UEM EDGENTA

A member of UEM Group

HIGHWAY CONCESSION CONFERENCE

Topic of Paper 14: Innovation and Technology For Minimum Disruption During Maintenance (C&S)

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UEM Edgenta Berhad
Infrastructure Services

CONTENTS

Introduction

UEM Edgenta – Core Sectors

Asset Management & Infrastructure Solutions company with specialised expertise in 3 core sectors

HEALTHCARE SUPPORT SERVICES

- UEM Edgenta serves over **300 hospitals across Malaysia, Singapore, Taiwan and India**
- In Malaysia, UEM Edgenta provides Hospital Support Services ("HSS") under a **10-year National Hospital Support Service Contract ("NHSS") to 32 Government hospitals in the Northern region of Malaysia**
- 40%-owned associates, Sedafiat and One Medicare also provide HSS to **26 hospitals in Sabah and 23 hospitals in Sarawak** respectively via the NHSS
- Expanded into regional private healthcare services in 2016 via acquisition of UEMS Pte Ltd, a market leader in HSS based out of Singapore, with **more than 20 hospitals in Singapore and more than 50 in Taiwan**

INFRASTRUCTURE SOLUTIONS

- Nation's leading engineering, project and infrastructure management and maintenance specialists, providing services to **major highways and roads, airports, urban transit and other key infrastructure**
- Provides asset management and maintenance services to over **2,500 km of expressways** and **roadways** across Malaysia and Indonesia
- Provided project management consultancy for the Light Rail Transit 2

- **Key Projects:**
  - North-South Expressway
  - East Coast Expressway 2
  - Penang Bridge
  - Cikampek-Palimanan (Indonesia)
  - Kelana Jaya & Ampang Light Rail Transit (Project Consultant)
  - Ipoh-Padang Besar and Rawang-Ipoh Double Tracking (Project Consultant)
  - Pan Borneo Highway Sabah (Lead consultant to the Project Delivery Partner)
  - Pan Borneo Highway Sarawak (Independent Checking Engineer)

PROPERTY & FACILITY SOLUTIONS

- **Technology-driven township and facilities management** services and solutions, with a focus on **asset enhancement and energy solutions**
- **Key Projects:**
  - 9 CIMB buildings in the Klang Valley
  - 20-year contract to provide asset maintenance and management services to the Prime Minister's Office
  - Tampines Hub, Singapore's first ever integrated community and lifestyle hub spanning 250,000 sq. m.
  - Hengyuan Refining facilities, Port Dickson
  - Various iconic Singapore government buildings (e.g. Parliament, Treasury, Ministry of Foreign Affairs, National Design Centre)
  - Energy efficiency initiatives at 5 Government hospitals and 2 Proton facilities (Proton Centre of Excellence and Tanjung Malim manufacturing plant)
  - WASL district properties in Deira, Dubai

2,500 km of roads/expressways across Malaysia and Indonesia

Of which 775 km of the North South Expressway mainline forming our nation's backbone

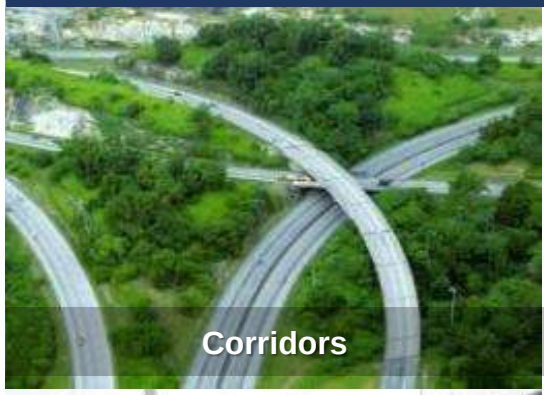
We provide strategic advisory services, design, development and management of major transport projects, and maintenance of infrastructure assets.

- In Malaysia, we are the nation's leading engineering design, project and network management and infrastructure maintenance specialists with 28 years of experience in infrastructure maintenance management.
- Our global team of engineers, researchers, planners and other transport infrastructure specialists provide a wealth of experience in the infrastructure sector. We have a track record in delivering multiple national infrastructure projects such as the North-South Expressway, the Light Rail Transit 2 and the KTMB Electrified Double Track from Rawang to Padang Besar.
- Our track record is evident in the network management and maintenance of over 2,500 km of expressways and state roads across Malaysia and Indonesia.

WHOLE OF LIFE CYCLE SOLUTIONS

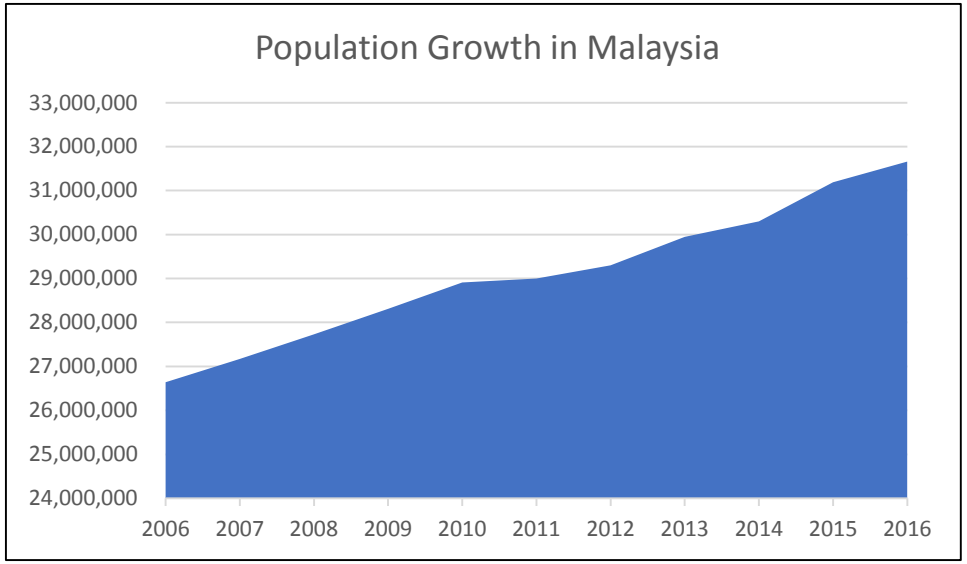
Consultancy	Services	
• Engineering and Consultancy Services • Project Management Services • Value Engineering • Asset Management Consultancy • Procurement and Contract Management • Geographic Information Systems • Asset Management Information System • Cost Modelling and Asset Life cycle Costing • Project Management Consultancy	• Pavement Rehabilitation • Traffic and Safety Management • Civil - Tunnels, Slopes, Bridges, Drainage, Landscaping, Line Markings, Toll Plazas, Rest and Service Areas • Mechanical and Electrical Works • Operations and Maintenance Services • Utilities Relocation Services • Environmental Testing and Monitoring • Bridge Structural Maintenance, Assessment and Repair • Material Testing Services • Pavement Condition Assessment • Soil Investigation and Field Testing • Slope Stabilisation, Repair and Rehabilitation • Geotechnical Instrumental Services • Building Condition Survey	• Centralised Command and Contact Center [Cloud-based work order management system and Internet of Things (IoT)] • Research and Development ❑ Pavement Research Centre ❑ Innovation Garage ❑ Continuous Improvement - LEAN

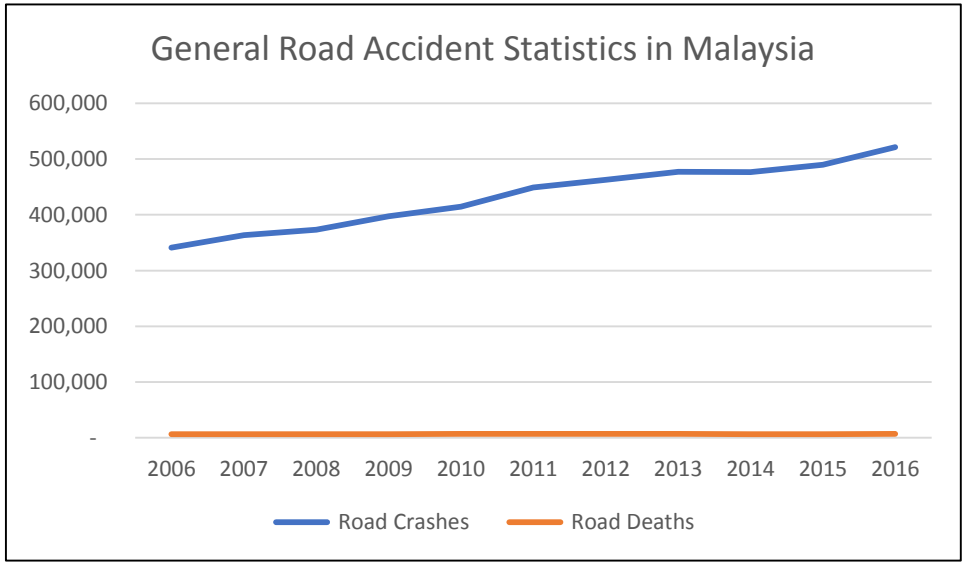
Portfolio Of Key Assets

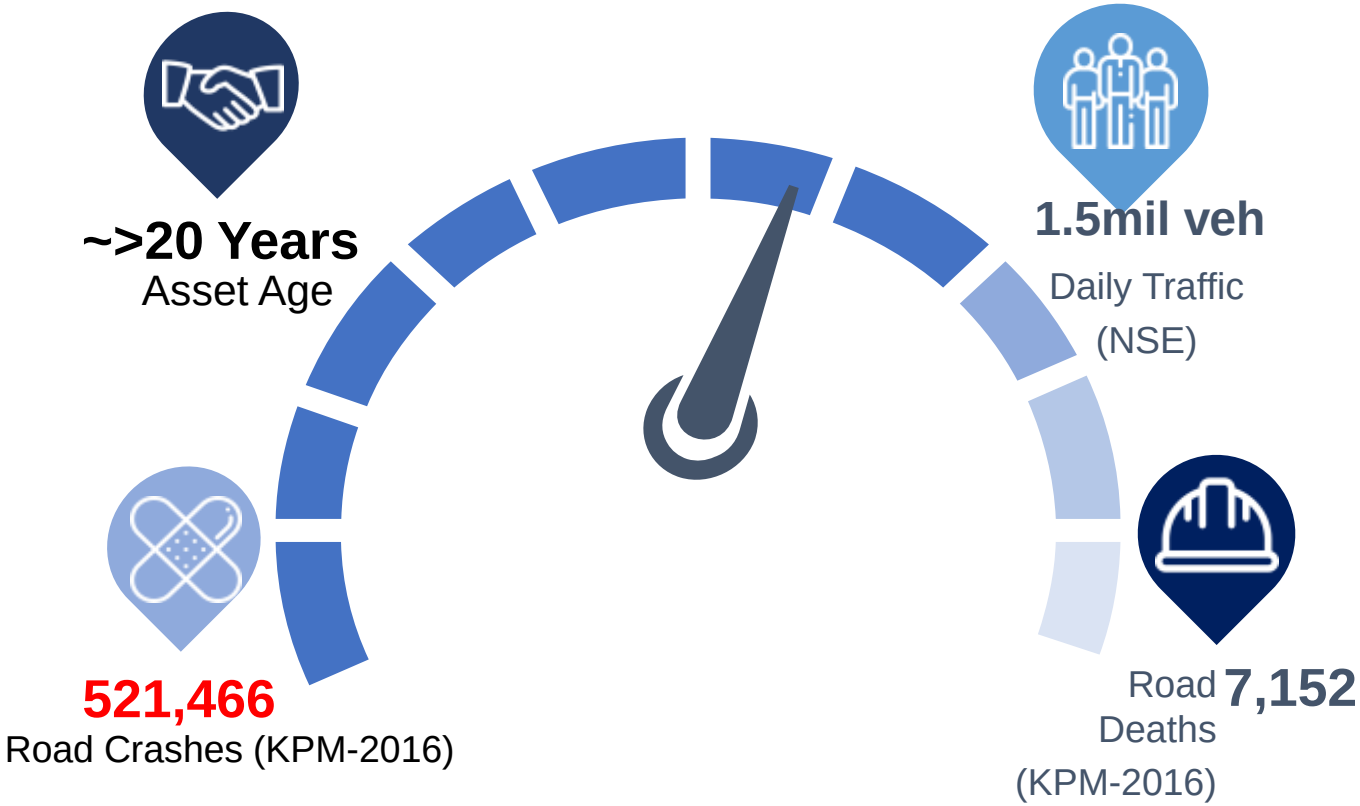
Civil Maintenance	MEE Maintenance	Facilities Maintenance	Speciality
 Corridors	 Roadway Lighting	 Toll Plaza	 Pavements
 Bridges	 Building Lighting	 Rest & Service Areas	 Traffic Management
 Slope	 Sewerage Systems	 Overhead Bridge Restaurants	 Research & Development

Current Scenario

Economic Growth, Asset Maturity & Development leading to Increased Customer Demands and Asset Management Challenges







Safety Improvements in line with Stakeholders Expectations

Launch of SAFETY VEHICLE on 25th May 2019

Notes
To improve and meet the increasing challenges towards “Goal Zero” safety

MoU signed on 18th June 2019

Notes
Focused on establishing new industry standards for safer work conditions for expressway maintenance workers at the frontlines as well as the safety of road users.


EMC
EDGENTA

Holistic Safety Program


Contractor engagement sessions


Defensive Driving training for PIT


Traffic Management training


Fatality Poster Session

3000

People engaged on **20 Do's and Don'ts** & 1000 people on 10 questions on **needle prick**

5000

People engaged **on Life Saving Rules** and rollout necessary materials and mini campaigns

4

poster sessions & 2 **LFI Videos** with engagement tracking

600

Frontline mandatory training on **Traffic management & Defensive Driving**

50%

LTI's are fully investigated

3 External Safety Award

Submitted (may not win due to fatalities)

Faster

Lane closure process from current 24 mins

06 Engagement

With stakeholders (DOSH,DOE,NIOSH)

1 PAPER

Presented at a **Malaysia Safety Conference**

MFV and **Joint Compliance audits** to continue


MIROS Collaboration Engagement

Safety Observations

Focus on closed out (target to be determined) per employee

C&S (Routine & Periodic Maintenance) - Disruption to Traffic

Civil Maintenance

DISRUPTION

On-site operation, supervision & maintenance of the following:

- Drainage
- Slope Rehabilitation
- Highway accessories, mainline structures and signages
- Waste collection and food waste composting
- Rest and Service Areas (RSA)
- Toll plazas, buildings
- Bridges
- Tunnel
- Landscape (hardscape & softscape)

Traffic Management

DISRUPTION

- Construction Site Traffic Management
- Event Traffic Management
- Lane Closures Management (high speed lane, contra flow, temporary lane)
- Incident intervention
- Highway patroling

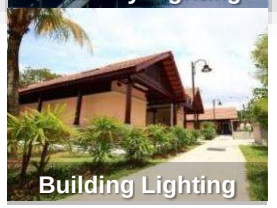
Pavement

DISRUPTION

- Pavement condition assessment (PCA)
- Pavement Research Centre
- Pavement construction and rehabilitation using:
  - Very Thin Overlay (VTO)
  - Micro Surfacing
  - Gap graded
  - Cold In Place Recycling (CIPR)
  - Hot In Place Recycling (HIPR)

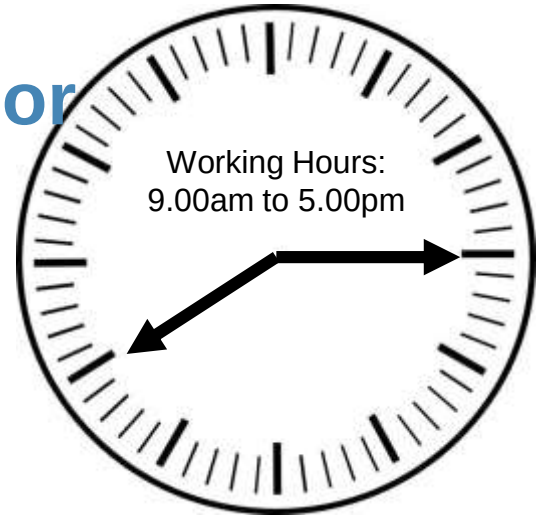
MEE Maintenance

Addressed in Separate Session



- Preventive, corrective maintenance, replacement, upgrading & improvement of the following system:
  - Air-conditioning & ventilation
  - Building automation
  - CCTV & perimeter security
  - Generator sets
  - Intelligent Transport System (ITS)
  - Power & lighting, etc.

Disruptions – Scheduled Works on Mainline Corridor

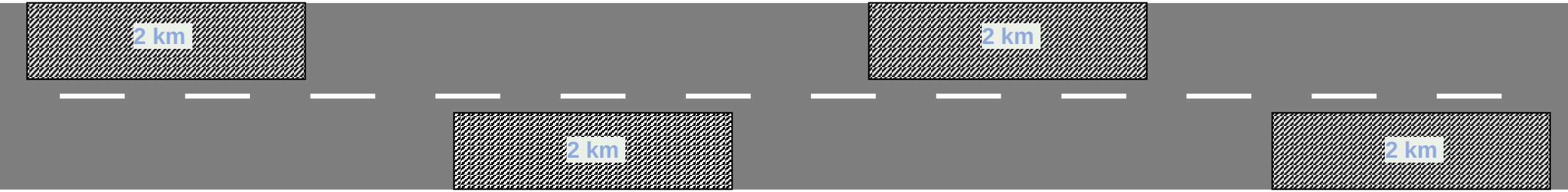


Average Lane Closure

4 locations per day, per section (8km)

Max Lane Closure

6 locations per day, per section (12km)



Average work time for every 2km closure

2 hours to 4 hours

Average TMV activation and deactivation for 2km

1 to 1.5 hours

Disruptions – Others (Adhoc)

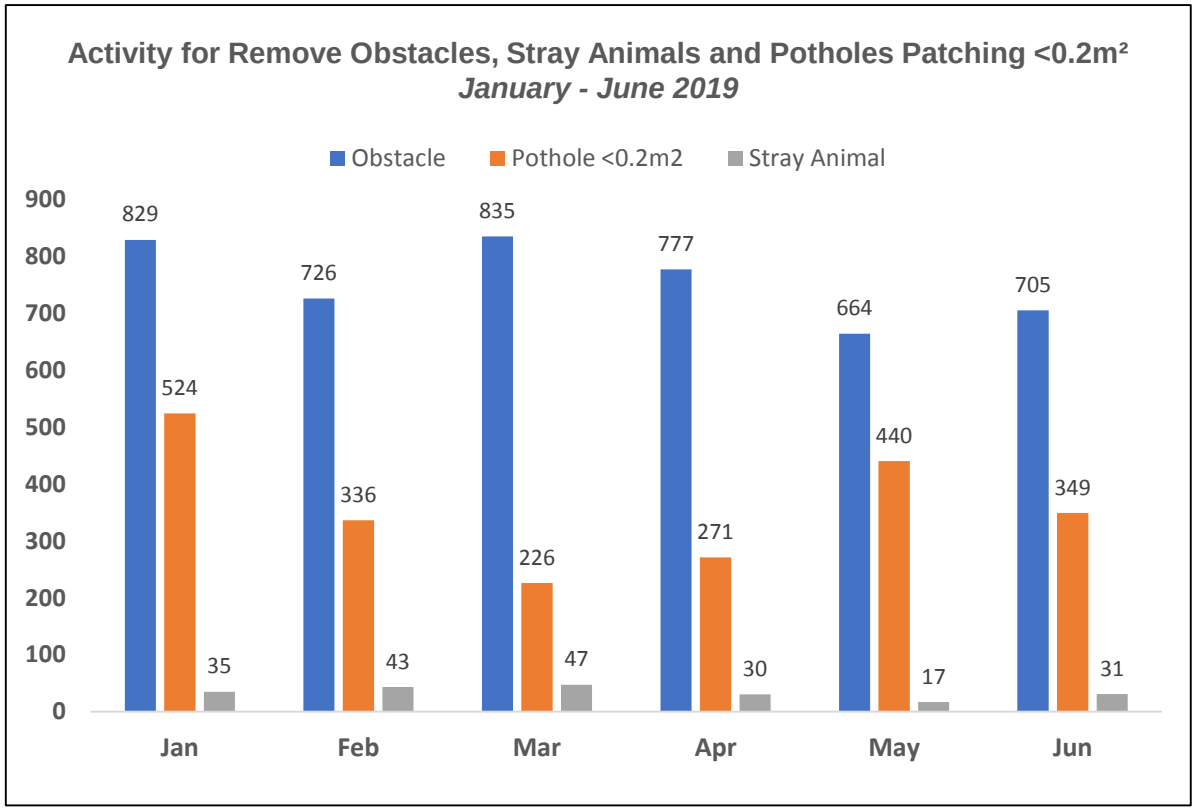


Chart 1: Total Activity of Disruption on Mainline by PIT

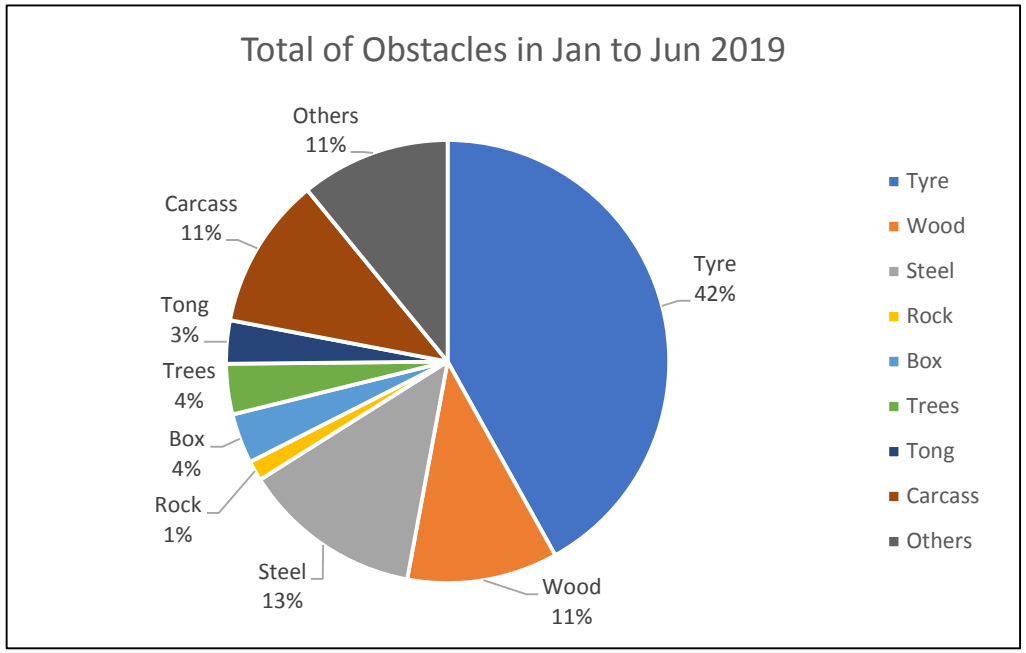


Chart 2: Total of Obstacles

Analysis

1. Average 1148 ad hoc cases monthly
2. Average 38 ad hoc cases daily
3. Average 2 ad hoc cases hourly
4. Tyre fragments has high numbers of obstacles on the mainline by 42%

Disruption Mitigation

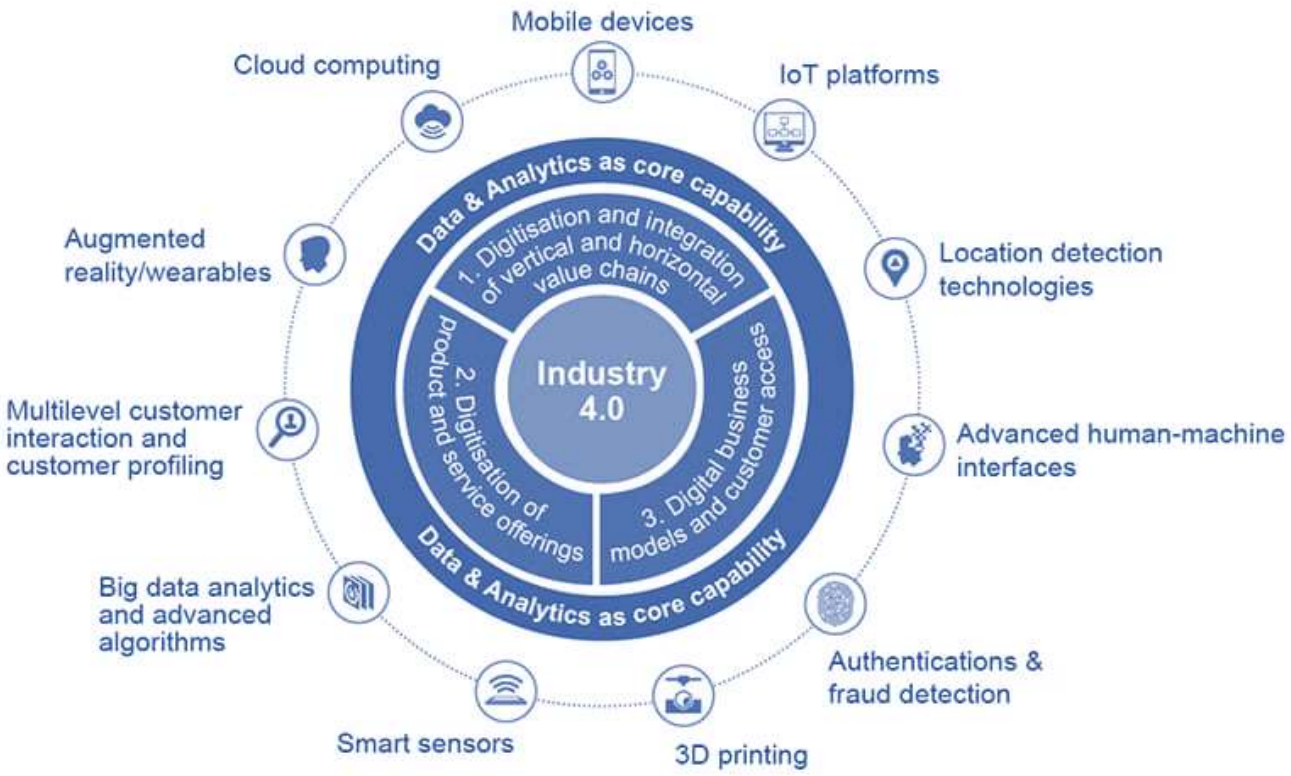
Moving Forward – Context of Future Outlook

1950 – Pit Stop 63 seconds
2013 – Pit Stop 3 seconds……..…21 times faster than 1950
2016 – Pit Stop 1.92 seconds……..…33 times faster than 1950

Innovation & Technology to Improve Services Delivery

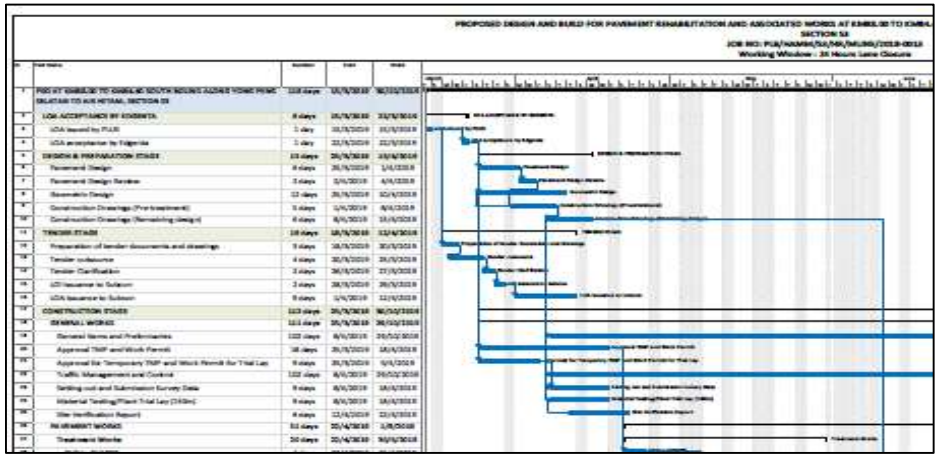
UEM Edgenta aliened with IR4.0 on commitment to improve services delivery to all stakeholders and have initiated **Programs in-house and in Conjunction with Business Partners**

Innovation Garage (TIDE*)	• Mechanisation • Automation • Digitalization
Continuous Improvement LEAN	• Work Planning • Value Stream Mapping • SMED
Research & Development	• Materials • Data Analytics • Technology
HSSE	• Safety Setup • Safety Equipment • Safety SOPs - Training



*Trending – Innovation – Disruption - Entrepreneurship

CI–LEAN : Traditional Project Planning



Microsoft Project: PSO2019 – Section SZ

Planned Adherence Monitoring Control System

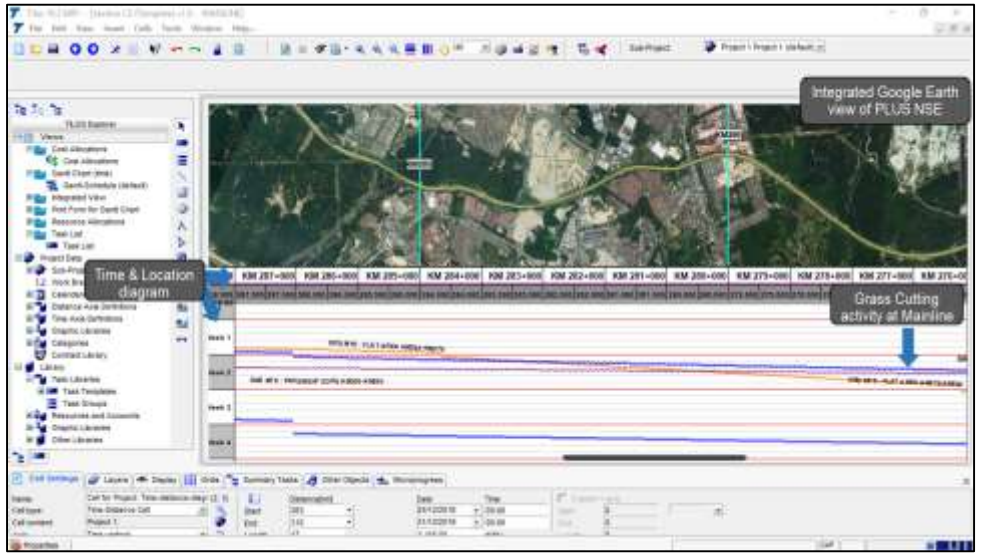
Primavera P6: CIPALI Highway

Drawbacks

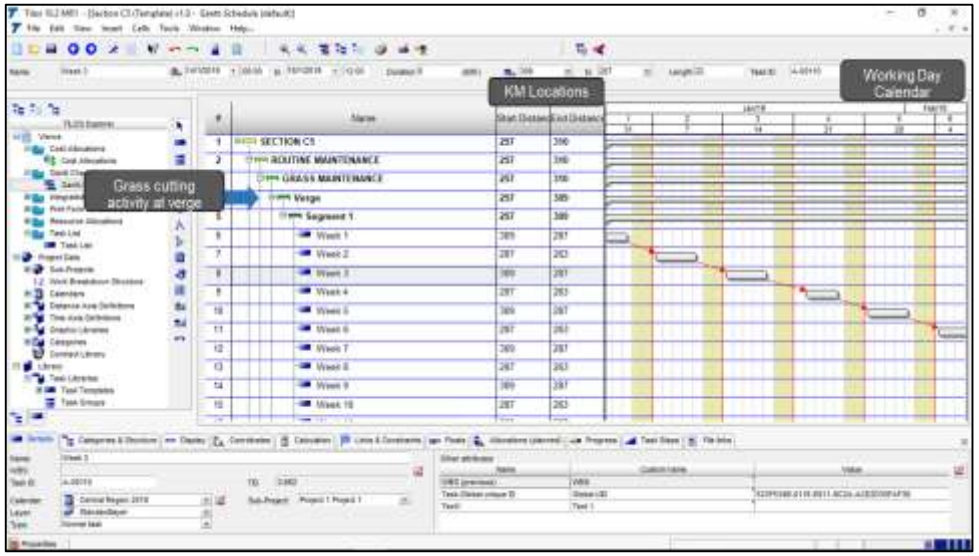
1. Non-Graphical View of Overall Work Tasks
2. Incapable to Integrate Routine and Planned Works for Linear Assets
3. Common for Project-Based Maintenance Works
4. Lack of Real-Time Monitoring of Work

CI–LEAN : Linear Project Planning

Linear projects present **unique challenges** because the crews and equipment move along the construction site to perform their work. Linear schedules can **communicate more information** because of the way distance related data is assigned to each individual task. The link between site and schedule information enables a quicker and deeper understanding of the construction plan.



Stimulation Running for TILOS



TILOS Grantt Chart

Notes

Key Attributes of Time – Location Linear Planning

1. Visual representation of works - projects which include time diagram and location diagram
2. Able to integrate multiple planning works in a single view
3. Additional clash detection analysis tools help to identify any clash interference between multiple works

CI–LEAN : Improvised Traffic Management (e.g. pavement heavy repairs)

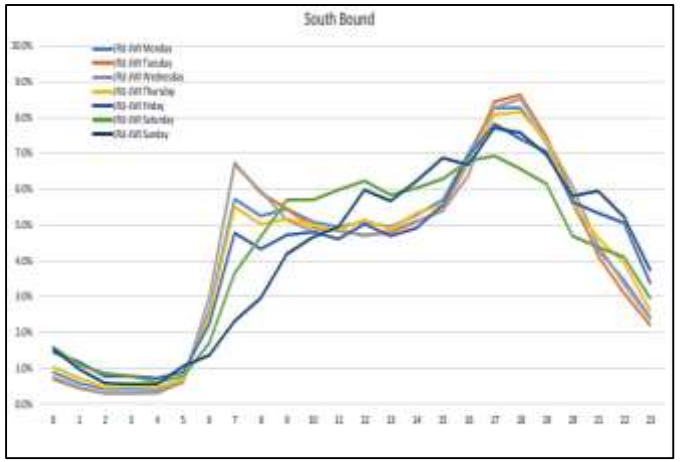
The overall approach of the study is divided into three (3) key stages:

Stage 1) **Baseline Demand**: Detailed OD toll plaza traffic volume data to generate hourly profile by day of week (24hrs from Monday to Sunday)

Stage 2) **Static Analysis:** Run hourly profiles of affected section into LOS Analysis. LOS illustrates the sectional performance of the proposed options

Stage 3) **Simulation:**

- Assess high traffic volumes subject to TMP measures.
- Simulate detailed traffic behaviour from outputs of Static Analysis using VISSIM.
- VISSIM provides visual representation of user behaviour, reflecting lane-changing, vehicle following, merging/weaving, and interaction of motorcycles.



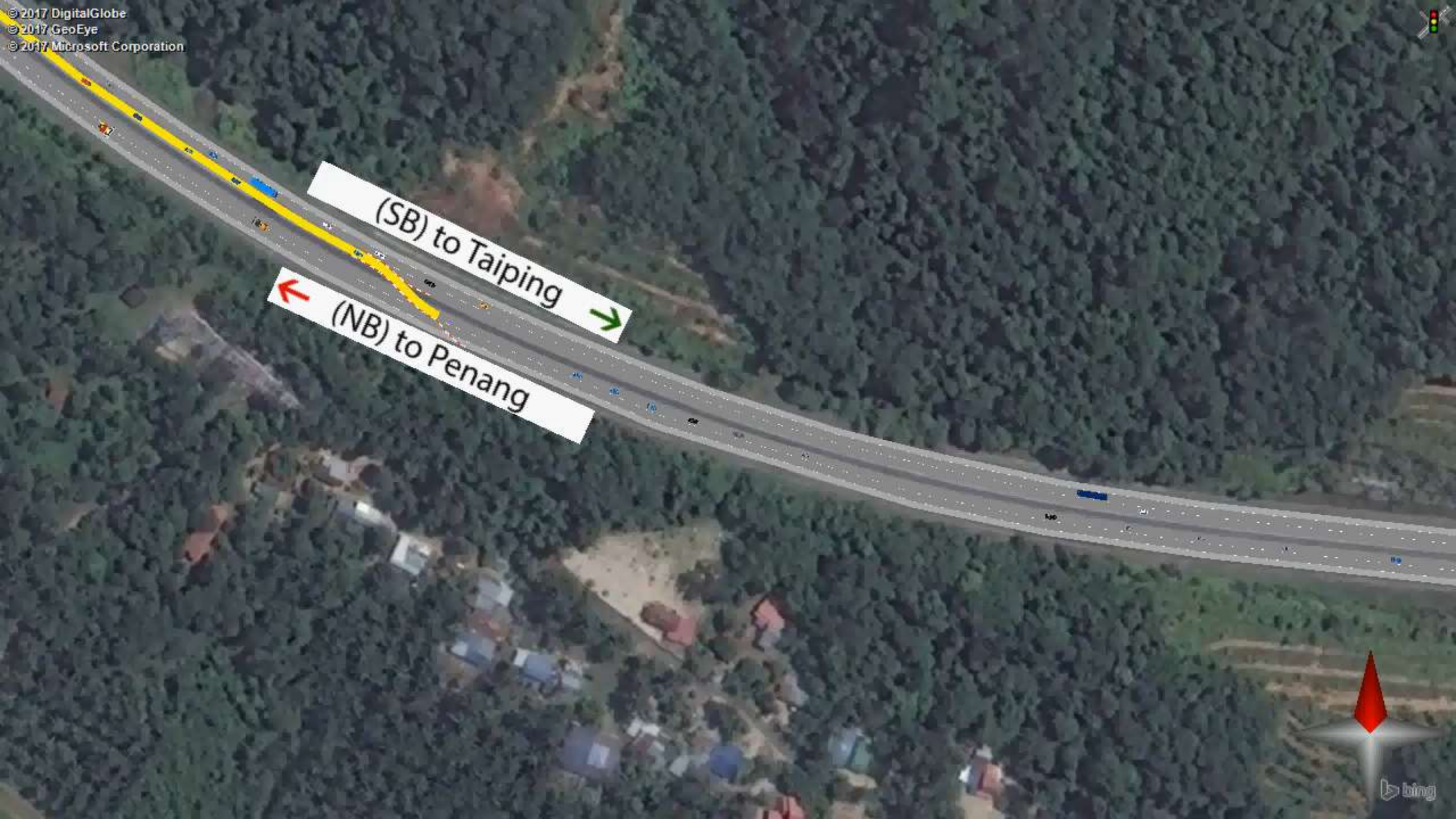
Stage 1: Overall Study Approach

Item	NB	SB
Volume (*veh*)	2,970	3,040
Avg. Delay / veh (*sec*)	16	795
Avg. Speed / veh (*km/h*)	82	60
Est. Queue (*m*)	0	2,280

Stage 3: Lane Closure Productivity

Location	Bound	Working Window	Level of Service (LOS)	
			SB/WB	NB/EB
Section Na	SB	24 hr Single Lane Closure	D	No Impact
Section Nb	SB	Night-time Only Single Lane Closure	C	No Impact
Section Nc	NB	Night-time Only Single Lane Closure	No Impact	E
Section Nd	NB	24 hr Single Lane Closure	No Impact	D
Section Cx	EB	Night-time Only Single Lane Closure	No Impact	D
Section Cy	SB	24 hr Single Lane Closure	D	No Impact
Section Ne	SB	24 hr Single Lane Closure Night-time Only Single Lane Closure	D	No Impact

Stage 2: Level of Service


© 2017 DigitalGlobe
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(SB) to Taiping
(NB) to Penang
bing

Technology - Command and Contact (CnC) Centre

- **Our CnC** is the central hub which houses our digital capabilities. As the centralized monitoring facility, it tracks assets in real-time and functions as a center for data and analytics.
- It uses **Microsoft Azure's cloud-based machine** learning for prediction and anomaly detection which enables operational insights to **better manage issues** and **provide a higher level of service delivery** to our customers.

UETrack Platform for Healthcare Services

Mobile resource optimisation platform for real-time tracking of resources and work progress

Road Asset Management System (RAMS)

A comprehensive and integrated enterprise system for an efficient and effective delivery of asset management and maintenance operation

Smart Facilities Management Solutions

An integrated facilities management system built on Microsoft's Azure IoT Hub and Machine Learning

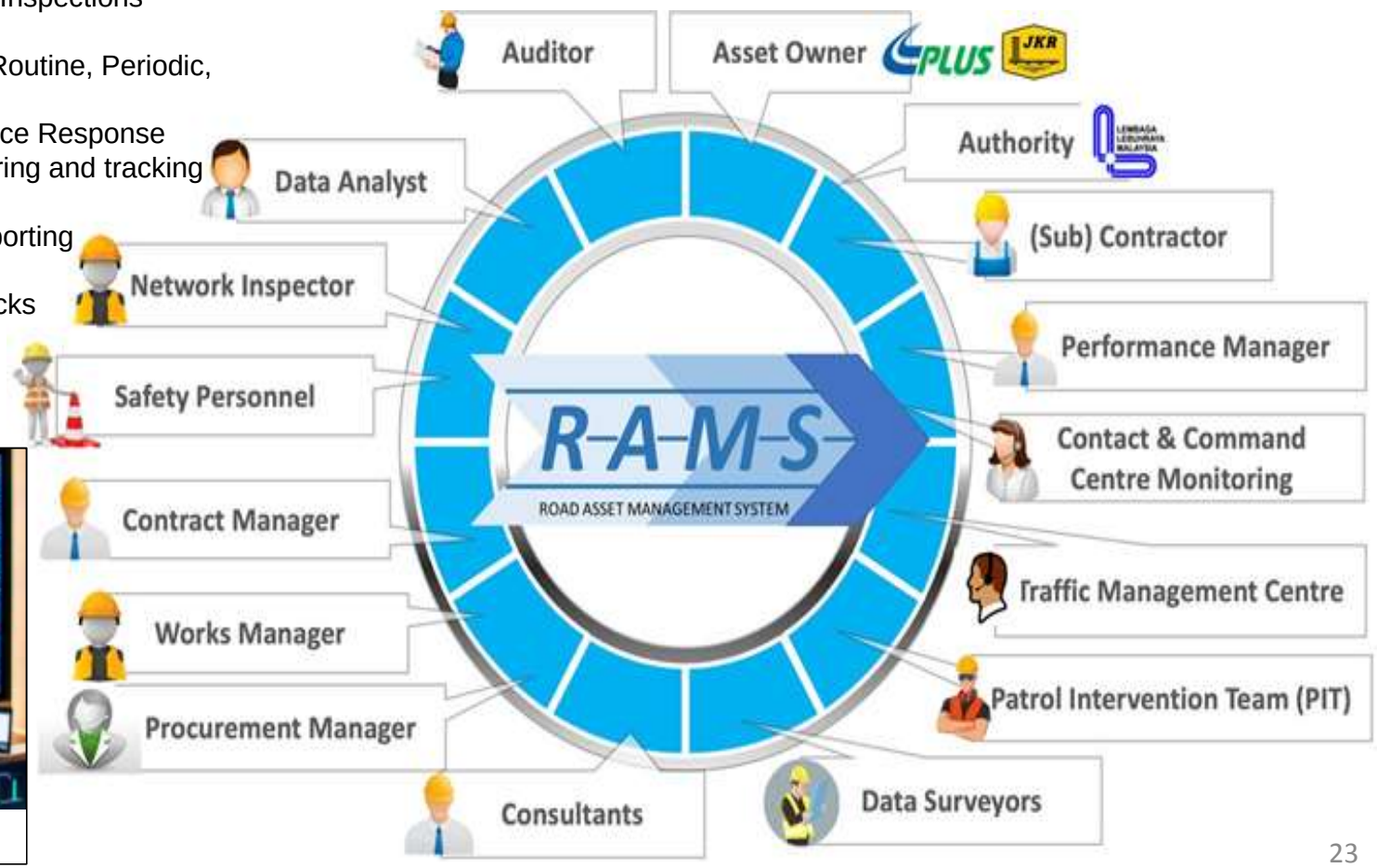
Technology – Work Monitoring, Reporting & Proactive Mitigation

Road Asset Management System (RAMS) - We have developed an integrated **asset management maintenance system** through our digital transformation efforts - Management and Operational processes will now be accessed via various smart devices anytime anywhere

- ✓ Inventory Register
- ✓ Condition Assessment, Inspections
- ✓ Notification of Defects
- ✓ Works Management – Routine, Periodic, Additional
- ✓ Emergency and Incidence Response
- ✓ Response team monitoring and tracking
- ✓ Performance Audit
- ✓ KPI Monitoring and Reporting
- ✓ Works scheduling
- ✓ Complaints and feedbacks
- ✓ Dashboard Monitoring
- ✓ HSE Beakon System

Contact and Command Centre

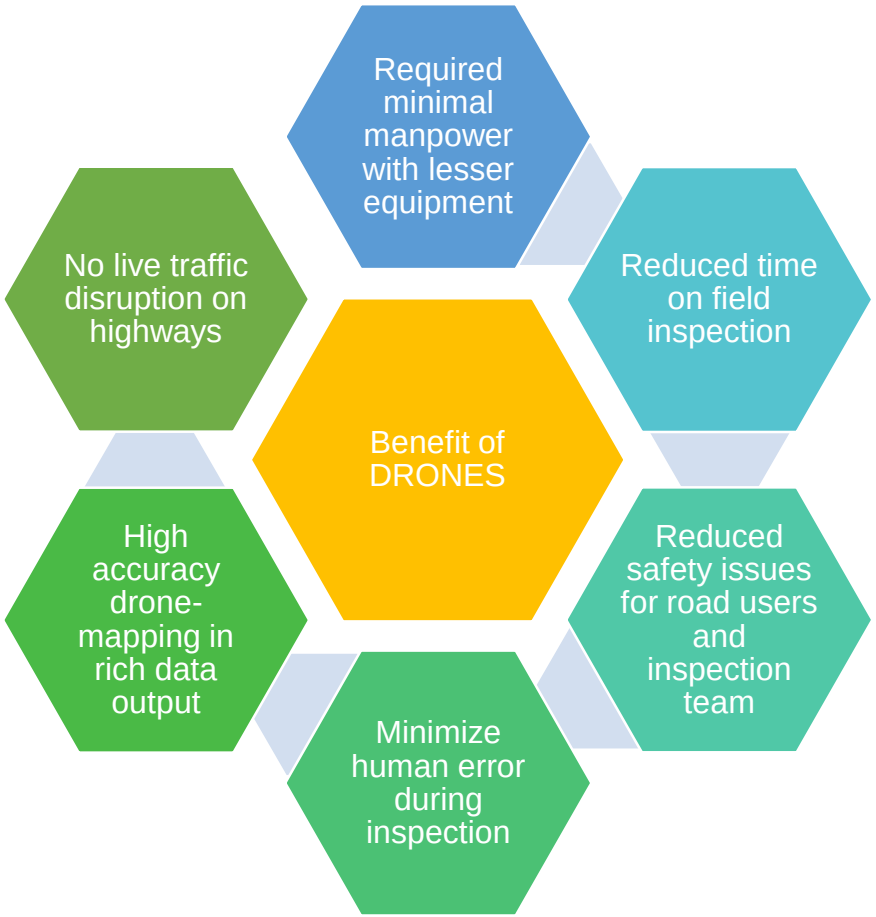
Connecting People



Technology – Drones enabling reduced Interaction with traffic

Capabilities with BIM & Drone

- ❑ 3D Mesh using drones
- ❑ Modelling linear assets in 3-dimensional space
- ❑ Asset tags linking data inventory software to 3-dimensional model
- ❑ Mitigation measures by using Road Safety Audits



Mechanisation – Resources Optimisation

Project Tide – Concept 2 – Mechanisation of Grass Cutting

This pilot project initiative is under **Project TIDE (Trending, Innovation, Disruption and Entrepreneurship)** – Innovation Garage with the aim of producing via rapid prototyping based on a given Problem Statement. The Problem Statement Concept 2 was "***by mechanizing maintenance works, we will improve efficiency and effectiveness (safety, productivity, cost) by 15% and start enjoying benefits within 12 months***"

	Current Manual Practice		Mechanised Vehicle	
Time (hour)	Traffic Management	1 hr	-	Grass cutter and IPV operate in tandem
	Grass Cutting	6 hrs	7 hrs	
	Break time	1 hr	1 hr	
Resources	Grass cutter worker	18 workers	2 workers	1 Hydraulic Arm Grass Mower
	Mobilisation team	3 workers + 1T Lorry & 2 Vans	-	2 workers

Notes

With the mechanization, the following key parameters are of focus:

1. Reduced workers from Exposure to Live Traffic (ETLT)
2. Increased productivity
3. Reduced reliance on manpower resources

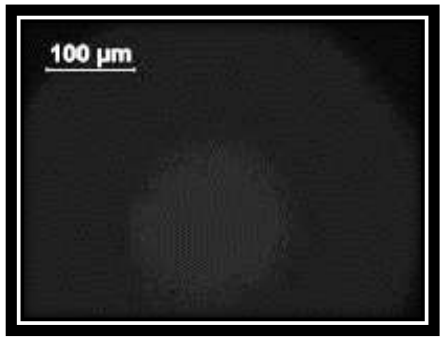
Hence Team Performance has proposed the utilization of a **Hydraulic Arm Grass Mower (MULAG)** working in tandem with an **Impact Protection Vehicle (IPV)** in order to increase **operational safety** (due to reduction of manpower exposure) and **improved efficiency** due to greater productivity within the same working time.

Research and Development - Materials

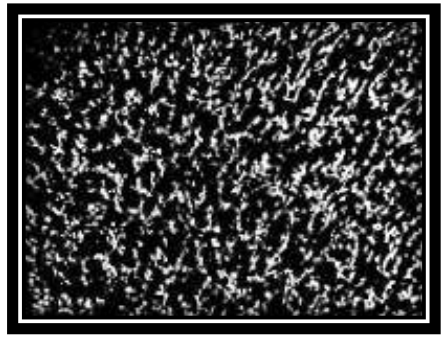
Pavement Research Centre (PRC) has been set up as part of UEM Egdenta Research and Development Centre. It is to carry out R&D on innovative pavement materials in conjunction with developing **improved materials** together with *associated maintenance techniques*. To improve whole of life cycle performance, i.e**. longer life – lower cost**

Sample of one of the products from Pavement Research Centre

ASPECT	Conventional 60/70	PMB
TECHNICAL PROPOSITION: DURABILITY		
Rutting Resistance at High Service Temperatures	Low	High
Cracking Resistance at Low Temperatures	Low	High
Moisture Damage Resistance	Low	High
Fatigue Resistance (Mix Elastic Response)	Low	High
COMMERCIAL PROPOSITION: LIFE-CYCLE COST		
Bitumen / Mix Cost	Low	High Initial Cost
Overall Life-Cycle Cost	High	Low (High Performance & Extended Pavement Life)



Conventional 60/70



Polymer Modified Bitumen

Roller Compactor

Double Wheel Tracker

Universal Testing Machine

Dynamic Shear Rheometer

Summary

Moving Forward

UEM Edgenta Efforts, aligned with Industry 4.0 for Operational Excellence
Have been making **substantial investments, strategic partnering with local and international organizations** for innovation and technology. However, success needs **holistic support**.

Minimum Disruption During C&S Maintenance

Innovation and Technology
(Industrial Revolution 4.0)

1 Industry Strengthening

- Organisation Transformation
- Digital Competency
- New Partnering & Procurement Models

2 Investment

- Research & Development
- Funding Support
- Increased Services Contract Tenure

3 Stakeholders Mindset

- Cultural Change
- Public Communication

Continuous Health, Safety, Security and Environment

Thank you