### HIGH OCCUPANCY VEHICLE (HOV)/ HIGH OCCUPANCY TOLL (HOT)/ MANAGED LANE WORKSHOP #1







August 21, 2007

#### **PROGRAM AGENDA**



- Introduction to Managed Lanes
- Technical Feasibility
   Institutional Feasibility
   Financial Feasibility
   Wrap Up and Next Steps

#### AGENDA



## Welcome



## Introduction to Managed Lanes

Technical Feasibility

Institutional Feasibility

Financial Feasibility

Wrap Up and Next Steps

#### NATIONAL EXPERIENCE WITH HOV, HOT & MANAGED LANES

- History of HOV, HOT and Managed Lanes
- Purpose and Benefits of Each
- Types of Lane Treatments
- Elements of a System
- Lessons Learned
- Concluding Thoughts

#### IT ALL STARTED WITH TRAFFIC CONGESTION...



Traffic congestion costs us time.

It costs us our peace of mind and quality of life. We don't travel when we want to.

- We don't go as far as we'd like.
- We don't use the most direct route.
- We limit where we choose to live and where we're willing to work.





#### ...AND LIMITATIONS ON MEETING RISING DEMAND.



Lack of Space Environmental Constraints Inadequate Funding Explosive Growth







#### THE FIRST HOV LANES WERE DEMONSTRATIONS.



- Shirley Highway
- Blue Streak Express
   Bus Lanes
- El Monte Busway
- XBL Lane, NJ











BENEFITS OF HOV LANES - TRAVEL TIME SAVINGS - TRAVEL RELIABIL

#### **MODE SHIFTS**

#### **Example HOV Growth On I-45N**





#### **HOV LANES BECAME POPULAR**



#### **1990s: HOT LANES WERE TESTED**

 $\Diamond$ 

- Early demonstrations on SR 91 (Orange County, CA) and I-15 in San Diego
- One new facility, one converted facility
- HOVs free, SOVs pay
- Electronic toll collection made demonstrations possible



Tested congestion pricing





#### WHAT ARE HOT LANES?



- Managed priced lanes giving preference to HOVs.
- Highest HOVs are typically free.
- Offers unimpeded travel and reliability benefits during peak periods



I-394 Minneapolis SR 91, Orange County



#### HOT LANE BENEFITS



#### User Benefits

- Reliable travel time
- Reduced delay
- More choices



#### System Benefits

- Greater throughput
- Improve mainlane capacity
- Preserves future capacity
- Improved air quality
- Revenue generation



SR 91, Orange County, CA

#### WHY NOW?



#### **Elected Officials see the Benefits**





#### WHAT ARE MANAGED LANES?



- Dedicated lanes serving different users over time.
- Real-time strategies used to preserve roadway operating capacity.
- Unimpeded travel offered during periods of peak demand.



#### FORMS OF LANE MANAGEMENT



# Eligibility/Occupancy Access Restrictions

Pricing







# TYPES OF LANE TREATMENTS CONCURRENT-FLOW LANES





#### TYPES OF LANE TREATMENTS REVERSIBLE LANES



I-10, Katy Freeway, Houston

#### TYPES OF LANE TREATMENTS CONTRAFLOW LANES



IS POSTIME INC





#### **PARK & RIDE FACILITIES**





US 290, Houston

#### **CLOSING THOUGHTS**



- Three feasibilities critical for any managed lane strategy: Technical, Institutional, Financial
- Managed lanes fit a unique role and are only part of a congestion management program that includes all other approaches to addressing demand.



#### CHARLOTTE'S EXPERIENCE WITH HOV LANES

# HIGH OCCUPANCY VEHICLE LANES

#### I-77 HOV LANES



### State's First HOV Facility

- Opened December 2004, 3 years from development of conceptual design
- Added to design-build contract
- Restricted to vehicles with 2+ occupants

HIGH OCCUPANCY VEHICLE LANES

- Restricted to HOVs at all times
- Some access restrictions 1-77

#### **I-77 HOV LANES**



 Multi-agency team met during project.
 Extensive public outreach/education effort (logo, website, brochures, speakers bureau, traffic court flyers).
 Conducted 2 HOV enforcement workshops (SHP, CMPD, DA's office).

OCCUPANCY VEHICLE LANES

#### HOV DEMAND AFTER 7 WEEKS OF OPERATION

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		General Purpose Per Lane		HOV Lane	
	Direction	Vehicles	Persons	Vehicles	Persons
	Southbound AM Peak Hour	1,472	1,583	266	664
1	Northbound PM Peak Hour	1,190	1,268	325	881



#### HOV DEMAND AFTER ONE YEAR OF OPERATION

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		General Purpose Per Lane		HOV Lane	
	Direction	Vehicles	Persons	Vehicles	Persons
	Southbound AM Peak Hour	1,589	1,722	296	836
	Northbound PM Peak Hour	1,278	1,352	332	864



#### I-77 HOV - AFTER FIRST YEAR



Travel time savings around 5 minutes



- 1232 bus passengers using HOV lane daily, up 53% from fall 2004
- 77% of respondents in fall 2005 poll were familiar with HOV lanes, up from 45% in 2004
- 17% used HOV lanes regularly based on poll responses
- § 56% of poll respondents thought I-77 HOV lanes were good idea



#### **DESIGN CHALLENGES**

Southbound HOV Lane Terminus
Northbound HOV Lane Terminus
Beginning of Northbound HOV Lane
Ingress/Egress along HOV Facility



#### SOUTHBOUND HOV LANE TERMINUS



# Extends south of I-277 Exit Ramp I-77 traffic volumes are lower, improving safety for merge

#### SOUTHBOUND HOV LANE TERMINUS



Design includes HOVonly bridge over I-85 This feature dictated 24/7 operation to prevent driver confusion. Allows HOVs to by-pass I-85 ramp traffic Southbound HOV Lane is 10 miles



#### **NORTHBOUND HOV LANE TERMINUS**



3 GP lanes + HOV lane drops to 2 GP at end of current widening
Merge creates 1-mile PM Peak queue
Design has lane drops from right
HOVs bypass queue because HOV lane becomes 1 of 2 GP lanes going north

#### **NORTHBOUND HOV LANE TERMINUS**



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NOTE: Stationing is in meters; distances measured in feet



#### **BEGINNING OF NORTHBOUND HOV LANE**



- Begins ½-mile north of I-85 interchange
- Allows trucks from I-85 to merge safely into left I-77 GP Lane
   Northbound HOV Lane is 5 miles



HOV 2

ONLY

RESTRICTED

24 HOURS

VIOLATORS



#### INGRESS/EGRESS ALONG I-77 HOV LANES

- Maximum HOV Facility Access
   Safety Access
  - Restrictions
## INGRESS/EGRESS ALONG I-77 HOV LANES



## Double white solid lines for prohibited HOV lane

access ♦6-inch lines



## INGRESS/EGRESS ALONG I-77 HOV LANES



Single white skip line for permitted HOV lane access

## ♦ 10-inch line



#### **I-77 ENFORCEMENT**



Fine is only \$10 because of interpretation of State statutes Violators still have to pay court costs of \$100 Violators also get 2 points on license NCSHP is primary enforcement agency |-77 OCCUPANCY VEHICLE LANES

#### **ELEMENTS OF STUDY FEASIBILITY**

Technical 🛑 Institutional 🔵 Financial







## DETERMINING FEASIBILITY OF MANAGED LANES



- Technical: Determine measurable benefits of HOV/HOT/MLs
- Institutional: Evaluate & shape stakeholder/public attitudes
- Financial: Look at costs, revenues and other impacts

#### **TECHNICAL FEASIBILITY**



- Utilize tools developed by PB rules of thumb – lessons learned to minimize delay in reaching decisions
- Employ revenue optimization model to quickly screen toll options (HOT Lanes)
- Factor in local conditions and standards – capitalize on previous work in the region

### **INSTITUTIONAL FEASIBILITY**

- Workshop, outreach, stakeholder interviews - measure perceptions of how locals would react to managed lanes being added to the freeway system
- Get pulse of the stakeholders early
- Identify and bring the right people to the table – and listen / identify what buzz is out there

## FINANCIAL FEASIBILITY

Define financing goals and objectives

- ♦ <u>HOT Lanes</u>:
  - Congesting pricing vs. revenue maximization
  - Self supporting system vs. contributions to O&M and/or capital expenditures

HOV Lanes:

- Identifying funding/revenue sources
- Appropriately sizing the project to match availability of funding (Phasing)





# BRAINSTORM DISCUSSION: WHAT ISSUES COULD AFFECT MANAGED LANES IN CHARLOTTE?

#### AGENDA



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## **OVERVIEW OF TECHNICAL GUIDELINES & THRESHOLDS**

- Lane Management Basics
  Oritical Thresholds
- Critical Thresholds
- Typical Criteria
- Conditions for Each Strategy to Work
- Typical Output from Screening



#### WHAT DOES LOS "C" LOOK LIKE?







#### **CRITICAL THRESHOLDS**



- Travel Time Savings
  - 0.5 minutes/mile or 5-7 minutes/trip
- Adequate Use
  - Initial (opening year)
  - Forecast (planning horizon)
- Ability to Add a Lane
  - May borrow off-peak direction lane or shoulder

#### **ADEQUATE USE**

#### Vehicles

- Perception based, varies by lane treatment
- Typically 400-600 vph initially
- Persons
  - Parity or better compared to GP lanes by planning horizon (5-20 years after opening)
  - 2000 persons per hour =
    - 500 2+ carpools, 15-18 loaded buses
    - 800 2+ carpools, no buses

#### **TYPICAL SCREENING CRITERIA**

- Presence of Congestion
- Demand-HOV vehicles
- Demand-Persons (HOV and transit)
- Demand-Toll paying commuters
- Demand-Commercial vehicles
- Travel Patterns
- Roadway Characteristics

#### FOR AN HOV LANE TO WORK

#### Vehicles

- Perception based, varies by type of treatment
- Typically 400-600 vph initially
- Persons
  - Parity or better compared to GP lanes by planning horizon (5-20 years after opening)
- Ability to add a lane
- Transit and rideshare potential
- Ability to enforce

#### FOR A HOT LANE TO WORK

#### Vehicles

- Typically 1000-1200 vph initially
- Maximum of 1600-1650 vph (LOS C)
- Ability to add a lane or convert an HOV lane
- Project champion and willing stakeholders
- Revenue Impact on Adequate Use
  - 2+: May not cover pricing O&M costs
  - 3+: Maximizes revenue at sacrifice to 85% of eligible HOVs

#### FOR A TRUCK TOLL LANE TO WORK

- Requires 2 directional lanes
- Vehicles: 800 trucks/hour
- Common origins and destinations
- Mandatory tolling for financial feasibility
- Willing stakeholders
- None built yet, studied in Atlanta, Los Angeles, Bay Area

## FOR AN EXPRESS/TOLL LANE TO WORK

- Minimum of 1 and preferably 2 additional directional lanes
- Vehicles demand of 1500 per lane/hour
- Common origins and destinations
- Willing stakeholders
- Ability to largely cover all costs from revenue

#### **TYPICAL SCREENING OUTPUT**

Evaluation Matrix for Screening Las Vegas HOV Corridors													
Corridor	Segment	Presence of Congestion		Bottlenecks		Transit Service Potenfial	Travel Patterns	HOV Demand		Available Space	Connectivity needs	Segment Summary	Segment Rank
<b>⊦</b> 15	s. of I-215	0	-			0				4	-	•	
<b>⊢</b> 15	I-215 to US 95/I-515	0		9		4				0	w/ I-215 & US 95	-	•
<b>⊢</b> 15	US 95/I-515 to 215	0	•	•						4	-	9	•
<b>⊢</b> 15	N. of 215	0	0	0	0	0		0	0	-	-	0	0
H215	I-515 to I-155	-		•		0		-		۲	w/ I-15	•	-
215	I-15 to Summerlín		•	•		0		-		4	W/ 1-15	•	-
215	Summerlin to US 95	0	0	C		0				-	-	0	C
215	US 95 to I-15N	0	C	0	C	0		-		9	-	0	C
US 95	I-15 to Summerin*	0				9					w/ I-15	9	
US 95	Summeriin to 215"	C	0					-			-	•	
US 95	N. of 215	0	0	0	0	٩		٠	C	9	-	C	0
I-515	Boulder Hwy to I-15	0	•		9			-		٩	-	•	
1-515	I-215 to Boulder Hwy	C	0	C	0	٩		-			-	0	
l-515	S. of I-215	0	0	0	0	0		۲	C	-	-	C	0
Summerlin	US 95 to 215"	0	0	0	C				•		-	0	C

Notes: \* = included in no-build

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#### **EXAMPLE OF HOV DEMAND THRESHOLD**



#### **OTHER EVALUATION CRITERIA**

- Connectivity
- Safety-design attributes
- Public attitudes/support
- Sector Enforceability
- Cost/cost effectiveness
- Impacts on others
- Revenue generation potential

## POTENTIAL SCREENING CRITERIA FOR CHARLOTTE REGION



Presence of Congestion
 HOV Demand
 HOT Demand
 Physical Attributes

#### **PRESENCE OF CONGESTION**



 Line-haul congestion on freeways:
 V/C > 1.0 & speeds < 30 mph in peak period

 Line-haul congestion on arterials:
 V/C > 1.0 & speeds < 20 mph in peak period

Bottlenecks (<0.5 mi.): V/C >1.0 & speeds < 20 mph in peak period</p>

#### **HOV DEMAND**

Adequate transit ridership where carpools < thresholds</p>

 Trip distances > 5 mi. for freeways & 3 mi. for arterials

 More persons per lane than GP lanes (using 2000 persons/GP lane)
 600 PCEs/hour (min.) for freeways; 200 PCEs/hour (min.) for arterials

#### **HOT DEMAND**



- Trip distances > 5 mi. on freeways & 3 mi. on arterials for commuters or large trucks
- 1000 PCEs/hour (min.) for freeways;
  400 PCEs/hour (min.) for arterials

## Commercial vehicles

- 400 large trucks directionally/hour
- Common O&Ds > 5 mi. using corridor
- Forecasted gross revenues

#### **PHYSICAL ATTRIBUTES**

- Space for commuter demand > 16 ft. by direction
- Space for truck demand > 34 ft. by direction

 Assess feasibility of borrowing needed managed lane capacity based on above dimensions



## DISCUSSION: WHAT TECHNICAL ISSUES SHOULD BE ÅDDRESSED ?

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INSTITUTIONAL FEASIBILITY



MARKET CHARACTERISTICS AND ELEMENTS FOR SUCCESS



Product

Placement

Pricing

Promotion

#### MARKET CHARACTERISTICS & ELEMENTS FOR SUCCESS

## Product

- Is it a product that people want to buy?
  - Is there a <u>demand</u> for moving more swiftly (that matches <u>financing requirements</u>)?
  - Is it more reliable?
  - Is it safe?
- Is a product that has broad-based support \*?
  - Project "champion" necessary regardless of managed lane strategy
  - Trusted agency sponsor (DOT, transit agency, city) and willing partners (FHWA, police, courts)
  - \*unique to projects that use public \$\$ or other public resources

#### MARKET CHARACTERISTICS & ELEMENTS FOR SUCCESS

Product: Is it a product that people want to buy?

#### Placement

- Can you provide the facility in the correct location?
  - Can you provide a safe, reliable facility at strategic locations where there is congestion?
  - Can the facility be easily and safely accessed at those locations?
    - » Transit access
    - » Entrances/exits/merges

#### MARKET CHARACTERISTICS & ELEMENTS FOR SUCCESS

- Product: Is is a product that people want to buy?
- Placement: Can you provide it in the correct location?



- Pricing
  - Will consumers be willing to "pay" the product price ?
    - Can you price it so that people are willing to pay (in money or behavior) to make it beneficial to use?
      - » Carpooling/vanpooling easy to form and meet?
      - » Toll attractively priced and easily understandable?

#### MARKET CHARACTERISTICS & ELEMENTS FOR SUCCESS

- Product: Is is a product that people want to buy?
- Placement: Can you provide it in the correct location?
- Pricing: Will consumers be willing to "pay" the price?

#### Promotion

- Can you deliver the facility so that people know about and can easily purchase it?
  - Enforce Requirements
    - » Occupancy
    - » Toll
  - User "Amenities"
    - » Transit Service
    - » Park & Ride Lots
  - Toll Collection and "\$ for Service"
    - » Transponder Distribution and Servicing
    - » "Money-Back" Guarantee

#### WHAT HAVE WE LEARNED?



## No Negative Impact to General Purpose Traffic

- Converting existing lane to a HOV/HOT/managed lane
- Shoulder use requires additional incident management commitment
- Merging into and out of the managed facility can create new congestion or crashes in the GP lane
- "Non-Compete Terms" for HOT/managed vs. GP Lanes
#### WHAT HAVE WE LEARNED?

## **Facility Perceived as Effective**

- Ensure that project has adequate usage day of opening for public acceptance and users safety
  - Meets minimum thresholds for use
  - Low level of violations
  - No perception of negative impacts on adjacent users
  - Access to/exit from tolled lanes do not impede GP lanes

#### WHAT HAVE WE LEARNED?

## **Facility Perceived as Customer Friendly**



- Easy to obtain and "reload" transponder
  - Easy to obtain in person, on phone or through internet
  - Rewards for account management via internet or frequency of use
- Policies and procedures for "money back" guarantee (HOT)
  - Users are "paying for level of service." What happens when the level of service isn't delivered?

#### WHAT HAVE WE LEARNED?



# Facility "Honest & Acceptable" to General Public

- Operator(s) of facility have a positive standing in the community
  - Denver and Texas examples
- Enforcement preparation and implementation
  - Troopers are trained and assigned
  - Judges educated regarding their enforcement role
- Fines are appropriate and legislatively enabled
  - Fines
  - Court Costs
  - Insurance Points

#### WHAT HAVE WE LEARNED?



## **Current Project Challenges**

- - People Moving vs. Vehicle Moving
  - Air Quality
  - Revenue Generation

#### WHAT HAVE WE LEARNED?





## **Current Project Challenges**

## Hybrid Usage

- Can clog HOV lane
- Hybrids use their gas engines (vs. energy efficient electric) when they are operating at 45+ mph 90% of the time, but are not "super energy efficient" when operating at freeway speeds -- conversely they offer more air quality benefits when operating in slowspeed traffic.

 "Speed is your enemy. The ideal routes have long stretches without stops, and speed limits of 30 - 35 mph. The maximum allelectric speed is 40 mph. The "sweet spot" for most hybrids, in "steady state" testing, is between 40 and 45 mph." http://www.hybridcars.com/gas-saving-tips.html





# STAKEHOLDERS INTERVIEW FINDINGS TO DATE

## **STAKEHOLDERS INTERVIEWED**



Stakeholders	Representing	Status
David Hoyle	NC Senate	
Sue Myrick	US Congress	
Lee Myers	Matthews	X
Buddy Motz	York County Commission	
Bill Thunberg	Mooresville	X
John Lassiter	Charlotte City Council	X
Lisa Renstrom	Sierra Club	X
Ronnie Bryant	Regional Partnership	X
Sgt. David Witherspoon	State Highway Patrol	X
Stacy Davis	Wachovia Bank	X
John Cox	Cabarrus Chamber of Commerce	X
Allen Tate/ Natalie English	Regional Roads Committee	
Alan Smith	Harris Teeter	X





# DISCUSSION: WHAT INSTITUTIONAL ISSUES SHOULD BE ADDRESSED?

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# Financing Pricing Examples

### FINANCING



Federal Demons- tration Funds	<ul> <li>TEA-21 – USDOT's FHWA and State and or Local agencies</li> <li>Value Pricing projects</li> <li>Project - The HOT Lane program in Houston</li> </ul>
State Funds	<ul> <li>E.g. State Infrastructure Bank – like private banks</li> <li>Projects - Pocahontas Parkway, VA and Butler Regional</li> <li>Highway in Ohio</li> </ul>
Local Sales Tax Initiatives	E.g. sales tax, motor fuel taxes, motor vehicle registration taxes, commuter taxes, tax increment financing, and other forms of special assessment
Bonds/ Private Financing	<ul> <li>taxable toll-revenue bonds – private financing</li> <li>tax-exempt toll revenue bonds – public financing</li> <li>Project – SR-91, Orange County, CA</li> </ul>
Innovative Financing Programs	<ul> <li>Section 129 Loans – allows Federal participation</li> <li>Transportation Infrastructure Finance and Innovation Act</li> <li>Project - President George Bush Turnpike, Dallas, first highway facility to be financed with Section 129 loans.</li> </ul>

### PRICING



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Variable Tolls	Toll roads, bridges, existing toll- free facilities			
Cordon Charges	Charges within an area			
Area- wide Charges	Per-mile charge in an area			
Variable Priced Lanes	<ul> <li>Express Tolls</li> <li>High Occupancy Toll lanes</li> </ul>			

#### **PRICING EXAMPLES**



Currently over 130 managed lanes projects in US and Canada





## **SR-91 EXPRESS LANE, ORANGE COUNTY**

- Privately financed
- Variable rate bank loans, long term loans, private equity, subordinated debt.
- FasTrak transponder
- HOV 3+ gets 50% discounts
- ♦ Toll \$1.10 \$7.75
- ♦ Time of day



A

CARPOOLS

## I-15 HOT LANES, SAN DIEGO



Value Pricing Pilot Program grant
 \$1.99 million local matching funds
 \$230,000 FTA



- 1998 FasTrak Dynamic Tolling
- \$ \$ 0.50 \$4.00 (\$0.25 increment),
  - maximum \$8.00
- ♦ HOV 2+ free



## I-10 & US-290 HOT LANES, TX

- ♦ 1998 QuickRide on existing I-10 HOV
- No SOVs, 3+ is free
- Limited 2+ pay \$3.00 toll during peak
- Revenue pays all operational costs



## I-394 HOT LANES, MN

- MnPass converted HOV to HOT
- Oynamically priced

CYCLES FRE

1200

- Free to HOV and motorcycles
- No toll during off-peak
- Average \$1.16 toll per trip

## I-15 EXPRESS LANE, UT

- Free to 2+, buses, motorcycles & clean fuel vehicles
- \$50 per month decal, renews monthly
- Longest HOT lanes in operation in the USA (38 miles)
- Fines are \$82 Salt Lake County and \$92 in
   Utah County



## **I-25 HOT LANES, DENVER**

- EXpressToll transponders
- Time-of-day (TOD) toll levels
- Free to HOV, buses, motorcycles
- Purpose cover M&O expenses not revenue maximization
- Actual Revenue
   3x estimated

НОТ	Annual Gross Revenue	Mi.	HOT lanes	Operation	Toll Range	Who Pays
SR-91, CA	\$39.5M	10	4	All-day TOD toll	\$0.75 – \$9.50	SOV toll, HOV3+ 50% free off-peak
I-15, CA	\$2.0M	8	2	Reversible Peak periods Dynamic tolling	\$0.50 – \$4.00	SOV toll, HOV2+ free
I-10, TX	\$0.16M <i>QuickRide</i>	13	1	Reversible Peak periods Fixed toll	\$3.00	NO SOV HOV2 toll/free off-peak, HOV3+ free
US-290, TX	See above	15.5	1	See above	See above	See above
I-394, MN	\$1.3M	9.8	2	Reversible & Concurrent Peak periods Dynamic tolling	\$1.00 – \$4.00	SOV toll, HOV2+ free
I-15, UT	n/a	38	2	All-day Both directions Monthly decal	<b>\$50</b> per month	SOV toll, HOV2+/clean- fuel free
l-25, CO	\$1.6M	7	2	Reversible Peak periods TOD toll	\$0.50 – \$3.25	SOV toll, HOV2+ free





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