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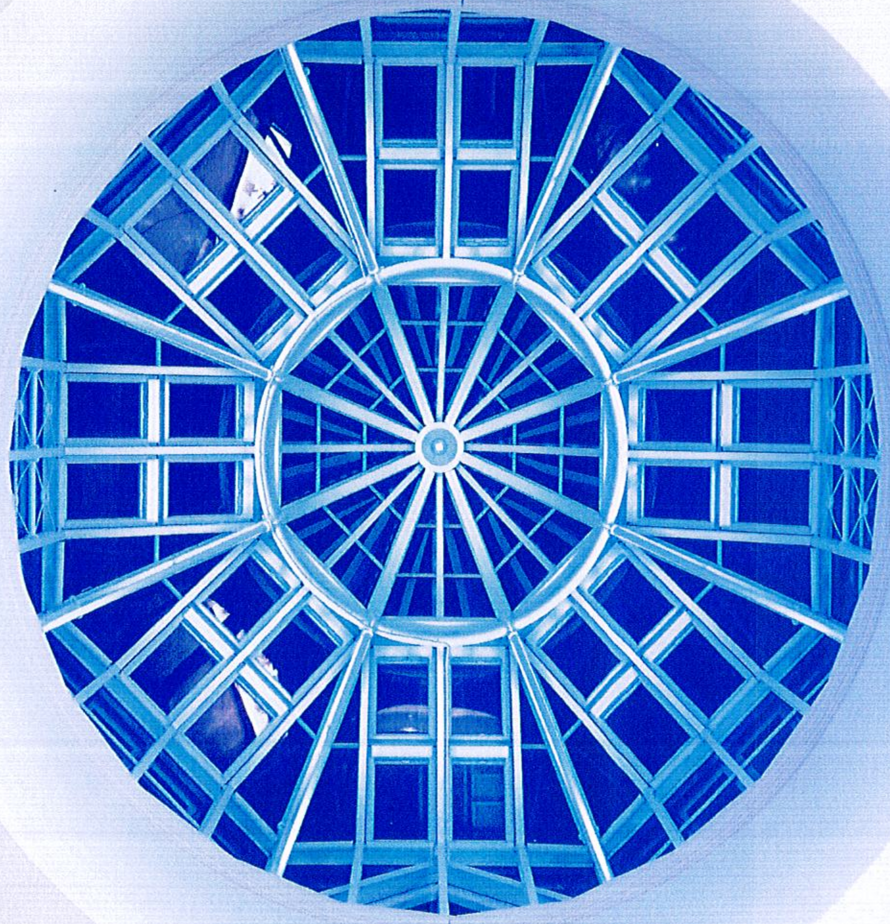

RETAIL JOURNEY
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WATER BORN
The winner of London's Illuminated River competition revealed

BODY TALK
Lighting's remarkable power to affect our senses

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BRIDGING SUCCESS

At 45-years-old, the Erskine Bridge across the River Clyde was long overdue for a lighting and electrical refurbishment. **Louis Fourie** and **David Phillips** explain how the project team overcame the challenges of a technically demanding contract

The completed Erskine Bridge: the new lighting scheme has extended luminaire and lantern design life, reduced maintenance costs and increased lighting levels

Erskine Bridge is a major crossing of the River Clyde that connects Renfrewshire and West Dunbartonshire. Opened to traffic by HRH Princess Anne on the 2 July, 1971, it carries in excess of 40,000 vehicles a day. It is one of four major crossings over the Clyde, and serves as an alternative to the Clyde Tunnel and Kingston Bridge crossings.

It is a 15-span steel box girder bridge, with the largest span being between piers five and six over the River Clyde. This part of the bridge is cable stayed with a central plane of two cable stays. The main span between tower centrelines is 305m and there are two 110m approach spans. The width of the road deck is 31.25m and the pylon height is 38m. The total length of the bridge (including approaches) is 1,321.87m and the navigational clearance is 45m.

With the bridge lighting and electrical infrastructure and systems being some 45-years-old, Scotland Transerv was commissioned to carry out a wholesale refurbishment. Works took place during the summer of 2016 over a 22-week contract period. The work was carried out by principal contractor Lightways (Contractors) Ltd with its sub-contractor Marmac Services Ltd, with project design by Clayton Fourie Consultancy and contract administration by Scotland Transerv.

The tender cost was £3.2 million, with an overall out-turn cost including additional instructed works of approximately £3.7 million. This article looks at specific elements of the lighting work involved in this project but, as an overview, the project comprised the following:

- Removal and replacement of the electrical cabling that supplied the internal lighting, electrical equipment and lighting columns on the bridge deck and bridge approaches
- Removal and replacement of the internal lighting units, electrical network and sockets with Zone 2 equipment
- Removal and replacement of bridge deck lighting columns and lanterns
- Removal of the high mast lighting columns at the south end of the bridge and replacement with standard lighting columns fitted with LED lanterns
- Removal and replacement of aircraft warning lights at the tops of the towers with LED lanterns and new support fixings
- Removal and replacement of 16 high masts and lanterns within the Dalnotter interchange at the northern approach.
- Installation of new cabling and lighting columns on the bridge approaches, including the removal of the lighting columns and high mast lighting in the central reservation south of the bridge with replacement columns installed within the verge.

Figure 1. XLPE/SWA/XPLE power supply cables →

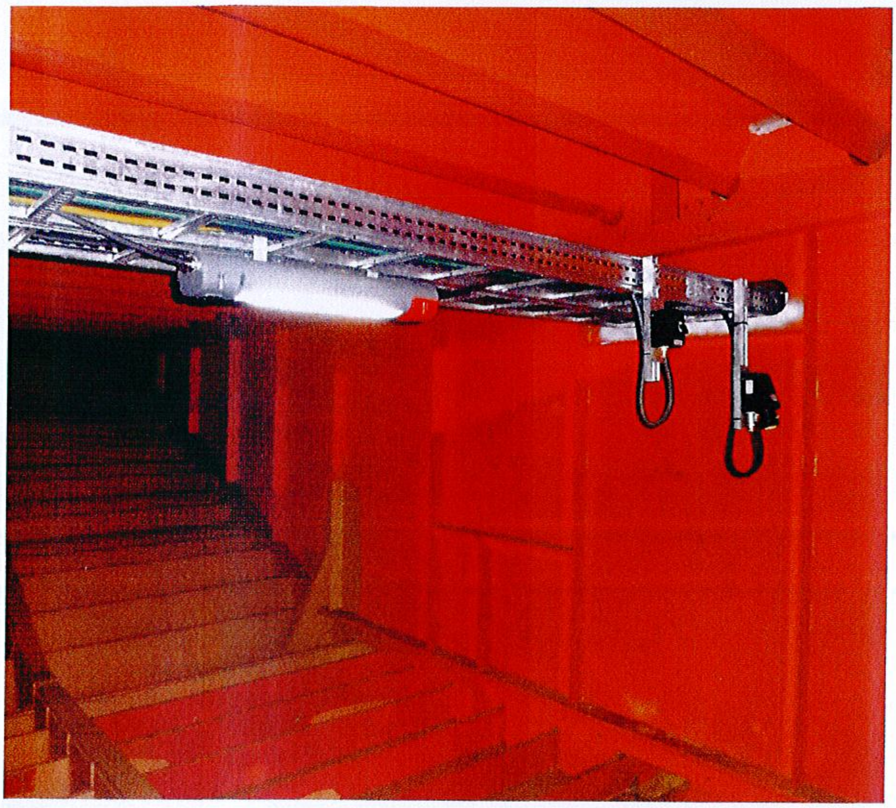

Figure 10. Cable ladders with LED Zone 2 luminaires, isolator and power socket

> "The principal benefits of the project are the 70% savings in overall energy consumption, with an associated saving of £3,000 per year in carbon tax

The six existing 100mm diameter steel cable ducts running end to end inside the bridge were removed without damage to the internal cables, and replaced by new cable ladders. The redundant cables and ducting were removed from the bridge structure and taken to a licensed recycling plant.

The existing service cables were not removed until the new services were installed and commissioned. All the new installations installed inside the bridge were by mechanical fixings only. No invasive drilling or welding was allowed during the installation process. The new open top cable ladder provided a defined corridor with segregated power and communication cables. This served to organise the cables and facilitate future maintenance and provision of new cabling.

The existing luminaires, distribution boards, sockets, cabling and wiring were disposed of in accordance with the WEEE directive. All redundant cables, ducting, lighting columns, pillars and similar were removed from the bridge structure and central reserve and taken to a licensed recycling plant. Because the existing distribution boards contained asbestos a licensed asbestos removal contractor was employed to arrange removal.

REPLACEMENT OF BRIDGE TOWER AIRCRAFT OBSTRUCTION LIGHTING

The scope of works required the four existing navigation lights to be replaced with new LED aircraft warning lights, cabling and electrical supply. This included the removal of the existing support bracket and replacement with a new stainless steel retractable bracket.

The new LED aircraft warning light complies with ICAO Annex 143, was designed to be visible horizontally over 360 degrees and have a flash rate of 20fpm. The unit was required to be fitted with a CMS node at the junction box to indicate the status of supply.

The new LED has built-in photocell and monitoring and provides a low consumption accurate optical light beam which reduces light pollution. The fitting has a 100,000-hour design life, so reducing the need for double fast lane traffic management closures every six months to replace the lamps and the associated need to send maintenance crews up onto the tower.

The new bracket is designed to hinge and rotate, bringing the lantern into the man access catwalk at the top of the tower, making it safer to maintain. In addition, new permanent power sockets at the base of each bridge tower for the operation of the tower access man rider and wrap-around platforms were fitted.

INSTALLATION OF INTELLIGENT ROAD LIGHTING MANAGEMENT SYSTEM

A new Philips Starsense wireless street lighting central management system (CMS) for monitoring lamp usage and lamp faults was installed.

The system was capable of dimming the luminaires if required. The CMS incorporates wireless communication technology and was required to be scalable within the South West Trunk Road Operating Area.

The CMS allows the operating company to switch or trim light output to appropriate lighting levels depending on the amount of traffic on the A898 and A82 at any time and do remote monitoring from computer or web enabled devices.

It also provides an extremely accurate control, monitoring and reporting system covering fault identification and diagnostics, predictive lamp failure, energy use, billing, lamp status, performance data and predictive maintenance. The system is capable of communicating live inventory and defect information to third party asset management systems.

Ballast nodes were fitted through a hole and mounted through the canopy of the luminaire. The ballast node provides the highest degree of system functionality as it allows dimming to be implemented remotely. The node is a light-weight, high-impact-resistance product, which can operate within a wide temperature range.

REPLACEMENT OF NORTH ABUTMENT UNDERPASS LIGHTING AND ELECTRICAL INSTALLATION

The electrical installation within the north abutment underpass was upgraded in accordance with BS7671:2008 inc.

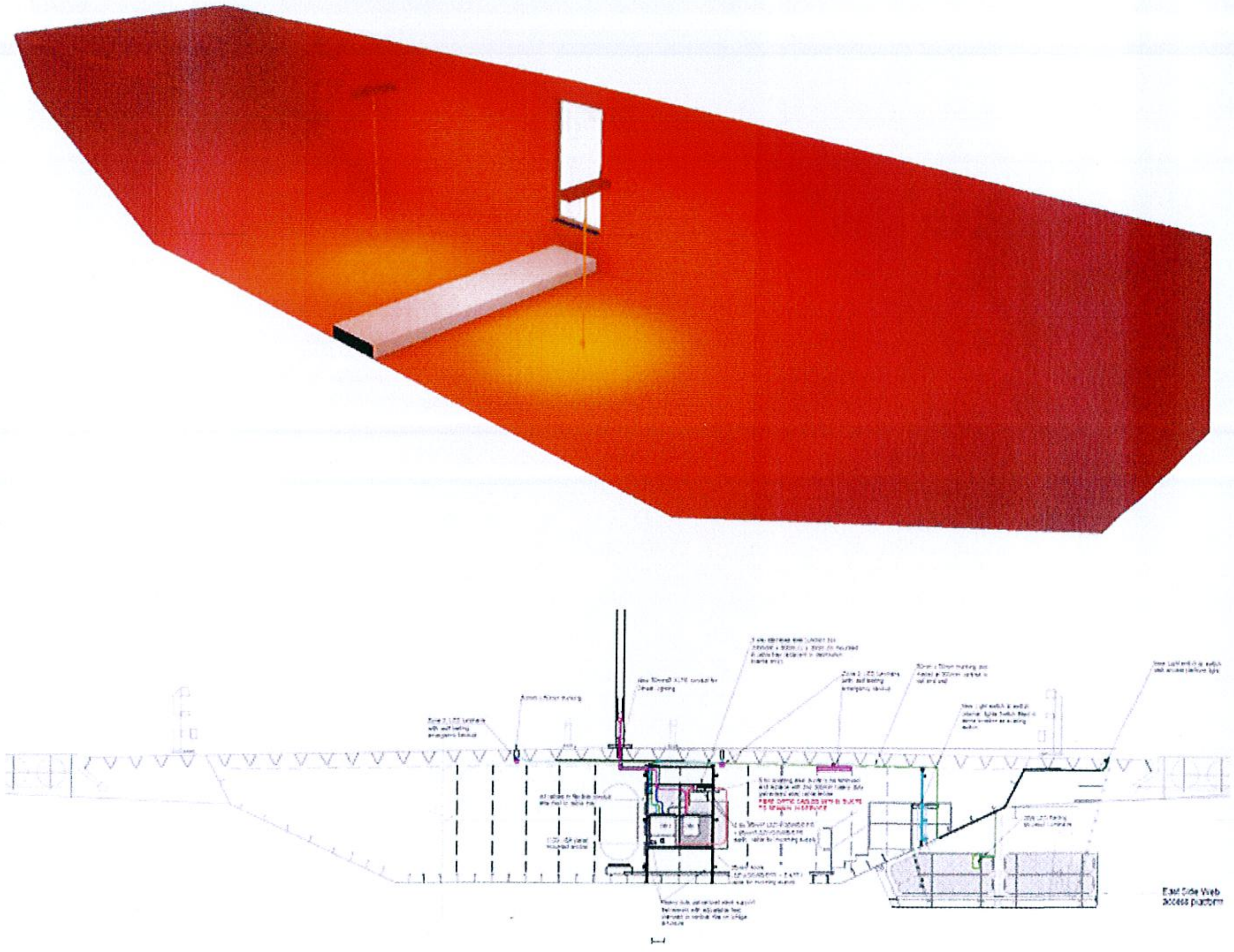

Figure 11. Typical cross section through bridge at web access platform location with (above) luminance modelling

Amendment No. 1 2011 (IEE 17th Edition Wiring Regulations). The existing underpass luminaires and covers were replaced with LED luminaires. The luminaires are configured to be switched on via solar time clock. The luminaires are fitted on to brackets fitted to the bridge structure via mechanical means.

CONCLUSIONS

This paper presents some of the technical and logistical aspects of the Erskine Bridge lighting and electrical refurbishment contract.

The principal benefits of the project both to the client and the operating company are the 70% savings in overall energy consumption, with an associated saving of £3,000 per year in carbon tax.

Power and electrical infrastructure, luminaire and lantern design life has been extended from three years to 25 years, resulting in reduced maintenance and therefore fewer planned road closures. All columns, high masts and feeder pillars had an extended 50 year design life. The lighting levels inside the internal structure have increased to 100 lux, with an associated reduction in energy of 50% with the additional benefit of emergency back-up lighting.

The execution and installation of the new bridge external street lighting, high mast lighting, internal deck lighting and associated power and electrical infrastructure presented major challenges. The internal deck works required continuous working within a Zone 2 confined space and both the central reserve above deck bridge lighting and the bridge north and south approach lighting and high mast lighting required working at height and extensive logistical traffic management planning to execute the works.

The successful construction of this technically demanding lighting and electrical refurbishment contract was the result of high levels of skill, diligence and application in the workplace by the Contractor Lightways (Contractors) Ltd and sub-contractor Marmac Services Ltd, together with good working relations by all project participants.

Louis Fourie is a director at Clayton Fourie Consultancy and David Phillips is resident engineer for Scotland Transerv at Erskine Bridge

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Engineer: Scotland Transerv