

Case Study

Project : Sheikh Khalifa Tunnel

Location : Abu Dhabi

Client : Department of Municipal Affairs
- Abu Dhabi Municipality

Consultant : Parsons International

Contractor : Samsung Saif Bin Darwish

System Supplier : EE-Consulting AG

Electrical Contractor : Danway

The Sheikh Khalifa Tunnel is one of the Middle East's longest tunnels. Built at an estimated cost of \$1.36 Billion, the tunnel run is 4.2 km long with a 2.4 km enclosed section and runs through Abu Dhabi's central business district. It is estimated that approximately 20% of traffic will now flow through the tunnel thereby easing traffic congestion along the surface. With no traffic signal lights inside the tunnel, the uninterrupted journey from Zayed Bridge to Mina Port or the Corniche will take around 20 minutes, with the same journey above ground taking twice that time.

The tunnel has four lanes each in both the outbound and inbound directions. At the end of the tunnel, it branches into five lanes — two lead towards the Abu Dhabi Corniche, and three lanes lead to Mina Port. Speed will be controlled by cameras with limits being visibly sign-posted on boards above the driving lanes. Environmental concerns were also taken into consideration when building the tunnel.

The tunnel begins on Dalma Street, and allows motorists to travel uninterrupted to the Corniche area and Mina Port. Bicycles, pedestrians, trucks weighing more than 2.5 tonnes or above 5.5 metres in height, as well as vehicles carrying gas cylinders and hazardous materials, are not allowed into the tunnel.

Tunnel Lighting Control System Sheikh Khalifa Tunnel Abu Dhabi - United Arab Emirates



Key User Benefits:

- ◆ **Energy Savings**
Light is adjusted to match traffic density and supply is stabilised. The energy consumption represents 95% of the total life cycle of a lighting installation.
- ◆ **Lower Maintenance & Operational Costs**
Due to the dimming, stabilisation and soft starting, the LED Lamps last 2X longer.
- ◆ **Increased Safety and Security**
Proper functioning of the lighting is monitored and problems are reported instantly.
- ◆ **Quicker Return on Investment**
A short RoI of 2-5 years
- ◆ **Systems Upgradable**
Due to the modular design of the systems, the system can be upgraded at a later stage.
- ◆ **Compatibility**
Due to the useage of universal protocols and interfaces this system can communicate to other lighting control systems, can control other utility systems or can report to central SCADA Systems



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The Client:

The Municipality of Abu Dhabi City was established in 1962 as the “Department of Abu Dhabi Municipality and Town Planning” with the objective of providing outstanding municipal services and modern infrastructure to the capital. The recent years have seen several green initiatives being rolled out including the replacing of 600,000 streetlights with new, low-energy Light Emitting Diode (LED) fixtures in a move that may save up to Dh500 million in energy costs. As a front runner to this initiative, LED lighting control technology has been incorporated into the high profile Sheikh Khalifa (AKA Salam) Street project.

The System:

The threshold lighting is provided with 1600 high pressure sodium (HPS) luminaires (400W and 250W) from Schreder providing a maximum luminance of 250-300 cd/m². The permanent / interior lighting was done with 5000 LED luminaires (48W) from Rudd/Cree (USA) providing a maximum of 15 cd/m².

The Tunnel Lighting Control Systems (TLCS) provides automatic operation of lighting in 4 day time and 2 night time stages. The control is based on the measurement in the approach zone of the tunnel and the actual traffic intensity in the tunnel. The TLCS system is distributed over the 16 locations along the tunnel with each tube having its own redundant control system.

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 LDBs in the same location. The luminance meters and photo cells are connected to the redundant Master PLCs. 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 connects to the TLCS via a Weblink and TLCS provides the operating platform.

The SCADA connections of the two industrial PCs are cross redundant, meaning that all information of one tunnel is available on the other system as well. Each lighting distributor panel (LDP) has a precision dimmer/stabilizer to control the voltage to the HPS luminaires. Stabilisation accuracy is $\pm 1\%$ phase independent.

The efficiency of the system is $>98\%$. No harmonics are introduced with this transformer based technology and the system has no moving parts that 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 will last 2-3 times longer. The dimming in the entrance zones saves about 30% energy. Each of the LED luminaires is fitted with a “Lighting Point Controller” and is mounted on the top of the luminaire. Each of the LED panels is equipped with a “Lighting Point Manager” that communicates to each of the LED luminaire via a power line carrier. With this technology each individual LED luminaire is controlled and monitored. This type of communication does not require additional cables and is very robust. In case of communication problems each LPC can be programmed as a repeater effectively extending the range of communications 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 luminaires causing the luminaires to last longer.

In total the control system will save 30-40% of energy and will increase the lamp



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life including the life of all other luminaire components. This will reduce the operational cost substantially and reduce Abu Dhabi's CO² footprint.

The Challenge:

The Sheikh Khalifa Tunnel is perhaps the first tunnel project in the Middle East to use LED Technology in conjunction with Lighting Controls. Even though Abu Dhabi Municipality were committed to the 'Green Cause' they were skeptical on the efficiency of having a Tunnel Lighting Control System installed in a tunnel.

Convincing a customer on the merits of a tunnel lighting control system is one thing and delivering on a project a complete different job.

BMTC's team of engineers were always at hand to advise and help with product installation. Once installed, the commissioning team would take over the site to ensure proper testing and commissioning of the site.

Trained at our partner facilities in Italy and Switzerland we ensure that all our systems are in peak working condition keeping the nation's tunnels and road safe and secure.

Project Snapshot:

Shown above are Tunnel Lighting / Energy Reports taken from the system at Sheikh Khalifa Tunnel. These are reports taken 3 months after commissioning of the project in Sep. 2012 and show the following

Consumption (kWh)		Energy Saving (kWh)	Energy Saving %	Actual Cost (AED)	Cost Saving (AED)
without dimming	with dimming				
533,060	123,494	409,566	76.53	49,397.54	163,826.46
Projected Savings over a period of 12 months ⇨					1,965,917.50



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About Us:

Established in 1968, Bahri & Mazroei Trading Co.LLC (BMTC) started its operations in Product Supply and Distribution of Electrical and Lighting Solutions. Over the last four decades, the company has expanded its portfolio to include Urban and Water Solutions. Named after its two founders, the late Mr. Salem Humaid Al Bahri and Mr. Rashid Humaid Ali Al Mazroei, BMTC has become a trusted name for Electrical and Lighting solutions in the UAE.

BMTC has a reference list that includes some of the biggest landmarks in the region including Burj Khalifa, Dubai Metro, Dubai International Airport, Madinat Jumeirah, Mirdif City Center, Emirates Hotel and Towers, Dubai Airport Tunnel, Grand Mosque,

Aldar Headquarters, Central Market Re-development, Shams Gate, Sowwah Square, Skeikh. Khalifa Tunnel, to name a few. The company holds distribution rights for several prestigious brands including Crabtree, MK by Honeywell, Eaton, Trilux, Tungsram, LG, Ex-Or, Schreder, Hei Solar, Oase, Havells etc.

Besides catering to the project segment within the construction industry, BMTC also caters to Industrial and Government departments as well as to other traders and export customers, through a network of showrooms. The company's flagship showroom is based just off the Dubai – Sharjah Road in the Port Saeed area. Seven other Showrooms in Deira, Nakhal, Sharjah, Abu Dhabi, Mussafah and Ras Al Khaimah

makeup the Distribution network and ensure prompt service to customers spread all over the country.

BMTC have always seen real estate as an ideal fit within its overall investment portfolio and today owns and operates several high value properties including commercial, residential, mixed use buildings and warehouses across the UAE. All of these properties are characterized by a high standard of accommodation facilities.

BMTC is part of the Bahri & Mazroei Group that also include Bahri & Mazroei Technical Systems Co.LLC (BMTS), and Telematics Networking & Communications LLC (Telematics).



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