Lantech Case Study

Ollachea Tunnel in Puno: How Lantech Switches Sustain Safety, Gas Control, and Lighting in an Extreme Environment

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The Ollachea Tunnel is today a global benchmark in road engineering and an emblematic case of how industrial communication networks become the backbone of safety and operations in critical infrastructures exposed to extreme geothermal conditions.

A unique tunnel in the world



Located in the district of Ollachea, Carabaya province, Puno region, the Ollachea Tunnel is part of the IIRSA Sur Highway Corridor – Section 4 (Inambari Bridge–Azángaro), connecting southern Peru's highlands with the jungle and the markets of the interoceanic corridor. The project extends over 1,024 m, of which 906 m correspond to the underground section, with the remainder consisting of access sections of 33 m at the entrance and 85 m at the exit. The work required an investment of nearly USD 100 million and is managed under a concession held by Intersur Concesiones S.A., under the supervision of the Ministry of Transport and Communications (MTC). Its commissioning benefits more than one million people by significantly improving traffic safety and flow, as well as freight and passenger transport in the southern part of the country.

The tunnel has been recognized with a Guinness World Record in the category "Highest-temperature geothermal waters traversed by a vehicular tunnel", being the first vehicular tunnel in the world to pass through very high-temperature geothermal waters. During the certification process, temperatures of up to 71.2 °C were recorded in the surrounding geothermal waters, representing one of the project's greatest engineering challenges. These extreme geological conditions

required specialized solutions in waterproofing, structural lining, and rigid pavement to ensure long-term stability, durability, and safe operation.

Electromechanical systems and tunnel intelligence

The Ollachea Tunnel incorporates a comprehensive electromechanical system aligned with the Roadway Manual – Tunnels and the electrical and safety regulations in force in the country. It features high-power LED lighting managed by industrial controllers that allow lighting levels and emergency modes to be adjusted according to traffic conditions. It also includes mechanical ventilation for smoke and contaminant control, fire and gas detection systems, closed-circuit television (CCTV), public address systems, variable message signage, and clearly identified evacuation elements.



All these subsystems are integrated into a control center that supervises tunnel behavior, traffic flow, and technical and safety alarms in real time. The ability to continuously monitor variables such as gas concentration, lighting levels, fan status, and camera operation is essential in an environment where geothermal conditions, high-altitude climate variations, and the criticality of traffic demand minimal response times. In this context, the communications network becomes a structural element as relevant as the tunnel lining itself, since any interruption can compromise the coordinated operation of safety systems.

Communications architecture with Lantech switches

The communications infrastructure of the Ollachea Tunnel relies on a network of Lantech industrial switches designed to operate 24/7 under demanding environmental conditions, with high availability and a strong focus on cybersecurity. In this project, three families of equipment were deployed for different services: **the IPGS-L5408MGSFP-48V-E model for CCTV and public address systems, the IGS-L5408MGSFP-24VI-E with PROFINET for gas monitoring and control, and the IGS-3204MGSFP-24V-E for the lighting network.**



The IPGS-L5408MGSFP-48V-E switch is a high-performance L2+ device with 8 10/100/1000T ports and 4 Gigabit/multi-Gigabit SFP ports, capable of handling large volumes of video and voice traffic over a redundant architecture with fast-recovery ring topologies. Its 48 VDC power options and the high PoE power budget available in PoE models allow it to support IP cameras, public address endpoints, and other field devices distributed along the tunnel, while maintaining centralized control and reducing the need for external power supplies. In an environment such as Ollachea, with vibrations, thermal variations, and strict continuity requirements, the combination of copper and fiber ports enables traffic segmentation and extension of links to the control center via fiber, providing immunity to electromagnetic interference.



The IGS-L5408MGSFP-24VI-E model with PROFINET support is used in the gas monitoring and control subsystem, connecting sensors, PLCs, and automation systems that govern ventilation and environmental alarms. Its dual 24 VDC power input

design and hardened industrial construction allow it to be integrated directly into control panels, minimizing power distribution complexity in technical rooms along the tunnel. Compatibility with automation protocols such as PROFINET facilitates convergence between the OT world (process control, fans, dampers) and the Ethernet network, while maintaining deterministic communications for control traffic and prioritization of critical data.



For the lighting system, the IGS-3204MGSFP-24V-E switch was implemented—a compact L2+ device with 4 Gigabit electrical ports and 2 multi-Gigabit SFP ports—focused on connecting controllers and field devices that manage the different lighting scenarios within the tunnel. Its reduced form factor and ability to operate on industrial 24 VDC power allow it to be installed in substations or cabinets near lighting electrical panels, reducing cabling distances and simplifying maintenance. The presence of fiber links ensures that, even in the event of local electrical disturbances, communication with the supervisory system remains stable and low-latency.

Robustness, availability, and cybersecurity in critical infrastructures

The Lantech industrial switches used in the Ollachea Tunnel share key characteristics for ITS tunnel applications: hardened design for harsh environments, wide operating temperature ranges, high immunity to electrical surges and electromagnetic disturbances, and support for redundancy at both topology and power levels. These attributes are especially relevant for a project located in the Andean mountain range, subject to vibrations, humidity, and thermal gradients associated with both altitude and the presence of geothermal waters.

From a cybersecurity perspective, the deployed switching platform offers advanced features such as VLAN-based segmentation, access control, broadcast storm protection, and mechanisms to detect and mitigate anomalous network behavior. These capabilities help reduce the attack surface of a critical infrastructure where a security incident could result in loss of tunnel visibility, communication failures with ventilation systems, or interruptions in public address and signage channels. The combination of high physical availability and logical protection ensures that the communications network not only withstands environmental conditions but also remains resilient against growing digital threats in tunnel operations.

Seamless integration with automation protocols such as PROFINET and the ability to simultaneously manage video, voice, sensor data, and control signals over a single Ethernet infrastructure confirm the role of these solutions as enablers of IT/OT convergence. This reduces operational complexity, facilitates remote diagnostics, and allows tunnel operators to have a unified view of all systems—from lighting and ventilation to surveillance and incident management.

Acknowledgments and outlook

The success of the Ollachea Tunnel is the result of coordinated efforts between the Peruvian State, through the MTC, the concessionaire INTERSUR CONCESIONES S.A., and an ecosystem of specialized companies that contributed high-level engineering solutions. In this context, Lantech expresses its appreciation to INTERSUR CONCESIONES for the trust placed in our industrial communications solutions for a project of unprecedented geotechnical and operational complexity in the country. We also extend special thanks to the system integrator INDUSTRIAL CONTROLS, responsible for the design and implementation of the control, communications, and automation systems that enable the tunnel to operate with the highest standards of safety and availability.

The experience gained in the Ollachea Tunnel reinforces Lantech's commitment to supporting tunnel projects, smart roads, and critical infrastructures across the region by providing industrial switches that combine robustness, OT integration, and cybersecurity. In a scenario where geology, altitude, and operational demands pose increasing challenges, the ability to design reliable communication networks becomes a decisive factor in transforming singular engineering works into safe, efficient, and sustainable systems for the communities they serve.

About Lantech

Lantech Communications Global, Inc. is an IRIS & ITxPT certified manufacturer of Ethernet products focused on the transportation markets, bus, train, trackside, ITS, smart city and many more applications. Our range of onboard EN50155 & E-Marked Ethernet switches & wireless/ LTE routers offer cutting edge design and functionality. We continue to work with our key customers in creating further enhancements & developments in on board passenger information, video security, trackside data communications by providing rugged 10GbE, PoE managed Ethernet switches, LTE/Wi-Fi routers in line with ITxPT and E-Marked certifications for various applications and critical solutions.

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