Ecava IGX is the Guardian of Bukit Berapit Railway Tunnels

How It Started

The Malaysian Government has initiated a project for the Electrification of Double Track Project (EDTP) which runs through the northern peninsular of Malaysia. The project involves the laying and electrification of two new **329km** long double track to replace the existing single track including new stations, bridges, the electrification of tracks and signalling systems. The project which started in January 2008 and scheduled to complete by 2013.

There are two double-barrel tunnels built as part of the project. These include a **3.3km long tunnel in Bukit Berapit**, which is the longest in South-East Asia. This gigantic project (est. investment price **RM16.5 bil (~4.1 bil USD))** is operated by **KERETAPI TANAH MELAYU Berhad (KTM Berhad) Malaysia**. It is the main rail operator in Peninsular Malaysia which had been running since year 1885.



It is known to be essential and compulsory to have an accurate monitoring and control system for railway tunnels, not only to ease the operators to have a convenient daily job routine, but also to ensure safety as the first priority. Therefore, in order to ensure full functionality of EDTP project, or more specifically, to provide and prepare the Berapit tunnel in the safest condition for trains to operate continually, **Ecava IGX** is selected as the SCADA solution to achieve these goals, and thus came out with **Bukit Berapit Tunnel Monitoring and Control** system (TMCS).

Berapit Tunnel Monitoring and Control System (TMCS) by Ecava IGX

TMCS is implemented to achieve the following goals:

- A) To monitor and control of the following systems:
 - Tunnel Lighting System
 - Electrical Distribution
 - Tunnel Ventilation & Cross Passage Pressure Pressurization
 - Hydrant System
 - Telephone and Emergency Telephone system
 - Public Address (PA) System
 - Tunnel CCTV System
 - Tunnel Access Control System
 - Tunnel Radio Communication System
- B) To provide event / data logging for display and printouts on the following:



- Alarm and status monitoring of all tunnel systems and equipment
- Monitor and control of tunnel lighting
- Monitor and control of tunnel ventilation
- Monitor and control of cross passage pressurization
- Monitor and control power distribution
- Information on plant running and performance (where applicable)
- Operational procedures during emergency events
- Management data
- Tunnel access control monitoring
- Interface with other equipment (where applicable)
- C) To store archives (in raw or CSV format) in hard disk for the purpose of extraction into external storage.
- D) To store data up to twelve (12) months period, and perform automated housekeeping for database older than 12 months by using FIFO concept.



The view of Bukit Berapit tunnels from outside along the railways.

Ecava IGX Makes Everything Automated

Ecava IGX has equipped a TMCS which is responsible to run automatic control tunnel ventilation system in accordance with the incidents plans programmed (based on emergency and maintenance philosophy). In the meantime, it also continuously monitor the status of tunnel operations and systems.

The security measures are even more strengthened by having Ecava IGX's alarm automation system. Any abnormal or failure behavior will trigger alarms generation to alert operators, and they will be automatically recorded and can also be printed or exported.

TMCS operates to provide comprehensive management information in the form of historical trends / report, with the purpose to ensure the most accurate assessment of tunnel operating costs which leads to top-level efficiency.

Manual control facilities for tunnel lighting and ventilation are executable from user workstations in accordance with the incidents plans philosophy.

TMCS provides the operational interface for the surveillance and control of the tunnels. There are four (4) TMCS servers installed in multiple crossstates technical control buildings, including one in the Kuala Lumpur central control center. TMCS is designed to allow multiple users access for 24 hours operation purpose by following the best security approaches. Thus, there are three (3) TMCS workstations furnished among those control buildings, which each of them has the same operation interface and functions as TMCS server.

In normal operation, among the four (4) TMCS servers in same network connection, one of them will be promoted as Master to control most of the monitoring, controlling, redundancy and data archiving work. While the rest will act as standby TMCS server. This redundancy is yet another



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approach to ensure the system availability for all time.



Operator can access TMCS via TMCS servers or workstations in same network connection.

The Architecture

The TMCS is designed based on the use of remote input output units and everything is interconnected via Ethernet TCP/IP private network. All of the system clocks for Operating Systems reside in Servers, Workstations and PLC are synchronized by a Master Clock via Network Time Protocol (NTP).

The TMCS is built as a distributed system with TMCS PLC panels mounted within the tunnel cross passages, and technical control buildings are interconnected by a private LAN (TMCS Network) to the TMCS Servers as well as interfacing with TMCS Workstations.

This system hierarchy is designed to allow local autonomous operation from different control buildings, to ensure the TMCS can be operated despite any communication failure in any of the control rooms.

The TMCS provides a safe, secure and comprehensive tunnel management system that requires minimum staffing level.



Bukit Berapit tunnel ventilation fallback panel.

The Hardware / Software:

Server Machine: Dell Power Edge 710 Server OS: Windows Server 2008 R2 Service Pack 1

Workstation Machine: Dell Precession T3500 OS: Windows 7 Professional Service Pack 1

PLC (Programmable Logic Controllers): GE Fanuc type RX3i Protocol: Modbus TCP/IP

SCADA: Ecava IGX IO tags: 8192 tags Redundancy: 4 servers Remote client: 7 clients

Database: PostgreSQL Database

SCADA Mimics Screenshots:

TMCS by Ecava IGX has been completed and fully implemented back in year 2013 and is currently serves as the strong backbone to support the Berapit tunnels, and ensuring all-time uninterrupted train operation.



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TMCS Overall View Mimic



TMCS Ventilation Fallback Panel Mimic

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