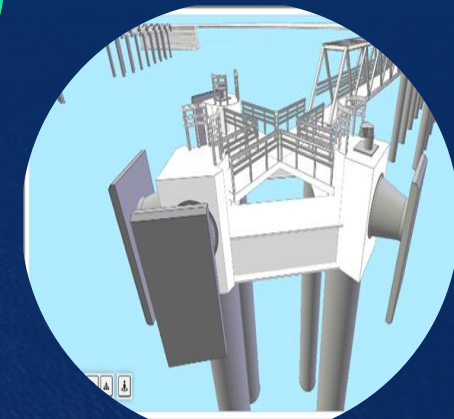
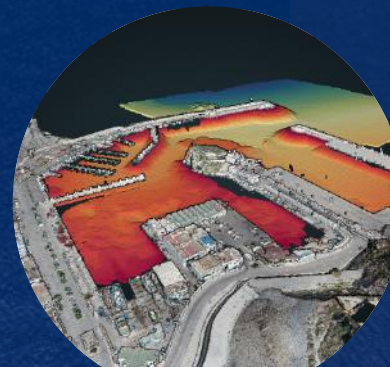
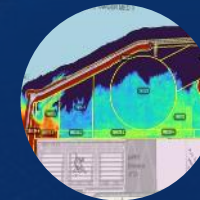
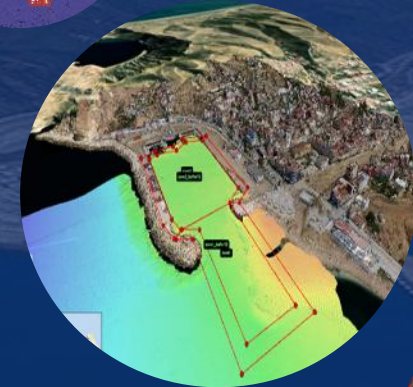
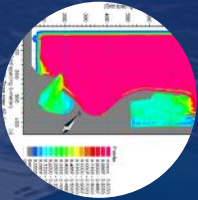
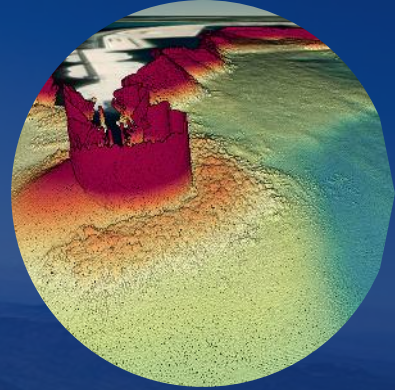
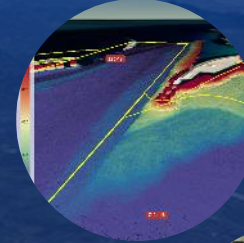




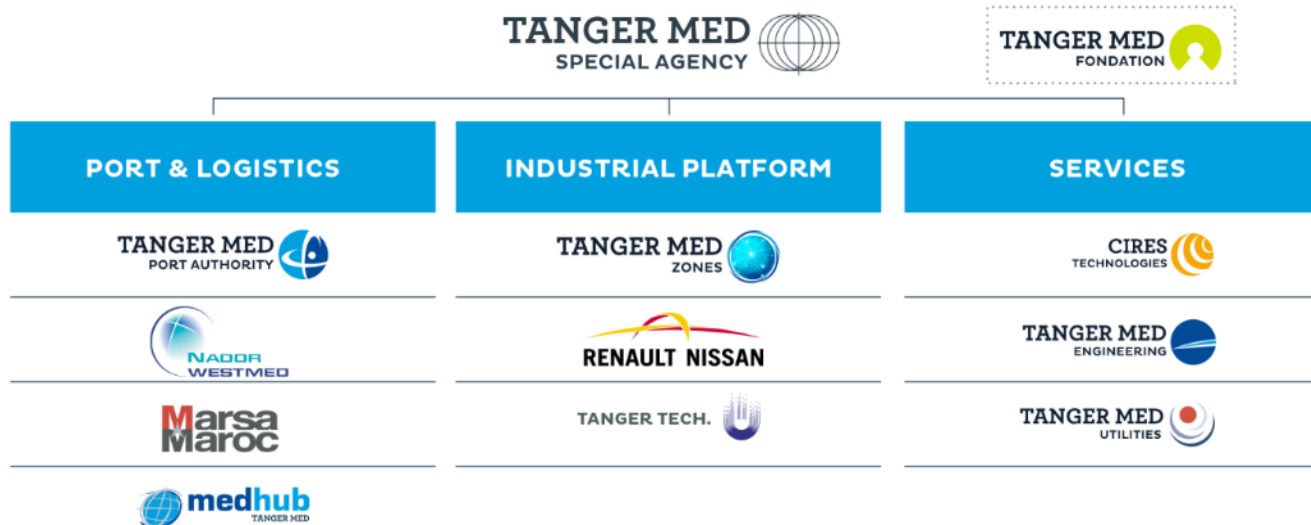
SMART PORT OPERATIONS: LEVERAGING ASSET INTELLIGENCE TO ENHANCE INFRASTRUCTURE RESILIENCE



ABOUT TANGER MED ENGINEERING

WHO WE ARE?

- ▶ Tanger Med Engineering (TME) is an engineering consultancy firm, specialized in planning, design, construction supervision and asset management of ports/maritime facilities, logistic and industrial projects.
- ▶ Based on the experience and the expertise of its engineers, TME delivers innovative, value-engineered solutions tailored to the client needs.
- ▶ TME is a subsidiary of Tanger Med Special Agency (TMSA). TMSA is a public limited company with an executive board and a supervisory board, in which government ministers and heads of the public entities concerned sit. TMSA is in charge of the development, planning and management of the Tanger Med industrial-port complex



BUSINESS SECTORS



**PORT
& MARITIME**



**LOGISTICS
& INDUSTRY**

FIELDS OF EXPERTISE

- FEASIBILITY STUDY, CONSULTING AND PROJECT TIMELINE
- DESIGN, ENGINEERING AND PROJECT MANAGEMENT
- ENERGY TRANSITION AND ENVIRONMENTAL IMPACT
- ASSET MANAGEMENT, MODELING AND TRAINING

KEY FIGURES

EXPERTISE DEPLOYED IN

40
Ports

20
SEZs

200
Engineers & Experts

ABOUT TANGER MED ENGINEERING

OUR CAPABILITIES & SERVICES



CONSULTING AND TRAINING

- Market and feasibility studies
- Public-Private Partnerships Schemes
- Technical due diligence
- Training for port officers (safety and security)
- Certified training for pilots in the Full Bridge Marine Simulator TMMS "TANGER MED MARINE SIMULATOR".



PORT AND MARITIME

- Masterplanning and design of container, bulk and ro-ro terminals oil and ro-ro terminals
- Design of maritime structures, berthing and mooring structures
- Hydraulics numerical and physical modelling including wave modelling (Mike 21 SW and BW), hydrodynamic modelling (Mike 21 HD), sediment transport (Mike 21 ST) and maneuverability studies
- Waterfront development, marinas and cruise terminals
- Land reclamation and dredging
- Integrated coastal zones management



LOGISTICS AND INDUSTRIAL

- Logistics platforms and dry ports
- Industrial parks and economic zones
- Industrial buildings
- Logistic warehouses and storage facilities
- Roads and utilities Design (water, power, drainage, ...)
- Tertiary and office buildings
- Access and control areas



ASSET MANAGEMENT

- Maintenance management
- Inspection, expertise and risk management
- Asset management system in accordance with ISO 55001
- Performance management and life cycle cost control
- Digitization of the asset management process



MOBILITY, ENERGY AND ENVIRONMENT

- Energy: HV substations, HV lines and distribution networks
- Renewable energies: photovoltaic and wind farms
- Environment and sustainable development: water cycles, wastewater treatment and recycling, waste management
- Mobility management systems

KEY FIGURES

1 000 Ha
of supervised port
terminals

40 Ports
accompanied both in Morocco
and worldwide

10 000 m
of meters of built linear
quay

400 000 m²
of constructed logistic
and industrial buildings

2 000 Ha
of developed logistic
and industrial platforms

ABOUT TANGER MED ENGINEERING

OUR TRAINING CENTER



Pilots and harbor masters Training and Marine simulation

- State-of-the-art training of the pilots, and captains of ships ;
- Training of officers and crew members in charge of navigational watch ;
- Training of the captains of tug boats and other support and environmental protection vessels ;
- Training of the staff in charge of marine traffic : port control, VTS

Training on ports operations and Material Handling

- Container handling operations
- Bulk/Breakbulk cargo material handling systems
- Material Handling Safety
- Material Handling Maintenance

Training on ports projects engineering and management

- Port structures and various port and maritime studies and masterplaning
- Mathematical Modeling of Marine Structures
- Physical modelling and similitude of marine structures
- Marine Geotechnical & Geophysical Survey
- Design of Seawalls and Breakwaters
- Design of Marine Facilities for the Berthing and Mooring
- Maintenance and asset management

→ Our training program is tailormade to meet our clients' needs



> 60 TRAINING SESSIONS

> 1200 DAYS OF TRAINING

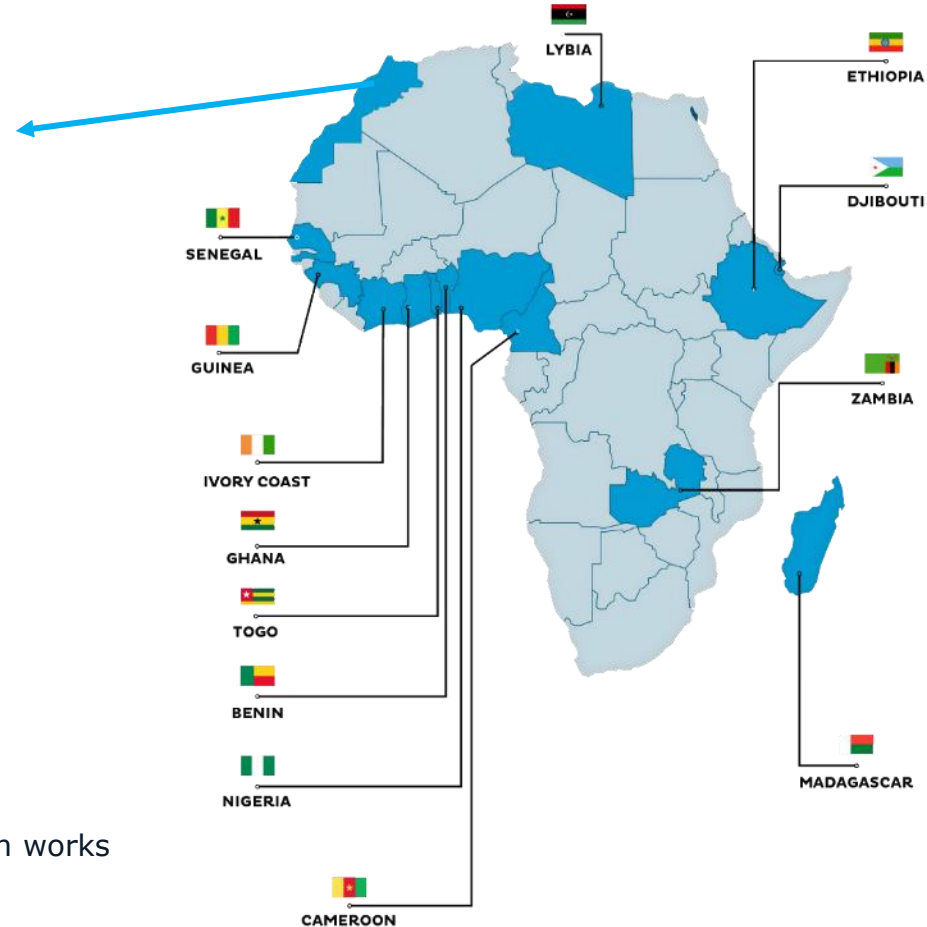
> 250 PARTICIPANTS FROM AFRICA

ABOUT TANGER MED ENGINEERING

OUR PROJECTS



TME has supported major ports in Morocco and in Africa.



- ▶ Feasibility and market studies
- ▶ Master planning, concept design and detailed design
- ▶ Tender documents
- ▶ Supervision, coordination and monitoring of construction works
- ▶ Infrastructure maintenance and asset management

ASSET MANAGEMENT EXCELLENCE

OUR SERVICES: ASSET MANAGEMENT AND PERFORMANCE IMPROVEMENT

- The Asset Management Department of TME offers a comprehensive suite of services designed to address the unique needs of our clients and all phases of asset management projects.



ASSET MANAGEMENT



MAINTENANCE AND REPAIR OPERATIONS



MONITORING, EXPERTISE AND TRAINING

ASSET MANAGEMENT SYSTEM

- **ISO 55001 Audit & Certification:** Clause-by-clause maturity assessment, 24-month roadmap, support up to third-party audit and certification achievement.
- **Asset Management:** Includes stock tracking, asset localization, maintenance planning, and management of asset-specific information in compliance with ISO 55001.
- **Digitalization & CMMS:** Deployment or modernization of CMMS solutions with ERP/SCADA/IoT integration, mobile workflows for work orders, real-time dashboards.

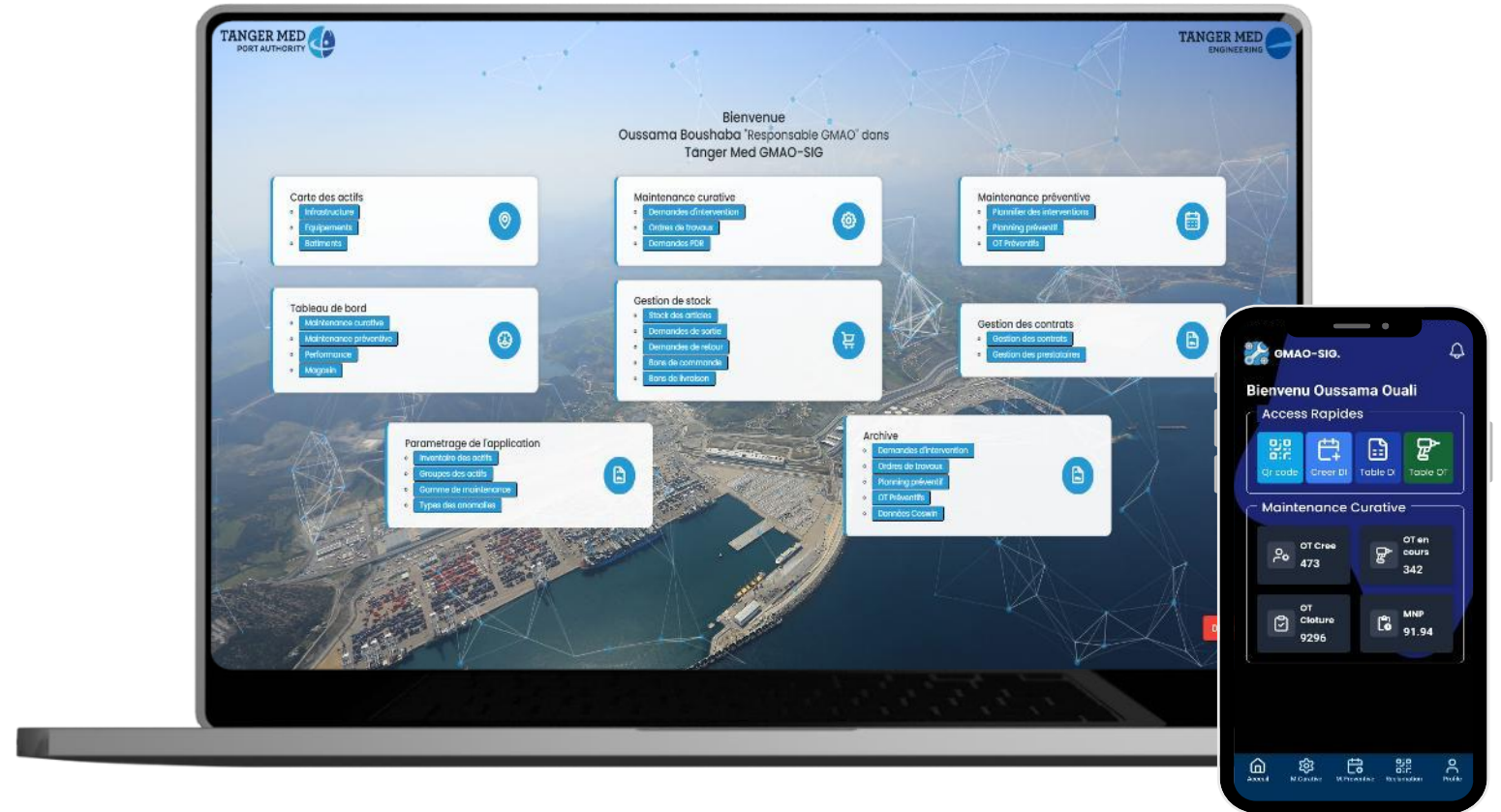
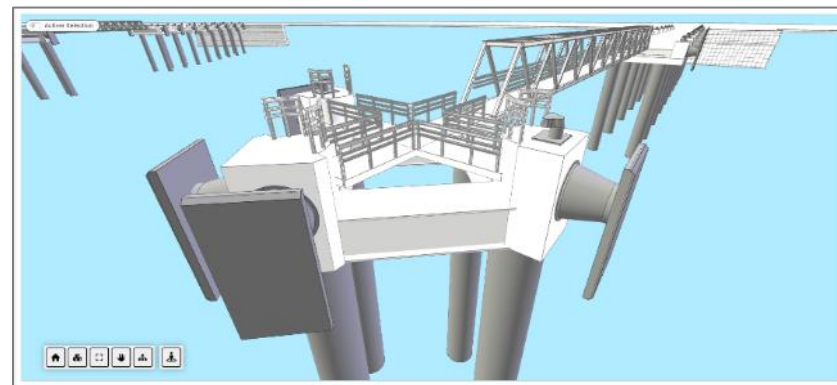
- **Gestion de la maintenance :** mesures correctives (identification, diagnostic, intervention) et préventives (systématique, conditionnelle, prédictive) réalisées grâce aux capteurs IoT pour surveiller l'état et la performance des équipements en temps réel.
- **Cost and budget management:** labor, inventory, procurement, equipment rental costs, budget preparation, periodic monitoring, variance reports.
- **Key performance indicators:** dashboard for the manager, including database queries for statistics and alerts.
- **Machine management:** operating hours, safety instructions, complexity, importance.

- **Monitoring & Expertise:** Monitoring of strategic assets through systematic or automated inspections using IoT sensors.
- **Cathodic Protection:** Study, design, and implementation of cathodic protection systems (sacrificial anode or impressed current) to prevent corrosion of submerged or buried metal structures; potential measurements, maintenance interventions, and performance audits.
- **Training:** Technical expertise in port dredging, and monitoring and maintenance of protection and access structures (e.g., quay, breakwater).
- **Digital Inspection & Digital Twins:** Drones, 3D/LiDAR scans, and BIM/Asset Twin for real-time integrity tracking.

ASSET MANAGEMENT EXCELLENCE

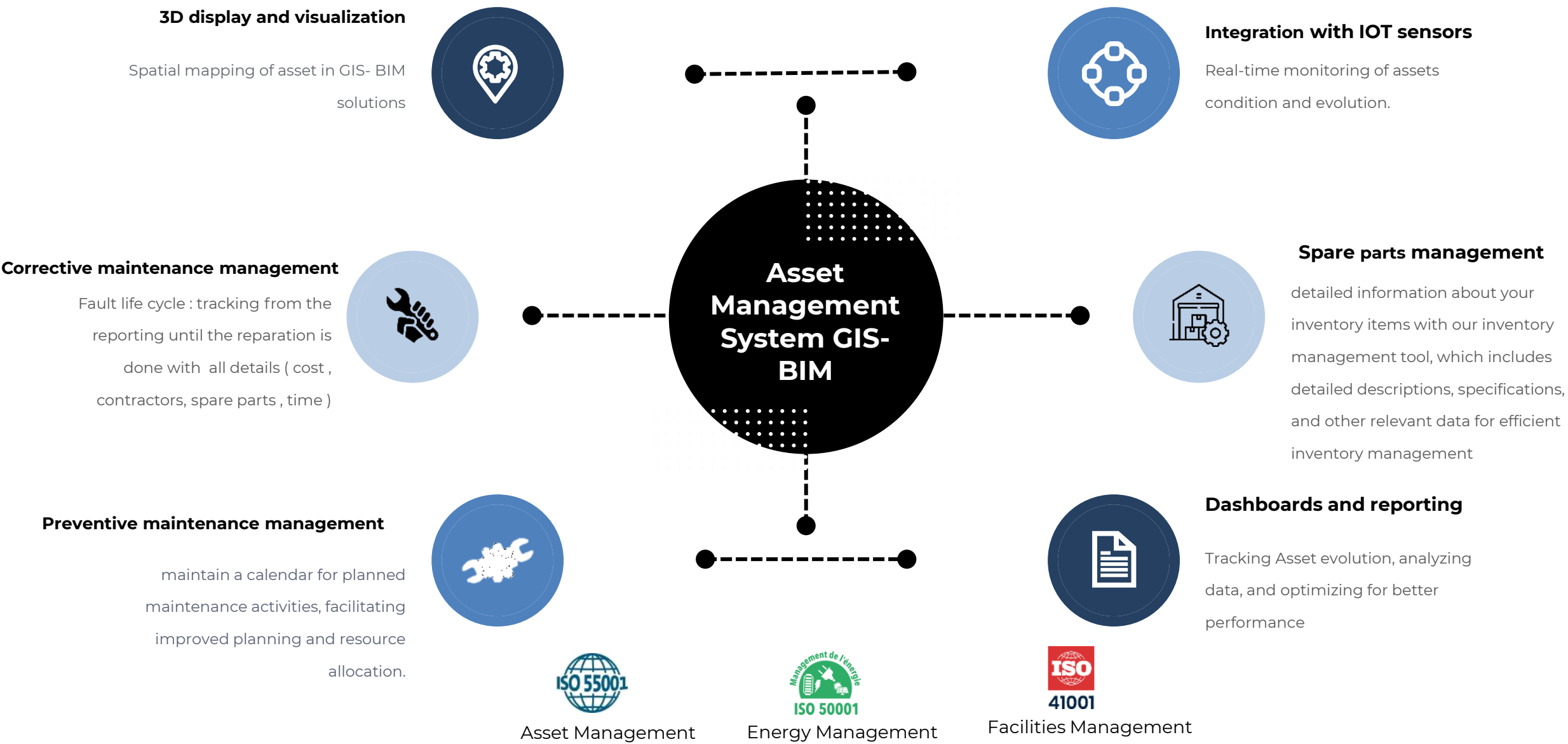
DIGITAL SOLUTIONS : INTEGRATED ASSET MANAGEMENT PLATFORM

The **AM GIS-BIM** System is a centralized collaborative solution developed with the aim of organizing, tracking, optimizing preventive and corrective maintenance, and ensuring the reliability of equipment and technical installations within the port infrastructure in real-time.



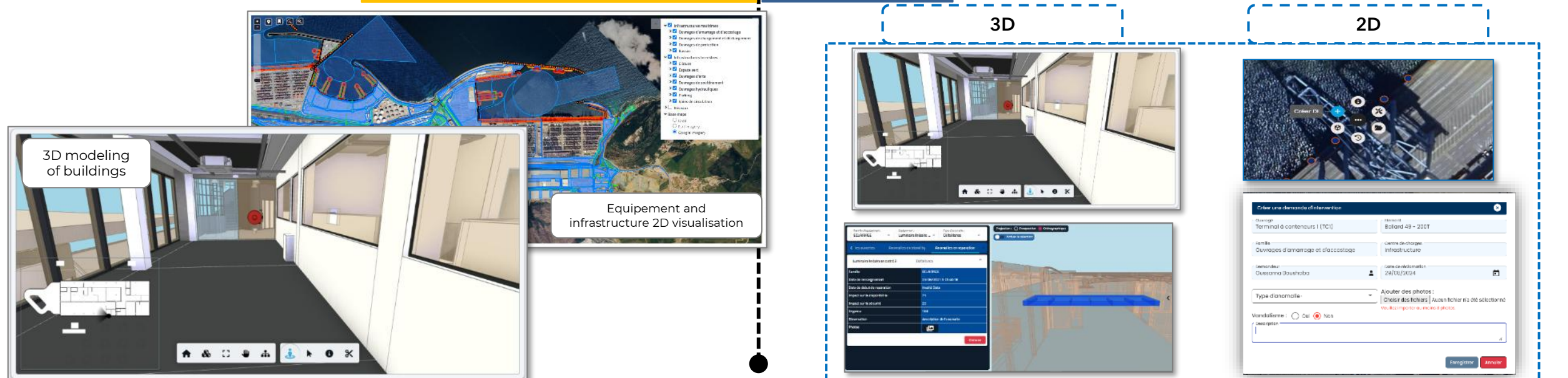
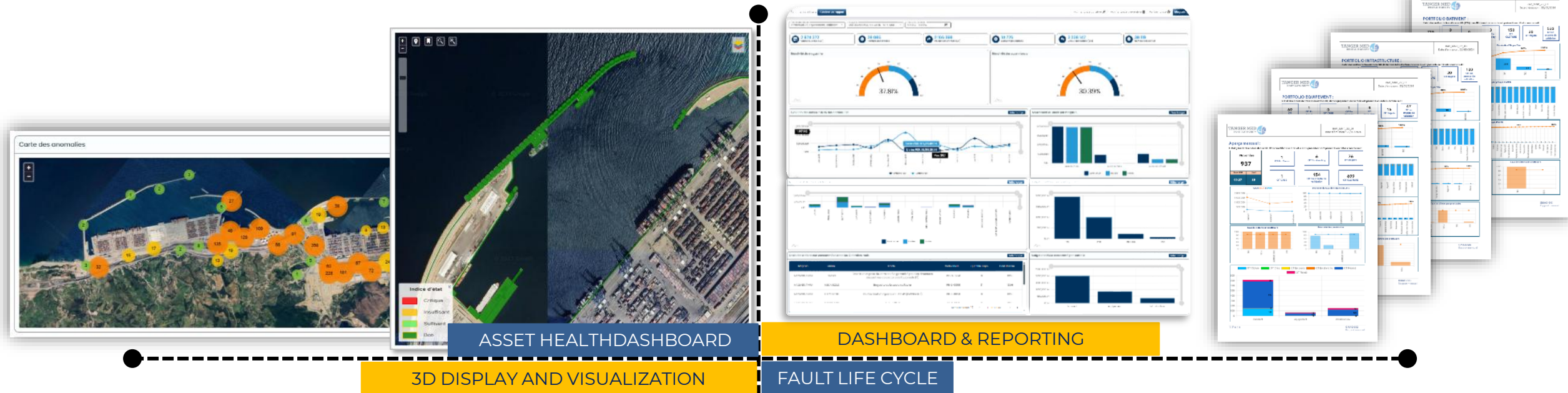
ASSET MANAGEMENT EXCELLENCE

DIGITAL SOLUTIONS : INTEGRATED ASSET MANAGEMENT PLATFORM FEATURES



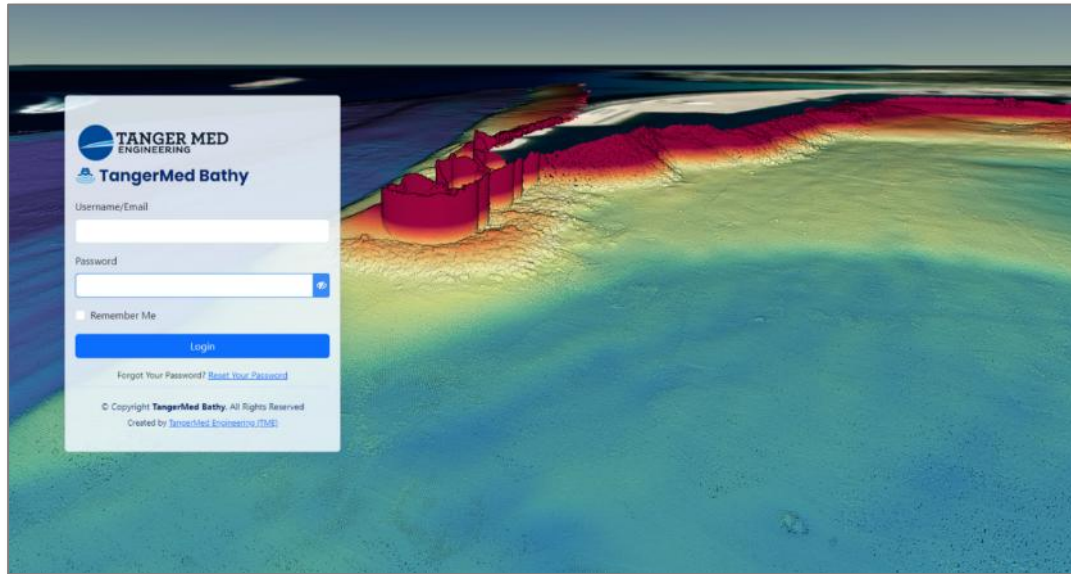
ASSET MANAGEMENT EXCELLENCE

DIGITAL SOLUTIONS : INTEGRATED ASSET MANAGEMENT PLATFORM FEATURES

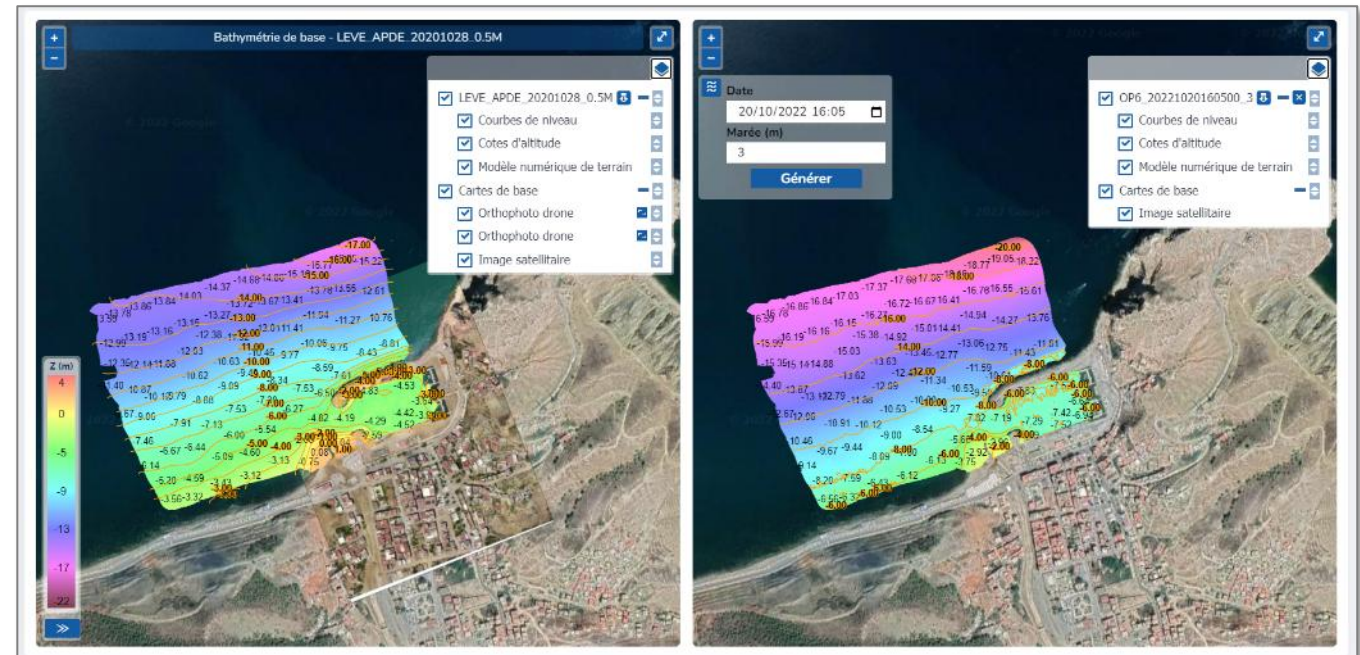


ASSET MANAGEMENT EXCELLENCE

DIGITAL SOLUTIONS : DREDGING & BATHYMETRIC SURVEYS



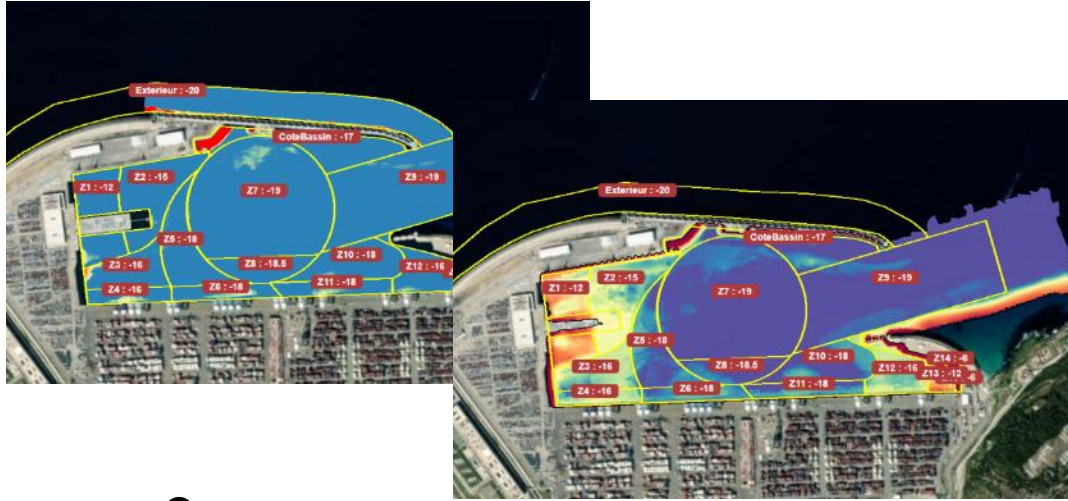
Tanger Med Bathy is a user-friendly application that provides a comprehensive solution for managing bathymetric data and point clouds, offering robust tools for data analysis and visualization, as well as monitoring seabed level changes



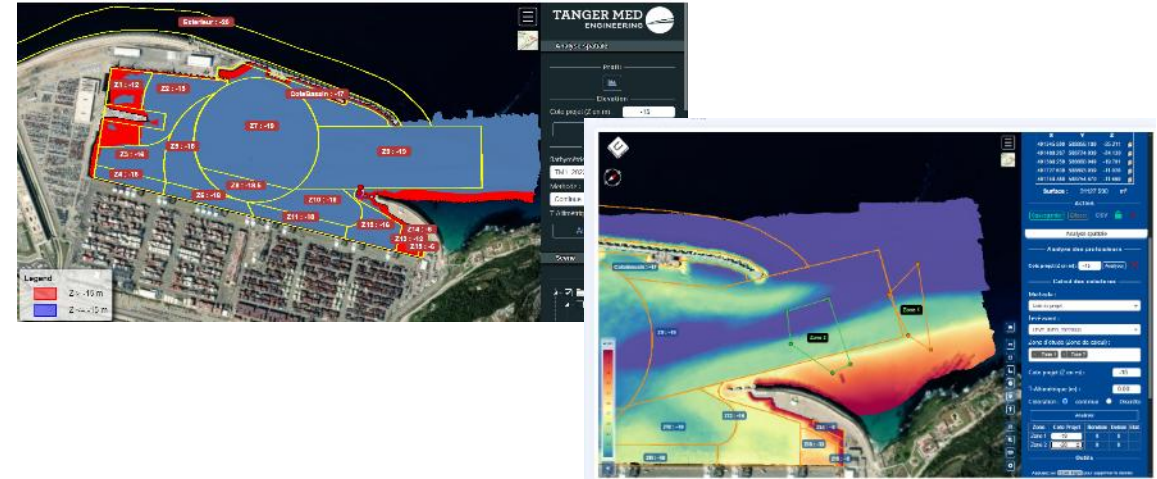
ASSET MANAGEMENT EXCELLENCE

DIGITAL SOLUTIONS : DREDGING & BATHYMETRY SURVEYS FEATURES

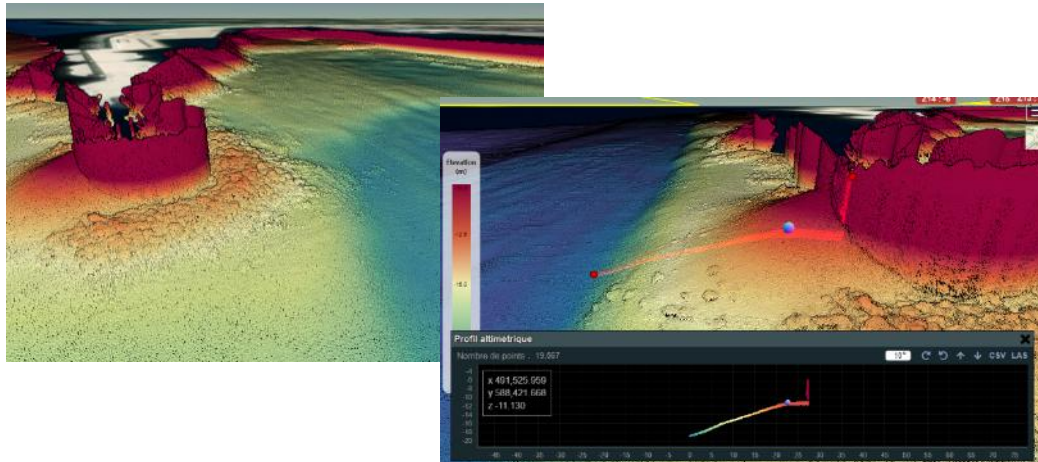
3DVISUALISATION



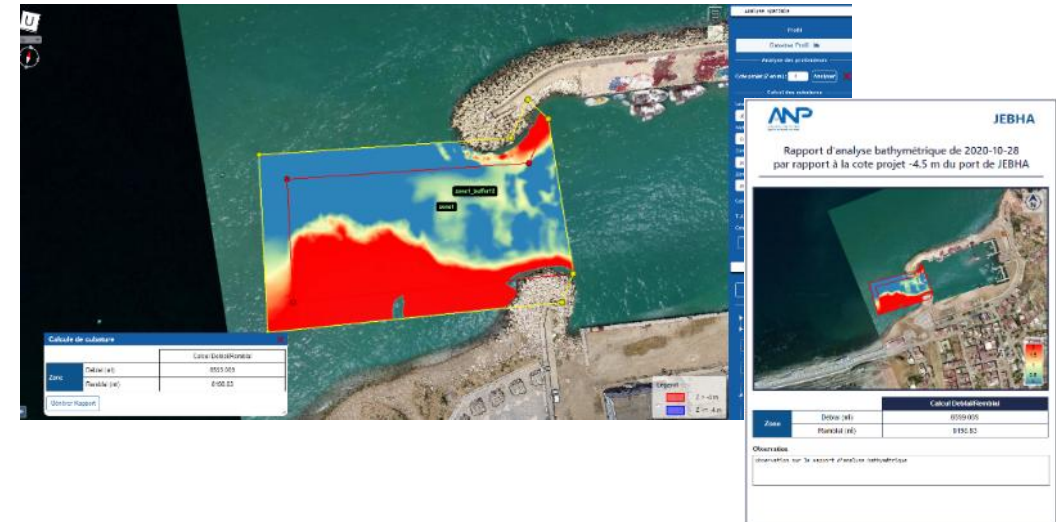
Bathymetric Survey analysis



Cubature Calculation and Change Mapping



Generation of thematic Maps



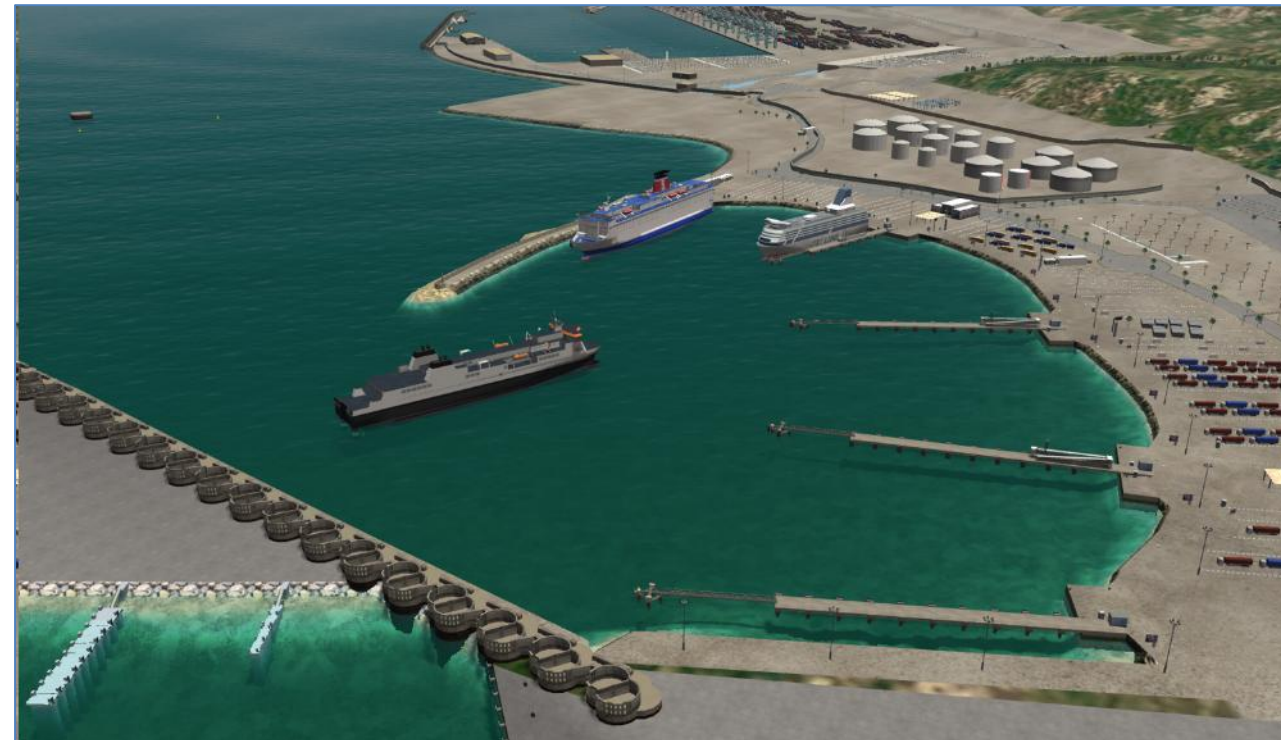
ASSET MANAGEMENT EXCELLENCE

DIGITAL SOLUTIONS : OPTIMIZING VESSEL TURNAROUND TIME MAKING USE OF NAVIGATION SIMULATION

- ▶ Navigation simulation, a tool to provide training for pilots in a virtual environment.
- ▶ Navigation simulation, a tool to accurately define port environmental operational limits (winds, tides, currents, waves), maximizing operational windows and optimizing port capacities.
- ▶ Port expansion masterplanning.



KRIBI PORT

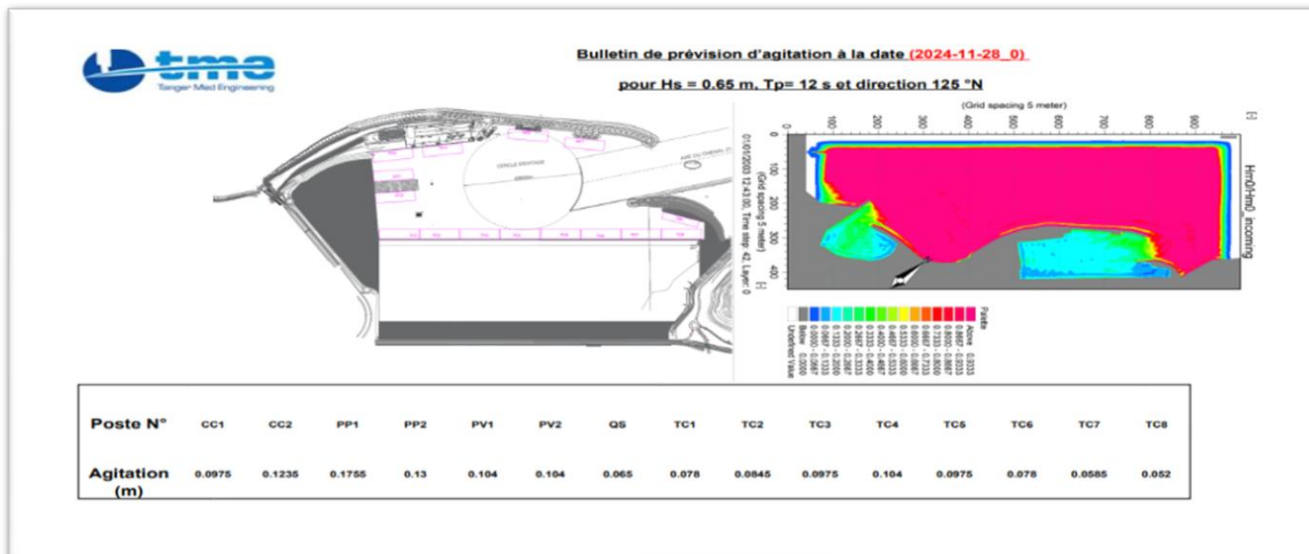
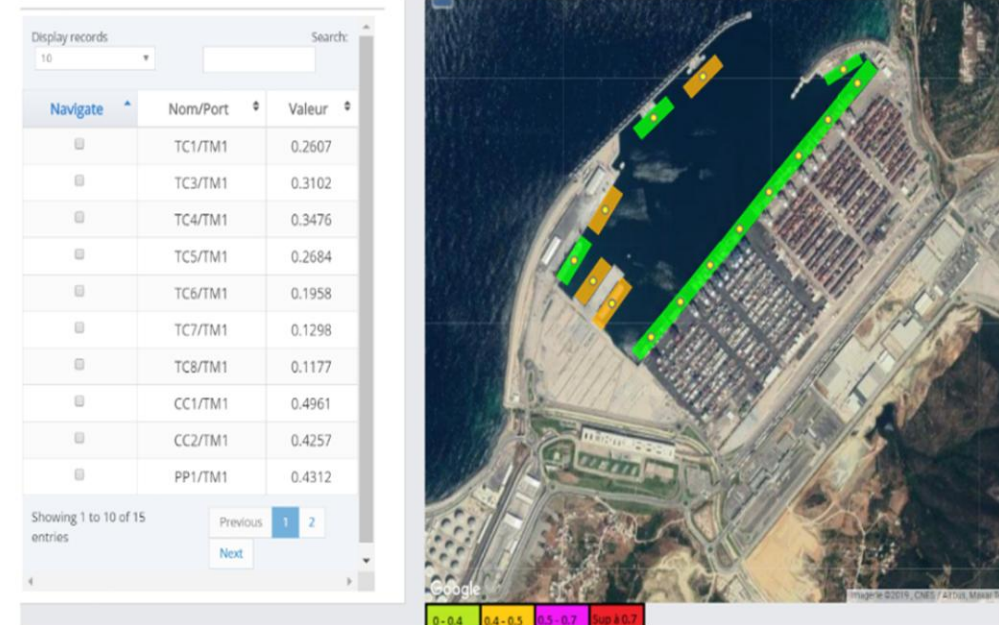


RORO PORT TM

ASSET MANAGEMENT EXCELLENCE

DIGITAL SOLUTIONS : REAL-TIME DATA & AGITATION MANAGEMENT — A STEP TOWARD SMART PORT OPERATIONS

- ▶ providing an integrated platform for real-time meteorological and agitation data across ports.
- ▶ Reducing vessel wait times and idle emissions through proactive scheduling and alerts
- ▶ Enhancing safety with instant notifications on adverse conditions and interactive dashboards
- ▶ Optimizing resource allocation to minimize environmental impact and support net-zero objectives and improve decision making through advanced analytics.



ASSET MANAGEMENT EXCELLENCE

CASE STUDY : MONITORING OF QUAYWALL INFRASTRUCTURE USING IOT+ AM GIS-BIM

1. The Challenge



Progressive Marine Corrosion

Structural vulnerability caused by continuous exposure to saltwater, leading to concrete degradation and steel reinforcement corrosion.



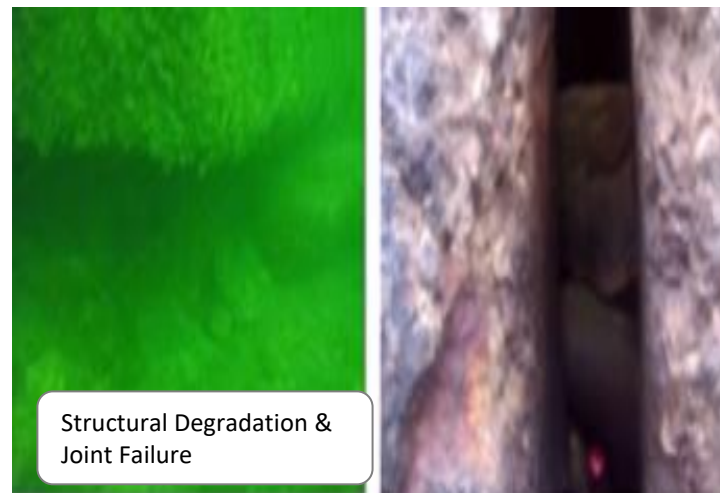
Hidden Degradation

Critical structural defects remain undetected through traditional visual inspections, creating safety risks.



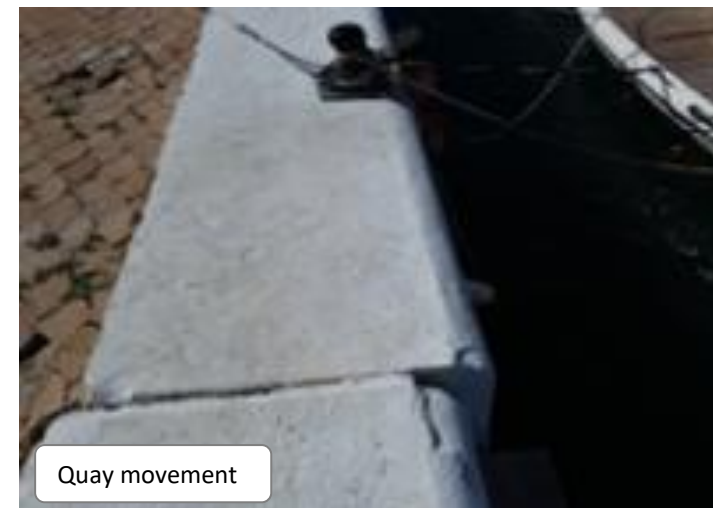
Unplanned Failures

Emergency repairs and port disruptions result from unexpected structural failures, causing operational losses.



Limited Visibility

Lack of real-time data on asset health and condition evolution prevents proactive maintenance strategies.

**40%**

Higher maintenance costs due to reactive approach

3x

Longer inspection times with manual methods

85%

Of structural issues detected too late

60%

More downtime from unexpected failures

ASSET MANAGEMENT EXCELLENCE

CASE STUDY : MONITORING OF QUAYWALL INFRASTRUCTURE USING IOT+ AM GIS-BIM

2. Digital & Predictive Solution

IoT Sensor Network

Installation of surface-mounted IoT sensors measuring strain, vibration, displacement, and corrosion levels in real-time.

CMMS Integration

Real-time condition monitoring seamlessly integrated into Computerized Maintenance Management System.

AI Health Scoring

AI-driven health scoring algorithms assess each quaywall segment and predict maintenance needs.

Automated Work Orders

Generation of automated work orders based on risk priority and predictive maintenance schedules.

GIS-BIM Visualization

Data visualization through GIS-BIM 2D asset model with real-time condition mapping.



"Transforming reactive maintenance into proactive asset intelligence"

Multi-sensor
Integration

2D
Visualization

Automated
Workflows

24/7
Continuous Monitoring

Real-time
Data Processing

Predictive
Maintenance



ASSET MANAGEMENT EXCELLENCE

CASE STUDY :Monitoring of QUAYWALL INFRASTRUCTURE USING IOT+ AM GIS-BIM

✓ 3. Results Achieved

Measurable Impact on Port Operations

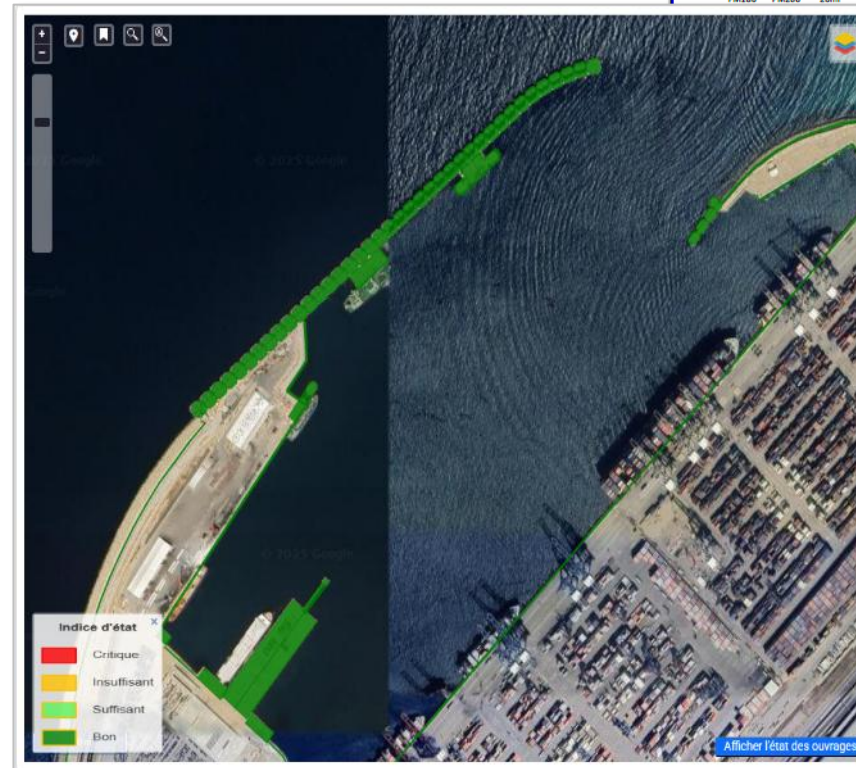
↓ **30%**
Structural Failures
Fewer unexpected issues

↓ **15%**
Maintenance Costs
Cost reduction

↓ **20%**
Inspection Time
Faster processes

↓ **40%**
Emergency Repairs
Reduced interventions

↑ **35%**
Alert Response Time
Faster response to critical situations



TANGER MED
ENGINEERING

Quai TC1_APM1_TM1
Fiche de Suivi d'Etat & Maintenance

Actif

Explication Condition Quay**

*Condition

Quai TC1_APM1_TM1

Longueur	Entre PM	Long. tronçon	Bollard	Défense	ETAT	Weight	total	ETAT	Weight	total	ETAT	Weight	total	ETAT	Weight	total
800m	PM000	PM020	20m	801	D01	D02	D03	4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
	PM020	PM040	20m	802	D04	D05		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
	PM040	PM060	20m	803	D06	D07		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
	PM060	PM080	20m	804	D08	D09		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
	PM080	PM100	20m	805	D10	D11		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
	PM100	PM120	20m	806	D12	D13		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
	PM120	PM140	20m	807	D14	D15		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
	PM140	PM160	20m	808	D16	D17		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
	PM160	PM180	20m	809	D18	D19		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
	PM180	PM200	20m	810	D20	D21		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				811	D22	D23		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				812	D24	D25		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				813	D26	D27		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				814	D28	D29		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				815	D30	D31		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				816	D32	D33		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				817	D34	D35		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				818	D36	D37		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				819	D38	D39		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				820	D40	D41		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				821	D42	D43		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				822	D44	D45		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				823	D46	D47		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				824	D48	D49		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				825	D50	D51		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				826	D52	D53		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				827	D54	D55		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				828	D56	D57		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				829	D58	D59		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				830	D60	D61		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				831	D62	D63		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				832	D64	D65		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				833	D66	D67		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				834	D68	D69		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				835	D70	D71		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				836	D72	D73		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				837	D74	D75		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				838	D76	D77		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				839	D78	D79		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60
				840	D80	D81		4	0,5	2,00	4	0,25	1,00	4	0,15	0,60

4,00

Condition Quay 4,00

"The integration of real-time monitoring and intelligent maintenance strategies has significantly strengthened quaywall resilience and improved operational continuity."

From Smart Tools to Resilient Ports



Smart Tools

IoT sensors, AI analytics, and automated systems



Intelligent Operations

Predictive maintenance and proactive decision-making



Resilient Infrastructure

Robust, adaptive, and future-ready port operations

Key Transformation Benefits



Enhanced Visibility: Real-time asset health monitoring across entire port infrastructure



Cost Optimization: Reduced emergency repairs and extended asset lifespan



Proactive Maintenance: Predictive algorithms prevent failures before they occur



Risk Mitigation: Early detection and prevention of critical failures



Operational Excellence: Continuous improvement through data-driven insights



Future-Ready: Scalable solutions that adapt to evolving port demands

"The journey from smart tools to resilient ports represents more than technological advancement—it's a fundamental shift towards sustainable, intelligent infrastructure that can adapt, learn, and thrive in an ever-changing maritime environment."

— Tanger Med Engineering Vision

YOUR PARTNER FOR INNOVATIVE SOLUTIONS



Name

Boushaba Oussama



Position

HEAD OF ASSET MANAGEMENT & DIGITAL SOLUTIONS DEPARTMENT



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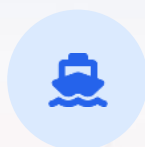


Location

Tanger Med Port, Morocco



"Let's shape the next generation of smart and resilient ports in Africa together."



Port Operations



Asset Management



Training & Consulting



Performance Optimization

TANGER MED
ENGINEERING



YOUR PARTNER FOR INNOVATIVE SOLUTIONS