

Dynamic Pricing Strategies for Managed Lanes

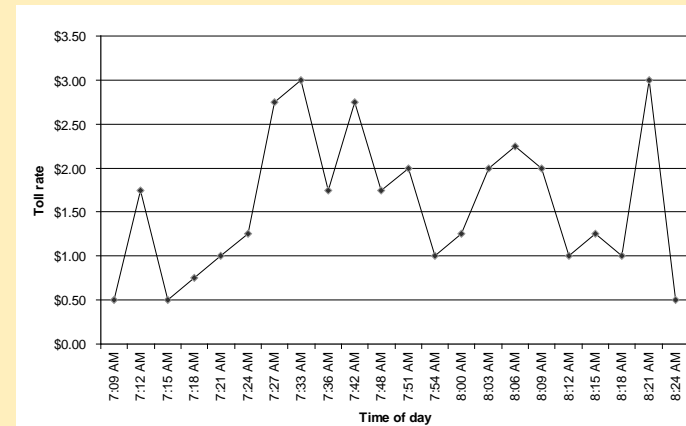
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High Occupancy/Toll (HOT) Lanes

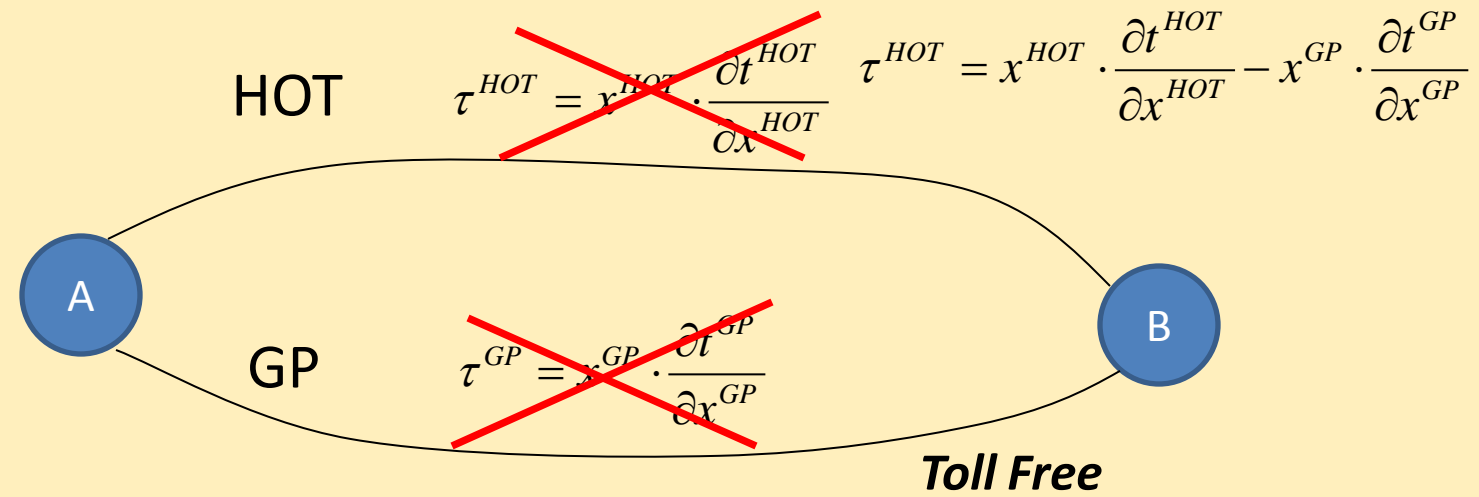
- One form of congestion pricing
- Allows lower-occupancy vehicles to pay to gain access, but free for high-occupancy vehicles
- First implemented in the U.S. in 1995 (SR 91 in CA)
- FDOT's I-95 Express Lanes open to traffic on July 11, 2008 and tolling started December 5, 2008 and January 15, 2010 for the northbound and southbound respectively

Pricing Strategies for HOT Lanes

- Objective
 - Provide a superior uncongested traffic service on the HOT lanes while maximizing the throughput of the freeway (FHWA, 2003)
- Dynamic Pricing for HOT Lanes
 - I-15 in California
 - I-394 in Minnesota
 - I-95 in Florida
- Key Question
 - What is the right price to charge?



A Simply Analogy



Observation

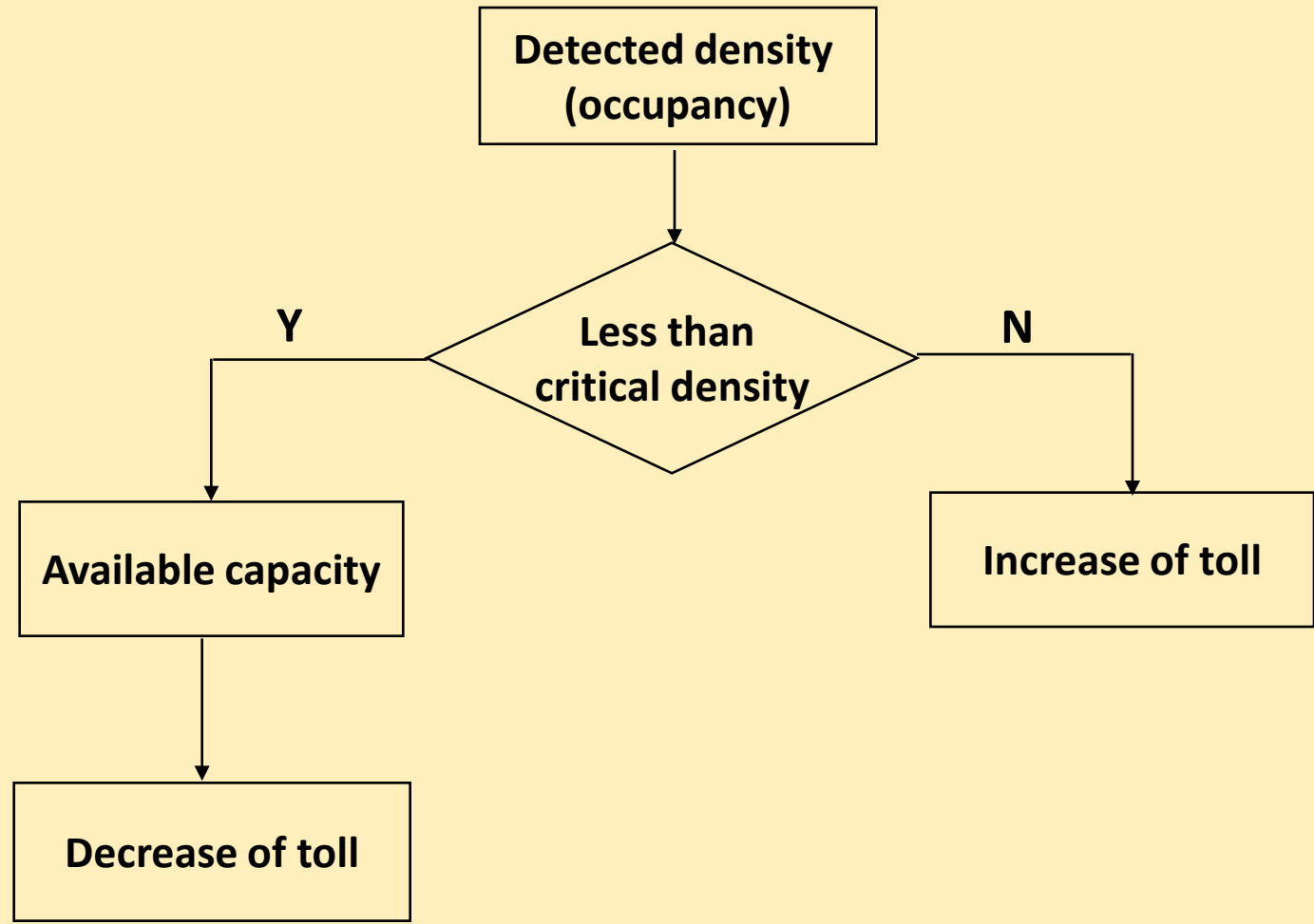
- The congestion toll varies dynamically
- The toll depends on the traffic conditions on both the HOT and GP lanes
- For managed lanes, public agencies are trying to price dynamically to achieve a certain objective. It is critical to monitor both the priced and unpriced lanes since the traffic conditions on those lanes will affect drivers' willingness to pay.

Another View

- “You're trying to price the toll lane and you set the price to maintain traffic volume for something like LOS-B to D. What's happening in adjoining lanes cannot be allowed to influence your price.”

– From the CON-PRIC listserv on April 8, 2010

Tolling Algorithm Implemented



Limitation

- The tolling algorithm is similar to the ones implemented in practice, which are mostly effective. But it may not be able to maintain the targeted level of service.
- Example: assuming that initially both HOT and GP lanes are uncongested. There is a demand surge and GP lanes get congested. Should the price of HOT lane increase or decrease?

Example

- The above tolling algorithm will further decrease the toll since there is still available capacity on the managed lane.
- However, the toll should increase because the travel time saving increases and more drivers are willing to pay to access the HOT lane. We should charge a higher price when it becomes more valuable.
- The above tolling algorithm may not be able to prevent the onset of congestion on HOT lane.

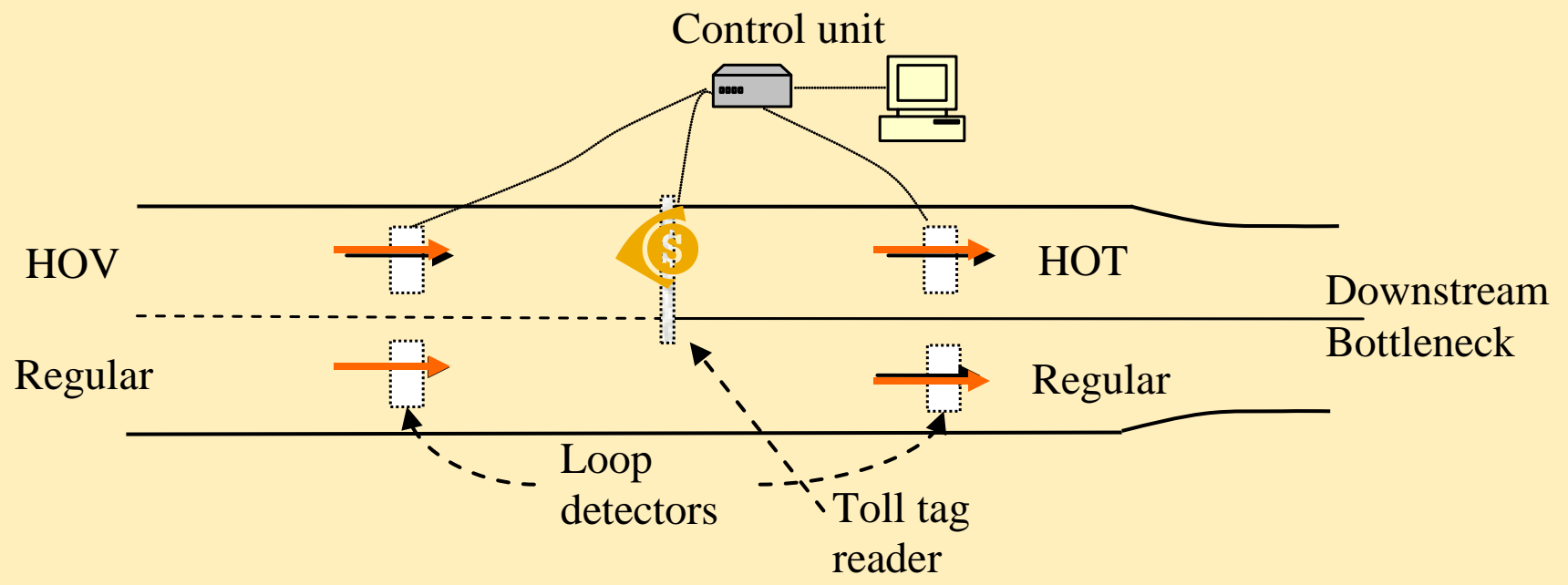
Possible Improvements

- Adjusting the toll rate of HOT lane based on the traffic conditions on both HOT and GP lanes
- Displaying travel time information on DMS to help drivers to make lane choice decision
 - Our recent FDOT-sponsored study shows that it has a significant impact
- The above will allow the toll to indicate a correct price signal of the value of traveling on managed lane.
 - “There is a huge disconnect with most drivers, who assume the higher tolls mean the free lanes are backed up and that if they pay they will get to go faster.” - Michael Turnbell, Sun Sentinel, April 6, 2010

Possible Improvements (Cont'd)

- Data mining for willingness-to-pay
 - “Revealed-preference experiments” are being conducted every a few minutes
 - Facing the displayed toll, drivers made their choice based on their willingness-to-pay. The choice outcomes are captured by traffic measurements
 - Drivers’ revealed willingness-to-pay can be learned by analyzing traffic measurements (flow, occupancy and speed) at limited sensor locations

Learning of willingness-to-pay



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Possible Improvements (Cont'd)

- Coordination among dynamic pricing, ramp metering and variable speed limit
- Guaranteed travel time via refunding
 - Charge additional premium for a guaranteed travel time; if the travel time saving is not delivered, refund toll and premium
 - Apply the real-options theory to determine the premium

Questions?

Innovations in Pricing of Transportation Systems: Workshop and Conference

May 13 – 14, 2010

Orlando, Florida, U.S.A.

<http://conferences.dce.ufl.edu/pricing/>

The focus of this workshop and conference is on innovative market-based approaches, perhaps in combinations with other strategies, to encourage a more efficient use of transportation systems and to devise better financing schemes for improving or enhancing these systems. The main purpose is to bring together practitioners, experts, and researchers from various transportation agencies and background (e.g., economics, transportation, civil engineering, operations research, industrial engineering, urban planning, social science, etc.) to discuss and share innovative ideas in pricing of transportation systems.