



## Project Report Tunnel Lighting Control Systems

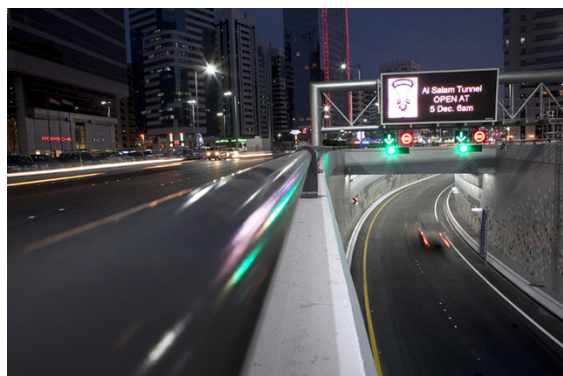
### Shaikh Khalifa Tunnel Abu Dhabi

**Project:** Sheikh Khalifa Tunnel Abu Dhabi  
**Client:** Abu Dhabi Municipality  
**Consultant:** Parsons International  
**Contractor:** Samsung Saif Bin Darwish

**System Supplier:** EE-Consulting AG, Ticos  
 Reverberi Enetec  
**Lighting:** Schröder / CREE  
**Local Partner:** Bahri & Mazroei Trad. Co.  
**El. Contractor:** Danway

#### Summary

Sheikh Khalifa Tunnel is connecting Dalma Street in the Sout-East and the Corniche near Mina Port trough a 3km long y-shaped tunnel on the Eastern side of Abu Dhabi. The tunnel has two tubes with 3-4 lanes each and is the Middle East’s longest road tunnel. It opened for traffic in January 2013. The South end of the tunnel has one entrance and one exit and the North two entrances and one exit, one leading to Mina Port the other to the Corniche.

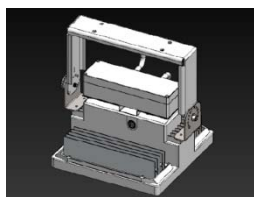


Above: North Side Corniche Entrance

The total cost of the project was AED 5Bn (€ 1Bn) and it took about 5 year to build it. The capacity of the tunnel is 12'000 vehicles per hour.

#### The Lighting

The threshold lighting is done with 1'600 high pressure sodium (HPS) luminaires (400W and 250W) from Schröder (Belgium) providing a maximum luminance of 250-300 cd/m<sup>2</sup>. The permanent / interior lighting was done with 5'000 LED luminaires (48W) from Ruud/Cree (USA) (see on left) providing a max.



luminance of 15 cd/m<sup>2</sup>.

#### The Tunnel Lighting Control System

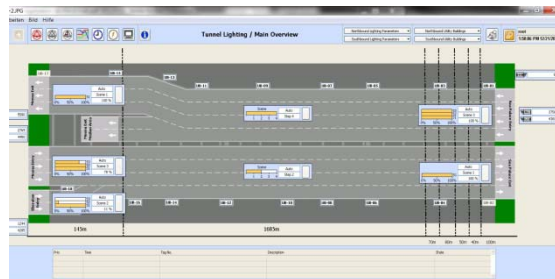


The TLCS provides automatic operation of the lighting in 4 day-time stages and two night time stages. The control is based on the L20 measurement in the approach zone of the tunnel and of the traffic density in the tunnel. The TLCS system is distributed over the 16 locations along the tunnel. Each tube has its own redundant control system.



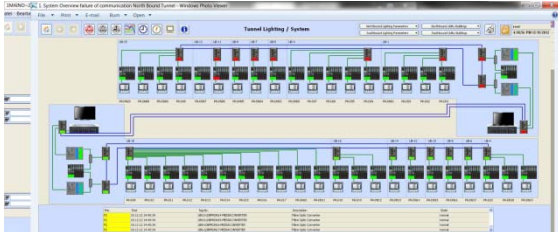
Above: Block Diagram of TLCS

The 8 locations of one tube are connected with a fiber optic ring network (TCP/IP). Each location has its own sub PLC using a PROFIBUS network to communicate to the other LDB's in the same



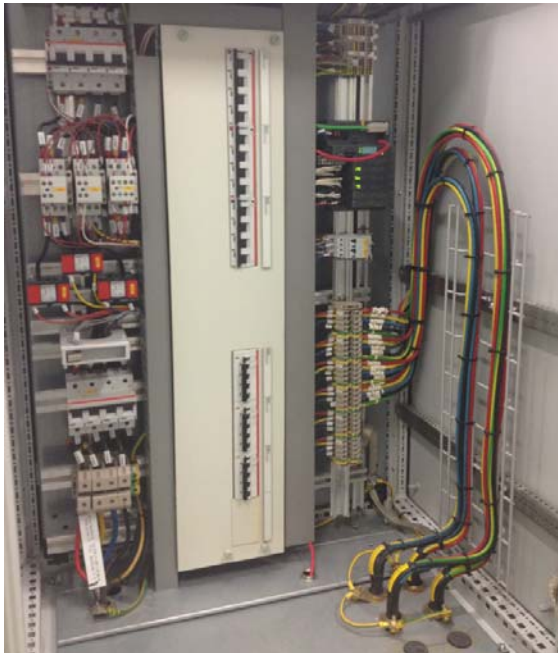
Above: TLCS Main Page

location. The luminance meters and photo cells are connected to the redundant Master PLC's. Each master PLC has an industrial PC serving as a SCADA interface. Two interfaces are provided for the SCADA: Weblink and OPC (Open Process Control). For normal operation Weblink is used, the SCADA is connecting to the TLCS via a Weblink and the TLCS is providing the operating platform. The SCADA connections of the two industrial PC's are



Above: TLCS Communication Page

cross redundant, meaning that all information of one tunnel is available on the other system as well. Each lighting distribution panel (LDB) has a precision dimmer/stabilizer (Reverberi STB) to control the voltage to the HPS luminaires. Stabilisation accuracy is +/- 1% phase independent.



Above: Part of LDB with CT's and MCB's

The Efficiency of the system is >98%. No harmonics are introduced with this transformer based technology. The system has no moving parts which require maintenance. The controllers are equipped

with automatic by-pass and performance monitoring systems. The stabilization is particularly important for the HPS luminaires. The HPS lamps



Above: Part of LDB with LPM and Power Meter

will last 2-3 times longer. The dimming in the entrance zone saves about 30% of energy! Each of the LED luminaires is fitted with a "Lighting Point Controller" (LPC) from Reverberi. The LPC is mounted on top of the luminaire (see picture previous page). Each of the LED panels is equipped with a "Lighting Point Manager" (LPM) communicating to each of the LED luminaires via power line carrier. With this technology each individual LED luminaire is controlled and monitored. This type of communication does not require and additional cables and is very robust. In case of communication problems each LPC can be programmed as a repeater effectively extending the range of communication beyond limits.

The LED luminaires are dimmed from 100-25% saving up to 80% of energy! The high savings are due to the efficiency increase of the dimmed LED luminaire! The luminaires will last much longer.

**In total the control system will save 30%-40% of energy** and will **increase the lamp life** including the life of all other luminaire components. This will reduce the operational cost substantially and reduce Abu Dhabi's CO<sub>2</sub> footprint.

**EE-Consulting AG** and its partners Ticos, Reverberi and Bahri & Mazroei Trading Co. have executed more than 30 installations in the Middle East and are the leading engineers and suppliers for Tunnel Lighting Control Systems and Public Lighting Management Systems in the region.