Moveable Concrete Barrier

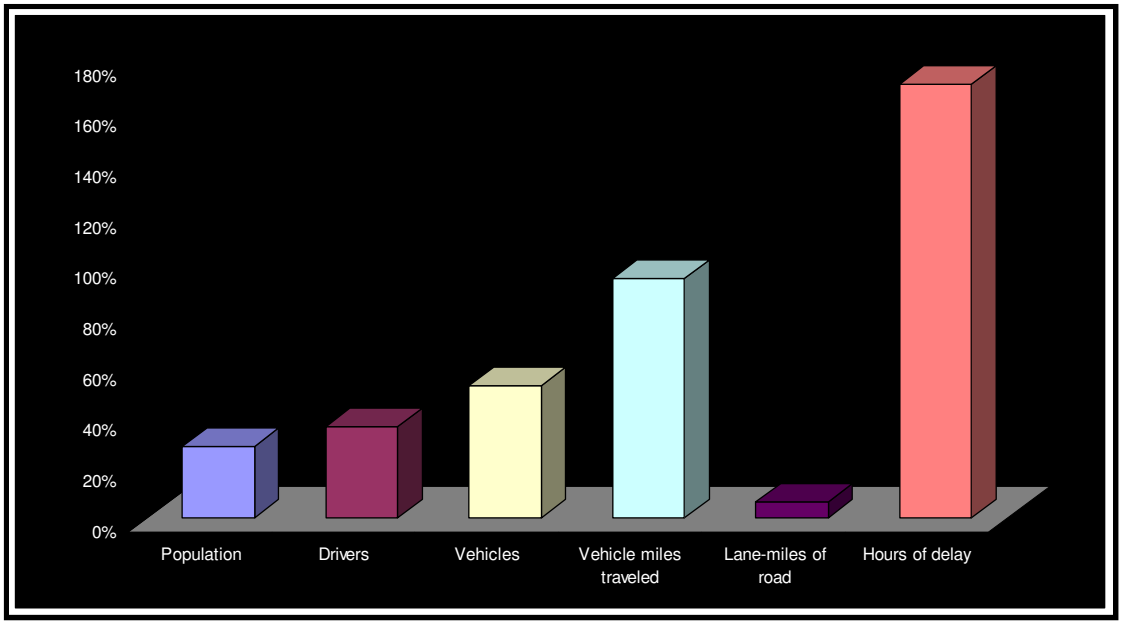
Flexible Positive Protection to minimize work zone congestion, increase safety & save time & money

Laura Huizinga-Barton
Lindsay Transportation Systems – Barrier Systems
Laura.Huizinga@Lindsay.com
616-994-2389

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

The Cost of Congestion

- Congestion in 2009 cost $115 Billion
- Americans traveled an extra 4.8 BILLION hours
- Americans purchased an extra 3.9 Billion gallons of fuel in 2009
- Air quality issues



- 50% of nations urban Freeways at / above capacity
- Data suggests the problem will continue to increase as economy recovers

Source: TTI, Urban Mobility Report 1-20-11 & The Road Information Program (TRIP) 5-01

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

WORLD NEWS

China's Boom Snarls Traffic In 60-Mile Jam

Trucks Clog a Main Route Into Beijing

By Shai Oster

BEIJING—A 60-mile traffic jam on the outskirts of the Chinese capital, on a road from Inner Mongolia, could last until the middle of next month, officials say—highlighting the extent to which China's booming economy is overwhelming its transportation network.

The snarls were triggered about 10 days ago when construction crews started work on a heavily traveled stretch of a major highway that extends West from Beijing. Since then, trucks at times have been reduced to creeping forward by less than a third of a mile a day, authorities say. Hundreds of police have been deployed to keep order.

Truck driver Long Jie, who hauled a 30-ton load of coal from Baotou in the mining belt of Inner Mongolia to Beijing, said that a trip that normally took him three days had now stretched to more than a week. Mr. Long said the delays would likely force his employer to raise the price charged for deliveries.

Zhang Minghai, director of the Traffic Management Bureau in Zhangjiakou, a city along the highway's path, said he didn't expect the situation on the road, known as National Highway 110, to return to normal until around Sept. 17, when roadwork is set to finish and closed traffic lanes can reopen.

"Thanks to the recovery in the Chinese economy, there are a lot more trucks on the road," Mr. Zhang said. And the growth in new vehicles is "always faster than the construction of new highways."

Out on Highway 110, police have been working to reroute cars and trucks carrying food and other essential supplies. People from villages along the highway are selling instant noodles to drivers from roadside stands and, when traffic is at a standstill, walking among the vehicles to hawk their wares.

When the traffic comes to a complete stop, many drivers leave their trucks' spartan cabs, which offer few of the amenities, such as audio-video systems and sleeping bunks, common in big rigs in the U.S. Groups of drivers sit in the shade of their trailers playing cards or napping.

The root cause of the congestion is the sharp rise in vehicle traffic as more and more trucks flood intercity highways moving goods from mines and factories to cities and ports. With freight-hauling capacity on the country's overburdened rail network constrained, more and more loads are moving by road.

China has been investing heavily to build new roads and expand existing ones. But it has struggled to keep pace with the number of new vehicles flooding onto the highways. Sales of mid-size and heavy commercial vehicles, including tractor trailers, rose 76% in the first half of 2010, according to J.D. Power & Associates.

A significant portion of China's postfinancial crisis fiscal-stimulus package has been earmarked for road building in recent years. But in the short run, all that construction is just making traffic problems worse.

Another major problem is wear and tear on Chinese roads, chewed up by trucks hauling heavy loads, especially along critical coal-transport routes such as Highway 110. Coal moves by truck along the road from Inner Mongolia—which has fewer rail links to the rest of the country—to factories and power stations near Beijing.

The current gridlock is unusual, and has been worsened by construction on Beijing's outermost ring road and another highway that feeds into the capital. But even in normal times, thousands of trucks line up along the main thoroughfares into Beijing, many laden with the coal used to fire the city's power plants and furnaces. Trucks are allowed into the city center only at night.

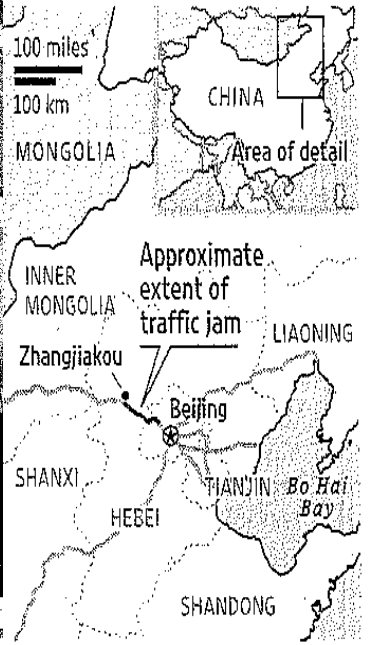
Beijing is particularly prone to traffic jams because it is a bottleneck point. Drivers from northwest China have to navigate its rings of concentric circular highways to get to coastal ports or to head south.

Swelling numbers of passenger cars in the capital contribute to congestion in the city and its suburbs. State media on Tuesday reported that average driving speeds in the capital could drop below 9 miles an hour if the city keeps adding cars at its current rate of 2,000 a day.

—Gao Sen and Sue Feng contributed to this article.

A woman sells food to truck drivers headed toward Beijing. Locals are capitalizing on the traffic, which moves as little as one-third of a mile a day.

A section of National Highway 110 on Tuesday, day 10 of the jam.



MAP-21 – Performance Management

Seven goals of “National Interest”, requires states and MPO’s to establish performance measures and standards

- **Safety**
- Infrastructure Condition
- **Congestion Reduction**
- System Reliability
- Freight Movement and Economic Vitality
- **Environmental Sustainability**
- **Reduced Project Delivery Delays**

Quickchange™ Moveable Barrier

Managed Lanes

Construction

LINDSAY™ TRANSPORTATION SOLUTIONS

BARRIER SYSTEMS®

Traditional Construction WZ Issues

- When lanes are taken, capacity is reduced & congestion increases
- If lanes are not taken the contractor has confined - unproductive workspace
- If plastic delineation devices are used more buffer space is required to separate workers / motorists
- Result: Increased accident

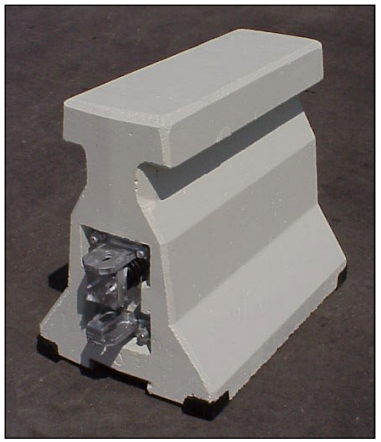

Confined workspace


Exposed Equipment

Unsafe removal / delivery

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

System Components



- Moveable Barrier, Transfer Machine & VLB's
- Steel alloy hinge pin system
- Modified T-Top acts as a lifting surface
- Maximum Dynamic Deflection 53" (4.4 ft) (1346 mm)
- Transfer / Reset = 1 Mile in 12 mins (4-18 ft width)
- NCHRP-350 TL3 Barrier

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

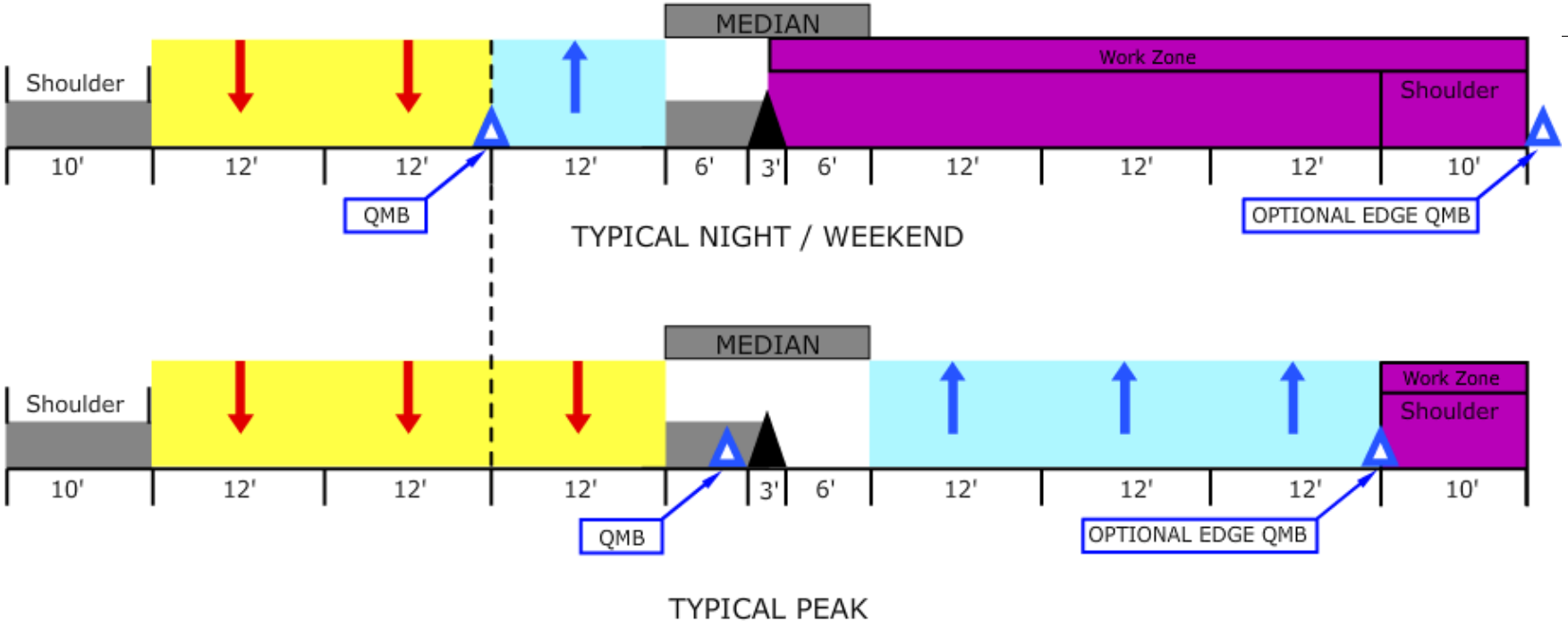
QMB Construction Applications

Partial Road Closures

Shoulder Work
Inside / Outside

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

Partial Road Closures



One side of the road is closed & traffic is moved to the other side. MB is used (as a "Moveable Median") to provide more lanes on the open side to managed peak demand. This provides unobstructed access to the closed side for the contractor to complete the work faster & safer.

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

St. Croix River Bridge Reconstruction
Partial Closure

- Completed in one season versus two
- Construction cost savings >$1M*
- User-delay cost savings >$1.5M*
- No crossover accidents during construction
- Av speed w/ MB 51 mph; versus 9 mph without MB

* Rush Hour Remedy, Ayres Associates

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

Indiana US-31 over I-465
Bridge Superstructure Replacement

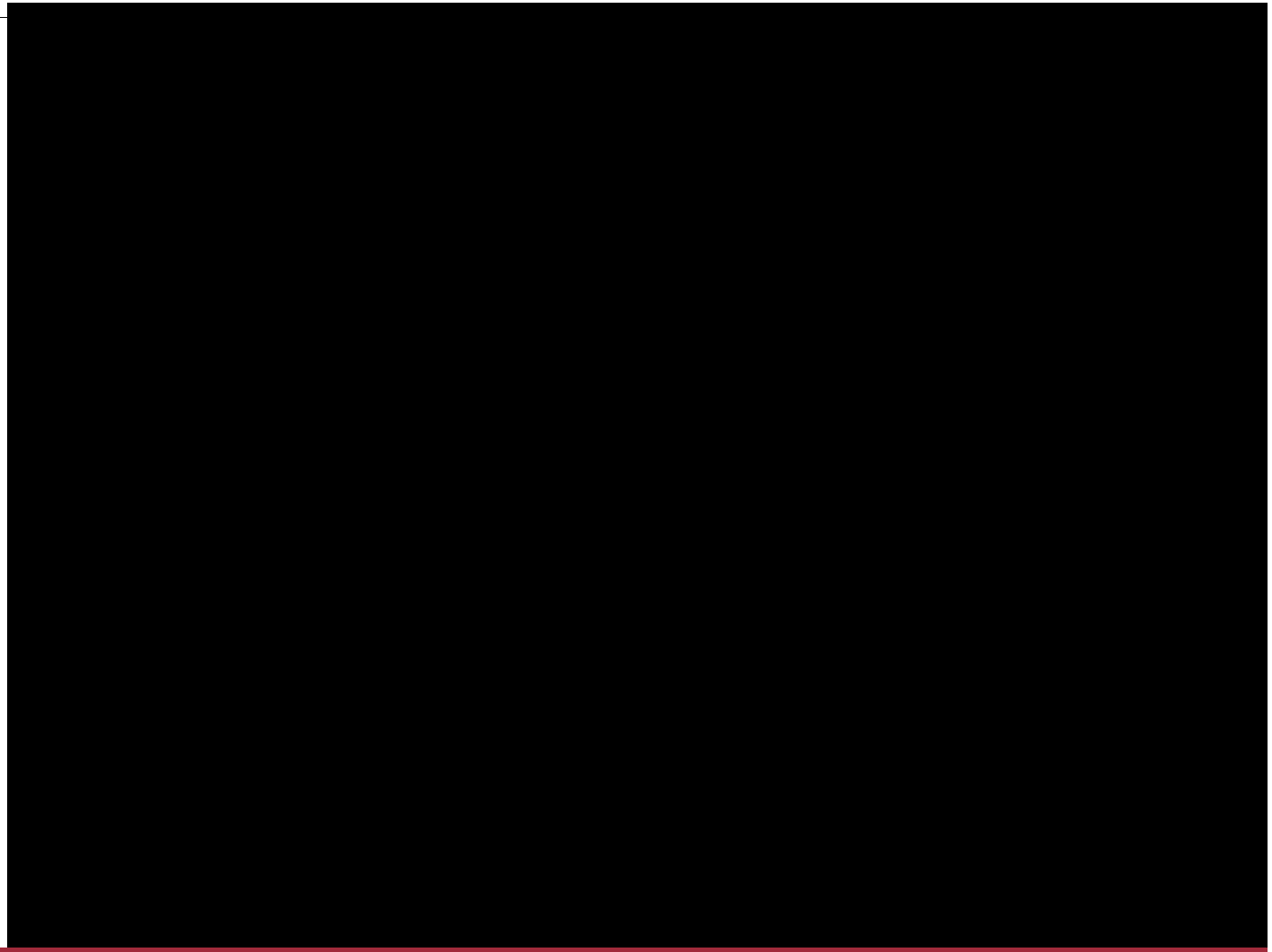
- Original plan, temporary bridge widening (Project Estimate $6 Million)
- Utilized Moveable Barrier in 2+1/1+2 pattern (Project Estimate $4.8 Million)
  - Actual Project Bid $4,016,316
  - MBW = $327,640
- $1.2 Million savings on Proj. Estimate
- Provided 2-lanes for peak traffic

2011 Honor Award for Engineering Excellence from the Indiana Chapter of the ACEC

Stephen J. Christian & Associates

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

Doyle Drive
San Francisco, CA



SR 171 Widening - Salt Lake City, UT
Partial Closure - Arterial

- 2 lanes always open in peak direction using 3 lanes vs. 4
- Project finished 7 months early
- Total benefits of using MB were $1.7 M - $2.4 M
- Greater than 10:1 B/C

Evaluation of Movable Barriers in Const WorkZone's,

Ken Berg, P.E. et al, TY Lin Int'l, 2010

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

Peoria, IL. McCluggage Bridge

Type Project: Dual Structure Redeck

Contractor: Midwest Construction

Length of Project: 1 Mile ADT: 50,000+

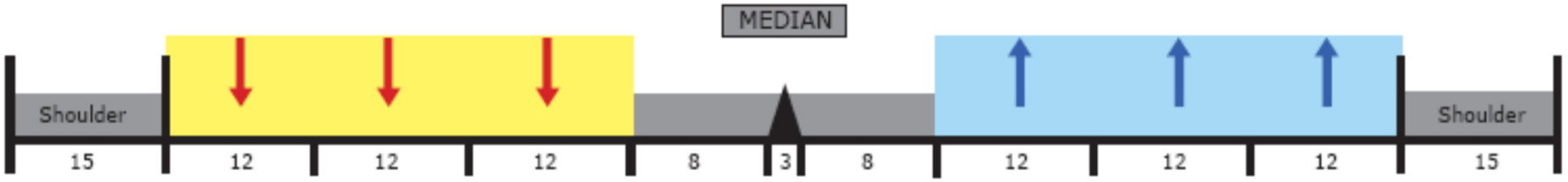
Innovative Strategies: Transferred traffic to one structure, providing unrestricted access for seismic retrofit and deck work. Reconfigured traffic on the other bridge w/ MTCB to accommodate AM & PM traffic.

Results: Reduced phasing time & cut completion time. Pos Sep traffic for improved safety. Received the FHWA Mobility and Safety Award. On time and below budget.

Reported by FHWA

Indianapolis, Indiana Case Study

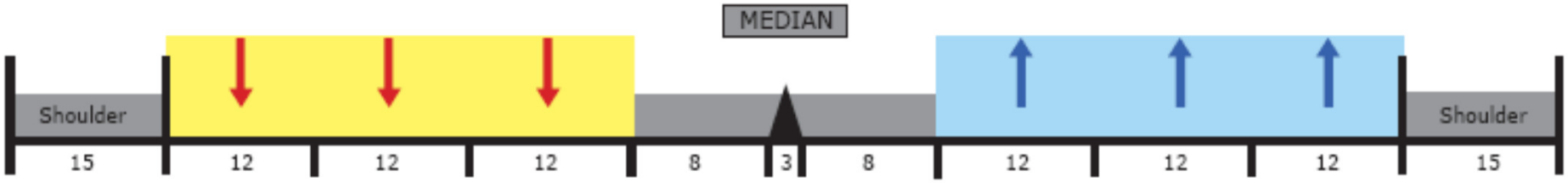
Typical 6-lane highway before widening. Must keep 3 lanes open each way to minimize queue (backup



TYPICAL ROADWAY CONFIGURATION BEFORE CONSTRUCTION

Contractor told by DOT:
"Motorists must have 3 lanes
in the peak direction at all times."

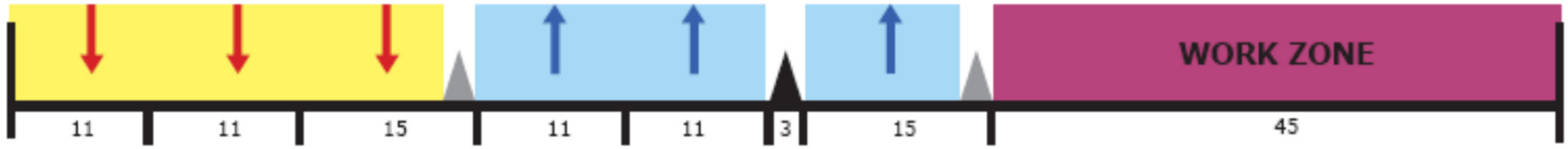
Typical 6-lane highway before widening. Must keep 3 lanes open each way to minimize queue (backup



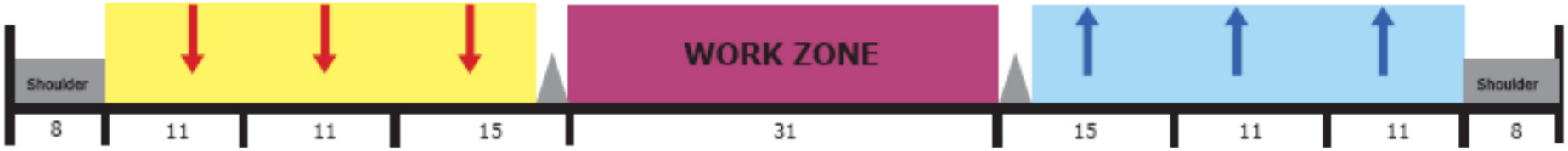
TYPICAL ROADWAY CONFIGURATION BEFORE CONSTRUCTION

Alternative #1: Work completed in three stages over two construction seasons

Stage 1: Five lanes to the right of the median barrier, one lane to the left.

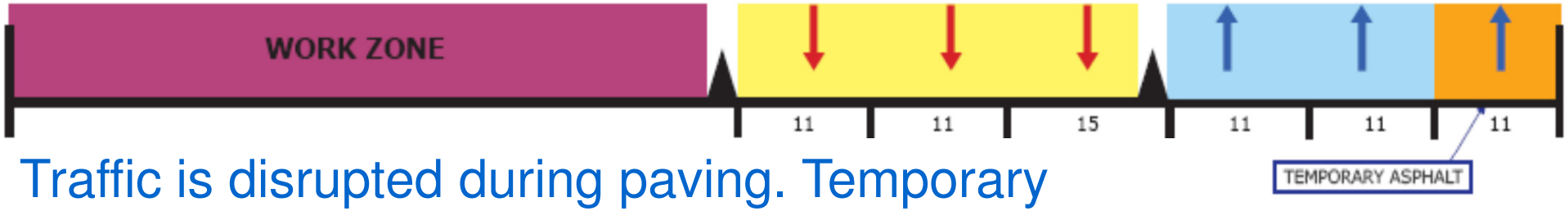


Stage 2: One lane to the right of the median barrier, five lanes to the left.



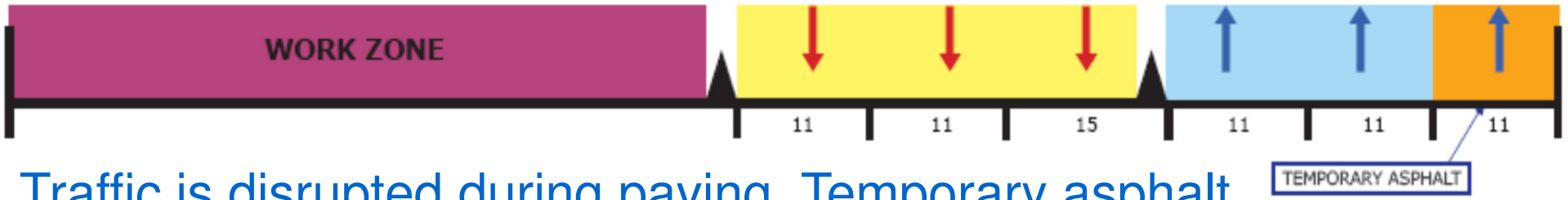
Stage 3: Work zone is in the median between temporary barriers

Alternative #2: Use costly temporary asphalt on both sides



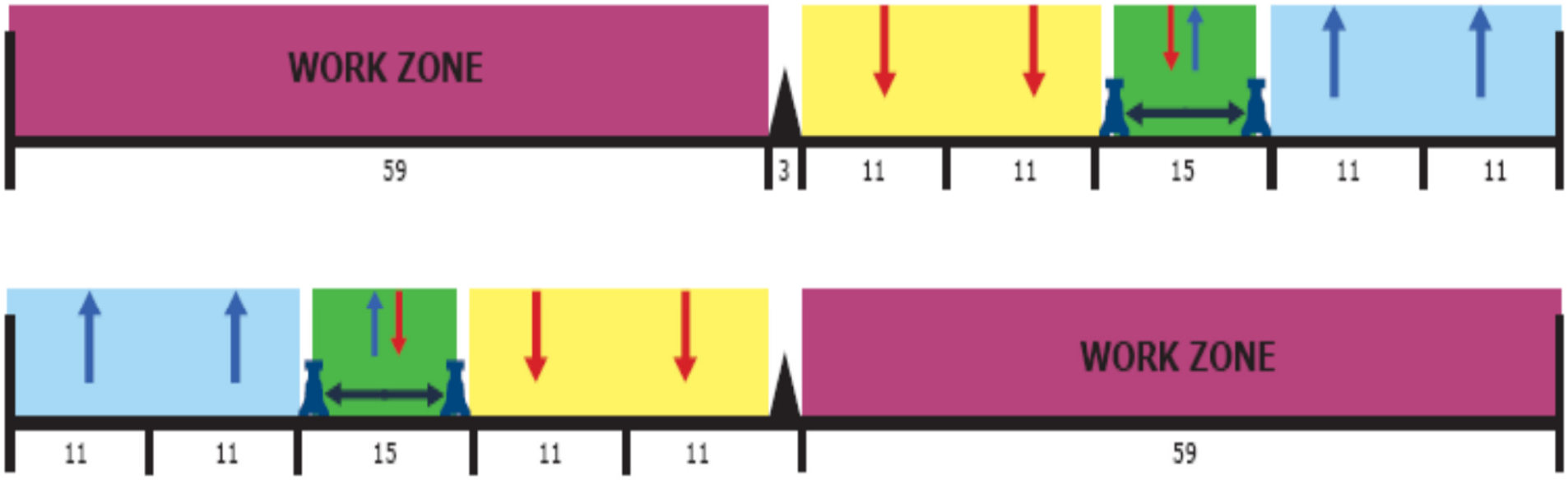
Traffic is disrupted during paving. Temporary asphalt costs can be very expensive - Required 2 Construction seasons

Alternative #2: Use costly temporary asphalt on both sides



Traffic is disrupted during paving. Temporary asphalt costs can be very expensive

Alternative #3: Use Moveable Barrier to reduce costs and construction stages



QMB keeps lanes open with no (or minimal) construction, reduces construction seasons by eliminating stages

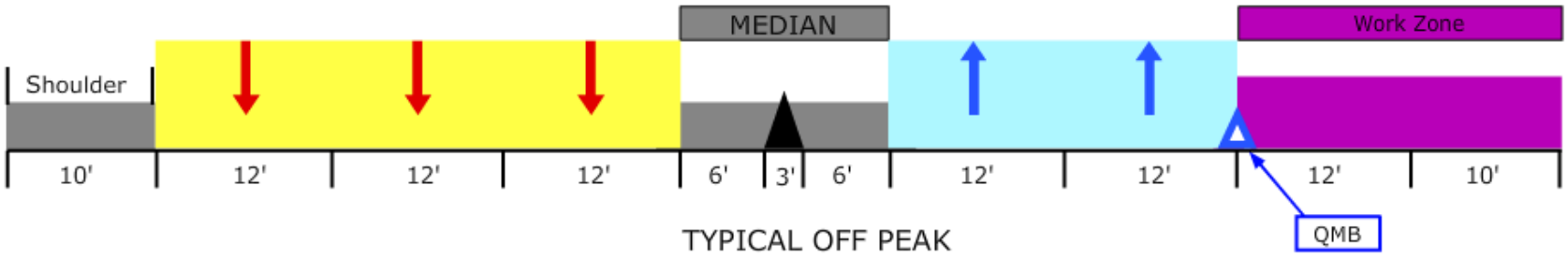
QMB Construction Applications

Partial Road Closures

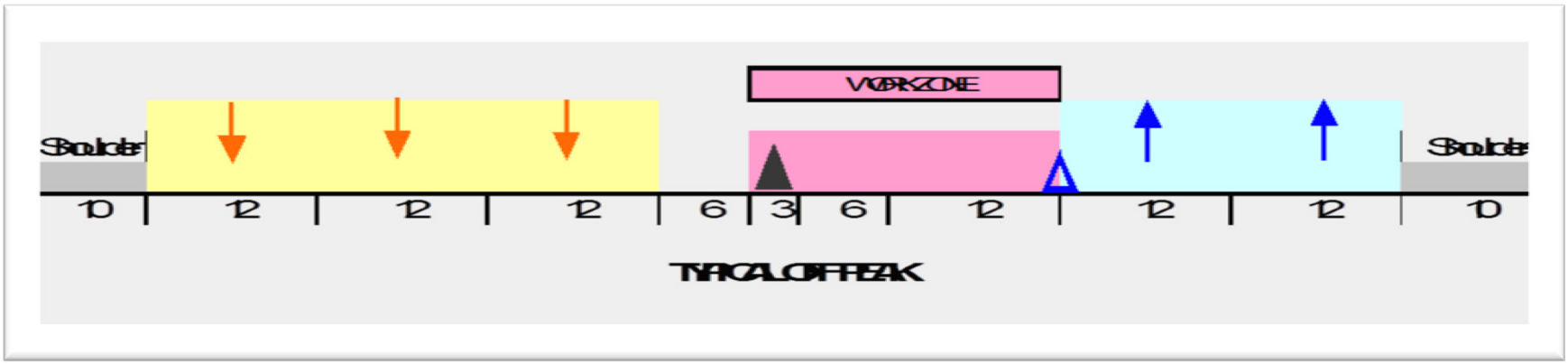
Shoulder Work Inside Outside

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

Outside Shoulder Work



Inside Shoulder Work



During peak hours, the barrier is stored on the outside or inside shoulder.
During off-peak hours, the barrier is moved out to expand the work zone

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

Off-Peak Expanded Workspace
Outside Shoulder Work

More Workspace /Off-Peak

More Lanes / Peak

Lane shifts under traffic, positively protecting workers, motorists & haul lanes

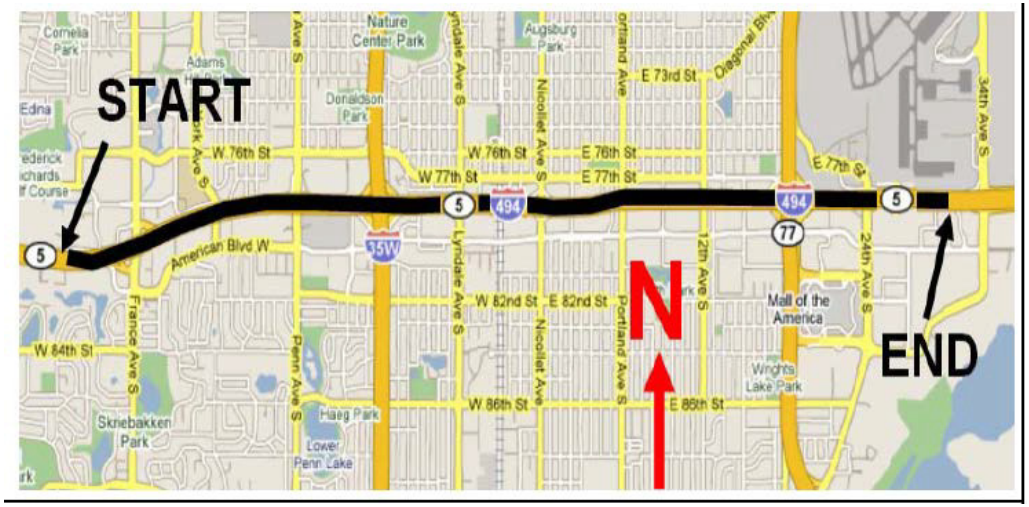
Long Island Expressway (LIE), NY

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

Long Island Expressway, NY

Minneapolis, MN I-494

- Reconstruction project on I-494 from Hwy 100 to 24th Avenue in Edina, Richfield, and Bloomington in 2012 and 2013
- Median guardrail removal & replacement with concrete median barrier
- Adding a WB Aux. lane between Nicollet Ave. & Portland Ave.
- 3+3, 6am – 6:30 pm daily balanced traffic, hourly traffic range 4,000 – 6,900



LINDSAY™ TRANSPORTATION SOLUTIONS

BARRIER SYSTEMS®

Minneapolis, MN I-494

- User Delay Calculations:

Location	Night Lane Closure w/MCB	All Day Lane Closure w/Static Barrier
I-35 to TH 77 EB	$32,350	$1,594,440
Penn – I-35 WB	$25,810	$2,767,130
I-35 – TH77 WB	$8,410	$1,046,270

Road user cost was calculated by using a queuing model spreadsheet developed in MnDOT by following with FHWA guidance on life cost analysis. $13.93 per person-hour for passenger cars and $17.51 per person-hour for trucks Heavy Commercial is about 5% on the corridor

- Benefits:
  - Accelerate construction time, Provide more space for construction workers, Reduce congestion, Decrease travel time for the public

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

Wash. DC IH-395 Beltway

Type Project: Pavement Reconst.

Contractor: Cianbro Construction

Length of Project: 5 Miles ADT: 120,000
Innovative Strategies: Used MTCB for Median Replacement then employed Contraflow lane concept to keep traffic moving smoothly. I-395 is a critical corridor around WDC.

Results: Flexible scheduling reduced phasing time, cut congestion, Shaved 81 days (almost 3 months) off completion. Received AGC Build America Award.

Reported by AGC

LINDSAY™ TRANSPORTATION SOLUTIONS

BARRIER SYSTEMS®

Chicago, IL.
S. Lakeshore Dr.

Type Project: Widening

Contractor: Walsh / Riteway Const. 7-02

Length of Project: 1 ½ Miles ADT: 60,000+

Innovative Strategies: MTCB enabled the contractor to increase the size of the work space, positively protect workers / motorists and protect the haul lanes.

Results: Contractor was able to quickly reconfigure traffic lanes and provide extra inbound and outbound lanes to reduce congestion and accelerate project completion

Source: Chicago DOT Report

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

Moveable Barrier Construction Applications Pay-Offs

- Flexible WZ accelerates const process to reduce time & overhead
- More lanes during peak hours reduces congestion
- Expanded workspace during off-peak hours speeds construction
- Added safety: Positive protection for workers and motorists

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

Quickchange™ Moveable Barrier System Support

Design:

- Design Assistance
- Applications Engineering
- Design / Phasing Reviews
- Translations

Operational Support:

- Training
- Maintenance
- Tech Rep Site Support
- 24 / 7 Trouble Shooting

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®

Questions?

Laura Huizinga
Barrier Systems, Inc.
3333 Vaca Valley Pkwy
Suite 800
Vacaville, CA 95688
Ph 707-374-6800
Cell 616-994-2389
Laura.huizinga@
barriersystemsinc.com
www.barriersystemsinc.com

LINDSAY™ TRANSPORTATION SOLUTIONS | BARRIER SYSTEMS®