

**ROAD ZIPPER**

THE ROAD ZIPPER SYSTEM™

***Moving People.
Safer. Faster.
Smarter . . . Better.***



Why Lindsay?

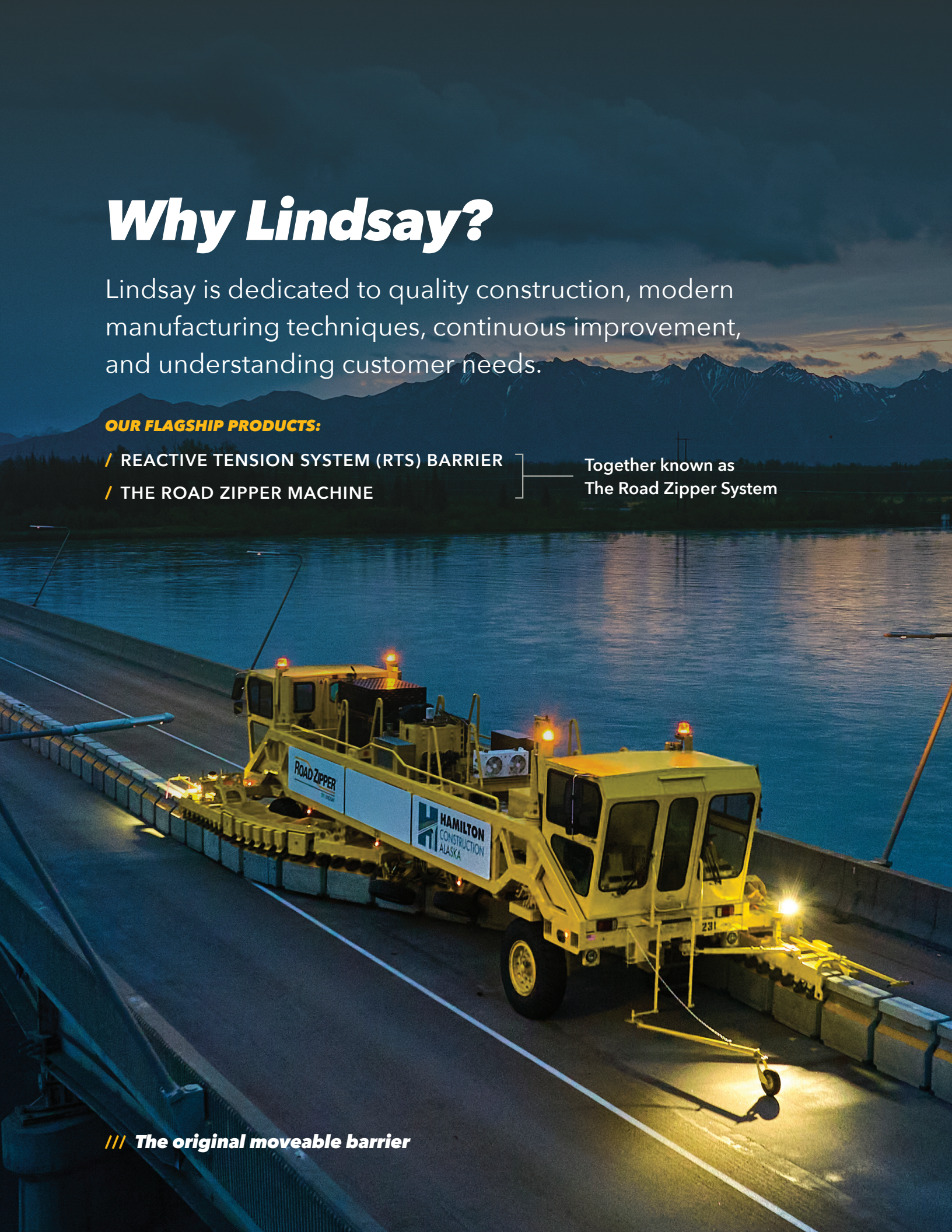
Lindsay is dedicated to quality construction, modern manufacturing techniques, continuous improvement, and understanding customer needs.

OUR FLAGSHIP PRODUCTS:

- / REACTIVE TENSION SYSTEM (RTS) BARRIER
- / THE ROAD ZIPPER MACHINE

Together known as
The Road Zipper System

/// The original moveable barrier



Since 1984, road authorities and contractors worldwide have used this cost-effective, reusable solution to:



Maximize budgets



Reduce congestion

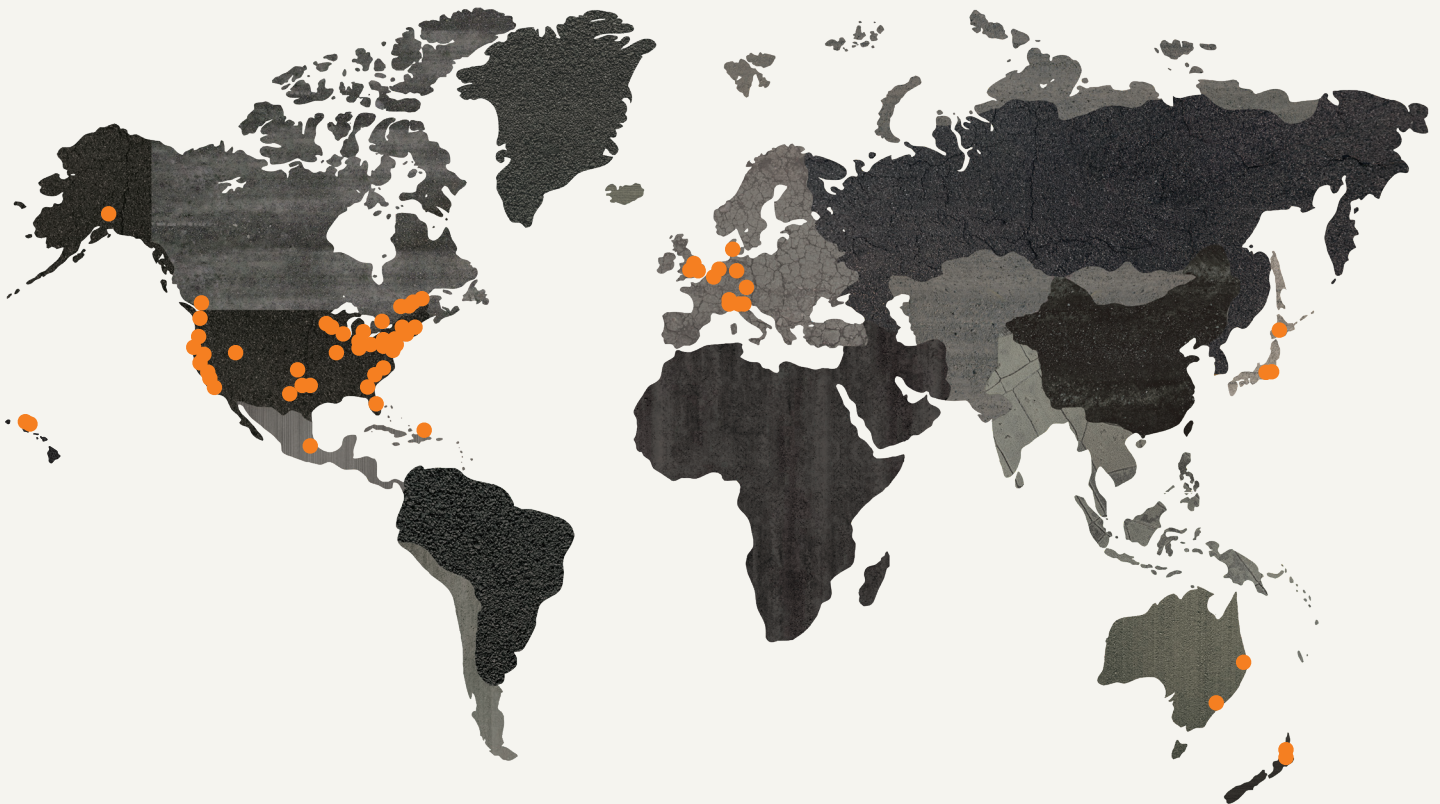


Improve safety



Increase traffic
throughput

Installations Around the World



+ United States (322)
+ Canada (9)
+ Mexico (1)

+ United Kingdom (11)
+ Holland (2)
+ Germany (1)

+ Denmark (1)
+ Austria (1)
+ Italy (5)

+ Japan (9)
+ New Zealand (2)
+ Australia (2)

The Road Zipper System

The innovative way to manage congestion without the major investment required to build new roads and bridges

The Road Zipper System is designed to cost effectively optimize capacity and improve traffic flow by making more efficient use of new or existing roadways.

This technology is used for managed lanes and roadway and bridge construction to create safe and dynamic highways that offer real-time travel lane reconfiguration while maintaining positive barrier protection between lanes.

The Road Zipper System offers road authorities and contractors a practical strategy for making congested highway systems more efficient, safe and functional. These benefits can be realized in less than one year and at a fraction of the cost of new construction.

Applications include bridges, tunnels, managed lanes and high-volume highways where additional right-of-way may not be available, the cost of construction is too high, environmental concerns may exist, or when the lack of funding may slow or prohibit support for new construction.

The Road Zipper System can also be used to create a barrier separated designated lane for commuter traffic, bicycles and pedestrians, rapid transit buses travel time, increase ridership and safe active transportation routes and generate toll revenue while adding the flexibility of using the travel lanes for general purpose during non-peak travel period.

Ultimately, this system is a quick and safe solution for long-term use.

BENEFITS:

- / Significantly reduces median crossover head-on crashes
- / 10-20% of the cost of adding a new lane
- / Improves commuter travel times and fuel efficiency
- / Adapts to changing travel patterns and commuter traffic
- / Operates in all weather conditions
- / Reusable and easily moves from project to project
- / Faster to implement than new construction

HOW IT WORKS

1

One-meter sections of highly reinforced concrete barriers are pinned together at each end to form a continuous barrier wall. The barriers have a "T" top, which acts as a lifting surface for The Road Zipper Machine.



2

The machine lifts (not drags) the barrier and passes it through a conveyor system. Unique, patented variable length barrier allows for roadway curvature and expansion joints.

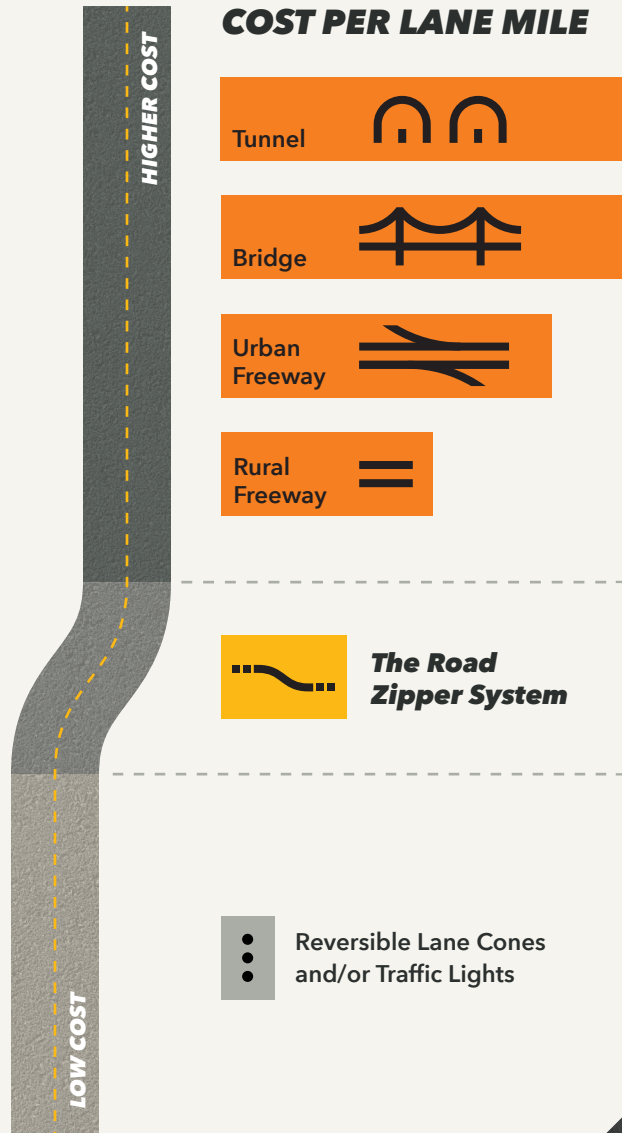


3

In one pass, the barrier is transferred up to 30 ft (9.1 m) and gently set down without damaging the road, at speeds up to 10 mph (16 km/h).



What Is The Cost Of Adding Capacity?

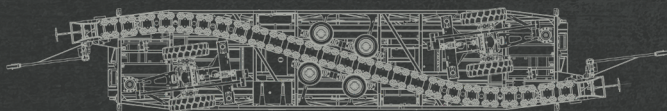


The Crossroad:

Where low cost meets safety

What is the cost of adding capacity - and at what price? The Road Zipper™ based solution is flexible, safe and stretches transportation dollars.

The Road Zipper Machine



The Reactive Tension System (RTS) barriers minimize lateral displacement and resist vehicle penetration when impacted, each barrier unit is connected end-to-end with tensioning hinge mechanisms and steel pins.

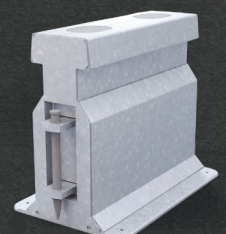
Concrete RTS barrier

Heavily reinforced Concrete RTS barrier



Steel RTS barrier

Steel RTS barrier (steel-encased filled with high strength concrete)



Managed Lanes

Moveable barrier technology provides a quick and cost-effective solution for highway capacity improvements. Since 1984, the Road Zipper System has been helping Transportation Authorities in providing the following “fast-build” solutions for efficiently mitigating congestion and improving mobility:

- / Managed lanes
- / Reversible lanes
- / HOV and HOT lanes
- / Bike and ped lane
- / Bus Rapid Transit (BRT)
- / Contraflow lanes
- / Truck lanes

Stretches transportation budgets

The Road Zipper moveable barrier expands the roadway capacity at a fraction of the cost of new construction.

Reduces congestion

Moveable barrier system allows having more lanes available for peak travel direction reducing travel times for daily and weekend commuters.

Increases safety

Positive barrier protection reduces the possibility of crossover, head-on crashes.

Provides a fast-build solution

New construction can take several years for studies, planning, reviews, design and construction. The Road Zipper moveable barrier system can often be deployed in about 1-2 years.

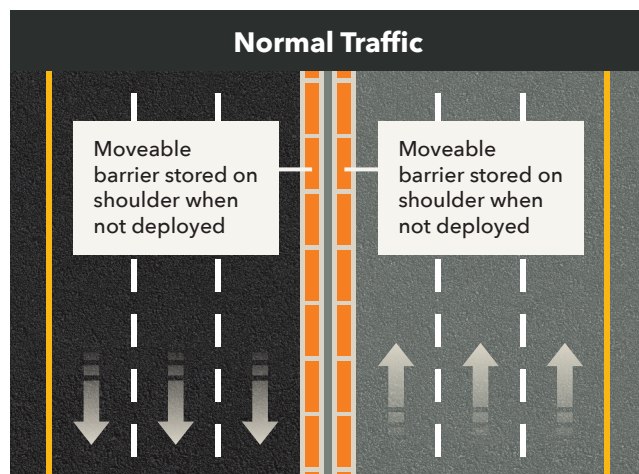
Offers green benefits

Reduced emissions due to increased fuel efficiency, better travel times and decreased congestion-related engine idling.

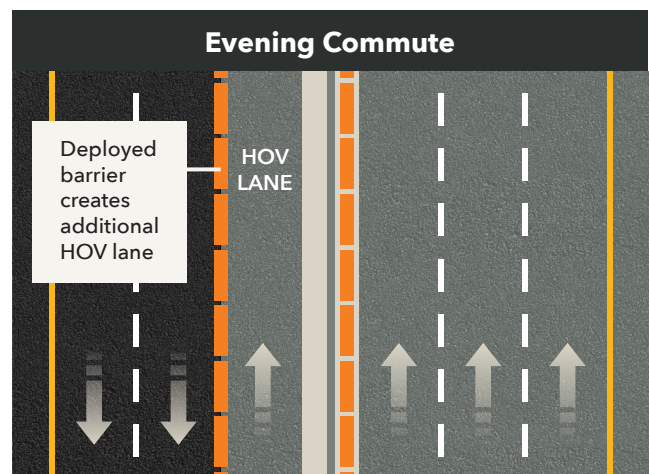
Creates protected dedicated lanes

Part-time dedicated lane using crash-tested physical barrier for HOV/HOT/buses/trucks or bike and pedestrian traffic.

DUAL CONTRAFLow LANES



Normal traffic with three lanes in each direction



The Road Zipper System creates an extra lane of traffic in the peak travel direction

/// The Road Zipper System allows entrance/exit points for dedicated managed lanes.

CASE STUDY

Interstate 30 | Dallas, TX

In operation since 1991



THE PROBLEM:

- / Tidal flow congestion significantly beyond capacity in morning and evening commute hours

THE ALTERNATIVE:

- / Roadway expansion to add a new HOV lane would have taken more than 5 years to complete and contraflow lane using pylons compromised safety and usage.

THE SOLUTION:

- / The Road Zipper contraflow HOV lane was deployed within a year of breaking ground for HOV lanes and at a fraction of the cost of new roadway construction.
- / Cost of widening deferred to a later date.

THE RESULT:

- / Time savings: 9 minutes (AM) and 4.5 minutes (PM)
- / Positively separated contraflow lane increased bus ridership by 38%, carpools increased by 300% in the morning peak period
- / Peak period travel speed increased by 86% from 22 to 41 mph
- / Offered flexibility for future expansions and helped sustain air quality goals

86% *increase in travel speed during peak period*

*Project jointly funded by TxDOT and DART.



Bridges

As the daily traffic on a bridge increases over time, bridge authorities must find a way to increase the capacity of the bridge to match the traffic flow. New bridge construction is extremely expensive, and can be delayed for decades due to necessary planning, permitting, reviews and funding constraints.

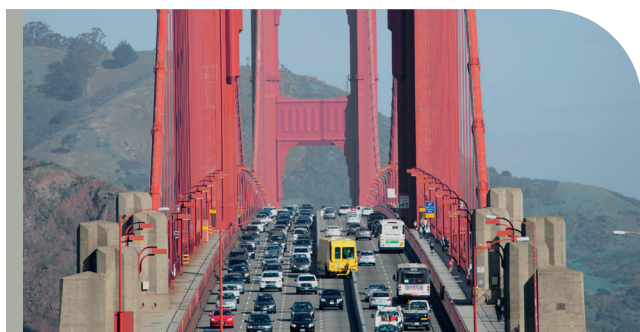
Flexible lane configuration or reversible managed lane using the Road Zipper is a cost-effective and expedited method of increasing bridge capacity by making additional lanes available to the peak travel direction. Other alternatives for flexible lane configuration include cones, pylons and overhead lights but these alternatives increase safety risk for crossover head-on crashes, which may increase serious injuries and fatalities.

The Road Zipper for managed lanes greatly improves traffic mobility and safety on bridges. Additionally, the Road Zipper system can also be used during bridge repair projects for flexible lane management. Quick lane closures, traffic crossover or moveable median strategies using

the Road Zipper can help address bridge work zone challenges like limited space or width, and equipment and duration constraints.

Work zones are particularly dangerous due to the proximity of workers and motorists, changing traffic pattern and visible distractions. As compared to channelizing devices, crashworthy Road Zipper moveable barrier increases safety by adding MASH TL 3 positive protection between workers and motorists or between bi-directional traffic.

The Road Zipper system helps improve work zone efficiency, safety and traffic mobility through the work zone. These benefits not only help reduce the time and cost of construction but also help with keeping motorists and workers safe.



Golden Gate Bridge, CA (operational since 2015)



Coronado Bridge, CA (operational since 2012)

CASE STUDY

Auckland Harbor Bridge | Auckland, New Zealand

In operation since 1990



THE PROBLEM:

- / Traffic volumes increased from 26 million passenger vehicles per year in 1980 to 42 million passenger vehicles in 1990.
- / 120,000+ vehicles per day
- / Narrow lanes, high travel speed (80-100 kmph), driver error and distraction, etc. contributed to head-on crashes leading to multiple injuries and fatalities

THE ALTERNATIVE:

- / Build another bridge to manage tidal flow
- / Physical barrier between bi-directional traffic to eliminate crossover crashes.
- / AHB was already expanded to broadest width including a tidal flow reversible lane using overhead signals

THE SOLUTION:

- / The Road Zipper moveable median to implement a reversible lane with safety against crossover crashes.
- / Positive barrier separation at a cost of ~\$4 million (USD) in 1990

THE RESULT:

- / Safer and efficient operation of managed (reversible) lane
- / Zero crossover crash fatalities
- / Increased use of center (median) lanes
- / Superior containment level and extremely low deflection when the moveable barrier was impacted by a vehicle
- / Expanded use of The Road Zipper System beyond bridge into downtown area

ZERO crossover head-on
fatal crash

Source: Leak, M. J., Hawkins, N. V., Sansom, E. P., & Dunn, R. C. M. (1992). The Moveable Lane Barrier on Auckland's Harbour Bridge: Problems, Solutions and Features. In PROCEEDINGS, 16TH ARRB CONFERENCE, 9-13 NOVEMBER 1992, PERTH, WESTERN AUSTRALIA; VOLUME 16, PART 4.



Auckland Harbor Bridge | Auckland, New Zealand



BEFORE: The bridge was opened as a four-lane steel truss bridge in 1959. In 1969, two 2-lane steel box extension structures were added, one structure along each side of the original bridge.

As traffic flows increased, overhead lane signals were installed to provide tidal flow operation during morning and evening peaks: five lanes of traffic traveling in the peak direction and three lanes in the off-peak direction.



AFTER: The Road Zipper System was the first in the world to be used on a significant grade (5%) and horizontal curvature. Currently, it provides physical separation for over 120,000 vehicles per day. Head-on fatal accidents have been eliminated.¹

¹Reference: Auckland Harbor Bridge, Attributes, www.nzta.govt.nz


Ben Franklin Bridge | Philadelphia, PA



BEFORE: The Ben Franklin Bridge between Philadelphia, Pennsylvania and Camden, New Jersey needed more lanes to accommodate peak period traffic flow. Central lane was used as a separation between oncoming traffic and overhead signs were used for lane management. Lack of positive protection between oncoming traffic led to crossover and head-on crashes.



AFTER: Since 2000, the Road Zipper System helps manage traffic flow by quickly reversing central travel lane direction based on the time of the day. Crashworthy Road Zipper moveable barriers add positive protection between oncoming traffic to improve safety against crossover and head-on crashes.



At Lindsay, we're saving lives and travel time around the world. As the population grows, roadways and bridges must evolve safely, efficiently, and sustainably. As the pioneering developer of the moveable barrier system, Lindsay is at the forefront of innovation, safety and reliability. Lindsay's Road Zipper system is a proven technology that improves traffic flow and commute times while prioritizing safety and saving millions of dollars in construction cost.

Together, we're unlocking the world's potential to move us all forward.



Construction

The Road Zipper System is designed to create a flexible, positive traffic barrier between opposing lanes of traffic, or between motorists and construction work zones while managing traffic mobility.



The Road Zipper system can help create wider work zone space for construction crews, and provides more lanes to the peak travel direction to mitigate work zone related travel delays and accelerate the construction process.

Improves safety

Positive barrier protection between bi-directional traffic and workers and motorists at all times.

Reduces congestion

Allows more lanes to be open to traffic and/or in the peak travel direction by reconfiguring the roadway lanes in real time.

Speeds construction

With a wider work zone space, contractors can combine or eliminate construction stages and complete construction early to save months or even entire construction seasons.

Creates efficiencies and increases quality

Dedicated haul lanes create safer, more efficient deliveries and material staging. More work zone space allows contractors to use larger, more efficient equipment, resulting in better quality repairs that last years longer.

Allows for rapid stage changes and/or accelerated construction

Moveable barrier reconfigures the travel lanes in minutes while it can take days to reposition miles of temporary concrete barrier.

CONSTRUCTION APPLICATIONS

The Road Zipper System creates a safer, flexible work zone that allows contractors to:

- / Expand the work zone during off-peak travel period and reduce or close the work zone during peak traffic periods to maximize traffic flow through the work zone.
- / Use larger, more efficient construction equipment in the expanded work zone.

- / Quickly change, combine or eliminate construction stages expediting the construction for earlier completion.
- / Combine flexible lane closure and lane reconfiguration strategies for accelerated construction projects.
- / Positively protect and/or separate work zone from motorists for a productive and efficient work area.

Manfreida Tunnel | Italy

Tunnel rehabilitation project



THE PROBLEM:

- / During rehabilitation, tunnel in one direction is closed to traffic and bi-directional traffic uses the other tunnel. Hence, 2/2 lane configuration is reduced to 1/1 with a buffer zone in the middle using plastic cone delineation. Heavy freight and general-purpose traffic on this corridor leading to the port of Milan can be a major congestion and traffic queuing concern due to limited alternative routes.

THE ALTERNATIVE:

- / 1/2 lane configuration using plastic cones and no buffer zone between bi-directional traffic compromises safety, travel speed and traffic mobility.

35,000 *worker exposure hours eliminated*

THE SOLUTION:

- / Flexible 1/2 lane configuration using crashworthy Road Zipper system improves safety for motorists and ensures smoother traffic flow especially for port-related freight traffic.
- / Dedicated and positively protected space for construction equipment, deliveries, and material staging creates a productive and safe work zone. Wider work zone space allows contractors to use larger, more efficient equipment, resulting in better quality repairs that last longer.

THE RESULT:

- / Separated work zone, positive protection between bi-directional traffic and real-time lane reconfiguration to accommodate heavy freight and non-commercial traffic.
- / Autostrada won International Tunneling Award (2024) for reducing construction related traffic congestion (50,000 vehicle hours) and eliminating worker exposure by 35,000 hours.
- / The project was awarded 'Silver' certification according to the ENVISION Protocol as a 'Modern and Sustainable Infrastructure' (2025).



Partial Width: For partial width construction, one side of the road can be completely closed for construction while all traffic is diverted to the other side, with a moveable median reconfiguring the roadway in real time to provide more lanes in the peak travel direction.



Median: Narrow median reconstruction using traditional methods usually requires closure of traffic lanes for the duration of the project. Moveable barrier allows all traffic lanes to be open during peak hours, and the median work zone is expanded during off-peak period.



Outside Shoulder: The Road Zipper System allows flexible lane or shoulder closure to widen the work zone during off-peak period enabling the use of larger, efficient equipment.

The Advantages of Future Flexibility

The Road Zipper System is a crashworthy alternative to add lane configuration flexibility - now and in the future.

For example, by designing and planning extra width of the lane(s)/shoulder for bridges, viaducts, tunnels and roadways, the infrastructure is prepared for safer and faster maintenance work using the Road Zipper moveable barrier system. Such design and planning also allows for future capacity and travel pattern changes.

Proactive as opposed to reactive approach to traffic mobility and operations planning is likely to

be a cost-effective strategy to allow transportation infrastructure to be flexible and future ready.

In addition to preparing for future traffic pattern changes, the Road Zipper solution also creates flexibility for multi-modal dedicated lane and emergency evacuation as compared to an anchored or permanent median.

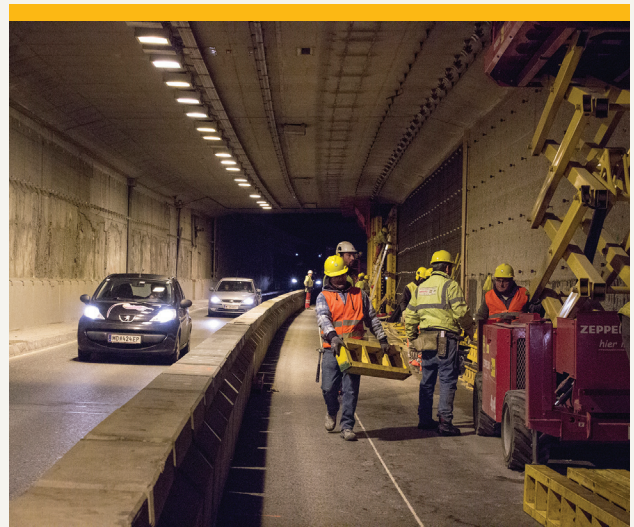
CASE STUDY

Vienna Tunnels | Austria

TUNNEL TESTED. TRAFFIC TRUSTED.

The Road Zipper System kept the A23 moving through 3 km of tunnel rehabilitation. Crews reconfigured the barrier nightly—protecting workers, maximizing lane availability, and preventing backups on this critical commuter corridor.

3 km *active work zone with zero impact to peak-hour flow*

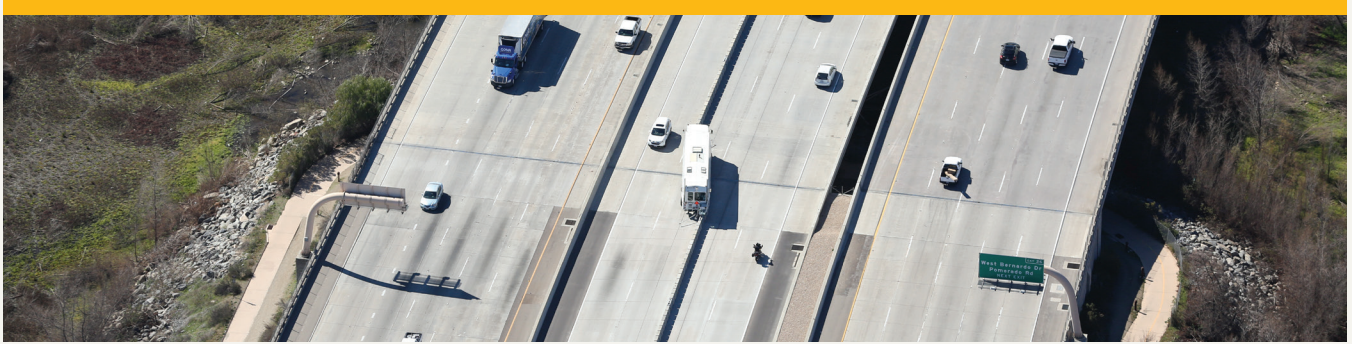


CASE STUDY

Interstate 15 | San Diego, California

In full operation since 2012

Express Lanes Project / Project Length: ~16 mi



THE PROBLEM:

- / Increased demand added 30-45 minutes to travel time
- / Travel demand was anticipated to increase by 30 percent between 1999 and 2020 making commute delays even worse if no improvements were made
- / Limited reliable and convenient transportation choices
- / Costly continuous arterial route parallel to I-151

2,500 vehicle increase per day
in 3 months of opening

Reference: SANDAG and CalTrans report
https://www.lindsay.com/uploads/files/resources/391-1_15_express_lanes_project.pdf

THE SOLUTION:

- / The Road Zipper system provided express lanes for BRT
- / Created direct access ramps with intermediate access points
- / Maximized capacity with use of dynamic lanes configured by the Road Zipper to handle peak traffic

THE RESULT:

- / The new express lanes with flexible lane configuration improved travel times and mobility for travelers and connected the Bus Rapid Transit centers and Park & Ride lots.
- / The facility's average daily use increased by 2,500 vehicles in 3 months of opening.



Interstate 15 | San Diego, California



Drop ramp for buses and rideshare

Dynamic highway using a moveable median

Bus Rapid Transit (BRT) station

Park & Ride lot

FREEWAY WITHIN A FREEWAY: One of the most progressive transportation agencies in the world, Caltrans District 11, and SANDAG (Metropolitan Planning Organization) developed a revolutionary plan to meet current and future traffic needs. Without the Road Zipper System, this plan would not have been possible.

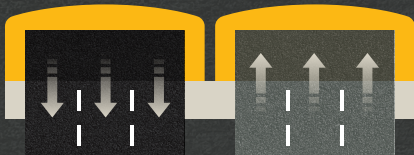
The I-15 Express Lanes feature four center lanes with a moveable barrier for maximum flexibility, multiple access points to the general-purpose highway lanes, and direct access ramps for high-frequency BRT service. The managed lanes were developed with the latest technologies that maintain proper flow rates, sense problems, adjust at necessary locations and keep travelers informed of their choices.



AVOIDING TUNNEL VISION

Traditional

3/3

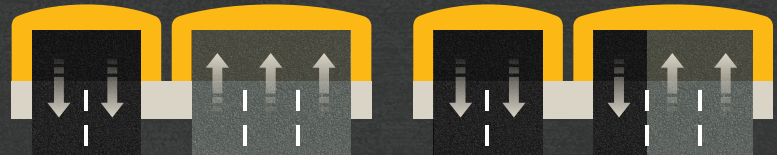


Due to limited space, very high costs, and extensive planning, tunnels require forward thinking design. Traditional designs typically utilize an equal number of lanes in each tunnel (3/3 configuration), which is a problem if higher capacity is desired without the budget.

Future Plan

2/3 - AM Peak Traffic

3/2 - PM Peak Traffic



If funds are available for a 2/3 lane tunnel configuration, road authorities can implement The Road Zipper System to gain the equivalent of six lanes of tidal flow capacity at the cost of five lane construction.

Moving People

SAFER

FASTER

SMARTER

- OPTIMIZES ROADWAY CAPACITY
- H2 & N2
- MASH TL3
- POSITIVE PROTECTION
- LOW DEFLECTION
- ZERO CROSSOVER FATALITIES
- NCHRP350 TL3
- REDUCES TRAVEL TIME
- OPERATIONAL IN MONTHS, NOT YEARS
- ACCELERATES CONSTRUCTION
- TOP TRANSFER SPEED 5-10 MPH (8-16 KM/H)
- RAPID CONSTRUCTION STAGE CHANGES
- MAINTAINS AIR QUALITY GOALS
- INCREASES FUEL EFFICIENCY
- REUSABLE ASSET
- A FRACTION OF THE COST OF NEW CONSTRUCTION
- IMPROVES TRAVEL TIME AND USAGE



/// Lindsay is the inventor and world's leading manufacturer of the moveable barrier technology for both managed lanes and construction work zone applications. Lindsay also offers a full line of road safety products as well as various safety accessories and specialty barrier products.



ROAD ZIPPER™



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