

HOT Lane Travel Demand Forecast

Historical Perspective and the Implications for Future Application

**2nd International symposium on
Freeway and Tollway Operations**

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June 22, 2009

HOT Evolution

- **HOT lane concept evolved over the last decades**
- **Several projects have been successfully implemented**
- **The HOT concept has gained growing interest in the U.S.**
- **Recent trend**
 - **HOT lanes → HOT network**
 - **More expectations on revenue generation**

HOT Evolution DFW Priced Facilities Plan

Mobility 2030 The Metropolitan
2009 AMENDMENT Transportation Plan

Priced Facilities

Legend

- Existing Toll Facilities
- Future Toll Facilities
- Future HOV/Managed Facilities*
- Freeways/Tollways

Fort Worth CBD



Dallas CBD



Corridor specific design and operational characteristics for the Freeway/Tollway system will be determined through ongoing project development.

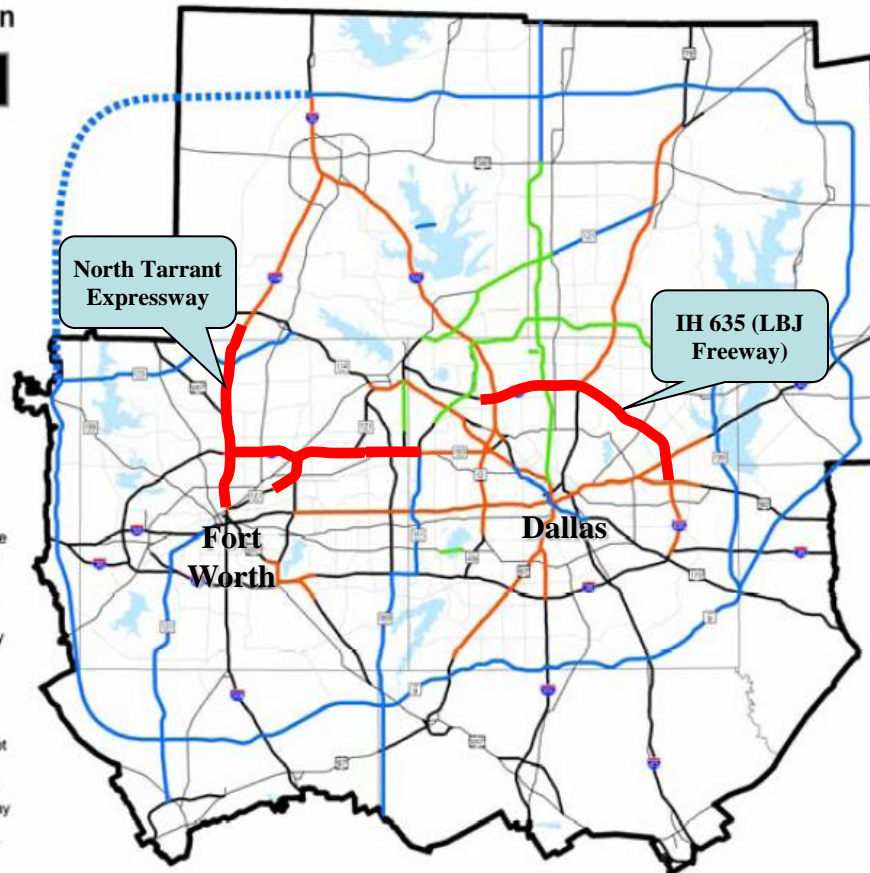
Additional and improved Freeway/Tollway interchanges and service roads should be considered on all Freeway/Tollway facilities in order to accommodate a balance between mobility and access needs.

All Freeway/Tollway corridors require additional study for capacity, geometric, and safety improvements related to truck operations.

New facility locations indicate transportation needs and do not represent specific alignments

Operational strategies to manage the flow of traffic should be considered in the corridors where additional freeway or tollway lanes are being considered.

* Existing lanes in corridor remain free. Toll charged on new capacity only and will include HOV Incentives.



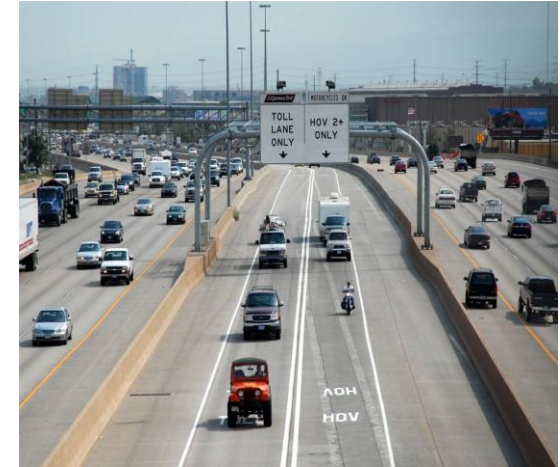
North Central Texas
Council of Governments
TRANSPORTATION

\$17.9 Billion of Innovative Funding Strategies (2006\$)

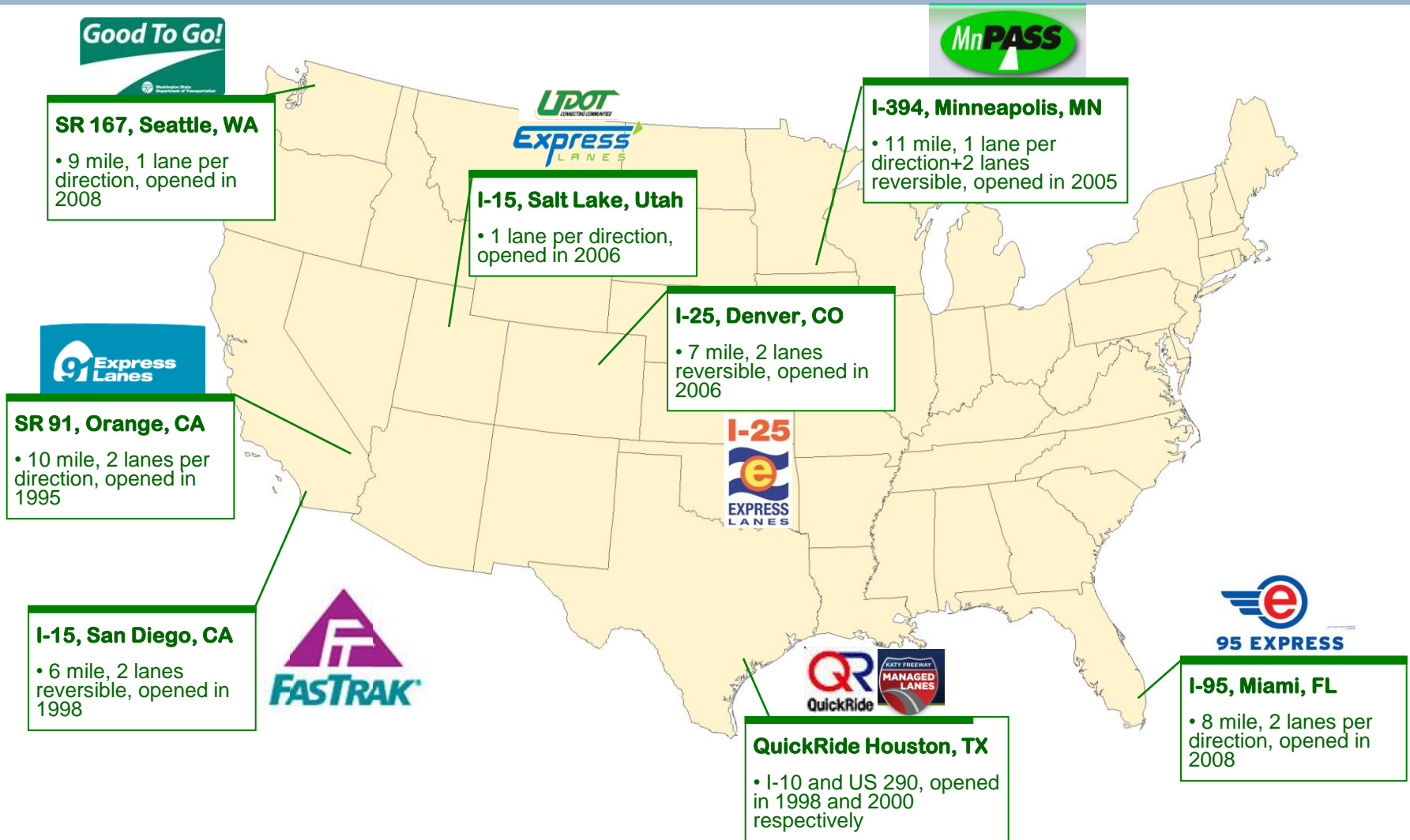
April 9, 2009

Unique Operations

- **Parallel Competing Route**
 - Infrequent uses
 - Critical benefit quantification
- **Mixture of Toll and HOV**
 - Eligibility or priority of services
 - Potential mode shift
- **Congestion Pricing**
 - Congestion-free flow on HOT
 - Potential peak spreading



Existing HOT Projects

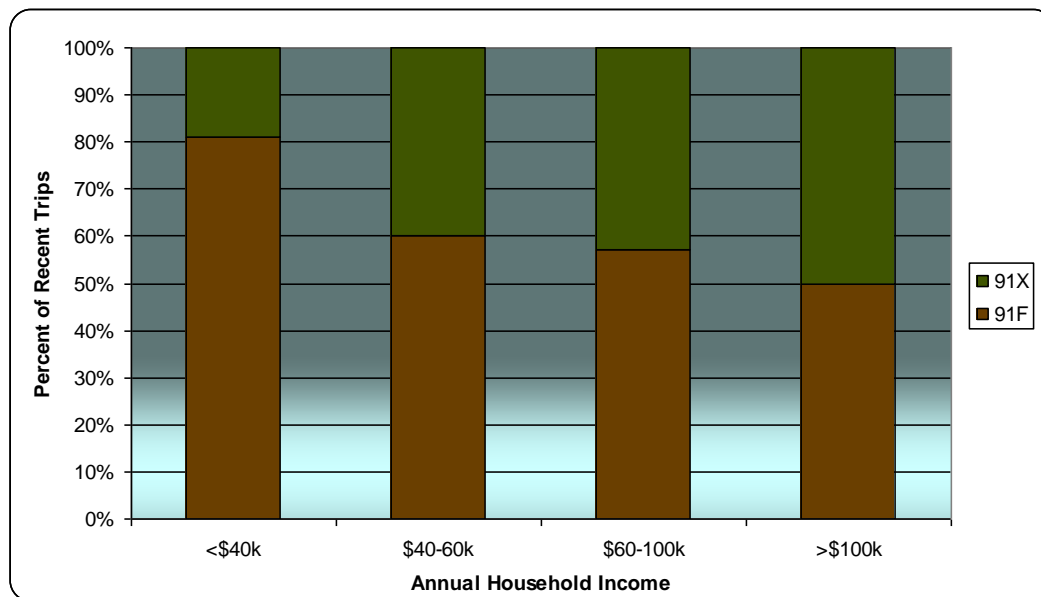


Understanding the Users

- **Who are the users?**
- **Why do they use HOT lanes?**
- **How often do they use?**

Who are the Users?

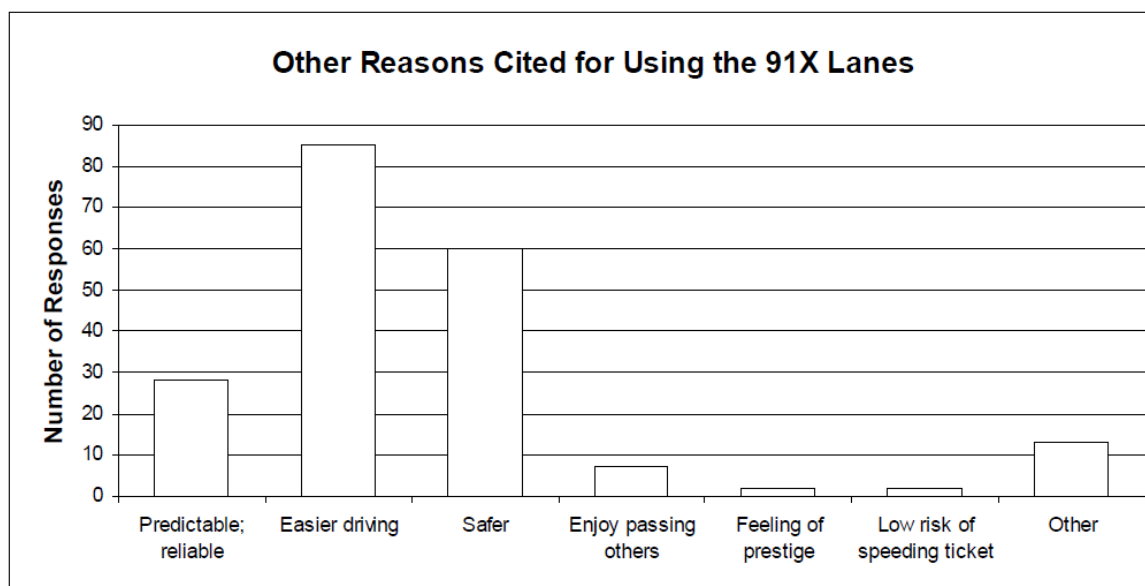
- Commute trips, longer distance trips and high occupancy vehicles are main customers
- Travelers with higher income are more likely and frequently to use HOT lanes



SR 91 Survey
in 1996

Why do they use?

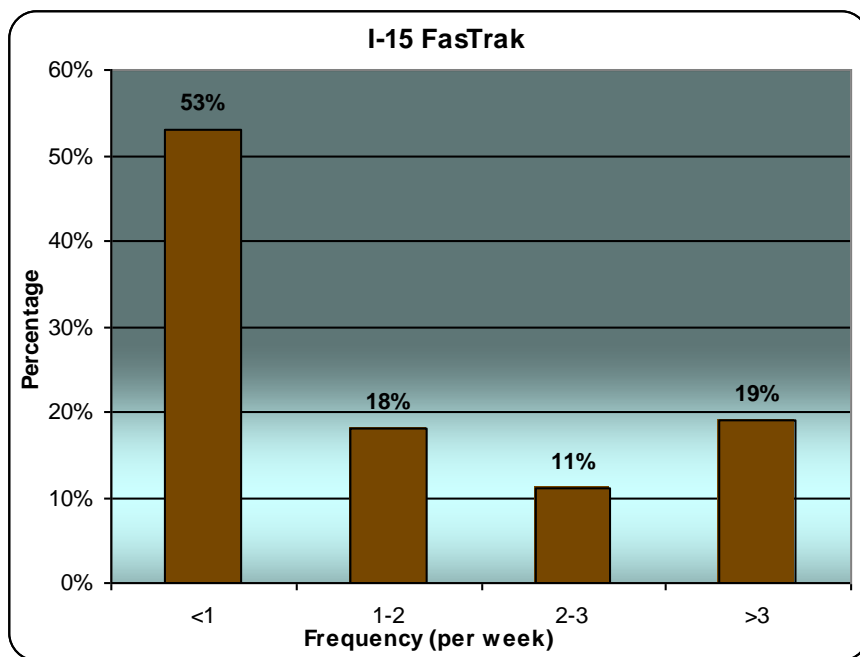
- Travel time saving is the primary driver
- On-time arrival (**I-15**), travel time reliability (**QuickRide**), driving comfort and safety (**SR 91**) are secondary factors



SR 91 Survey
in 1999

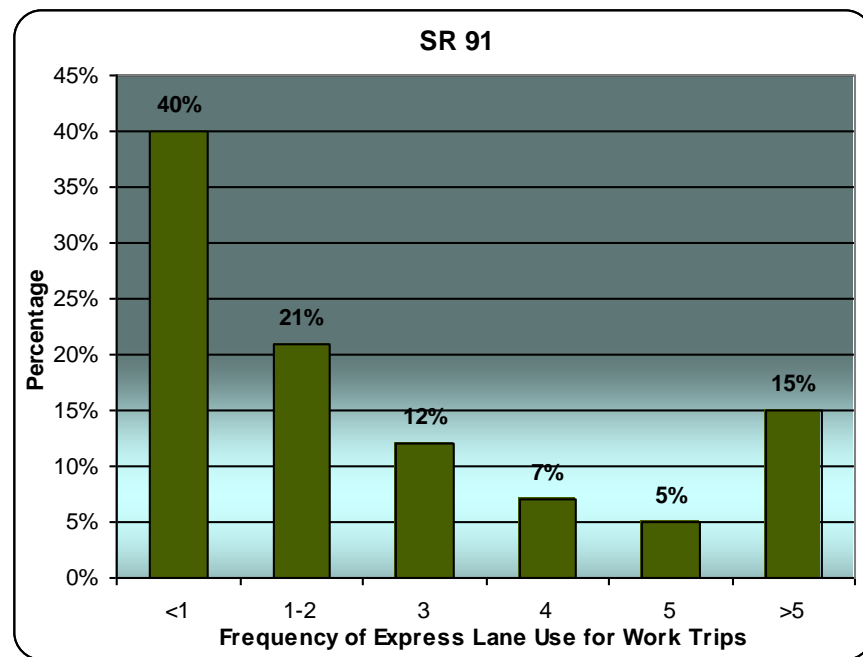
How often do they use?

- Less than once per week (QuickRide)
- Twice per week (MNPASS)



Average = ~ 1.6

Source: Hultgren, L. and K. Kawada. San Diego's Interstate 15 High-Occupancy Toll Facility Using Value Pricing. ITE Journal, June 1999



Average = ~ 2.5

Source: Edward C. Sullivan and Joe E. Harake (1998) "California Rount 91 Toll Lanes Impact and Other Observations", TRR 1649

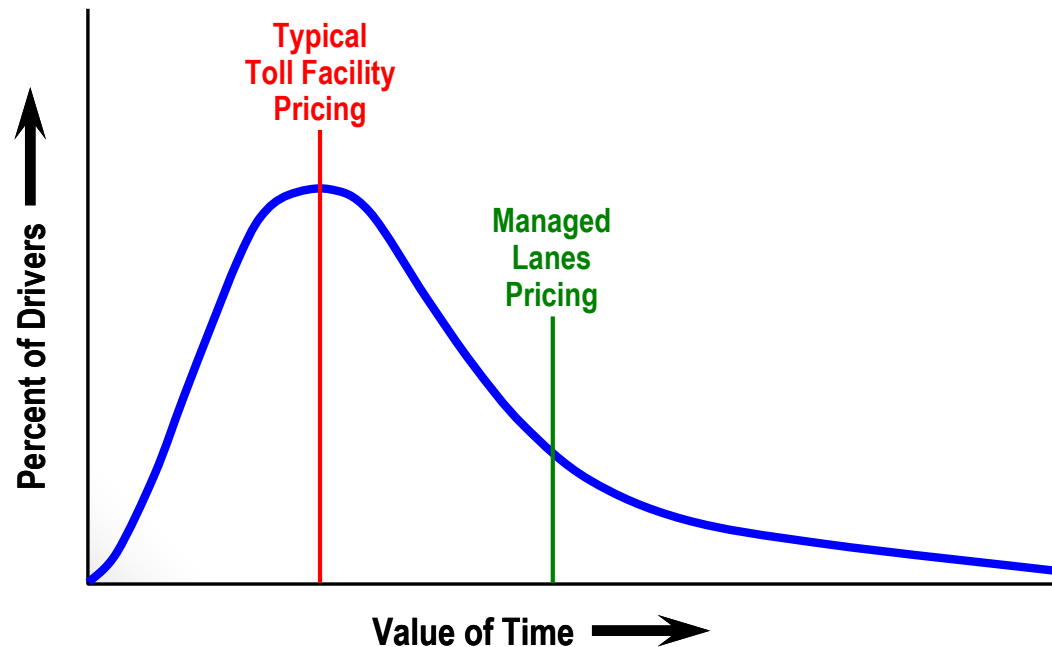
Challenges on Demand Forecast

- **Willingness-to-Pay**
- **Travel Time Saving**
- **Mode Shift**
- **Peak Spreading**
- **Congestion Pricing**

Willingness-to-Pay

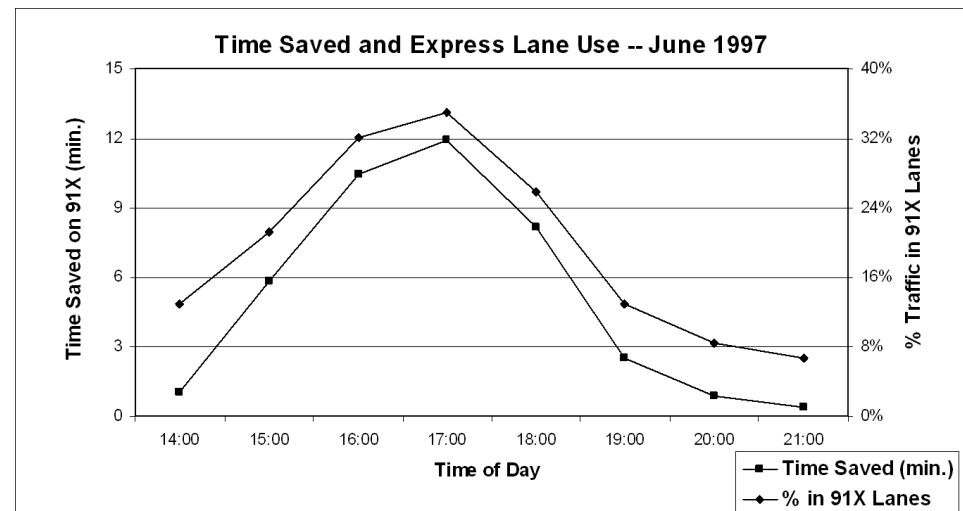
- **How reliable is VOT calculation?**
 - VOT varies across locations and by project
 - VOT under time pressure

- **How important is reliability?**
 - Reliability accounts for one third of the service benefit



Travel Time Saving

- Actual time saving during peak hours (min per mile): 0.6-1.0 (SR 167), ~0.7 (I-15), 0.9-1.3 (SR 91)
- Perceived time saving vs actual saving (min): 20 vs 4 (I-15), overestimate by 5-30 (SR 91)
- Should “buffer time” be included?
- Modeling travel time difference



Source: Edward C. Sullivan (2002) "State Route 91 Value-Priced Express Lanes Updated Observations", Transportation Research Record 1812

Mode Shift

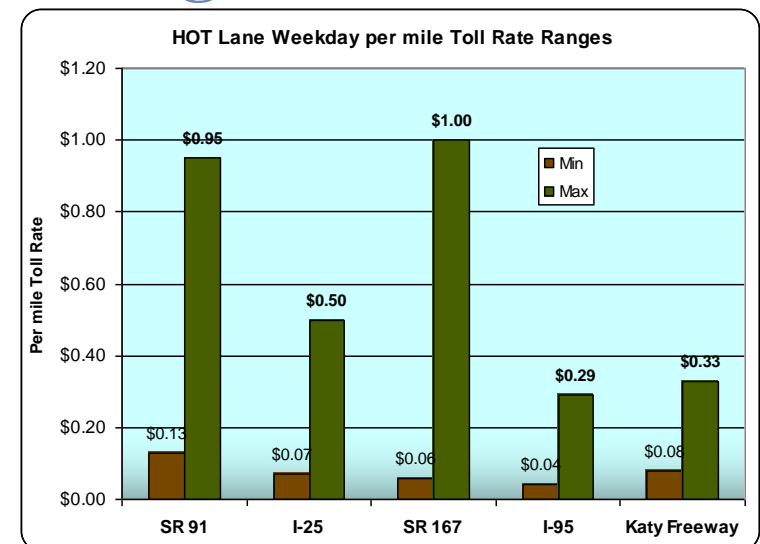
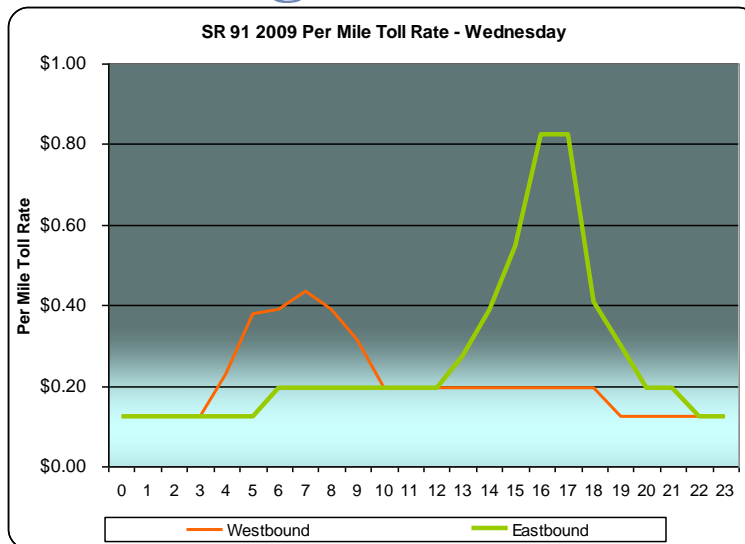
- **Important for revenue forecast due to the differential pricing**
- **Shifts were found on both ways between SOV and HOV with the conversion of HOV to HOT**
- **Mixed observations of the total impact**
 - **SR 91: one-time 40% increase in HOV3+ volume**
 - **QuickRide: mode shift from SOV to HOV accounts for 50% of total QuickRide trips**
 - **I-394: HOV volumes decrease**
 - **I-15 FasTrak: HOV volumes on I-15 mainlane decline**

Peak Spreading

- Important for the toll rate estimate and revenue projection
- The magnitude depends on the demand elasticity and toll difference
- Field observations:
 - I-15: “there was a shift from the middle of the peak toward the shoulder of the peak for either peak period”
 - SR 91: Westbound (AM peak) is more sensitive than eastbound (PM peak); no conclusion made for PM peak
 - QuickRide: “Substantial shifts in mode and time of travel are possible with HOV2 value pricing”

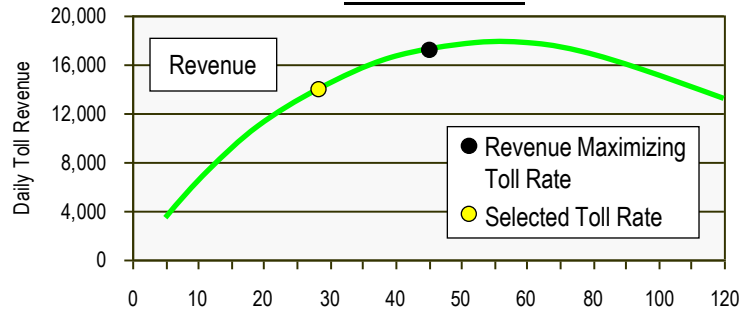
Congestion Pricing

- Pricing by occupancy, varies based on traffic level
- Toll sensitivity analysis is used to determine the optimum toll
- Price elasticity hinges on the reliable estimate of time saving and the diversion algorithm

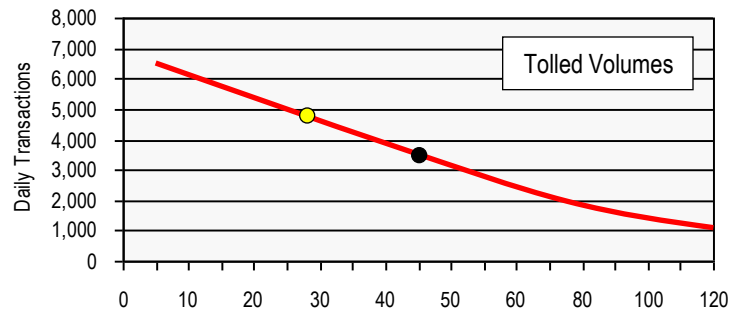


Congestion Pricing

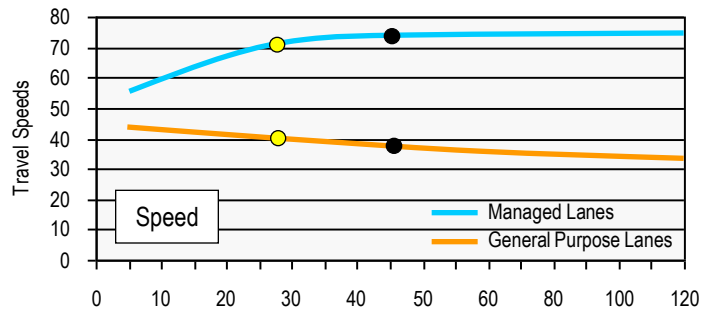
Southbound



Per Mile Toll Rate In Cents Per Mile

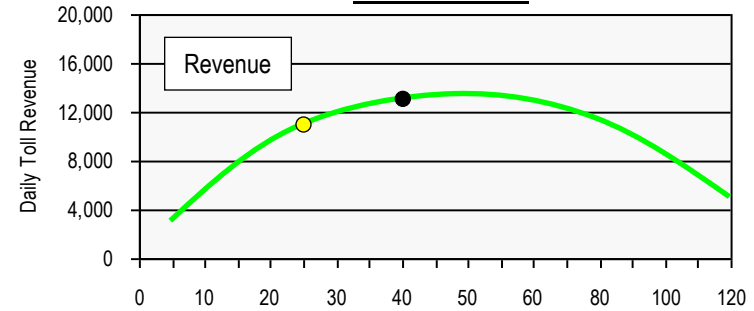


Per Mile Toll Rate In Cents Per Mile

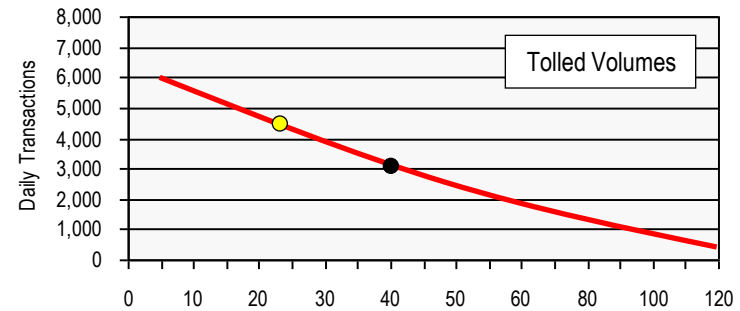


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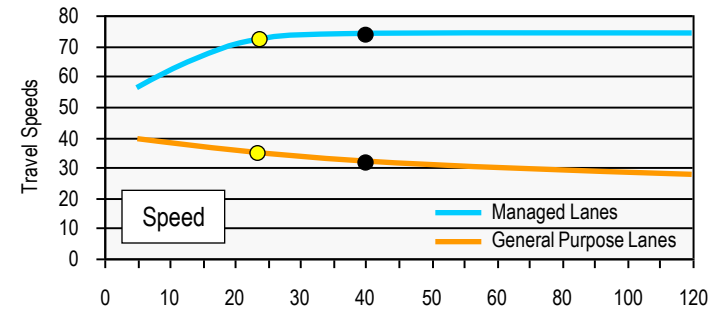
Northbound



Per Mile Toll Rate In Cents Per Mile



Per Mile Toll Rate In Cents Per Mile

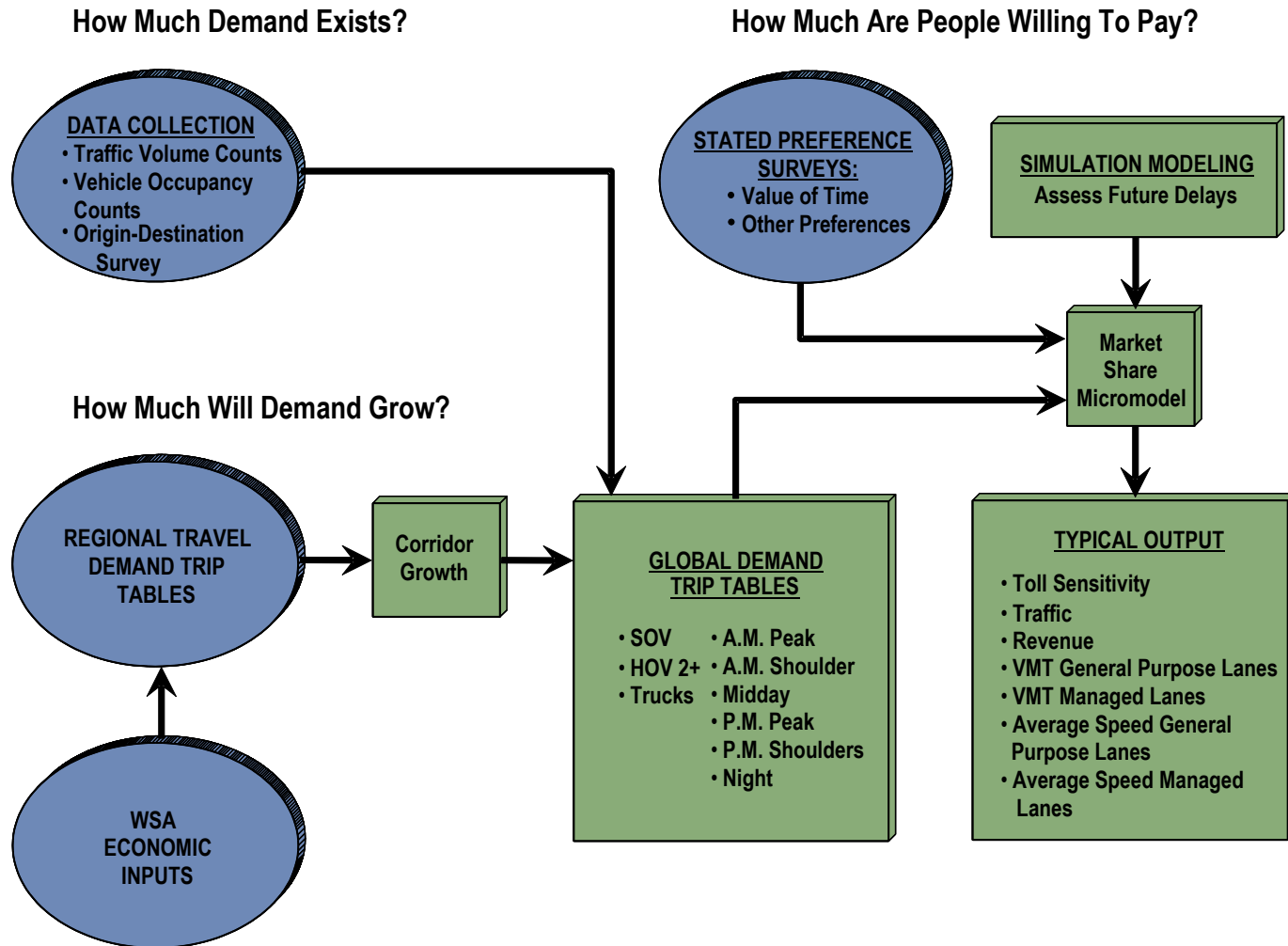


Per Mile Toll Rate In Cents Per Mile

Demand Modeling

- **Traditional four-step model is still the primary tool but with variations**
 - **Generalized cost method**
 - **Toll diversion method**
 - Trip table split within mode choice
 - Toll choice in traffic assignment
 - **Logit model application**
 - **Dynamic traffic assignment**

WSA Approach



Summary

- **HOT lane unique operating characteristics pose challenges for demand and revenue forecast**
- **Existing findings and observations provide invaluable information for the understanding of HOT lanes**
- **Some HOT impacts remain unclear or not well quantified; more before and after studies are needed**
- **Sensitivity and uncertainty analysis should be conducted to evaluate the variation of base forecast**

Thanks !

Questions?

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