Networks vs. Individual Managed Lanes:

How and Why They Differ

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Two very different types of Managed Lanes

- ML 1.0: Carpool (HOV) lane that sells excess capacity to non-carpools.
- ML 2.0: Express toll lane selling congestion relief, while providing some HOV preference.

Key differences between ML 1.0 and ML 2.0

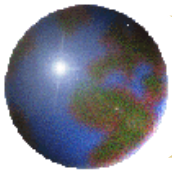
	ML 1.0	ML 2.0
HOV type	HOV-2+	HOV-3 or above
Infrastructure	Conversion	Construction
Revenue use	Transit ops	Debt service
Configuration	1 lane/dir.	2 lanes/dir.
Examples	I-15, I-394 I-25, SR 167	SR 91, I-495

Performance differences between ML 1.0 and ML 2.0

	ML 1.0*	ML 2.0**
Percent tolled	32.5%	83%
Annual revenue	$1.7M	$37.5M

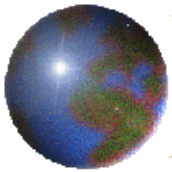
*Average of 4 projects
**SR 91 only

Managed Lanes Projects, 2009



Regions planning ML networks

- In Long Range Plan already:
  - Dallas
  - Houston
  - San Diego
  - San Francisco
- Being considered:
  - Atlanta
  - Los Angeles
  - Miami
  - Seattle
  - Washington, DC



Why ML networks should adopt the ML 2.0 model

- Need to add significant new capacity
- Need to pay for new capacity
- Need to “manage” nearly all traffic
- Enforcement considerations

Need for considerable new capacity

- Many freeways have no HOV lanes to convert.
- ML to ML flyover connectors needed.
- Direct access ramps, for transit/other users also needed.


Main Lanes
Managed Lanes
Direct Access Road to Arterial
Direct Transit Access Ramps
BRT Station

Potential ML Networks

Metro Area	Lane-Miles	Existing HOV l-m.	% New	Cost $B*
Atlanta	486	128	74%	$5.2
Dallas	500	80	84	4.8
Houston	447	133	70	3.5
Los Ang.	1009	624	38	13.5
Miami	237	20	92	2.5
San Fran.	583	285	51	6.1
Seattle	505	205	59	5.1
Wash, DC	475	170	64	6.8

*2000 $, HERS

Cautions re network cost estimates

- Costs are 2000 $, from FHWA HERS
- Single lane per direction
- Roadway construction cost only (not including gantries, electronics, etc.)
- Assumes all full-width lanes.
- For comparison, a hypothetical 2008 mostly dual-lane network for Miami has 597 ln-mi and estimated 2008 cost of $7.2B.

Revenue potential to cover majority of construction cost

Metro	Est. Cost	Est. Bond	% of Cost
Atlanta	$5.2B	$3.1B	60%
Dallas	4.8	3.2	66
Houston	3.5	2.2	64
Los Ang.	13.5	8.3	62
Miami	2.5	1.4	56
San Fran.	6.1	3.7	61
Seattle	5.1	2.7	53
Wash, DC	6.8	3.0	44

For reliable LOS C traffic, most vehicles must be priced.

Atlanta I-75 HOT Lane study (HOV-2)

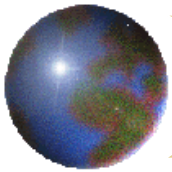
PM peak, 2030, MLs with 28% of total lane capacity approach 25% of traffic; hence, are closed to SOVs.

91 Express Lanes, (HOV-3 discount)

PM peak, 2006, MLs with 33% of total lane capacity handle 49% of total traffic, nearly all of whom pay the market price.

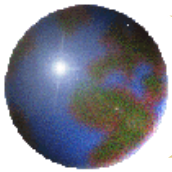
Synergy of Managed Lanes and bus rapid transit (BRT)

- Value-priced lane is *virtual equivalent* of an exclusive fixed guideway.
- Pricing limits vehicle flow to what's compatible with LOS C conditions.
- Reliable high speed is sustainable long-term, thanks to pricing.
- Houston implementing first such project on new Katy Freeway managed lanes.



How ML network differs from stand-alone ML

- Complex pricing
- Complex signage
- Complex system operations and control
- Need for automated enforcement

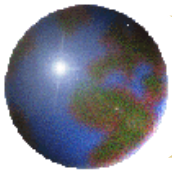


Complex pricing

- From any entrance to any exit (a la 407 ETR in Toronto)
- Different demand on different links
- Hence, link-specific pricing
- Probably price as cents/mile, based on miles driven each link.

Complex signage

- Variable message signs
- Placed prior to each link
- Current rate/mile for upcoming link
- No way to convey total trip price



Complex system operations and control

- Dynamic pricing on dozens of links
- Maintain LOS C on all links
- Cope with incidents
- Major investment in ITS

Need for automated enforcement

- Most freeways don’t have space to add “declaration” or “enforcement” lanes.
- Networks with many links and multiple entrance/exit points would require multiple enforcement zones.
- Visual observation is even more labor-intensive with multiple zones.

Limitations of roadside and in-vehicle occupant detection

- Lack of rear-seat capability of most approaches.
- Added cost for all cars (if in-vehicle), when only a small fraction use HOV or HOT lanes.
- Long phase-in period, if in-vehicle (20-year fleet turnover).
- Serious privacy concerns.

Alternative: redefine carpools eligible to use HOT lanes

- Original purpose of HOV lanes was to get *commuters* to share rides, leaving vehicles at home.
- *Registered* carpools would restore this concept, via local ride-sharing agencies.
- Agency would audit employers to ensure carpools remain in operation.

Enforcement of registered carpools

- Carpool gets transponder with carpool ID number.
- Tolling software charges zero or discount toll during peak periods.
- Enforcement becomes standard electronic toll enforcement:
  - Valid transponder
  - Valid account

Policies for ML Networks

- HOV 3 or higher (Super-HOT)
- Guaranteed capacity for BRT service
- Registered carpools only
- Charge per mile, per segment (dynamic pricing)
- Flyover connectors at principal-flow interchanges
- 2 lanes/direction where feasible

BRT/Managed Lanes *Move People*

Level of Service	Vehicles per Hour	Vehicle Speed	Vehicle Occupancy	Passenger Trips per Hour (ptph)	Equivalent Lanes
LOS C	1,600	50-60	1.2	1,920	1
Bus Toll Lane @ 25* (1.6%)	1,587 **	50-60	2.7	4,296	2.2
Bus Toll Lane @ 50* (3.2%)	1,575**	50-60	4.0	6,242	3.3
Bus Toll Lane @ 100* (6.4%)	1,551**	50-60	6.5	10,134	5.3

*Assumes an 80-Passenger Bus

** Assumes 15% HOV3

Source: Tampa-Hillsborough County Expressway Authority

How ML/BRT network compares with Light or Heavy Rail Transit

500 ln-mi ML/BRT: $5 B (@$10M/ln-mi)
500 ln-mi ML/BRT: $8 B (@$15M/ln-mi)
250 rt-mi LRT: $31 B, per FTA
250 rt-mi HRT: $38 B, per FTA

Plus, the ML/BRT guideway would not depend on limited FTA funding.

ML network effects (vs. stand-alone ML)

Effect	Implication
Higher total usage	Greater revenue/mile
Higher transponder use	Lower collection costs
Greater bus ridership	Increased transit share
Increased complexity	Greater equipment cost
Economies of scale	Some cost savings

Conclusions

- Managed Lane networks differ profoundly from stand-alone MLs
- To be feasible, ML networks must operate as ML 2.0.
- Loss of HOV-2 carpools can be offset via much higher person throughput from BRT.
- Policy decisions are critical to success of ML networks.

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