
CONFERENCE
OMAINTEC
2024
EXHIBITION
THE 21ST INTERNATIONAL
OPERATIONS & MAINTENANCE
CONFERENCE IN THE ARAB COUNTRIES
Integrating Digital Twin and Asset Management System
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#OmaintecConf
An Initiative by
OMAINTEC
المجلس العربي للتشغيل والصيانة
Arab Operations & Maintenance Council
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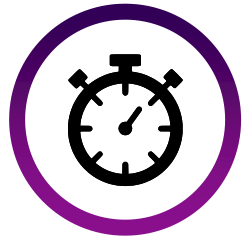
مجموعة أكزيكون الدولية

AMS Traditional Methods Weaknesses

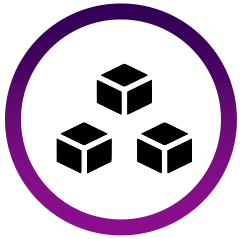
Reactive Approach

Critical Data Gaps



Lengthy Data Collection

Subjectivity & Inconsistency



Isolated Data Structure

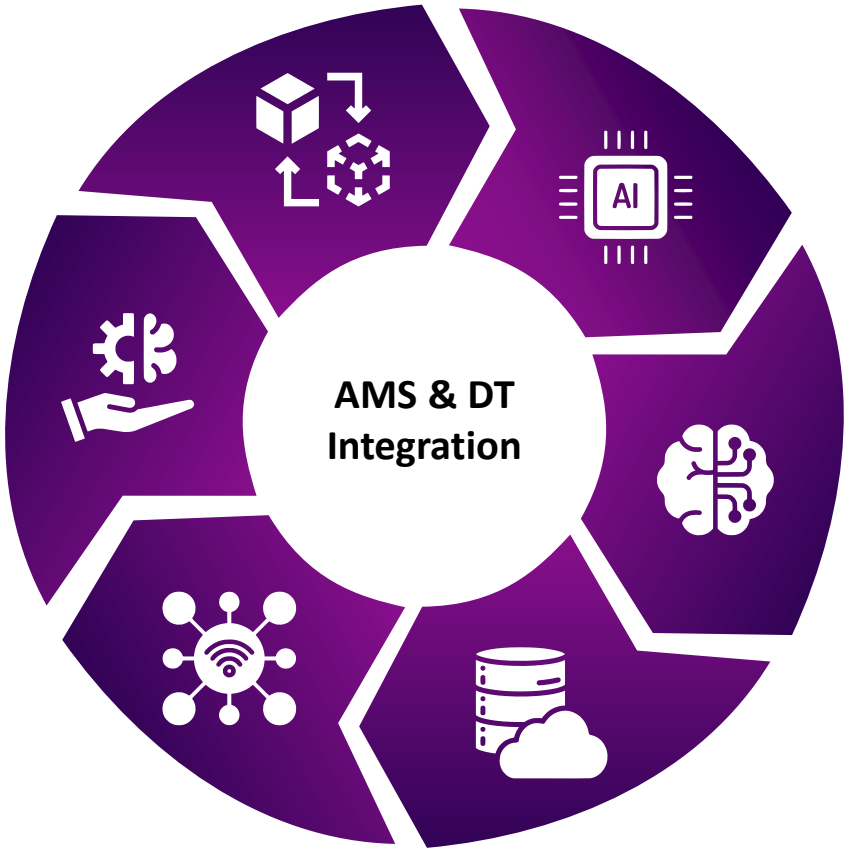
Outdated Analysis Techniques

Smart Maintenance Decision Tool

Digital Twin Technology

Digital Training & Education

Internet of Things (IoT)



Artificial Intelligence

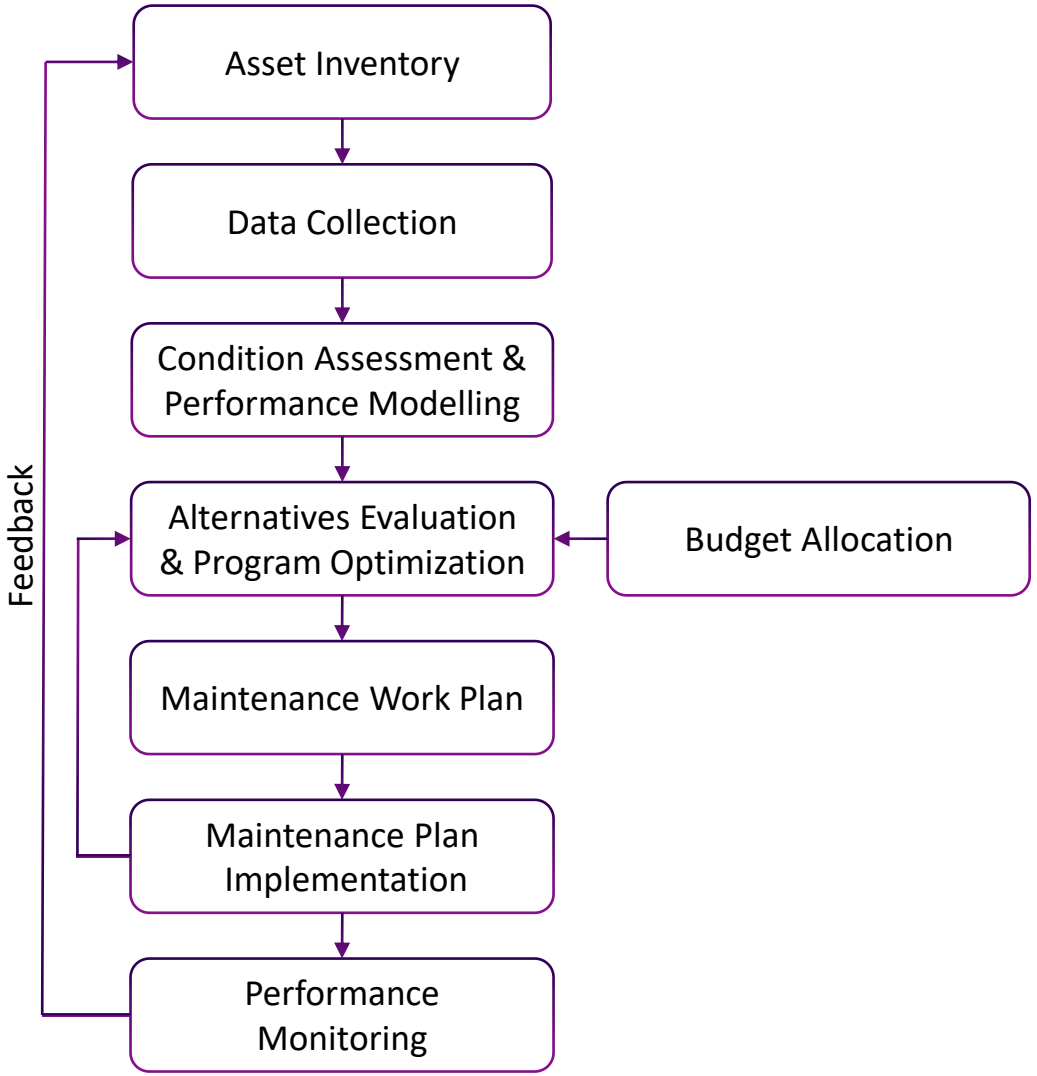
Machine Learning

Cloud Database

Asset Management System (AMS)

Asset Management System (AMS) is a systematic process of maintaining, upgrading and operating assets, combining engineering principles with sound business practice and economic rationale, and providing tools to facilitate a more organized and flexible approach to making the decisions necessary to achieve the public's expectations providing a systematic framework for effective asset maintenance

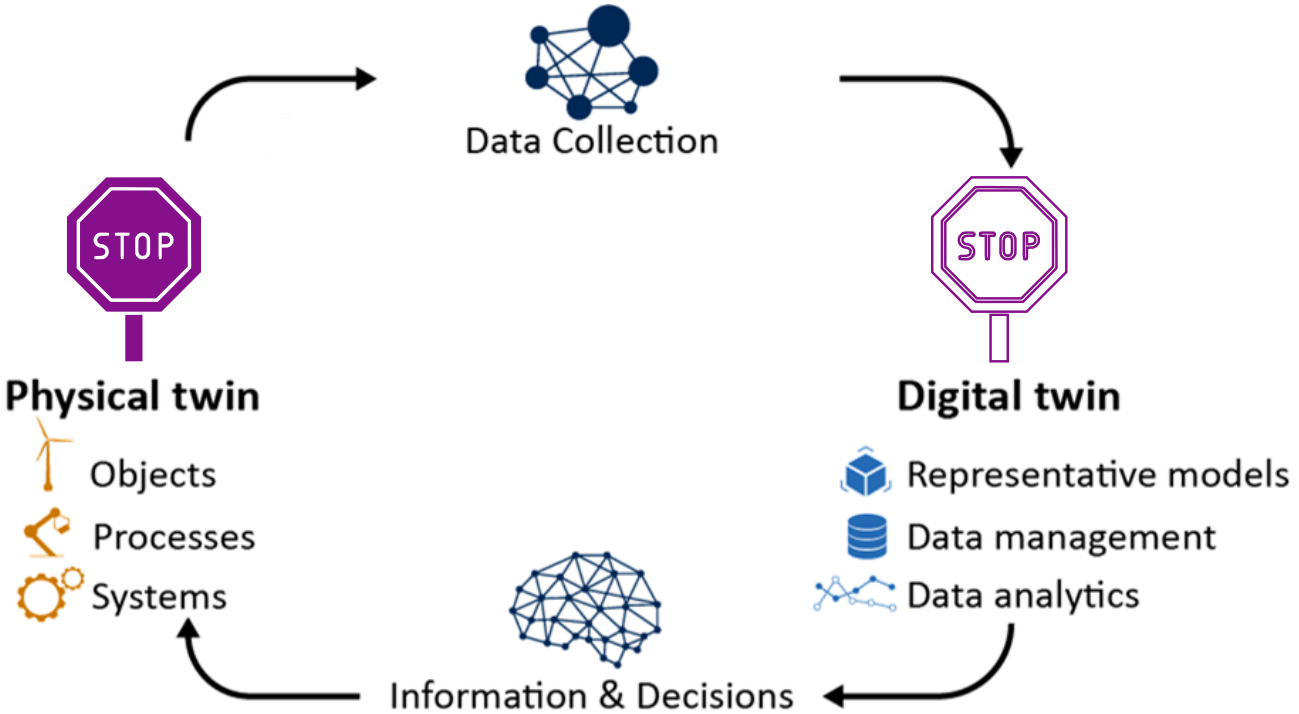
"Empowering Transportation Agencies Achieve Roadway Excellence"



Digital Twin Technology (DT)

Digital twin technology involves creating a dynamic virtual replica of a physical object or system. This virtual counterpart mirrors the real-world asset in real-time, constantly updated with data streamed from sensors, IoT devices, and other sources.

Digital twin technology serves as a bridge between the virtual and real worlds. By leveraging real-time data collected from physical sites, we can create virtual replicas of our infrastructure and enhance our understanding of its current state.



Smart Maintenance Decision Tool Methodology

Physical Layer
Historical & Current
Data Collection

Cloud-Database Layer
Data Storage & Digital Twin
creation

Analysis Layer
ML,AI Algorithms
Computations

Application Layer
Web/Mobile
Platforms

Case Study (Awes Ebn Thabet Road, Jeddah, KSA)

Road Name: Awes Ebn Thabet Road

Location: Al-Mohamdya region in Jeddah, KSA

Significance: Crucial connection between Prince Sultan Rd and Al-Madinah Al-Monawra Rd.

Pavement Characteristics:

- Flexible asphalt pavement.
- Three lanes in each direction.
- Lane width: 3.2 meters.

Reason for selection: Traffic challenges and suboptimal pavement condition

Investigation Focus: Left lane from Prince Sultan Rd to Al-Madinah Al-Monawra Rd.

Awes Ebn Thabet Road

Physical Layer (MFV)

Title: Multi-Function Vehicle

Content: LCMS-2, Panorama Camera, GPS, DMI, IMU

Role: Collects real-time data using advanced sensors and equipment

Key Data: Captures distress data, roughness data, pavement images

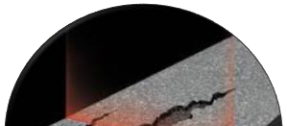
Importance: Enables comprehensive data collection for detailed analysis

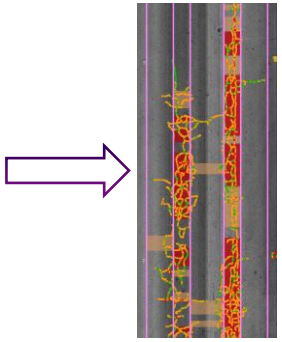
Objective: Introduce the MFV as a key tool for real-time data gathering

Digital Camera 360 Degrees

Laser Crack Measurement System (LCMS2)

Laser Digital Profiler





Distance Measuring Instrument

Physical Layer (MFV)

Physical Layer (F-FWD)

Title: Fast-Falling Weight Deflectometer

Content: Standard Falling Weight, Loading Plate, Deflection Sensors, DMI, GPS

Role: Measures pavement deflection to assess structural integrity

Key Data: Provides essential information for structural analysis

Importance: Aids in predicting pavement performance and longevity

Objective: Highlight the role of FWD in assessing pavement structure

Standard Falling Weight

Loading Plates & Deflection Sensors

Physical Layer (GPR)

Title: Ground Penetration Radar

Content: GPR Antenna, DMI, GPS

Role: Determines pavement layer thickness and subsurface features

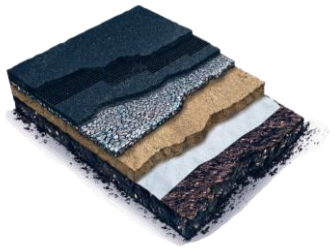
Key Data: Gathers critical information for pavement modeling

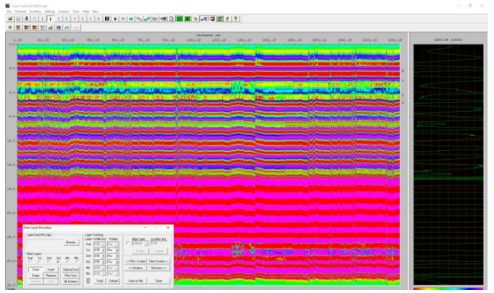
Importance: Essential for understanding subsurface conditions

Objective: Illustrate the role of GPR in subsurface data collection

GPS Unit

Ground Penetration Radar





Physical Layer (PFT)

Title: Pavement Friction Tester

Content: Standard Brake Tire, Water Tank, DMI, GPS

Role: Measures pavement surface friction for safety assessment

Key Data: Contributes to a holistic understanding of pavement conditions

Importance: Aids in decision-making for maintaining safe road surfaces

Objective: Emphasize the role of PFT in ensuring road safety

Standard Tire

Water Tank

Physical Layer (Mobile Mapping)

Title: Mobile Mapping Vehicle

Content: LIDAR, Panorama Camera, DMI, GPS

Role: Captures geospatial data using advanced mapping technologies

Key Data: Enhances GIS capabilities for detailed spatial analysis

Importance: Supports accurate mapping and visualization of road networks

Objective: Present the significance of mobile mapping in spatial analysis

Distance Measuring Instrument

LIDAR+360 Camera+GPS

Cloud-Database Layer

Flexible Database

Massive Storage Area

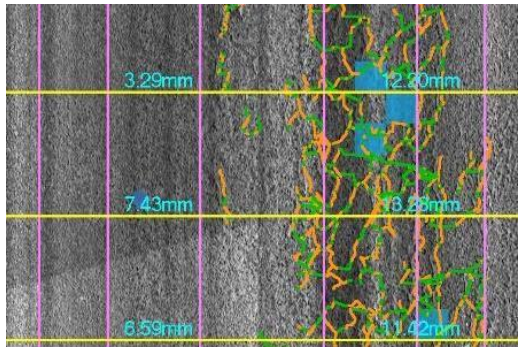
Robust Security

Query Support

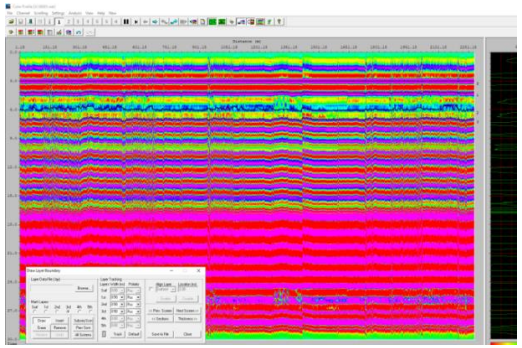
Seamless Integration

Disaster Recovery

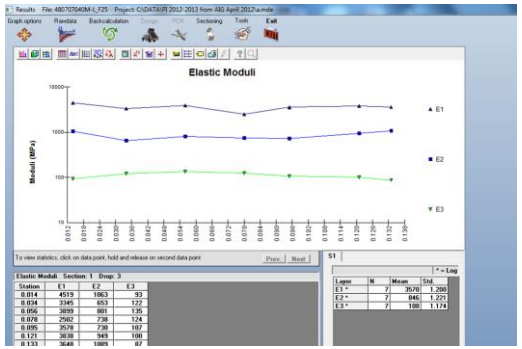
Pre-Analysis Data Processing - Awes Ebn Thabet Road



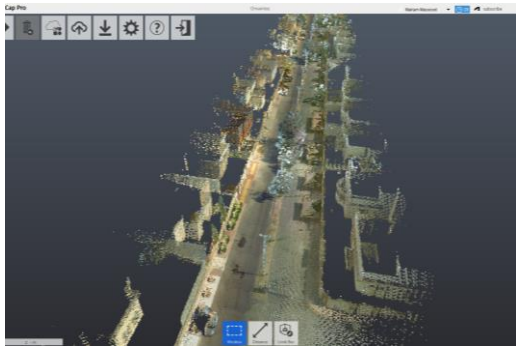
MFV Data
Surface distresses data detection



GPR Data
Pavement layer depths determination

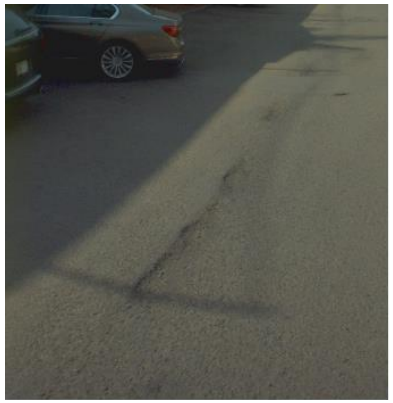


FWD Data
Pavement structural integrity calculation



Point Cloud Data
3D point cloud model creation

Detected Surface Distresses- Awes Ebn Thabet Road



Rutting along with Raveling

Poor patch around manhole

Depression in manhole

Severe weathering and raveling

Bleeding

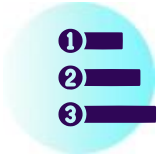
Data Analysis Layer

PCI: Calculation from processed distresses

IRI: Measurement for ride quality assessment

Assets: Non-paved elements condition assessment

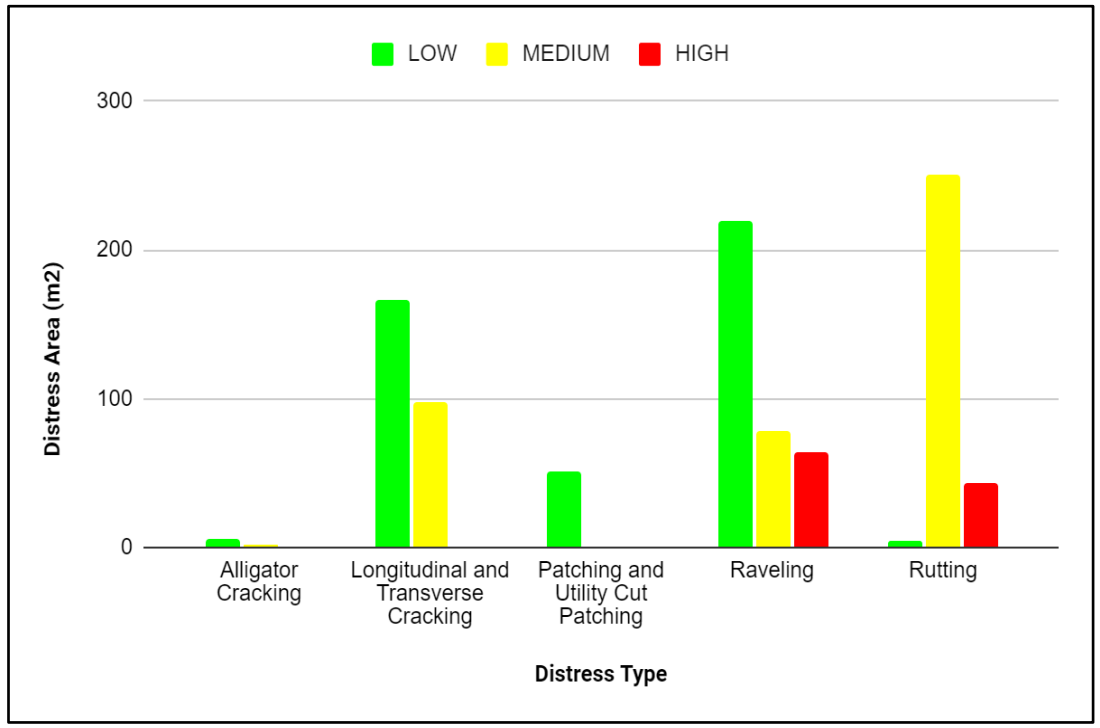
M&R Strategies: Different M&R strategies, life cycle cost analysis



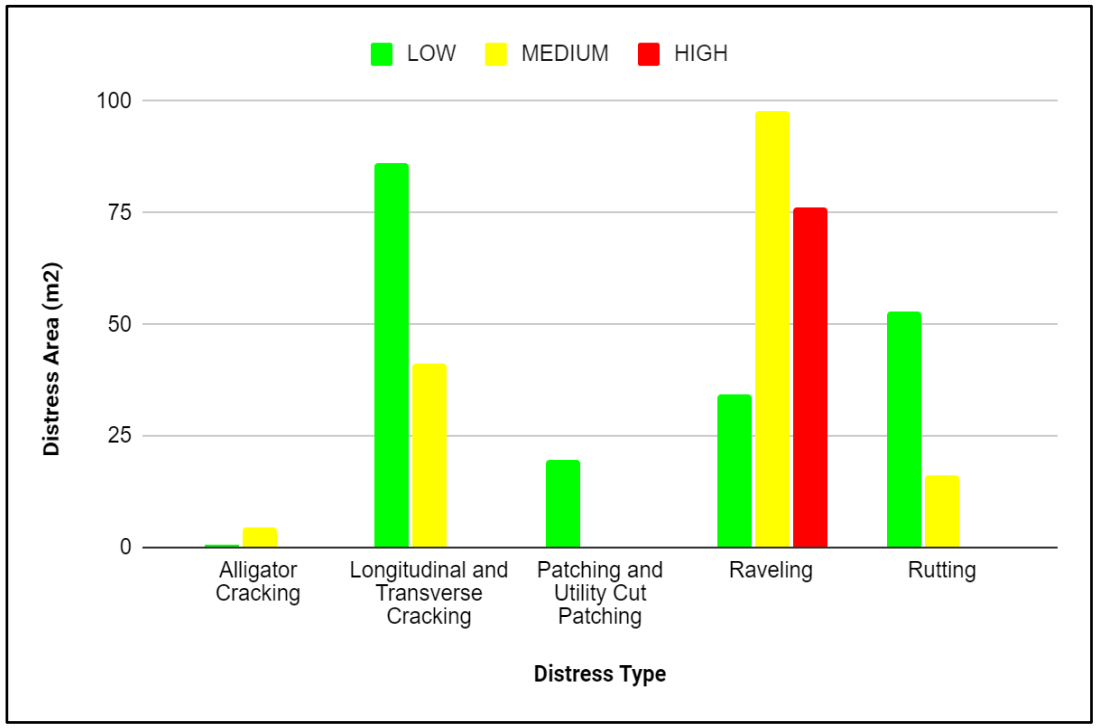
Prioritization: Priority analysis to optimize resource allocation

Future Planning: Performance models for future infrastructure planning.

Data Analysis Results - Awes Ebn Thabet Road



Pavement Distresses Details in Section_1



Pavement Distresses Details in Section_2

Data Analysis Results - Awes Ebn Thabet Road

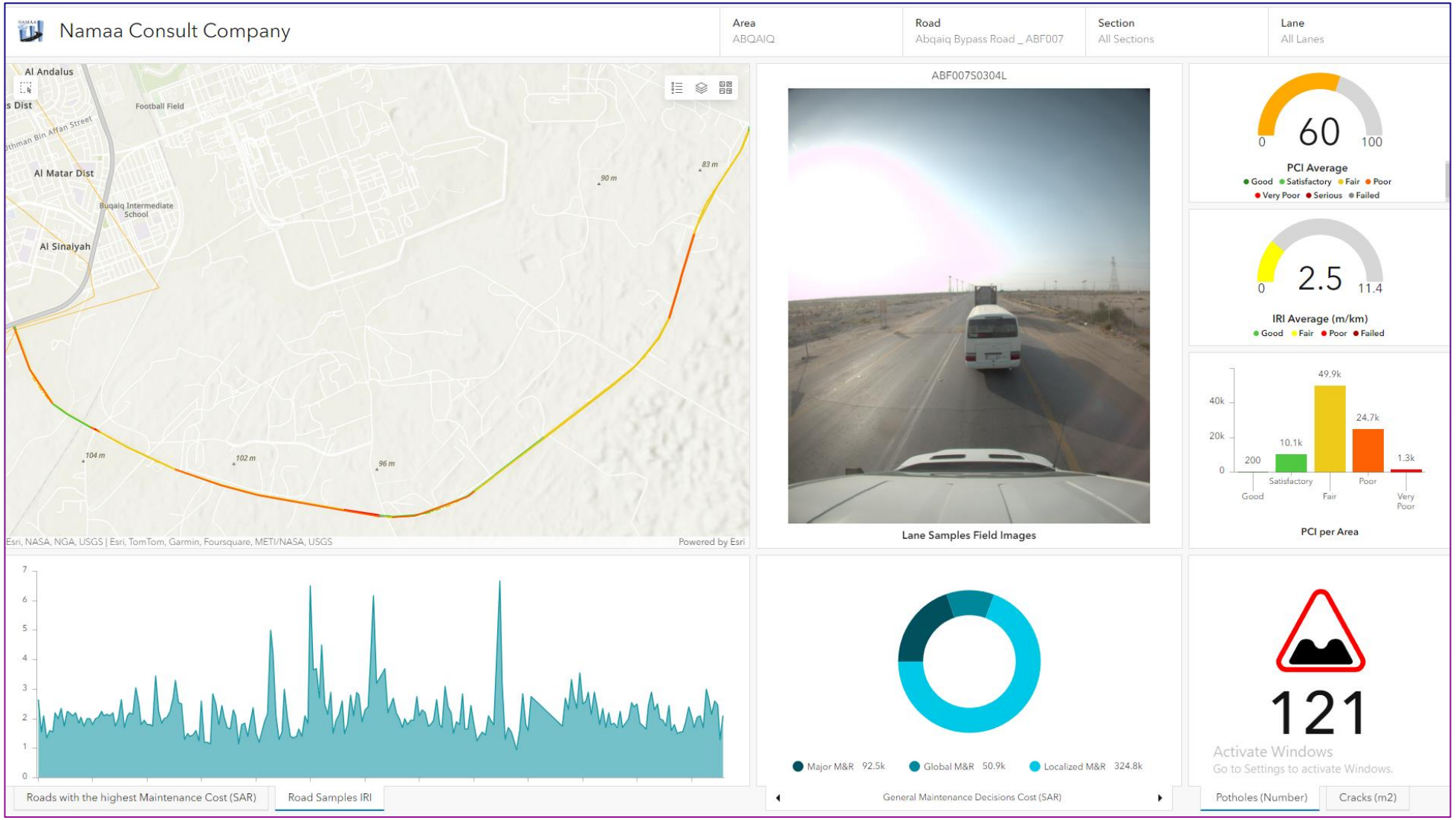
Section ID	Reading Type	Value
Section_1	PCI_MFV	35
	IRI_Profiler (m/Km)	3.8
	FN_ (Friction Tester)	36
	D1_(FWD) (µm)	350
Section_2	PCI_MFV	45
	IRI_Profiler (m/Km)	5
	FN_(Friction Tester)	39
	D1_(FWD) (µm)	330

Table 3: The Results from Different Equipment in the Study Area

Section ID	Maintenance Decision Type	Unit Price (SAR/m^2)	Area (m^2)	Cost (SAR)
Section_1	Mill and Overlay	30	864	25,920
	Deep Patching	150	21	3,150
Section_2	Mill and Overlay	30	1408	42,240
	Deep Patching	150	49	7350
		Total	2342	78,660

Table 4: Maintenance Decision Details

Application Layer – Reporting & Visualization



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THANK YOU!

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