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74<sup>th</sup> ANNUAL MEETING & EXHIBITION  
September 16-20, 2006 • Hyatt Regency Dallas • Dallas Texas USA

**IBTTA**  
International Bridge, Tunnel and Turnpike Association

**Texas Transportation Institute**

## Active Management 101: Techniques for Making Managed Lanes Work


Breakout Session: Operations and Mobility  
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## Overview


- ❖ What are *Managed Lanes*?
- ❖ What are the technical challenges?
- ❖ What are techniques for addressing the challenges?
- ❖ Where can I get more information?



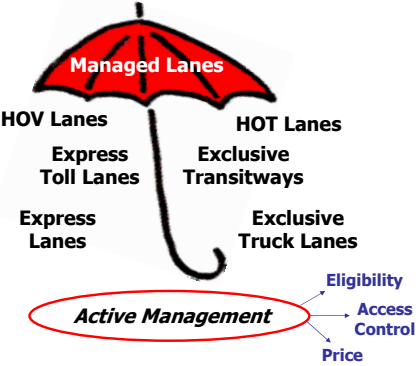
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## Defining Managed Lanes

- ❖ Strategies implemented in response to changing conditions
- ❖ *Proactively managed*
- ❖ May involve using more than one operational strategy with the goal of achieving unimpeded flow








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## In the beginning....HOV Lanes


Number of vehicles needed to carry 45 people

Bus	
Vanpool	
3 Person Carpool	
2 Person Carpool	
Single Occupant Automobile	

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## Managed Lanes

- ❖ Next generation of HOV Lanes
- ❖ HOV, Bus Rapid Transit, Congestion Pricing coming together
- ❖ Current projects relatively simple; future projects more complex

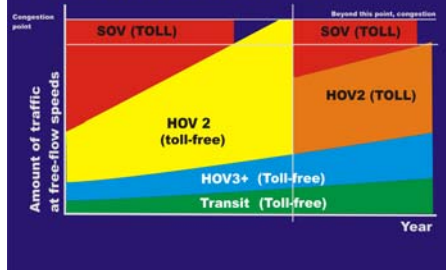


## Technical Challenges

- ❖ Operating objectives
- ❖ Lane separation and safety
- ❖ Access design
- ❖ Driver information
- ❖ Enforcement
- ❖ Traffic management/toll integration



## Lifespan of a HOT lane



## Lane Separation and Safety

- ❖ Key Findings
  - Substantial injury crash rate increases
  - Crash increase attributed to vehicles in HOV lane and first adjacent freeway lane
  - Contributing factors:
    - Traffic volumes/congestion
    - Ramp terminal spacing
    - Reduced HOV cross section
    - Speed differential
- ❖ Recommendations
  - Non-barrier cross section design – minimum 10' inside shoulder, 4' buffer

## Operating Objectives

- ❖ Policy questions that will guide operating strategy and design:
  - Who is allowed to use the managed lanes?
  - Who will receive toll exemptions or discounts?
  - What kind of pricing schedule will you use?
  - What is your operating threshold (e.g., speed)?
  - What happens when that threshold is exceeded?
  - Will the facility operate differently in the peak and off-peak periods?

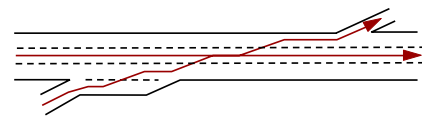
## Lane Separation and Safety



The Dallas Morning News  
HOV lanes impact: big bump in crashes  
Study cites 41% jump in injury-accident rate on LBJ, 56% rise on I-35E

## Access Design

- ❖ Weaving distances
- ❖ Mid-stream access design
- ❖ When is a direct-connect ramp needed?

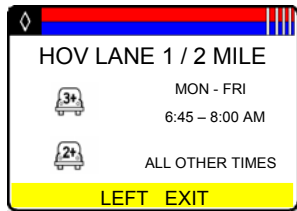


## Access Design

- ❖ Weaving distances
  - 900' weaving distance per lane under heavy congestion (2700' to cross 3 lanes)
- ❖ Mid-stream access design
  - 1300' to 1500' opening
- ❖ Direct connect ramps
  - Ramp volumes >400 vph



## Driver Information



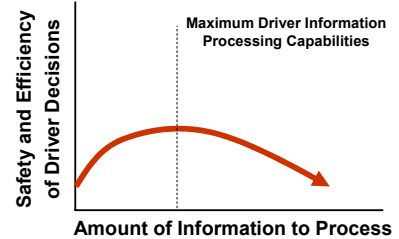
- ❖ Use of banners, plaques, symbols, color
- ❖ Sign placement – mounting position
  - Managed lanes vs. general purpose lanes
- ❖ Address early in the planning process
- ❖ Consider communication alternatives for complicated operating schemes and toll structures

## Enforcement

- ❖ Field observation in the short term
- ❖ Long term
  - Remote occupancy detection systems
    - Multi-band infrared
  - In-vehicle occupancy detection
    - Sensing technologies



## Driver Information



## Enforcement

- ❖ HOV – where it gets messy
  - Enforcement cannot be automated
  - Visual verification in the field is required
  - Separation of vehicles can increase costs significantly



## Traffic Management/Toll Integration

- ❖ Proactive management
  - Setting variable tolls to control demand
  - Life-cycle operations
- ❖ Other operations functions
  - Traffic/performance monitoring
  - Incident management
  - Enforcement
  - Maintenance



## Traffic Management/Toll Integration

“Concept of Operations” that integrates...



- Pricing
- Traffic management functions
- Signing/driver information
- Incident management
- Enforcement
- Toll operations

- ❖ Research underway:
  - Role of carpools in managed lanes
  - Truck toll lanes
  - Mid-stream access design parameters
  - Lane separation techniques
  - Managed ramps
  - Signing and traffic control devices
- ❖ Helpful resources:
  - TxDOT/TTI
    - <http://managed-lanes.tamu.edu/>
  - FHWA
    - [http://ops.fhwa.dot.gov/freewaymgmt/managed\\_lanes/index.htm](http://ops.fhwa.dot.gov/freewaymgmt/managed_lanes/index.htm)
  - TRB HOV Committee
    - <http://www.hovworld.com>
  - TRB Congestion Pricing Committee
    - <http://www.trb-pricing.org/>