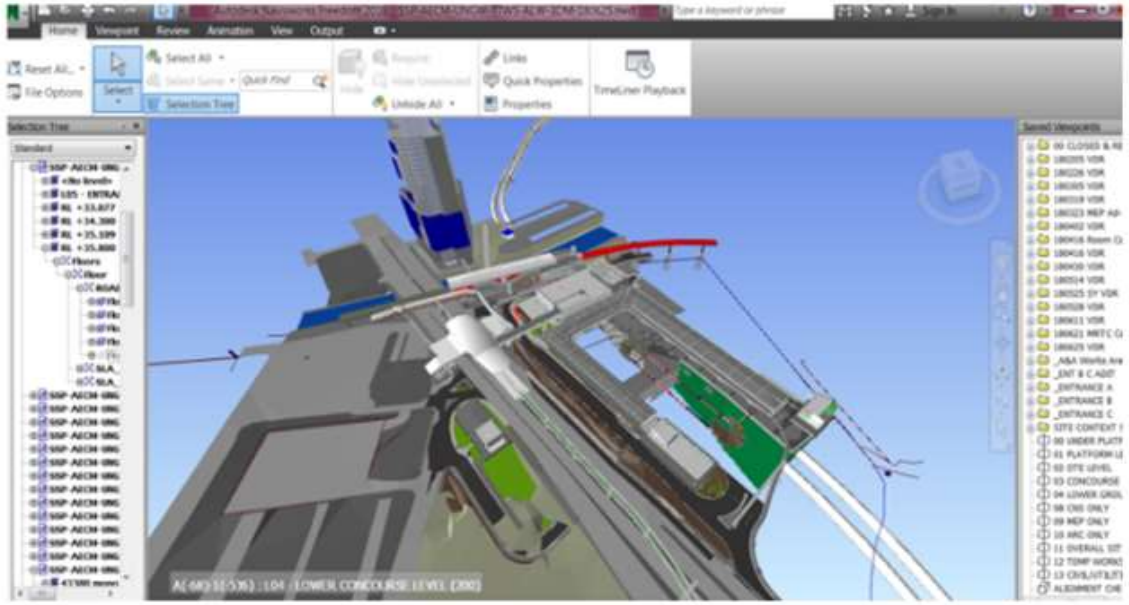
MMC-GAMUDA
KVMRT (T) SDN BHD

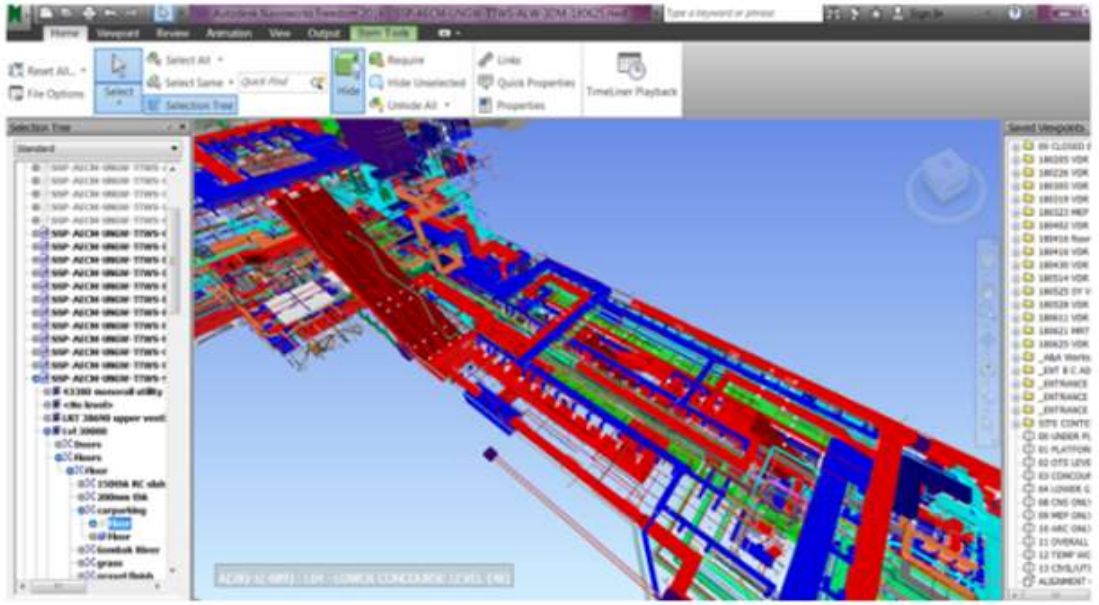
Digital Implementation and Adoption by MGKT.

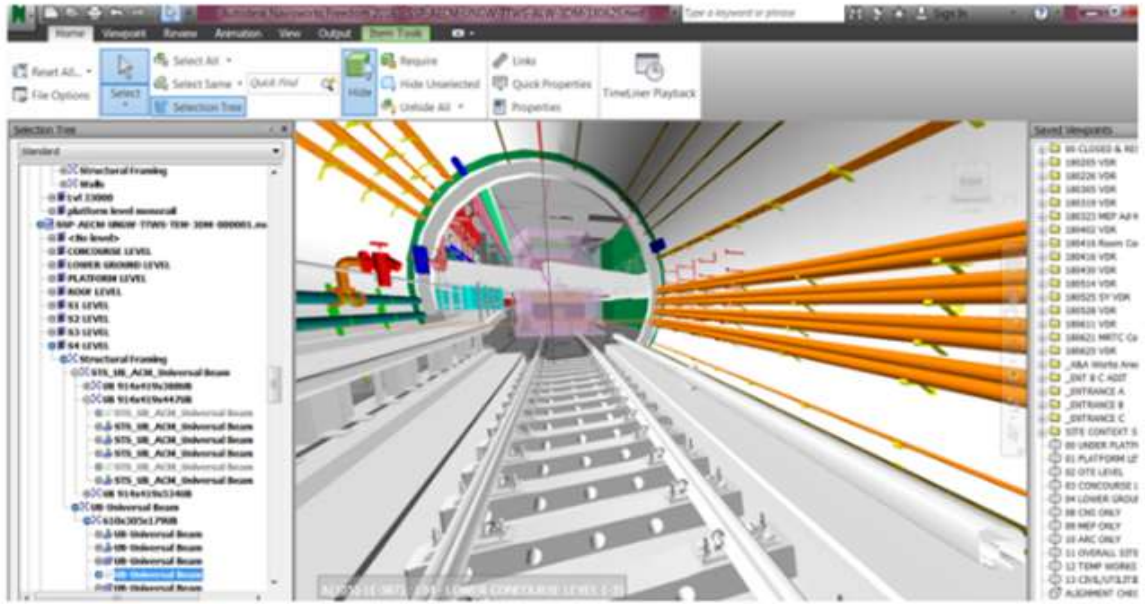
- 3D DESIGN AUTHORING (Modelling)
- 4D and 5D digital workflows.
- Cloud based Digital Solutions
- Common Data Environment (CDE) – Cloud Based
- BIMcollab – Cloud Based
- Construction Management Software Tools – Fieldview – Cloud Based
- Geospatial Information Systems (GIS) – Cloud Based
- Data Analytics – IBM Cognos – Cloud Based
- Site Data models using Drones
- Augmented Reality
- IT strategy
- Training
- BIM Level 2 Information Management & Certification

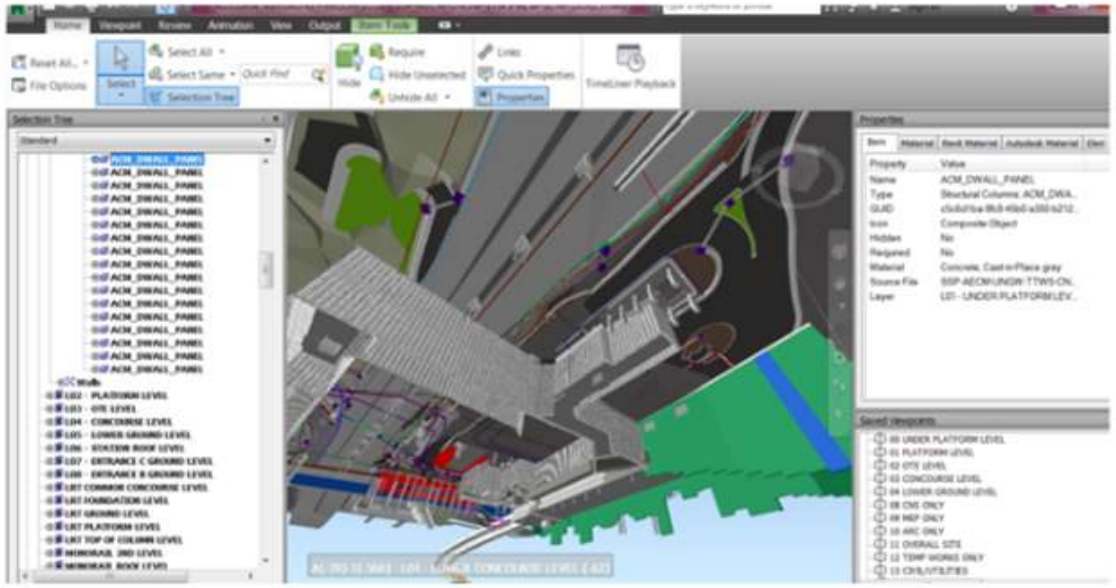
3D DESIGN AUTHORING (Modelling)

MMC-GAMUDA
KVMRT (T) SDN BHD









4D KBNS STATION
Planning Template – M & E

MMC-GAMUDA
KVMRT (T) SDN BHD

Monday 8:00:00 AM 7/13/2020 Day=1 Week=1
New Data Source (Root) [58%]
KAMPUNG BARU NORTH STATION [M&E 54%]
SITE INSTALLATION [60%]
Platform Level [28%]
ABWF Platform [54%]
ABWF Zone 1 [76%]
ABWF 1st Fix (Civil 76%]
ABWF Zone 2 [76%]
ABWF 1st Fix (Civil 76%]
ABWF Zone 3 [54%]
ABWF 1st Fix (Civil 54%]
Building Services [28%]
Zone 2 - BufferArea4 [33%]
Under Platform Level [45%]
Building Services [45%]
DRS [90%]
T&C [40%]
ECS [25%]
FPS [25%]
ELE [40%]
DRS [40%]

Field View™

Can track all MEP installation, Testing & Commission activities from start to finish With RED flags raised against late program items

ZONE 1

Appearance Profiles :

	START	END
1st FIX		
2nd FIX		
CABLE PULLING		
PICO		
FINAL FIX		
ACTIVITY GAP		
PAT		
SAT 1		
SAT 2		
MODEL APPREANCE		

Platform Level M&E 15/07/20 to 01/06/2021

100% Quantification & Productivity rates derived from the MEP 3D Model

4D STWS STATION
Planning Template – Structural

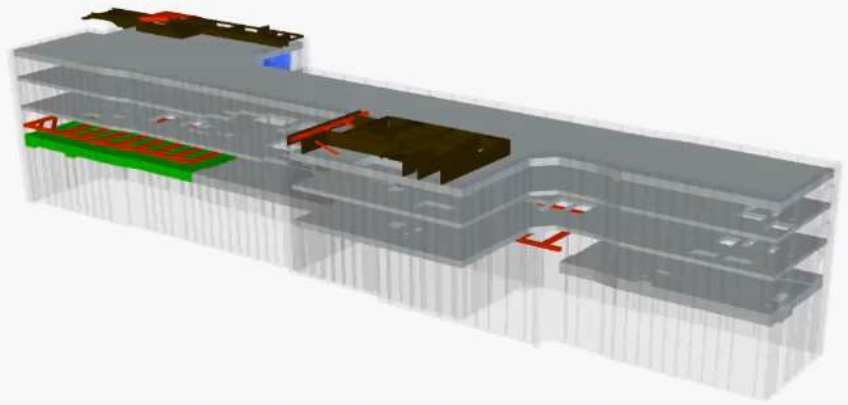
MMC-GAMUDA
KVMRT (T) SDN BHD

STWS Construction Progress
Up to September 2019

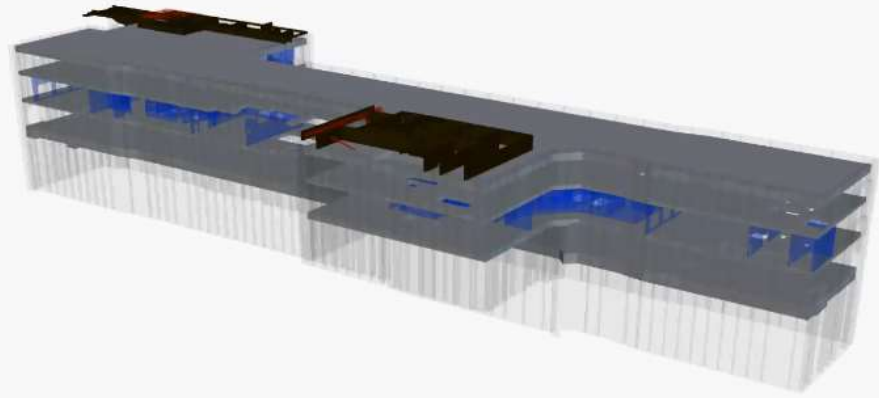
PLANNED

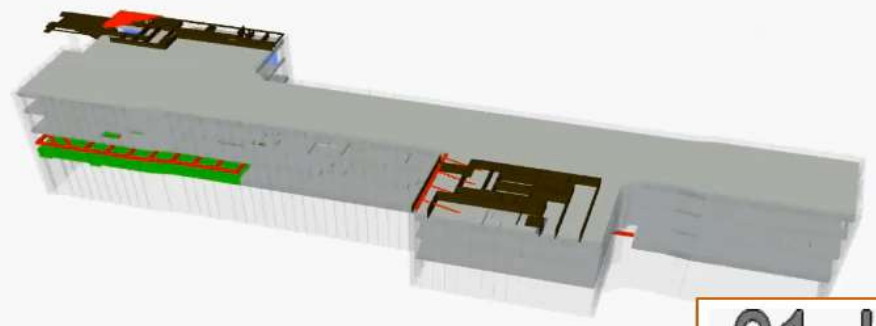
ACTUAL

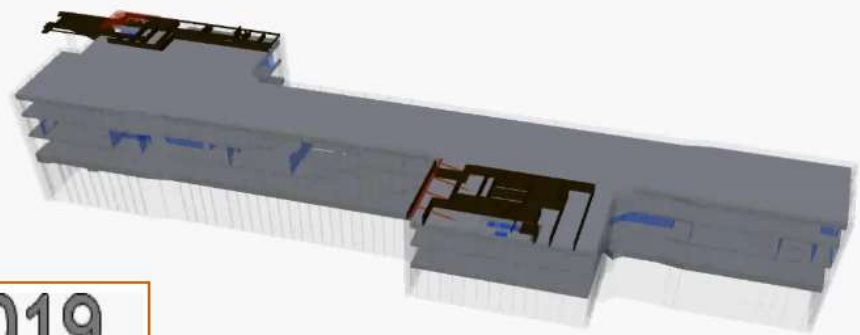
Progress : 68.42%



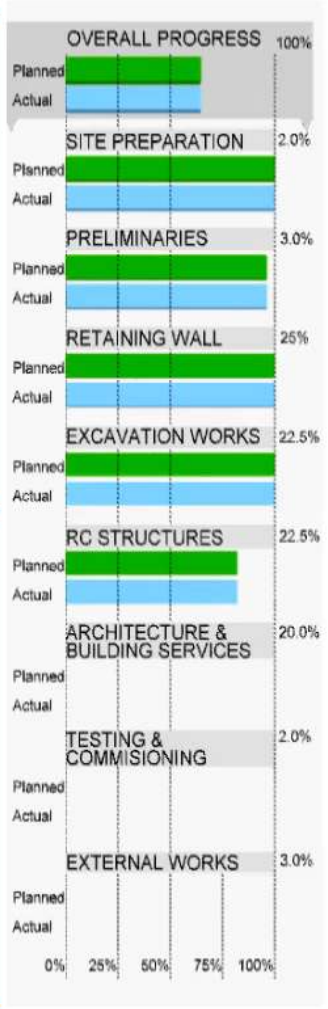
Progress : 71.06%







01 Jun 2019



Appearance Profiles :

	START	END
RETAINING WALL		
EXCAVATION		
RC STRUT / SLAB		ORIGINAL
RC WALL / COLUMN		
RECTIFICATION		
ABOVE ROOF STRUCTURE		ORIGINAL
DISASSEMBLE		REMOVED
STEEL STRUT		

5D digital workflows.

TTWS – 5D Revenue V Cost

MMC-GAMUDA

TITIWANGSA STATION CONSTRUCTION
PROGRESS AND REVENUE UP TO MARCH 2018

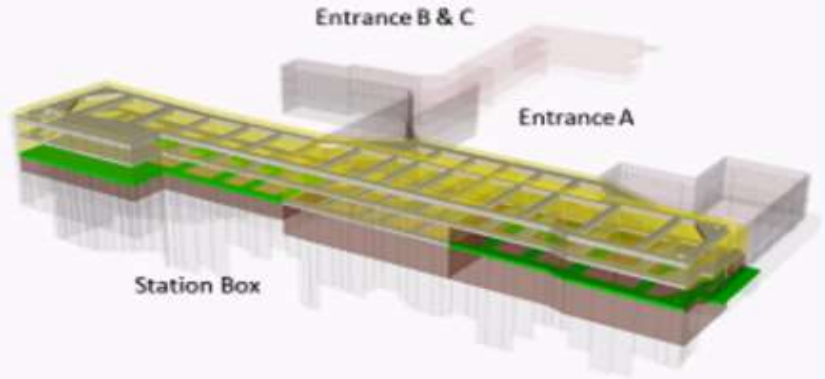
Based on Baseline 3.0 rev

MMC-GAMUDA
KVMRT (T) SDN BHD

MRT CORP

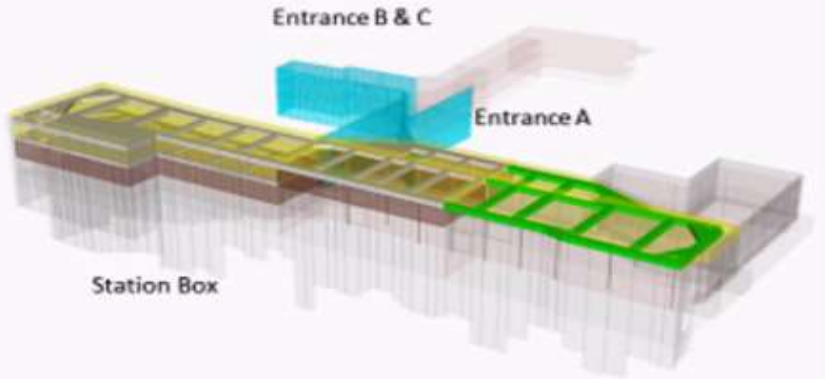
PLANNED

Progress : 48.45%
Total Revenue : RM40279741.00
Total Cost : RM36251766.90

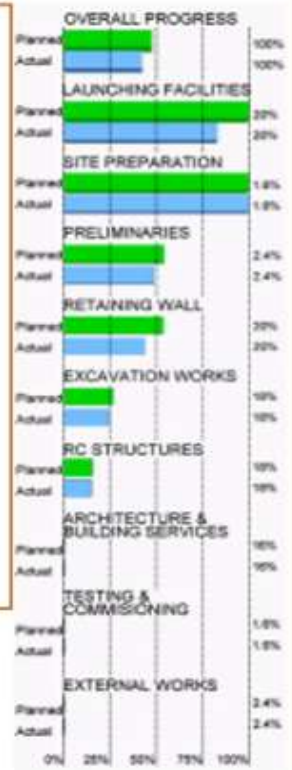


ACTUAL

Progress : 42.34%
Total Revenue : RM40279741.00
Total Cost : RM36251766.90



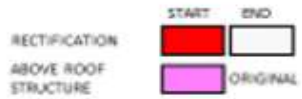
31 March 2018



Cumulative Revenue :

Cumulative Cost :

Appearance Profiles :



See Animation

15

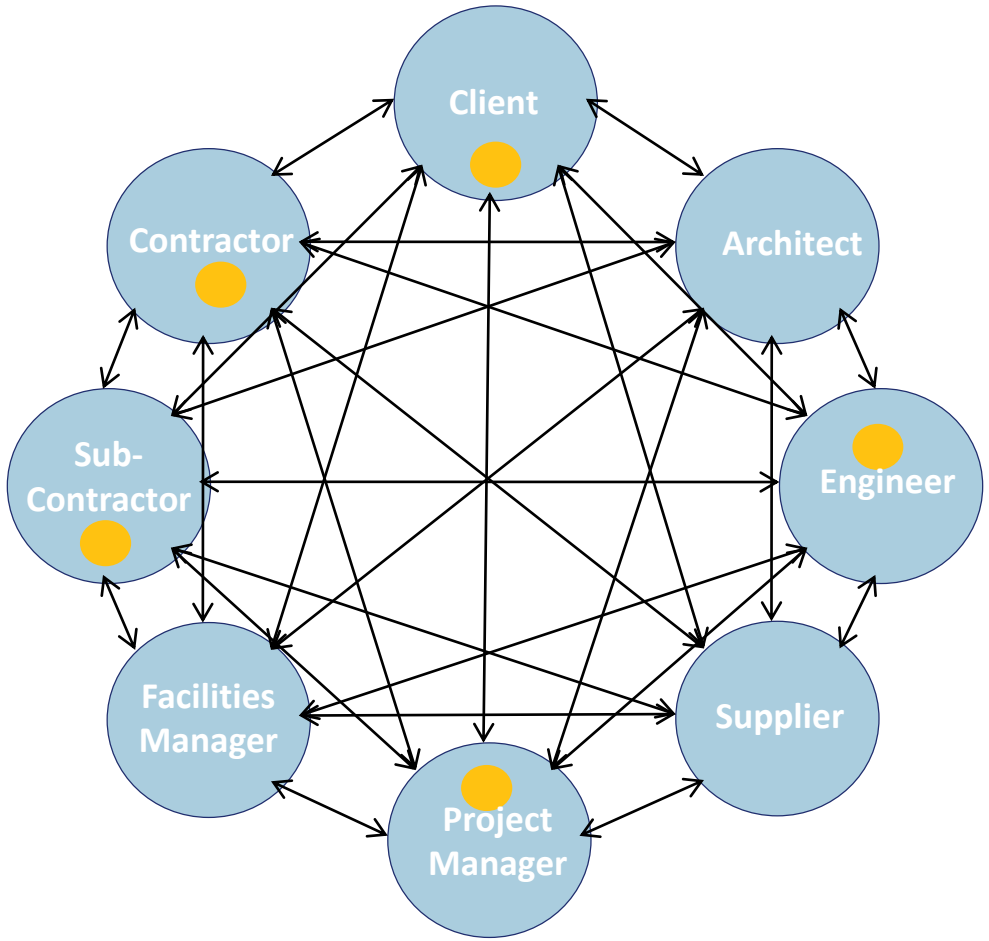
Measuring, Monitoring and tracking cost using specialist 5D applications

Common Data Environment (CDE) – Cloud Based

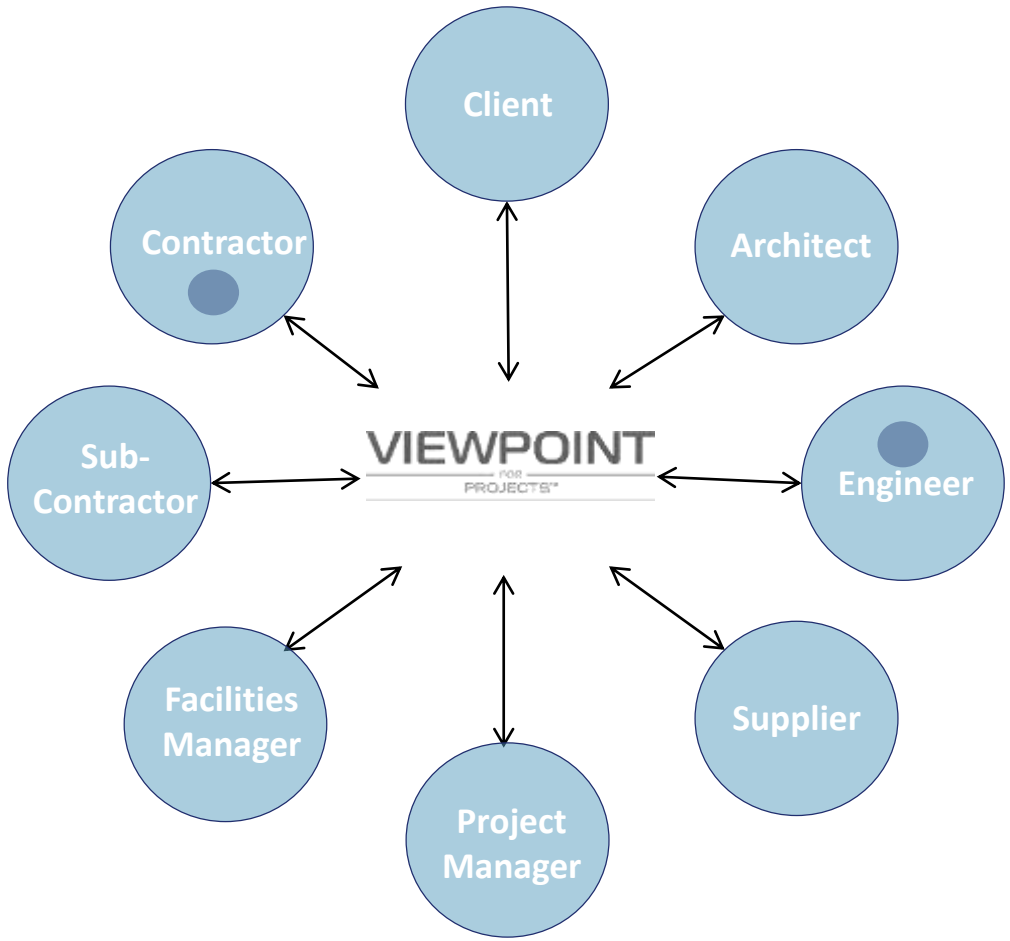
MMC-GAMUDA
KVMRT (T) SDN BHD

.

Traditional Communication



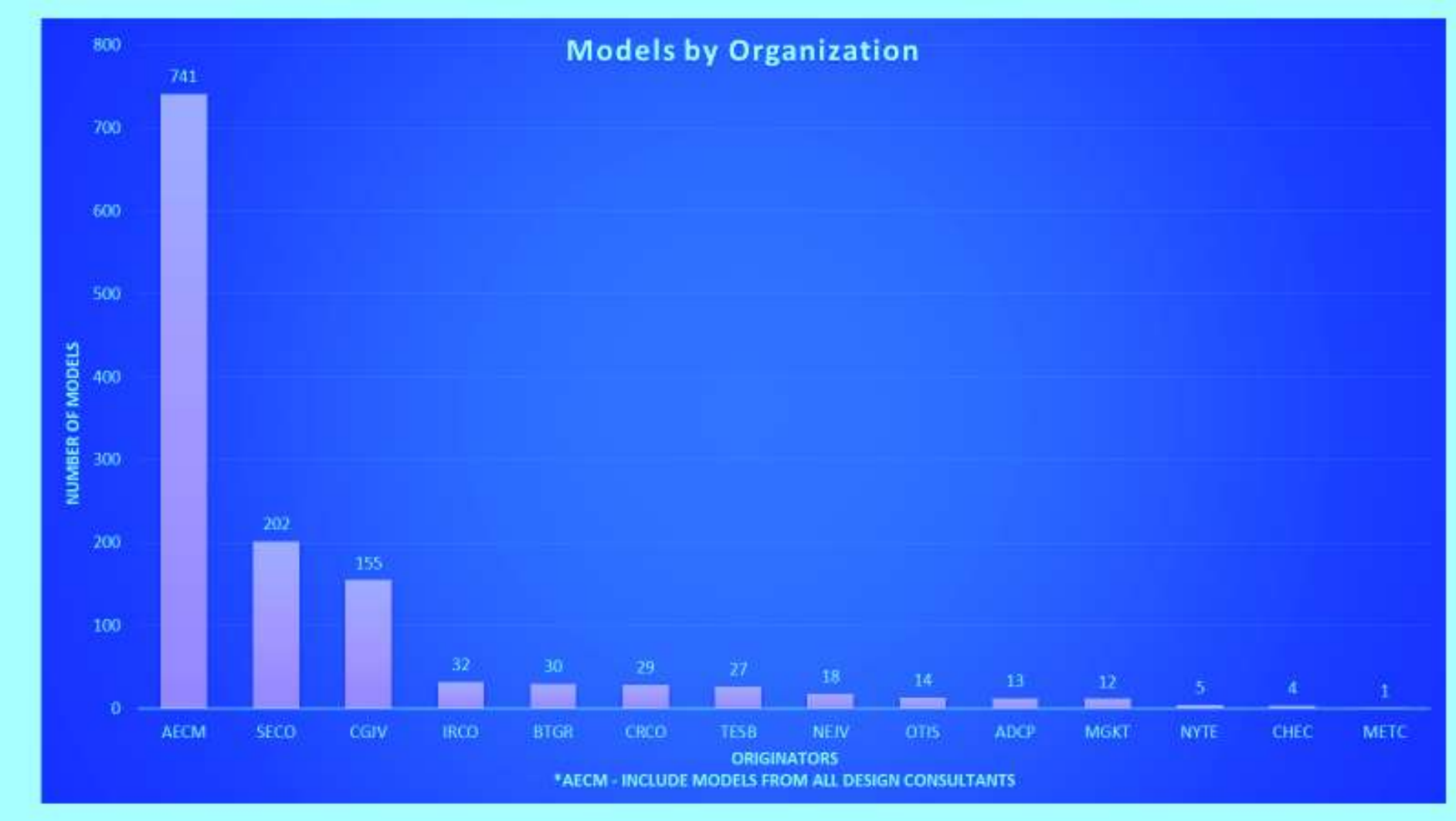
VFP Communication



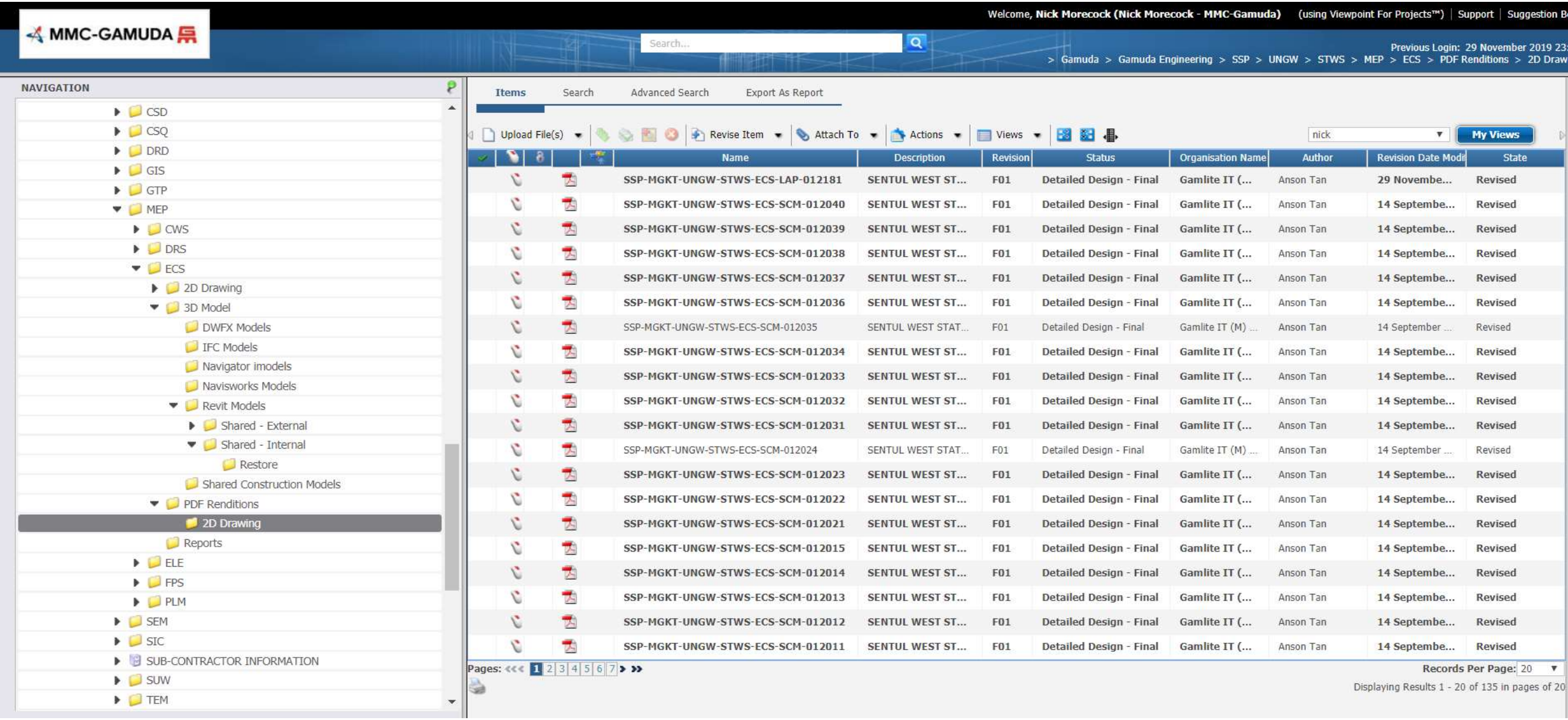
Adopting a CDE Optimises and Simplifies the Information Management process

• Project Information Management & Exchange

- Common Data Environment
- 1,570 Users
- 3,800 Model Files
- Over 100,000 documents
- Single Source



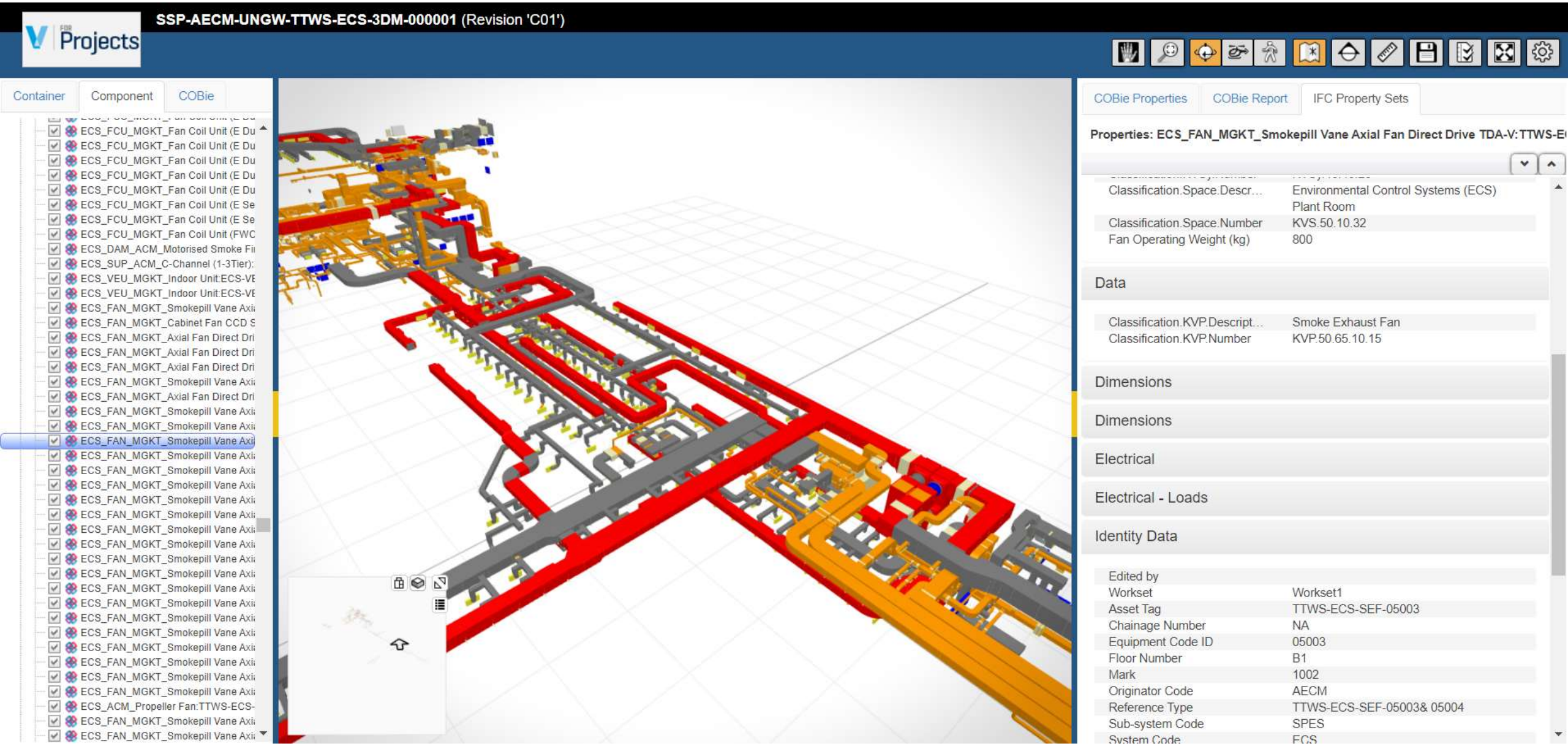
Common Data Environment (CDE) – Cloud Based.



VFP is hosting MMC-Gamuda M&E sub-contractors 2D Shop Drawings for Review and Approvals

Common Data Environment (CDE) – Cloud Based

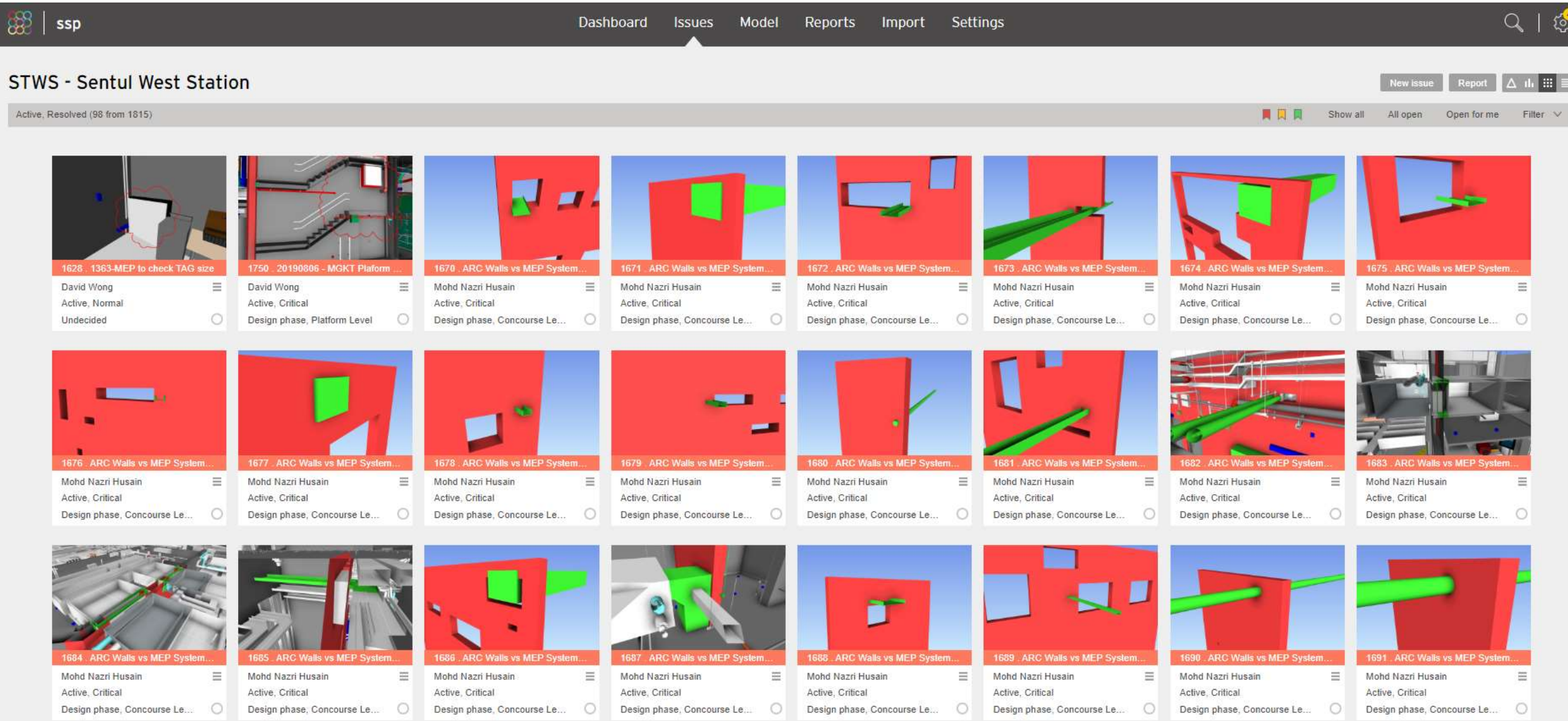
MMC-GAMUDA
KVMRT (T) SDN BHD



VFP is hosting Design and Construction 3D Models

BIMcollab – Cloud Based

MMC-GAMUDA
KVMRT (T) SDN BHD



project Issue Report extract from BIMcollab for KBNS June 2019

Construction Management Software Tools – Fieldview – Cloud Based

Mobile Field Construction Management – Removing traditional paper based Forms to DIGITAL

Data capture & automated workflows – replication of any paper-based process

Site Diaries, Inspections, Permits to Work, Health & Safety, Progress Photos, QA/QC Claims, Installations, Tunnelling Environmental etc.

Digital Fieldview processes transforming the way we work on site

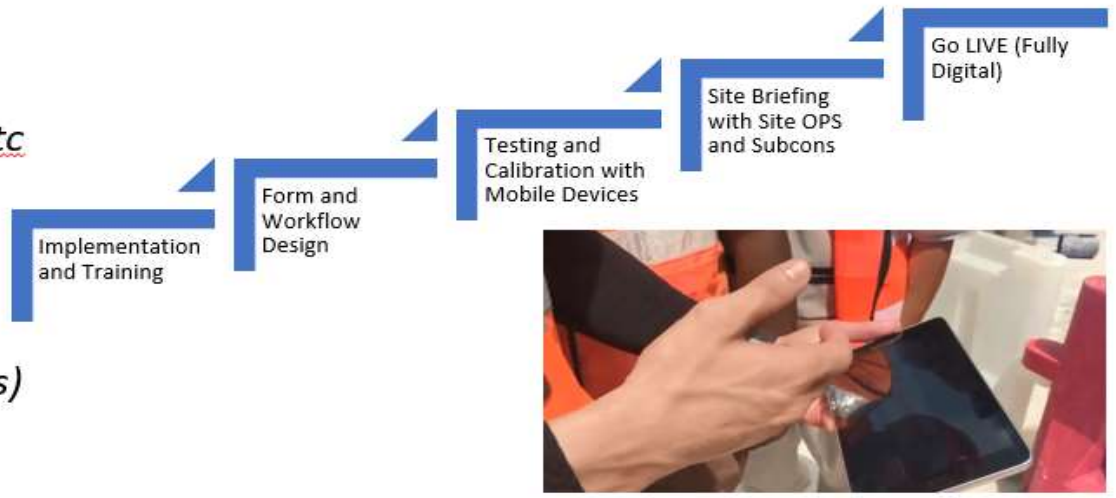
MMC-GAMUDA
KVMRT (T) SDN BHD

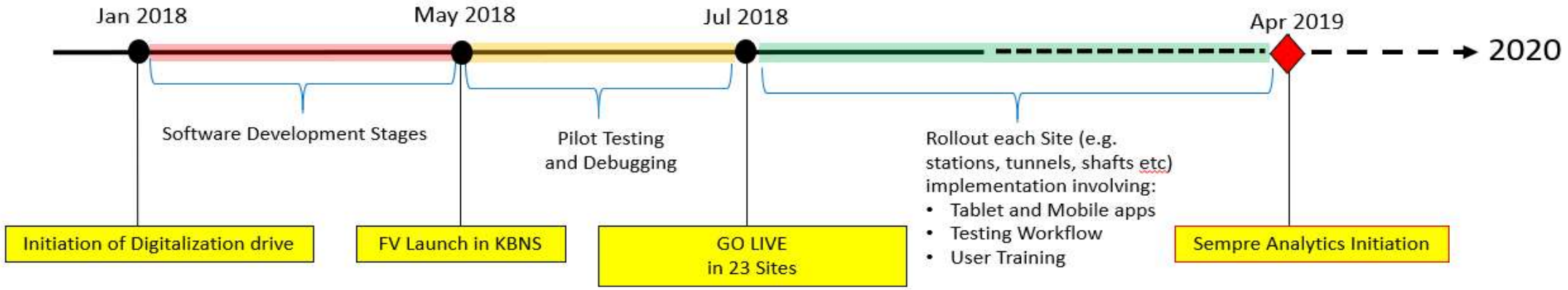
Construction Management Software Tools – Fieldview – Cloud Based

MMC-GAMUDA
KVMRT (T) SDN BHD

Fieldview Progress Status in UG (LIVE since March 2018)

- ***70,000 Forms*** *to date*
- *average 600 Forms raised per-site each month*
- *480 Form design templates for OPS, SHE, QAQC, MEP, ABWF etc*
- ***900 users*** *in UG (including Subcons)*
- *Subcons mainly use Mobile Phones and Laptops*
- *ongoing Training and Support*
- *DDC and SC on-board (IAR, NCR and SWO)*
- ***200 tablets*** *distributed for MGKT staff (iPad and Samsung Tabs)*





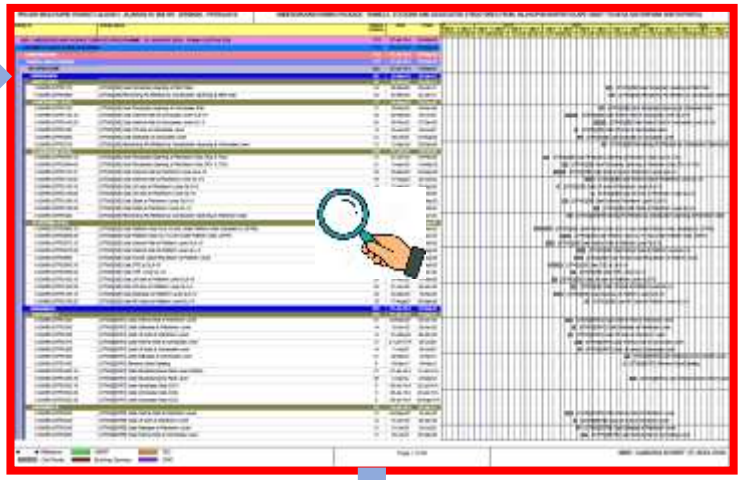
Fieldview Implementation Status

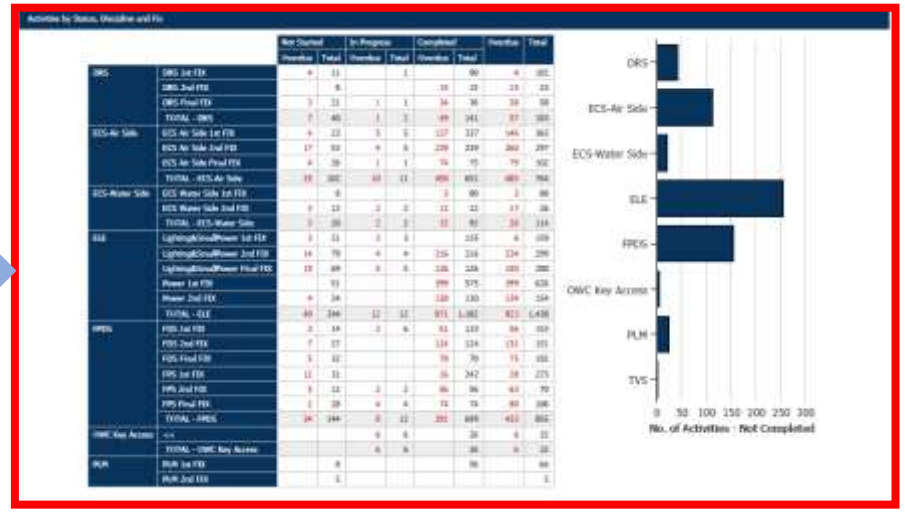
Process

MMC-GAMUDA KVMRT (T) SDN BHD

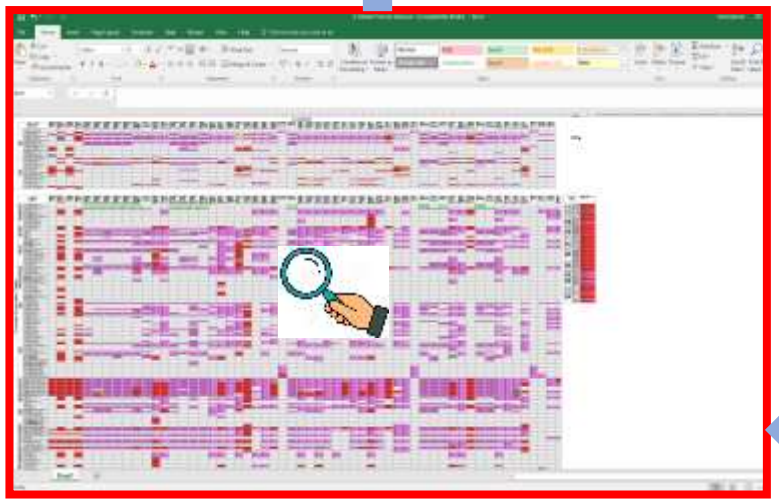
1. 3D Design Model use for Quantification

2. P6 CIP Baseline Programme

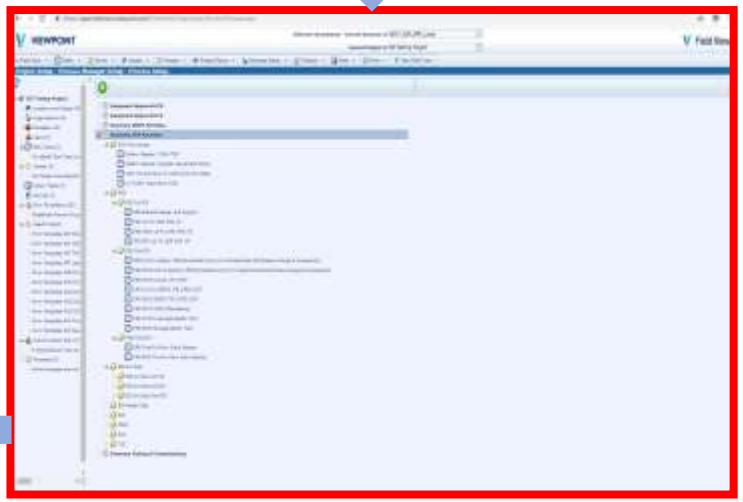




5. Cognos Data Analytics-
Tracking Progress, Real time Project analysis



4. Monitor/Review in Realtime (operational)



3. Detailed Process/Task activity in FV

Design Process summary for Fieldview Construction Progress and reporting

Construction Management Software Tools – Fieldview – Cloud Based

MMC-GAMUDA

SSP Line 2 Equipment Maintenance Asset Data Challenge

Typical Underground MRT Station

Contains approx 10,000 LRU's / Maintainable Assets

+

Each Asset has approx 120 separate lines of attribute fields

Total data set for CMMS per station is in excess of 1.2 Million data cells

=

	Master Attributes List	CMM
3	**Asset Information**	
4	Asset / Parts Particular	
5	Asset Tag	Asset T.
6	Originator Code	To fill in
7	System Code	To fill in
8	Sub-system Code	To fill in
9	Equipment Type (LRU) / Component Code	To fill in
10	Equipment Code ID	Equipm

Captured and managed in FieldView

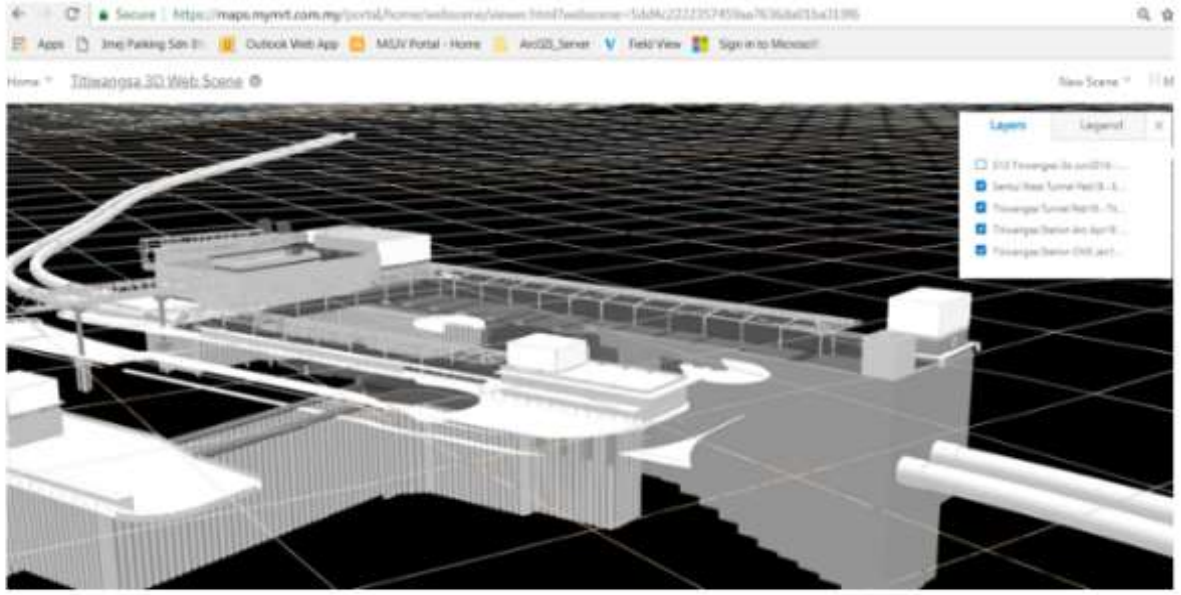
Field View

Asset Data requirement captured and managed in Fieldview

Geospatial Information Systems (GIS) – Cloud Based

MMC-GAMUDA
KVMRT (T) SDN BHD

GIS – 2D and 3D Web Portal and Online Database



Extract form SSP Line 2 GIS Cloud based Web Portal

Geospatial Information Systems (GIS) – Cloud Based

MMC-GAMUDA
KVMRT (T) SDN BHD

MRT CORP WINS GLOBAL GIS AWARD

Mass Rapid Transit Corporation Sdn Bhd (MRT Corp) has won this year's Special Achievement in GIS (SAG) Award by Esri Inc for its implementation of the first cloud-based Geographic Information System (GIS) in Asia by fully integrating Building Information Modelling (BIM) and Reality Modelling into the ArcGIS Portal.

The SAG Award by the United States GIS software, location intelligence, and mapping company is one of most coveted in the GIS industry internationally. This award is given to Esri users around the world for their outstanding work with GIS technology.

MRT Corp was selected out of more than 100,000 organisations worldwide for its innovative use of GIS and BIM technology in the Architecture, Engineering & Construction (AEC) industry.

The SAG Award winners were announced at the Esri User Conference 2019, attended by over 19,000 attendees on 8 July 2019 at the San Diego Convention Center, United States.

Thousands of SAG Award nominations are submitted by Esri users every year from around the world. The submissions are then personally reviewed and selected by Esri President and founder, Mr Jack Dangermond himself.

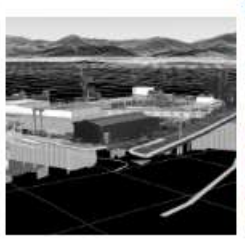
The Sungai Buloh-Serdang-Putrajaya (SSP) Line Geospatial Web Portal powered by ESRI ArcGIS technology serves engineering, topographic and environmental data of project sites for better informed decision making, improved project execution and reduced risk exposure.

The portal has enabled the project teams to retrieve and access spatial data in an easy-to-use cloud-based platform which has increased productivity, data-sharing and data retrieval between different engineering disciplines.

It has facilitated the collaboration and sharing of geospatial information in a centralised cloud platform. The project team can easily explore and navigate the mapping platform; layering it with data from other disciplines.

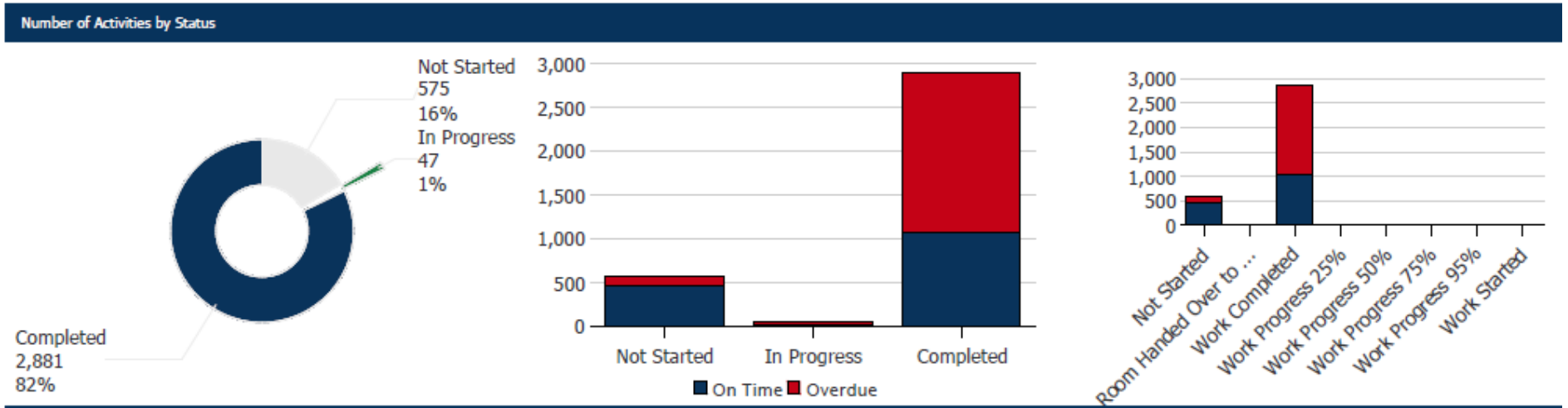
The project team members can view, analyse and query data on this platform; increasing overall productivity and ease of data sharing between disciplines, contractors and departments.

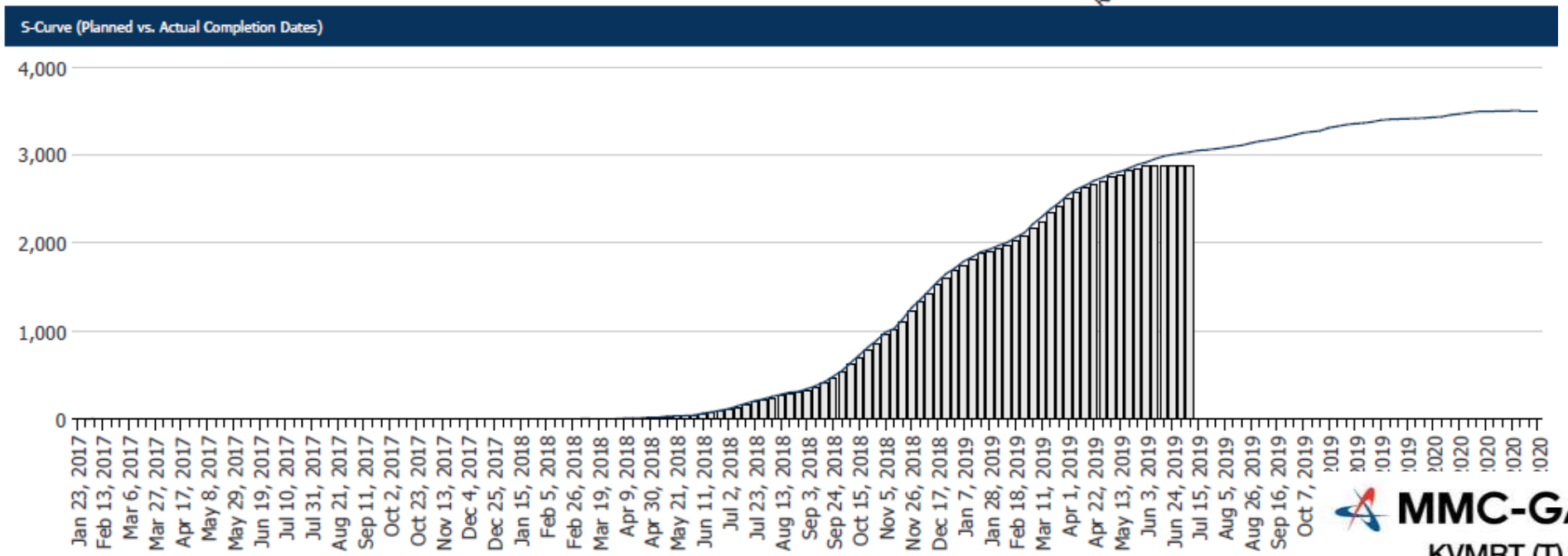
The MRT SSP Line Project has been recognised as the industry leader for advanced digital technology implementation such as BIM Level 2 and GIS in this region and as a testament to the use of technology to enhance productivity, efficiency and quality for project delivery.



Asia Geospatial Award + Special Achievement Award by ESRI inc US

Live Progress reporting by Status and S-Curve reports from Cognos





MMC-GAMUDA
KVMRT (T) SDN BHD

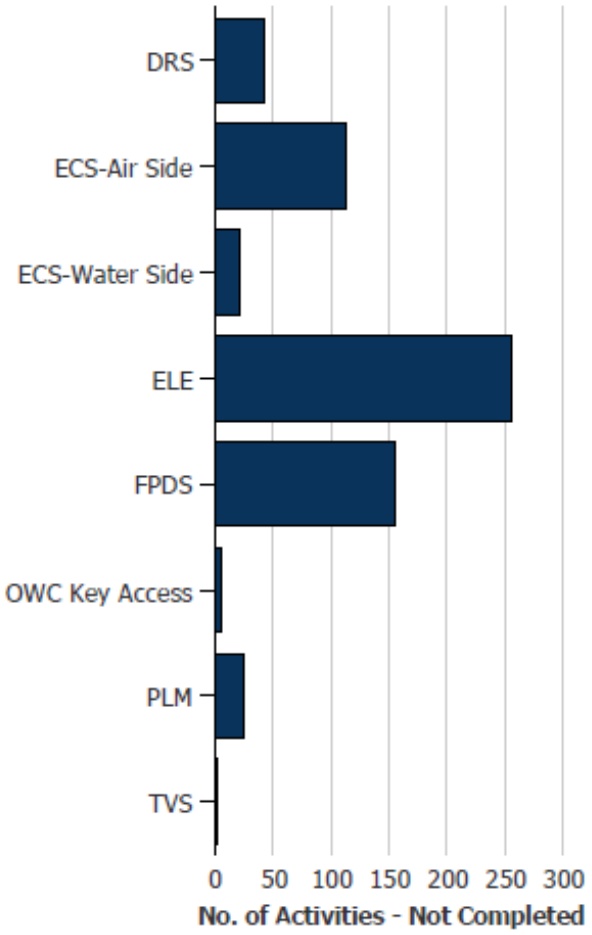
Live Progress reporting by Status, Discipline and Fix in Cognos

Activities by Status, Discipline and Fix

Discipline

Fix		Not Started		In Progress		Completed		Overdue	Total
		Overdue	Total	Overdue	Total	Overdue	Total		
DRS	DRS 1st FIX	4	11		1		90	4	102
	DRS 2nd FIX		8			15	15	15	23
	DRS Final FIX	3	21	1	1	34	36	38	58
	TOTAL - DRS	7	40	1	2	49	141	57	183
ECS-Air Side	ECS Air Side 1st FIX	4	23	5	5	137	337	146	365
	ECS Air Side 2nd FIX	17	53	4	5	239	239	260	297
	ECS Air Side Final FIX	4	26	1	1	74	75	79	102
	TOTAL - ECS-Air Side	25	102	10	11	450	651	485	764
ECS-Water Side	ECS Water Side 1st FIX		8			3	80	3	88
	ECS Water Side 2nd FIX	3	12	2	2	12	12	17	26
	TOTAL - ECS-Water Side	3	20	2	2	15	92	20	114
ELE	Lighting&SmallPower 1st FIX	3	21	3	3		135	6	159
	Lighting&SmallPower 2nd FIX	14	79	4	4	216	216	234	299
	Lighting&SmallPower Final FIX	19	69	5	5	126	126	150	200
	Power 1st FIX		51			399	575	399	626
	Power 2nd FIX	4	24			130	130	134	154
	TOTAL - ELE	40	244	12	12	871	1,182	923	1,438
FPDS	FDS 1st FIX	3	14	2	6	51	133	56	153
	FDS 2nd FIX	7	27			124	124	131	151
	FDS Final FIX	5	32			70	70	75	102
	FPS 1st FIX	12	31			16	242	28	273
	FPS 2nd FIX	5	12	2	2	56	56	63	70
	FPS Final FIX	2	28	4	4	74	74	80	106
	TOTAL - FPDS	34	144	8	12	391	699	433	855
OWC Key Access	<<			6	6		26	6	32
	TOTAL - OWC Key Access			6	6		26	6	32
PLM	PLM 1st FIX		8				56		64
	PLM 2nd FIX		5						5

Status



MMC-GAMUDA
KVMRT (T) SDN BHD

MMC-GAMUDA
KVMRT (T) SDN BHD

Data Analytics – IBM Cognos – Cloud Based

Live Progress reporting by Location Report in Cognos

Station

Lvl

Zone

Room

Location

Status

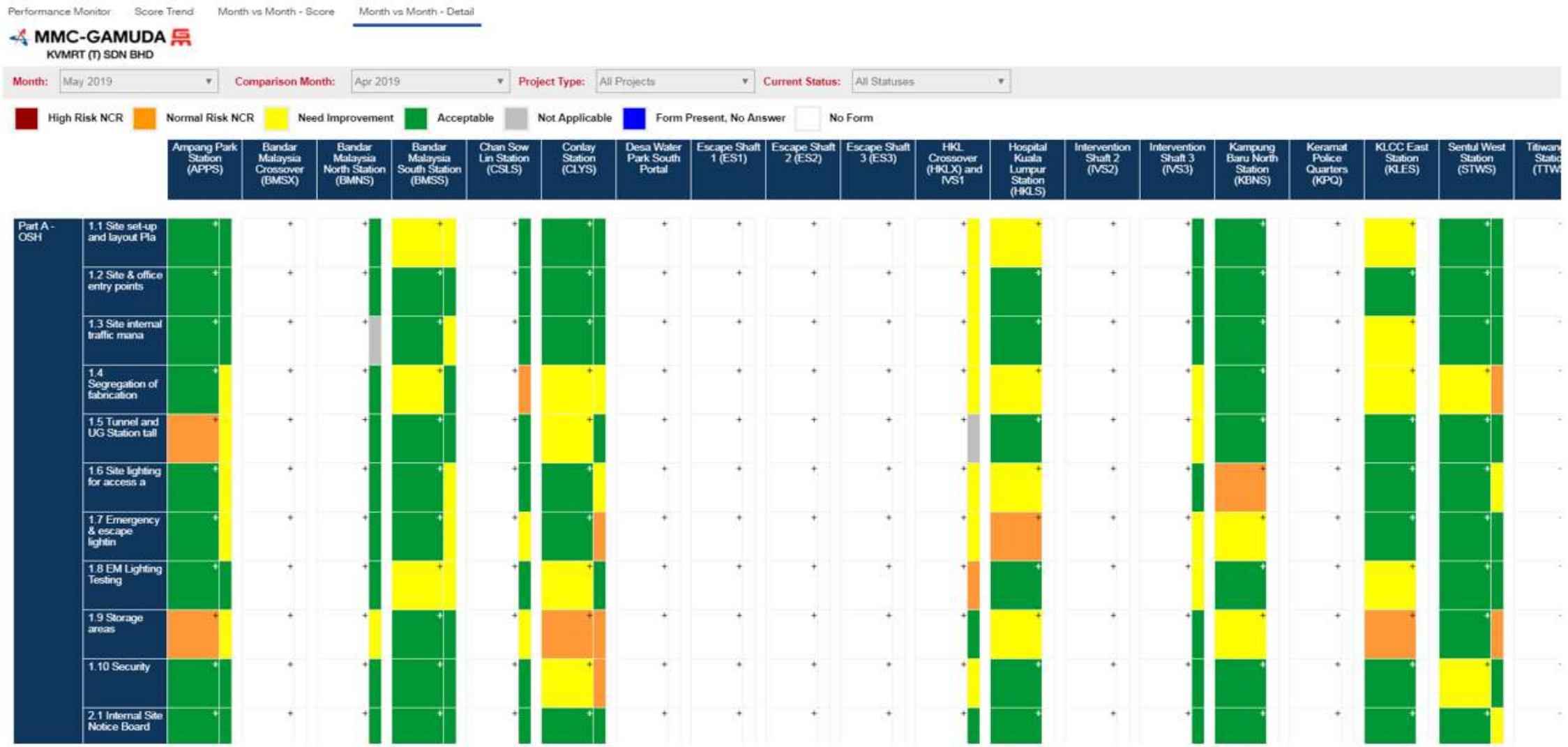
Activities by Location

Lvl	Zone	Room	Not Started		In Progress		Completed		Overdue	Total
			Overdue	Total	Overdue	Total	Overdue	Total		
STWS CONCOURSE LEVEL	OVERALL	OVERALL		3			6	6	6	9
		TOTAL - OVERALL		3			6	6	6	9
	ZONE 1.01 - CMTS, CTER, MDF RM, BMS RM, SERVER RM, ICSS RM, CORRIDOR (BOH) 07, TER	ZONE 1.01.01 - TER			2	2	34	50	36	52
		ZONE 1.01.02 - CMTS					35	58	35	58
		ZONE 1.01.03 - CTER					34	54	34	54
		ZONE 1.01.04 - BMS RM					33	52	33	52
		ZONE 1.01.05 - ICSS RM					31	50	31	50
		ZONE 1.01.06 - MDF RM, SERVER RM, CORRIDOR (BOH) 07	3	3	1	1	41	67	45	71
		TOTAL - ZONE 1.01 - CMTS, CTER, MDF RM, BMS RM, SERVER RM, ICSS RM, CORRIDOR (BOH) 07, TER	3	3	3	3	208	331	214	337
	ZONE 1.02 - UPS RM, DB RM 05	ZONE 1.02 - UPS RM, DB RM 05			5	5	43	59	48	64
		TOTAL - ZONE 1.02 - UPS RM, DB RM 05			5	5	43	59	48	64
	ZONE 1.03 - SPR&HR/WATER TANK&PUMP RM, ECS CTRL RM03, ECS PLNT RM04, GAS RM09/10, SPR/WR/CW TANK1/2	ZONE 1.03 - SPR&HR/WATER TANK&PUMP RM, ECS CTRL RM03, ECS PLNT RM04, GAS RM09/10, SPR/WR/CW TANK1/2	13	43	3	3	17	50	33	96
		TOTAL - ZONE 1.03 - SPR&HR/WATER TANK&PUMP RM, ECS CTRL RM03, ECS PLNT RM04, GAS RM09/10, SPR/WR/CW TANK1/2	13	43	3	3	17	50	33	96
	ZONE 1.04 - CORRIDOR (BOH) 08, FIRE/ELV/LV/ECS/SPD	ZONE 1.04 - CORRIDOR (BOH) 08, FIRE/ELV/LV/ECS/SPD	2	22	1	2	35	71	38	95
		TOTAL - ZONE 1.04 - CORRIDOR (BOH) 08, FIRE/ELV/LV/ECS/SPD	2	22	1	2	35	71	38	95
	ZONE 2.01 - AFCER, CSO, SCR, STRONG RM	ZONE 2.01.01 - AFCER			1	1	35	52	36	53
		ZONE 2.01.02 - CSO			1	1	31	41	32	42
		ZONE 2.01.03 - SCR			1	1	51	66	52	67
		ZONE 2.01.04 - STRONG RM			1	1	32	42	33	43
		TOTAL - ZONE 2.01 - AFCER, CSO, SCR, STRONG RM			4	4	149	201	153	205
	ZONE 2.02 - DB RM 06, CORRIDOR (BOH) 12, PRE-ACTION SPR CLOSET	ZONE 2.02 - DB RM 06, CORRIDOR (BOH) 12, PRE-ACTION SPR CLOSET					49	71	49	71
		TOTAL - ZONE 2.02 - DB RM 06, CORRIDOR (BOH) 12, PRE-ACTION SPR CLOSET					49	71	49	71
	ZONE 2.03 - ECS CONTROL RM 04, ECS PLANT RM 05, CHILLER PLANT RM, GAS RM 11/12	ZONE 2.03 - ECS CONTROL RM 04, ECS PLANT RM 05, CHILLER PLANT RM, GAS RM 11/12	7	26	2	2	41	72	50	100
		TOTAL - ZONE 2.03 - ECS CONTROL RM 04, ECS PLANT RM 05, CHILLER PLANT RM, GAS RM 11/12	7	26	2	2	41	72	50	100
	ZONE 2.04 - CORRIDOR (BOH) 13, ES-03, TV/ECS/VS/LV/SPD/ELV/VE	ZONE 2.04 - CORRIDOR (BOH) 13, ES-03, TV/ECS/VS/LV/SPD/ELV/VE					48	74	48	74
		TOTAL - ZONE 2.04 - CORRIDOR (BOH) 13, ES-03, TV/ECS/VS/LV/SPD/ELV/VE					48	74	48	74
	ZONE 3.01 - CONCOURSE PAID/UNPAID, RETAIL AREA 01/02/03/04, LFT-02/04, ECP 09/10/11/12	ZONE 3.01 - CONCOURSE PAID/UNPAID, RETAIL AREA 01/02/03/04, LFT-02/04, ECP 09/10/11/12	3	36			29	61	32	97
		TOTAL - ZONE 3.01 - CONCOURSE PAID/UNPAID, RETAIL AREA 01/02/03/04, LFT-02/04, ECP 09/10/11/12	3	36			29	61	32	97

Data Analytics – IBM Cognos – Cloud Based

MMC-GAMUDA
KVMRT (T) SDN BHD

Live SHE Audit Charting with Sempre Cognos



Real time SHE NCR Report Generated form Cognos

Site Data models using Drones

MMC-GAMUDA
KVMRT (T) SDN BHD

Survey and GIS - 3D Drone Image Modelling – BIM Verification, Checking and Progress

3D Reality Models and Drone

SSP Line 2 TLS 3D Point Cloud and Drone acquisition

Stations, Shafts and Crossovers

3D Survey Equipment and Software

TLS Leica P40 Hi-def Laser Scan

Leica iStar Panaromic Camera

DJI Phantom 4 Pro Drone (for Exterior and Aerial)

Leica Cyclone Point Cloud Software

AutoDesk Recap Point Cloud Software

3D Modelling and Processing Software

Bentley Context Capture

High-end 3D Processing Workstation (DELL Alienware)

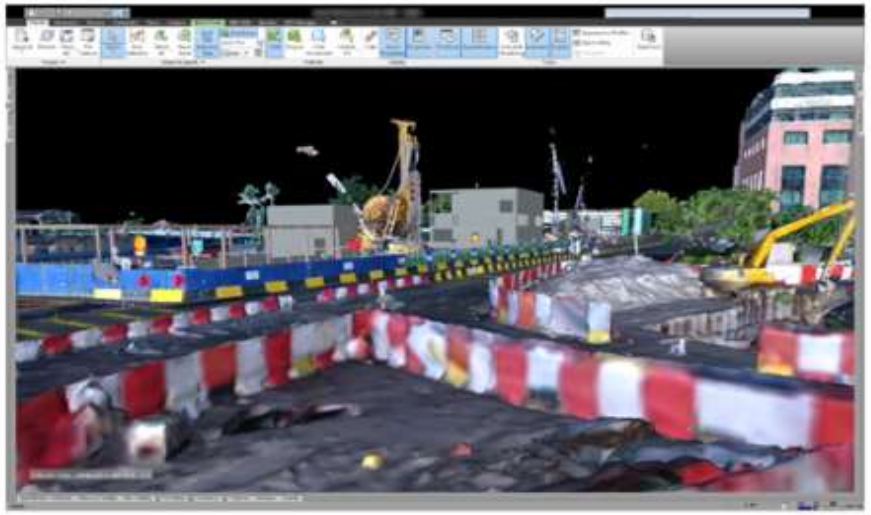
https://www.youtube.com/watch?v=UvUPdZEWhSY&feature=youtu.be

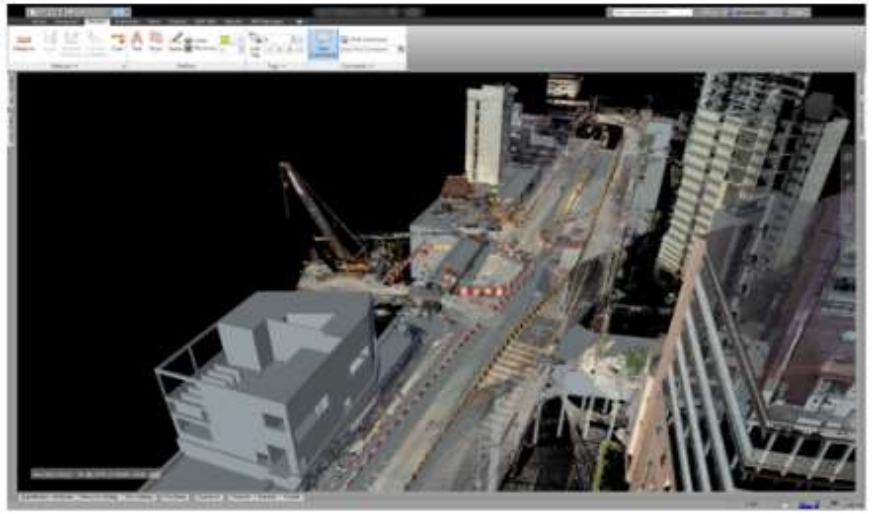
Digital tools in use on SSP on Line 2

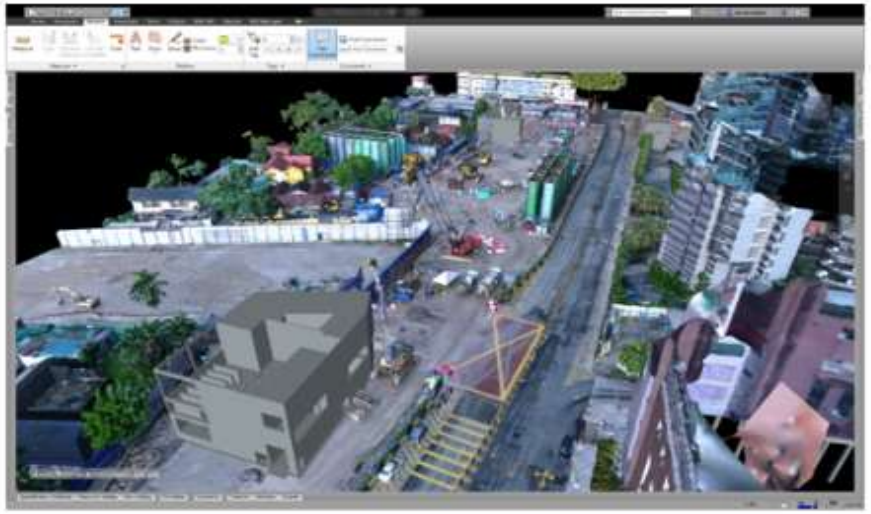
Site Data models using Drones

MMC-GAMUDA
KVMRT (T) SDN BHD

Integration – BIM Revit Models + TLS Point Cloud + 3D CC Drone Model







Integrating Digital outputs on SSP Line 2

Site Data models using Drones

MMC-GAMUDA
KVMRT (T) SDN BHD

REALITY MODELING

MMC Gamuda KVMRT (T) Sdn Bhd

Drone Surveying for BIM and GIS Data Capture- Malaysian Metro Megaproject
Kuala Lumpur, Malaysia

Project Playbook: AssetWise, ComplyPro, ContextCapture, Navigator, OpenRail, ProjectWise

READ PROJECT SUMMARY +

MMC GAMUDA KVMRT (T) SDN BHD

We've struck gold again by winning The Year in Infrastructure Bentley Awards 2019 under the Reality Modeling Category, echoing our last win in Bentley's 2017 Be Inspired Awards under the BIM Advancements in Rail & Transit Category. This time we won for our ingenious use of drones and various software to deliver accurate 3D reality meshes of our sites, making them accessible across the project and effectively saving thousands of hours for surveyors, engineers and project managers with a better digitalized workflow.

Augmented Reality

IT Strategy

MGKT as part of our BIM Level 2 certification requirement have developed detailed documentation that defines our IT strategy. Detailed IT Policy, Disaster recovery, IT standards and MGKT's IT infrastructure is documented extensively as a detailed solution and plan designed to support, protect and secure the integrity of MGKT's project information.

Training

Facilities like Gamuda's GLC and BIM training facilities are essential resources that combined with the continuous training policies and development of in-house training materials that have been developed internally for MGKT technologies are essential for creating the necessary employee skill sets.

BIM training facility at GLC

ACTUAL TRAINING NUMBERS as of MAY 2019

Course Title	No of MGKT Staff Trained
Navisworks	100
BIM fundamentals	243
3D Modelling essentials	180
Revit MEP Essentials	16
Revit structure Essentials	70
Solibri	8
Costx 4D & 5D	67
Fieldview	1060
Viewpoint for Projects	160
Cognos (Data analytics)	10
BIM Level 2 Essentials	100
BIM Level 2 for Site Managers	80
BIM Level 2 for Information Managers	15
Total	**2109**

BIM Level 2 - Information Management

MMC GAMUDA KVMRT (T) SDN. BHD.

PLAN TITLE

BIM IMPLEMENTATION STRATEGY

Reference No.	:	[LEAVE THIS BLANK]
		(Formerly: [Leave this blank])
``Revision	:	[00]
Date	:	DD Month YYYY

Action	Name & Position	Signature
Approved by	Satpal S Bhogal (Project Director)	
Reviewed by	Name Surname (Job Title)	
Reviewed by	Name Surname (Job Title)	
Prepared by	Name Surname (Job Title)	
Prepared by	Name Surname (Job Title)	
Reviewed by	Name Surname (Job Title)	
Reviewed by	Name Surname (Job Title)	
Prepared by	Name Surname (Job Title)	

Table of Contents

PAS 1192-2:2013
Incorporating Corrigendum No.1

Specification for information management for the capital/delivery phase of construction projects using building information modelling

bsi.

Strategy Documents developed by MGKT for Project compliance and BIM Level 2 certification

MMC-GAMUDA
KVMRT (T) SDN BHD

BIM Level 2 Certification – Certification was achieved in September 2019

bre

Certificate of Approval

Certificate Number: BIM10042 Issue: 01

This is to certify the BIM Level 2 Prepared capabilities provided by

MMC Gamuda KVMRT (T) SDN BHD

are in accordance with the requirements of

PAS 1192-2:2013

(Specification for Information management for the capital/delivery phase of construction projects using building information modelling), having complied with the requirements of BIM Level 2 Prepared, outlined in Scheme Document SD222 Rev 6.0

MMC Gamuda KVMRT (T) SDN BHD is subject to periodic surveillance and is licensed to use the BRE Global Certification Mark on documentation directly related to BIM Level 2 Prepared capabilities.

Company Address

Level 3A-3, Corporate Building (Block E),
Pusat Komersial Southgate,
No.2, Jalan Dua,
Off Jalan Chan Sow Lin,
55200 Kuala Lumpur,
Malaysia

BIM Role

Lead Supplier

Signed for BRE Global Limited — Laura Critien, Certification Manager

Date of this issue	Date of First issue	Expiry Date
23 August 2019	23 August 2019	22 August 2021

This certificate remains the property of BRE Global Limited and is issued subject to terms and conditions. For details go to www.breglobalbldngs.com/terms

To check the validity of this certificate go to www.breglobalbldngs.com/check or contact us.

T: +44 (0)333 321 8811 E: BREGlobalEnquiries@brogroup.com
BRE Global Limited, Garston, Watford WD25 9XX

BF2030 Rev 0.0 Page 1 of 1 © BRE Global Limited 2019

BRE GLOBAL CERTIFICATION

BIM Level 2 prepared
Certificate Number BIM 10042

Thank you

MMC-GAMUDA
KVMRT (T) SDN BHD

- **Why Digital?**

- To establish a collaborative design process using a common data environment (CDE).
- To create deliverables through a standardised production processes.
- To embed non-geographical content (Asset Data) for use within future operations and maintenance.
- To eliminate waste.
- Digital Twins for visualisation, Planning Simulation, Cost Analysis, Coordination, clash mitigation, predictive analysis
- Leads to benefits in less re-work, more efficient processes driving time savings, improved quality and reduce costs.
- To develop strategies that drive accurate data collection for improved Project insights and decision making.
- We don’t have a choice!! It’s a necessity to remain in business.