Strategic Use of Highway Capacity
Boston, MA SE Expressway
Moveable Barrier System Components:

- 18" Reactive Tension System (RTS) Barriers
- Barrier Transfer Machine (BTM) lifts barriers by the “T-Top”
- Lateral transfers of 8 - 24 ft. in one pass, up to 10 mph
- VLBs allow for radius curves, tapers, & expansion joints
- NCHRP-350 TL3 & TL4, MASH TL3
Moveable Barrier Managed Lane Benefits

• Increase Capacity with existing roadway or with less construction
  • Quicker Deployment of managed lane
  • Less Expensive than adding lanes
• Flexibility to Reconfigure Lanes
  • Special events
  • Construction/Maintenance Operations
  • Emergency/Incident Management
• Add Capacity where adding lanes is difficult
  • ROW acquisition, Bridge issues, Roadside Geometry
• Interim or Permanent Solution
Case Study: I-30 in Dallas, Texas

• Texas Department of Transportation (TxDOT) and the Dallas Area Rapid Transit (DART) sought a short-term strategy to increase capacity on the I-30 corridor

• Led to the implementation of the first contraflow High-Occupancy Vehicle (HOV) lane to use a movable barrier in Texas
Project Intent and purpose

• In 1989, DART considered options after voters rejected a bond initiative to expand rail

• DART wanted to build transit-supportive infrastructure that could begin operating in 18-24 months

• Corridor identified because of significant congestion, 65-70% of peak period travel in the peak direction
Feasibility Assessment

• Reviewed design alternatives and operational issues

• Three options:
  1. An exclusive HOV facility in the median
  2. A concurrent flow HOV facility on the inside shoulder
  3. A contraflow HOV facility using a lane in the off-peak direction

• Chose contraflow HOV because of time limitations, and constraints from existing bridges
Concept of contraflow and Movable Barrier

Concept of “borrowing a lane” in the opposite direction for use as an HOV lane
Implementation and Deployment

• Construction started in December 1990
• First 5.2-mile segment opened in September 1991
• Expanded in 1994, and again in 2003
• Currently 11-mile facility with 22 miles of movable barrier and 4 barrier transfer machines
Design Considerations

• I-30 needed to have specific features to ensure proper placement of movable barrier
  • Freeway re-striped to make accommodation
  • Some sections of the inside shoulder were leveled off to reduce elevation difference from general purpose lanes
  • Space to store barrier transfer vehicles at termini
Concept of Operations

• A plan that outlined key steps for the movable barrier

1. Vehicle for the morning peak period will be stored near downtown on the freeway median and parked on the inside shoulder during operating hours

2. The vehicle will then close the lane by moving the barrier back to the midpoint and returning to the storage building

3. For the afternoon peak direction, storage for the barrier transfer vehicle will occur in the median area at Dolphin Road
Carpool (HOV) Enforcement

- HOV Lanes require enforcement to ensure traveler compliance
- Barrier-separated facility had limited access points
- More access points leads to increased potential for HOV violations
Perspective from DART

• Operated facility from 1991 to 2013
• Saw many benefits of the movable barrier
  • **Inherent safety benefit** as opposed to pylons and lane striping
  • Protects moving traffic from crashes on either side
  • After opening, saw a **9-12 minute travel time reduction**
• Lessons learned
  • Wanted to integrate **more technology** (Note: TxDOT installed automatic gates in 2016)
  • **Congestion now occurs in both directions**, as opposed to ~30 years ago. More of a public acceptance challenge to “borrow a lane.”
Perspective from TxDOT

• Operates facility from 2014 to present
• Felt facility helps to capture excess capacity for the peak direction
• Current operational costs
  • $212,000 per month (or roughly $2.5 million annually) to support operations and maintenance
  • $100,000 per year for the Dallas County Sherriff (patrol twice per week with an irregular schedule)
Summary

• DART and TxDOT implemented the I-30 contraflow movable barrier system as a short-term improvement

• ...but it still operates almost 30 years later with little issues

  • Increased safety from physical separation
  • Increased person throughout from travel time savings, improved transit reliability
Safety With Flexibility: Reversible Lanes

Moveable concrete barrier creates reversible lanes in minutes with positive barrier separation, returns lanes to general purpose traffic in off-peak.

**Dallas, Texas:**
- 15,000 drivers save 14 min/day
- Carpools increased 300%
- Bus ridership increased 38%
- Average vehicle occupancy: 2.9
- Benefit / Cost ratio 6.5:1
- DART’s most important revenue route
- In 2010 TX A&M University reported the HOV lane carried 17,735 persons per day.
The Solution: Automate the Lane Closure process

• Plastic gates to delineate
• Remotely Controlled and solar powered
• Lane Closure Operating Time: 4 minutes
Boston, MA
Reversible / HOV - SE Expressway I-93

• In operation since 1995
• 6 Miles in Length
• Very narrow corridor, minimal shoulders in contraflow lane
• Operating Schedule
  • 5:00 am to 10:00 am
  • 3:00 pm to 8:00 pm
• 2+ HOV
• Time savings up to 15 min (am) and 10 min (pm)
Golden Gate Bridge
First month with the Road Zipper System

January 28, 2015:
“A southbound vehicle moved into the fast lane on the south end of the bridge. The driver hit the barrier, weaved off and then hit it two more times for a total of three hits in 150 feet.”*

February 14, 2015:
“Another southbound motorist moved from the lane nearest the sidewalk to the middle lane, hit another car and pushed that vehicle into the movable barrier.”*

“We’ll never know if, without the barrier, these incidents would have resulted in head-on collisions. What bridge travelers do know is that with the barrier in place mid-span, head-on accidents are relegated to history.”*

*Dick Spotswood, Marin Independent Journal, 2/24/15
Ben Franklin Bridge, Philadelphia, PA

Moveable Median: Before & After

- Lights, striping & buffer lane
- Congestion
- Crossover accidents

- Recovered use of buffer lane
- More capacity
- Head-on collisions eliminated

Source: Delaware River Port Authority
Sydney - Victoria lane before and after Roadzipper

- Roadzipper system provides 4/2 in peak with 1 dedicated BRT lane.
- “Bus Only” lane from 5:30 am to 9:45 am

- Old layout was INFLEXIBLE with 3/3 that could not handle the peak traffic
- Delays of 18 minutes common for all users including buses
RTSGuard: Protection for Pedestrian / Bicycle Pathways

- 42” high
- MASH TL-3 approved
- Separates pedestrians and bicyclists from vehicle traffic
- Provides glare reduction for traffic

Provides flexibility to move the barrier for:
- Maintenance / Inspections
- Event or incident mgmt.
- Sweeping & cleaning
Managed Lanes Benefits
With Moveable Barrier

- Mitigate traffic congestion
- Provide positive barrier protection
- Implement Managed Lanes for a fraction of the time and cost of new construction
- Meet regional mobility & safety goals
- Reclaim unused capacity
- Generate additional revenue
- Reduce injury accidents
Questions / Comments?
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