

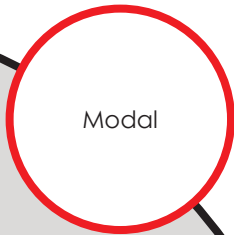


Caltrans Division of Research,
Innovation and System Information

Research



Results



Modal

AUGUST 2018

Project Title:

Pricing Urban Transportation
Networks: Multi-modal Strategies
Leveraging Big Data

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Task Manager:

Sukhdeep Nagra,
Transportation Engineer (Civil)
Sukhdeep.Nagra@dot.ca.gov

Pricing Urban Transportation Networks: Multi-modal Strategies Leveraging Big Data

This research will propose, model and evaluate an enriched cordon toll which exploits connected vehicle technology to price vehicles according to the amount of travel within a cordon.

WHAT WAS THE NEED?

A drawback of traditional cordon tolls is that they do not depend on how much vehicles travel inside the cordon. This research will evaluate a tolling scheme that remedies this drawback. Vehicles would pay for each minute spent circulating on the street network according to a formula that will be optimized and validated. The proposed work was motivated by three ideas. Cordon tolling is too rough a tool. Macroscopic fundamental diagram theory opens the door to better pricing. New sensor data makes new forms of pricing technology feasible.

WHAT WAS OUR GOAL?

Our goal was developing a theory of circulation-based pricing and then demonstrate its realism, viability and benefits. With circulation pricing, a toll authority would charge vehicles for each minute they are traveling inside a cordon, excluding time parked; i.e., for the time they are circulating. This idea is inspired by the equity principle that travelers should pay for the capacity they use, and by the fact that, in the Macroscopic Fundamental Diagram theory, the city can be viewed as a factory that processes at a given rate vehicle-hours (or vehicle-kilometers) rather than trips.



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knowledge that improves
California's transportation system

WHAT DID WE DO?

The researchers focused their work on the theory of zone pricing, with a special focus on the potential for schemes that consider differences among how different drivers use the network – how much time they spend or how much travel they do inside the zone. The mission was to set out principles and predictions for an era, not long from now, when advances in technology, growing public familiarity with pricing and pressure on governments to relieve congestion without expensive infrastructure will make it feasible to align usage and charges more closely. The final report summarizes the work the research has done in that direction and broken up in three focuses. One section surveys the history of zone pricing around the world. The second section summarizes a paper published by the authors on the advantages of fine-grained pricing to the optimal scheduling of commute trips. Finally, the last section summarizes other research on mode choice.

WHAT WAS THE OUTCOME?

In summary, the research funded by this grant has taken a deep look at the details of applying congestion pricing to whole areas of downtown streets – a practice we call “zone pricing.”

The second section surveyed the history of zone pricing thus far and touched on Singapore’s Electronic Road Pricing 2.0 scheme, which will charge vehicles for the distance they travel. That possibility – pricing cars for the distance they travel instead of just to enter a high-demand area – has been the focus of our theoretical work.

The third section summarizes already published research, which considers the utility of distance tolling for the optimal scheduling of trips. It finds substantial benefits from using tolls to prioritize short trips at times of highest demand, so that the greatest number of people can reach their destinations on time.

The fourth section summarizes an unpublished research considering how travelers with different trip lengths choose between entering the zone and another alternative – driving around it or taking transit – rather than rescheduling as in found in previous research. It finds substantial benefits from using distance tolls instead of trip tolls (though both are far superior to the status quo of gridlock), because trip tolls tend to disproportionately discourage short trips, which contribute less to congestion.

WHAT IS THE BENEFIT?

It is the authors’ hope that the papers and thesis written stand as original and – above all – useful contributions to a topic that is only increasing in importance. There can be little doubt that, in the United States and elsewhere, intelligent tolling will be part of a multi-pronged solution to congestion. Lrepid thought about the advantages and disadvantages of various designs will be imperative to the systems’ success.

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http://www.dot.ca.gov/research/researchreports/reports/2016/CA16-2805_FinalReport.pdf