



**“Zenitel supported Bane NOR’s esteemed engineering team, offered valuable guidance and collaborated closely throughout the entire process, including the design, implementation, and delivery. It was a truly significant project, and we are grateful to have had the opportunity to contribute to its success.”**

Market Segment:  
**Rail Infrastructure/Tunnels**

Country of installation:  
**Norway, Europe**

Year of Installation:  
**2022**

End customer:  
**Bane NOR**

Solutions:  
**Emergency Audio**

Key Products:  
**VAIA-48V**

Key Technology:  
**VIPA Audio Platform**

## The Follo Line safeguarded with emergency solution

**Zenitel deliver reliable IP-based Emergency Audio system to enhance Bane NOR’s operational and maintenance procedures.**

### The Customer/End User

Bane NOR, responsible for development and maintenance of the Norwegian railway network, undertook a notable endeavor to connect Oslo and Ski through a remarkable 22.5-kilometer tunnel. Known as the Blix tunnellen, with its twin bores, it proudly stands as the longest railway tunnel in the country. This tunnel serves as a crucial high-speed rail link, substantially reducing travel time for passengers. As an integral component of the project, the Emergency Audio system played a vital role in ensuring the safety of both passengers and staff, further enhancing the overall security measures.

### The Requirement

The Follo Line Project sought a highly scalable, ultra-reliable IP-based Emergency Audio system to provide guidance to passengers and staff from the train to refuge areas in emergency situations as well as being able to assist with general maintenance activities. The project presented notable technical complexity, necessitating innovative engineering solutions incorporating state-of-the-art technology and safety features to ensure smooth and secure operations.

The system needed to provide synchronized coverage across all 48 cross passages, refuge entrances, various escape routes, and operations control facilities within the extensive Follo Line Tunnel complex. To meet the requirements of the extremely demanding environment, specialized loudspeakers capable of withstanding

high-pressure conditions were needed, along with amplification running on 48VDC that could automatically adjust volume to compensate for variations in background levels, particularly during emergencies. Additionally, the system had to be compact due to limited space in the communication racks.

The challenges inherent in the tunnel environment called for specialized design and delivery services to ensure optimal system performance, including acoustic modelling, comprehensive system testing, and site measurements. Due to contractual obligations, the system had to be delivered in two parts by separate subcontractors - Infranord and AGJV. However, the ultimate aim was to integrate these parts into a fully unified solution for Bane NOR.

## The Solution

Zenitel's VAIA-48V proved to be an ideal fit for the project. Engineered to the highest standards, VAIA combines amplification, digital signal processing, and comprehensive control within a single 1U package. This makes it a cost-effective and space-efficient solution, providing flexible emergency zonal coverage. Moreover, VAIA's flexible IP networking capabilities are well-suited for distributed applications like the tunnel. Finally, its low distortion Class D amplifiers, built-in redundancy, and powerful DSP control make it an excellent choice for installations that prioritize redundancy, audio quality, and maximum efficiency.

The core system consisted of 80x VAIA units housed in communication cabinets distributed throughout the tunnel and connected via a fault-tolerant IP network. Connected to the controllers were wide range of inputs,

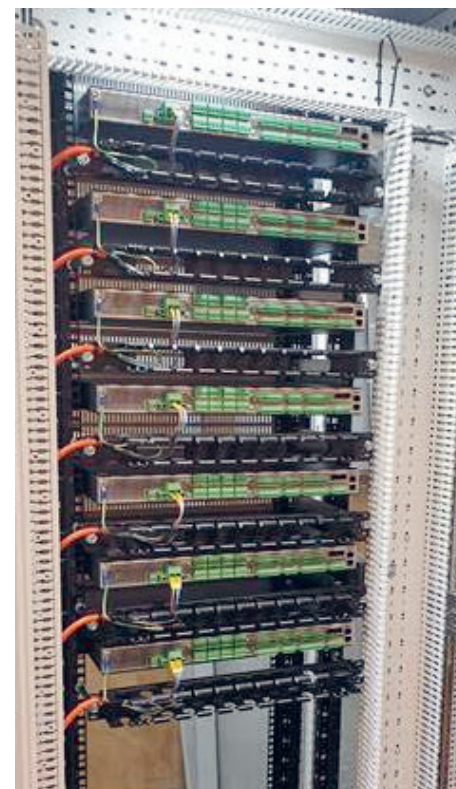
including 48x VRMS4-IP microphones, 2x centrally deployed control and monitoring PC workstations, and 67x ANS04-ES ambient noise sensors. The loudspeakers installed along the tracks were carefully selected to withstand the high pressures and fine dust particles generated by passing trains whilst delivering clear, intelligible audio.

## The Result

In close collaboration with Zenitel, Bane NOR successfully installed and handed over an advanced IP-based Emergency Audio system that met all of the project requirements, ensuring the overall safety and security of both staff and passengers.

The exceptional speech transmission index (STI) measured in the tunnels and the overall audio clarity serve as evidence of the customized design and outstanding performance of the new VAIA solution. The system's lower power consumption and high availability further enhance its efficiency and reliability, solidifying its position as a cutting-edge solution for Bane NOR's requirements.

Along with the other safety subsystems, we help to deliver a smooth and reliable experience for passengers, for complete security and peace of mind. The Follo Line not only save significant journey time, but also result in a reduction of CO2 and greenhouse gas emissions for more sustainable travel.



## Why Zenitel?

Zenitel is well positioned to drive the future of intelligent critical-communication solutions. Through our portfolio of IP products & solutions, with built-in intelligence and a focus on cybersecurity, we provide organizations with superior, scalable security and flexibility. Zenitel is the proven, preferred choice for environments requiring crystal-clear audio to ensure the protection of human life, property, assets and the management of critical activities. With interoperability at all levels, we seamlessly integrate with access control, video management and security platforms.