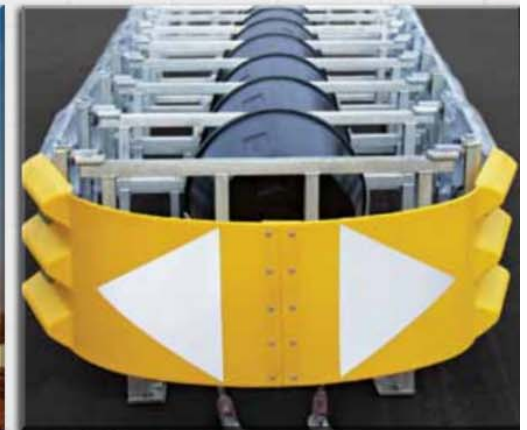


THE LINDSAY TRANSPORTATION ADVANTAGE



LINDSAYTM
TRANSPORTATION SOLUTIONS

BARRIER SYSTEMS[®]
BY LINDSAY

RAILROAD PRODUCTS
BY LINDSAY

SNOLINE[™]
BY LINDSAY

Moveable Concrete Barrier Systems



MCB for Permanent Applications



MCB for Construction Applications

QMB

QUICKCHANGE MOVEABLE BARRIER SYSTEMS

“The Road Zipper®”



Concrete Barrier Sections Barrier Transfer Machine



Variable Length Barriers



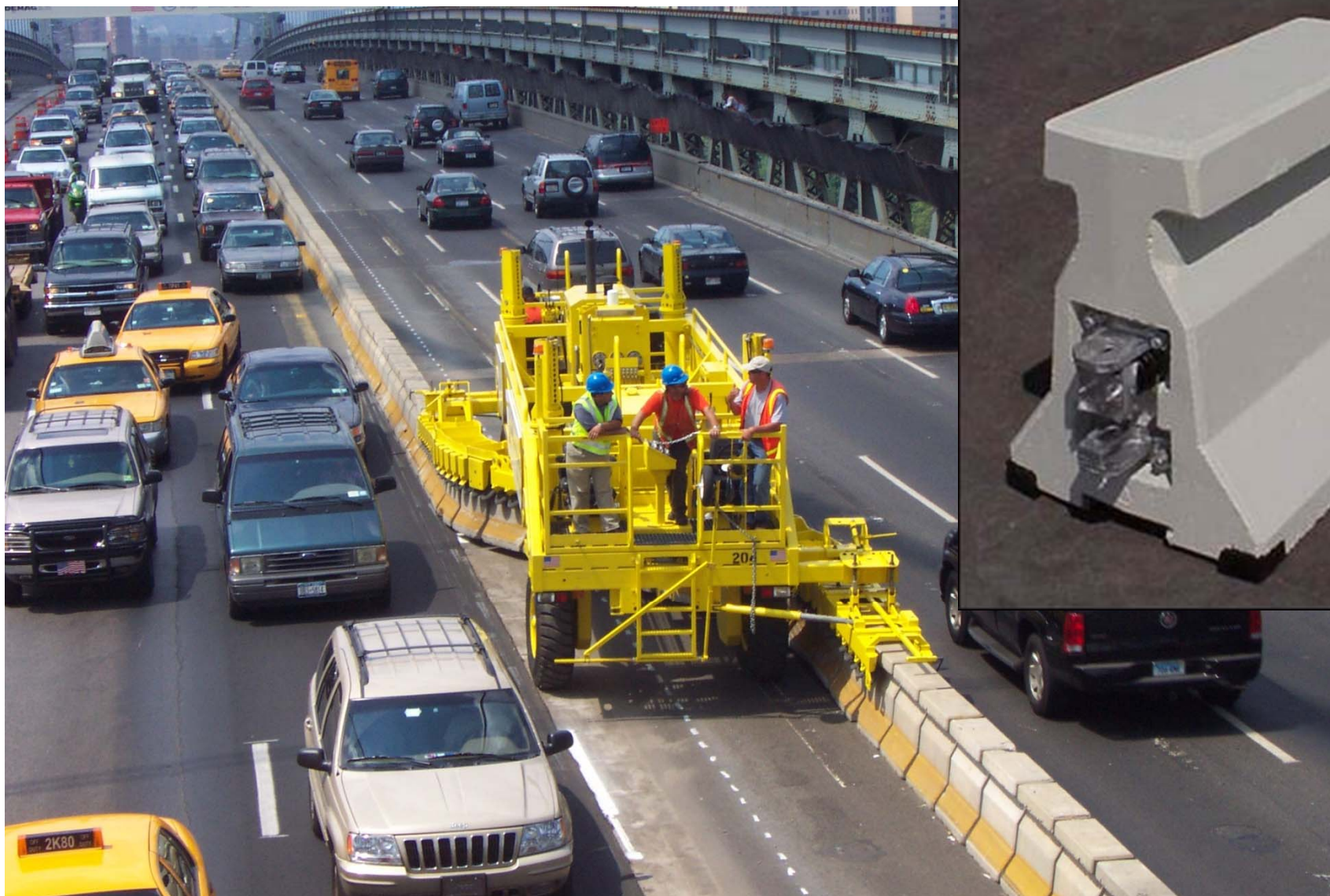
ABSORB 350





3 Standard Barrier Configurations...

Standard 24" Concrete Barrier



18" Reactive Tension System "RTS Barrier"



18" Reactive Tension System (RTS) QMB

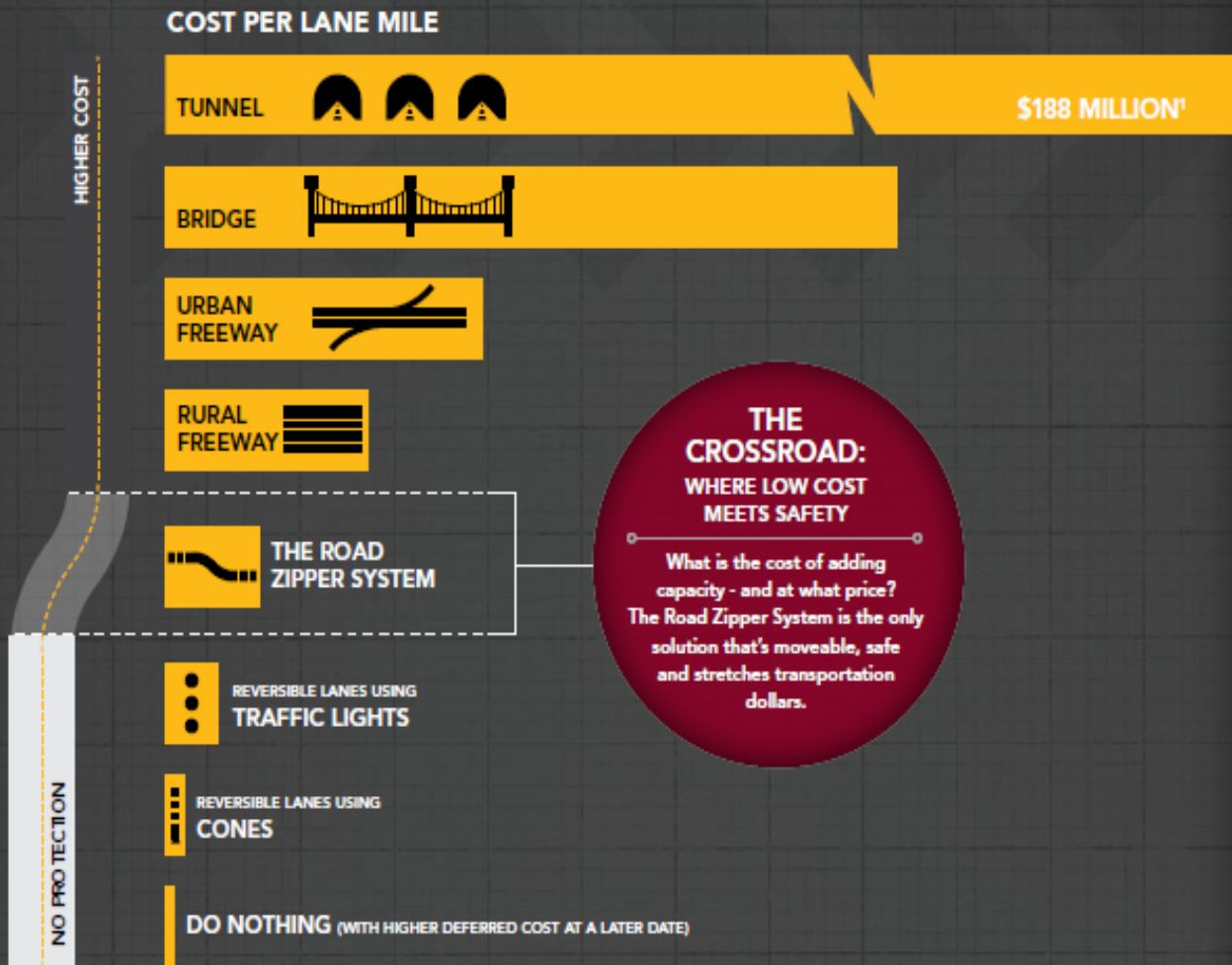


13" Steel Reactive Tension Barrier



WHY QMB?

WHAT IS THE COST OF ADDING CAPACITY?



¹ Washington State Department of Transportation, <http://americandreamcoalition.org/highways/HighwayCosts.pdf>

- Cost Effective Method of Increasing Capacity on Existing Roads
- Rapid Deployment
- Positive Barrier Protection at all Times

Long Term Reversible Managed Lane Applications

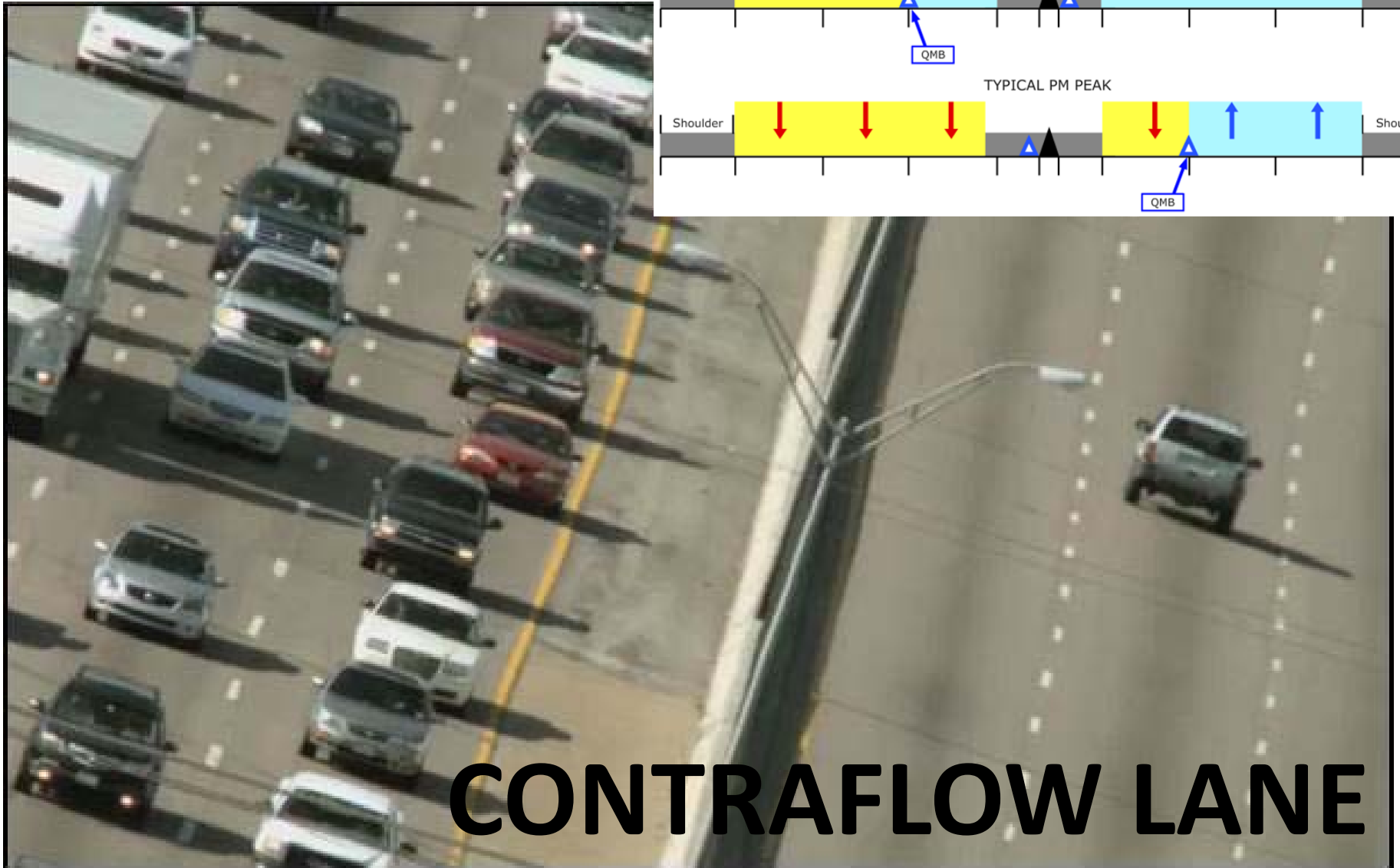
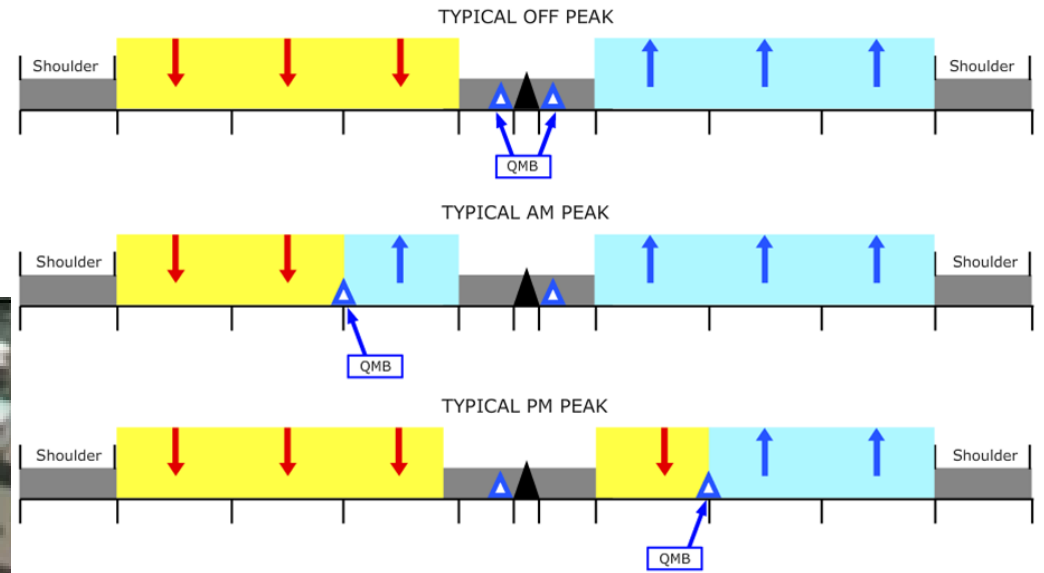
Moveable Median



Contraflow Lanes

- HOV
- HOT
- Value Price Toll





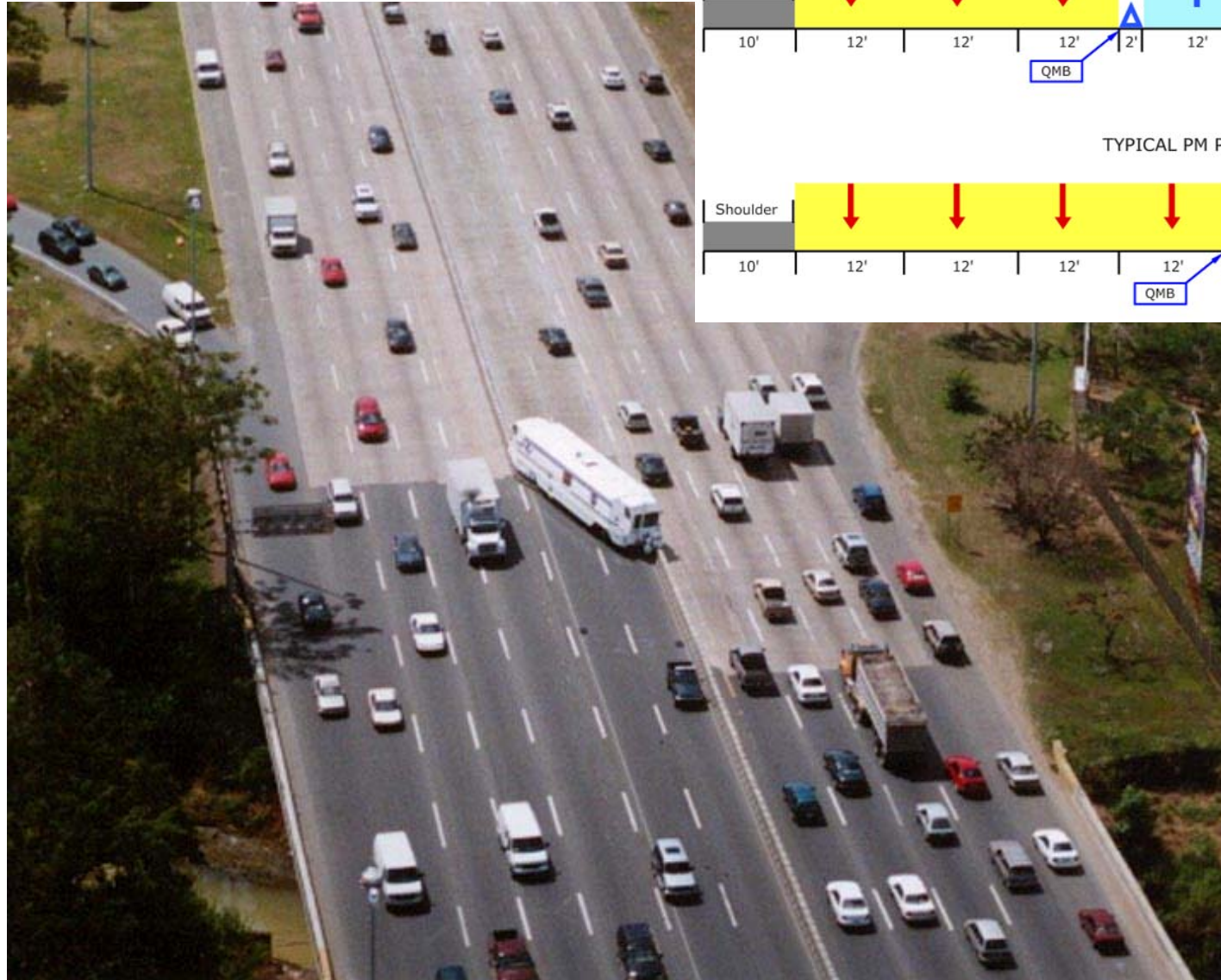
CONTRAFLOW LANE

DALLAS I-30 CONTRAFLOW/HOV

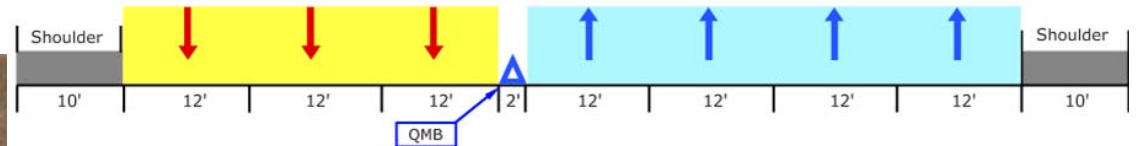


- Saves 14 Mins /Day
= 1 Million Hours Yearly
- Carpools up 300%
- Bus use increased 38%
- 15,000 AM / PM Commuters
- Meeting Dallas Air Quality Goals
- Benefit – Cost Ratio 6.5 : 1

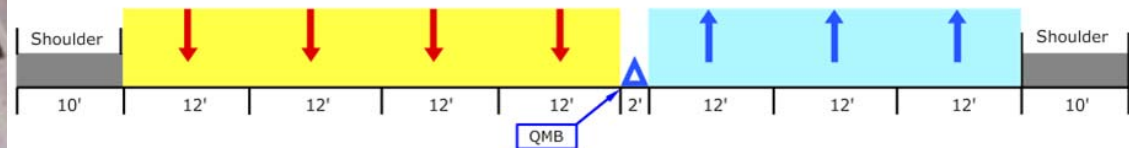
MOVEABLE MEDIAN



TYPICAL AM PEAK

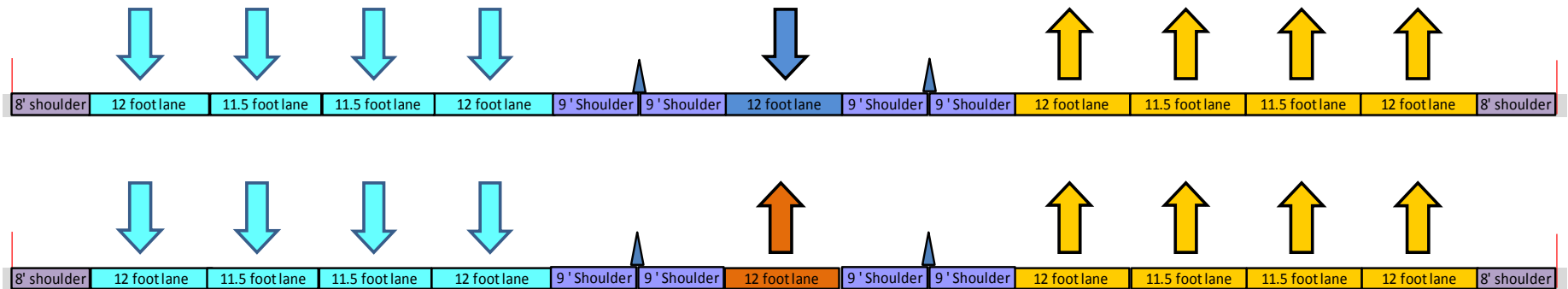


TYPICAL PM PEAK



Existing Fixed Wall Case – Actual cross section I-69 Houston, TX

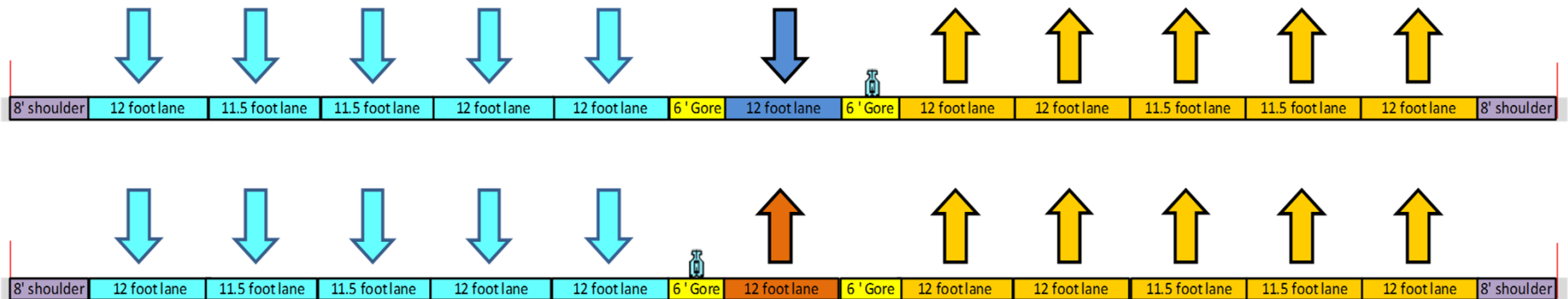
Single Reversible Lane with Wide Separation Zones



- This Cross section is taken from the actual I-69 roadway with 158' total width
- The total width of travel lane and shoulders in the reversible lane is sufficient to allow traffic to bypass a disabled vehicle
- Total number of lanes is limited to 4+4 general purpose plus one reversible managed lane,
Total = 9 lanes
- **Roadway utilization efficiency for active lanes is 67%**
(106'/158')

Single Moveable Wall (Moveable Median) Solution

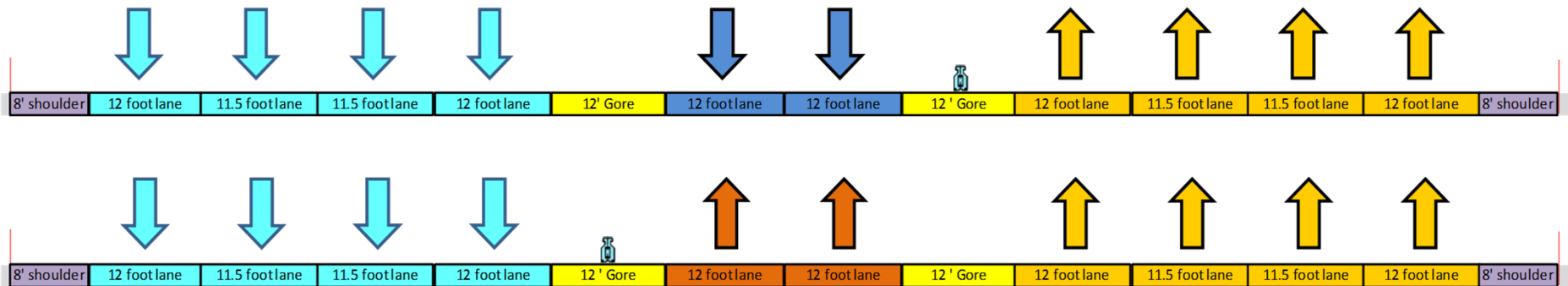
Single Reversible Lane with Moderate Separation Zones



- Using the same Roadway as shown in the two previous cases this alignment **yields two additional general purpose lanes**
- Total number of lanes is 5+5 general purpose plus one reversible managed lane,
- ***Total = 11 lanes***
- While the total space allotted to the managed lane and center shoulders is only 24 feet, adequate incident management capability is retained because there is only one isolating barrier wall and therefore there is free access to the lane at all times.
- **Roadway utilization efficiency is increased to 82% in this case** (130'/158')

Single Moveable Wall (Moveable Median) Solution

Dual Reversible Lanes with Wide Separation Zones

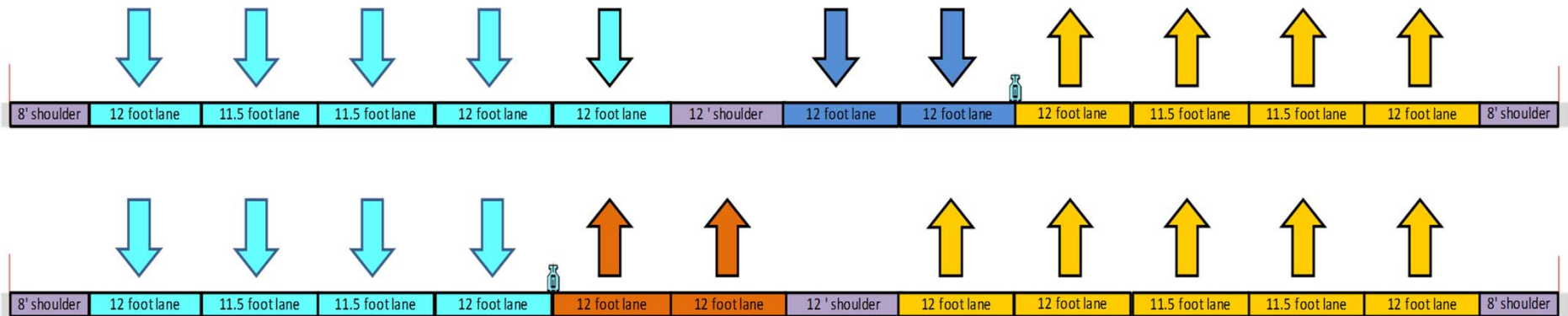


- Using the same Roadway as shown in the three previous, cases this **alignment yields two managed lanes**
- Total number of lanes is 4+4 general purpose plus two reversible managed lanes
- ***Total = 10 lanes***
- The total space allotted to the managed lane and center shoulders is 48 feet, providing more than adequate incident management capability with one full 12 foot shoulder between the general purpose and managed lanes, and with only one isolating barrier wall there is free emergency access to the lane at all times.
- **Roadway utilization efficiency is increased to 75% in this case** (118'/158') compared to the fixed wall case



Single Moveable Wall (Moveable Median) Solution

Dual Reversible Lanes with 5 Peak Direction Lanes



- This option utilizes overhead signage/lights in conjunction with Moveable Barrier to yield two reversible managed lanes separated by a 12 foot shoulder/gore area from 5 peak general purpose lanes.
- This option allows increased capacity in the managed lanes yet still provides congestion relief in the general purpose lanes
- The off peak direction maintains 4 lanes and is positively separated from the opposing flow by the moveable barrier
- The peak period lane count is 4+5 plus 2 , with a ***Total =11 lanes***
- **The roadway utilization efficiency with this concept is 82%**
(130/158)



Designing for Future Flexibility...



QMB Permanent System Cost

\$1.5M per Barrier Transfer Machine

\$1.5M per Mile of New Barrier

**1/10th the Cost of New Urban Lane Miles According to FHWA*

Operating Costs??

Build 2 Lanes -- QMB 2 Lanes

Capital Investment --	\$28M	\$5.5M
20yr Operating Cost --	N/A	\$6.1M
Roadway Maint. --	\$4.3M	N/A
Cost of Capital --	\$12.7M@4%	\$2.4M@4%
Total 20yr Cost --	\$45M	\$14M

TOTAL ANNUAL COST-- \$2.25M \$0.7M



PERMENANT QMB SYSTEM:

- Deploys & is Operational in Months vs. Years

Increases Available
Capacity

Increases Flexibility,
Safety & Mobility on
Texas Roadways



PERMENANT QMB SYSTEM:

**Increases Available
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**Increases Flexibility,
Safety & Mobility on
Texas Roadways**

- **Deploys & is Operational in Months vs. Years**
- **Offers Positive Barrier Protection at all Times with Excellent Incident Management Characteristics**



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- **Deploys & is Operational in Months vs. Years**
- **Offers Positive Barrier Protection at all Times with Excellent Incident Management Characteristics**
- **Aids in Achieving Air Quality Goals**



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- Deploys & is Operational in Months vs. Years
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- Aids in Achieving Air Quality Goals
- Is a Re-useable Asset, Can be Redeployed When Required

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- Deploys & is Operational in Months vs. Years
- Offers Positive Barrier Protection at all Times with Excellent Incident Management Characteristics
- Aids in Achieving Air Quality Goals
- Is a Re-useable Asset, Can be Redeployed When Required
- Reduces Congestion While Stretching Transportation \$\$ - 1/10th the Cost of New Urban Lane Miles According to FHWA

Improving Work Zone Safety and Mobility



Construction System Components



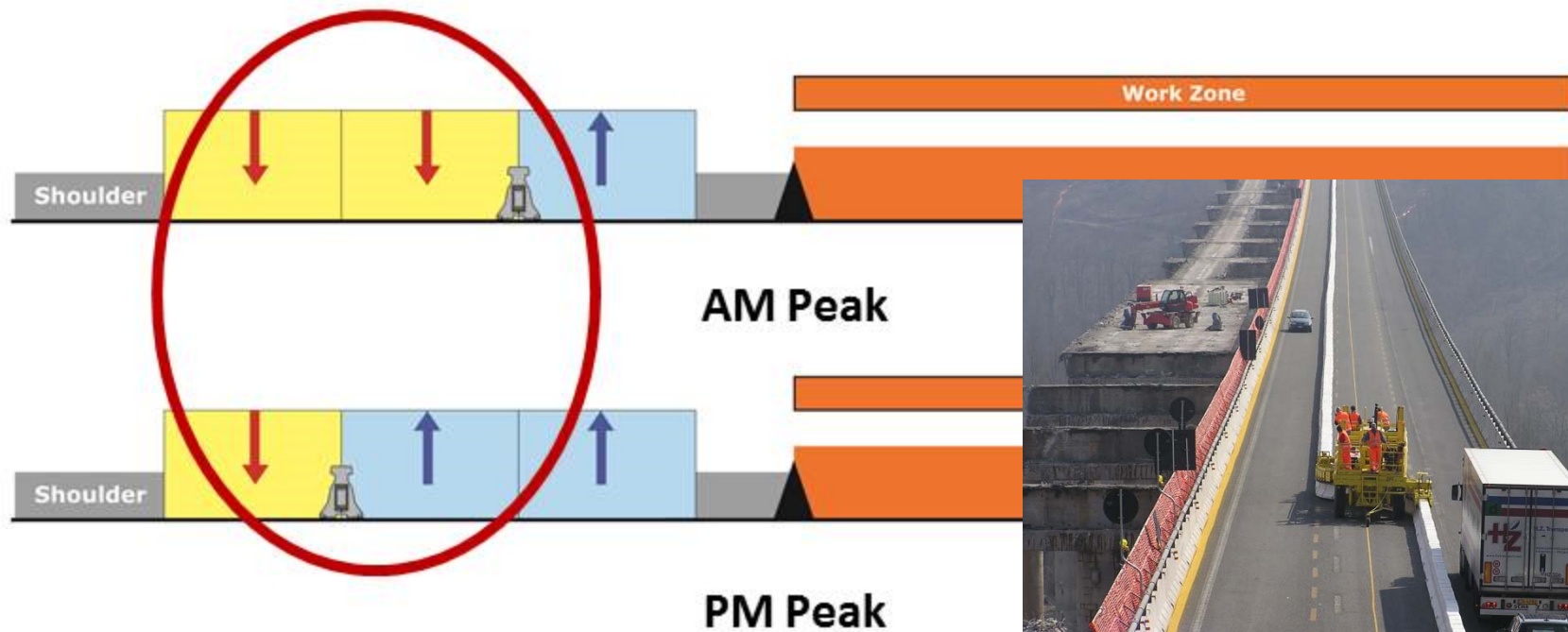
 **LINDSAY™**
TRANSPORTATION SOLUTIONS

 **BARRIER SYSTEMS®**
BY LINDSAY

Partial Closure Moveable Conc Barrier (MCB) - (3) Lanes

Option 3:

One side of the road is closed. Traffic is moved to the other side. Moveable barrier is deployed on the traffic side as a “moveable median” to create 2-1 or a 1-2 configuration to maintain 2 lanes in the peak traffic direction at all times while using only 3 lanes.



Camden, NJ. IH-30 Partial Closure

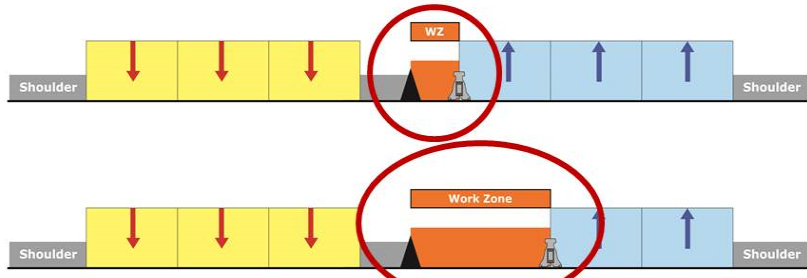
- **Type Project:** Widening Hwy Reconst.
- **Contractor:** Agate Construction Co.
- **Length of Project:** 2 Miles ADT: 225,000
- **Innovative Strategies:** Used MCB to expand work space during off peak periods and positively separate opposing traffic.
- **Results:** Shaved 4 months off completion. Reduced congestion, and traffic disruptions. Eliminated one stage, Bridge widening. VE recommendations w/ MCB saved NJ DOT \$7 M (1/3 of estimate) on a \$23 M project. "Without MCB it would have required demolishing & rebuilding overheard structures"



Inside Shoulder Work Moveable Concrete Barrier (MCB) - (3) Lanes

BARRIER SYSTEMS[®]
BY LINCOLN

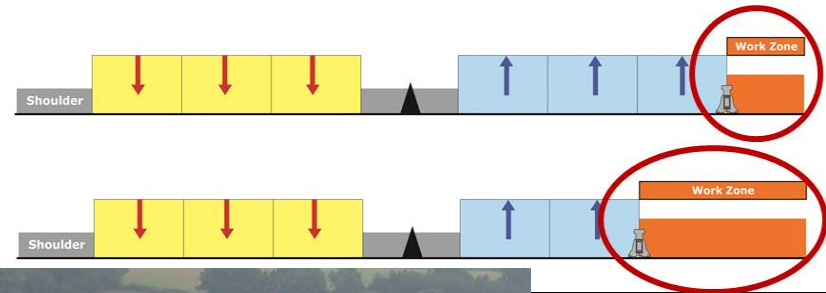
- Barrier similarly positioned to maintain 3 lanes in each direction
- During peak hrs, barrier remains stored or positioned on shoulder.
- During off-peak hrs, barrier moved out to expand the WZ
- More efficient equipment & methods, accelerates const. process
- Delivery & removal of materials safely behind positive protection



Outside Shoulder Work Moveable Concrete Barrier (MCB) - (3) Lanes

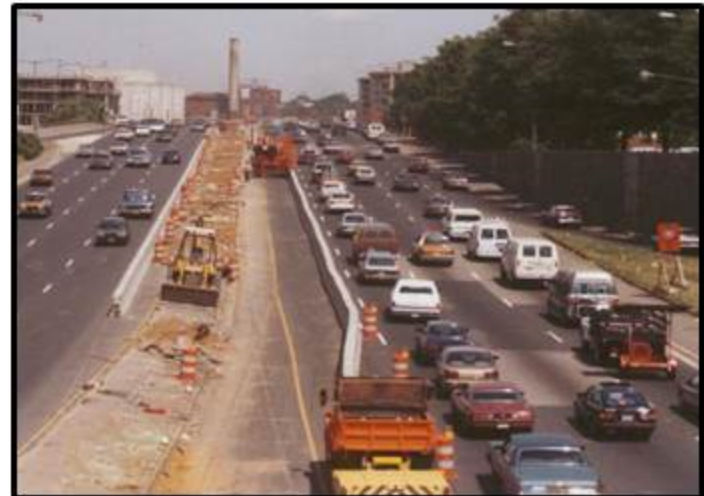
BARRIER SYSTEMS[®]
BY LINCOLN

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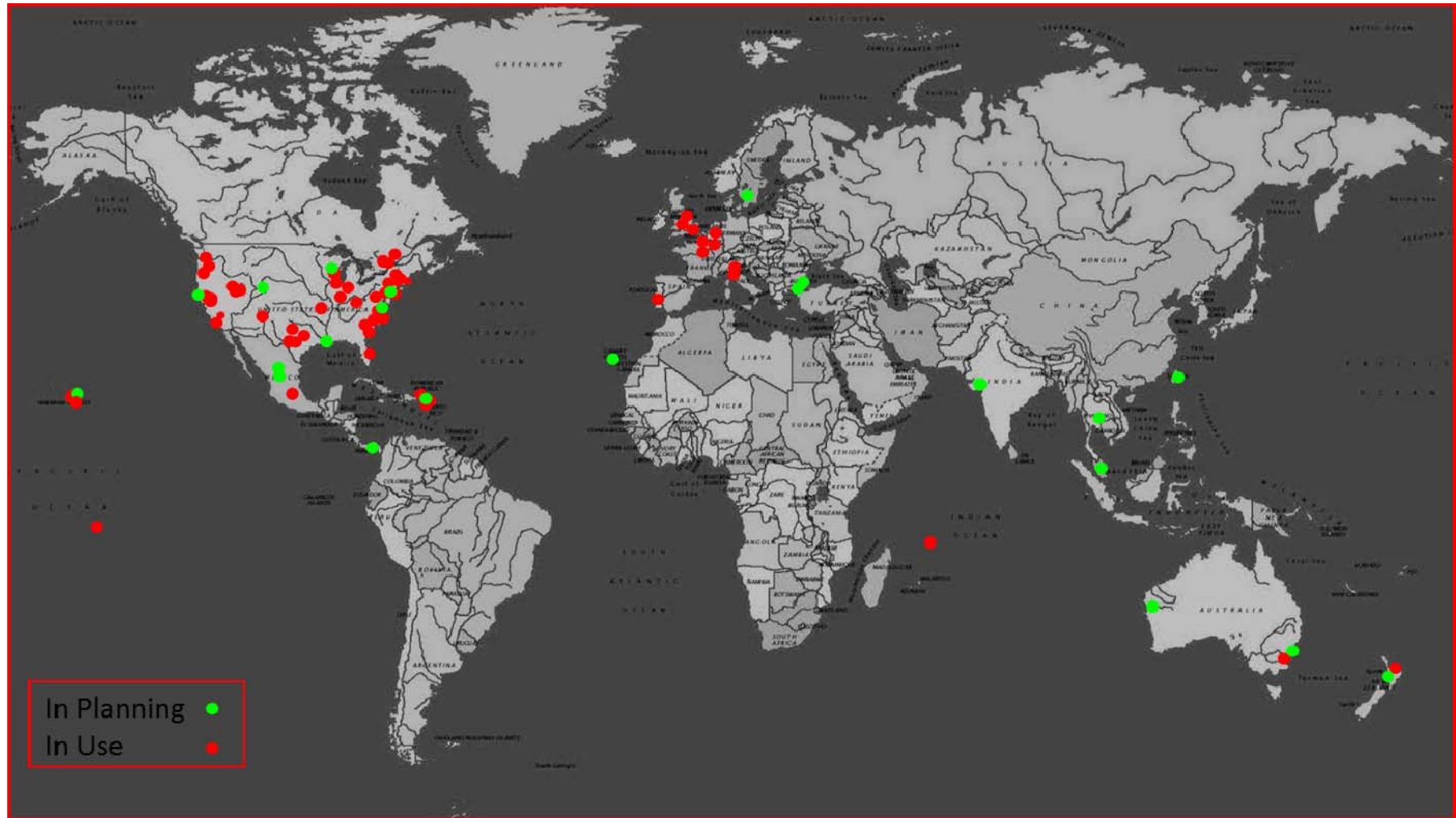


Wash. DC IH-395 Beltway Reconstruction

- **Type Project: Pavement Reconst.**
- **Contractor: Cianbro Construction**
- **Length of Project: 5 Miles ADT: 200 K**
- **Innovative Strategies: Employed MCB and contraflow lane concept to keep traffic moving smoothly on this critical WDC corridor.**
- **Results: Flexible scheduling helped to reduce construction stages, reduce congestion, Shaved 81 days (almost 3 months) off completion. Received AGC Build America Award.**



Moveable Barrier - Where has it been used



**Over 200 projects throughout the
U.S. and 12 other countries**



Texas Work Zone Projects w/ QMB

- *Austin, TX IH-35 at Yager Lane - Bridge Replacement*
- *El Paso, TX IH-10 at Lee Trevino - Pavement Rehab*
- *Austin, TX IH-35 at Parmer Lane- Median Replacement*
- *Dallas, TX NTTA Toll Rd - South End Widening Project*
- *Austin, TX Loop 1 – Bridge Widening Project*
- *Dallas, TX US 67 at IH-20 - Widening Project*
- *Ft. Worth, TX - North Tarrant Expressway (NTE) Project*
- *San Antonio – IH-35 Bridge Rehab Static Barrier (Completed)*
- *Austin – IH-35 Stassney Rd. Widening/Bridge Replacement (In Progress)*
- *Austin – IH-35 Oltorf Rd. Widening/Bridge Replacement (In Progress)*
- *Dallas – NTTA Toll Rd – DNT Widening Project (In Progress)*
- *Austin, - MOPAC Design Build Project (In Progress)*
- *Dallas – NTTA Barrier Rehab project (In Progress)*

Work-zone QMB Cost...



\$25 to \$35 If

Case studies show QMB:

- *Reduces congestion*
- *Lowers road user costs*
- *Better haul lane protection*
- *Reduced risks delivering / removing*
- *Higher production rates*
- *Enhanced safety*
- *Lower temporary asphalt costs*
- *Faster completion*
- *Lower project costs!*



\$55 to \$75 If

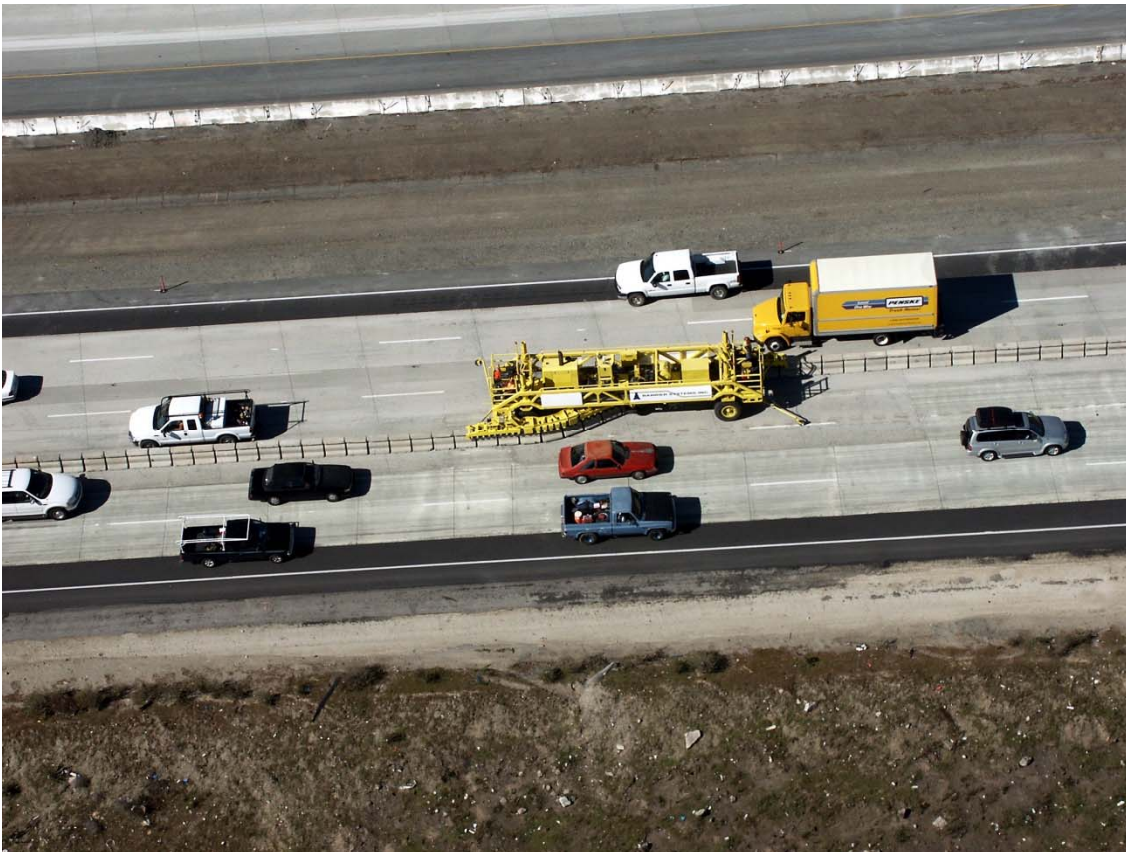
- QMB Allows Extra Lanes During Peak Traffic & Unrestricted Work Zone During Off-Peak Hours

Work Zone QMB

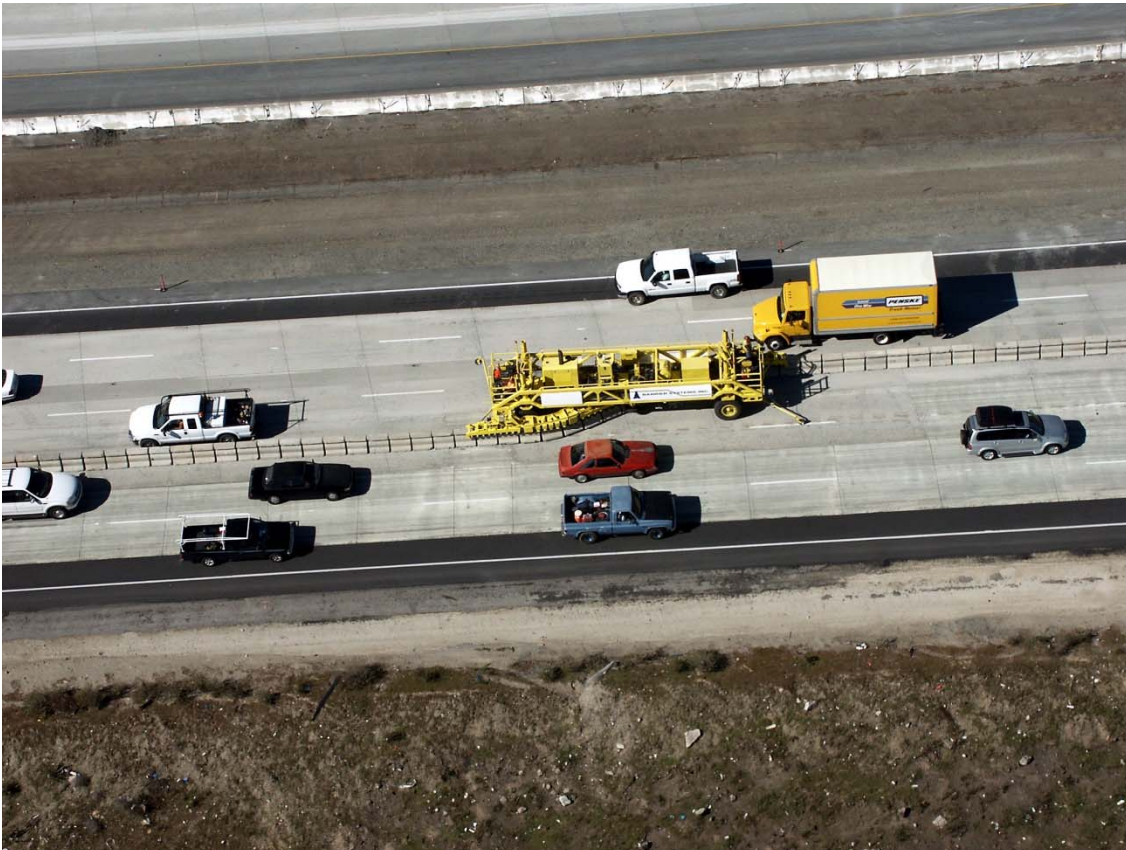


Work Zone QMB

- QMB Allows Extra Lanes During Peak Traffic & Unrestricted Work Zone During Off-Peak Hours
- Accelerates Construction... Reduces Traffic Congestion

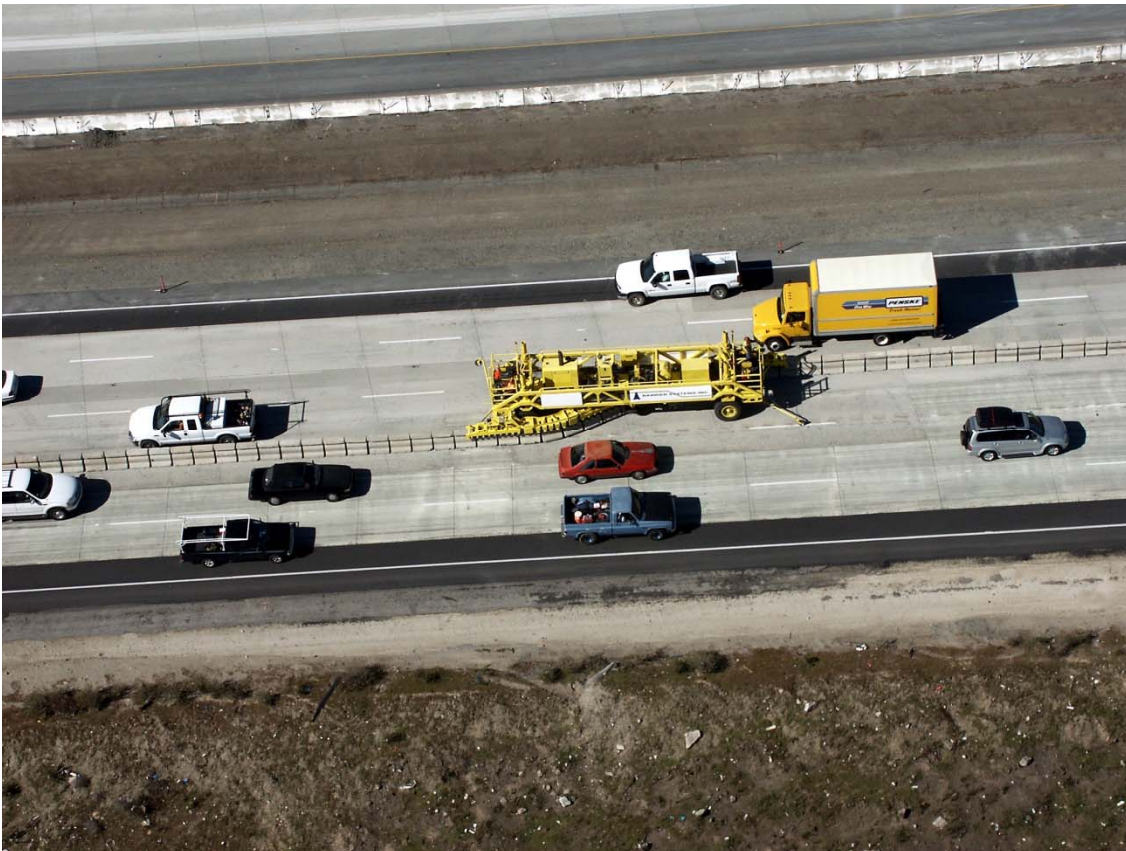


Work Zone QMB



- **QMB Allows Extra Lanes During Peak Traffic & Unrestricted Work Zone During Off-Peak Hours**
- **Accelerates Construction... Reduces Traffic Congestion**
- **Can Reduce, Combine or Eliminate Entire Construction Phases**

Work Zone QMB



- QMB Allows Extra Lanes During Peak Traffic & Unrestricted Work Zone During Off-Peak Hours
- Accelerates Construction... Reduces Traffic Congestion
- Can Reduce, Combine or Eliminate Entire Construction Phases
- Provides Positive Barrier Protection for the Workers and for The Traveling Public at All Times

QUESTIONS?

