PRASA's Nerve Centre

All photographs by Natalie Payne.

In 2011, GAPP Architects and Urban Designers won the competition for the design of the new operational control centre for Gauteng's railways and it was the dynamic lighting concept that motivated the jury's decision. Anthony Tischhauser of Pamboukian light design reports.

Rail transport will form the backbone of public transport in Gauteng. With a complete overhaul of passenger rail services, a new rail traffic management centre will centralise 43 signal cabins and steer the fully automated signalling on the province's network. This is an important feature in PRASA's (Passenger Rail Agency of South Africa) programme to mend the neglected and outdated railway network and speed up services. All rolling stock will be replaced and stations renovated, including CCTV cameras. Central command-control of signals will improve the capacity, efficiency and safety of trains on the network. Corrected track geometry will enable trains to run at speeds of up to 120 km/hr.

The RFP (Request for Proposal) document for the limited and invited competition was extremely thorough, based on Portuguese Railway's Operational Control Centre (OCC) in Porto.

What, at the time, were radical principles were applied to the control room, with managed daylight and electrical lighting rhythms. The RFP was very clear about including daylight for the health of staff, and that it should also be a Green Building. GAPP's design for the PRASA Gauteng Nerve Centre (as it is called) directly opposite Kaalfontein Station, Kempton Park, featured these requirements; originally providing the control room with a mix of daylight through eye-shaped skylights and side windows with controlled electric light, diffused by translucent ceiling fabric, for cloudy days and night work.

The lighting concept embraced the physical and psychological effects of light on people. By day or night, there would be an interplay of continuously changing programmed light. The lighting concept by Paul Pamboukian supported the well-being of the operators over a recurring 24 hour cycle. The first design saw the application of cold cathode because of its subtle colour nuances. Owing to the technical nature of the work space the lighting would also convey mood and be aesthetic.

As human beings are exposed to electrical light for longer periods, blue rich (short wavelength) light frequencies during hours of darkness are linked to a number of health risks, which include increased




diabetes, depression and cardiovascular problems. We need to be exposed to sufficient amounts of light of the right spectrum, for a sufficient amount of time and at the right time, for our biological clocks to synchronise with the solar day. Otherwise, we may experience decrements in physiological functions, neurobehavioral performance and sleep. This is due to the effect of light on melatonin, a hormone secreted by humans to regulate their circadian rhythms.

Specifically, three types of light signals impact the circadian system: dynamic wavelengths of bright blue-dominant daytime light of the morning hours; dynamic long red wavelength dominant light, present during the late afternoon and early evening hours; and regularly occurring periods of darkness at night. Circadian rhythms are biological rhythms that repeat approximately every 24 hours. These conditions, which are found within the natural diurnal cycle, can be mimicked with the use of dynamic electric light and controls. Colour has an impact on human biochemical and psychological processes. The light should also be free of glare and the walls not contribute to light reflection. The contrast ratio to the media screens is controlled to reduce fatigue. Each desk has a warm adjustable task light.

The plan of the Nerve Centre follows the shape of an 'eye'. The building is a vertically layered structure of solid floating planes with spaces woven in-between: entrance lobby, atrium, training areas, meeting and staff rooms, lounge and canteen. The complex is ordered around a central atrium off the entrance. LED sticks of linear light, all the same length, criss-cross the three stories adding to the public face of the building. The controls are placed in an adjacent room for accessibility, as they are generally the elements to fail. The bell-shaped control room is nestled against an elliptical layered wall plane. It has five continuous raked rows of grouped desks, 36 in total. Each individual operator has a series of four computer screens to monitor train movement.

The dimmable dual fluorescent fittings of 2700 K and 4500 K (original specification 6000 K) colour temperature, change continuously according to the time of day. The daylight is reduced to a slither that filters in without being explicitly visible from behind the parapet and without permitting a view to the sky, at the high end of the space to give operators an idea of the time of day. Bands of Extenzo translucent stretched ceiling fabric with a light transmission of 48% conceals the fittings and distributes the light. A huge concentric elliptical LED screen spans 60 m across the wider end of the space recording the entire network as an entity, viewed by operators for shared discussion. The impressive tracking of train movement by the time-mimic system is a technical truism.

The Nerve Centre represents a significant technical and functional evolution, its main role being to command, control and supervise all functions and activities relating to rail operation processes, within its area of coverage. It also allows network operation to be optimised, increasing its available capacity and improving the quality of the service provided with higher levels of reliability, availability and safety. From here rail passengers will, in future, be informed on train performance, punctuality and emergencies. LiD