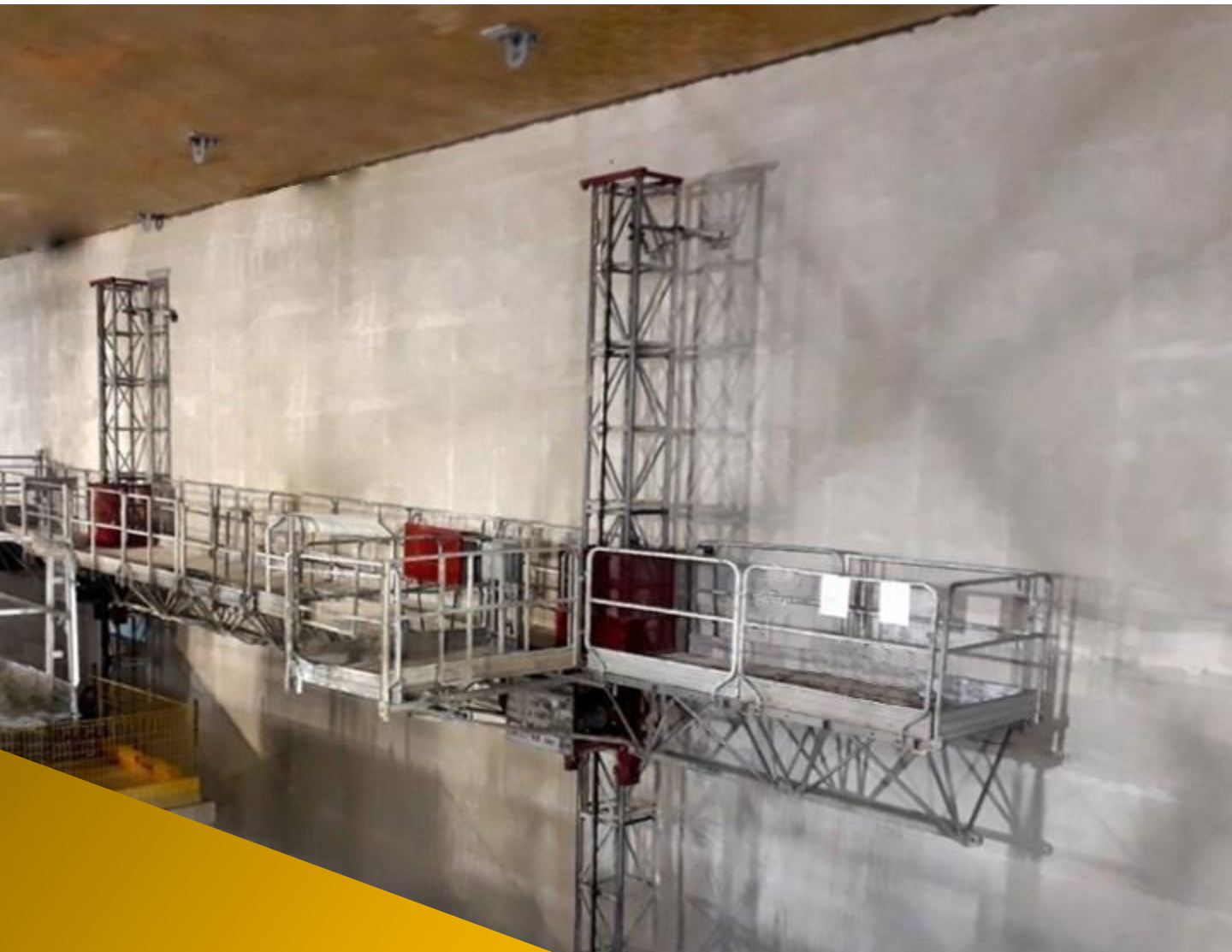


CCTV Monitoring

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
- Minimizes 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/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



Vicinity Alert Device

Provide vicinity alert system to prevent collision

- Sends alert to machine operator to halt operations if banksman is located nearby
- Improves machine operator and banksman safety awareness

Application of Technology



Machinery LED Lights

Provide LED lights on heavy machinery

- Accentuates the heavy machineries on site
- Improves safety awareness on site

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



Hazard Alert System for Machineries

Install sensors on heavy machineries which detects workers or objects nearby.

- Reduces risk of collision with workers or objects
- Enhances safety of heavy machineries

Application of Technology



NEW

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

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

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

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

Health



Health

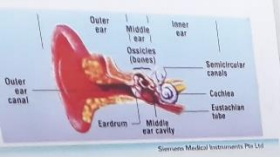


Health Checks

Conduct regular health checks for all workers

- Ensures that workers are in good health before work starts

ve which in turn moves the fluid to using nerve impulses that the brain decodes sound.



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

Health



Healthier Dining Options

Provides healthier eating options for the workforce

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



Conduct periodical sports events for staff and workers

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

Sport Event

NEW



Sanitization Of Common Areas

Provide sanitizing agents to clean common areas.

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



Virtual Meeting

Provide alternative means of communication when necessary.

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



Hands-free Hand Sanitizer Dispenser

Provide hand sanitizer dispensers at multiple locations.

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



Safe Distancing at Work

Practice safe distancing at work areas.

- Eliminates close contact transmission through safe distancing



Demarcation of Rest Areas

Provide demarcation at rest areas so that workers can practice safe distancing during breaks and meal times.

- Eliminates risk of transmission through close contact



Table Screen Divider

Provide dividers for tables at workers' rest area

- Minimises risk of transmission by providing additional protection

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

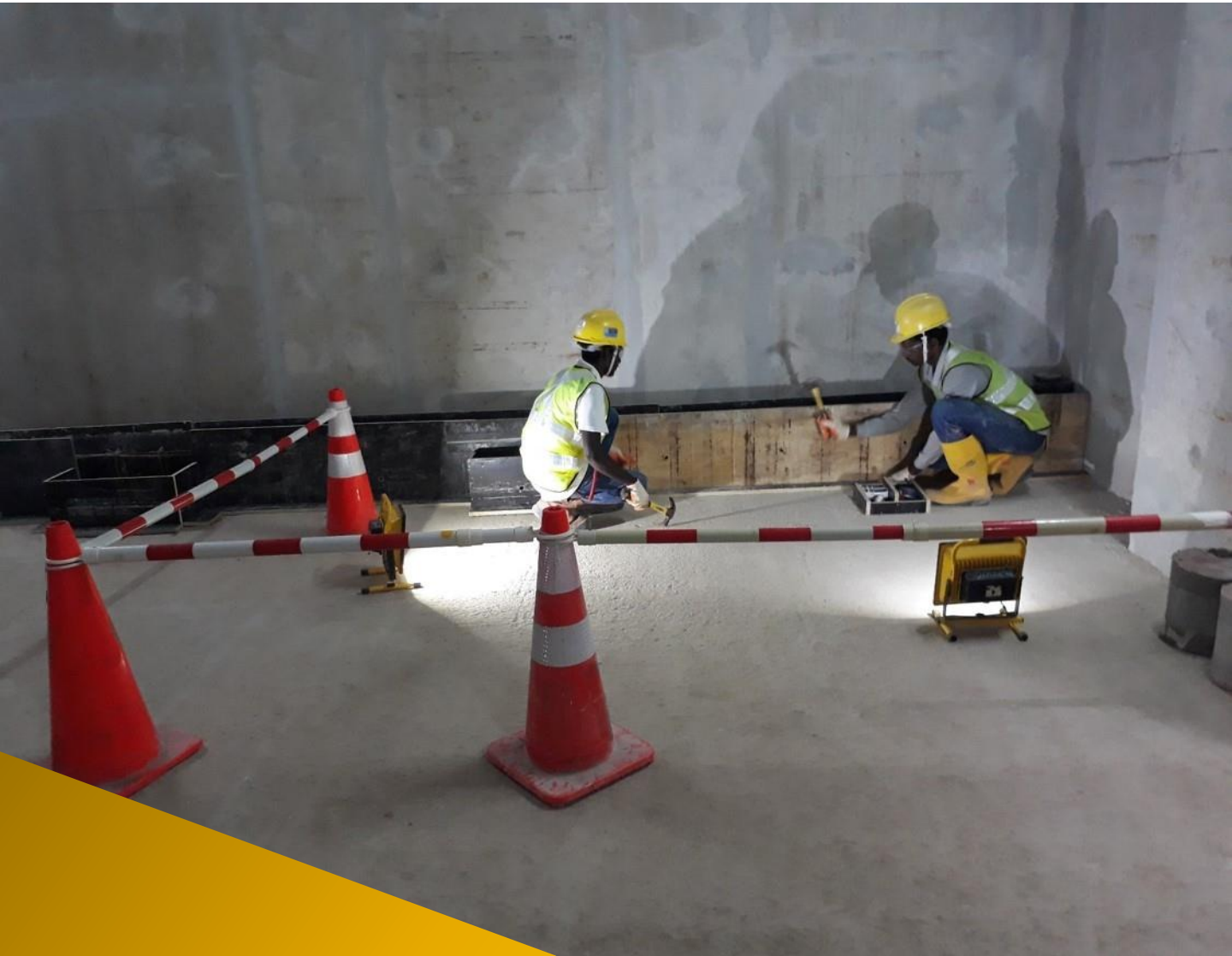
- Eliminates risk of workers tripping on rebar gaps



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

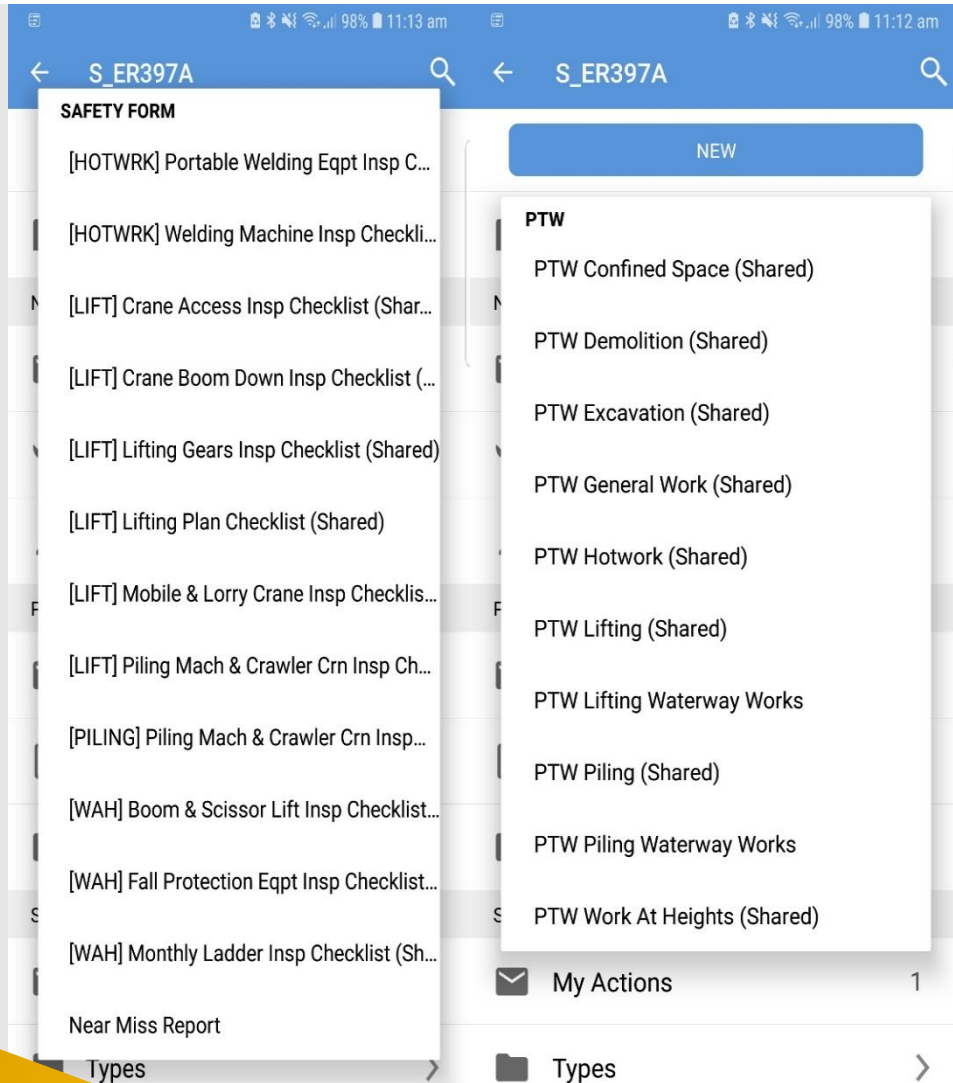
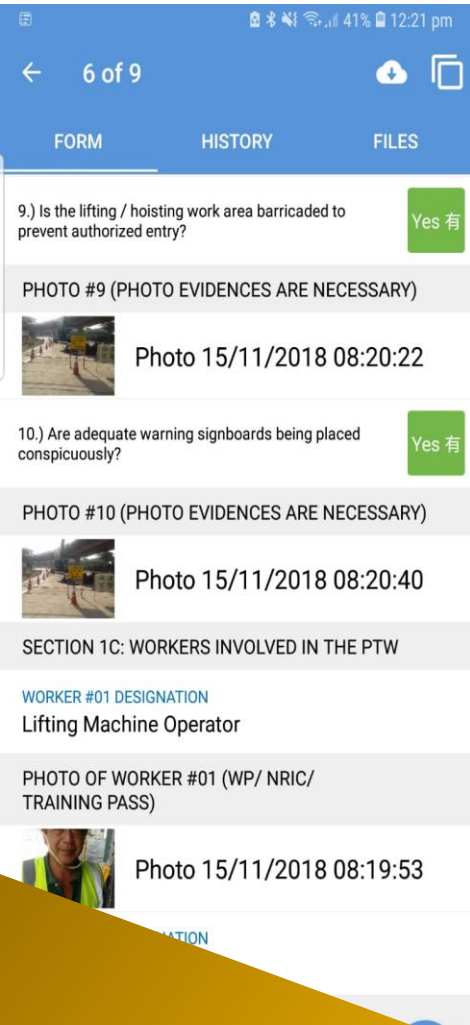


Portable LED Flood Lights

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 Permit System

Provide electronic monitoring and approval system

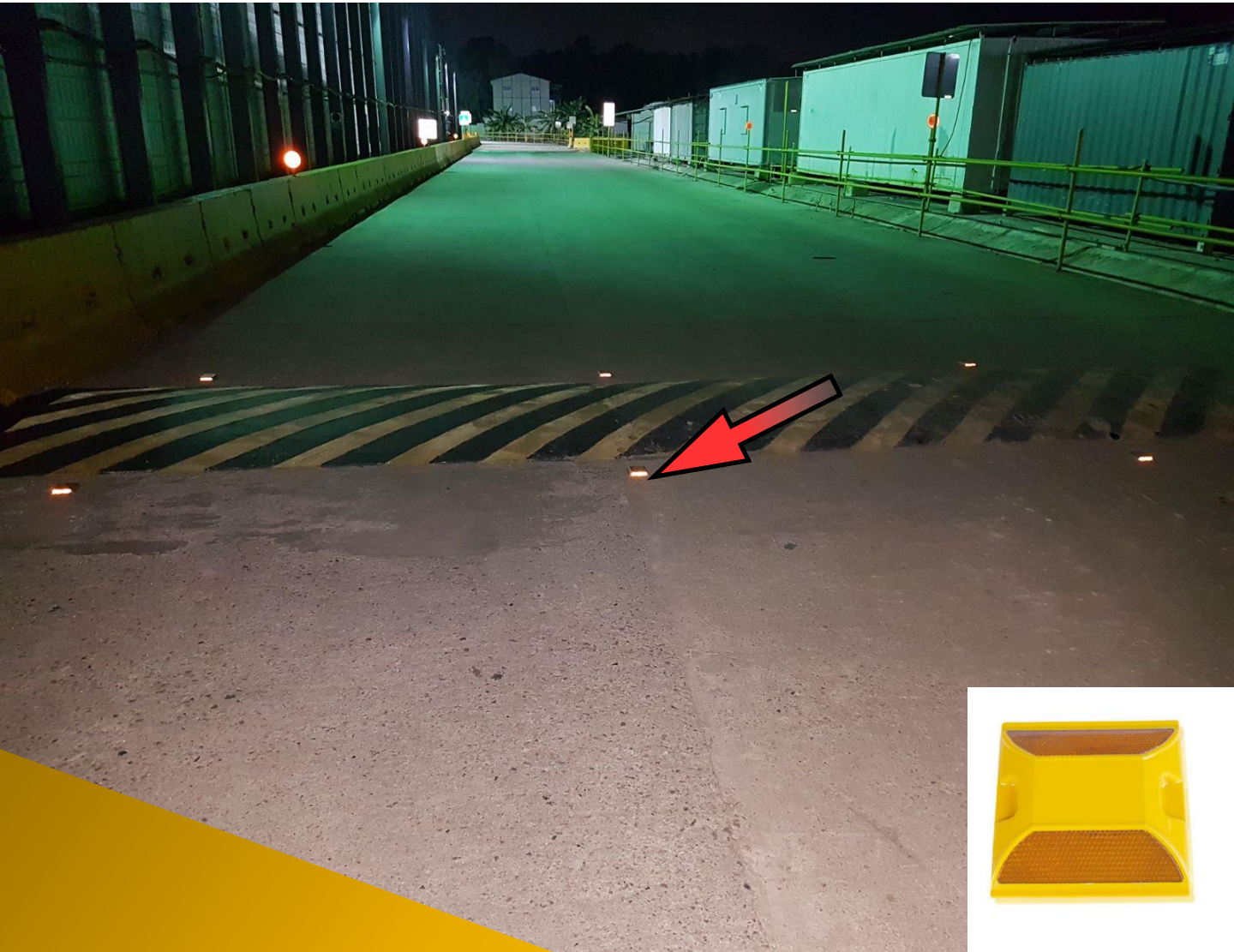
- Increases productivity through the use of paperless system
- Allows documents to be accessed on-the-go
- Allows on-site verification



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



Road Reflectors

Provide road reflectors along access routes to alert drivers of humps

- Enhances visibility of speed-reducing devices
- Reduces tendency of speeding
- Improves alertness of drivers

Innovation



Lifting Brackets

Provide lifting brackets to secure loads

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



H-beam Lifting Clamps

Provide H-beams lifting clamps to secure H-beams

- Provides better grip during lifting operations
- Improves lifting operation safety

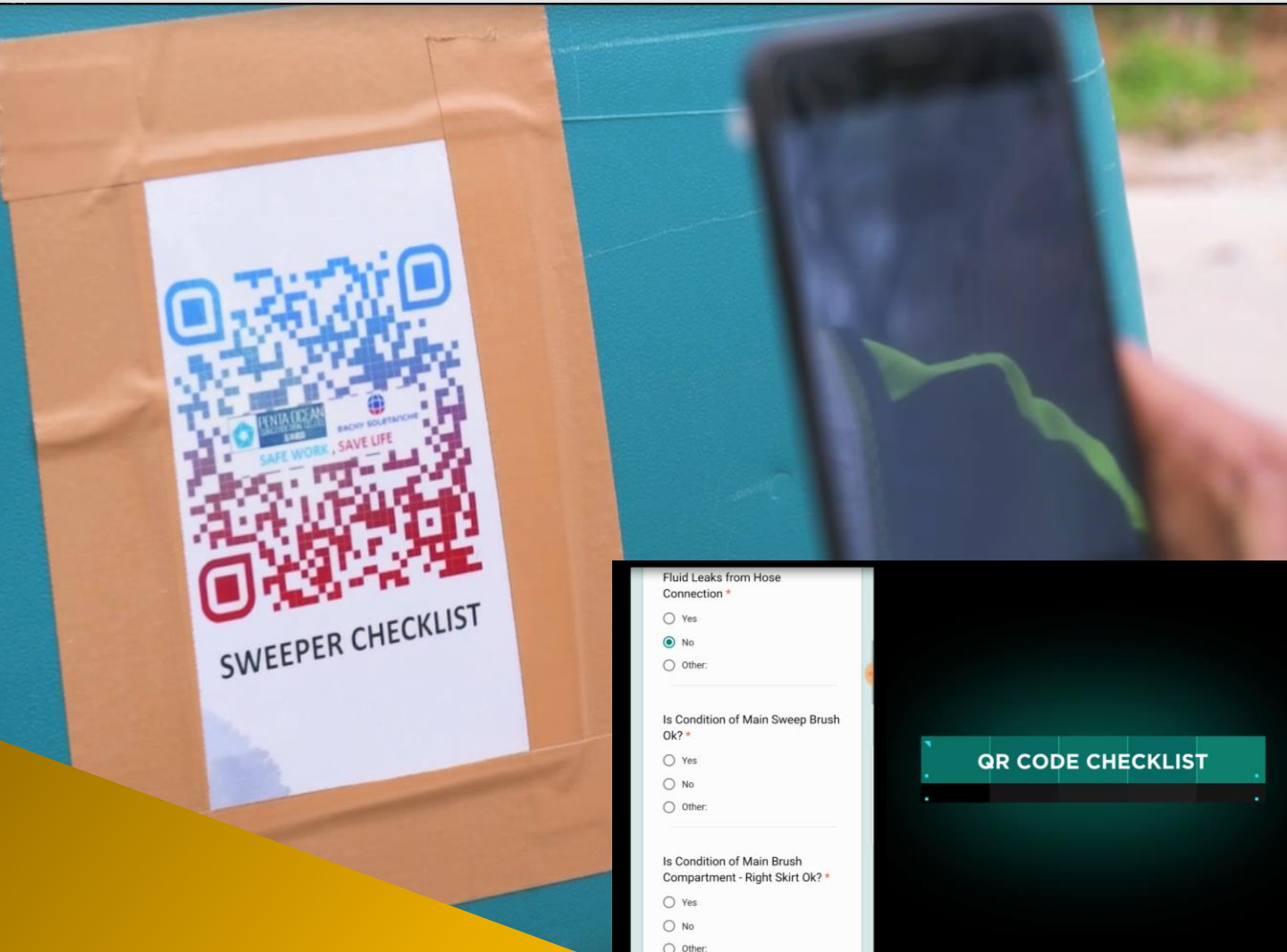
Innovation



Height Alert System

Provide height alert system for machineries to prevent overreaching

- Warns workers of maximum reachable height to prevent collision



QR Code Checklist

Provide QR code checklist on machineries to facilitate inspections

- Enables instantaneous retrieval of inspection checklists and other documents
- Improves accountability of documents

Innovation



Provide siren for lifting operations

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

Portable Lifting Siren



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



Safety Goggles Hooks

Provide hooks to attach to safety goggles

- Ensures that safety goggles do not slip off easily
- Improves focus at work



Local Exhaust Ventilation

Provide local exhaust ventilation at work areas

- Controls dust at source
- Improves ventilation for workers

Innovation



Platform ladder

Provide platform ladder with guardrails and toe-boards

- Prevents falling object hazards with inbuilt toe-boards
- Prevent falling hazards with handrails



Proprietary Fall Protection System

Provide fall prevention barricades

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

Innovation



Brake Pulley

Provide material hoisting equipment

- Reduces the need for manual handling by means of engineering control
- Prevents tripping hazards as workers do not need to carry materials down the stairs



Provide trolley to facilitate transporting of materials

- Reduces risk of injuries by workers carrying heavy objects

Stairs Climber



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



Provide remote release system for RC elements

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

Precast Lifting System

Innovation



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

Innovation



Dust Collector

Provide proper dust collector for hand tools.

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

Innovation



Removable Foot Steel Plate

Provide removable steel plate for foot protection

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

Innovation



Anti-Vibration Gloves

Provide anti-vibration gloves for workers doing hacking works.

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

Innovation



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

NEW



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

Innovation



Pre-fab Barricades

Provide pre-fab barricades with toe-boards

- Ensures consistency in standard of barricades on site
- Improves work efficiency through modular fabrication



Material Cage

Provide lifting cage to lift loose materials.

- Reduces risk of falling objects during lifting operation
- Improves efficiency as loose materials can be shifted more quickly and with less manpower required



Blinker Light

Provide blinker lights on mobile scaffold.

- Highlights prominent mobile scaffolds along access ways
- Reduces tripping and overhead hazards

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



Material Storage Racks

Provide racks and containers for storage of loose materials

- Prevents tripping
- Improves general housekeeping

Welfare



Welfare



Double Storey Rest Area

Install double storey workers' rest area

- Occupies less space on site
- Houses more workers

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



Ventilation Fan Silencer

Install silencer at the end of ventilation fan

- Reduces noise emission from ventilation fan

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



Jagged Edge Noise Barrier

Provide innovative noise barriers with enhanced performance

- Reduces noise emission from site

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



Localized Noise Enclosure

Provide localized noise enclosure for night works at LRT platform

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

Noise Control

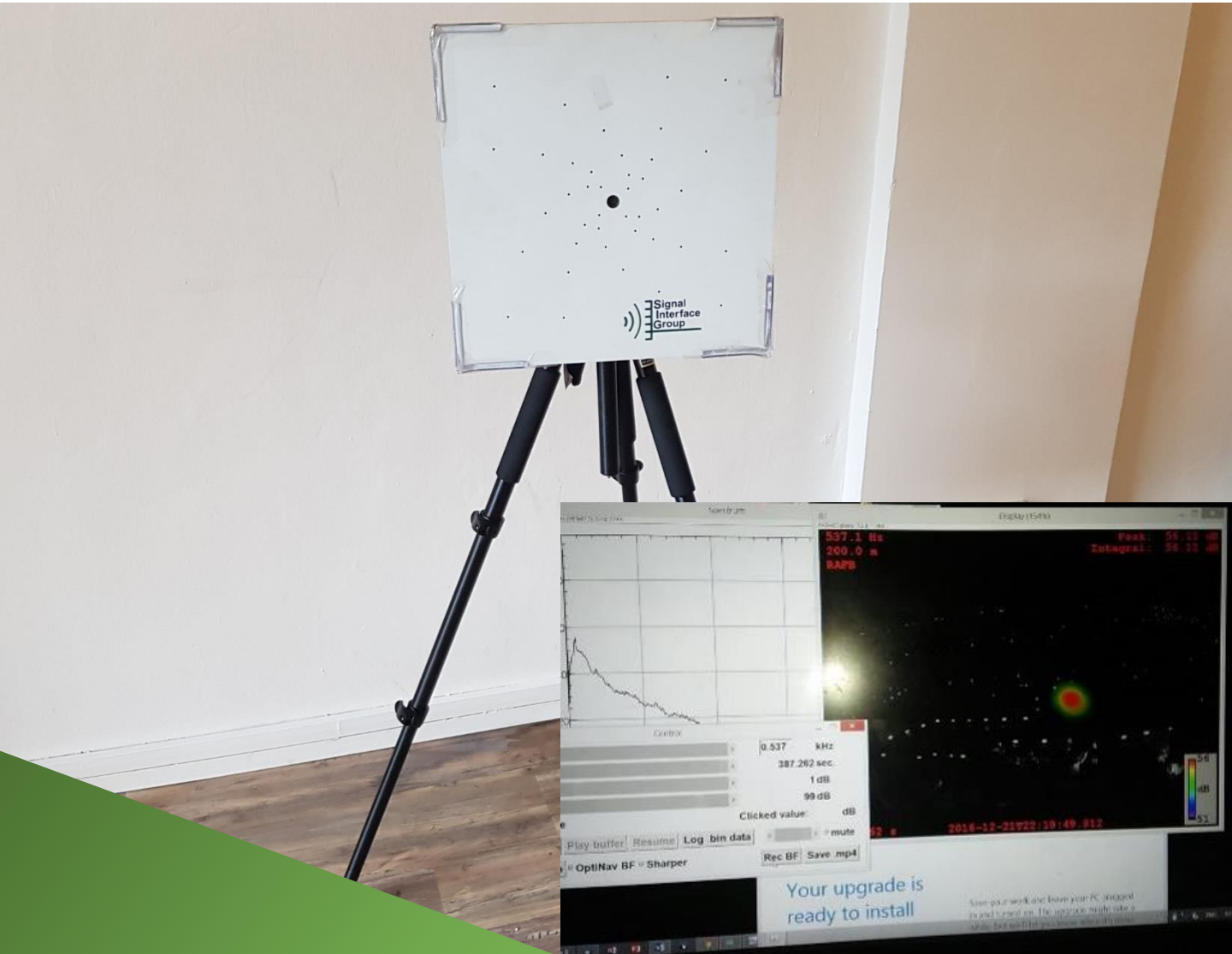


Rubber Mat

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

Resource Conservation



High Pressure Jet Boot Wash

Provide high pressure jets for washing of boots

- Uses less water for washing boots

NEW

Solar-powered Lighting

Harvest solar energy to power lighting

- Reduces energy consumption
- Results in cost savings

Vector Control



Mosquito Magnet

Provide mosquito magnet at workers' rest areas to supplement vector control efforts

- Eliminates adult mosquitoes from site

Vector Control

BEFORE



AFTER



End Cap for Bolt Socket

Install end cap for bolt socket of tunnel segment rings

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

Vector Control



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

The netting is impregnated with insecticide, which is slowly released into the air to provide 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

NEW



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



Geotextile Bag

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

- Reduces silt content more effectively than sedimentation ponds.

Water Pollution Control



Sand Bags for Silty Water Contingency

Provide a dedicated storage area for standby sand bags

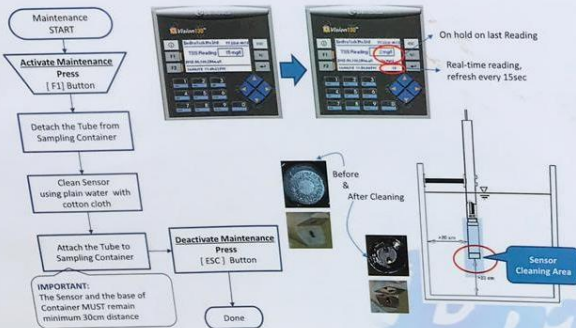
- Allows for more efficient containment in the event of silty water discharge

Water Pollution Control

NEW



General Maintenance – Sensor Cleaning



General Maintenance



ECM Plant Maintenance Guide

Display maintenance guide at ECM treatment plants for ease of reference by plant operators

- Strengthen the competency of ECM plant operators

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

