قطـــر تستحـــق الأفضـــل
Qatar Deserves The Best

CONTRACT 5: INTELLIGENT TRANSPORTATION SYSTEM (ITS)

CONSULTANCY SERVICES

Project ID: IA 10/11 D 027 G

TMS/SCADA Specimen Design Overview

31st March 2016

DOCUMENT CONTROL PANEL					
File Name:		TMS-SCADA SPECIMEN DESIGN OVERVIEW_20160221.DOCX			
Contract Name/Project ID		Contract 5 – ITS Consultancy Services / IA 10-11/D/027/G Task 051			
File Location (Project Mates):					
Deliverable Name:					
Version	**Date**	**Status**	**Author**	**Reviewer**	**Approver**

Glossary of acronyms	
Term	**Definition**
AHJ	Authority Having Jurisdiction
BoQ	Bill of Quantities
DMS	Dynamic Message Sign
EFA	Electrostatic Fluid Accelerator
EXW	Expressway
GME	Ground Mounted Enclosure
HDPE	High Density Poly Ethylene
IAN	Interim Advice Note
ITS	Intelligent Transportation Systems
LAN	Local Area Network
LCS	Lane Control Sign
MEP	Mechanical Electrical Plumbing
PLC	Programmable Logic Controller
PMC	Programme Management Consultant
PME	Pole Mounted Enclosure
PNS	Plant Numbering System
PWA	Public Works Authority (Ashghal)
SCADA	Supervisory Control and Data Acquisition
TMS	Tunnel Management System
UPVC	Unplasticided Poly Vinyl Chloride
WAN	Wide Area Network

Table of Contents

Executive Summary

This document provides an overview of the Tunnel Management System SCADA (TMS) Specimen Design.

The Specimen Design has been created in order to act as an example of how Ashghal requires designers to deliver SCADA tunnel designs for approval from a presentation perspective only. The scope of this specimen design was defined as follows:

1) Issue of a generic Plant Numbering System to standardize the way items are named for all TMS/SCADA projects across the deliverable.
2) Preparation of standard templates for use in TMS/SCADA designs:
    a. Equipment List
    b. I/O list
    c. Alarm List
    d. Examples of application of the list(s)
    e. HAZOP
    f. Example of application of the HAZOP
3) Preparation of Specimen Standard Plans:
    a. Abbreviations, symbols and legends
    b. Site Plans
    c. Schematics
        i. Topology Architecture
        ii. Interface block diagrams
    d. Sub-System Interface block diagram
    e. Equipment Layout
    f. Network Topology
        i. High level network topology
        ii. Detailed network topology
    g. Enclosure details
    h. Marshaling cabinet details
    i. Manual Override Panel (s) ITS and MEP

    BoQ template

This Specimen Design is not exhaustive and is illustrative only. Designers are expected to produce SCADA TMS designs which are complete and correct for their respective design outputs, following careful examination of the individual tunnel requirements.

Currently a Concept of Operations for tunnel management is not available, and therefore this specimen design has been created utilising best practices available from European sources. It is recommended that a tunnel working group be created with members from key stakeholders, to establish a national tunnel management strategy.

1 Understanding the TMS Specimen design

1.1 Plant Overview

In order to produce a specimen design a sample plant has been defined for illustration purposes only. The plant includes three different types of critical infrastructures:

- Tunnel E: an enclosed roadway section which is assumed be classified as tunnel category A as per IAN20. This structure features a substation compound which includes an equipment and a control room ready to host the TMS and telecommunication components enabling Ashghal or any AHJ to exercise local control of tunnel operations.
- Underpass K: an enclosed roadway structure that is not classified as tunnel and has not a control room of its own but still requires automation to manage drainage and flood detection as per IAN23 requirements. This critical infrastructure is assumed be managed from a remote control location.
- EFA Pump Station: A facility that is not supporting tunnel operations, but it is important to Ashghal to gain control over it through the control facilities planned for deployment.

Tunnel E and K Underpass are twin bore structures, both bores are physically separated by a wall and each bore is one way traffic. Both enclosed structures do not have merges nor diversions between the portals nor the up and down access and exit ramps.

1.2 Plant Numbering System (PNS)

Please refer to the PNS provided with this Specimen design for reference and guidance on how to apply an ID to every component monitored and controlled by the TMS.

1.3 Lists

Three different listings are used to describe the devices monitored and controlled:

- The Equipment list: a comprehensive list including every device monitored or controlled or both by the TMS. The equipment list shall provide as a minimum the following information:

  Equipment: number, a sequential numbering for equipment count

  Equipment: description.

  Equipment: ID as per the PNS

  Equipment: alias, a short name used to group devices or differentiate them

  Equipment: revision number used to keep track of changes made to equipment to be monitored and controlled by Ashghal.

Location: road/building as per the PNS (where applicable)

Location: chainage/room as per the PNS (where applicable)

Location: traffic direction as per the PNS (where applicable)

Location: lane / hard shoulder as per the PNS (where applicable)

Equipment: communications type hardwired I/O or ModBus (or equivalent protocol)

Equipment: unit no

Associated camera, indicates the camera as per the PNS that will automatically be pointed by the TMS to watch the equipment in the event of incident.

Camera: description

Camera: revision number used to keep track of changes made to equipment to be monitored and controlled by Ashghal.

Drawing number, reference drawing where the monitored or controlled device is specified to support tunnel operations as per the MEP / ITS design

Drawing version, must match the current approved edition of the drawing number used as reference.

- The Input/Output (I/O), a comprehensive list detailing every control signal exchanged between the system controllers and the field devices to completely monitor and control the sub-systems as well as crosscheck the alarm information to avoid false positive alarms. The I/O list shall include as a minimum the following information:

  Signal count: a sequential numbering for signal count

  Signal Tag: Tag - One tag identifier for each signal. Two signals cannot have the same tag. It will be based on the PNS

  Data Type: a classification of the information exchanged DIN=Digital Input, DOUT=Digital Output, AIN=Analog Input, AOUT=Analog Output

  Read: Read - Enabled to Read the Database Point from the PLC; R="Yes"; Blank="No"

  Write: Write - Enabled to Write to the PLC for the Database Point; W="Yes"; Blank="No"

  I/O Assignment: the interface used to transport the signal information PLC/RIO = Hardwired to PLC or RIO; BUS/COMM=Fieldbus; DB=Database I/O, not a physical I/O

Signal Description

Major: grouping into specific signal type/category

Minor: grouping into generic signal type/category

Signal pick up location, based on the PNS

Signal: operating modes defined by the signal, as an example on/off; available/unavailable; normal/high; normal/failure, etc.

Equipment ID: PNS based Equipment designation as per Equipment list

Outstation ID: PNS based Outstation RIO designation

Outstation Name: RIO Name - A description of the RIO or location or function - used to identify from which RIO the signal is picked up.

Outstation PLC ID: PNS based Outstation PLC designation (as an example lighting PLC)

Outstation PLC Name: PLC Name - A description of the PLC or location or function - used to identify from which PLC the signal is picked up.

Master PLC ID: PNS based PLC, this is a dual hot stand-by PLC SIL2 or higher safety instrumented systems

Master PLC Name

Field Signal Conductors: copper wires specification for hardwired I/Os

Comments

- The Alarm list shall provide a comprehensive listing of the I/O that deliver alarm information only. The content of the alarm list shall include the same information listed on the I/O list.

1.4 Plans

Please refer to the plans section of this specimen for reference on what is the minimum acceptable content of a TMS/SCADA deliverable plan set.

1.5 Diagram explanations

ITS components not related to the TMS are shown for reference purposes only, typically these components are “greyed out” and should only be considered if appropriate to the overall design.

Cut out sheets that do not include any elements of the TMS have been removed from this specimen design, it is up to the individual designers whether or not they include these as part of their design package.

1.5.1 Drawing 2001

This represents an example of the information flow only between TMS and SCADA components. Individual tunnel requirements are expected to differ

1.5.2 Drawing 2002

This represents an example of devices, their interaction and flow of data using both network connectivity and hard wired sensors. Individual tunnel requirements are expected to differ.

1.5.3 Drawing 4001

This represents an example of a control room configuration. Each tunnel will have it's own set of requirements for a tunnel control room. This should be determined following examination of the individual tunnel requirements.

Designers should take into consideration redundancy of systems when designing the control room. Connectivity to ITS equipment, such as LCS and/or DMS via the PLC should be covered, in the event of a total server disaster, thus enabling control of these devices to alert motorists.