Building Information Modelling – Asset Management - Railway Safety (BIM-AM-RS) to Enhance Railway Safety in Hong Kong

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- Objective
- BIM-AM-RS on enhanced staff training
- BIM-AM-RS on predictive maintenance
- E&M InnoPortal

Objective

Extend the usage of BIM for asset management to enhancement of railway safety:

- improve operation safety and reliability
- enhance staff competence via 3D interactive training



Enhanced Staff Training

Simulate past railway incidents for staff training





VR Training with Haptic Suit







Enhanced Staff Training

Progress:

- EMSD provided sample training modules to MTRCL to promote BIM-AM-RS VR training
- MTRCL will develop more BIM-AM-RS VR training modules using haptic suit by end 2019







Predictive Maintenance

- IoT for major railway systems
- Al algorithm for data analytics & providing alerts before equipment failure
- Health indices to keep track of asset conditions
- Visualize system performance via 3D BIM environment



Predictive Maintenance - Implementation Framework



Real Time Monitoring of Railway Assets



Dissolved Gas Analysis (DGA)

(i) Monitoring of Power System



(ii) Monitoring of Stray Current





(iii) Point Switch Monitoring

(iv) Rail Crack Monitoring

u mm 4 mm 4 mm 4 mm 4 mm 5 mm

(v) Pantograph /

OHL Monitoring

Partial Discharge (PD)



(vi) Monitoring of Escalator

Facilitate MTRCL's new technologies implementation

System	2017	2018	2019	2020	2021	2022	2023	Beyond
Others Original Manifesting								
Stray Current Monitoring								
- Installation Completed								
Rail Crack Monitoring								
 Installed with on-board optical cameras 								
- Install in new trains of other lines								
- System learning and tuning for accuracy								
Pantograph / OHL Monitoring								
- Installed in two lines (IR and optical cameras)								
- Install in two other lines with AI analytics and alert								
- System learning and tuning for accuracy								
Power System								
- Install sensors for transformers and switchgears								
Point switch monitoring								
- Install sensors for railway lines								
- System learning and tuning for accuracy								
Escalator								
- Install sensors and devices								
- Data collection, system learning and tuning for accuracy								

Completed

Planning

(i) Monitoring of Escalator

Small objects detection: issue real time alert to station staff



(i) Monitoring of Escalator

Bulky objects detection: issue warning messages to passengers and alerts to station staff



(i) Monitoring of Escalator

Condition Monitoring

• Phase 1 Determine Health Condition of Escalators (Q1-Q4 2019)



- Phase 2 Predictive Maintenance and Real Time Alert (mid 2019 to Q4 2020)
 - To formulate the data modelling and AI analysis for abnormalities





- Phase 1: Train borne pantograph and OHL monitoring system installed
 - IR camera for arcing and high temperature monitoring
 - Optical cameras for monitoring of pantograph and OHL structural movement
 - Maintenance staff to review records



Installation



Cantilever monitoring



Arcing and High Temperature Detection at Section Insulator

Phase 2: Optical & infrared cameras with AI engine providing real time alert

- Two sets to be installed
- Will expand to other train lines on Q1 2021 to mid-2023



Detect repeated arcing alarms

Detect signs of arcing and high temperature on section insulator

Trackside 3D cameras installed in Jul 2019





Mongkok East Station

Visit overseas countries to appreciate the use of new technologies







Real time detection of pantograph defects

Overhead Line /

Cantilever

10829

KTL UP

102.79

4.475

Building Information Modelling - Asset Management for Railway Safety (BIM-AM-RS) 11 October 2019 11:48 User : Tom CHAN Overview Equipment 3.1 🙄 **Overall Health Index** 天水園 Tin Shui Wai 羅湖 Lo Wu 上水 Sheung Shu Up Top Risk Asset 太和 Tai Wo 大埔城 Tai Po Market 大學 第一城 City One 馬鞍山 Ma On Shan 島渓沙 Wu Kai Sha 粉嶺 石門 大水坑 恆安 0 Equipment 💵 Health Index 朗屏 落馬洲 Lok Ma Char 兆康 火炭 O D 馬場 Fo Tan O O B B B Raceco 沙田園 Sha Tin Wa 83829 **KTL UP** 96.92 5.925 Transformer Siu Hono 元朗 50157 KTL UP 82.61 5.4 Transformer 新界 沙田 C 車公廟 錦上路 Point Machine 56827 **KTL UP** 107.99 5.525 荃灣西 大团 🖨 **KTL DOWN** 110.93 5.075 Point Machine 11662 A Pantograph 65936 **KTL DOWN** 105 5 5.425 荔景 Lai King 九龍塘 Kowloon Tong 長沙灣 鑽石山 彩虹 Diamond Hill Choi Hur 荃灣 Tsuen 大窩口 葵興 葵芳 Kwai Fong 美孚 深水埗 樂富 Lok Fu 黄大仙 Wong Tai Sin Tai Wo M 九龍灣 97520 **KTL DOWN** 63.85 5.15 Pantograph Bay 荔枝角 Lai Chi Kok 石硖尾 太子 Prince Edward Pantograph 18063 KTI UP 106.51 4.875 牛頭角 Ngau Tau Kok 資琳 Po Lam 南昌 Overhead Line / 69558 **KTL UP** 60.26 5.85 旺角 Mong Kok 旺角東 Mong Kok East 速增加 觀塘 Cantilever 坑口 Hang Hau Kwun Tong 油麻地 Yau Ma Tei 47746 **KTL DOWN** 61.99 5.575 Overhead Line / 奧運 藍田 Lam Tir 欣澳 Cantilever 機場 將軍澳 佐敦 Jordan 何文田 Ho Man Tir Airpor Ō 迪士尼 Dis 柯士甸 尖沙咀 油塘 調景嶺 Yau Tong Tiu Keng Leng 九龍 eyland R 0 黄埔 Watch List d 東涌 Tung Chung 副門 Ngang Pag 246 34 康城 LOHAS Park 红磡 Hung H 香港西九龍 尖東 East Tsim Sha Tsui 大嶼山 82.61 5.4 Transformer 50157 KTL UP 香港 Transformer 83829 KTL UP 96.92 5.925 香港大學 西灣河 Sai Wan Ho 堅尼地城 西营盤 Sai Ying Pun 上環 中環 Central 灣仔 Wan Chai 銅鑼灣 天后 炮台山 北角 鰂魚涌 太古 Tai Koo 金鐘 Track 38940 KTL UP 128.48 0 ----Track 83424 KTL UP 108.7 0 筲箕灣 Shau Kei Wan ---- 油土紅线 — 5用线 o 海洋公園 Ocean Park ALARIA William Char 2.25 - 神品線 -港島 Stray Current 81989 CHH 杏花邨 Heng Fa Chuer 0 - -10 黄竹坑 Point Machine 78023 **KTL DOWN** 113.26 3.975 - NAULE ABME Wong Chuk Han 教品影响 ____ _____N110,8,95 0 0 柴灣 Chai Wan O 海怡半島 利東 LeiTung Point Machine 11662 **KTL DOWN** 110.93 5.075 0-0 Litter Real O-O WHEM * 1100 1010 Pantograph 97520 **KTL DOWN** 63.85 5.15

Building Informatio	Logout														
		11 October 2019 11:32													
Overview	Overview Equipment														
Q Search Box	Equipment Type	Asset ID 🎝 🎝	Make	Model 1	Year of Service	Serial No. 🌐	Line l†	Distance (km)							
Input Asset ID Q Chainage	Transformer	26460	Siemens	SR16	6	DC21818232075	KTL UP	100.64							
Station : YMT Line : All From : km To : km System / Equipment Type Power System P-Way Signalling Rolling Stock Station Equipment CO	Transformer	92250	Hyundai	SD84	1	LC6893863313	KTL DOWN	100.34							
	Track	83424	Trackwork	KQ12	11		KTL UP	108.7							
	Track	89310	Trackwork	NT75	3	-	KTL DOWN	112.62							
	Switchgear	58309	ABB	XP7	9	EH25957062735	KTL DOWN	101.12							
	Switchgear	81783	Siemens	MM6	1	BQ11645199960	KTL UP	107.36							
	Stray Current	49754	-	-	-	-	YMT	-							
	Power Cable	22441	AFL Global	ZA97	8	-	KTL DOWN	104.2							
	Point Switch	78023	Thales	EV3	11	GF59327189873	KTL DOWN	113.26							
	Point Switch	56827	Thales	PB99	10	EC95180000913	KTL UP	107.99							
	Point Switch	51486	Thales	TX30	12	IU93114215436	KTL UP	109.53							
	Point Switch	11662	Thales	DY78	9	ZT64651658253	KTL DOWN	110.93							
	Pantograph	18063	CRRC	FV26	12	FS8734959069	KTL UP	106.51							
	Pantograph	65936	CRRC	YM65	7	FU79193629611	KTL DOWN	105.5							
	Overhead Line / Cantilever	10829	TE Connectivity	BU68	6	FQ21688435843	KTL UP	102.79							
	Escalator	27033	Kone	GK67	4	MT38413696201	YMT	-							





Building Information Modelling - Asset Management for Railway Safety (BIM-AM-RS)

11 October 2019 11:44 User : Tom CHAN Overview Equipment Real Time Monitoring Q Search Box 3 Q Input Asset ID Pantograph Thickness (mm) Chainage Health Index 4.875 20 Station : All Location KTL UP 106.51km Make CRRC 15 All Line : Model FV26 From : km To : km Year of Service 12 10 System / Equipment Type Serial No. FS8734959069 Power System Incident History P-Way 5 Signalling X Maintenance History Rolling Stock 0 Pantograph Documents 4 Station Equipment -5 GO -500 -400 -300 -200 -100 0 100 200 300 400 500 Building Information Model Position (mm) Kooldikte grafiek Carbon profile 3D View Carbon position: - Laser position - Image position: Analyse details Pantograaf 1, Koolstrip 2* Value Status Alarm Rule Alarm Limits Label Measurement 1 J Gier hoek (Yaw) 0.3° Ok Rolhoek (Roll) 2 1 0.1° Ok Stamphoek (Pitch) -0.7° 3 1 Ok --4 1 Dikte koolstrip 9 mm Ok -and a state Opdruk 5 1 4 mm Ok -6 Y Opdruk kracht 104 N Ok --

E&M InnoPortal

https://inno.emsd.gov.hk/en/it-wish-list/index.html





ENERGY DATABASE MANAGEMENT SYSTEM (MATCHED WITH I&T SOLUTION S-0049) (MATCHED

E&M InnoPortal

 Cooperation agreement signed on 11 June 2019 with 12 academic and research institutions to promote I&T in government



Thank You

