



Singapore's Cross Island Line Contract 116

ZERO HARM JOURNEY

SINGAPORE PROJECT:

CR116 : DESIGN & CONSTRUCTION OF ANG MO KIO INTERCHANGE STATION AND TUNNELS

15 August 2024

Presented by :

Henry Kim

Senior Project Director

CR116 ZERO HARM JOURNEY

1. Introduction to CR116
2. Construction Methodologies
3. Challenges in CR116 Project
4. Adopt Technology in CR116 Enabled WSH
 - i) Design for Safety
 - ii) Construction Safety
 - iii) Sustainability & Environmental Safety



SINGAPORE'S MRT LINE



- 7 MRT LINES
- >140 STATIONS
- 200KM
- Excavation depth
 - Shallowest – Newton at 12m below ground level
 - Deepest – Bencoolen at 43m below ground level
- No of train-car
 - 6-car train - High Capacity MRT Lines (EWL, NSL & NEL)
 - 3-car train – Medium Capacity MRT Lines (CCL, DTL & TEL)
- Latest MRT Lines Opening
 - 23 June 2024
 - TEL Stage 4 : Tanjung Rhu to Bayshore

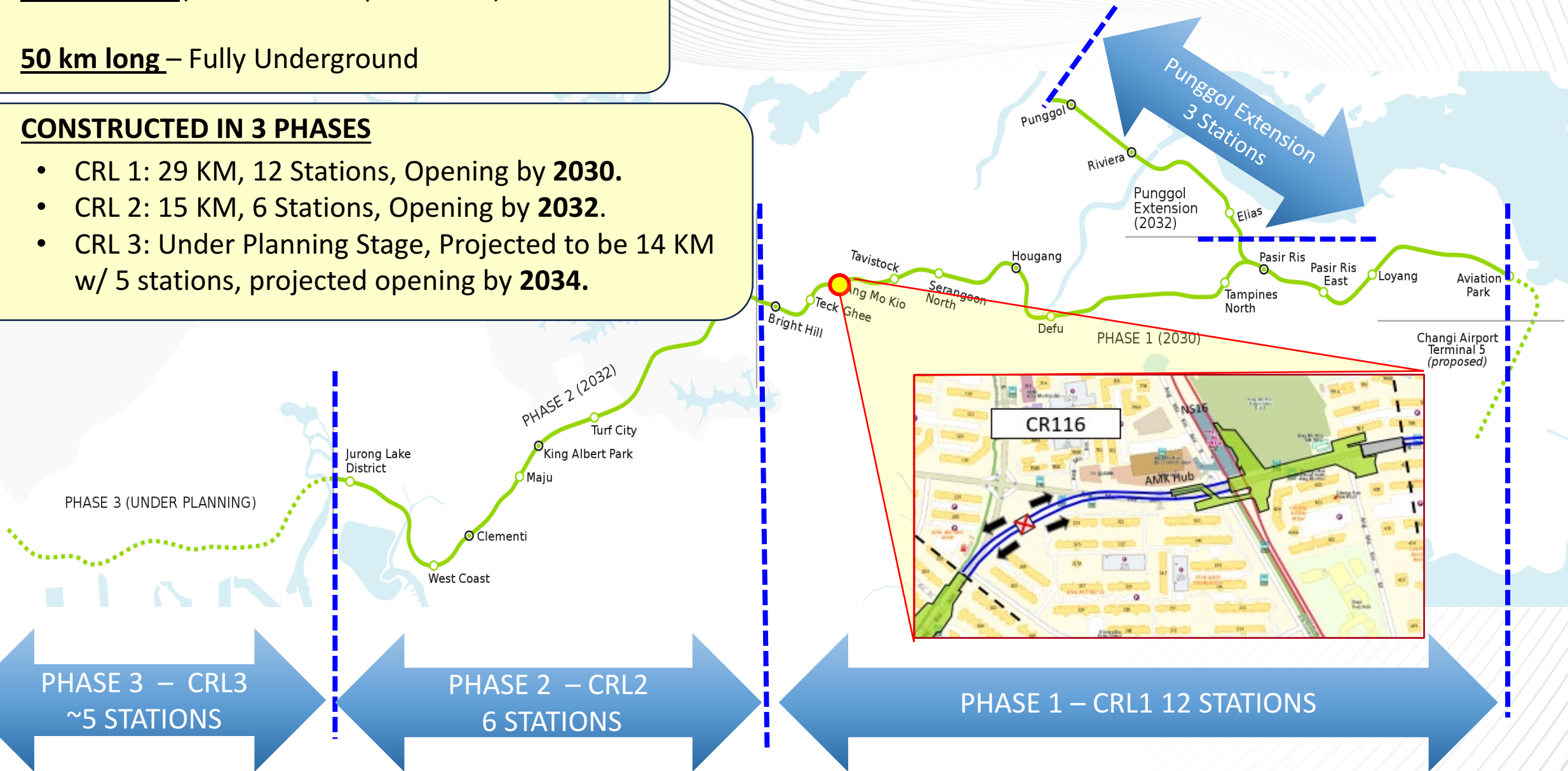
Cross Island Lines Packages Introduction

- **8th MRT line** (MRT=Mass Rapid Transit)

- **50 km long** – Fully Underground

- **CONSTRUCTED IN 3 PHASES**

- CRL 1: 29 KM, 12 Stations, Opening by **2030**.
- CRL 2: 15 KM, 6 Stations, Opening by **2032**.
- CRL 3: Under Planning Stage, Projected to be 14 KM w/ 5 stations, projected opening by **2034**.



PHASE 3 – CRL3
~5 STATIONS

PHASE 2 – CRL2
6 STATIONS

PHASE 1 – CRL1 12 STATIONS

CR116 PROJECT INFORMATION

DESIGN & BUILD OF AMK STATION & TUNNELS

Main Contractor : Gammon – Bachy Soletanche JV

Contract No. : CR116

Contract Sum : S\$ 644,378,000.00

Employer : Land Transport Authority

Architect : Ong & Ong

QP(Design) : WSP Singapore

QP(Geotech) : GEOCONSULT Asia Singapore

QP (Supervision) : CKMbT International

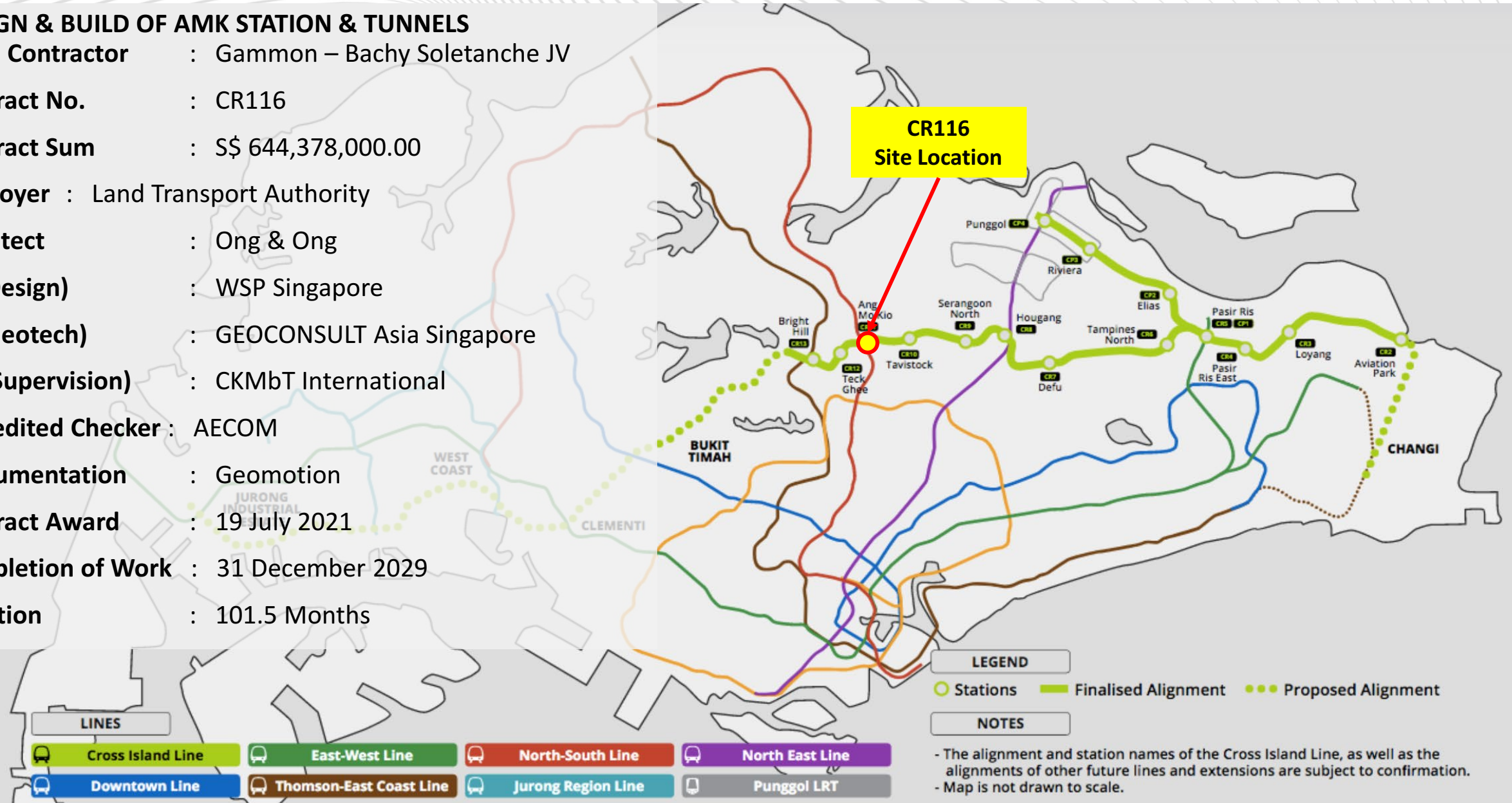
Accredited Checker : AECOM

Instrumentation : Geomotion

Contract Award : 19 July 2021

Completion of Work : 31 December 2029

Duration : 101.5 Months

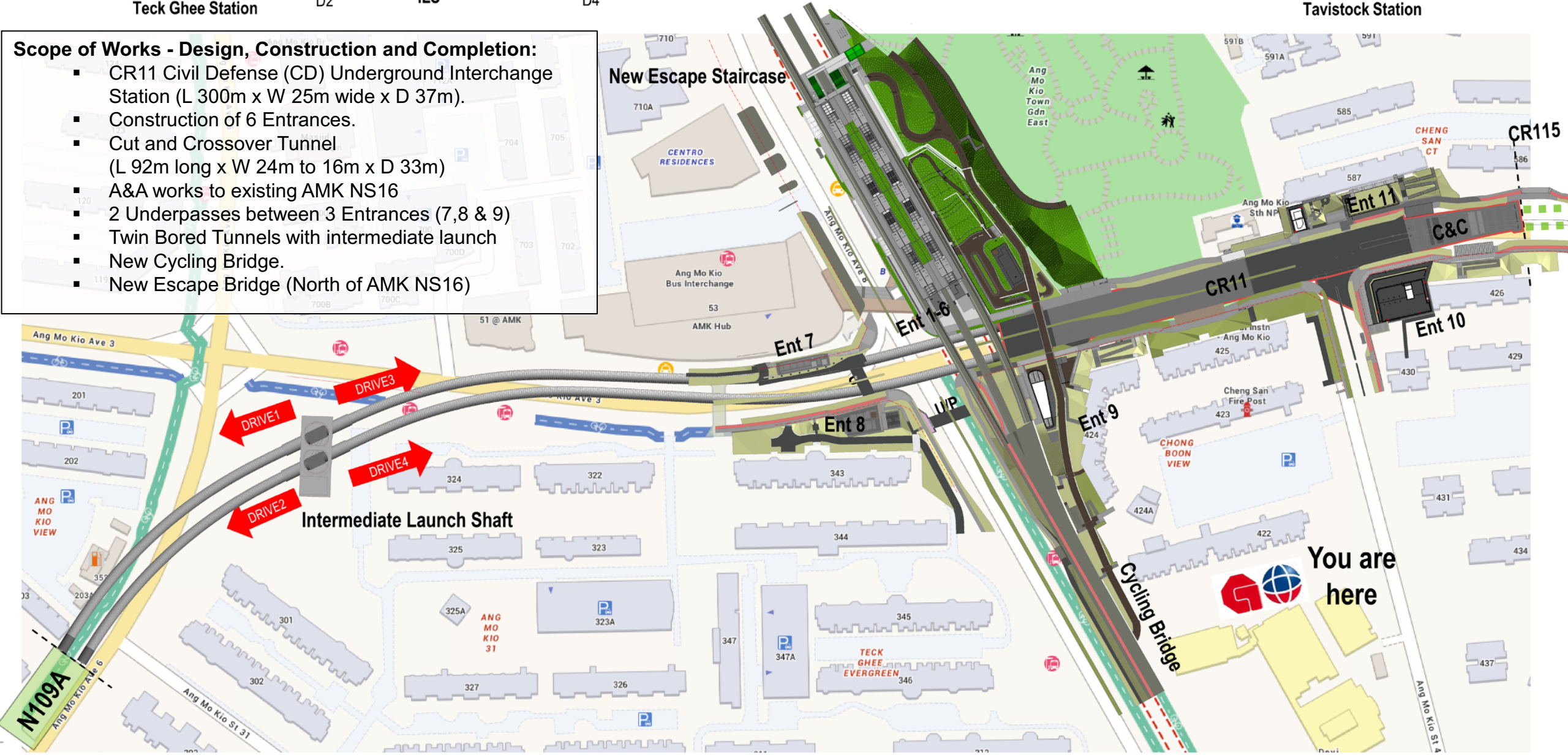


SCOPE OF WORKS



Scope of Works - Design, Construction and Completion:

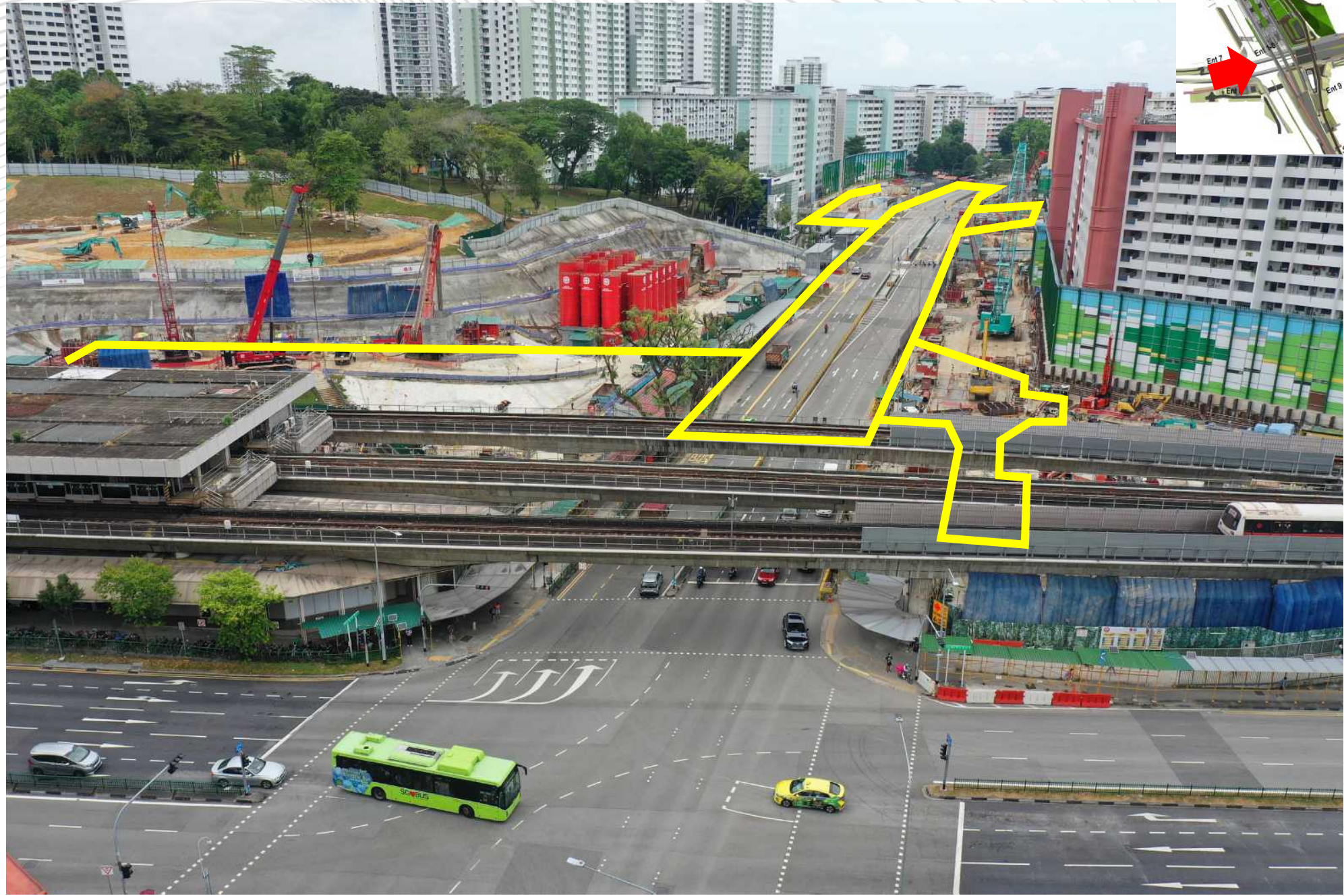
- CR11 Civil Defense (CD) Underground Interchange Station (L 300m x W 25m wide x D 37m).
- Construction of 6 Entrances.
- Cut and Crossover Tunnel (L 92m long x W 24m to 16m x D 33m)
- A&A works to existing AMK NS16
- 2 Underpasses between 3 Entrances (7,8 & 9)
- Twin Bored Tunnels with intermediate launch
- New Cycling Bridge.
- New Escape Bridge (North of AMK NS16)



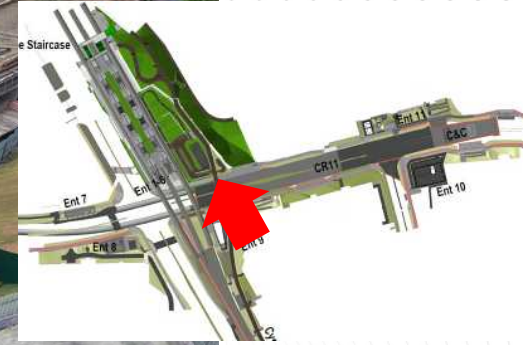
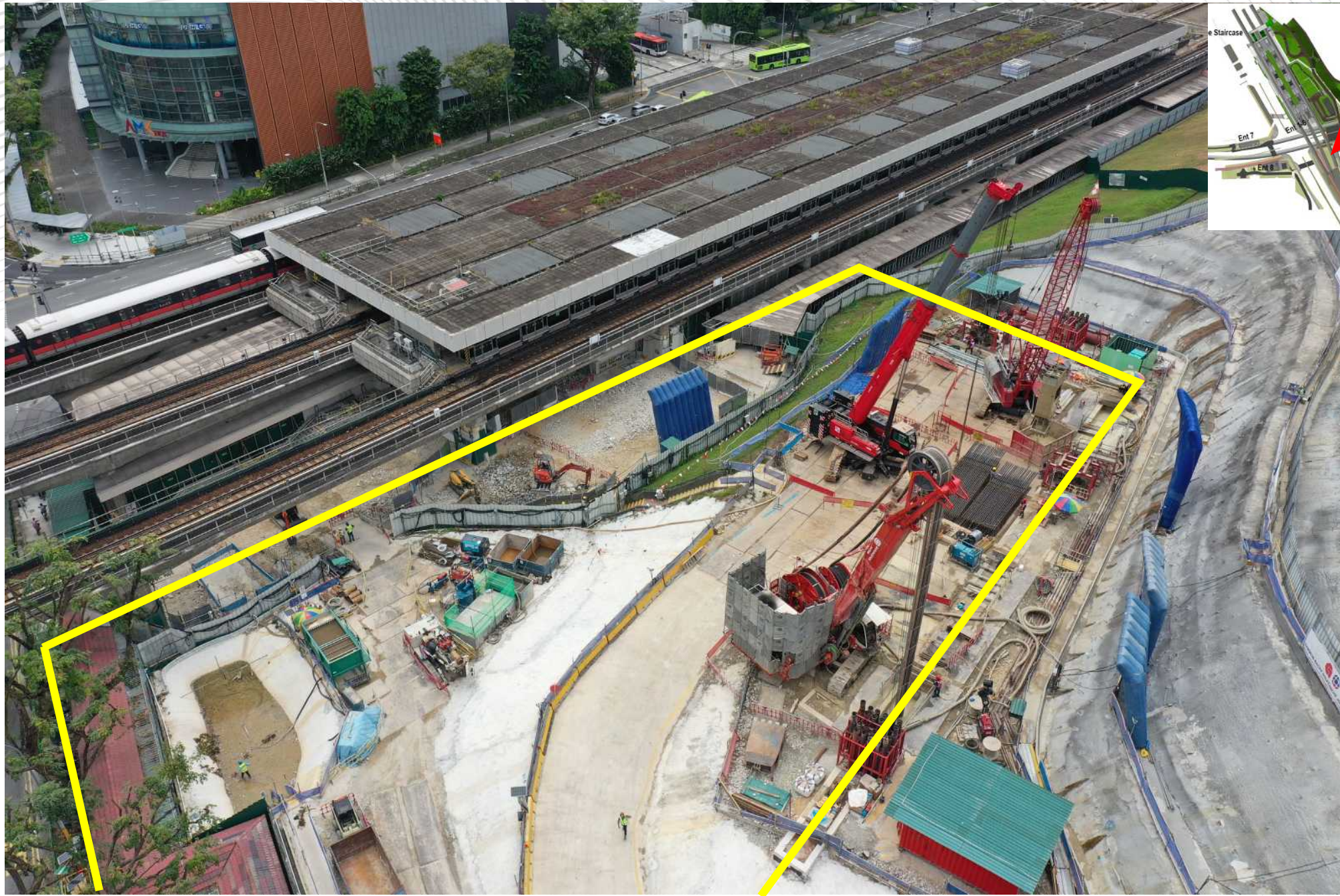
3. CONSTRUCTION METHODOLOGIES

S/N	Area	Construction Method
1	Station & Entrances	<ul style="list-style-type: none">▪ Diaphragm wall as Earth Retaining Structure System (ERSS)▪ Top- Down Construction with 5-levels of RC slab▪ Combination of RC struts and steel struts▪ All entrances are top-down except for Ent 8, Ent 7 and Jacking Shaft
2	Cut & Cover	<ul style="list-style-type: none">▪ Diaphragm wall as Earth Retaining Structure System (ERSS)▪ Top- Down Construction with 2 levels of RC slab▪ Combination of RC struts and steel struts
3	Bored Tunnel	<ul style="list-style-type: none">▪ Twin Cell Shaft Construction▪ Shaft ERSS – Diaphragm wall▪ 1 Slurry TBM & use for 4 drives▪ No initial drive as the first 30m of tunnel for each bound is by NATM (New Austrian Tunnelling Method)

AERIAL VIEW OF CR116



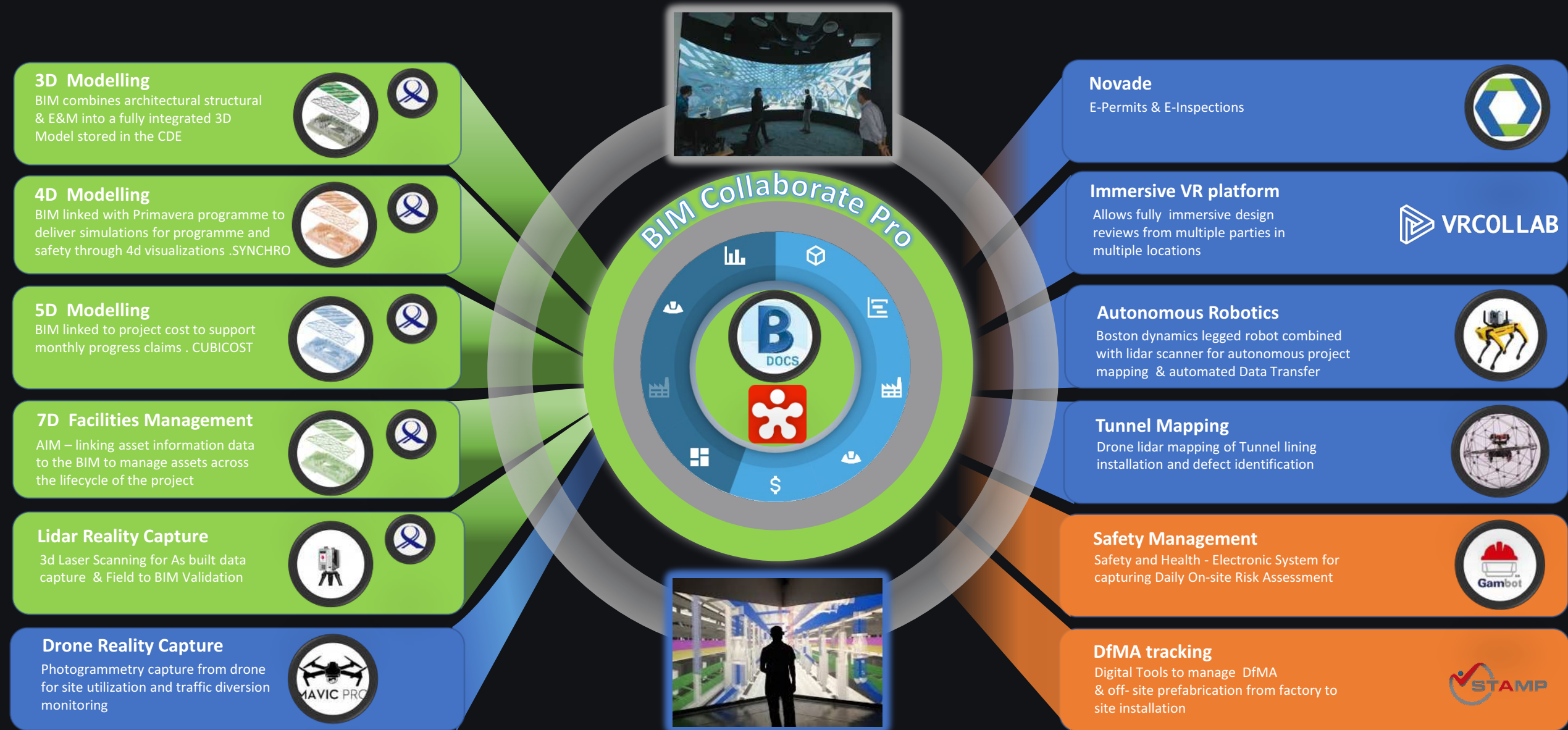
AERIAL VIEW OF ENTRANCE 1-6 INTERFACE WITH AMK NS16



CHALLENGES IN CR116 PROJECT

1. Densely populated residential area
2. MRT reserve lines (1st reserve and 2nd reserve lines)
 - a. DBC (Department of Building Control)
 - b. Toppling Analysis/ etc
3. Mixed Geology
4. Presence of utilities underground
5. Works during engineering hours only (A&A works)

Gammon Bachy Soletanche Integrated Digital Platform CR 116



COMMON DATA ENVIRONMENT – Autodesk Construction Cloud

AUTODESK Construction Cloud

Document Management - CR116 B - Syed Nazri Bin Syed Shamshudin

Folders | Reviews | Transmittals | Issues

View by: Folders | Sets

Upload files | Showing 263 items | Search

<input type="checkbox"/>	Name ^	Title	Set v	Version	Last updated	Updated by	Markup	Issue	Location	Review status	⚙
<input type="checkbox"/>	ACCOMMODATION SCHEDULE	CR11 ANG MO KIO STATION ...	Tender Consolidat...	V1	Mar 26, 2022 1:02 PM	Wei WANG	0	0			
<input type="checkbox"/>	T/ CR116/ CR11/ ACF/ 0870/ -	CR11 ANG MO KIO STATION ...	Tender Consolidat...	V1	Mar 26, 2022 10:25 AM	Wei WANG	0	0			
<input type="checkbox"/>	T/ CR116/ CR11/ ACF/ 0872/ -	CR11 ANG MO KIO STATION ...	Tender Consolidat...	V1	Mar 26, 2022 10:25 AM	Wei WANG	0	0			
<input type="checkbox"/>	T/ CR116/ CR11/ ACF/ 0873	CR11 ANG MO KIO STATION ...	Tender Consolidat...	V1	Mar 26, 2022 10:25 AM	Wei WANG	0	0			
<input type="checkbox"/>	T/ CR116/ CR11/ ACF/ 0875/ -	CR11 ANG MO KIO STATION ...	Tender Consolidat...	V1	Mar 26, 2022 10:25 AM	Wei WANG	0	0			
<input type="checkbox"/>	T/ CR116/ CR11/ ACF/ 0876/ -	CR11 ANG MO KIO STATION ...	Tender Consolidat...	V1	Mar 26, 2022 10:25 AM	Wei WANG	0	0			
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<input type="checkbox"/>	T/ CR116/ CR11/ ADF/ 0801/ -	CR11 ANG MO KIO STATION ...	Tender Consolidat...	V1	Mar 26, 2022 10:25 AM	Wei WANG	0	0			
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<input type="checkbox"/>	T/ CR116/ CR11/ ADHB/ 0850/ -	CR11 ANG MO KIO STATION ...	Tender Consolidat...	V1	Mar 26, 2022 4:40 PM	Wei WANG	0	0			
<input type="checkbox"/>	T/ CR116/ CR11/ ADHB/ 0851/ -	CR11 ANG MO KIO STATION ...	Tender Consolidat...	V1	Mar 26, 2022 4:40 PM	Wei WANG	0	0			

Approved Drawings

- 00. Tender Consolidated
 - 1. Architecture
 - 2. C&S
 - 3. Building Services
- 01. Preliminary Stage
- 02. Pre-Final Stage
- 03. Final Stage
- 04. Construction Stage

Project Files

- A. LTA APPROVED DOCUMENTS
- B. TENDER DOCUMENTS
- C. ADMINISTRATIVE FOLDER
- D. WORKFLOWS
- E. VIRTUAL DESIGN AND CONSTR...
 - E0 BEP
 - E1 WIP
 - E2 SHARED
 - E3 PUBLISHED



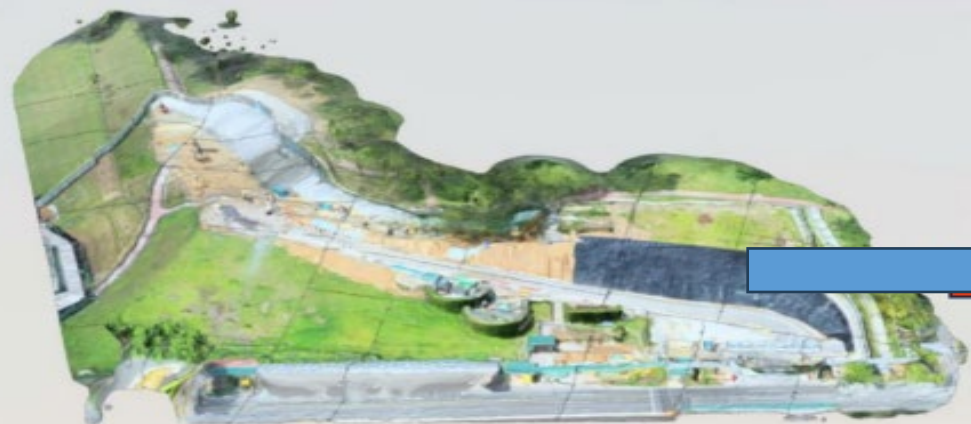
AERIAL DRONE + PIX 4D PLATFORM



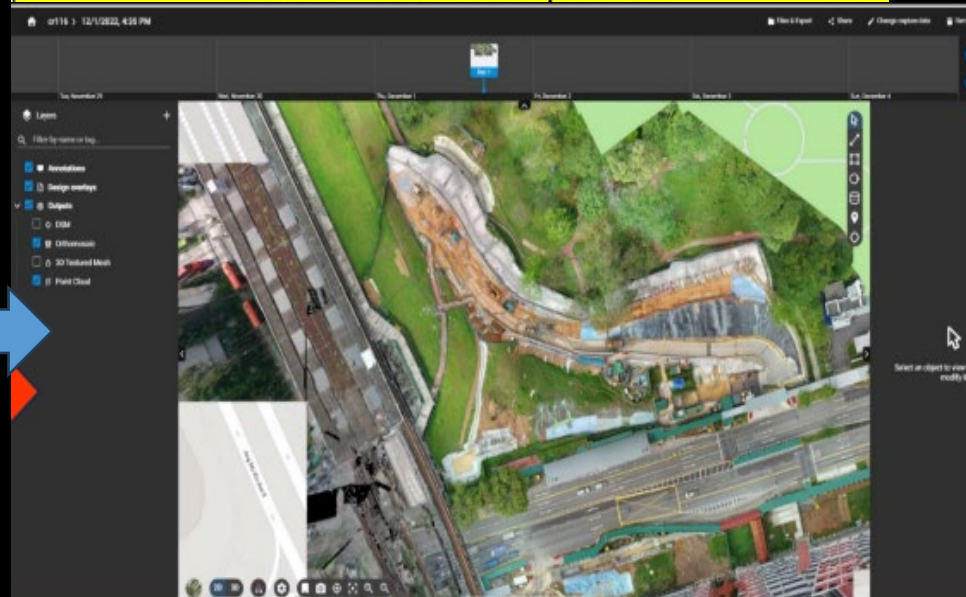
Drone Mapping Set-up / Mission Flight



Actual Photo for comparison



Drone Photos generates 3D Model by PIX4D



Result: Drone photos combined in PIX4D to create detailed map of site.



AERIAL DRONE + PIX 4D PLATFORM



CONTRACT NO : CR116
CONTRACT NAME : Design and Construction of Ang Mo Kio Interchange Station and Tunnels
CONTRACTOR : GBSJV

MONTH : 01 FEB 2024
PHOTOGRAPH NO : 21
DESCRIPTION : Aerial View at Proposed Emergency Exit Bridge facing North, Viewpoint 21



AERIAL DRONE + PIX 4D PLATFORM

CR116 - AMKTGE > 12/30/2022, 4:51 PM



Compare

December 2022

Layers +

Filter by name or tag...

- Annotations
- Design overlays
- Outputs
 - DSM
 - Orthomosaic
 - 3D Textured Mesh
 - Point Cloud



2D 3D [Navigation icons]

WGS 84 / UTM zone 48N Metric Easting: 371,988.629 m Northing: 151,558.818 m Z: 28.696 m

Read-only

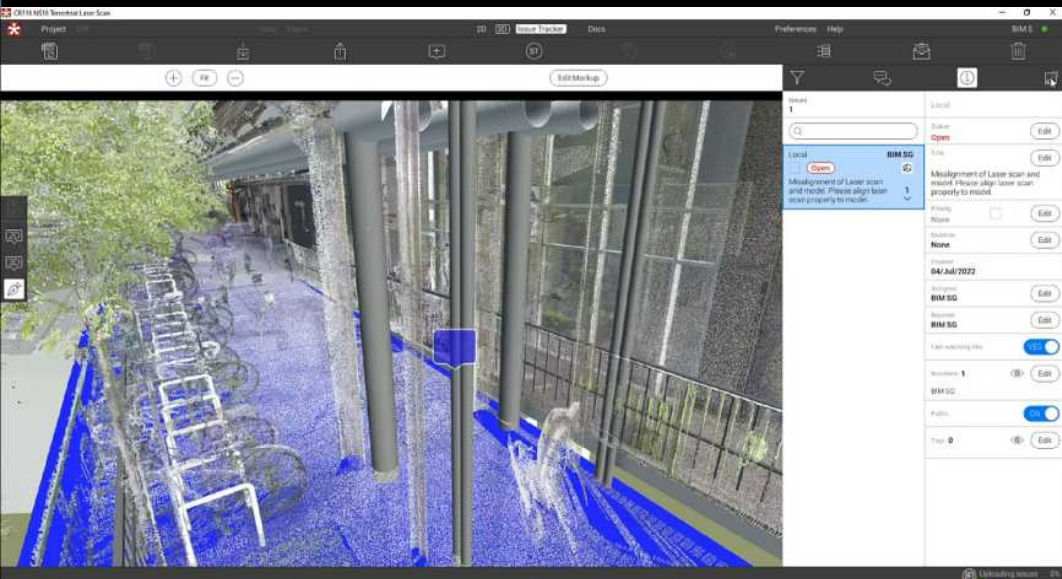
3D mesh generated from drone photogrammetry used to plan utilisation





Leica 3D laser scan for BIM Model creation of Existing Station





Leica 3D laser scan for BIM Model creation of Existing Station



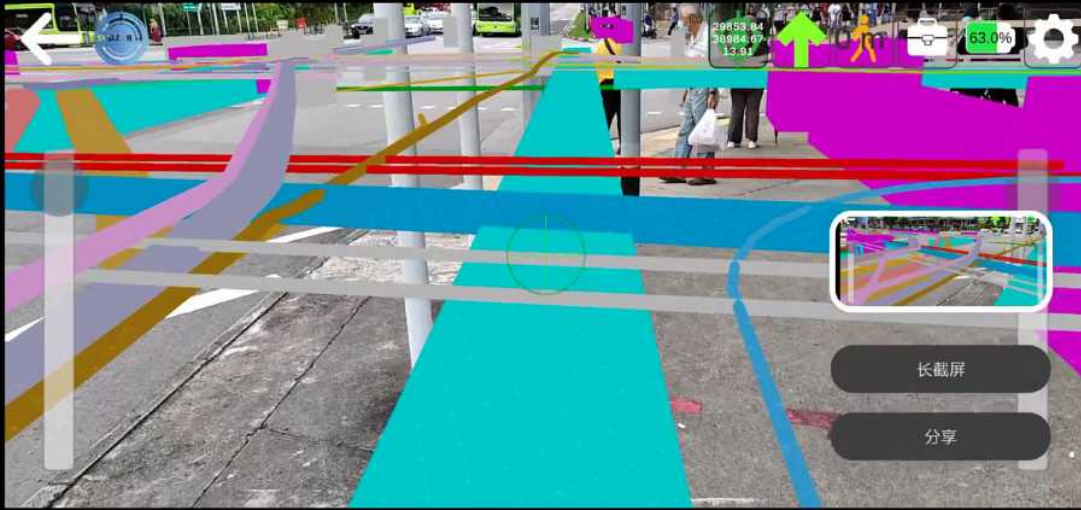
VR IMMERSIVE CAVE on site & VR Collab Implementation



Design reviews & virtual mockups facilitated by BIM

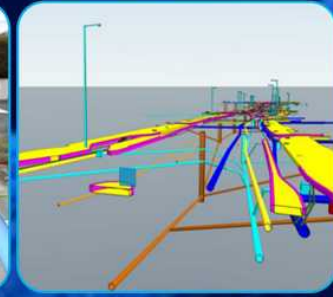
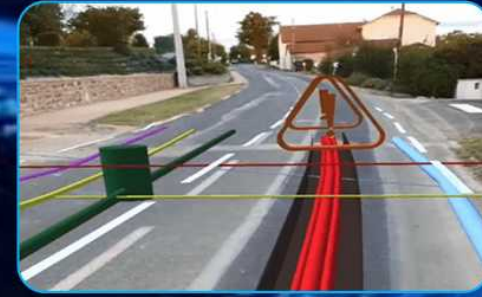


Augmented Reality for underground services detection.

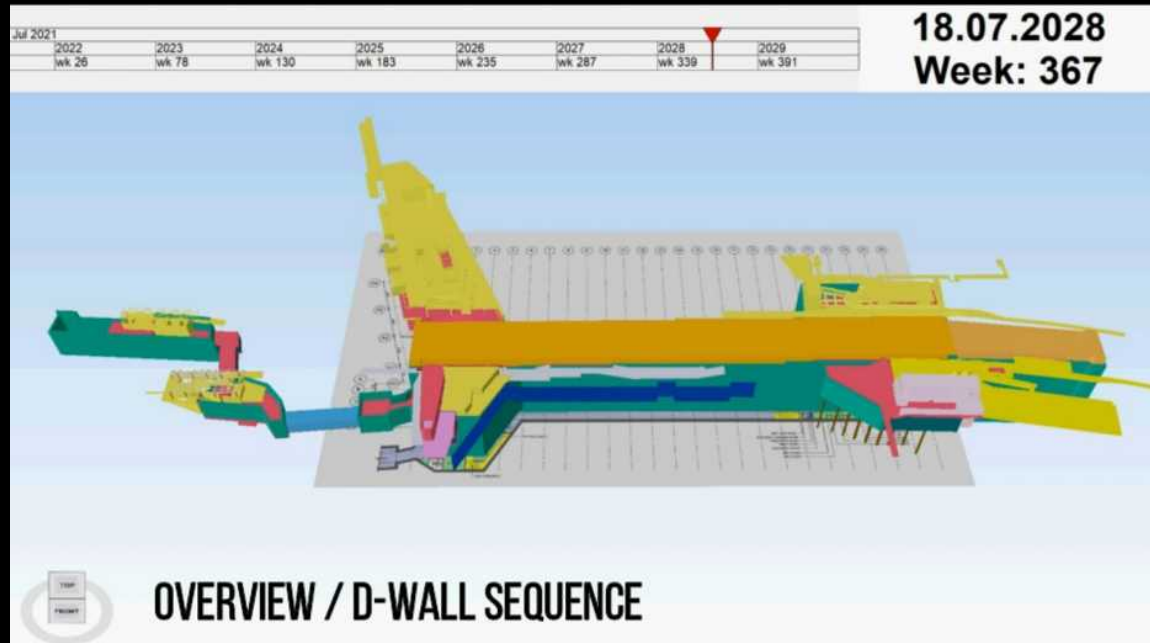
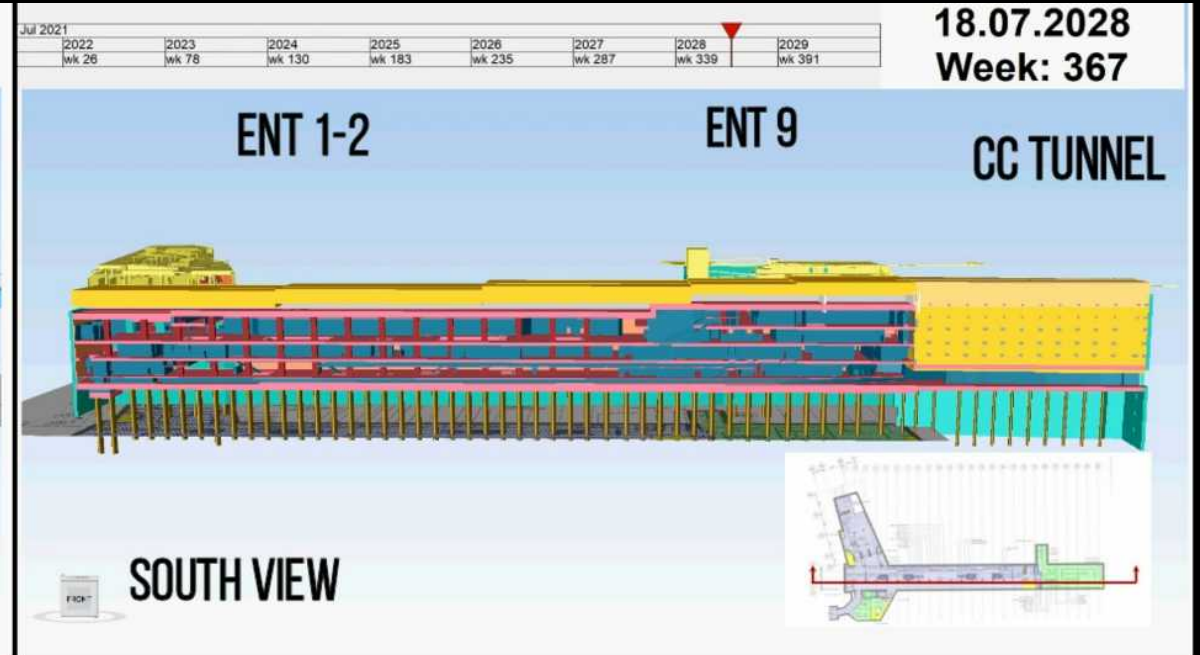
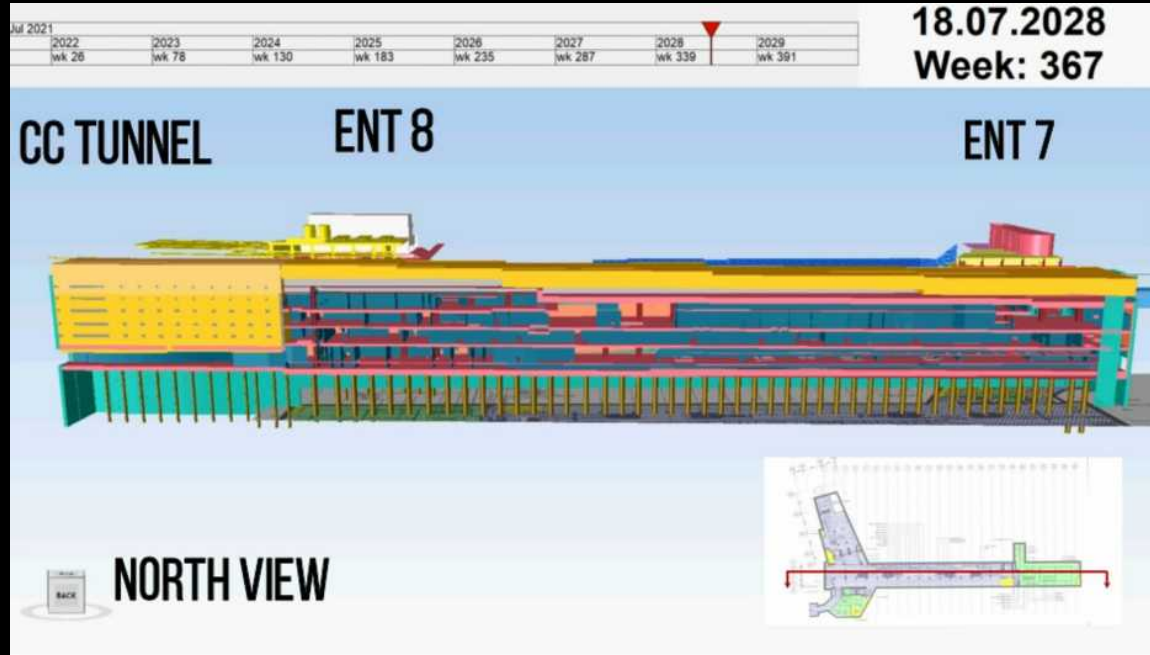


AVUS

augmented visualisation of underground services

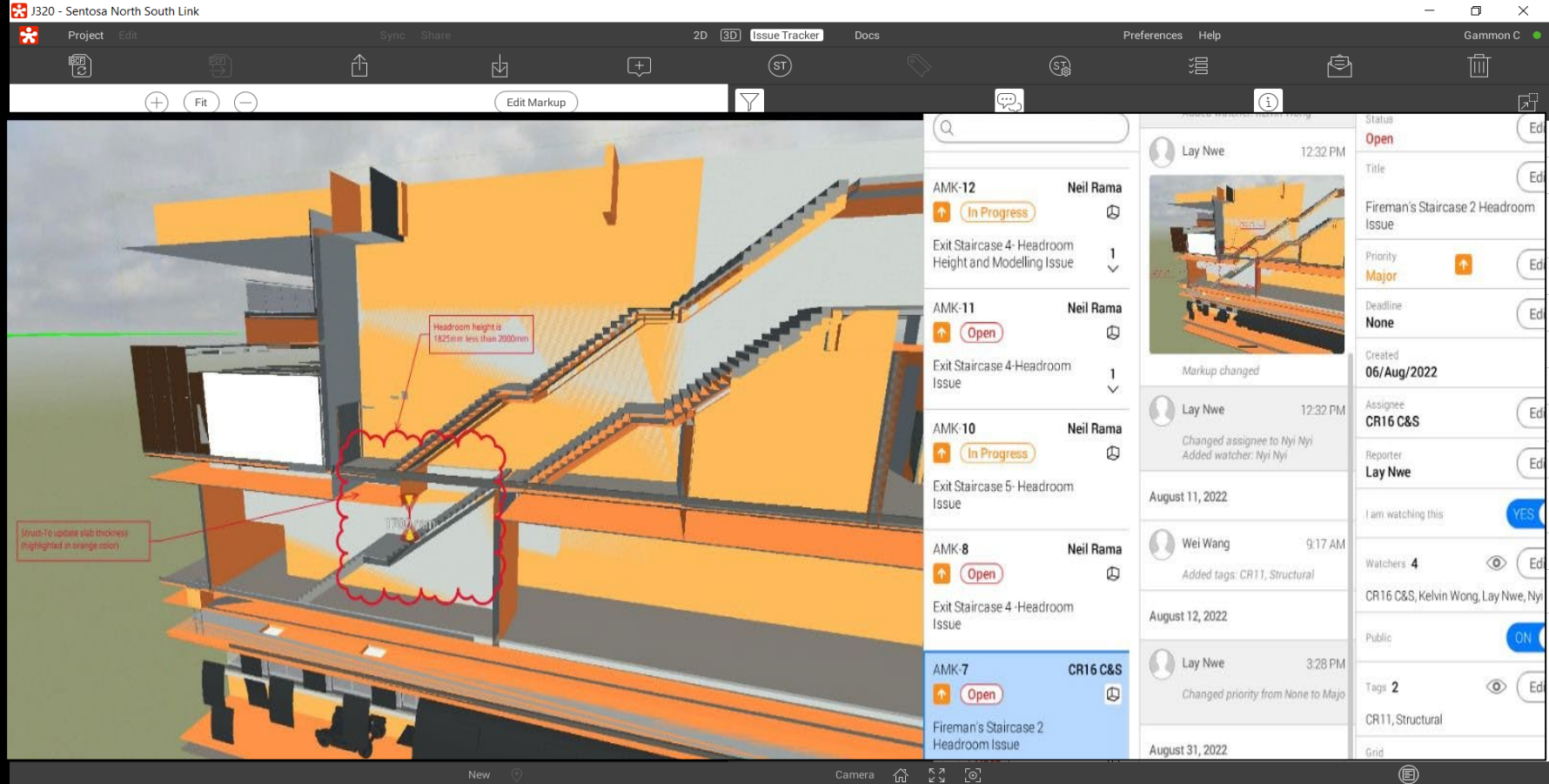
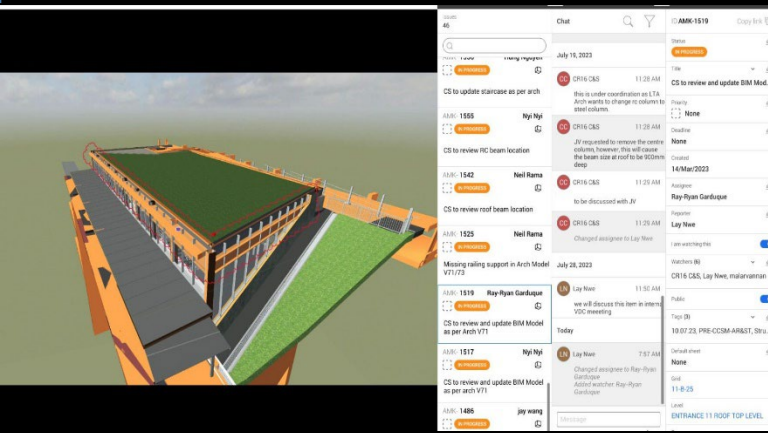
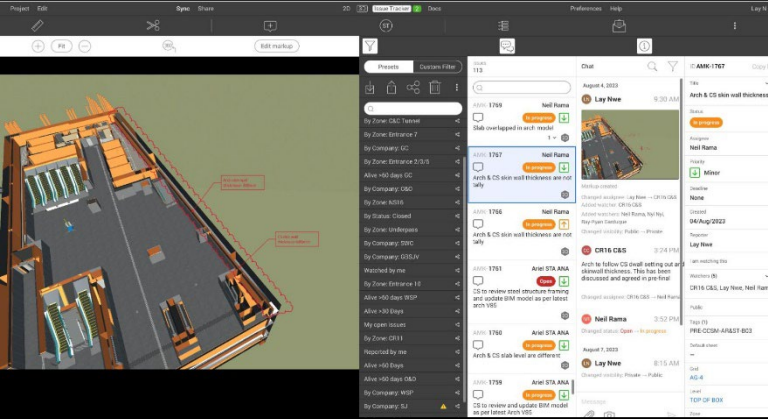


4BIM using Synchro for 4d construction simulation



BIM COLLABORATION

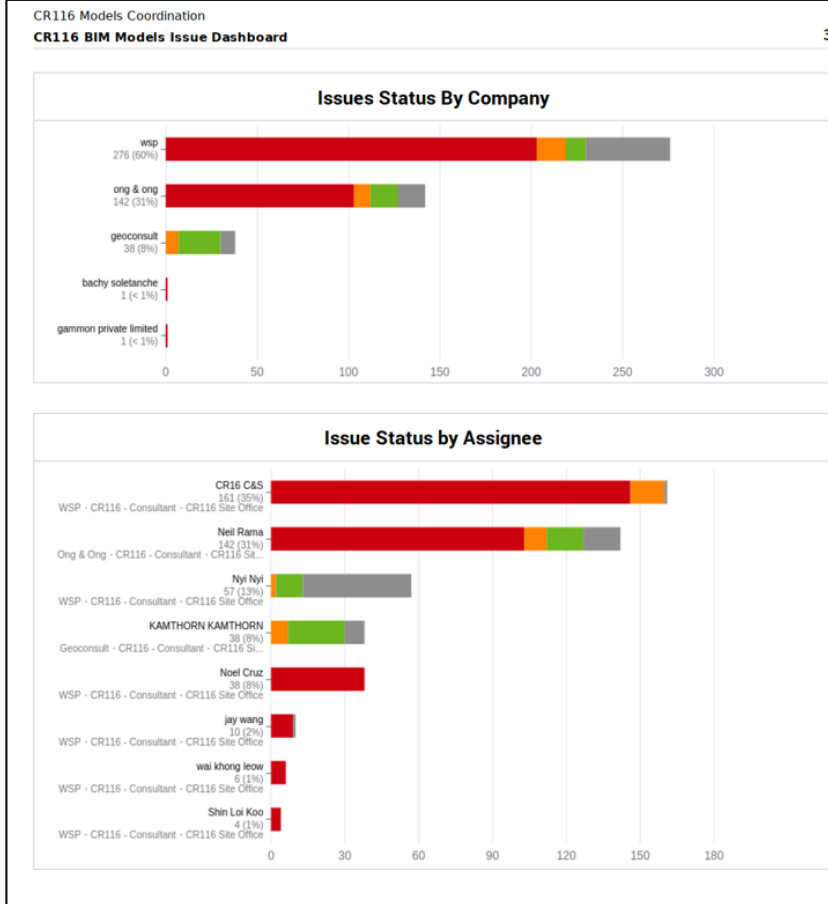
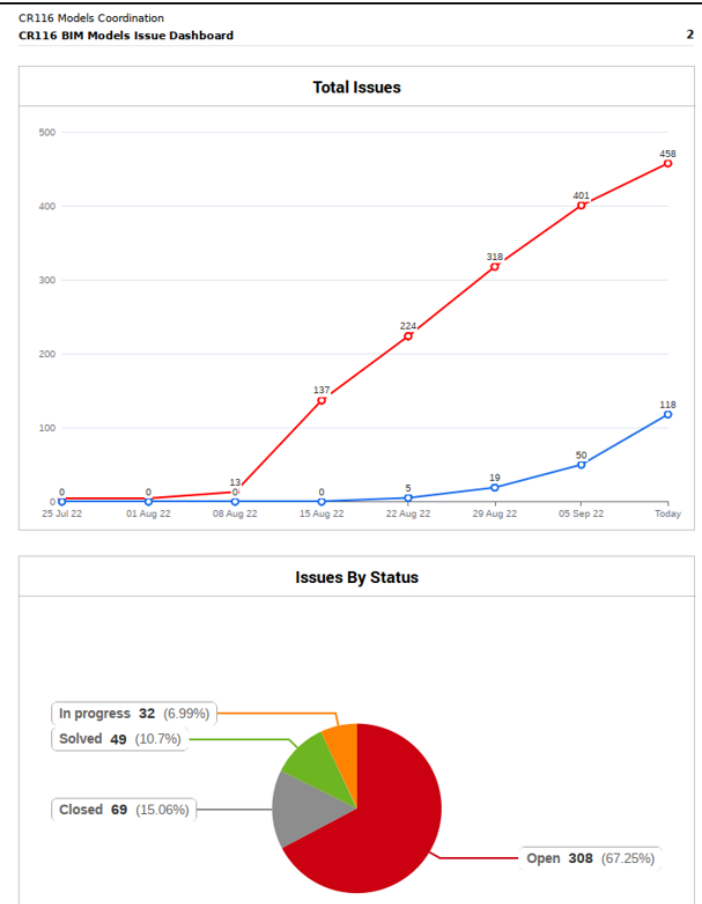
Revizto for collaboration



BIM ACCESSIBILITY FOR ALL STAKEHOLDERS , FOR COMMENTING,ISSUE TRACKING & DESIGN STATUS



BIM COLLABORATION, Clash Detection and issue tracking



Clash Automation

Clash test is being edited by you. Only you can edit the clash test until you refresh it.

Filters

Name	ID	Count	Severity	Status	Category	Location	Assignee
B1 SUBWAY LEVEL (ENT 06)	2086	5	0	Open	CLASH	B1 SUBWAY LEVEL (ENT 06)	A3-2
ENTRANCE 7	2097	4	4	Open	CLASH	ENTRANCE 7	A1-2
ENTRANCE 7	2102	12	12	3	Open	ENTRANCE 7	A3-2
ENTRANCE 7	2106	15	15	4	Open	ENTRANCE 7	A2-2, A3-2, A...
ENTRANCE 7	2111	20	20	4	Open	ENTRANCE 7	A1-2, A3-2, A...
ENTRANCE 7	2117	8	9	4	Open	ENTRANCE 7	A-4, A-4F
TOP OF BOX ENT 8	2156	46	46	2	Open	TOP OF BOX ENT 8	A-F, B-4, D...
ENTRANCE 7	2183	10	10	2	Open	ENTRANCE 7	C-17, C-18
ENTRANCE 7	2189	53	53	20	Open	ENTRANCE 7	D-4, D-5, E-9...
TOP OF BOX ENT 8	696	10	10	0	Open	TOP OF BOX ENT 8	D-1, B-2
TOP OF BOX ENT 8	707	2	2	0	Open	TOP OF BOX ENT 8	B-2
TOP OF BOX ENT 8	710	12	12	0	Open	TOP OF BOX ENT 8	B-10, B-20, C...
TOP OF BOX ENT 8	723	1	0	0	Open	TOP OF BOX ENT 8	E-5
TOP OF BOX ENT 8	725	1	0	0	Open	TOP OF BOX ENT 8	E-5
B1 SUBWAY LEVEL (ENT 06)	1481	2	0	0	Open	B1 SUBWAY LEVEL (ENT 06)	C-24
WALKWAY BRIDGE TOP LEVEL	1902	8	0	0	Open	WALKWAY BRIDGE TOP LEVEL	10-1, 10A
GROUND LEVEL (ENT 05)	1903	5	5	0	Open	GROUND LEVEL (ENT 05)	10-2, 10C
ENTRANCE 7	1919	2	0	0	Open	ENTRANCE 7	A-7, B
ENTRANCE 7	1920	6	0	0	Open	ENTRANCE 7	1-6, 1-6C
ENTRANCE 7	1921	10	0	0	Open	ENTRANCE 7	1-9C
ENTRANCE 7	1969	2	0	0	Open	ENTRANCE 7	9-A-3
ENTRANCE 7	1970	35	0	0	Open	ENTRANCE 7	5-A, 9-A-5-10
ENTRANCE 7	1971	17	17	0	Open	ENTRANCE 7	9-B-1

CR116 Models Coordination CR116 Issues

5

Issue: Do not allow M&E services to run above CD Shelter Door

Assignee: maulanarman Mutharan

Status: Lay New

Created: 17/Sep/2022

CR116 Models Coordination

CR116 Models Coordination CR116 Issues

6

Issue: M&E services run below ceiling level

Assignee: maulanarman Mutharan

Status: Lay New

Created: 17/Sep/2022

CR116 Models Coordination

BIM ACCESSIBILITY FOR ALL STAKEHOLDERS , FOR COMMENTING,ISSUE TRACKING & DESIGN STATUS



Robotic Fumigation at CR 116



Use of robots for assisting in vector control



Machinery Critical Parts Inspection by Drone for Mechanic Assessment

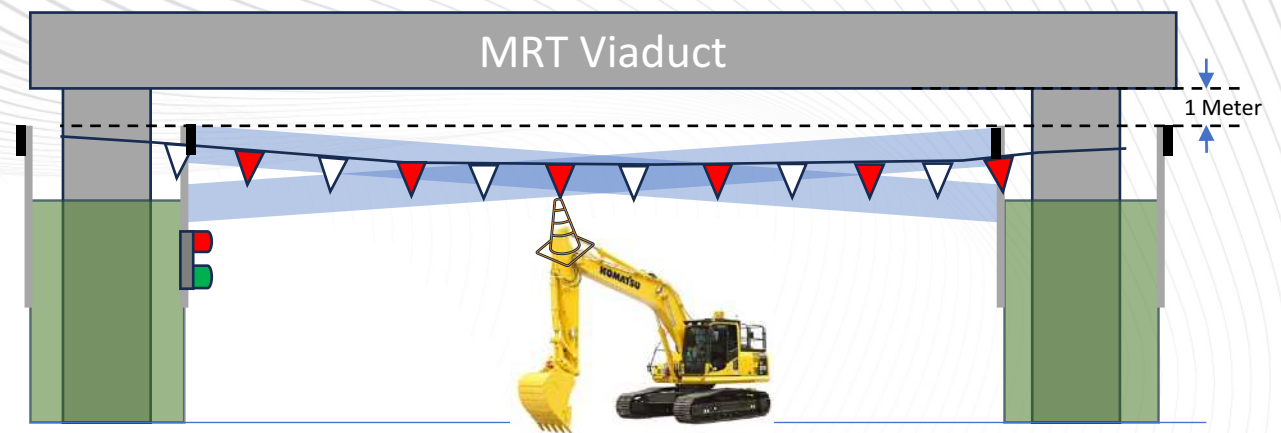




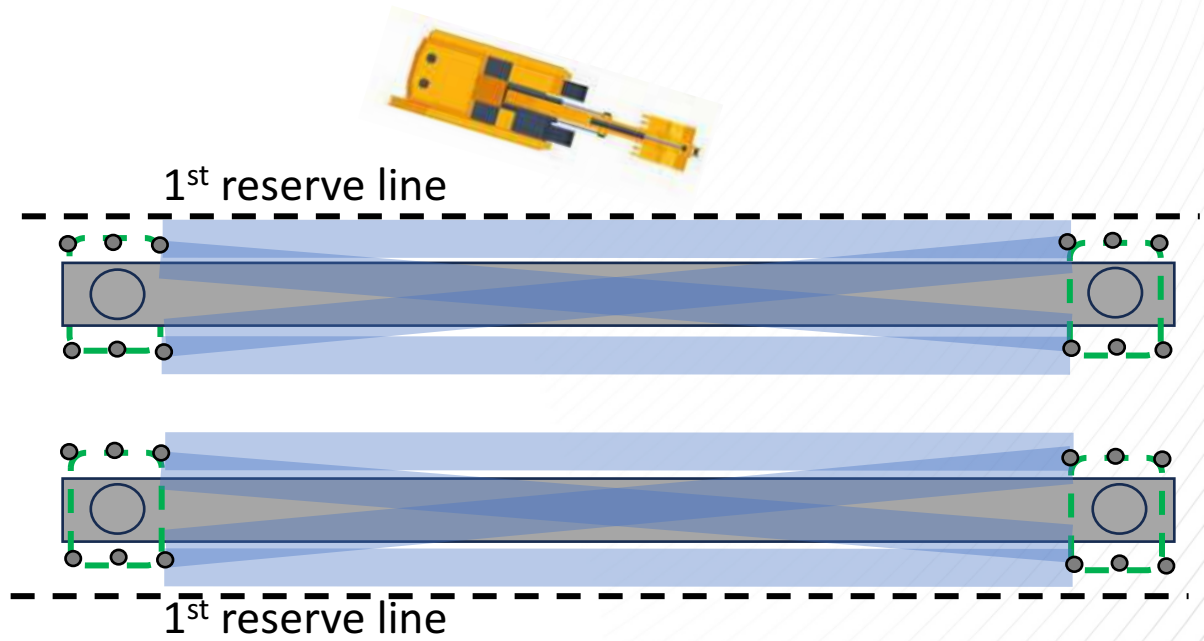
PHOTO BEAM SENSOR BELOW MRT VIADUCT – 1ST RESERVE LINES



Photobeams located below MRT Viaduct at Jacking Shaft



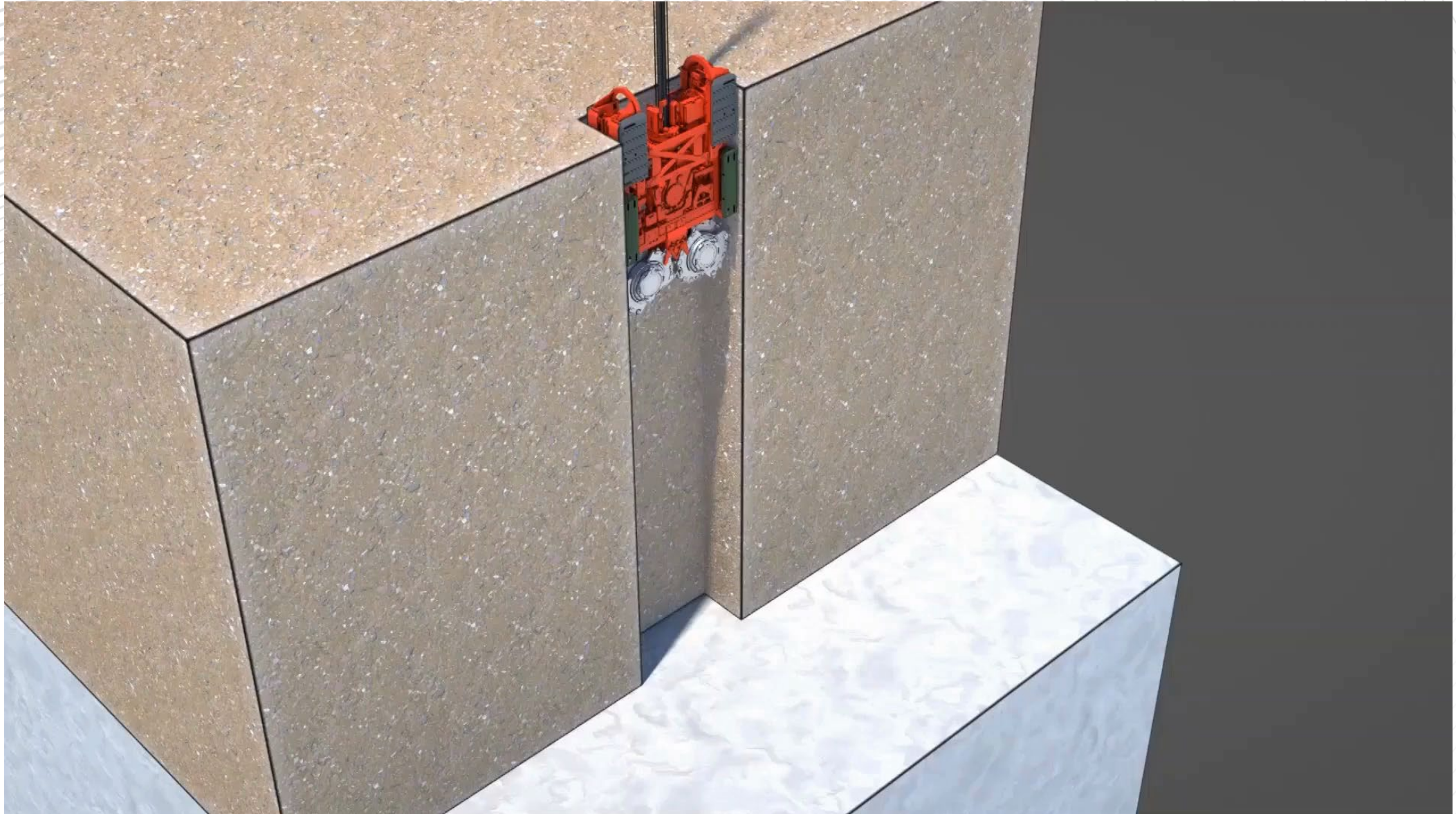
Longitudinal View



Plan View



DW MACHINE WITH GRIPPER TECHNOLOGY





BIM for Safety – Pictorial Method Statement

CASTING ENTRANCE 1-6 BASE SLAB

HAZARDS

1. COLLAPSE OF BAR CHAIR FOR THICK SLAB.

MITIGATION

1. MARK TO USE REBAR CHAIRS FOR THICK SLAB - TO BE DESIGNED BY VE.
2. ALL DEVICES IN PLACE TO BE INSTALLED BEFORE INSTALLATION ON TOP REBAR FOR THICK SLAB.
3. STRICTLY NO ENTRY IN REBAR IN REBAR CAGES DURING TOP REBAR INSTALLATION.

PLANKS ON REBAR SURFACE TO PREVENT TRIPPING ON REBAR GAPS

Gammon BACHY SOLETAICHIE CR116 DESIGN AND CONSTRUCTION OF ANG MO KIO INTERCHANGE STATION AND TUNNELS Land Transport Authority

SAFETY HIGHLIGHTS FOR ENTRANCE 1-6

View in Section

STEP-2 CUT THE SPLAY STRUTS

STEP-3 REMOVE THE LACING

STEP-4 CUTTING HOLES IN THE STRUTS (DESTROYING)

STEP-5 CUT THE END OF THE STRUT

STEP-6 REMOVE THE STRUTS ONLY BY ONE

WHEN CUTTING, SECURE THE STRUTS WITH LIFTING HOOKS FROM THE CRANE ABOVE

CUTTING & REMOVING STRUTS

HAZARDS

1. EXPLOSION OF OXY-ACETYLENE TANK INSIDE THE STRUCTURE.
2. DROPPING OF STRUTS BEFORE LIFTING UP TO THE GROUND.
3. WORKERS MIGHT FALL FROM WALLERS OR SCAFFOLDS IF LIFTINES ARE NOT SECURED.

MITIGATION

1. ALL OXY-ACETYLENE TANKS AWAY BY LOCKED IN ABOVE SHEDDING
2. HOLES FROM OXY-ACETYLENE TANKS FOR CUTTING OPERATION MUST BE CLEARLY HIGHLIGHTED ALL THE WAY
3. ALL STRUTS MUST BE SUPPORTED OR HOUD BY CRANE DURING THE CUTTING OPERATION
4. WORKERS MUST WEAR SAFETY HARNES AND HOOKED TO THE LIFELINE ALL THE TIME

DETAIL OF STRUT DE-STRESSING (Section View)

Gammon BACHY SOLETAICHIE CR116 DESIGN AND CONSTRUCTION OF ANG MO KIO INTERCHANGE STATION AND TUNNELS Land Transport Authority



Technology Focus



People Focus



ENTRANCE 1-6

PAGE 29

1. Excavate to soffit of S3 strut.

Gammon BACHY SOLETAICHIE CR116 DESIGN AND CONSTRUCTION OF ANG MO KIO INTERCHANGE STATION AND TUNNELS Land Transport Authority

SAFETY HIGHLIGHTS FOR STRUT INSTALLATION

HAZARDS

1. FALLING OF STEEL STRUTS INTO THE EXCAVATION OPENINGS.
2. MOVEMENT OF THE LOADS MIGHT HIT AND DAMAGE THE PERMANENT & TEMPORARY WORKS.

MITIGATION

1. CRANE SET UP ON GROUND AND LEVEL SURFACE.
2. FATAL ZONE SHALL BE SET UP AROUND MACHINERIES.
3. LIFTING PLAN TO BE APPROVED BY LIFTING ENGINEERS.
4. EACH MEMBER OF LIFTING LOADS SHALL BE CHECKED BY ENGINEERS AND LIFTING TEAM.
5. TWO TAND-WIN SHALL BE USED TO CONTROL THE MOVEMENT OF LOWERING STRUT.
6. ENSURE THAT WORKERS ARE NOT REQUIRED TO WORK UNDER SUSPENDED LOADS.

Gammon BACHY SOLETAICHIE CR116 DESIGN AND CONSTRUCTION OF ANG MO KIO INTERCHANGE STATION AND TUNNELS Land Transport Authority

Using **Lightning** Alert system



- **Lightning alert system placed strategic locations at site**
- **Project Key personnel will receive the SMS alert**
- **WSHC/WSHO will post in the Contractors Chat Group for their immediate action**
- **Alerted when thunderstorm is within the 6km radius**



Novade E permits & E inspections

Digitising individual forms and processes is an easy way to start to build efficiencies into site operations and removing some of the cumbersome, manual processes involved. Get real-time visibility on PTW & Inspection applications on multiple locations on site. You do not need to be on-site to know what is going on. This

Reduce administration costs with easy data entry and reporting.

Increase accountability with rigorous approval process.

Gain traceability with digital signoffs and proper authentication technology.

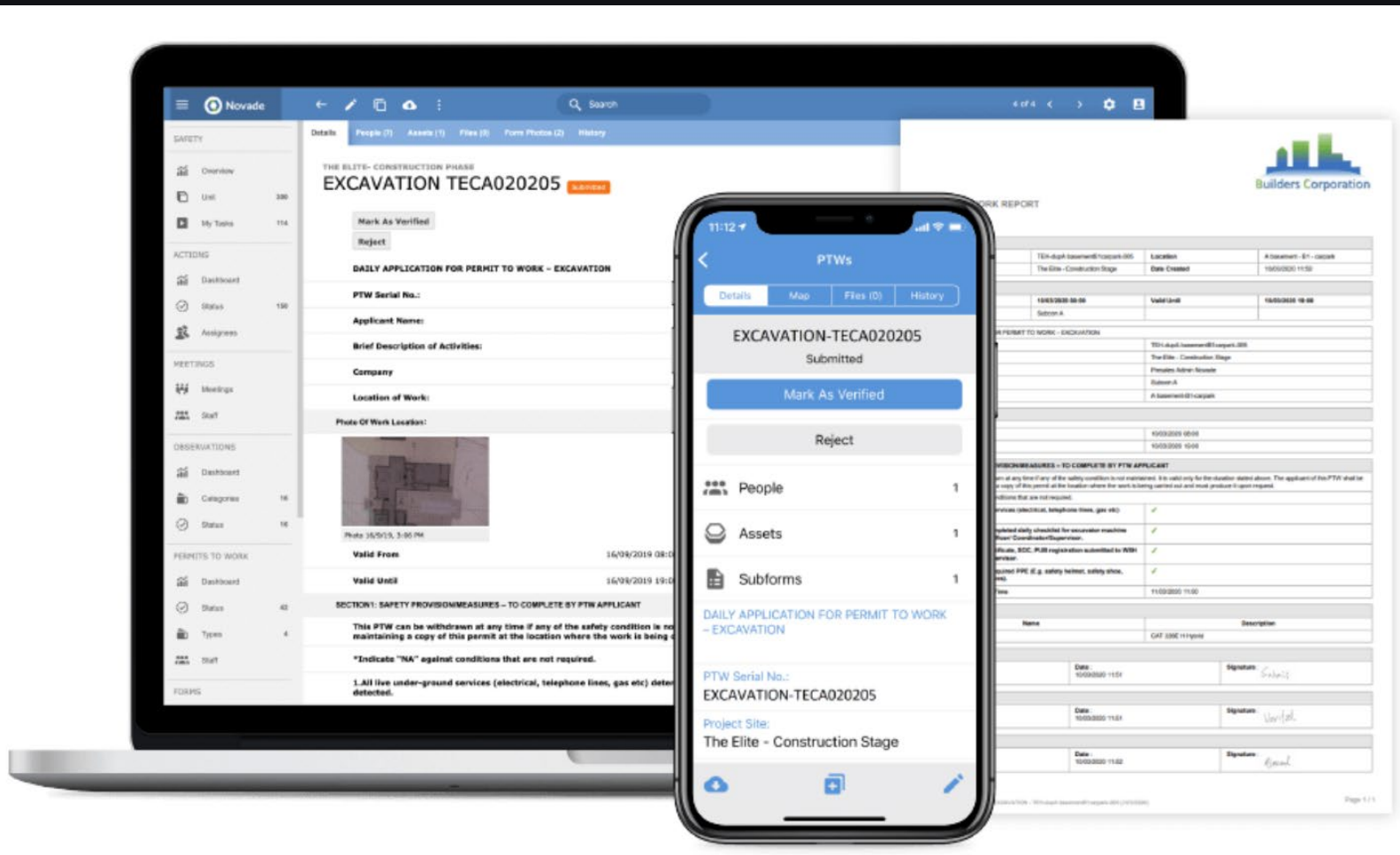
Reduce time taken for the submission and approval process. No more time wasted on paper-based systems – chasing forms and approvals before commencing work.

Enforce consistent standards across multiple sites and different types of work activities. Benchmark HSE performance across these sites with the data captured.

Drive HSE performance with analytics. Build insights on e.g., reasons for permit rejections. Link near misses or incidents to PTW applications.

Keep records safely in the cloud. Say goodbye to the thousands of manual forms.

Easily access and retrieve PTW records in case of an audit.





DIGITALISE PERMIT TO WORK / REQUEST FOR INSPECTION

3:35 96%
←

DETAILS FILES HISTORY

RFI-[NEW]
Draft

Zone
CR11/C2/Gridline 1-7/A-C

Type
Request for Inspection (Subcon)

Assignee

Scheduled Date
Today 12:00 AM

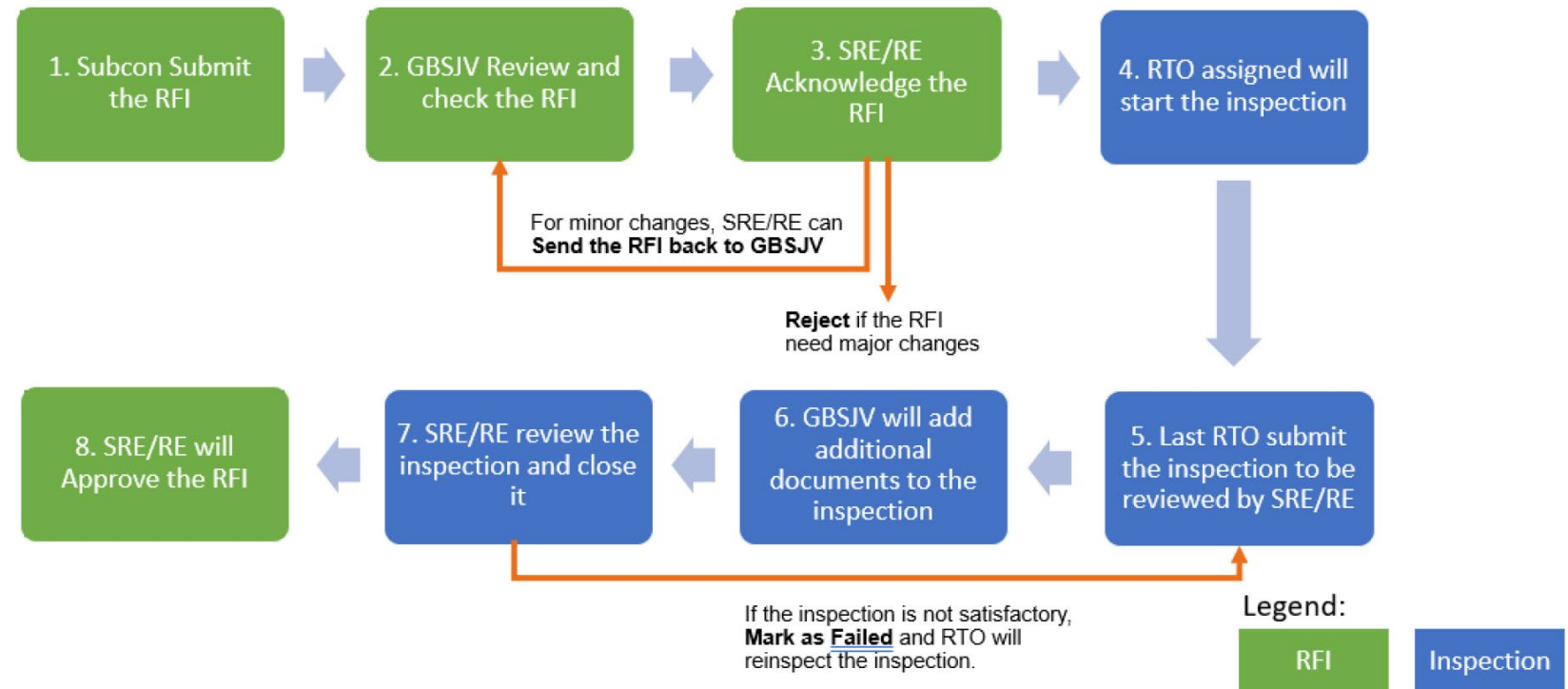
Proposed Date
Today 12:00 AM

Scope Of Work
A&A Works

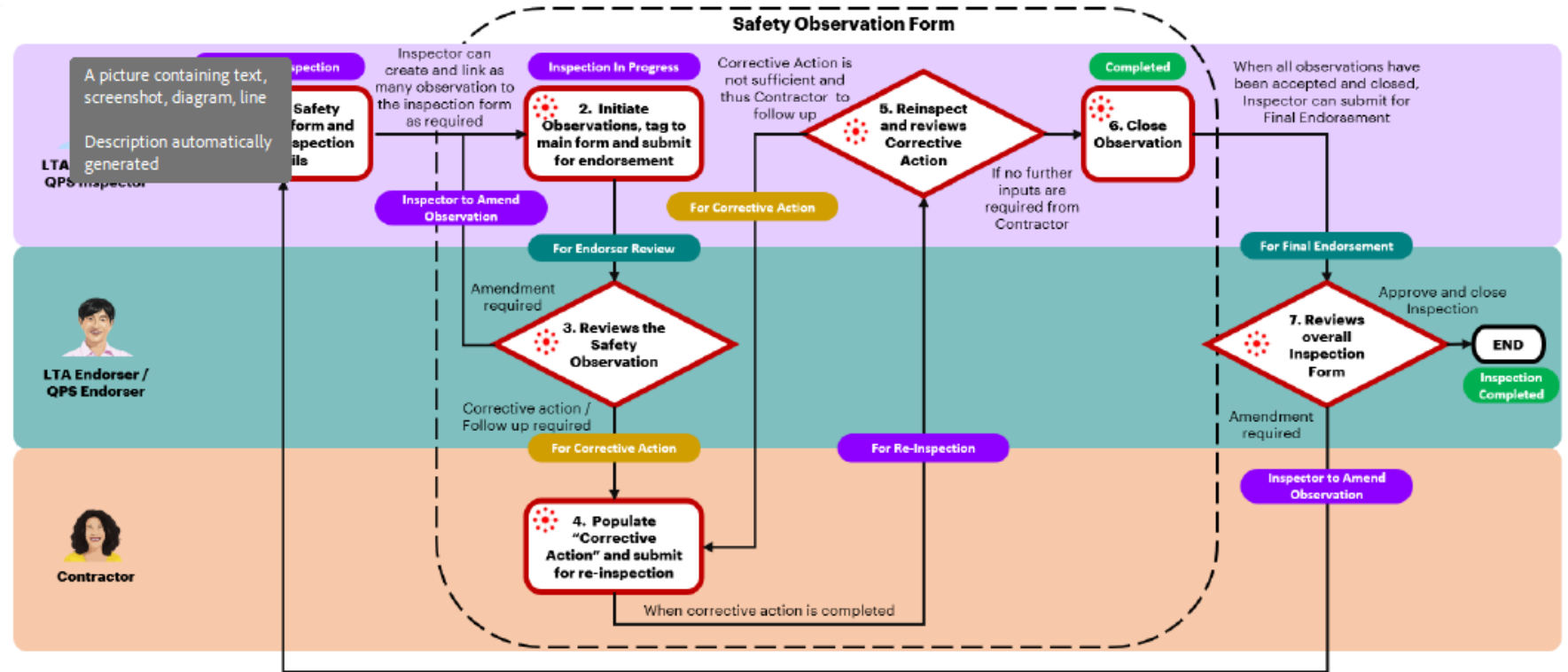
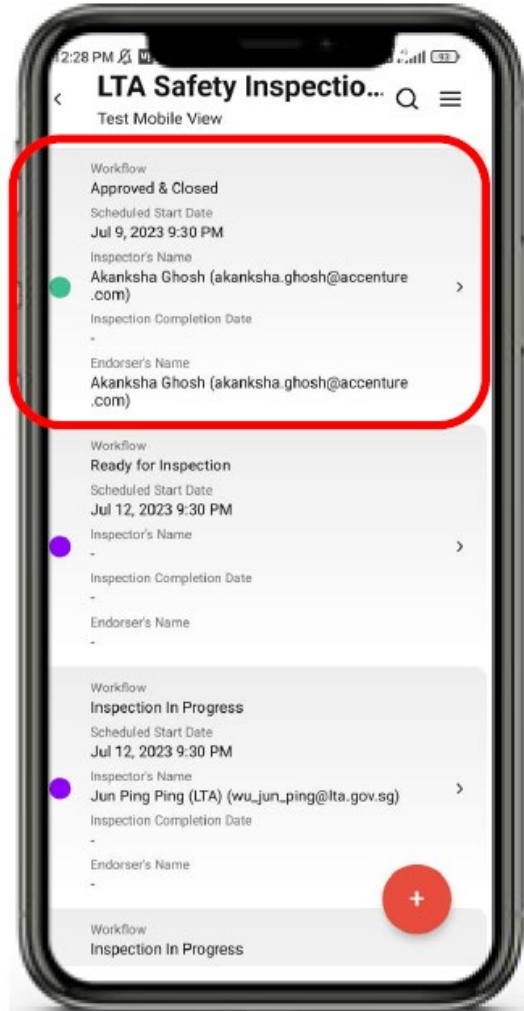
Main Form
Request for Inspection (Subcon)

SUBMIT

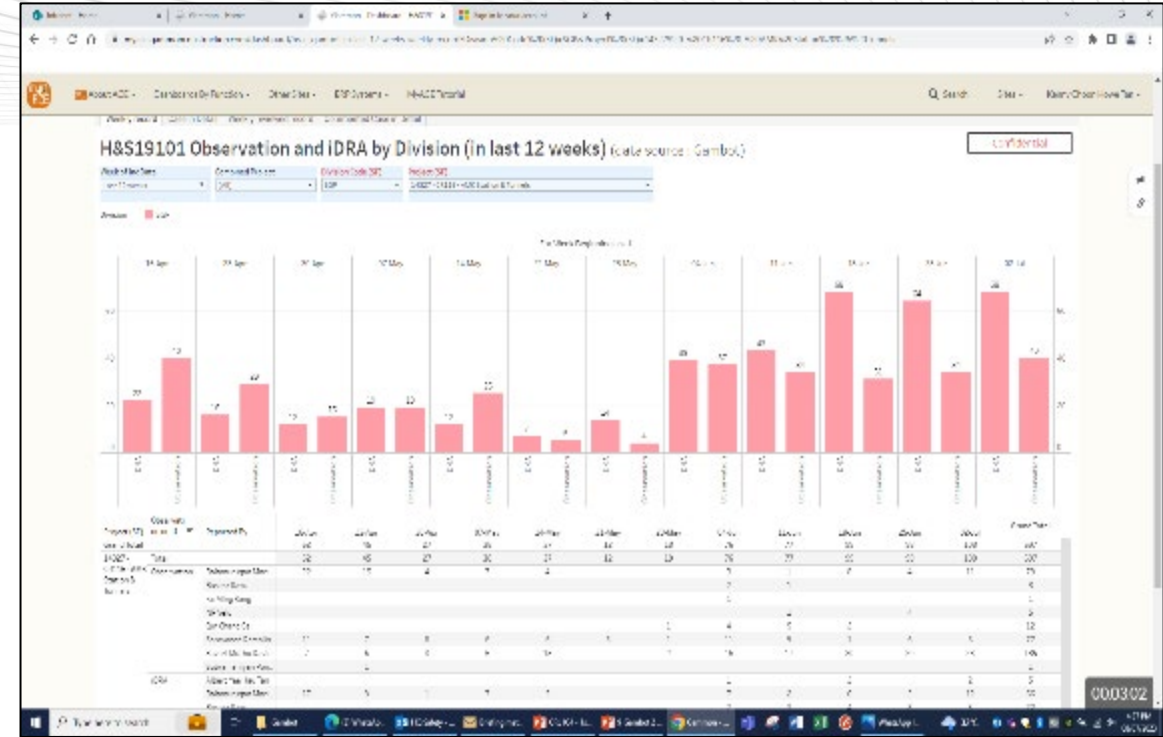
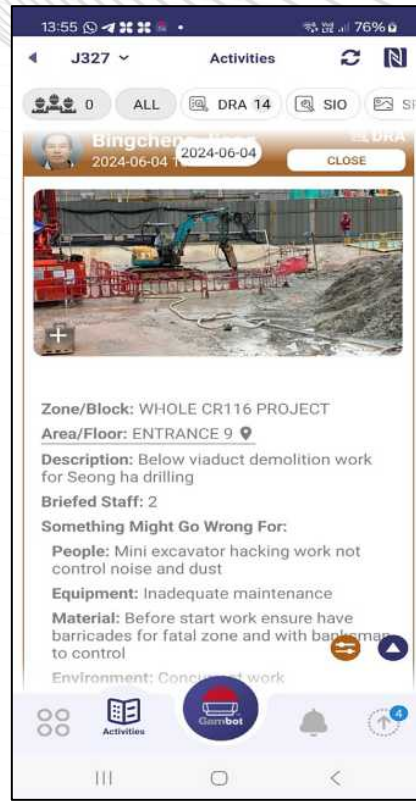
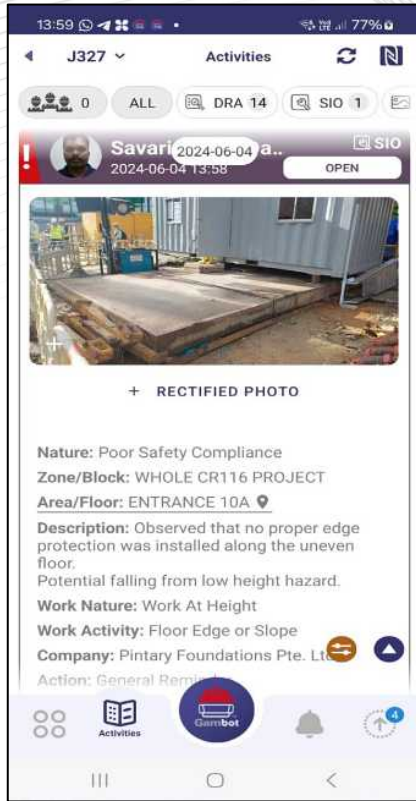
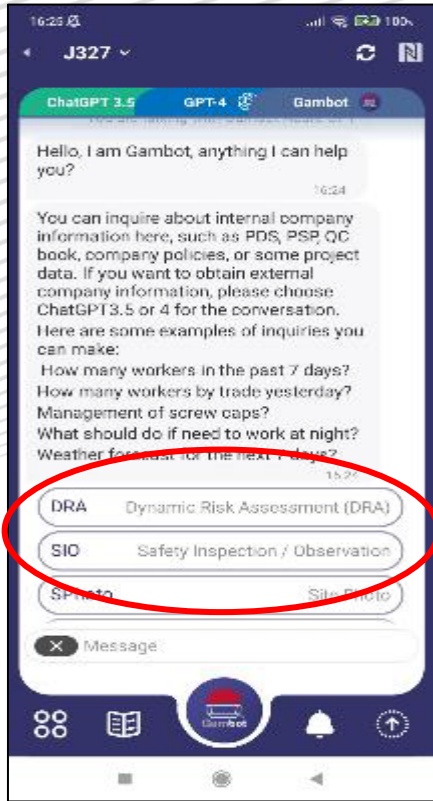
CR116's RFI Workflow



InSIGHT digital platform use for safety inspection and RFI



Gambot 2



Gambot 2 is an online that can be used on both desktop and handphone apps :

- Early intervention of hazard exposure and improve WSH standard on site and easy monitoring and cover wider area, save time and assess the data correctly.
- Conduct on-site risk assessment and remind the team to comply SWP. It is convenient in communication, can trace easily, save time and can assess by higher level.



SAFETY SYSTEM – SHAFT ACCESS SAFETY

1

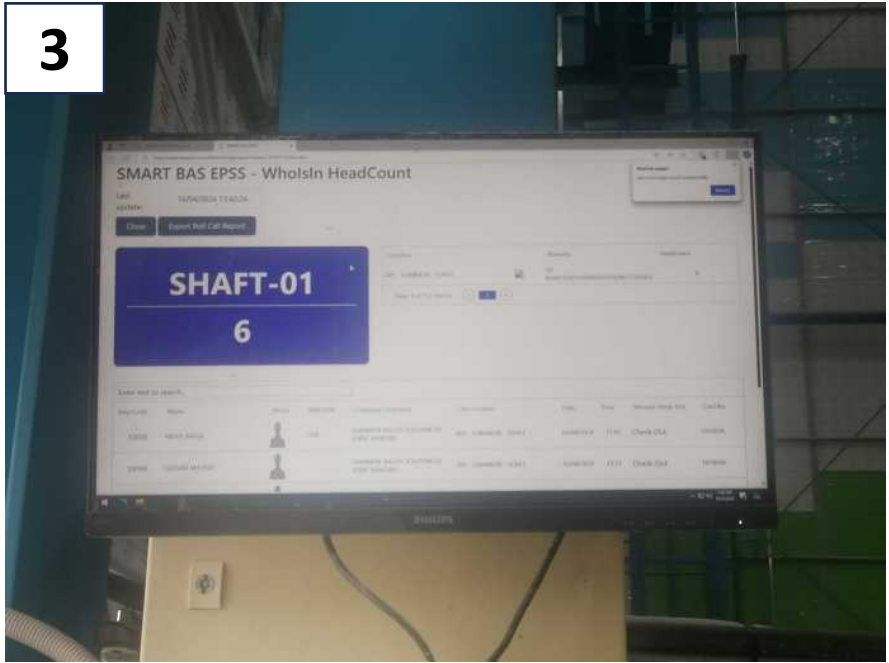


- 1) Provision of Modular Scaffold for safer and more rigid access into shaft vs Metal Scaffold system
- 2) Lux Level Test with sufficient lightings at Intermediate Launching Shaft (Accessway & Work Area)
- 3) RFID System for Tunnel Shaft
 - Live Head Count for Emergency Preparedness

2

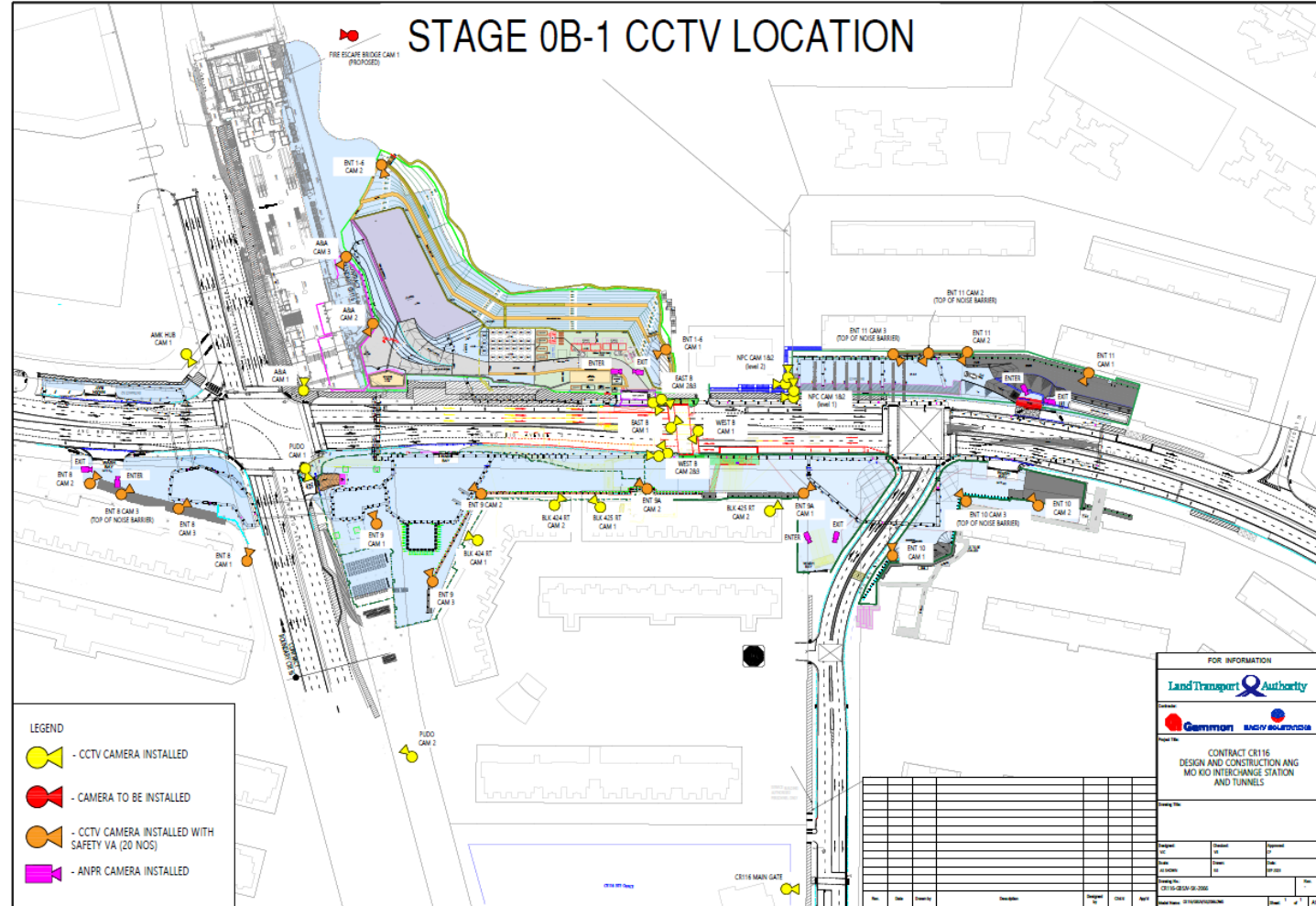


3



Video Analytics (VA Camera) : Accurate Detection of Safety Observation

Features of Video Analytics Camera	Description
Facial Recognition	Worker registration can be carried out
Pedestrian intrusion into Construction Vehicular Access	Detect the presence of workers within identified access for vehicle
Effective usage of personal fall arrest system for fall prevention measure.	Detect the usage of body harness for personnel working at height with continuous anchorage
Usage of safe means of access for working at height	Detect usage of platform ladders for access instead of A-frame ladder
Installation of physical barricade around heavy machineries to keep personnel away from operation zone.	Detect the presence of effective barricades to demarcate non-access zones
Installation of fall prevention measures at edge of structures and excavation	Detect the continuous presence of effective guard rails to prevent fall
Presence of competence workforce in the vicinity of high-risk activities.	Detect skillsets and credentials of personnel of the competent workforce and ensure no trespassing into hazardous area by unauthorized workforce.



Video Analytics (VA Camera) Accurate Detection of Safety Observation

15/04/2024 Mon 10:34:12
Ent 8 Cam 2

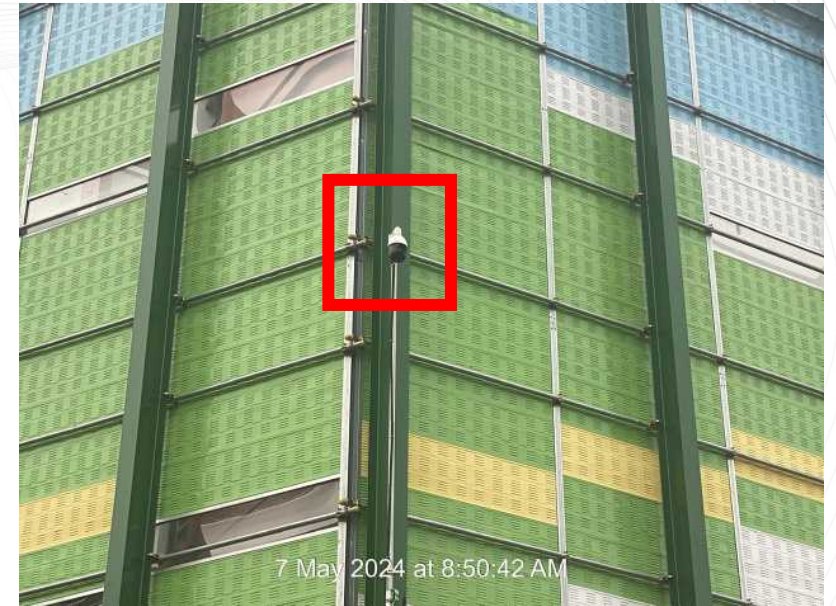


Invigilo, [Apr 15, 2024 at 10:34 AM]

Safety Observation – PPE Non-Compliance detected

Location: Ent 8 Cam 2

Video Analytics (VA Camera) Accurate Detection of Safety Observation



Invigilo, [May, 02 2024 at 10:32 AM]

Safety Observation –
1 people intruded in vehicular
access zone

Location: Ent 8 Cam 2

Heat Stress Management System - WBGT meter to monitor



Certificate of Calibration

CETM Calibration Laboratory

Customer:	Certificate Number: 202403669
Gammon-Bachy Soletanche JV 1 International Business Park #10-01 The Synergy Singapore, 609917	Date of Issue: 29-Apr-2024
	Calibration Date: 29-Apr-2024
	Due Date: 29-Apr-2025
	Calibration Type: As-Found
	Received Condition: Functional
Model: HS10	
Serial Number: 10886512	
Manufacturer: TRIPLETT	
Description: HEAT STRESS METER	
Procedure Name: Triplett HS10: 1YR/VER/DIR/MU/SAC	

This calibration is traceable to the SI units through recognised national measurement institutes (NMC, NPL, NIST, PTB, NIM, etc.), radiometric techniques, or natural physical constants. The reference standards used in the calibration are stated in page 2 of this report. The Laboratory Quality Management System complies with the requirements of ISO/IEC 17025:2017(E) and also operates generally in accordance with the principles of ISO 9001.

The calibration was performed using MetCal software procedure with name stated above. The method and type of calibration are identified in the procedure name; a detailed list of explanation of each term can be found under Note A in page 2 of this report. Calibration results reported herein refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument. The measurements were performed at room temperature of $23^{\circ}\text{C} \pm 1^{\circ}\text{C}$ and $(60 \pm 10)\%$ relative humidity.

The actual interval of calibration should be determined by customer based on their applications requirement. The Due Date stated above was with customer's agreement or instruction. This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from CE-Test & Measurement (S) Pte Ltd.

The reported expanded measurement uncertainty was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%. The random effect uncertainty component arising from UUT was not included.


Authorized By : Jay Yeo


Calibrated By : Wai Wen Liang

Page 1 of 3



**Deployment of WBGT
Meter with Tripod
Stand on site**



USING 4D BIM FOR SAFETY TRAINING



Ground Improvement works at AMK Ave 3 in front of ILS site



AMKTGE Stage 1 slope cutting works

- BETTER VISUALISATION FOR WORKERS' UNDERSTANDING OF THE WORKS
- WORKER ABLE TO "SEE" THE DANGER BEFORE WORK COMMENCED



RMF briefing the workers

SAFETY TRAINING



Safety time-out show video to workers



Safety time-out on fall from height



Safety time-out for lifting operation & heavy machine operators



Environmental Campaign on mosquitoes breeding & Dengue Fever Prevention



Traffic Management Safety



Shows slides to workers during the safety time out

Battery operated portable exoskeleton crane for drilling works



NOISE REDUCTION IMPLEMENTED FOR RESIDENTIAL AREA



12m Noise barrier



Full noise enclosure at launching shaft



Silent Up install at machine



6m inflatable noise ballon

White noise device converting High Pitch to Low Pitch

[Home](#) / [Products](#) / [Parts](#) / [Vehicle Safety](#) / [Brigade Reversing & Vehicle Safety](#) / [Brigade Warning Alarms](#) / [Brigade BBS-Smart \(Self Adjusting\) Reversing Alarm](#) / [Brigade White Sound SA-BBS-97 SMART \(Self Adjusting\) Reversing Alarm 12-24 Volts – 77-97 Decibels \(A1399\)](#)



Brigade White Sound SA-BBS-97 SMART (Self Adjusting) Reversing Alarm 12-24 Volts – 77-97 Decibels (A1399)

£74.70 exc. VAT

Brigade BBS 'White Sound' SMART 12/24v reversing alarm. Self adjusting, suitable for medium duty use. From 77-97 decibels. Comes with lifetime warranty.

1

[Add to basket](#)

 [PayPal](#) Pay in 3 interest-free payments of £24.90. [Learn more](#)

Product Description

[Brigade White Sound SA-BBS-97 SMART \(Self Adjusting\) Reversing Alarm 12-24 volts – 77-97 Decibels](#)

Brigade BBS 'White Sound' SMART 12/24v reversing alarm. Self adjusting, suitable for medium duty use. From 77-97 decibels. Comes with lifetime warranty.

- 12-24 Volts
- 36-80 Volts (HV)
- IP68
- Size (WxHxD) 127 x 76 x 65mm
- Lifetime warranty

Brigade Reversing Alarms

Reversing 'beep beep' alarms were first introduced to Europe in the 1970s. They provided a vital step forward in safety, yet over time they have been shown to have a number of inherent problems; specifically concerning their environmental impact, but also in terms of safety – the exact reason they were introduced in the first place. Advances in technology mean there is now a much better alternative.

bbs-tek® white sound® alarms are a revolutionary new generation of warning alarm. They are the safest reversing alarms in the world and do not cause a noise nuisance. Already fitted across a range of industries from mobile plant machinery to airport luggage buggies, bbs-tek® is fast becoming the reversing alarm of choice. In fact, in New York City it is the only alarm permitted on construction vehicles. Brigade's vision is to ensure that every commercial vehicle is fitted with a white sound alarm to reduce reversing fatalities.



White noise generator

Mosquito Eliminator Device Installed at site



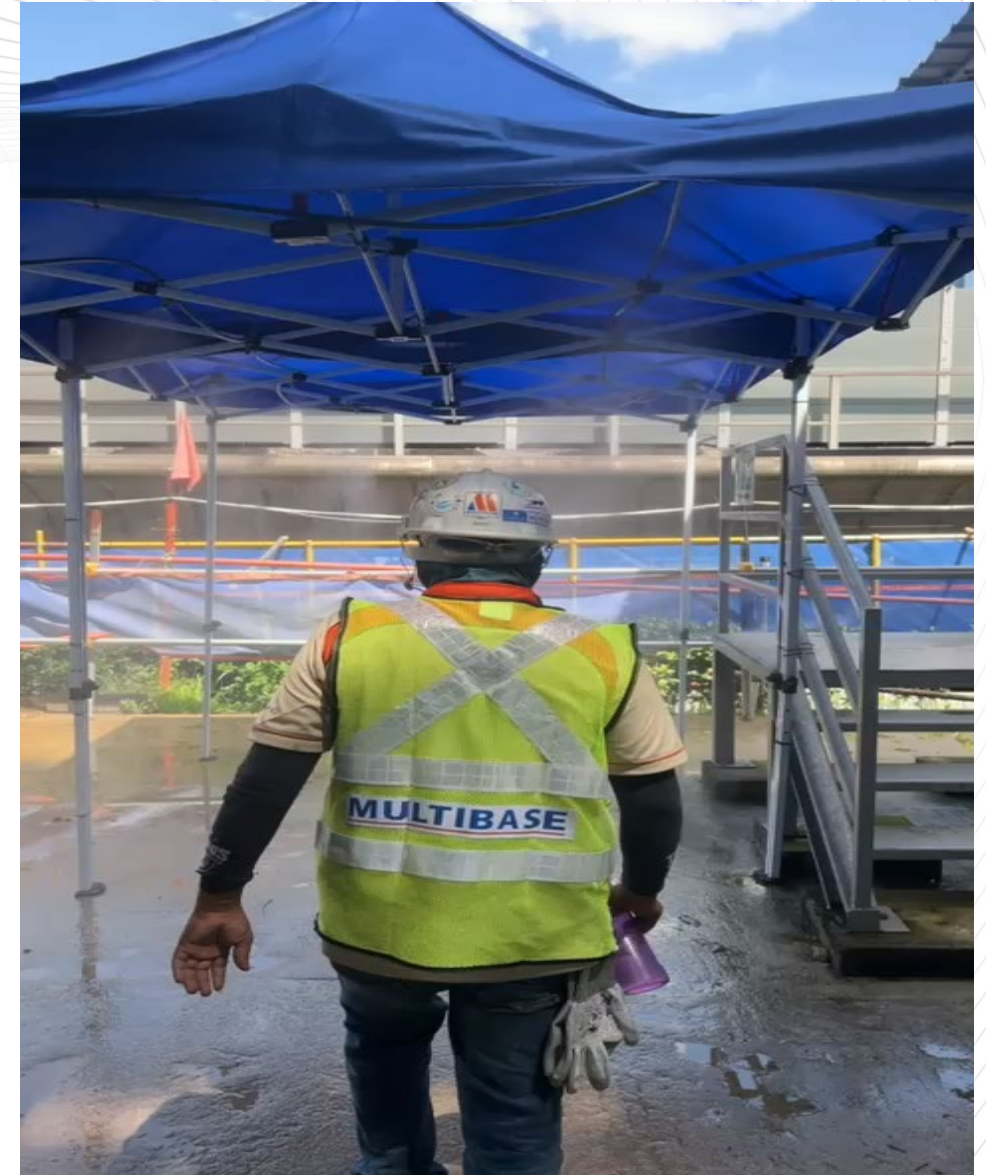
It's an innovative and effective solution to kill Dengue and Zika mosquitoes from the surrounding area. It's cost-effective, eco-friendly, durable, and maintenance-free.

MN Ultron device is an innovative solution that kills mosquitoes with Dr. K solution chemical approved by NEA without harm to your health or environment.

It's a cost-effective alternative that works perfectly with its compact design and long-lasting Solar Panel of up to 30 days on standby mode! Our device has been tested in many countries around the globe with a great success rate!

<https://www.youtube.com/watch?v=FLDMOJg6b>

Provision of cool zone misting station



WORKER'S WELFARE



Worker's Voice Meeting



Diwali Celebration for Workers



Monthly Safety Award



Winner Cultural Dancing



Winner Cultural Dancing



Hari Raya Celebration for Workers



Fruit Sharing Day



Birthday celebrations



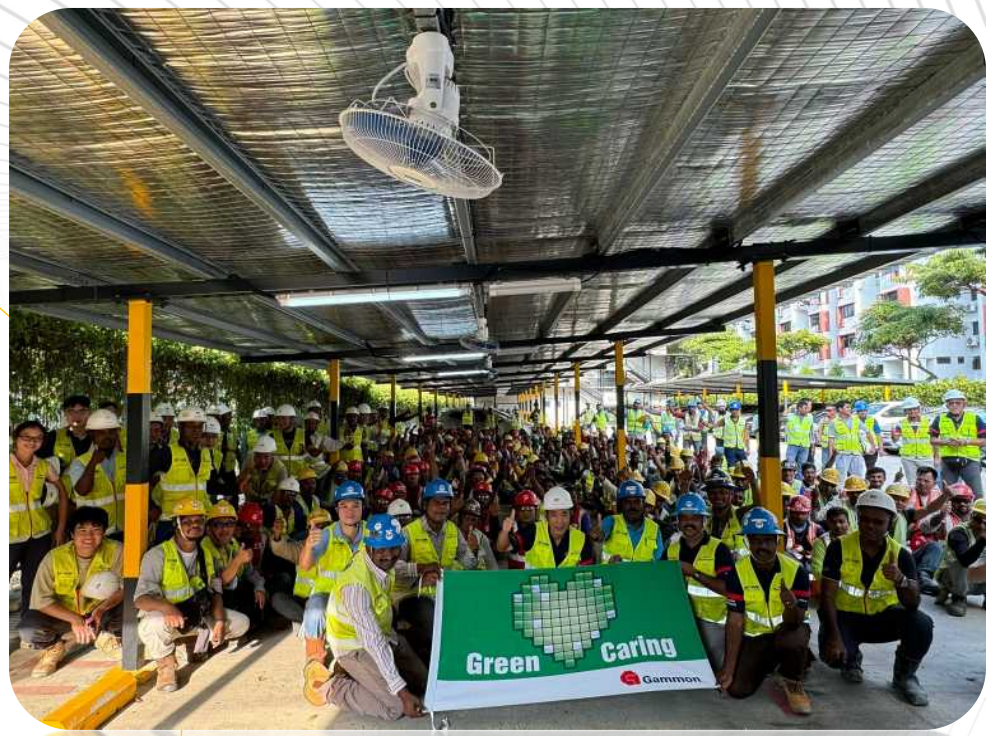
Hari Raya Lunch for Workers



Hari Raya Lunch for Workers



Safety Sharp Award



Safety Award



WSH Best Supervisor Award

Green & Caring Site Commitment Award

Thank you

