Digitalization Journey of Smart Operation & Maintenance (D&M) with Augmented Reality

Presented by Ir LEE Che Kit Chief Engineer / Digitalisation & Technology Division, EMSD

29 July 2022



EMSD's Engineering Services



Regulatory Services

- Regulation of electricity, gas, lifts and escalators, amusement rides, railway safety
- Promotion of energy efficiency, emission reduction and the use of renewable energy

Trading Services

- Professional E&M engineering services to various government departments and public institutions
- One-stop E&M and vehicle engineering services, including project management, procurement, O&M, etc.

1,000,000+E&M Systems / Facilities

8,000+ Venues in HK





Digitalised E&M Engineering Solutions







← J000866367-01

ASSIGNMENT

HEATING, VENTILATION & AIR-COND INST

JOB

OVERVIEW TECO Status: N/A Work Centre: B89E0 Priority:*

Urgent

MAT: C01 Equipment:

SLA Covered Job

Functional Location:

(AMSHQ-AC) Created By:

ADMIN

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DETAILS & CCS DATA

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Energy Audit Form 能源審核表格

EMSD's 2nd 5-year Plan



E&M Digitalisation

Through continuous innovation, EMSD strives to provide digitalised and innovative engineering E&M solutions to clients in maximizing public values – 3 strategies involve:

- 1. Provide digitalised E&M services and innovative solutions for smart city development and policies in response to climate change
- 2. Establish Professional expertise with global perspectives and best practices for digitalisation
- 3. Embrace innovative technology, collaborate with trade partners, and promote digitalisation of E&M services





BIM for Asset Management (BIM-AM) as the basis for E&M digitalization

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The Development Bureau (DEVB) BIM Roadmap



*Extracted from DevB Secretariat Report

Submission Hub

DEVB Technical Circular

Building Information Modelling for Asset Management (BIM-AM) Standards and Guidelines

Update of BIM-AM Standards and Guidelines in Progress

Version 21

2019



香港特别行政區政府 The Government of the Hong Kong Special Administrative Region 政府總部 Works Branch

發展局 工務科 香港添馬添美道2號 政府總部西翼 18 樓

Ref : DEVB(W) 430/80/01 Group : 2, 5, 6

Development Bureau Technical Circular (Works) No. 12/2020

Adoption of Building Information Modelling MANDAI for Capital Works Projects in Hong Kong

Development Bureau

Government Secretaria

18/F, West Wing, Central Government Offices 2 Tim Mei Avenue, Tamar,

Hong Kong

23 December 2020

Scop

This Circular sets out the policy and requirements on the adoption of Building Information Modelling (BIM) technology.

2. This Circular applies to works either by government staff, consultants or contractors

Effective Date

This Circular takes effect on 1 January 2021.

Effect on Existing Circulars and Circular Memoranda

This Circular supersedes DEVB TC(W) No. 9/2019.

BIM Uses

Works Departments shall adopt the stipulated mandatory BIM uses in 1 respective stages of a project. Works Departments may adopt the optional BIM uses when necessary.

		BIM Use	Investigation, Feasibility and Planning	Design	Construction
	1	Design Authoring	Mh	М	М
	2	Design Reviews	Mh	М	М
	3	Existing Conditions Modelling	Mi	М	М
	4	Site Analysis	Mi	Μ	
	5	3D Coordination		М	М
	6	Cost Estimation	0	Mª	Mb
	7	Engineering Analysis		\underline{M}^{l}	\underline{M}^{l}
	8	Facility Energy Analysis		0	0
	9	Sustainability Evaluation	0	Mj	Mj
	10	Space Programming	0	Mc	
	11	Phase Planning (4D Modelling)		Mď	М
	12	Digital Fabrication		Mk	Me
	13	Site Utilization Planning			Mf
	14	3D Control and Planning			M ^m
	15	As-Built Modelling			М
	16	Project Systems Analysis			0
	17	Maintenance Scheduling			Mg
	18	Space Management and Too to			0
	10	Asset Management			M ⁿ
	20	Drawing Generation (Drawing Production)		М	М
Legend:					
Space Management and Tracking			g		
Asset Management					
Drawing Generation (Drawing					м

Annex 1

Asset Management

In addition to enhancing productivity and reducing risks and costs of 17. capital works projects, BIM technology can also optimise operation and

DEVB TC(W) No. 12/2020

Mn

Page 4 of 17

maintenance. WDs should critically review their departmental asset information requirement and management strategy in order to leverage the information contained in the BIM models to facilitate asset management over the whole asset lifecycle. Therefore, WDs should proactively collaborate with their maintenance agencies of the built assets to agree on a standard practice for handover of as-built BIM models and documentation which contain the essential asset information requirements (AIR) to facilitate effective asset management.



19



BIM-AM Journey



BIM and BIM-AM



BIM combines data from multiple devices & systems



Equipment Information (e.g. Equipment manual)

Equipment Operation Data (e.g. Power consumption)



Maintenance Records (e.g. Parts replacement)













BIM-AM and Digital Twin to Streamline O&M Workflow



A Step Forward... 5G Smart Glasses

- Leverage on innovative technologies to set up remote support
- Real time remote assistance from backoffice
- Back-office can grasp the real time situation of the sites
- Free two hands for works
- Interactive collaboration enhances teamwork efficiency
- Save travelling time and cost

Smart Glass- Mixed Reality MR Technology





A Step Forward... 5G Smart Glasses

Back-end



Digital white Board

 Communicate through Notebook/ Desktop/ Tablet

Front-line



Mobile Devices

Version 1.0

<image>

Version 2.0

Smart Glass-Mixed Reality MR Technology



What is Mixed Reality (MR)



Virtual Reality (VR)

 Immersed in a fully artificial digital environment

Augmented Reality (AR)

- Overlays virtual objects on our physical world with spatial registration
- Not a artificial environment (VR)

Mixed Reality (MR)

- Integration of real and virtual worlds
- Real time interaction with physical and digital objects





Traditional VS Smart O&M

Traditional

Difficulty in locating asset

X

- Low accuracy for locating by 2D Drawing
 - Decrease in maintenance efficiency as instability

Daily Maintenance



Smart O&M

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Traditional VS Smart O&M



Difficulty in handling multitask

Difficulty in communication with on-site staff

Difficulty in grasping on-site situation for assistance

Emergency Response

Real time two-way communication

High accuracy in providing guidance for O&M

High efficiency because of hands-free advantage



Other Possibilities of 5G Applications





5G Implications for Robotic Applications



- Real-time data transmission
- Teleoperation and telepresence with robots
- Cloud-powered AI, without the need of pre-programming for decision making
- High transmission rate for video streams, point clouds, etc.

5G Robot Trial in Community Isolation Facility (CIF)

- 5G-based quadruped robot
- Supplies delivery in the CIF since Mar 2022
- Adapt to different environment, e.g. grass, slope and stairs
- ✓ Reduce infection risks
- ✓ Alleviate manpower pressure in the CIF







Potential 5G Robotic Applications for O&M Purpose

- Routine/ designated inspections in plant room areas
- Obtain environmental information and identification information of sensing equipment
- Real-time live video streaming

✓ Remote monitoring to cope with sudden shortage of workers e.g. epidemic outbreak

✓ Prevent industrial hazards for extreme environment

 \checkmark Reduce inspection time and labour costs





International Reference in Robotic Trials for O&M Purpose



Perimeter-fencing security checks at the Hans Christian Andersen Airport for signs of damage in real time.

Autonomous inspections at National Grid sites, identifying hotspots and problems in the station components.

Ericsson-powered 5G unleashes Spot the robot for airport inspection

Available in English 日本語 简体中文

If you flew in or out of Hans Christian Andersen airport near the Danish city of Odense recently and glanced out the window, you might have seen a four-legged robot called Spot freely patrolling the perimeter fencing and checking for damage. But this was no fairy tale. The robot was real and connected to TDC NET's Ericsson-powered 5G. The 5G use-case trial was a partnership with the Danish Technological Institute.

NEWS | MAR 08, 2021

5G Innovation Networks #5Gusecase



Spot the robot patrols Hans Christian Andersen Airport perimeter fencing



5G Drones

- Automated inspection system based on 5G and drones technologies
- Drone data and videos captured transmitted over 5G
- Drone platform that provides flight task scheduling, waypoint flight, and data acquisition and analysis services with AI algorithm





Potential 5G Drone Application - Automatic PV Panel Inspection





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Summary

5G drives new opportunities to improve public services

- ✓ Supports new generation of innovations e.g. VR, MR, Metaverse
- ✓ Improves end user experience
- ✓ Optimize service efficiency
- ✓ Enhance traditional business workflow





Thank you.

