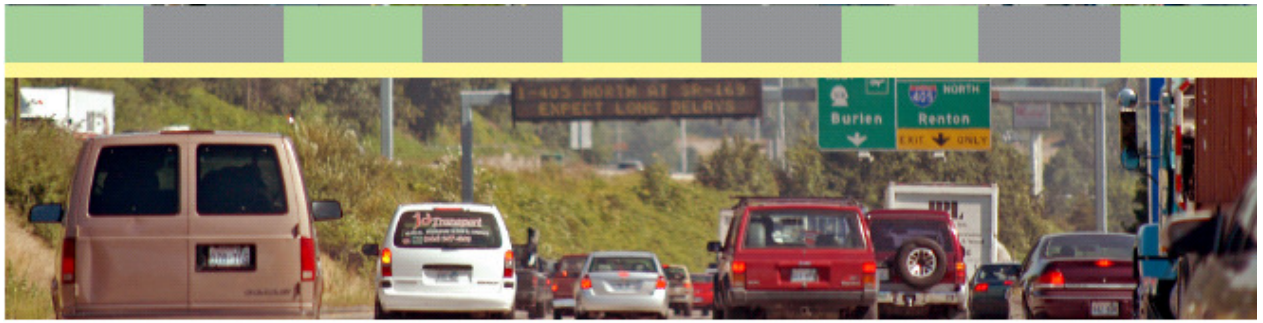


Traffic Choices Study

Findings from a Road Pricing Experiment

Symposium on Mileage-Based User Fees

April 14, 2009

Project Background

Road Finance: The Past…

- **Early Finance**
  - Most roads built by "private" companies and financed through tolls
  - Public contributions financed through general taxes
  - In 1901 New York City imposes a vehicle registration fee
  - By 1914 all states collect vehicle registration fees
- **Federal Aid Road Act of 1916**
  - Federal grants to States to improve public roads system
  - Led to the formalization of State Road Authorities
  - Prohibited tolls on Federal Aid facilities
- **A Tax on Fuels**
  - Oregon is the first; 1919
  - By 1929 all 48 states impose a tax on fuels
  - Federal fuel taxes imposed in 1932

Road Finance: …the Present…

Current finance approaches are familiar and relatively easy and efficient to administer, but…

- Road Finance System is financially weak: poor fiscal elasticity of gas tax while costs are rising
- System performance is declining: congestion; deteriorating roads; land use and transit not obviating the problems
- Gas tax (and other tax-based) finance perceived as unfair: benefits are targeted while the taxes are broadly applied
- Conventional road finance is a vicious circle: low charge per mile fails to address peak loads which prompts road building without fiscal resources
- Demand pricing can break the circle: charges are levied selectively which controls excessive congestion and yields revenues for new capacity as it is really needed

Road Finance:…and, the Future?

Long-run viability of existing transportation finance approaches in question…

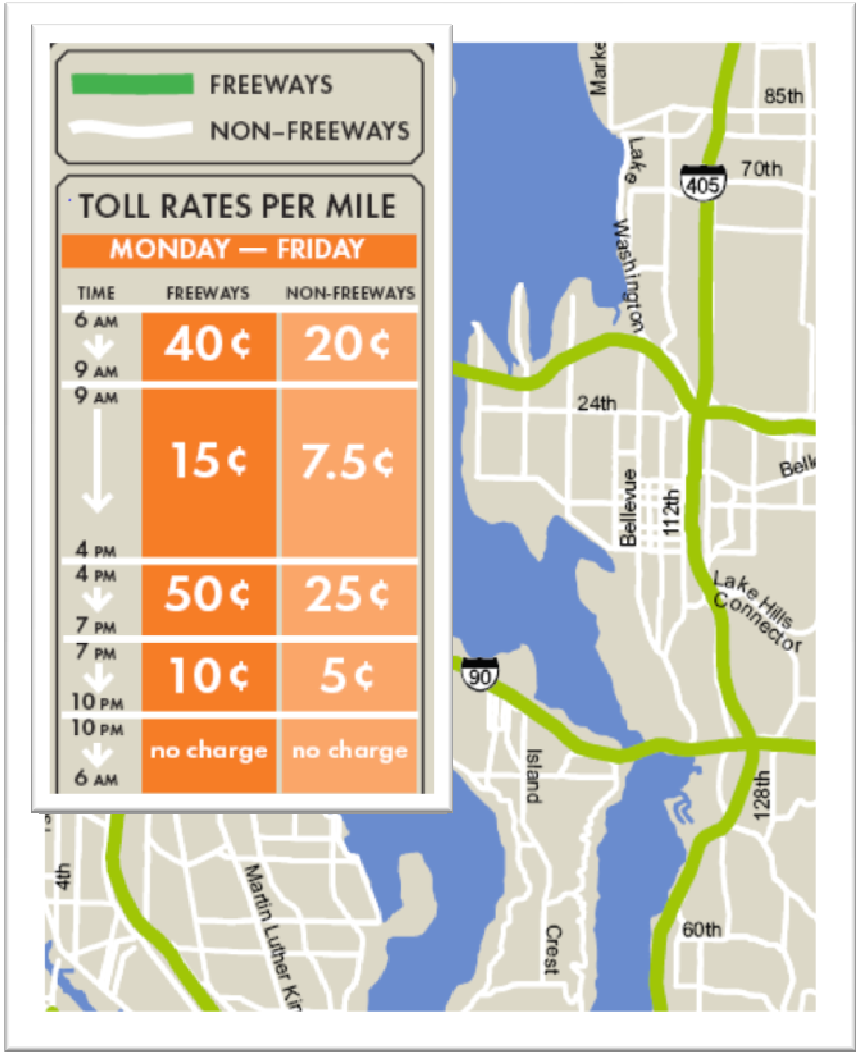
- TRB Special Report 285: The Fuel Tax and Alternatives for Transportation Funding
  - should undertake serious exploration of the potential of road use metering and mileage charging
- Surface Transportation Policy and Revenue Study Commission
  - recommends the next surface transportation authorization act require a major national study to develop the specific mechanisms and strategies for transitioning to an alternative to the fuel tax to fund surface transportation programs
- Surface Transportation Infrastructure Finance Commission
  - a federal funding system based on more direct forms of “user pay” charges, in the form of a charge for each mile driven , has emerged as the consensus choice for the future.

Traffic Choices Study

- **Detailed analysis of road user choice and behavior under a broad and sustained tolling experiment**
  - Tolling on all major roads
  - Tolls based on time of day and type of road
  - True price incentive with hold harmless design

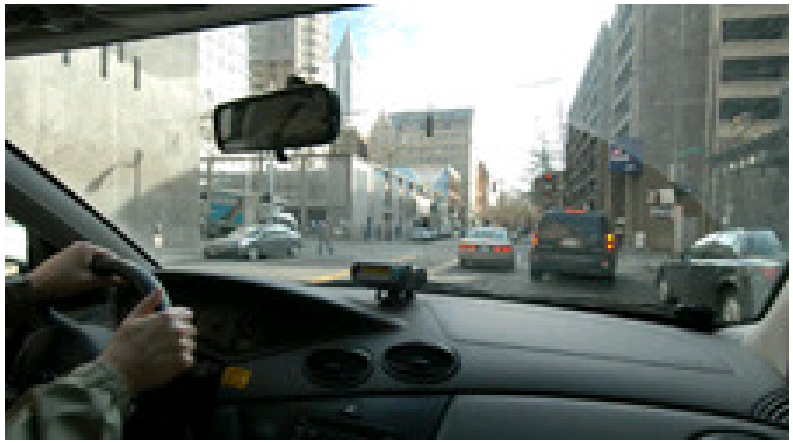
- **Development and proofing of tolling technical applications and systems design**
  - In-vehicle GPS-based tolling
  - Cellular communicating to central system
  - Large-scale operational test showing the feasibility of network-wide tolling

- **A pilot for understanding key policy variables and requirements**

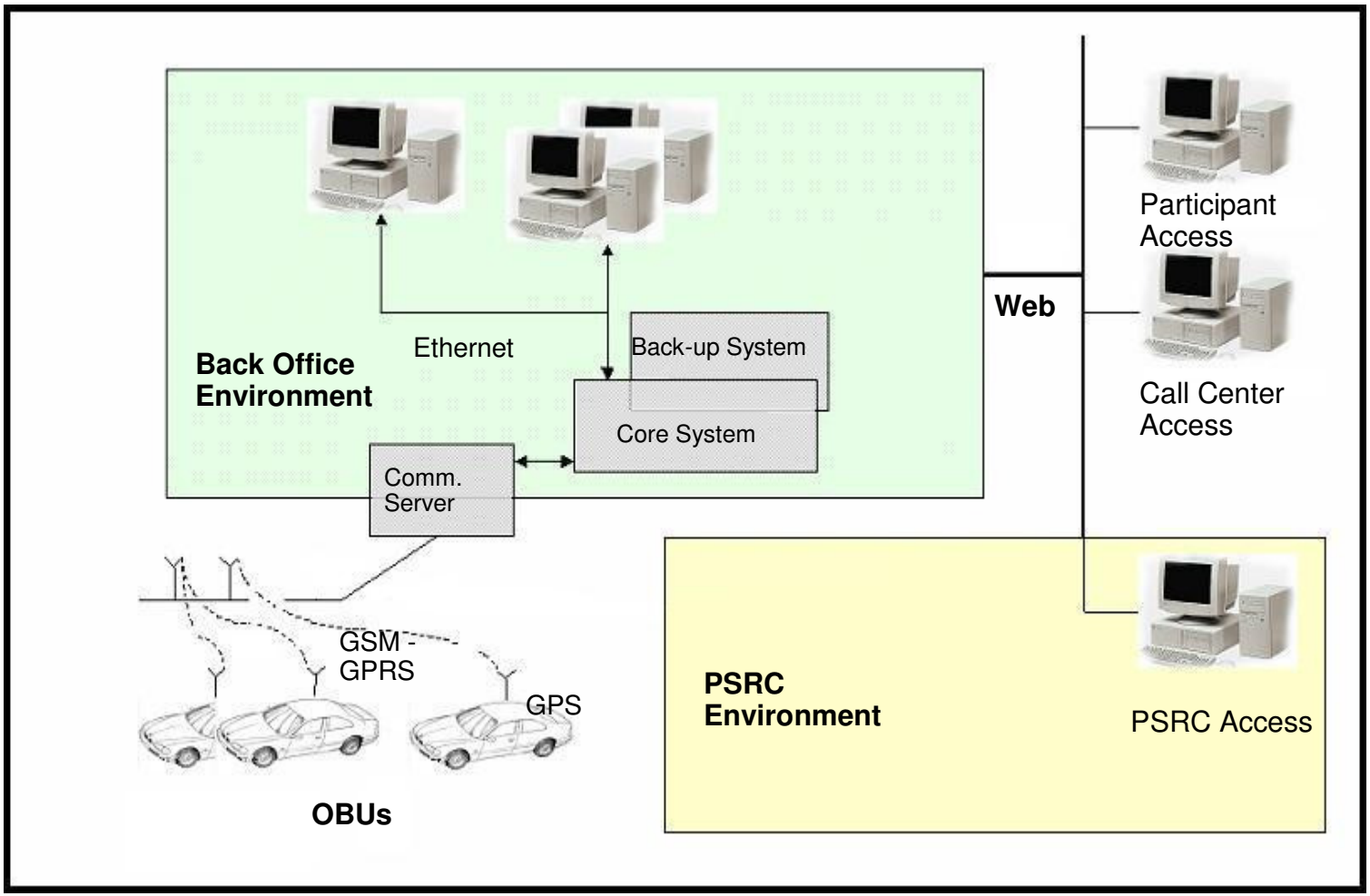


Participant-Centered Project

- 275+ households; 400+ vehicles
- Randomly selected from an enriched pool of potential participant households
- Each household was provided a unique travel endowment account, based on their baseline travel behavior
- Tolls were levied against this endowment account
- At the end of the tolling period participants were given any remaining account balance



Technology


Back Office Environment
Ethernet
Back-up System
Core System
Comm. Server
Web
Participant Access
Call Center Access
GSM - GPRS
GPS
OBUs
PSRC Environment
PSRC Access

Project Operations

- **450 OBU installations and removals**
- **System fully operational for over 18 months**
- **Over 270 participating households**
  - Up to 18 months of trip records per household
- **Hundreds of customer service calls**
- **Over 4,000 invoices distributed**
- **Over 100,000 device to central system transactions**
- **Over 750,000 individual trip records**
- **Household surveys and focus groups**

Behavioral Analysis

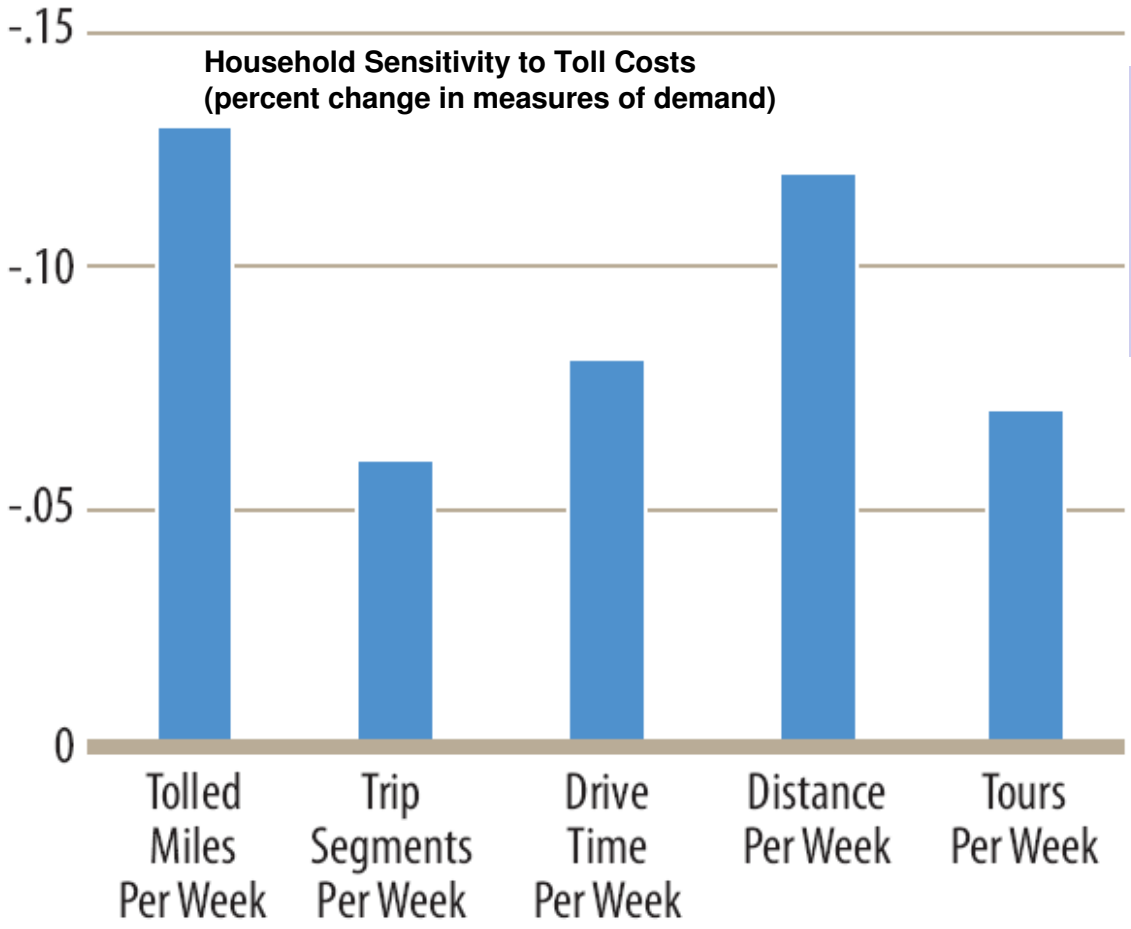
Measured Dimensions of Demand Elasticity

- **Demand Dimensions**
  - Tours Per Week
  - Tour Distance (Miles Per Week)
  - Drive Time (Minutes Per Week)
  - Tour Segments (Segments Per Week)
  - Tolled Tour Distance (Tolled Miles Per Week)
  - Tour Start Time
  - Tolls Paid

- **Across tour (trip) purposes**
  - Home-to-Work
  - Work-to-Home
  - Home-to-Home
  - Work-to-Work
  - All Trips

- **Primary explanatory factors**
  - Toll Costs
  - HH Income
  - Drivers per HH
  - Transit Access

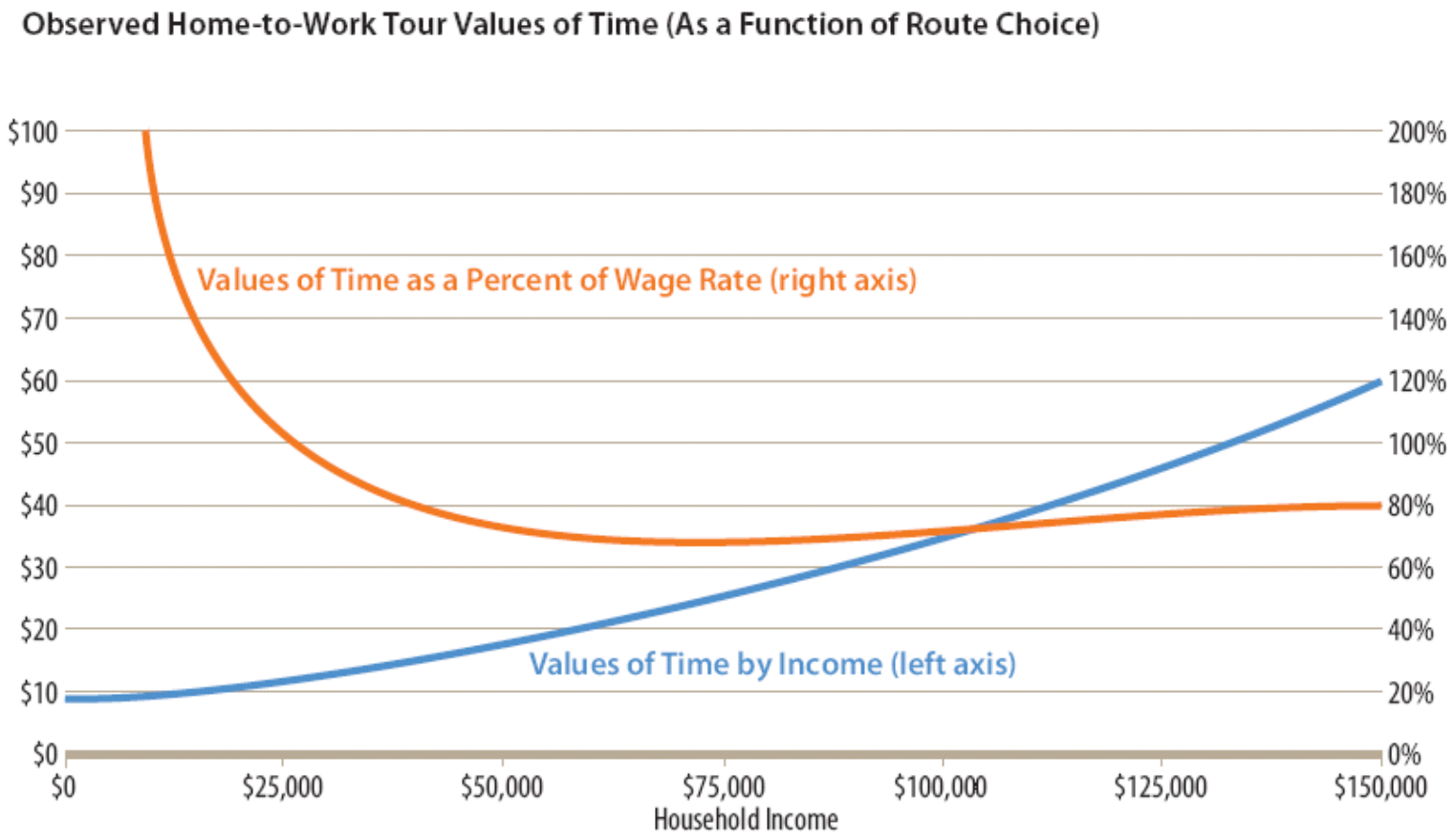
Drivers Responded to Tolling by Altering Their Driving Behavior



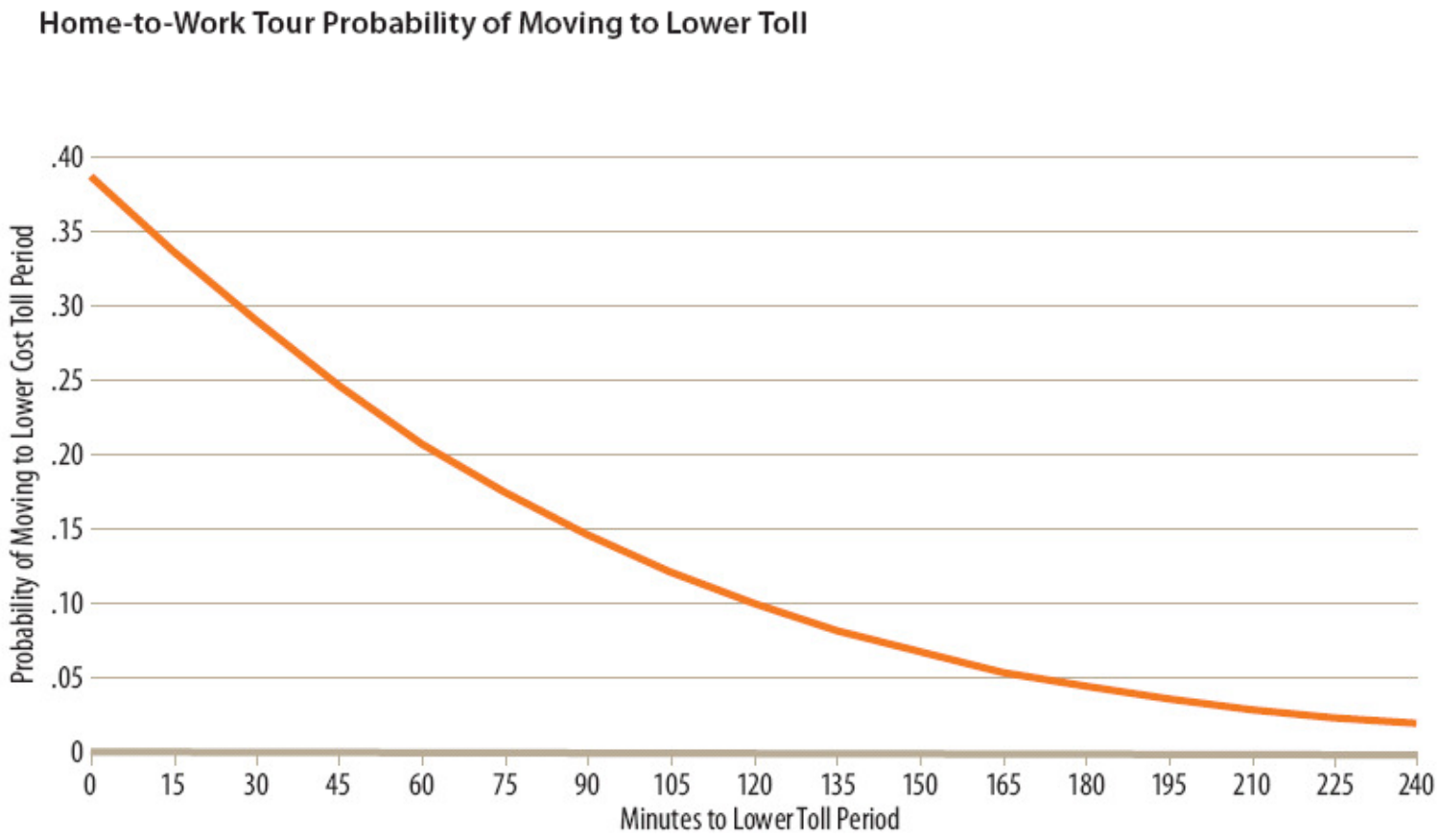
Motorists made small-scale adjustments in travel that, in aggregate, could have a major effect on transportation system performance.

Elasticities measure percent change in driving behavior in response to 100% increase in trip costs

Value of Time Observations: Home-to-Work Tours

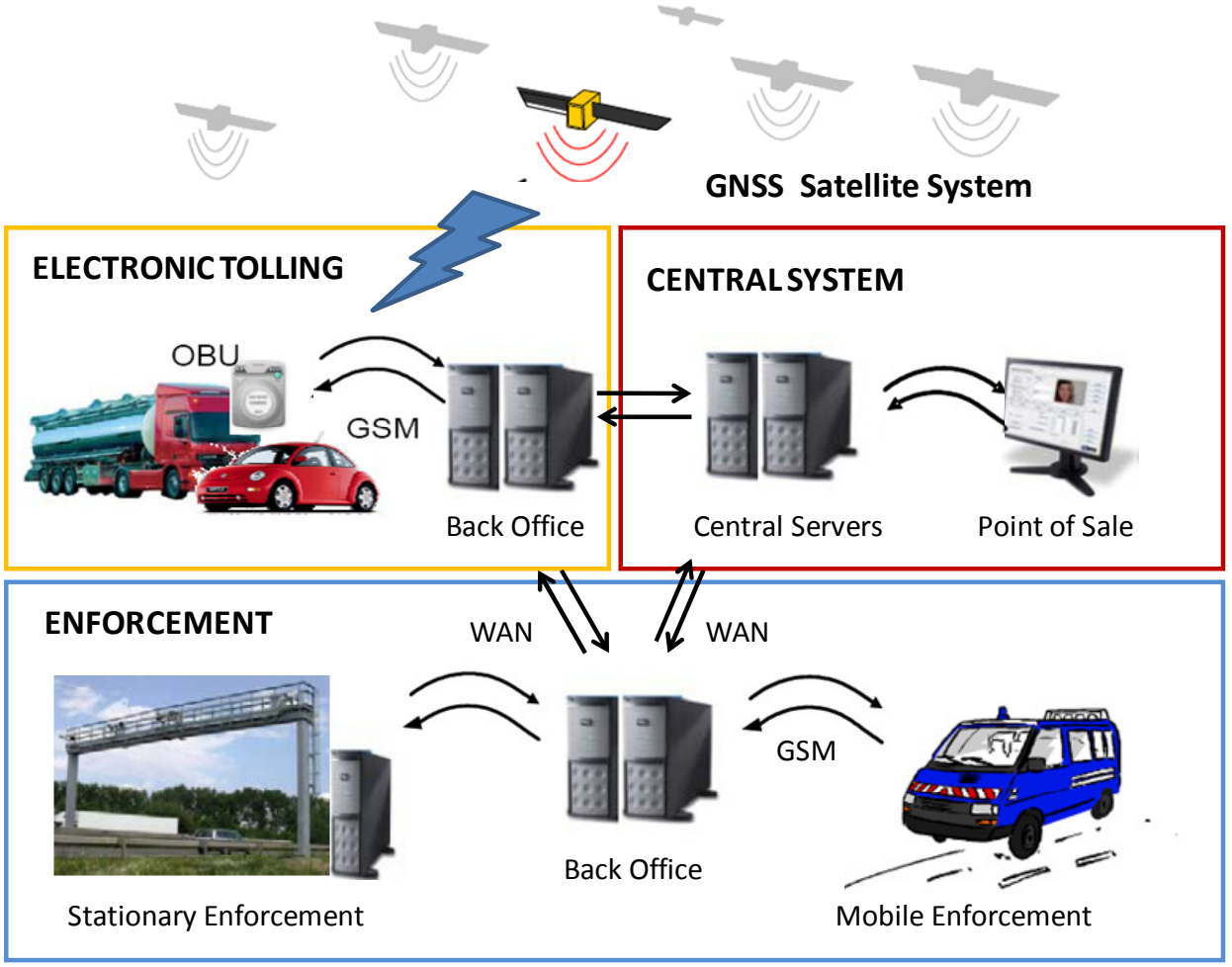


Departure Time Response



Implications for Road Management

High Level Architecture for Network Road Pricing



Network Road Tolling Cost Estimate

Central Puget Sound Region

System Elements	Capital (2008 Dollars)	Annual (2008 Dollars)
OBU and installation	$665,000,000	–
OBU / Installation – New Vehicles	–	$31,500,000
OBU – Repair / Replacement	–	$25,200,000
Training / Certification – Installers	$500,000	$50,000
Spare OBUs	$1,750,000	$20,000
OBU Subtotal	**$667,250,000**	**$56,770,000**
Stationary Stations	$20,000,000	$1,060,000
Transportable Stations	$1,875,000	$187,500
Mobile Stations / Vehicles	$1,200,000	$1,400,000
Enforcement Back Office	$5,000,000	$2,750,000
Enforcement Subtotal	**$28,075,000**	**$5,397,500**
Central System	$25,000,000	$20,000,000
Staff / Operations Training	$500,000	$100,000
Space for Central System / Back Office / Call Center	–	$200,000
Central System Subtotal	**$25,500,000**	**$20,300,000**
Data Communications Subtotal	**–**	**$201,758,800**
Other Subtotal	**$27,715,000**	**$3,500,000**
Grand Total	**$748,540,000**	**$287,726,300**

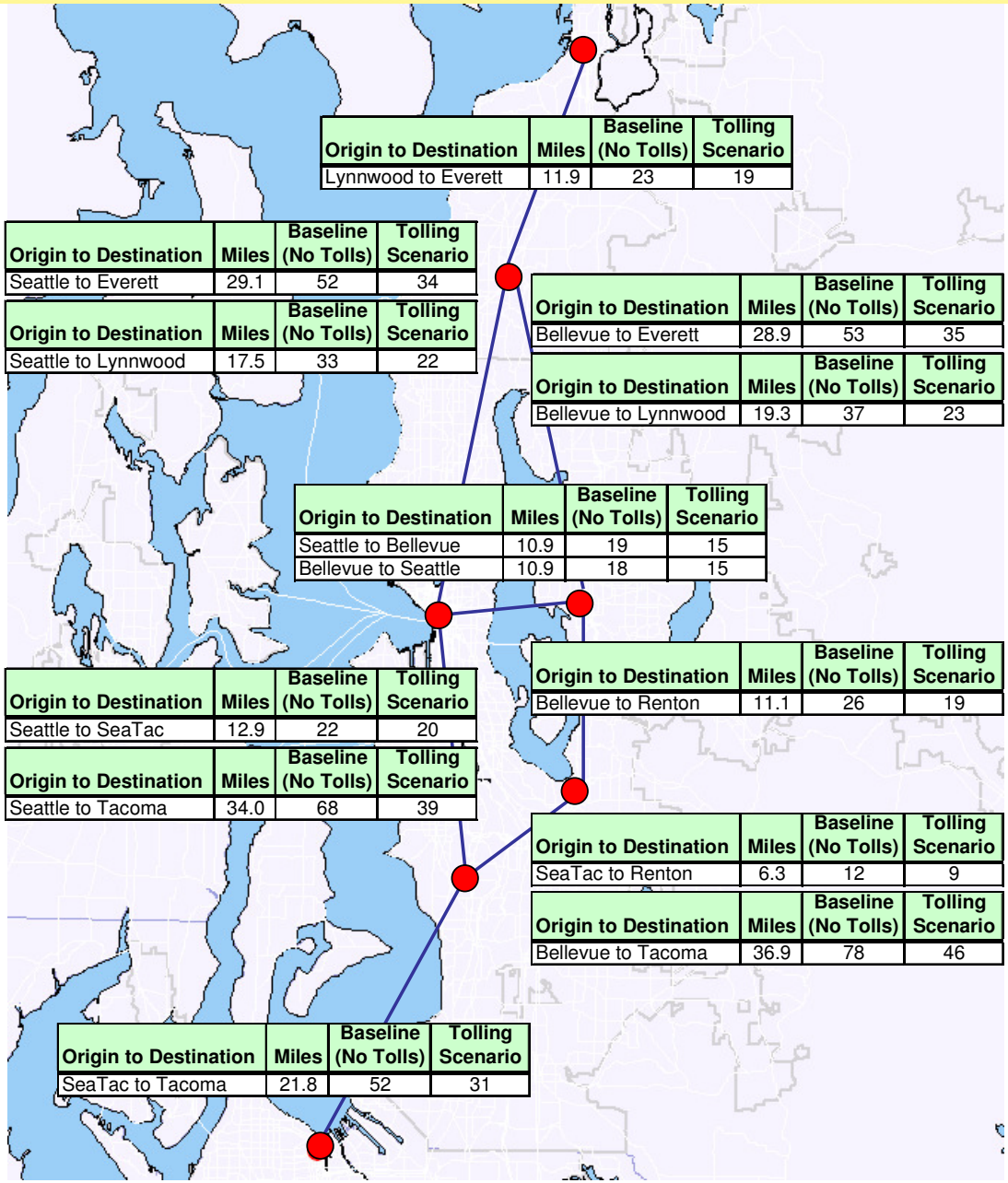
Modeling: Afternoon Peak Travel Times

Drive alone work trips

Across all paths

Base Case vs. Tolling Scenario

- ❑ **Total VMT down 7%**
- ❑ **Total VHT down 5%**



Origin to Destination	Miles	Baseline (No Tolls)	Tolling Scenario
Lynnwood to Everett	11.9	23	19

Origin to Destination	Miles	Baseline (No Tolls)	Tolling Scenario
Seattle to Everett	29.1	52	34

Origin to Destination	Miles	Baseline (No Tolls)	Tolling Scenario
Seattle to Lynnwood	17.5	33	22

Origin to Destination	Miles	Baseline (No Tolls)	Tolling Scenario
Bellevue to Everett	28.9	53	35

Origin to Destination	Miles	Baseline (No Tolls)	Tolling Scenario
Bellevue to Lynnwood	19.3	37	23

Origin to Destination	Miles	Baseline (No Tolls)	Tolling Scenario
Seattle to Bellevue	10.9	19	15
Bellevue to Seattle	10.9	18	15

Origin to Destination	Miles	Baseline (No Tolls)	Tolling Scenario
Seattle to SeaTac	12.9	22	20

Origin to Destination	Miles	Baseline (No Tolls)	Tolling Scenario
Seattle to Tacoma	34.0	68	39

Origin to Destination	Miles	Baseline (No Tolls)	Tolling Scenario
Bellevue to Renton	11.1	26	19

Origin to Destination	Miles	Baseline (No Tolls)	Tolling Scenario
SeaTac to Renton	6.3	12	9

Origin to Destination	Miles	Baseline (No Tolls)	Tolling Scenario
Bellevue to Tacoma	36.9	78	46

Origin to Destination	Miles	Baseline (No Tolls)	Tolling Scenario
SeaTac to Tacoma	21.8	52	31

Benefits and Costs of Network Road Tolling

Present Value Benefits/Costs	Millions of 2008 Dollars
Benefits	
Time Savings	$36,600
Reliability Benefits	$4,500
Operating Cost Savings	$2,500
Toll Effects on Consumer Surplus	-$97,100
System Operator Benefits (Tolls)	$87,000
Present Value of Benefits	$33,600
Costs	
OBU Costs	$1,500
Enforcement	$100
Central System	$500
Data Communication	$3,300
Other	$100
Present Value of Costs	$5,500
Present Value of Benefits less Costs	**$28,200**
Benefit-to-Cost Ratio	**6.1**

Estimating Revenue Potential

Gross proceeds from variable network tolls (not necessarily optimal toll rates):

$2.8 - $3.2 billion per year

Region's share of State fuel tax proceeds:

$500 million per year

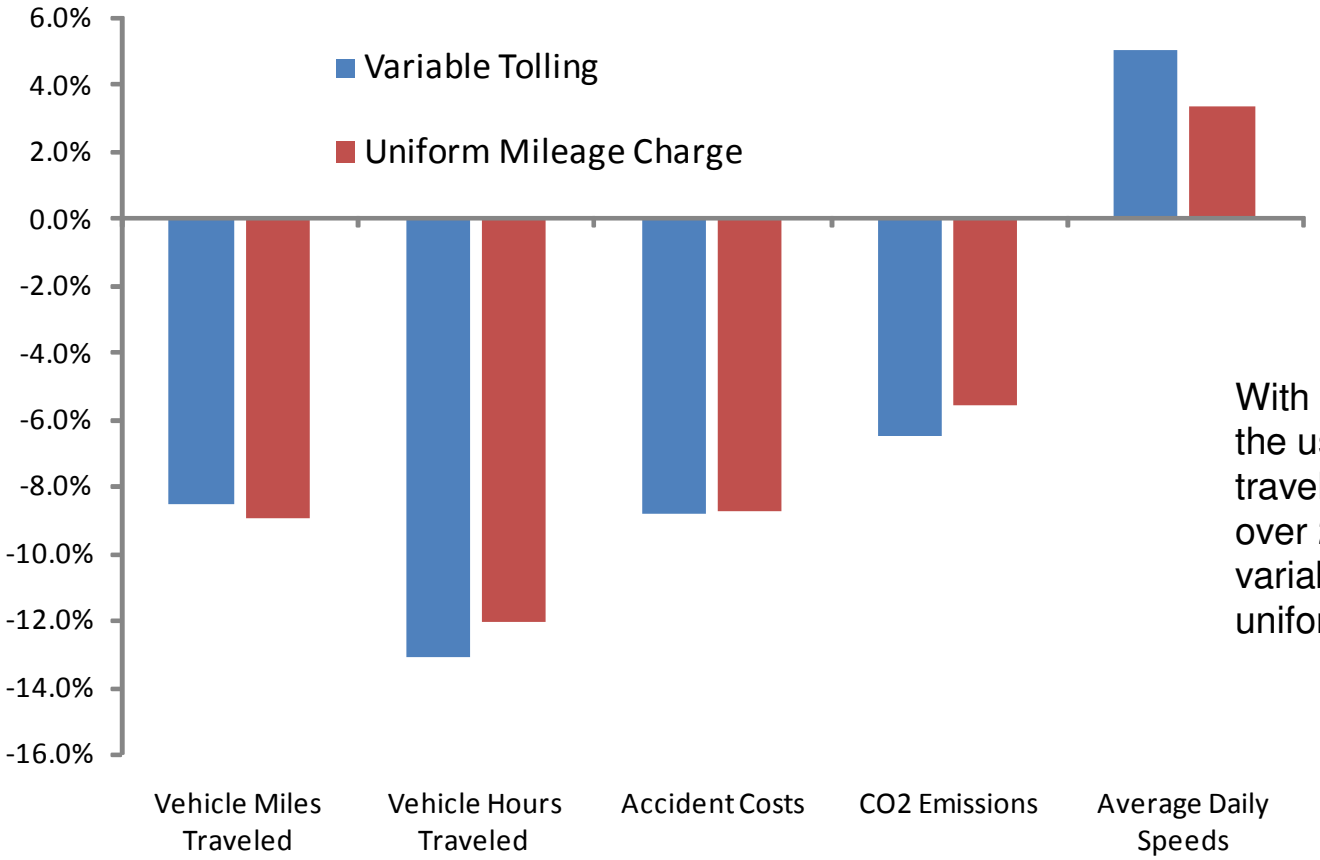
Costs for a fuel tax collection system

- Initialization Costs = NA
- Operations = 1% of proceeds

Costs for a network tolling system, (based on cost model)

- Initialization Costs = $750 million
- Operations = 5-8% of proceeds

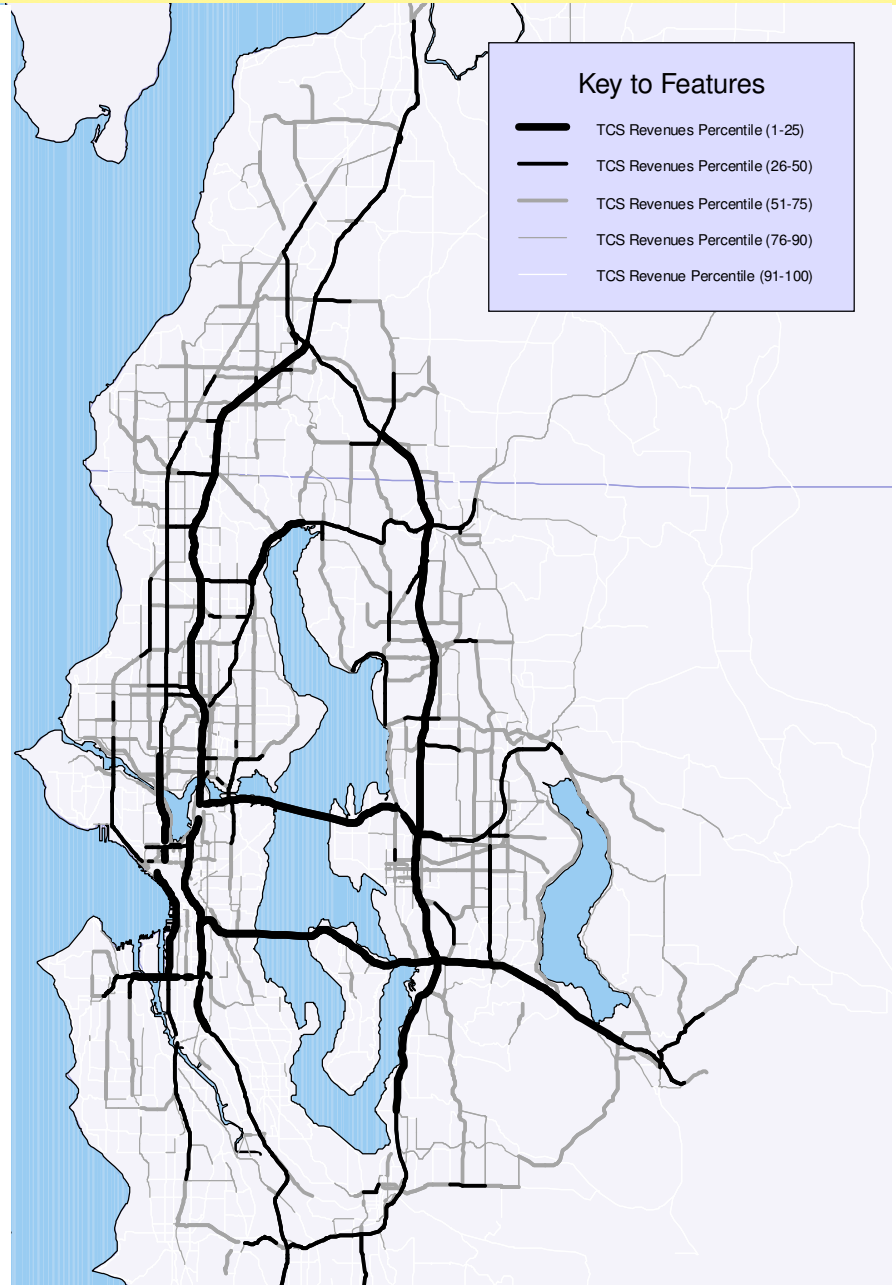
Variable Tolls and Mileage Charge Compared to a Base Case (no new charges) in 2040



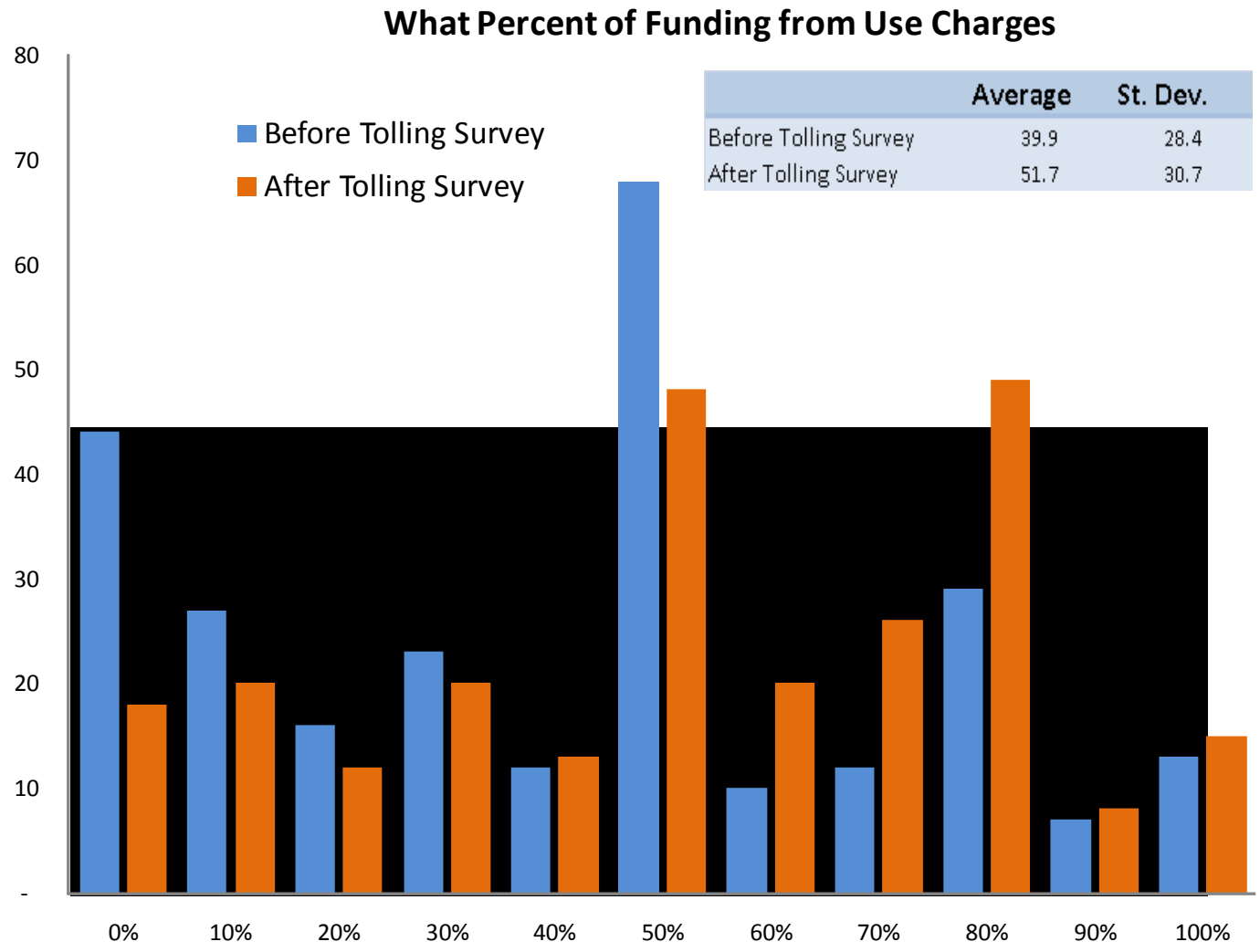
With similar revenue yields the user benefits (largely travel time savings) are over 2.5 times larger for variable tolls than for a uniform charge.

Toll Revenues On the Road Network

- 5% of centerline miles produced 50% of toll revenues
- Next 50% of revenues spread broadly across the core urban network
- 25% of the centerline miles produced less than 1% of total revenues

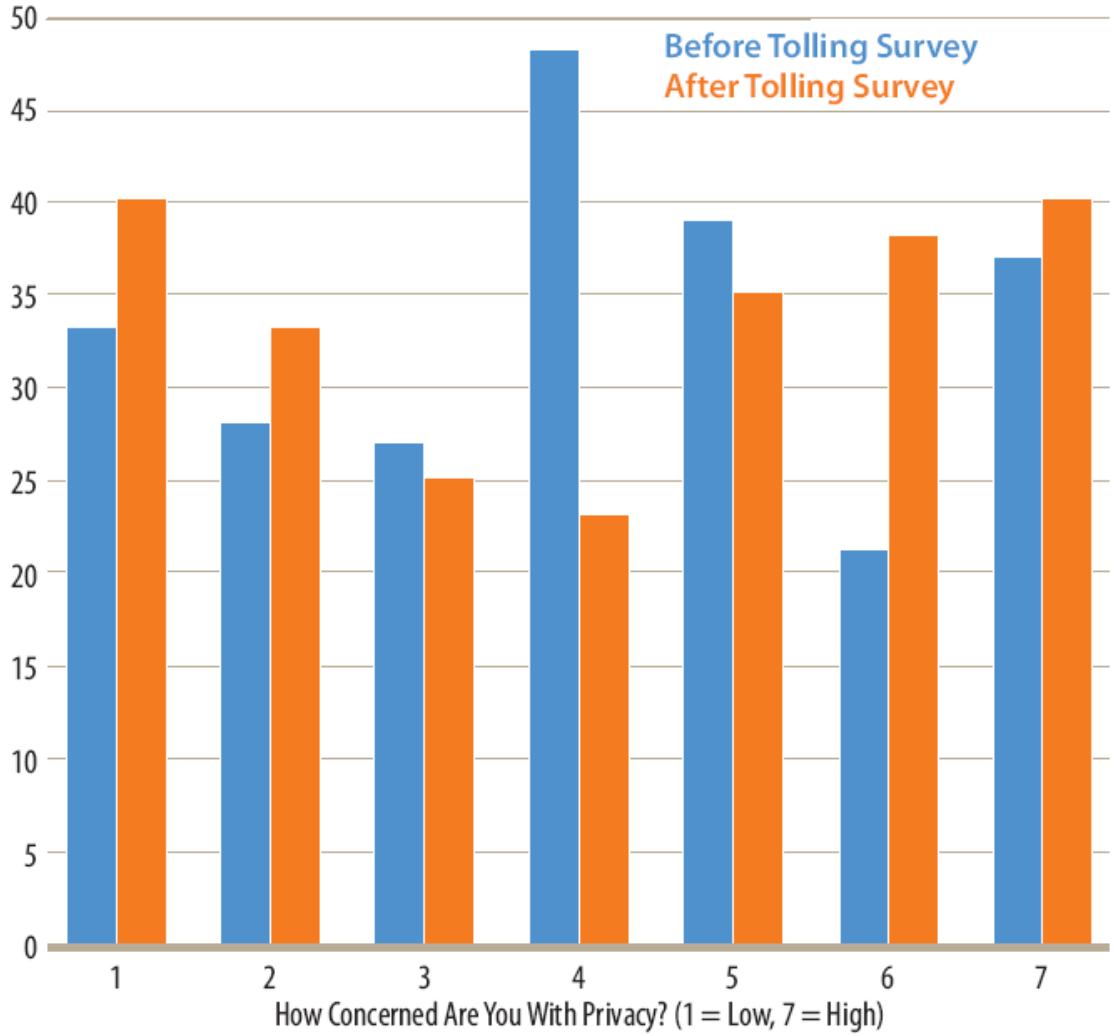


Participant Opinions on Funding



	Average	St. Dev.
Before Tolling Survey	39.9	28.4
After Tolling Survey	51.7	30.7

Participant Opinions About Privacy



Conclusions

1. Observed response of drivers to tolls suggests there is a dramatic opportunity to significantly reduce traffic congestion and raise revenues for investment.

2. Not all aspects of a road network tolling system have been fully demonstrated yet. But the core technology for satellite-based (and whole road network) toll systems is mature and reliable.

3. A large-scale U.S. deployment of a GPS-based road tolling program will depend on proven systems, a viable business model, and public acceptance of underlying concepts.

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