

OCTOBER 25, 2023

Sunsetting traditional ITS SCADA with AVEVA

Futureproofing Intelligent Transportation System (ITS) SCADA

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Ashghal Public Works Authority (PWA) Qatar



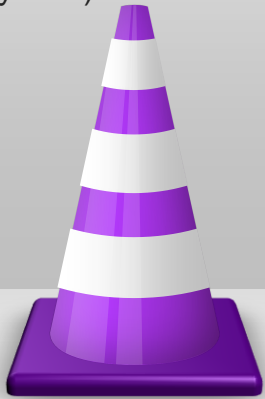
AVANCEON
Tomorrow's solutions, today.



Roads Network Operations & Maintenance Department (RO&M)

Highways & Roads

- 12,000+km linear and 33,000+km lanes
- 10+ highways & corridors equipped with ITS (Intelligent Transportation System) devices



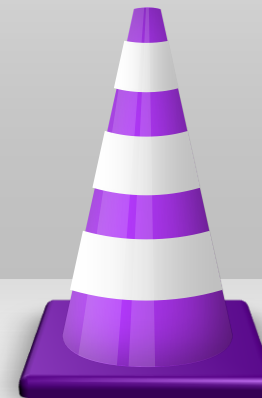
Intersections

- 400+ intelligent intersections



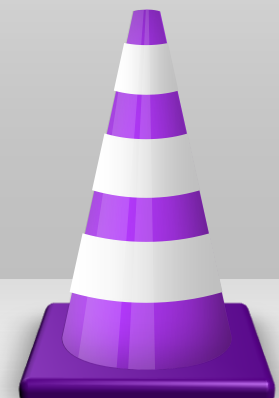
Tunnels & Underpasses

- 50 tunnels and underpasses equipped with ITS devices



Bridges

- 50 bridges, foot bridges & cable bridges



ITS (Intelligent Transportation System) Devices in ROMD



8+ Over Height Detection System (OVDS)



1210+ CCTV



Pan-Tilt-Zoom Camera (PTZ)



2220+ Lane Control Signs (LCS)



1070+ License Plate Recognition (LPR)



200+ Automatic Incident Detection Camera (AID)

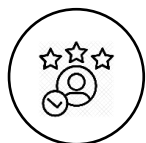


370+ Dynamic Message Signs (DMS)

Our Global Presence



+30
Years of
commitment



+12
Key
partners
worldwide



+1,500
Medium &
large-scale
projects



+200
Government &
blue-chip
customers



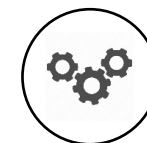
+200
Employees



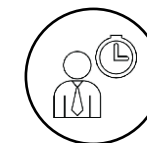
+9
Offices, 3
Operating
Centers



+15
Industrial
Segments Served



+70%
Control System
Engineers



+300K
Man Hours



Worldwide Headquarters
North America
Regional Operations Center
Exton, PA, USA

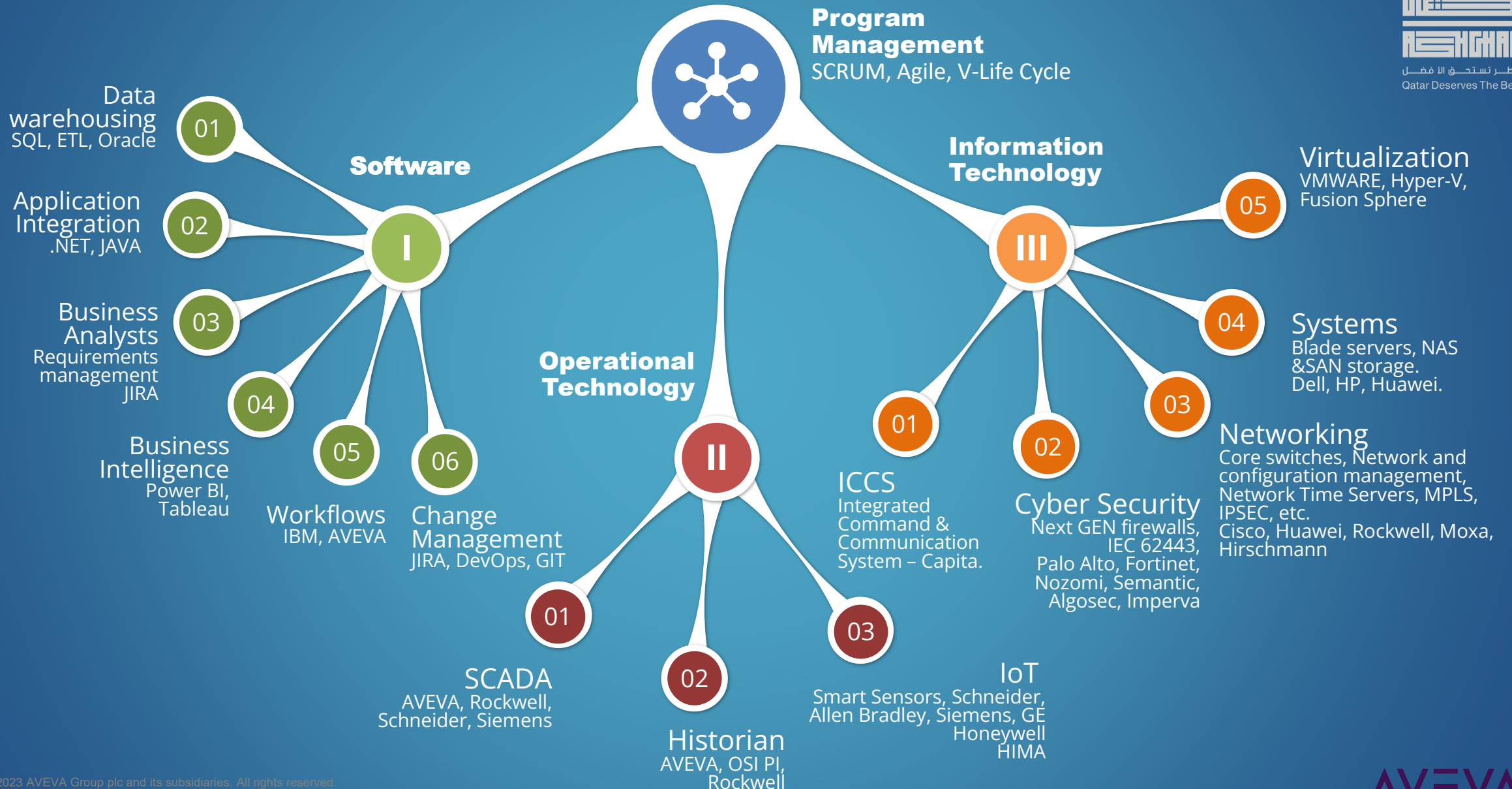


Middle East Operations
Saudi Arabia, UAE & Qatar



Southeast Asia
Regional Operations Center
Lahore & Karachi

Next Gen OT/IT Converged Control System & SCADA



Digital Transformation

OmniConnect
Collects data from any source



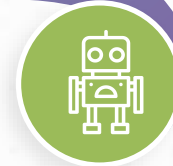
Analytics
Publishes data on any visualization or analytics software



MultiCloud
Ingests and pushes to any cloud



Machine Learning
Artificial Intelligence & Machine Learning



Data-lake
Stores data into any data-lake



KPIs
Computes and configures KPIs as required



Why the need for sunset?

While industry specific SCADA systems are quick and easy options, these lack some of the key features that we considered essential for critical operations for our road tunnels.

Cyber Security



- Cyber Security: Qatar introduced stringent cyber security framework compliance requirements
 - 2014: National ICS Security Standard (latest revision at 3.1)
 - Security Framework Qatar 2022 v1.0
- These security standards drive asset owners to adopt COTS (Commercial Off The Shelf) software that have Cyber Security Certifications for these software.

Serviceability & GIS Awareness



- We were looking for a platform that has broad support base in terms of integrators and market skillset availability
- High serviceability is a desired factor as it helps avoid vendor lock-in scenarios



- As our assets are spread across the country, it was important to have a SCADA system with built in GI capabilities.

Flexibility & Developer Ecosystem



- We wanted the ability to have flexible architectures when it comes to deployment as we have local and central control rooms.



- We wanted to enjoy the add-on products developed by a larger developer ecosystem presently and in future. (e.g. version management, GIS).

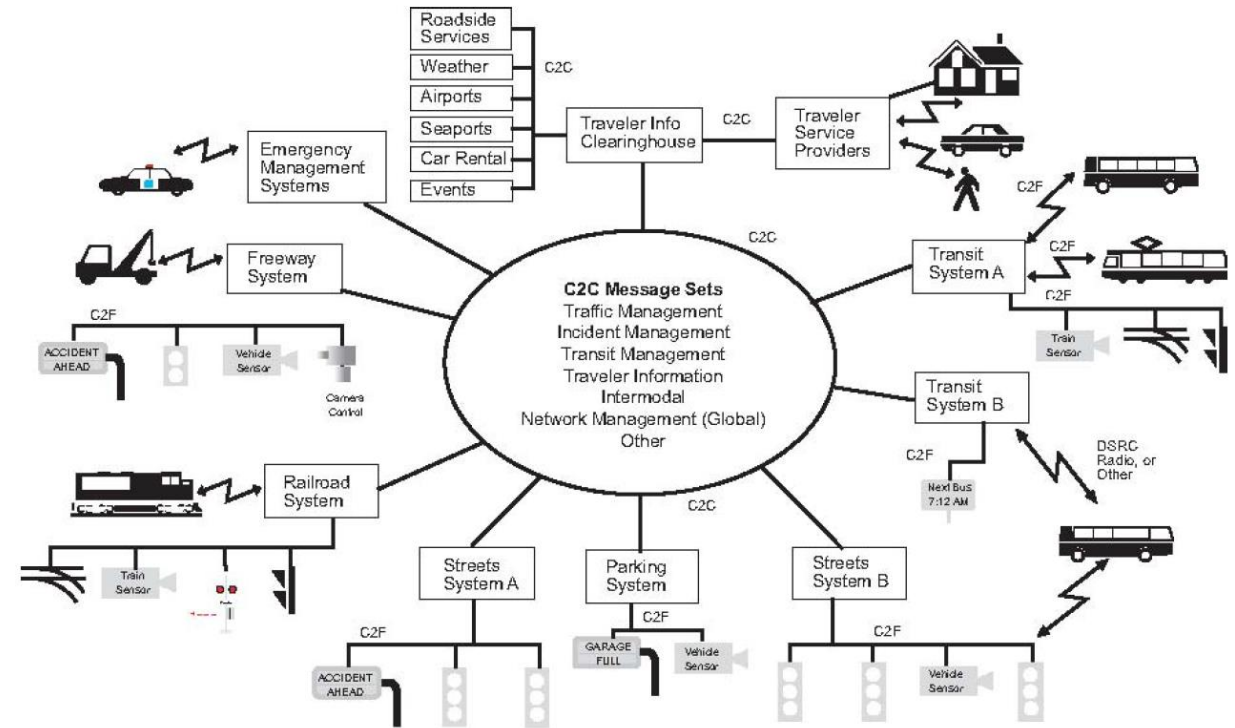
Challenges

From obscure protocols to secure handshaking – it required extensive collaboration with AVEVA development team and third parties

NTCIP Protocol

Extracts from NTCIP001 V4 Guide 2009

- National Transportation Communications for ITS Protocol (NTCIP)
- Used for remote control of roadside devices
- Center to Center (C2C) & Center to Field (C2F) schemes
- “NTCIP is a family of open standards, defining common communications protocols and data definitions.”



COME TO NTCIP



NTCIP Framework

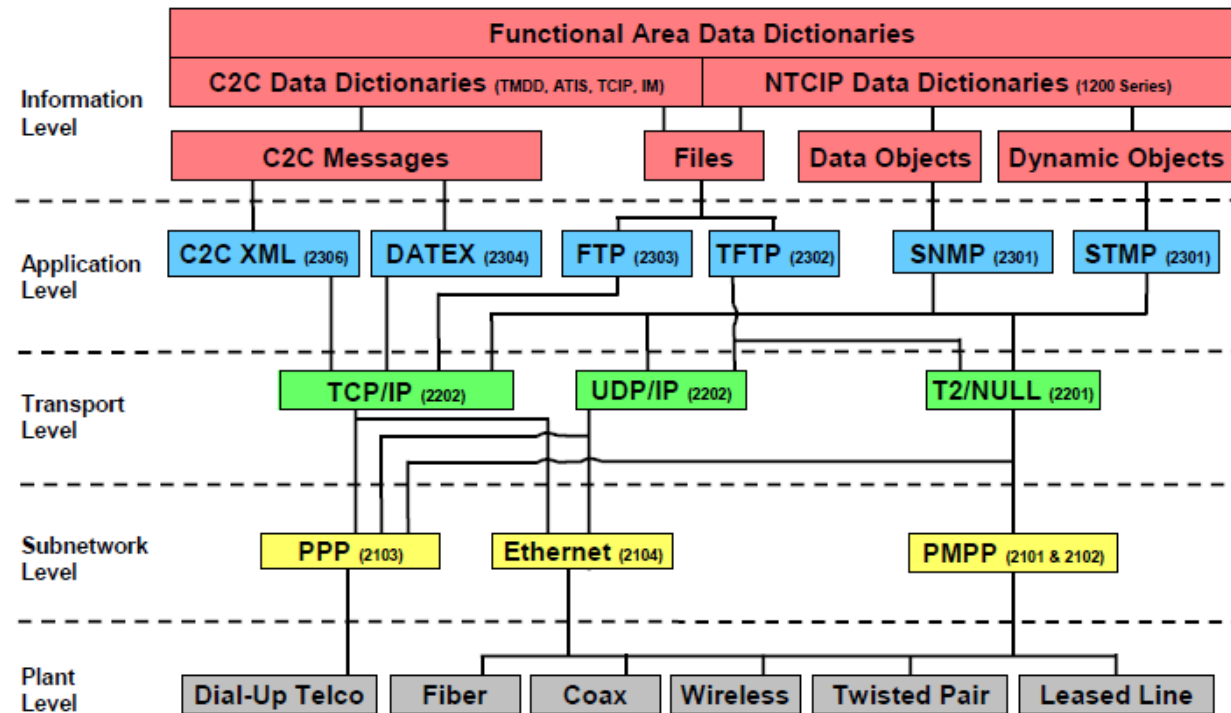


Figure 4 NTCIP Framework

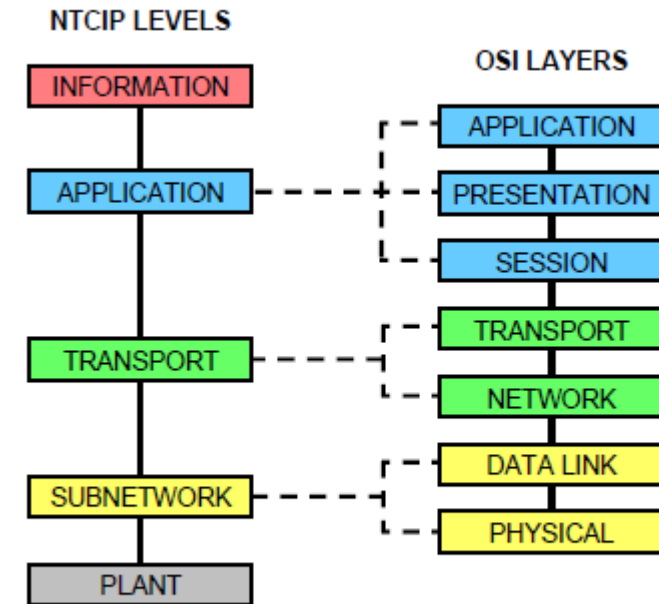


Figure 5 OSI Layer to NTCIP Level Mapping

NTCIP Published Standards

PUBLISHED STANDARDS

NTCIP 1102:2004, *Octet Encoding Rules (OER) Base Protocol* Published October 2005

NTCIP 1103 v03, *Transportation Management Protocols* Published December 2016

NTCIP 1104 v01, *Center-to-Center Naming Convention Specification* Published May 2008

NTCIP 1201 v03, *Global Object (GO) Definitions* Published March 2011

NTCIP 1202 v03A, *Object Definitions for Actuated Signal Controllers (ASC) Interface* Published May 2019

NTCIP 1202 v03A-SE01, *Object Definitions for Actuated Signal Controllers (ASC) Interface (TPG-Enabled)* Published May 2019

NTCIP 1202 v02, *Object Definitions for Actuated Traffic Signal Controller (ASC) Units – version 02* Published November 2005

NTCIP 1203 v03, *Object Definitions for Dynamic Message Signs (DMS)* Published September 2014

NTCIP 1203 v03A-SE06 TPG, *Object Definitions for Dynamic Message Signs (DMS)* Published August 2017

NTCIP 1204 v0426, *National Transportation Communications for ITS Protocol Environmental Sensor Station (ESS) Interface Protocol* | Newly Published April 2022

NTCIP 1204 v03, *Environmental Sensor Station (ESS) Interface Protocol* Published October 2009

NTCIP 1205 v01Amd1, *Object Definitions for Closed Circuit Television (CCTV) Camera Control* Published September 2014

NTCIP 1206:2005, *Object Definitions for Data Collection and Monitoring (DCM) Devices* Published November 2005

NTCIP 1207 v02, *Object Definitions for Ramp Meter Control (RMC) Units* Published September 2014

NTCIP 1208:2005, *Object Definitions for Closed Circuit Television (CCTV) Switching* Published October 2005

NTCIP 1209 v02, *Object Definitions for Transportation Sensor Systems (TSS)* Published May 2014

NTCIP 1209 v02A-SE06 TPG, *Object Definitions for Signal Control and Prioritization (SCP)* Published August 2017

NTCIP 1210 v01, *Field Master Stations (FMS)—Part 1: Object Definitions for Signal System Masters (SSM)* Published September 2013

NTCIP 1211 v02, *Object Definitions for Signal Control and Prioritization (SCP)* Published September 2014

NTCIP 1211 v02A-SE03, *Object Definitions for Transportation Sensor Systems (TSS) (TPG-Enabled)* Published August 2017

NTCIP 1213 v03 *Object Definitions for Electrical and Lighting Management Systems (ELMS)* Published January 2023

NTCIP 1213 v02, *Object Definitions for Electrical and Lighting Management Systems (ELMS)* Published March 2011

NTCIP 1218 v01, *Object Definitions for Roadside Units (RSUs)*, Published September 2020

NTCIP 1218 v01A-SE-01, *Object Definitions for Roadside Units (RSUs) (TPG-Enabled)*, Published September 2020

NTCIP 2101:2001, *Point to Multi-Point Protocol Using RS-232 Subnetwork Profile* Published November 2001

NTCIP 2102:2003, *Point to Multi-Point Protocol Using FSK Modem Subnetwork Profile* Published September 2005

NTCIP 2103 v02, *Point-to-Point Protocol over RS-232 Subnetwork Profile* Published December 2008

NTCIP 2104:2003, *Ethernet Subnetwork Profile* Published September 2005

NTCIP 2201:2003, *Transportation Transport Profile* Published September 2005

NTCIP 2202:2001, *Internet (TCP/IP and UDP/IP) Transport Profile* Published December 2001

NTCIP 2301 v02, *Simple Transportation Management Framework (STMF) Application Profile (AP) (AP-STMF)* Published July 2010

NTCIP 2302:2001, *Trivial File Transfer Protocol Application Profile* Published December 2001

NTCIP 2303:2001, *File Transfer Protocol Application Profile* Published December 2001

NTCIP 2304:2002, *Application Profile for DATEX-ASN (AP-DATEX)* Published September 2005 | NTCIP 2304 will no longer be updated. Please direct to ITE TMDD Standard for updates.

NTCIP 2306 v01, *Application Profile for XML Message Encoding and Transport* Published December 2008 | NTCIP 2306 will no longer be updated. Please direct to ITE TMDD Standard for updates.

NTCIP 8002 Annex B1, *Content Outline for NTCIP 1200-Series Documents (for Standards Engineering Process (SEP) Content)* Published September 2016

NTCIP 8003:2001, *Profile Framework* Published December 2001

NTCIP 8004 v02, *Structure and Identification of Management Information (SMI)* Published June 2010

NTCIP 8005 v01, *Procedures for Creating Management Information Base (MIB) Files* Published June 2010

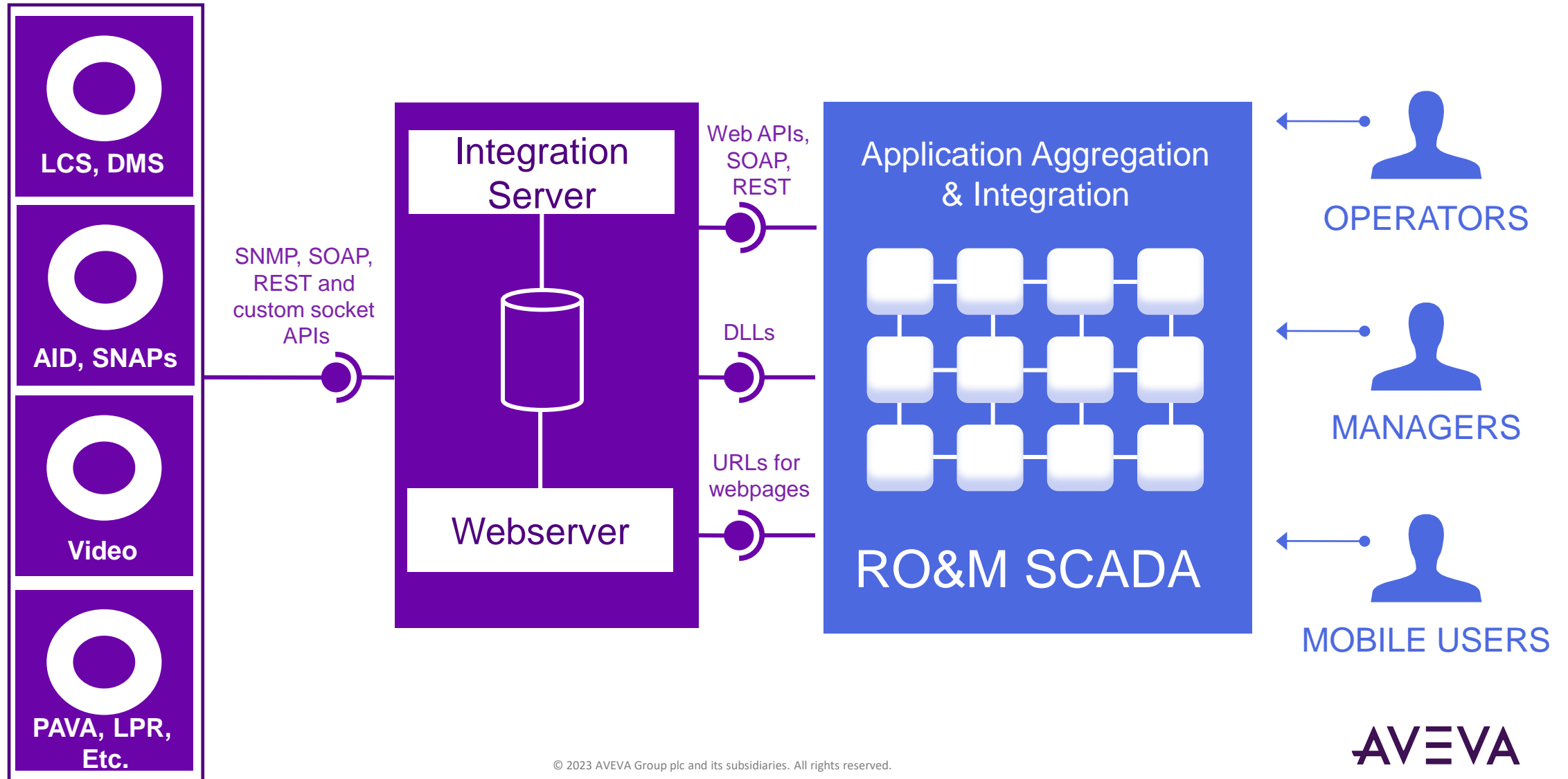
NTCIP 8007 v01, *Testing and Conformity Assessment Documentation within NTCIP Standards Publications* Published May 2008

NTCIP 9001 v04, *The NTCIP Guide* Published July 2009

NTCIP 9012 v01, *Testing Guide for NTCIP Center-to-Field Communications* December 2008

NTCIP 9014 v01.20, *National Transportation Communications for ITS Protocol, Infrastructure Standards Security Assessment (ISSA)* Published August 2021

High Level Integration Scheme



Integrations

NTCIP & Other Integrations for ITS devices

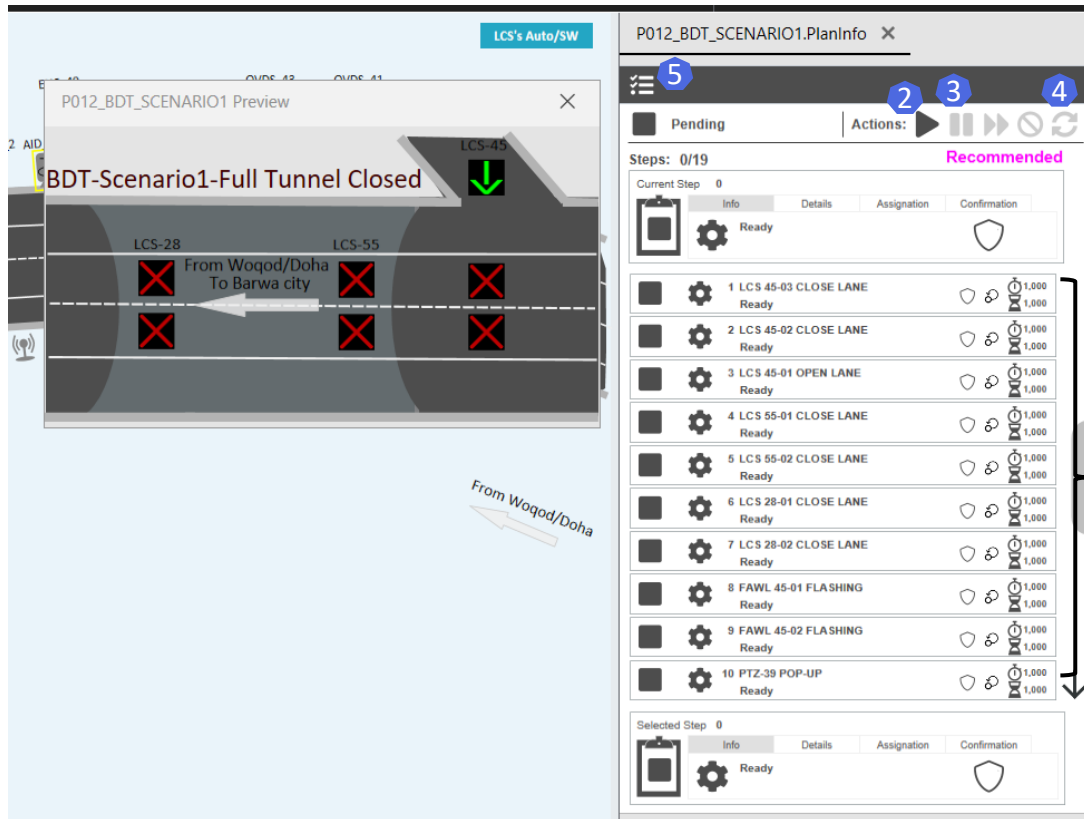
- LCS (Lane Control sign) - NTCIP Protocol
- DMS (Dynamic Message Sign) - NTCIP Protocol
- AID (Automatic Incident Detection)-SOAP
- SNAPs - SOAP
- ONVIF (Open Network Video Interface Format) - SOAP
 - Video Streaming
 - PTZ (Pan, Tilt, Zoom) Controlling
- PAVA (Public Address & Voice Alarm Systems) - SOAP
- LPR (License Plate Recognition System) - SOAP
- AITek NVR Integration (Decoder for Videos) - REST API

Response Plans (RPs) / Scenarios

- RP/ERP: Predefined list of actions performed in a sequence to manage traffic in case of planned / unplanned events.
- Some examples of response plans are:
 - Full tunnel closure / slow
 - Zone 01 Lane 01 Closure
 - No trucks allowed
- We wanted the ability to create and modify these response plans without the need for scripting and coding.
- We wanted the ability to activate a specific plan either manually or via triggers received from the field.



Response Plans (RPs) / Scenarios



P012_BDT_SCENARIO1.PlanInfo

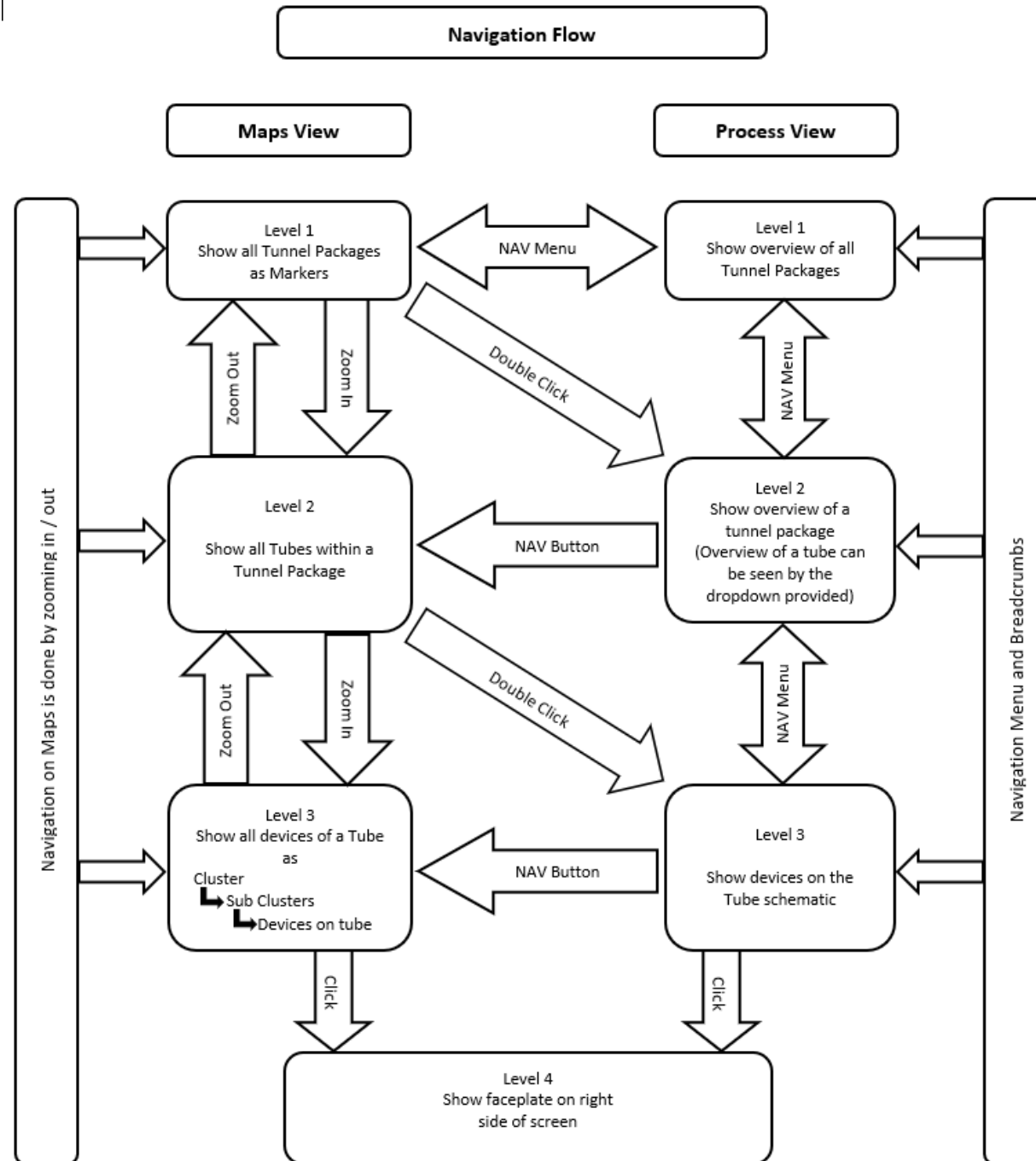
Steps: 0/19 **Recommended**

Sr. #	Description	Priority
1	LCS 45-03 CLOSE LANE	1,000
2	LCS 45-02 CLOSE LANE	1,000
3	LCS 45-01 OPEN LANE	1,000
4	LCS 55-01 CLOSE LANE	1,000
5	LCS 55-02 CLOSE LANE	1,000
6	LCS 28-01 CLOSE LANE	1,000
7	LCS 28-02 CLOSE LANE	1,000
8	FAWL 45-01 FLASHING	1,000
9	FAWL 45-02 FLASHING	1,000
10	PTZ-39 POP-UP	1,000



Sr. #	Description
1	Emergency response plans steps
2	Play button to execute the plan
3	Pause button to stop the execution temporarily. Button will be enabled once the plan is started
4	Reset button to reset the plan after it is completed. Operator may need to reset a plan so it is ready for future execution
5	Preview button to view a graphical representation of the plan
6	A pop-out screen showing a preview of the selected plan

Navigation

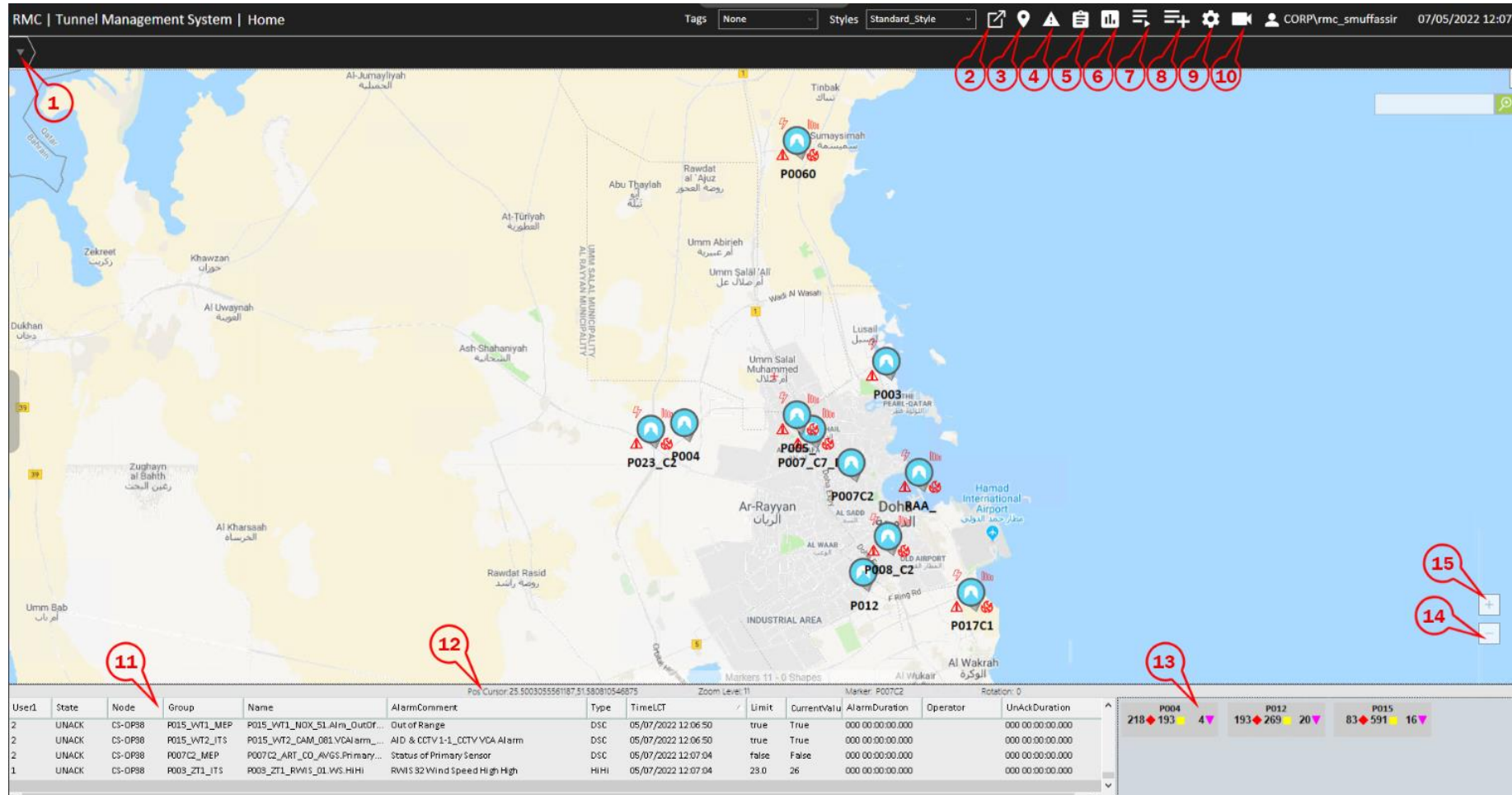


GIS View – Level 01

RMC | Tunnel Management System | Home

Tags: None | Styles: Standard_Style

07/05/2022 12:07



User1	State	Node	Group	Name	AlarmComment	Type	TimeLCT	Limit	CurrentValu	AlarmDuration	Operator	UnAckDuration
2	UNACK	CS-DP38	P015_WT1_MEP	P015_WT1_NOX_S1.AIm_OutOf...	Out of Range	DSC	05/07/2022 12:06:50	true	True	000 00:00:00.000		000 00:00:00.000
2	UNACK	CS-DP38	P015_WT2 ITS	P015_WT2_CAML081.VCAI arm...	AID & CCTV 1-1_CCTV VCA Alarm	DSC	05/07/2022 12:06:50	true	True	000 00:00:00.000		000 00:00:00.000
2	UNACK	CS-DP38	P007C2_MEP	P007C2_ART_CO_AVGS.Primary...	Status of Primary Sensor	DSC	05/07/2022 12:07:04	false	False	000 00:00:00.000		000 00:00:00.000
1	UNACK	CS-DP38	P003_ZT1 ITS	P003_ZT1_RWNIS_01.WS.HIHI	RWNIS 32 Wind Speed High High	HIHI	05/07/2022 12:07:04	23.0	26	000 00:00:00.000		000 00:00:00.000

Pos: Cursor 25.5003555561187, 51.580810546875 | Zoom Level: 11 | Marker: P007C2 | Rotation: 0

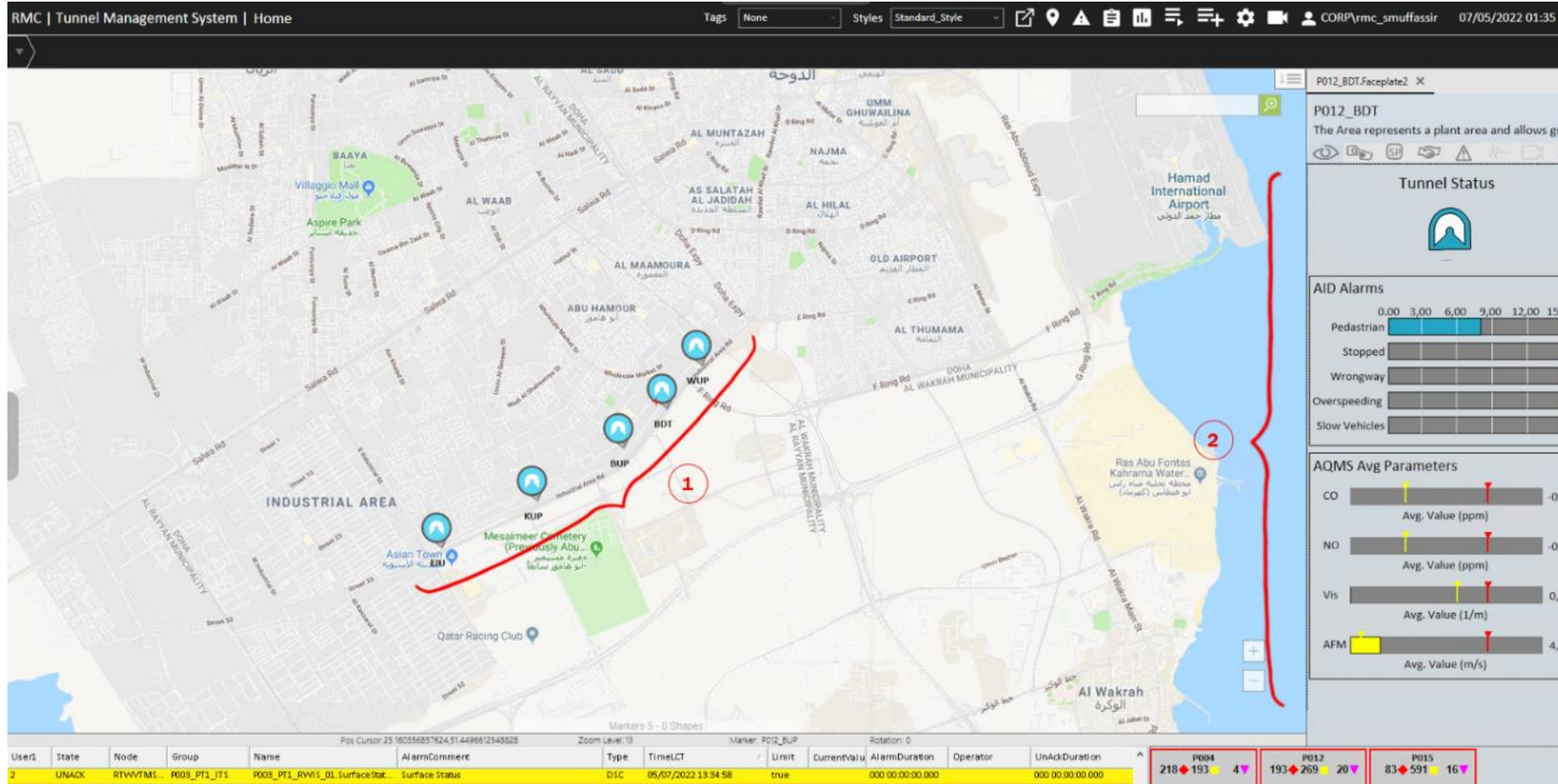
Summary: P004 218 193 4, P012 193 269 20, P015 83 591 16

GIS View – Level 02

RMC | Tunnel Management System | Home

Tags: None | Styles: Standard_Style


07/05/2022 01:35



P012_BDT.Faceplate2 X

P012_BDT
The Area represents a plant area and allows gro

Tunnel Status



AID Alarms

	0.00	3.00	6.00	9.00	12.00	15.00
Pedestrian	[Progress bar]					
Stopped	[Progress bar]					
Wrongway	[Progress bar]					
Overspeeding	[Progress bar]					
Slow Vehicles	[Progress bar]					

AQMS Avg Parameters

CO	Avg. Value (ppm)	[Progress bar]	0.02
NO	Avg. Value (ppm)	[Progress bar]	0.03
Vis	Avg. Value (1/m)	[Progress bar]	0.00
AFM	Avg. Value (m/s)	[Progress bar]	4.36

UserID	State	Node	Group	Name	AlarmComment	Type	TimeLCT	Limit	CurrentValu	AlarmDuration	Operator	UnAckDuration
2	UNACK	RTVVTMS	P003_PT1_JT5	P003_PT1_RVW5_01_SurfaceStat...	Surface Status	DISC	06/07/2022 13 34 58	true		000 00:00:00.000		000 00:00:00.000

P004
218 ◆ 193 ▼ 4 ▼

P012
193 ◆ 269 ▼ 20 ▼

P015
83 ◆ 591 ▼ 16 ▼

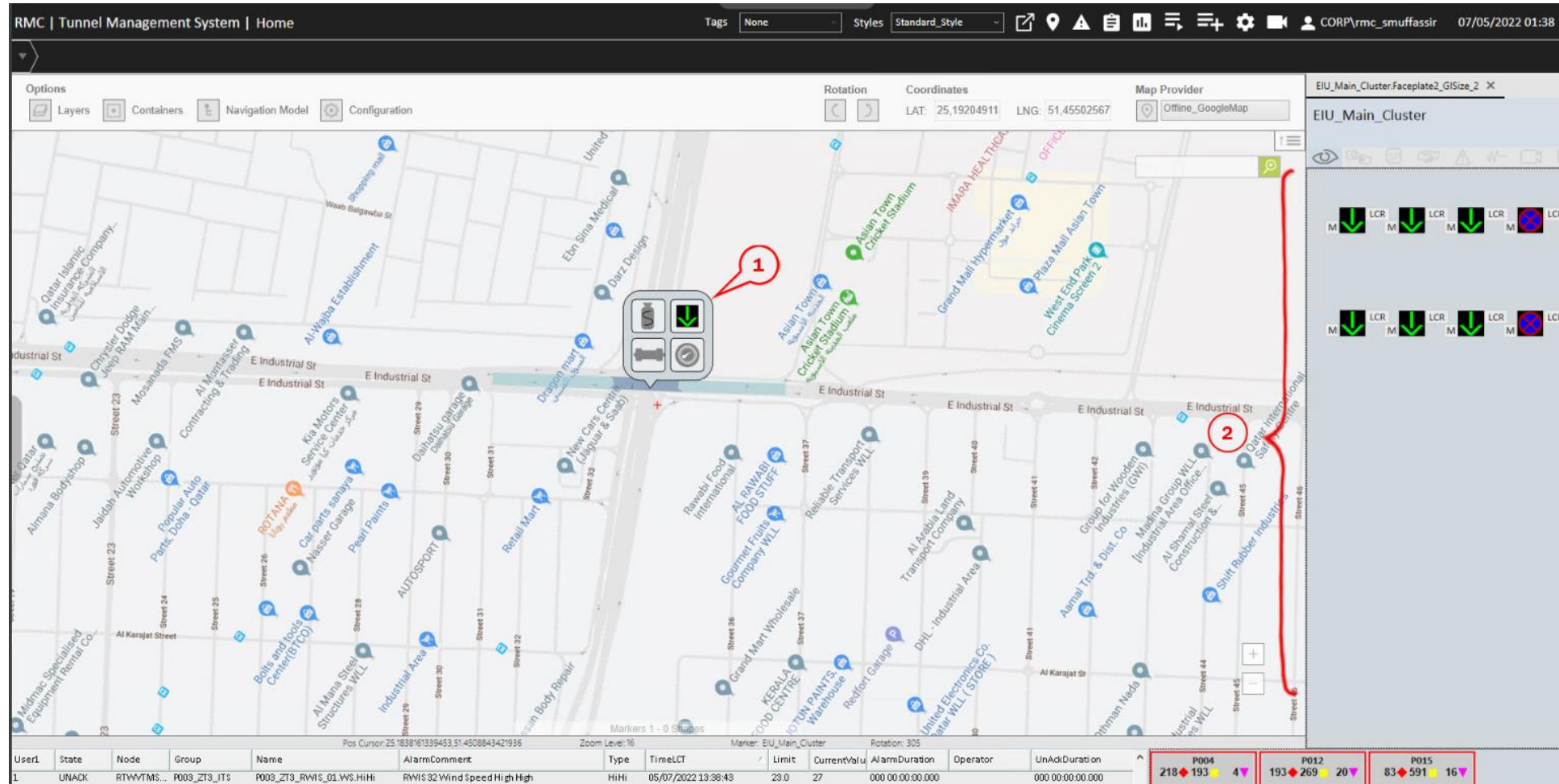
GIS View – Level 03

RMC | Tunnel Management System | Home

Tags: None | Styles: Standard_Style | Map Provider: Offline_GoogleMap

Options: Layers, Containers, Navigation Model, Configuration

Rotation: [Left Arrow] [Right Arrow] | Coordinates: LAT: 25,19204911 | LNG: 51,45502567



Map Provider: Offline_GoogleMap

EU_Main_Cluster.Faceplate2_GISize_2 X

EU_Main_Cluster

UserL	State	Node	Group	Name	AlarmComment	Type	TimeLCT	Limit	CurrentValu	AlarmDuration	Operator	UnAckDuration
1	UNACK	RTWWTMS...	P003_ZT3 ITS	P003_ZT3_RV1S_01_WS.HIHI	RV1S 32 Wind Speed High High	HIHI	05/07/2022 13:38:43	23.0	27	000 00:00:00.000		000 00:00:00.000

Pos Cursor: 25.1838161339453, 51.4508843421936 | Zoom Level: 16 | Marker: EU_Main_Cluster | Rotation: 305

Summary: P004 218 ♦ 193 ♦ 4 ▼ | P012 193 ♦ 269 ♦ 20 ▼ | P015 83 ♦ 591 ♦ 16 ▼

GIS View – Level 05

RMC | Tunnel Management System | Home

Tags: Alias/Friendly Tag | Styles: Standard_Style

Rotation: [Left] [Right] | Coordinates: LAT: 25,19251511 | LNG: 51,45583033 | Map Provider: Offline_GoogleMap

Options: Layers, Containers, Navigation Model, Configuration

Callout 1: P012_EI_VF_06 Tunnel Ventilation Fan

Control Location	SCADA
Fan Status	Available
Fan Vibration	0,00
Fan Air Flow Temperature	39,15
Fan Air Flow Pressure	-1,00
Number of Motor Starts - Yday	0,00
Number of Motor Starts - Today	0,00
Total Number of Motor Starts	31,00
Run Hours - Yday	0,00 Hrs
Run Minutes - Yday	0,00 Mins
Run Hours - Today	0,00 Hrs
Run Minutes - Today	0,00 Mins
Absolute Run Mins	0,00 Mins
Absolute Run Hours	0,00 Hrs
Accumulated Run Minutes	29,00 Mins
Accumulated Run Hours	0,00 Hrs

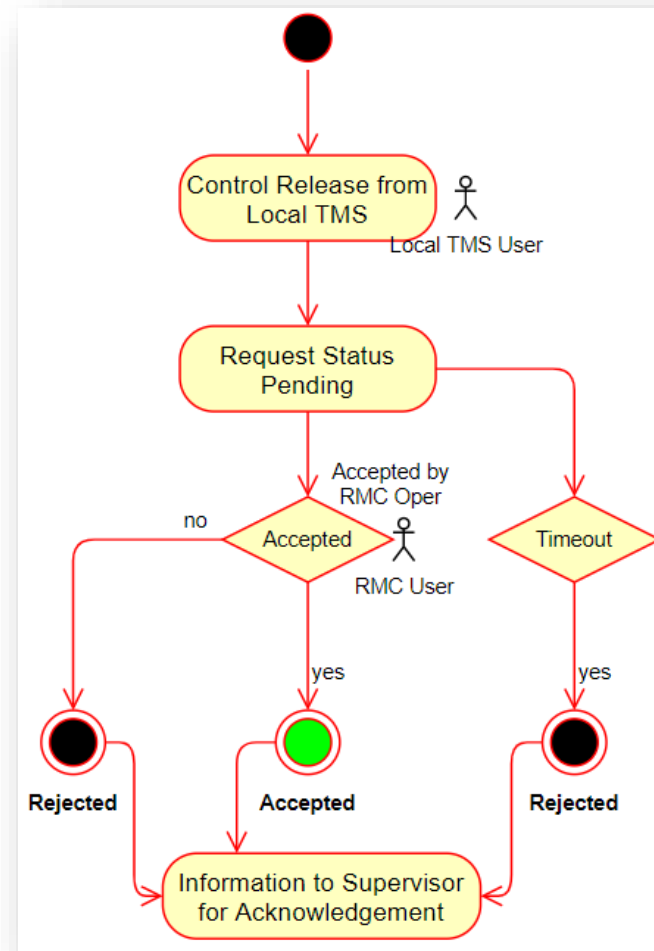
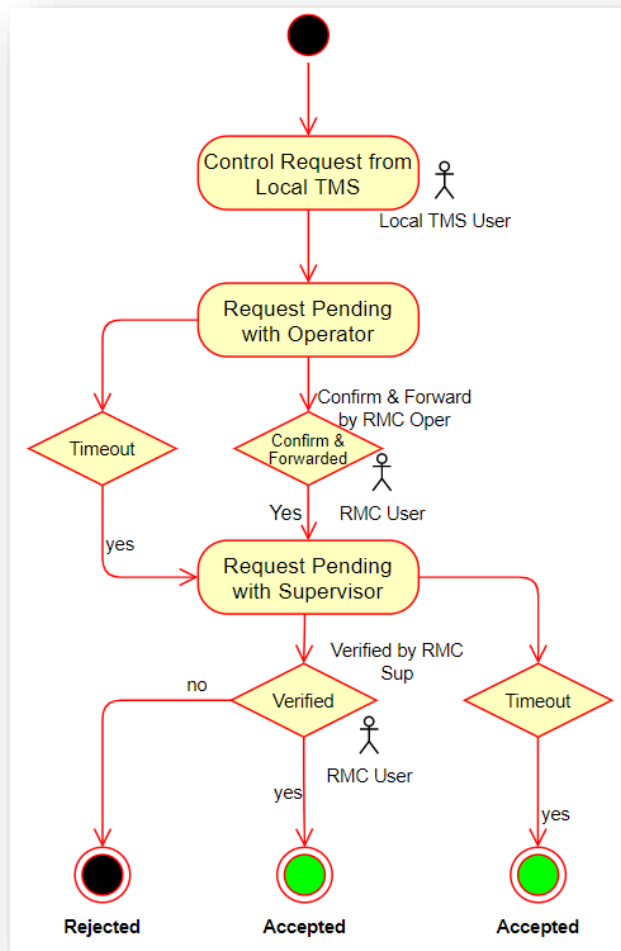
Callout 2: AP78_1_L4, AP78_1_L3, AP78_1_L2, AP78_1_L1

Callout 3: Alarm Status

User1	State	Node	Group	Name	AlarmComment	Type	TimeLCT	Limit	CurrentValu	AlarmDuration	Operator	UnAckDuration
2	UNACK	RTVM/TMS...	P007C2_AS	P007C2_TSB_AS_5BM Close5	Door Close	DSC	05/07/2022 13:41:48	false	False	000 00:00:00.000		000 00:00:00.000

Summary: P004 218 193 4, P012 193 269 20, P015 83 591 16

Operational Changeover



Verified Write ✕

P012.ControlTackbackCmd
 Control Take back by Master RMC
 Please reenter your credentials to set **P012.ControlTackbackCmd** to **1**.

Domain:

User name:

Password:

Please also provide credentials for a user with permission to verify this operation.

Domain:

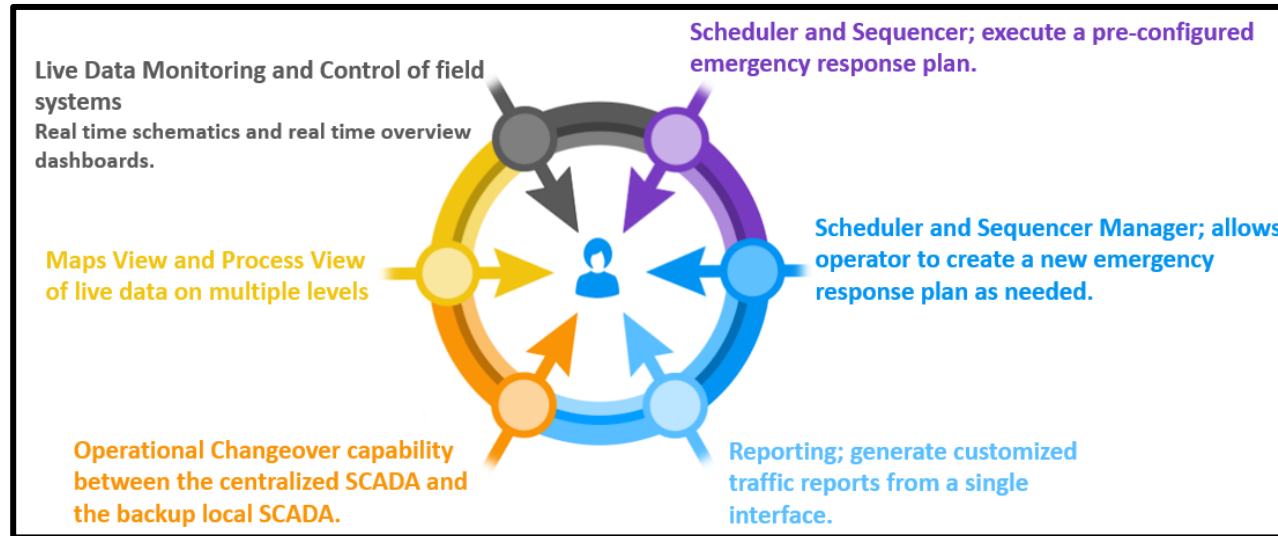
User name:

Password:

Comments

Single touchpoint for all systems

AVEVA™ System Platform as the focal point



12 Remote sites connected

50+ tunnels and underpasses

15+ integrated subsystems

~11464 total integrated assets

Tunnel Management System

“Cyber Security compliance & enhancing the communication suite to include customized ITS Equipment drivers were critical success factors for the project. They [Avanceon] helped us achieve this.”

Manzoor Maqbool A. Ansari – Senior ITS Engineer, Roads Design Dept., Ashghal

“The system has successfully contributed to the success of the FIFA event by providing a smooth and enjoyable transportation experience for spectators, minimizing disruptions and optimizing overall traffic operations”

Abdulrahman A S Ansari - RMC Operations Manager, Ashghal.

Ashghal improves incident management with single pane of glass view of critical road tunnels

Challenge

- Qatar is a host to regional and international public events like the FWC, Asian games, etc. These are attended by a significant number of spectators. This results in increased traffic volume around stadiums and host areas.
- Handling traffic scenarios entailed interacting with multiple systems (MEP, Intelligent Transportation (ITS) System devices, GIS, etc.). There was no Single Pane of Glass (SPoG) view available to operators for this.

Solution

- All ITS subsystems were integrated using AVEVA™ System Platform
- Customized drivers (e.g. NTCIP) were developed for this purpose
- 1100+ traffic plans with 5500+ steps were programmed
- Increased situational awareness by using GIS map views with real-time statuses

Results

- **Reduced response times to handle incidents and emergencies**
- **Ramp up time for bringing new operators to operations has reduced from weeks to days as they only have to train themselves on a single platform.**





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VP, Digital Transformation

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Questions?

Please wait for the microphone.
State your name and company.



Please remember to...

Navigate to this session in the mobile app to complete the survey.



Thank you!



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Tomorrow's solutions, today.

قطر تستحق الأفضل
Qatar Deserves The Best

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 [@avevagroup](https://twitter.com/avevagroup)

ABOUT AVEVA

AVEVA is a world leader in industrial software, providing engineering and operational solutions across multiple industries, including oil and gas, chemical, pharmaceutical, power and utilities, marine, renewables, and food and beverage. Our agnostic and open architecture helps organizations design, build, operate, maintain and optimize the complete lifecycle of complex industrial assets, from production plants and offshore platforms to manufactured consumer goods.

Over 20,000 enterprises in over 100 countries rely on AVEVA to help them deliver life's essentials: safe and reliable energy, food, medicines, infrastructure and more. By connecting people with trusted information and AI-enriched insights, AVEVA enables teams to engineer efficiently and optimize operations, driving growth and sustainability.

Named as one of the world's most innovative companies, AVEVA supports customers with open solutions and the expertise of more than 6,400 employees, 5,000 partners and 5,700 certified developers. The company is headquartered in Cambridge, UK.

Learn more at www.aveva.com