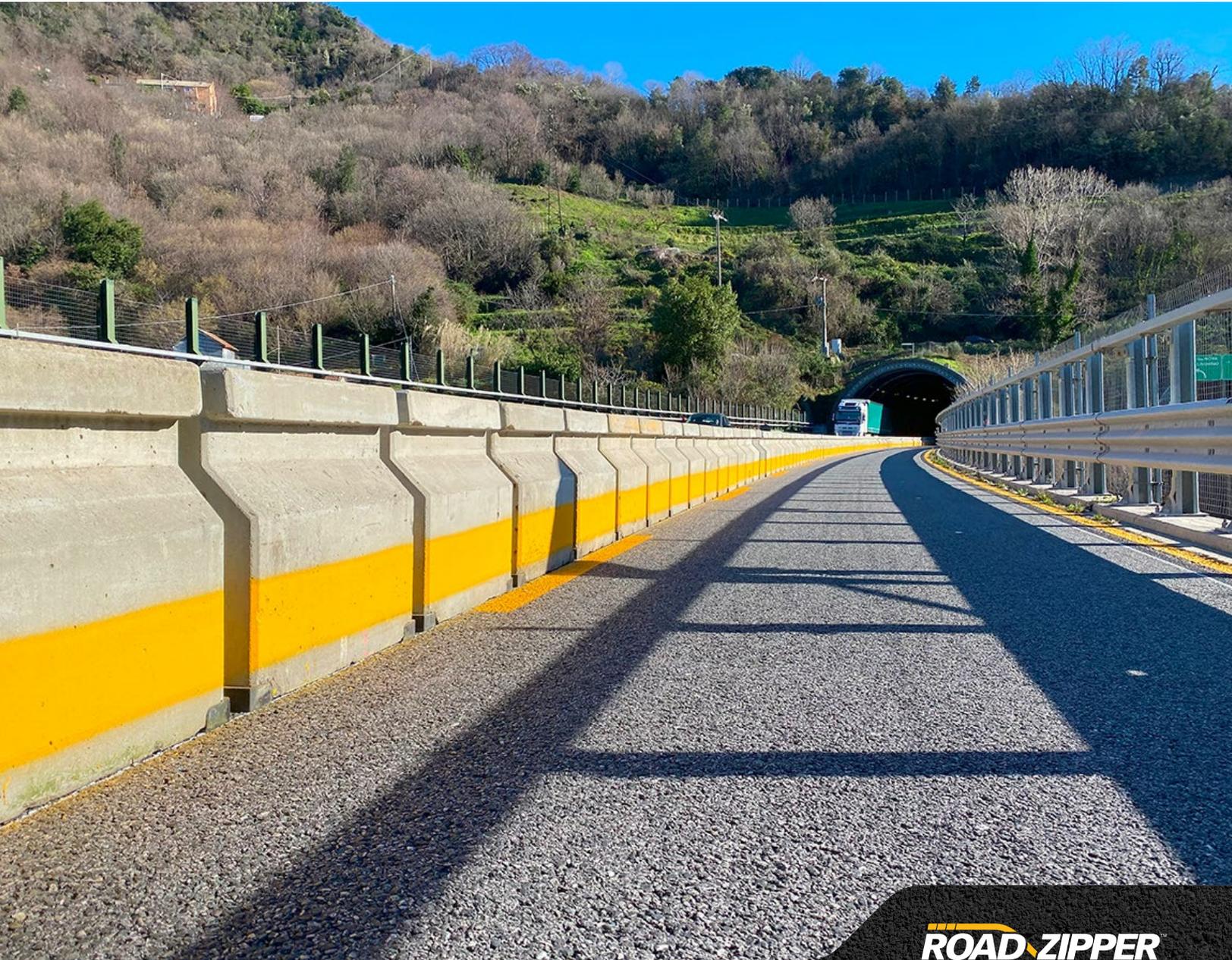


Tunnel Rehabilitation Projects

Italy, A26 Genova Voltri - Gravellona Toce Motorway



ROAD ZIPPER™

Project Overview

Starting in 2022 and through 2025, Autostrade per l'Italia (ASPI) planned and carried out modernization works on multiple tunnels on the A26 Genova Voltri - Gravelona Toce motorway. ASPI's tunnel renewal strategy to extend the life of the tunnels by 50 years required the complete closure of the tunnel (or one direction of the roadway) for several months and the need to divert traffic onto the other carriageway. The A26 Genova Voltri - Gravelona Toce motorway is a critical freight corridor for the region to and from the port

of Genoa. Therefore, any traffic diversions or lane closures must be carefully planned to optimize traffic flow (including heavy or oversized commercial traffic) and to maintain traffic and worker safety.

Traditionally, for work zones where one carriageway or tunnel is completely closed to traffic and all traffic uses the other tunnel, ASPI planned the open-to-traffic tunnel lane configuration to include (1) lane in each direction and a "buffer" lane as a safety gap between opposing traffic. The opposing traffic flows were separated by a plastic

delineation device to allow lane quick reconfiguration for the buffer lane to be used in specific cases like congestion mitigation, crash-related queuing, wider freight or commercial traffic, etc. While dynamic lane use was necessary for ASPI to maintain traffic mobility in the corridor but traffic safety was compromised when using plastic delineation. On A26 being a mobility-critical corridor, ASPI was proactive in addressing safety concerns during the project planning stage.

The Flexible, Efficient Solution

ASPI, in collaboration with Tecne and Amplia Infrastructures (both companies of the Autostrade per l'Italia Group), partnered with Lindsay to enhance traffic management and work zone safety on the A26 highway tunnel rehabilitation project. ASPI implemented the Road Zipper

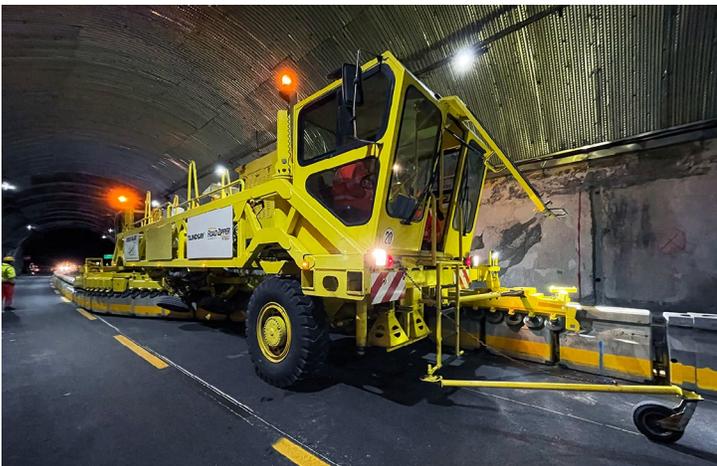
System™ for two rehabilitation projects, Manfreda (including 2 tunnels) and Lagoscuro (including 6 tunnels and 2 viaducts). With one carriageway completely closed to traffic, ASPI faced the risk of severe congestion, freight delays and increased crash potential.

Using the Road Zipper, ASPI

optimized traffic mobility throughout their work zones and ensured worker safety and safer journeys for all road users.

Flexible positive protection using the Road Zipper provides additional safety compared to channelizing device lane closures (traditionally used in ASPI work zones), while still

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The Road Zipper barriers are crash-tested to MASH TL3 & TL4 and EN 1317 N2 & H2 standards.

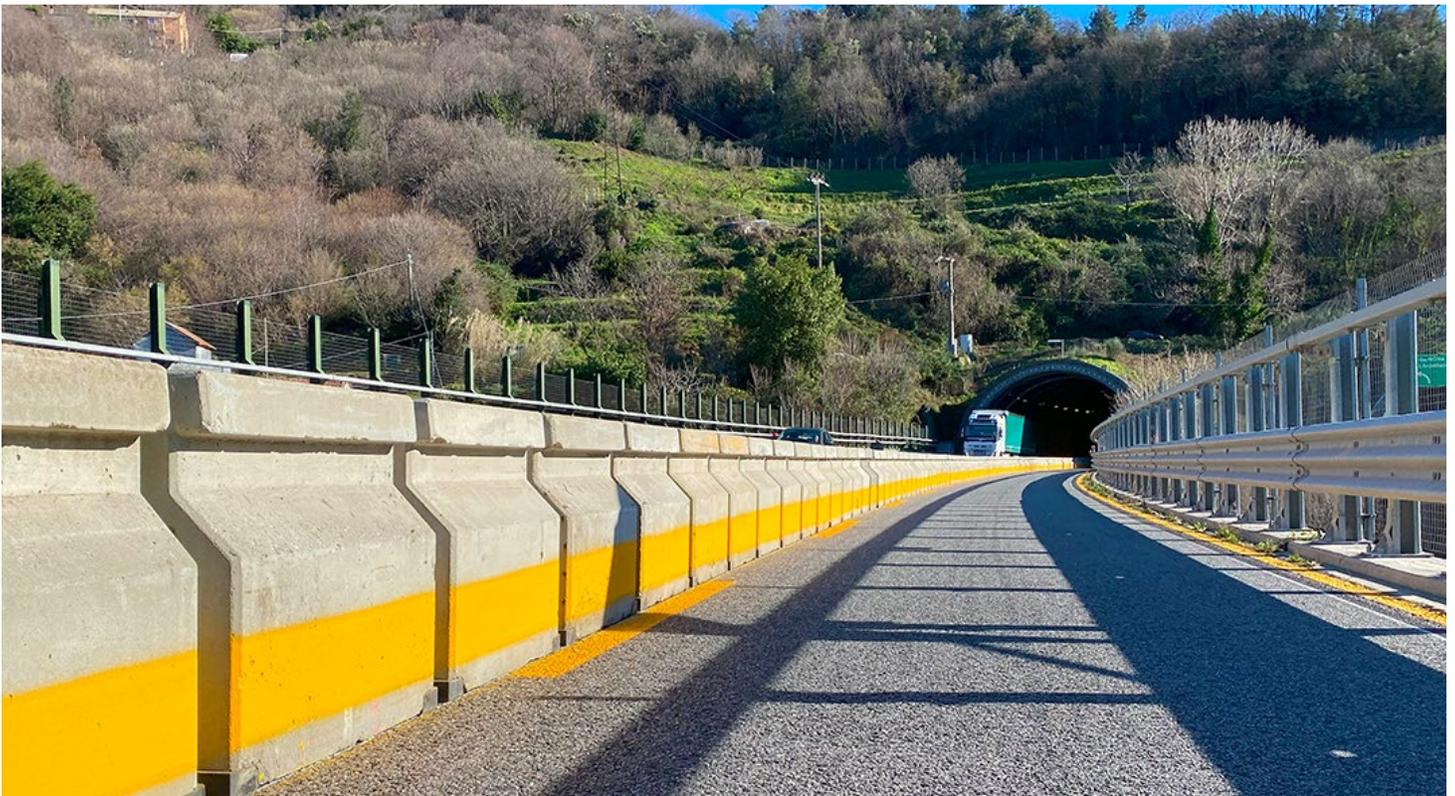
allowing quick lane reconfiguration. Additional benefits include reduced risk of traffic queues during peak travel times compared to a static barrier lane closure and potentially providing increased work space, when needed for contractors.

Lindsay and ASPI worked together to identify strategic locations and application of the Road Zipper moveable barrier system to develop a tailored and seamless traffic management solution. The projects included a full closure of the direction of the roadway or tunnel affected by construction for a complete separation of the work zone from moving traffic. A completely separated work zone helped increase the overall safety and also made the work zone more efficient for worker productivity and equipment-use. The southbound and

northbound roadway (direction of the roadway not affected by construction in a project phase or stage) were used for bi-directional traffic by utilizing Road Zipper system as a moveable median and by adding traffic crossovers on either end of the work zone. With top transfer speed of 8 km per hour, the Road Zipper machine helped reconfigure the travel lanes quickly to address daily travel pattern changes. The Manfreida project (January, 2022 – March, 2024) used 2 km of moveable barrier wall to change travel lane configuration four to five days per week while Lagoscuro project (October 2023 - June 2025) used 8 km of moveable barrier wall reconfigured twice daily Monday through Thursday or in case of emergencies. To accommodate seasonal travel, the traffic control plan

also included work zone suspensions during winter holidays and the summer. When asked to describe the projects, ASPI mentioned, “the use of the Road Zipper “Lagoscuro” between km 20 and 29 of the north roadway allows simultaneous execution of the assessment works on six tunnels (Poggio, Castello, Lagoscuro, Ciutti, Curli, Setteventi), preservative and developmental restoration works on bridges and viaducts, tunnel upgrading works according to D. LGS. 264/2006 and replacement of the safety barriers.”

The detailed design of the Road Zipper based traffic control considered the complex roadway geometric characteristics including a complex analysis of planimetric and elevation profile layout and reduced vertical clearances in tunnels.



Project Benefits

As daily traffic continues to increase with daily peak travel periods, road authorities must find safety solutions to optimize the capacity of their transportation network to better match the travel demand in a work zone. ASPI prioritized safety for road users and workers and developed an experimental project for dynamic construction work zone management using the Road Zipper system, to achieve the following improvements:

- Significant and measurable increase in the safety for road users using crashworthy separation of opposing traffic flows with the Road Zipper barrier;
- Significant and measurable increase in safety for workers due to no exposure during setup and removal of traffic control;
- Dynamic lane management allowed use of the middle lane by the peak travel direction, limited traffic queues and consequently increased traffic safety for road users.

Non-peak lane closures or directional traffic crossovers using the Road Zipper moveable barriers reduces user delay costs by quickly establishing lane reconfiguration, under traffic, with the benefit of positive protection to increase traffic safety. Lindsay's Road Zipper System provides a smarter, safer, and faster way to manage congestion and improve the way people move on the road. Compared to channelizing devices lane closures, the Road Zipper provides positive protection and additional safety measures, while still allowing the flexibility of quick lane reconfiguration. Additionally, as compared to static barrier lane closures off-peak lane closures using the Road Zipper reduce the risk of traffic queues during peak travel times and provide increased workspace for contractors, when needed.

As compared to the standard or conventional work zone, the Dynamic Road Zipper based work zone allowed construction phases to be completed in continuity by



reducing traffic flow and mobility related work zone deactivations. This helped complete the Manfreida Tunnel project work 15 months ahead of schedule.

- 63% fewer staff-hours of roadside personnel exposure.
- 23% fewer staff-hours of security and access exposure.
- Significant reduction in the likelihood of head-on collisions and rear-end collisions.

ASPI and its collaborating subsidiaries, Tecne for design and Amplia for construction, were recognized internationally for the Manfreida project. The project won the 2024 ITA Tunnelling Awards as the best Innovative Project of the year and was awarded SILVER certification according to the ENVISION Protocol as a MODERN AND SUSTAINABLE INFRASTRUCTURE in 2025.

References:

- Video – [ASPI's ITA award video](#)
- Video – [ASPI's IBTTA conference video](#)