



Handling Congestion for Dynamically Priced Managed Lanes with a Maximum Toll Cap

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The Problem

Agencies view dynamic tolling as valuable for ensuring performance on managed lanes

Tolls **increase** and **decrease** in response to demand

...but reports about **high tolls** have led to **considerable public backlash**

Media Headlines

The toll on I-66 inside the Beltway hit \$46.75 on Wednesday morning

In Texas, Toll Roads Proliferate—and a Backlash Builds

Paid-Access Highways Gain Favor Amid Limited Transit Funds; 'If You Can't Afford It, Don't Build It'

Anti-toll movement may upend North Carolina's first transportation P3

\$75 tolls and \$200 martinis: Seattle's future is nearer than you think

Agency Response

Common response to adverse public reaction is to limit, or **cap toll increases**

But... toll caps **limit the ability** to actively manage demand

Because... congested facilities **move fewer people and vehicles**

Prior Experience and Research

NCHRP Project 03-96
(Web-Only Doc 191)

Estimated capacity for ML facilities for the HCM

Key factors

Separation Type

Access Points

Number of Lanes

Free-Flow Speed (mph)	Estimated Lane Capacities (veh/hr/ln)				
	Continuous Access	One-Lane Buffer	Two-Lane Buffer	One-Lane Barrier	Two-Lane Barrier
75	1,800	1,700	1,850	1,750	2,100
70	1,750	1,650	1,800	1,700	2,050
65	1,700	1,600	1,750	1,650	2,000
60	1,650	1,550	1,700	1,600	1,950
55	1,600	1,500	1,650	1,550	1,900

Research Plan

Developed two case studies: **95 Express** in Florida, **I-405 ETLs** in WA State

Phone interviews with agency staff to obtain a qualitative perspective

Speed, volume, and toll rate data to obtain a quantitative perspective

SE Florida: 95 Express

Operated by Florida DOT

Two-lane with pylons

Phase 1A & 1B: 7.3 miles

Phase 2: 14-mile extension

One toll gantry per segment



95 Express: Toll Policies

Florida State Legislature establishes toll rates and policies

“Maximum toll on I-95 between MM 4 and MM 12 will not exceed \$1.50 per mile”

But... “If the ELs reach max for 45 days during 6-month period, the max toll increase by \$0.50”

Registered HOV3+ travel toll-free

Toll-exempt volume constitutes 6.5% of total

95 Express: Dynamic Toll Processes

WSDOT uses **open-source algorithm** originally developed by Minnesota DOT

Uses **15-minute speed and volume data** to calculate density

Pre-established table that links toll rates to specific traffic density ranges (e.g., LOS C to \$1.50 - \$3.00)

Data collected from sensors **spaced every 1/3-mile**

95 Express: Mitigation Around Toll Cap

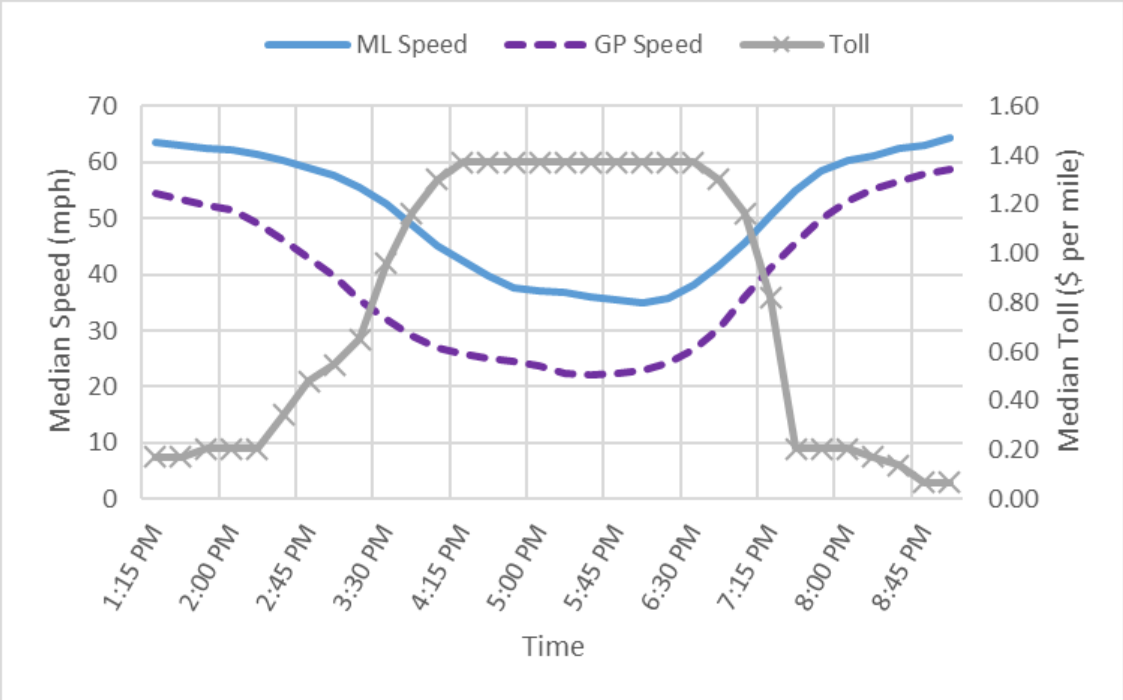
FDOT modified algorithm to be more responsive to traffic density

Added weights to specific traffic data sensors

Increased resources for incident management and enforcement

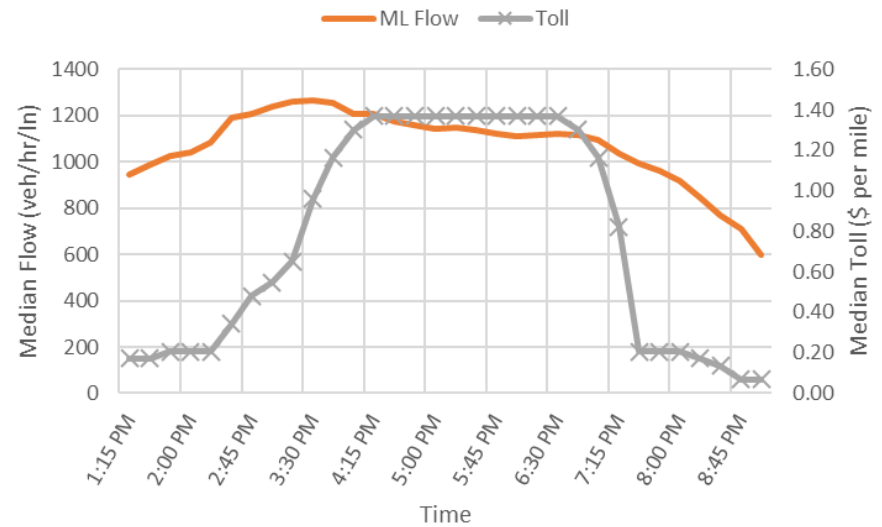
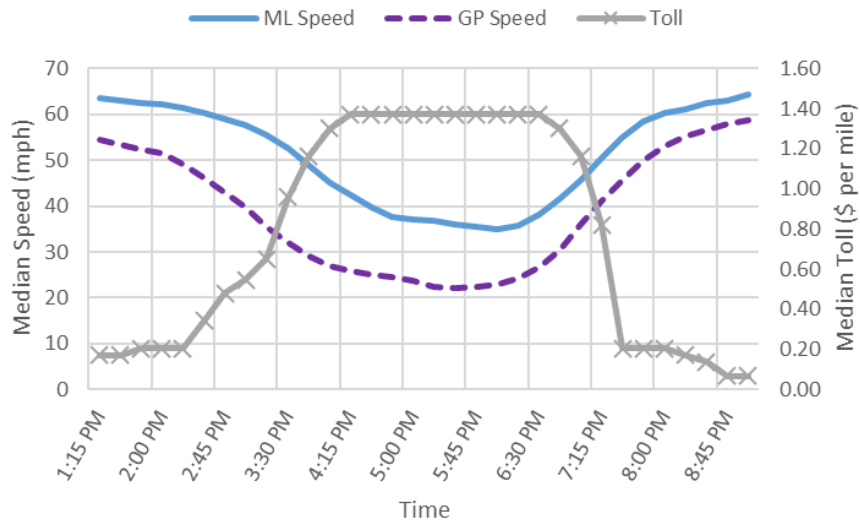
Increased pylons (from 10 to 5 ft. spacing)

95 Express: Performance for Phase 1 Northbound (7.3 miles)



Data represents conditions for all weekdays from July 2017 to June 2018, except for major holidays.

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WA State: I-405 Express Toll Lanes

15 miles (~7 mi of two-lane, ~8 mi of one-lane)

Striped buffer separation

At-grade intermediate access with direct connect ramps



I-405 ETLs: Toll Policies

Washington State Transportation Commission establishes toll policies and rates

Range from \$0.75 to \$10.00

Tries to meet threshold of **at least 45 miles per hour**
90 percent of the time

HOV3+ toll free during peak, **HOV2+** other times

30% of peak travel is toll-free

I-405 ETLs: Dynamic Toll Processes

WSDOT uses **fuzzy logic** for algorithm

Collects speed and volume data **every 5 minutes** from in-pavement loops

Avoids manual overrides of algorithm to allay public concerns

Observes that **“HOV-Only” mode** leads to worsened conditions

I-405 ETLs: Mitigation Around Toll Cap

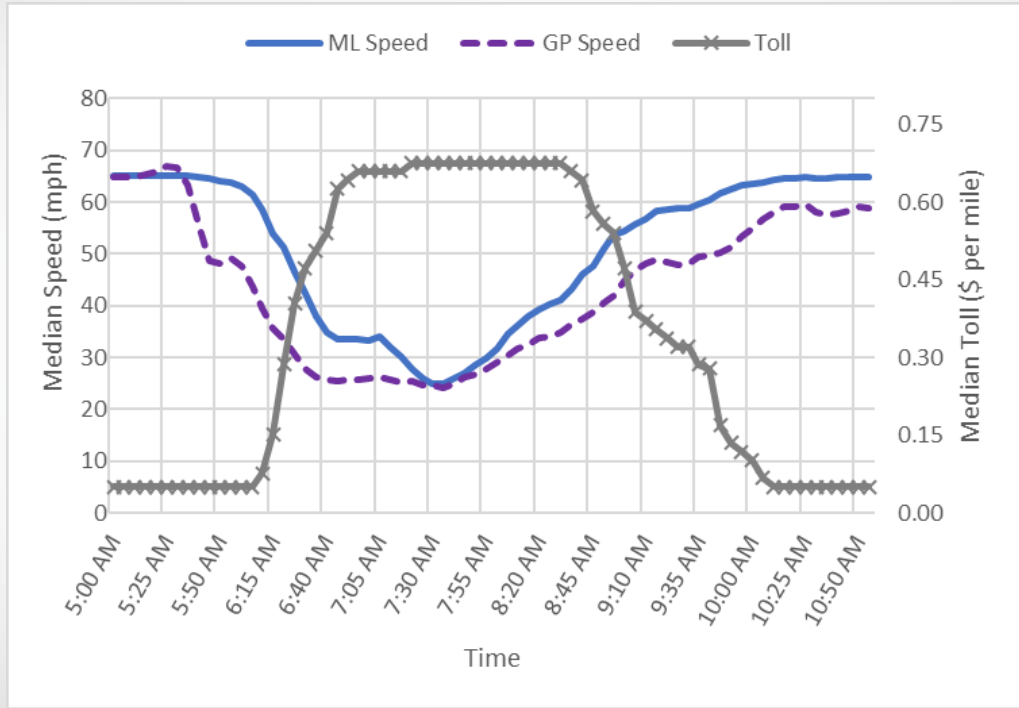
WSDOT made attempts to **adjust toll algorithm**,
scrutinized and **weighted traffic sensors**

Opened 1.8-mile NB **peak period shoulder**

Considered **pylon lane separation**, but other states
saw no improvement

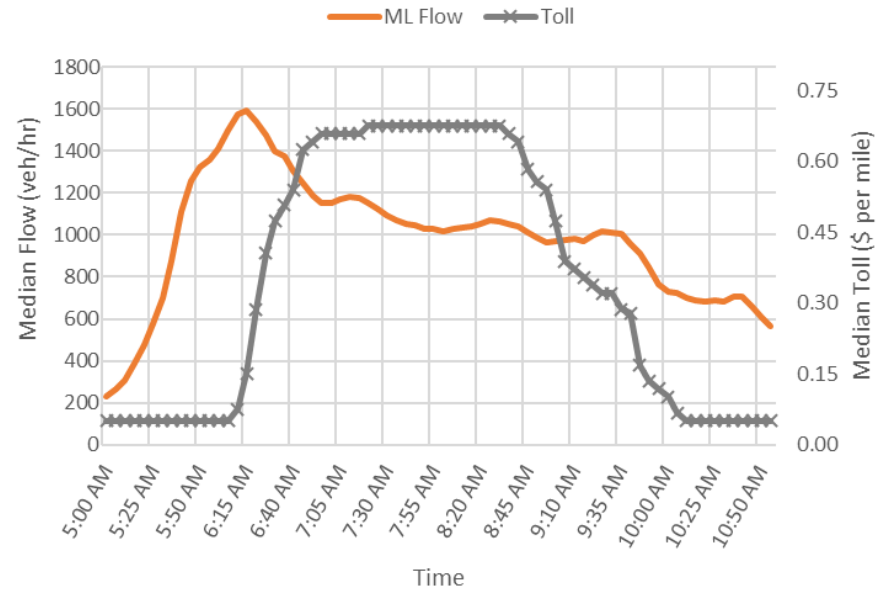
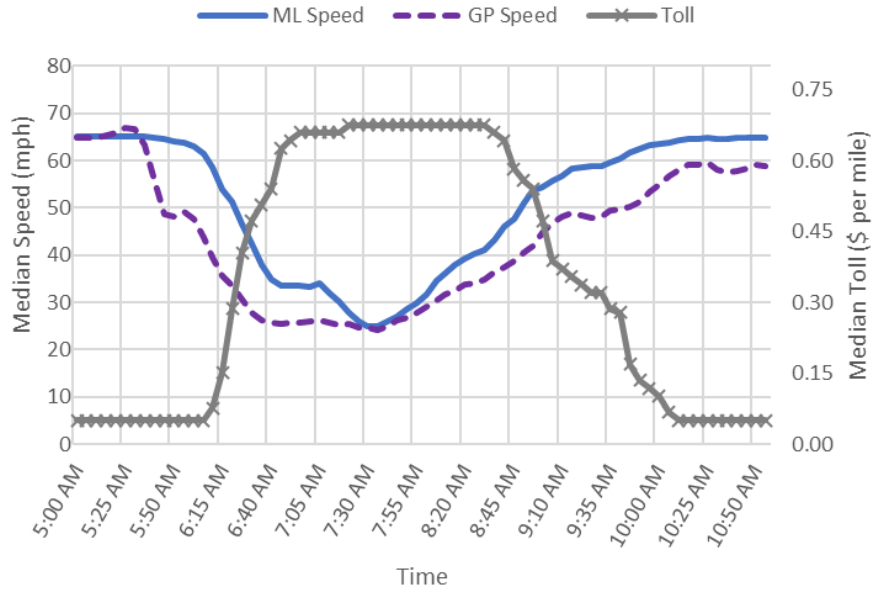
Trying **roving enforcement patrols** and automated
occupancy detection

I-405 ETLs: Performance for One-Lane SB Section (MM 26.16 and 27.44)



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Summary of Findings

1. Agencies spent considerable effort to change factors not directly related to tolling—raising the toll cap is a last resort

(e.g., enforcement, illegal lane changes, occupancy)

2. Current research and practice do not separately assess causes of congestion

(e.g., max toll cap vs. lane separation type)

3. Vehicle flow is an essential metric for managing performance

Too much weight on traffic density

Summary of Findings

4. Early peak period drivers who cause congestion pay lower tolls than travelers who experience slower speeds

Ex. 3:30 PM traveler pays \$7 for 52 mph

6:00 PM traveler pays \$10 for 35 mph

5. Agencies may want to consider shifting to higher toll rates earlier in the peak period

Special Thanks

Staff from the Florida DOT and Washington State DOT

FHWA Office of Operations

Questions? nickwood@tamu.edu

Need Help from State DOTs to Answer NCHRP Synthesis Survey

Topic 50-08: “Emerging Challenges to Tolling on Price-Managed Lanes”

Need these State DOTs to Reply:

- Alaska
- Delaware
- Hawaii
- Illinois
- Kentucky
- Louisiana
- Maine
- New Hampshire
- New York State
- North Carolina
- Pennsylvania
- West Virginia