



# Construction Safety Week 2022

## 建造業安全周2022

### Safety 2.0

29 Aug 2022

# Sharing:

1. Changing Safety culture – Safety Ambassador & Safety Questionnaire
2. Adopting Modern methods of construction and Innovative technologies



# Changing Safety Culture – Safety Ambassador

## Duties of Safety Ambassador

A “Safety Ambassador” is nominated in each work team, being the role model of his team on safety. The nomination is valid for two months and new nomination will be launched. His main duties are as follows:

1. Ensure Good Housekeeping in the team’s work area.
2. Comply and encourage 12 basics
3. Proper use of PPE
4. Safety Follow Up.
5. Report Near-Misses.
6. Give or collect Safety Suggestions.
7. Interventions
8. Facilitate in conducting pre-work briefing



**0** ZERO HIGH POTENTIAL ACCIDENTS



BARANGER Etienne



Ivan CHAU



TITUNG Subash



GURUNG Hem Kumari



GURUNG Shanti



LEE Ying Choi



CHEUNG Sam Ho



TSANG Koon Fai



GHALE Kumar



RAI Biman



GURUNG Tara



GURUNG Raman



RAI Gajahang



HUANG Zeng Yi



GURUNG Shohhit



LIMBU Gaurav



LIMBU Bibek



LIMBU Bhimraj



GURUNG Udaye



RAI Yam Kumar



LIMBU Deshbir



RAI Uday



LO Chi Hung



THAPA Sujan



PUN Harka Bahadur



LEE Chi Wah



THAPA Khum Bahadur



ONONYE Augustine Nwabanwanne



THAPA MAGAR Bhupendra



THAPA Khem Bahadur



CHHETRI Rajan Jung Karki



DANGI Tank Bahadur



POBLET E Wed Deppas



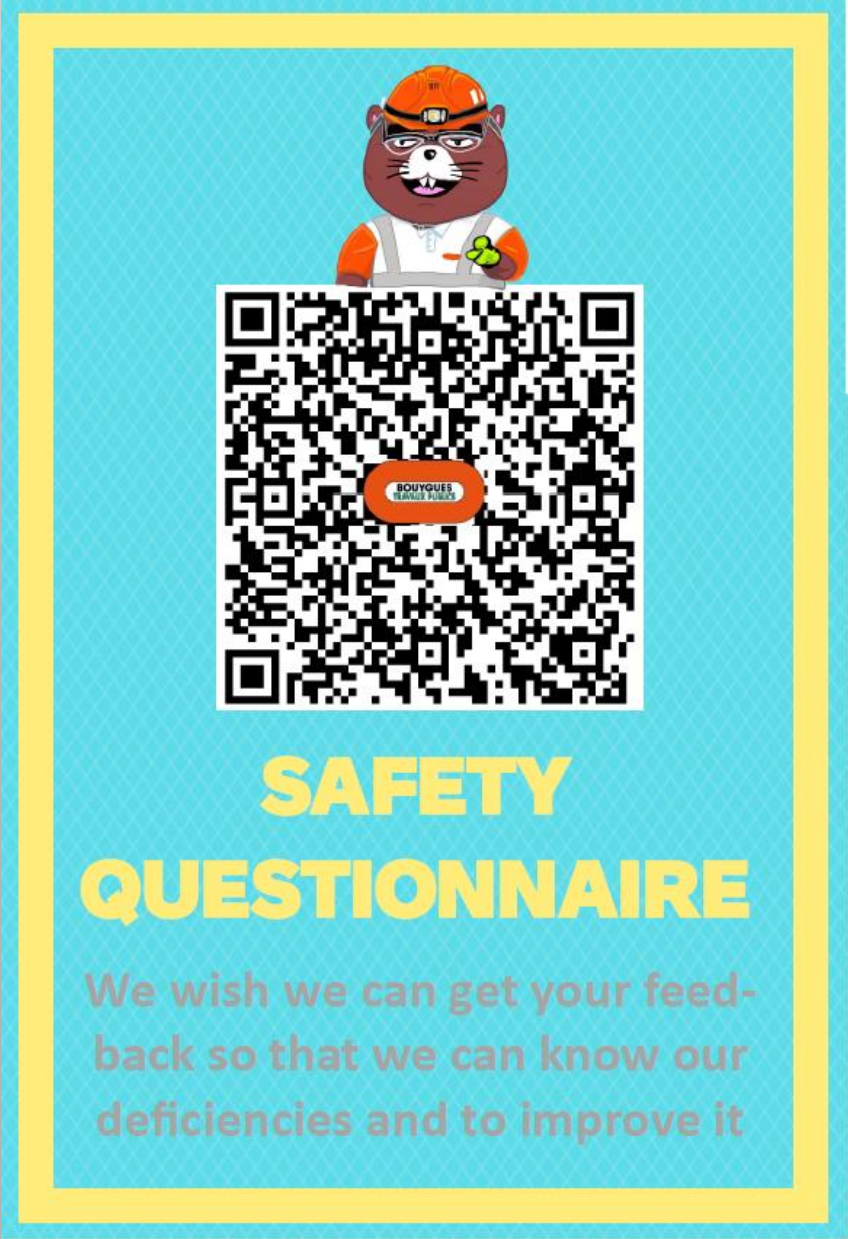
LIMBU Bishnu Chongba ng



# Changing Safety Culture – Safety Ambassador

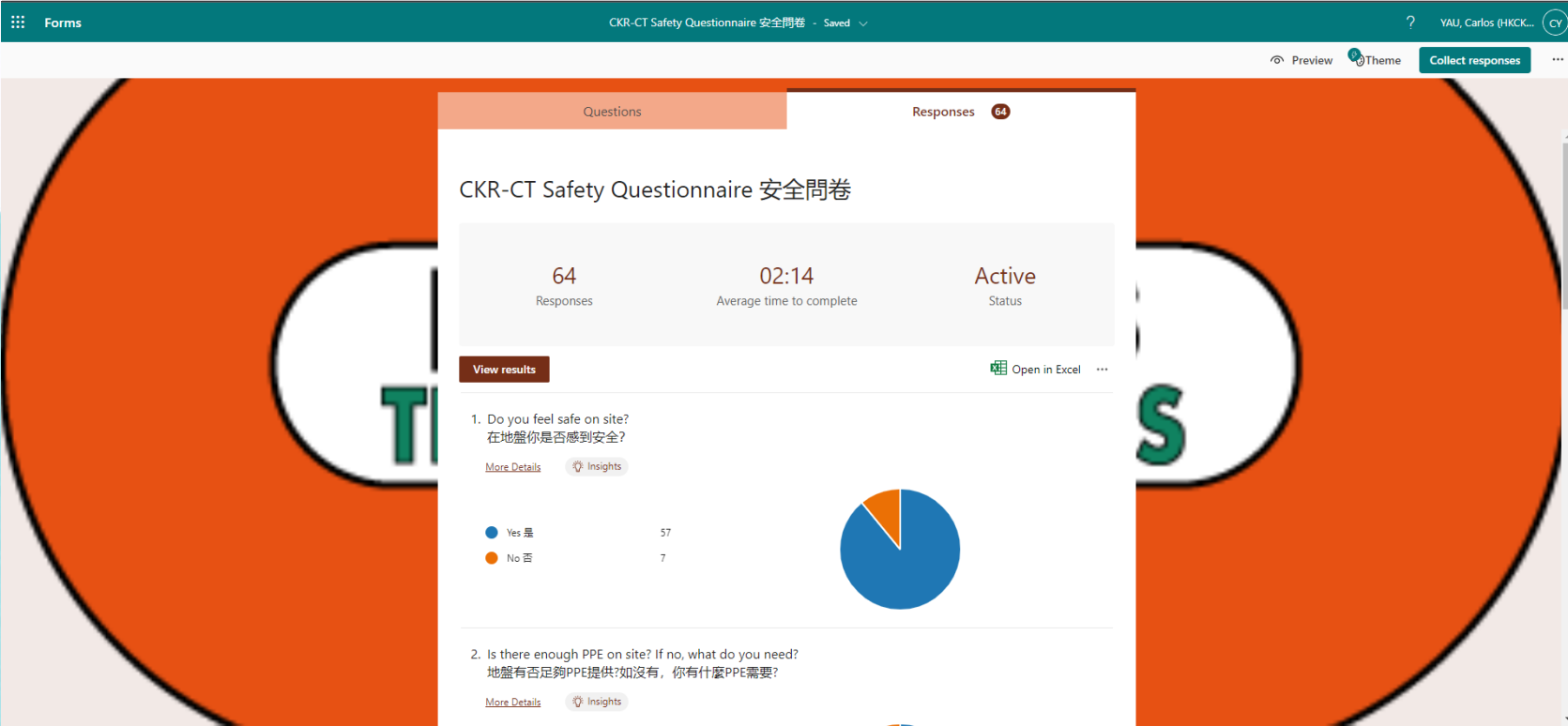


# Changing Safety Culture – Safety Questionnaire



**SAFETY QUESTIONNAIRE**

We wish we can get your feedback so that we can know our deficiencies and to improve it



Forms CKR-CT Safety Questionnaire 安全問卷 - Saved

Preview Theme Collect responses

Questions Responses 64

CKR-CT Safety Questionnaire 安全問卷

64 Responses	02:14 Average time to complete	Active Status
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View results Open in Excel

1. Do you feel safe on site?  
在地盤你是否感到安全?

Yes 是	57
No 否	7

2. Is there enough PPE on site? If no, what do you need?  
地盤有否足夠PPE提供:如沒有, 你有什麼PPE需要?



## Adverse Working Environment In Tunnel:

- Confined space
- Temperature is higher
- Humidity is higher
- Visibility is lower
- Risk of collapse
- Limited working space
- Tight works programme
- Long working hours
- Rapid operations

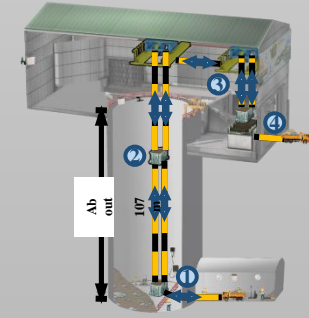
Lion Rock Tunnel 1960s to 1970s

# Adopting Modern methods of construction and Innovative technologies



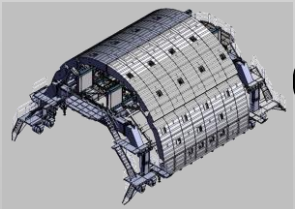
**1 Design & Planning Issue**

**1 BIM**



**4 Vertical Lifting**

**4 Overhead Crane**



**5 Lining Cycles**

**5 Lining Shutter**

Tuen Ma Line

Towngas



**6 Major Fault / MTR Crossing**

**6 ACIS**



**7 Man-Plant Collision**

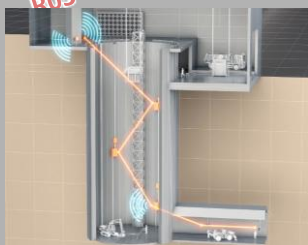
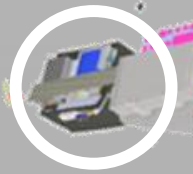
**7 Blaxtair**

**3 Work Force Tracking**

**3 Omniscient**



Tsuen Wan Line & Kwun Tong Line



**2 Communication in Tunnel**

**2 Wi-Fi**

Queen Elizabeth Hospital

East Rail Line

Eastbound (EB)  
Westbound (WB)

Pilot TBM Tunnel

R01

R02

F05

F04

F02

F03

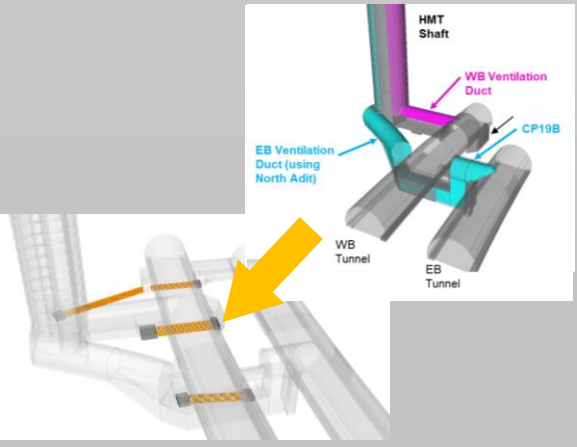
R03



# BIM Application



## 01 Design & Planning



## 02 Method Statement



Contract No. HY2018/08  
Central Kowloon Route - Central Tunnel

### METHOD STATEMENT

Method Statement for Ma Tau Kok - Installation and Commissioning of 80T Overhead Crane

DOCUMENT REFERENCE NUMBER:

CHKR	DATE	REV	BY	CHKD	DATE

APPROVED BY: [Signature]

DATE: [Date]

PROJECT: [Project Name]

SCALE: [Scale]

REVISIONS: [Table]

APPROVED BY: [Signature]

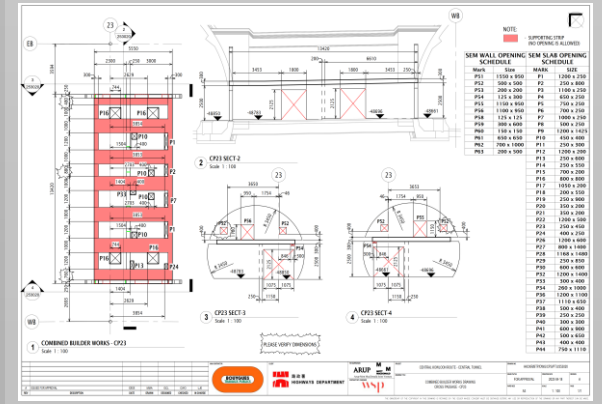
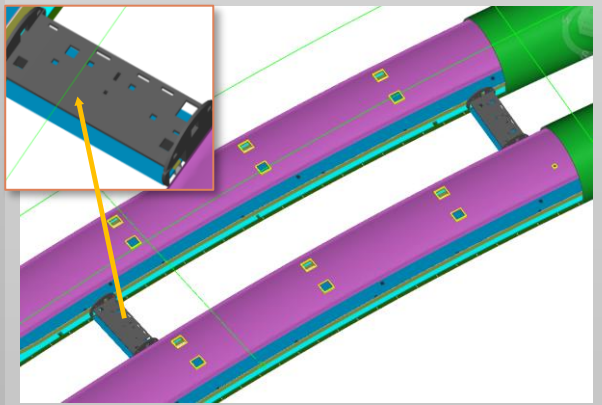
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PROJECT: [Project Name]

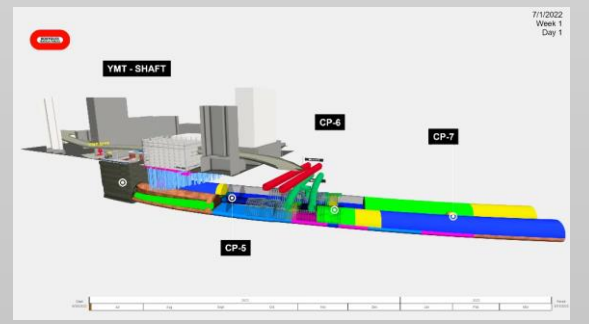
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REVISIONS: [Table]

## 03 Interface Coordination



## 04 Progress & Programme



### HMT REMAINING WORKS GENERAL SEQUENCE

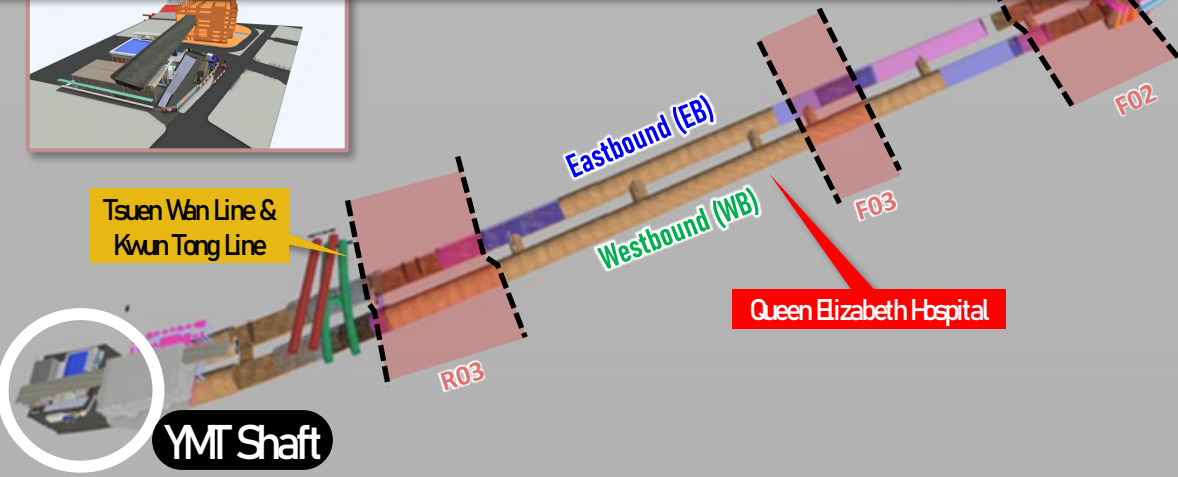
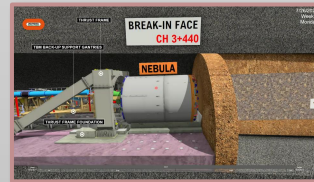
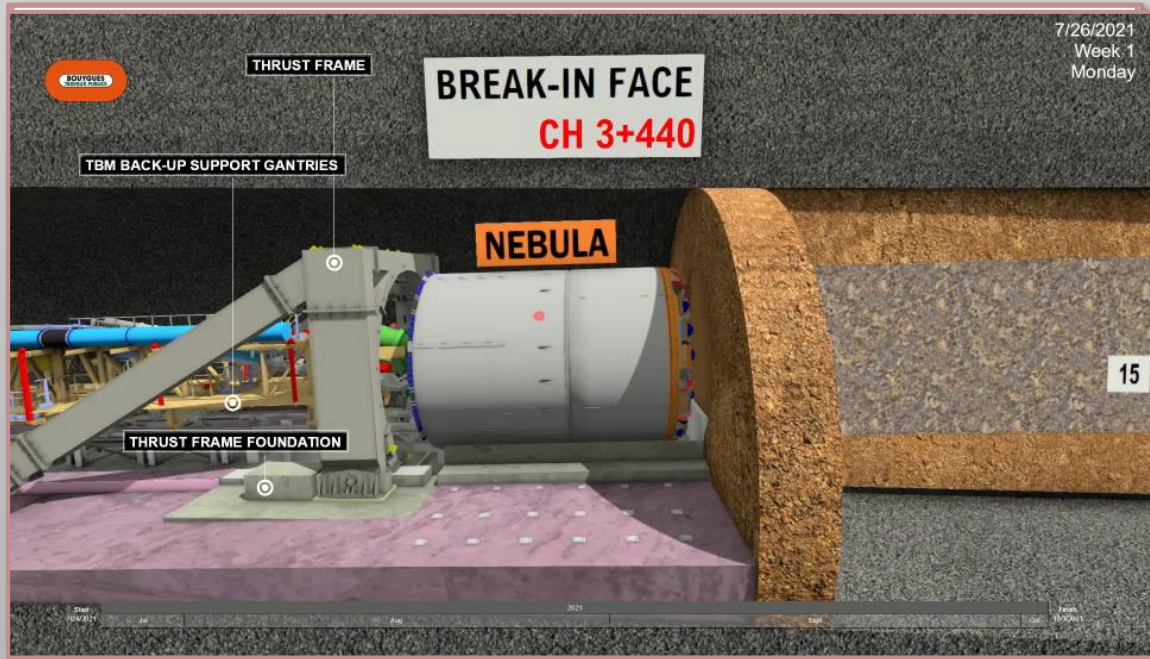
NO.	DESCRIPTION	START DATE	END DATE	STATUS
1	Concrete Slab Casting	2022-01-15	2022-01-20	Completed
2	Formwork Removal	2022-01-20	2022-01-25	Completed
3	Reinforcement Installation	2022-01-25	2022-02-05	In Progress
4	Concrete Slab Casting	2022-02-05	2022-02-10	Completed
5	Formwork Removal	2022-02-10	2022-02-15	Completed
6	Reinforcement Installation	2022-02-15	2022-02-25	In Progress
7	Concrete Slab Casting	2022-02-25	2022-03-05	Completed
8	Formwork Removal	2022-03-05	2022-03-10	Completed
9	Reinforcement Installation	2022-03-10	2022-03-20	In Progress
10	Concrete Slab Casting	2022-03-20	2022-03-25	Completed



# Adopting Modern methods of construction and Innovative technologies – BIM Model



A member of the Bouygues Construction group



1 BIM

2 Wi-Fi

3 Omniscient

4 Overhead Crane

5 Lining Shutter

6 ACIS

7 Blaxtair

# Adopting Modern methods of construction and Innovative technologies –W-Fi – Backbone for Communication and IoT



## RISKS / PROBLEMS

- No telecommunication coverage



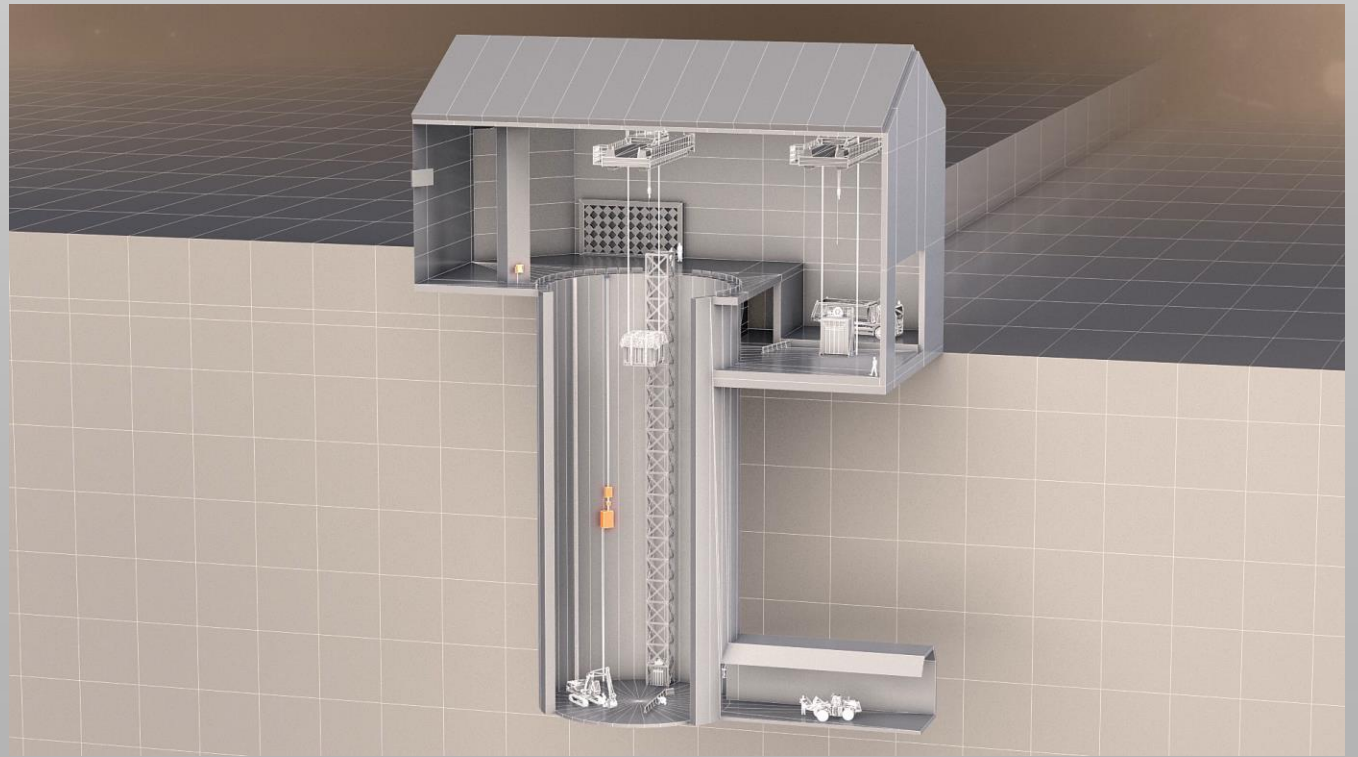
## SOLUTIONS

- Extend W-Fi network coverage to underground tunnel
- Maintain seamless communication between underground and surface operations



## RESULTS / MERITS

- Empower data transmission and cloud-based system applications





# Adopting Modern methods of construction and Innovative technologies – Omniscient Worker Management System



## RISKS / PROBLEMS

- Multiple work fronts inside tunnel
- Scattered work forces



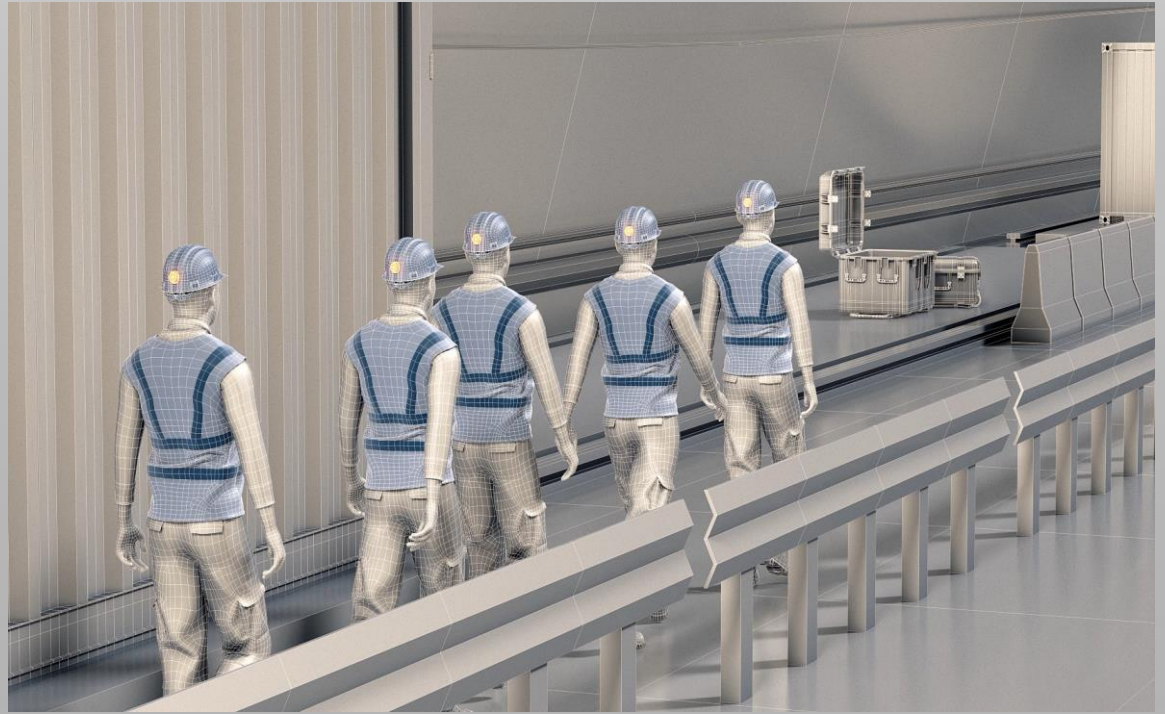
## SOLUTIONS

- Bouygues in-house developed system
- Track workers' location along tunnel



## RESULTS / MERITS

- Enhance emergency response
- Facilitate rescue operation
- Optimize workforce deployment
- Provide data for resource planning analysis



# Adopting Modern methods of construction and Innovative technologies - -Overhead Crane -



## Safety Features

### Hb Man Tin Shaft

- Muck Out Capacity: **4,000t / day**
- **60T** Capacity Overhead Crane
- **7 min** cycle time
- Max. Lifting Speed: **50m / min**
- Best Record **5,500t / day**  
(~ **200** buses / day)
- As of last week, **>1,500,000t lifted**  
(~ **56,000** buses)
- Estimated total, **>3,000,000t lifted**  
(~ **110,000** buses)

		Lifting Risks Identified			
		Overloading	Excessive swinging	Unbalanced load Leading to toppling or long-term fatigue	Overspeed Possible crane failure
Engineering Solutions	Acceptance Test	<ul style="list-style-type: none"> <li>• Load cell installed</li> <li>• Overload alarm</li> <li>• Soft locking</li> </ul>	<ul style="list-style-type: none"> <li>• Software to identify periodic change of load cell reading</li> <li>• Software slow down crane motion</li> </ul>	<ul style="list-style-type: none"> <li>• Independent load cells on each wire</li> <li>• Soft locking if weight difference is &gt; 10%</li> </ul>	<ul style="list-style-type: none"> <li>• Software to limit max travel speed</li> <li>• Software to detect over-speeding</li> <li>• Soft breaking if over-speeding</li> </ul>
		<ul style="list-style-type: none"> <li>• Static load test</li> <li>• Horizontal dynamic test (same level)</li> <li>• Overload test (80t)</li> </ul>	<ul style="list-style-type: none"> <li>• Horizontal dynamic test (vertical travel)</li> </ul>	<ul style="list-style-type: none"> <li>• Eccentric load test</li> </ul>	<ul style="list-style-type: none"> <li>• Max speed test</li> <li>• Free fall test (by bypassing speed limit)</li> </ul>



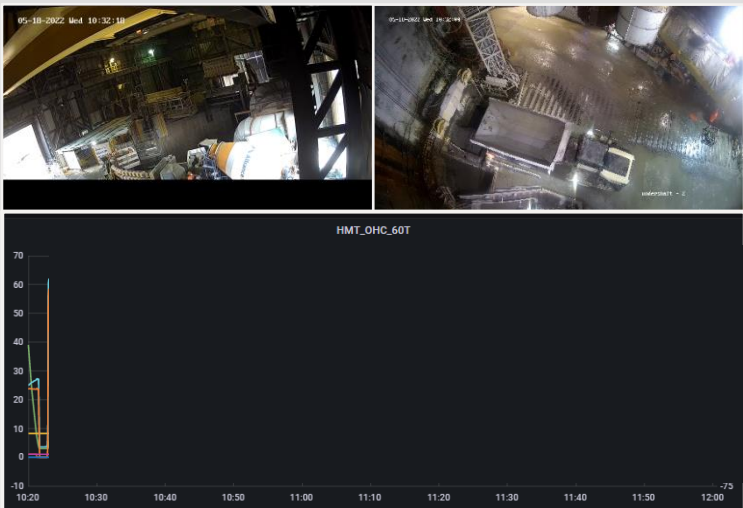
**200 Double Deck Buses**



# Adopting Modern methods of construction and Innovative technologies - Overhead Crane - Efficiency



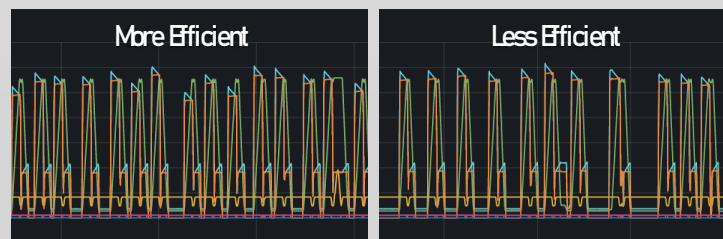
## Crane real-time monitoring



## AI Assisted Algorithms and Analysis



Time Series Data Classification and Fingerprinting



Efficiency Estimation

## Improvements implemented

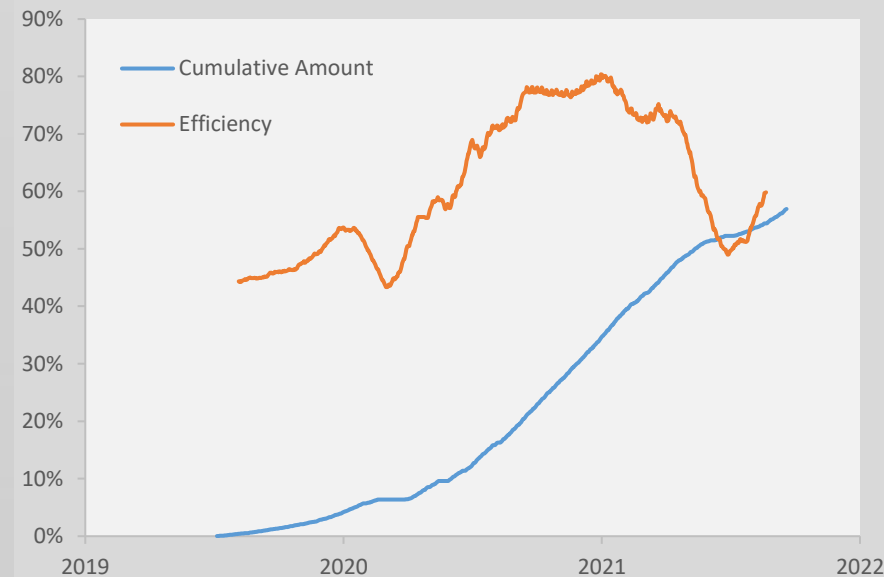


1 skip



= 1 trip

## Mucking out performance



## Data Collected



### Crane Activity

#### Encoders

- Bridge
- Trolley
- Hoist

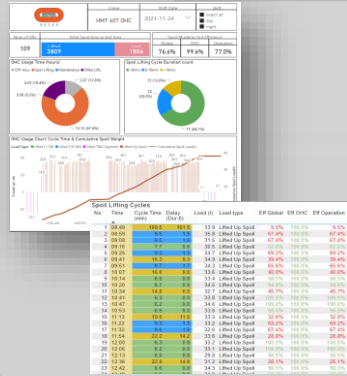
#### Load cells

- Left wire
- Right wire

### Others

- Power draw
- Breakdown
- Vibration

## Automatic Crane Reports



### Crane Shift Report

- Daily total spoil mucked out
- Nr. of plant and material lifts
- Crane idling time
- Crane efficiency
- Operation efficiency

# Adopting Modern methods of construction and Innovative technologies - Project- Lifting Gear Management



## RISKS / PROBLEMS

- Tedious procedures of lifting gear certificate tracking
- Manual searching system for certificate



## SOLUTIONS

- Lifting gears with QR code tag
- Digital system to store and manage all lifting gears



## RESULTS / MERITS

- Instantaneous access to lifting gear certificate
- Eliminate manual record retrieval process
- Dashboard for Lifting Gear Certificate Validity Management





# Adopting Modern methods of construction and Innovative technologies - Tunnel Concrete Lining Shutter

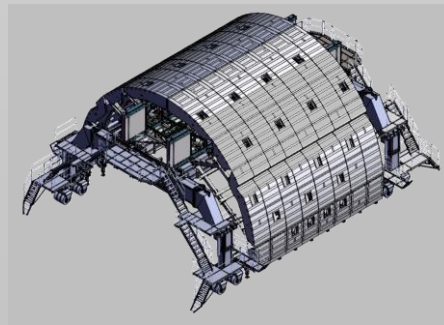
## RISKS / PROBLEMS

- Wastage of timber panels for repetitive cycle
- Heavy materials handling for metal panels
- Worker injuries
- Blockage of traffic windows



## SOLUTIONS

- Remote hydraulic-controlled metal formwork



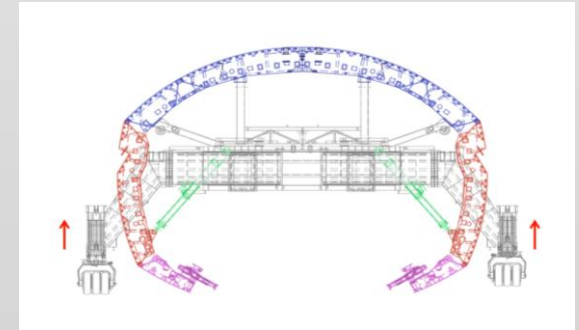
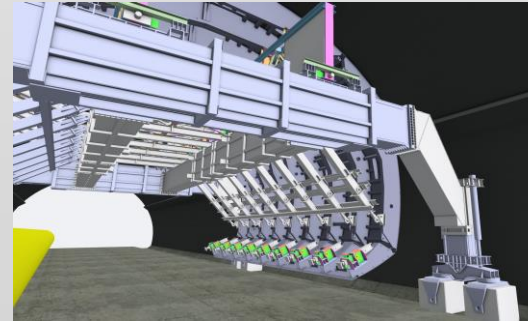
## RESULTS / MERITS

- Consistent lining quality
- Wide traffic window
- Faster and consistent concrete cycles
- Reduce carpentry / manual handling works
- Reduce working at height duration
- Less skilled labour required
- Better control for structure capacity



## Hydraulic-Controlled Panels

- Fully controlled mechanized system
- Eliminate high risk operations
- Ergonomic design
- less fatigue to workers



## Concrete Pressure Sensor

### Safety:

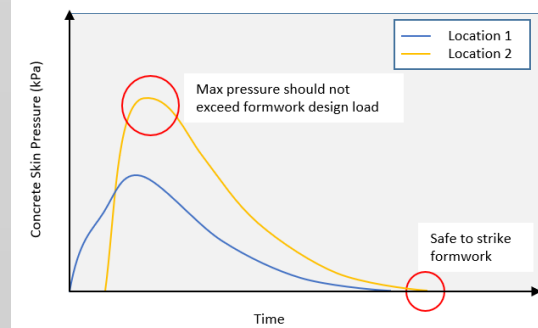
- Prevent over-pressuring the formwork



### Cycle Improvement:

- Optimizing pour rate
- Double confirm with maturity meter for formwork striking

### Theoretical Pressure vs Time curve





# Adopting Modern methods of construction and Innovative technologies - Automated Canopy Installation System

## RISKS / PROBLEMS

- Canopy installation in averse ground condition
- Significant manual handling procedure associated
- Induced worker injuries



## SOLUTIONS

- First-ever application in Hkng Kong
- Safe canopy pipes connection
- Remote controlled operation

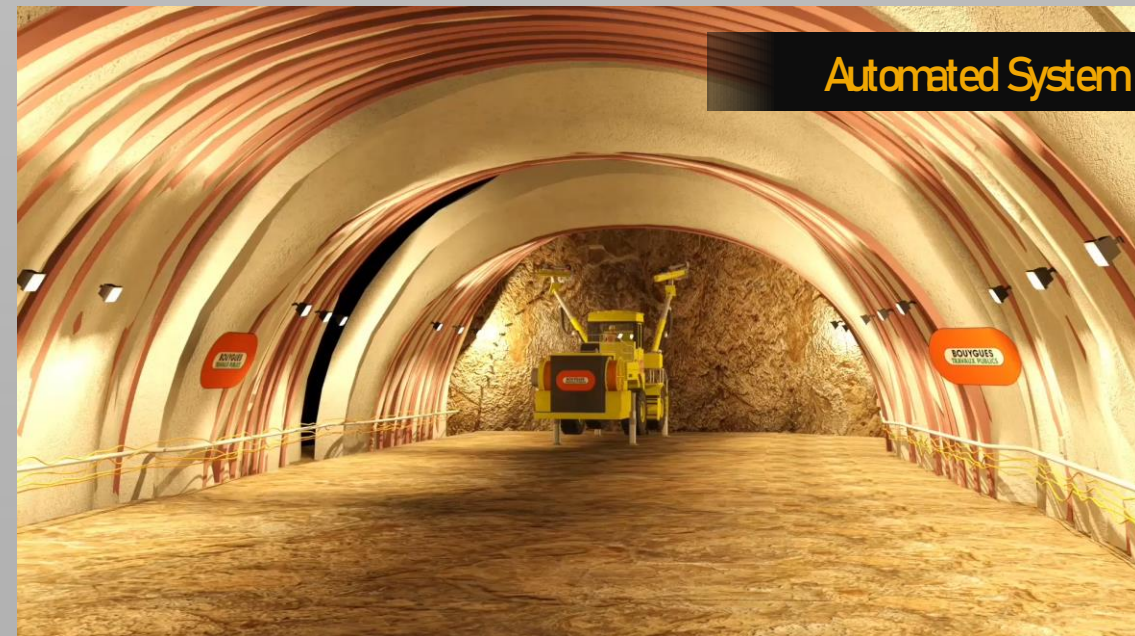


## RESULTS / MERITS

- Minimize the risk of finger/palminjuries
- Manual handling reduction
- Eliminate pipe connection by hand



Traditional Method



Automated System



# Adopting Modern methods of construction and Innovative technologies - Artificial Intelligence (AI) Camera on Tunnel Wheeled Vehicles

## RISKS / PROBLEMS

- Man - Plant Collision
- Injuries / fatal accident



## SOLUTIONS

- Anti-collision system by AI camera
- AI distinguishment of human and plant



## RESULTS / MERITS

- Reduce tiredness in false alarm
- Customizable ranked detection zones
- Provide audible alarm and flashing signal on driver's screen





# Adopting Modern methods of construction and Innovative technologies - HALO Beam Installation on Mobile Plant





# Adopting Modern methods of construction and Innovative technologies - Pipes/ tubes Handler





# Adopting Modern methods of construction and Innovative technologies - BeelInventor Anti-Collision System





# Adopting Modern methods of construction and Innovative technologies - AI Camera System Installed in TBM Launching Shaft





# Adopting Modern methods of construction and Innovative technologies - Audible Pedestrian Bollards



When there is a vehicle passing through the site entrance, the warning light will turn red with Chinese wording '不准橫過'

When there is no vehicle, the warning light will turn green with Chinese wording '請前進' and the pedestrian can cross the road.







A member of the Bouygues Construction group

# THE SAFE WAY IS THE ONLY WAY



A member of the Bouygues Construction group



THANK  
YOU

