Driver Satisfaction With an Urban Arterial After Installation of an Adaptive Signal System

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85th Annual Meeting of the Transportation Research Board
January 25, 2006
Outline

• Study Overview
• Methodology
• Survey Results
• Conclusions
Study Overview
Study Objectives

- Measure changes in driver satisfaction with their driving experience on an urban arterial due to the implementation of an adaptive traffic signal system
  - Hypothesis: there will be an increase in driver satisfaction due to the ITS enhancement
- Develop and test methodology for assessing changes in driver satisfaction due to ITS enhancements
- Establish driver satisfaction as a measure of improvement to transportation network operations
• Customer satisfaction is an important component in evaluating the effectiveness of Intelligent Transportation Systems (ITS) enhancements

• Previous qualitative research (Pecheux, Flannery and Lappin) finds that:
  - Drivers notice service characteristics on familiar routes
  - These service elements influence their level of satisfaction with their driving experience
General Approach: Pre-Post Design

Pre-test  Treatment  Post-test

where treatment = adaptive traffic signal system

- **Pre-Post Test**: survey panel of drivers before and after installation of adaptive traffic signal system
- **Control Group**: survey second panel of drivers who drive on a comparable route (with no deployment) at same times as treatment panel
- **Focus on “normal” day-to-day operation, excluding incidents and events**
Selecting a Test Site

- SCATS adaptive signal timing system being deployed along 2 mile corridor in Cobb County, Georgia
  - Expect effects of deployment to be noticeable to drivers
  - Project “ready to go”
- Cobb County to determine if 55 additional intersections should be instrumented
- Georgia Institute of Technology conducts pre/post travel time and delay study on Paces Ferry (fielded at same time as Volpe study)
Characteristics of Study Route

- Two mile corridor along Paces Ferry Road; 15 signalized intersections
- Mix of residential, office park, retail development; crosses railroad tracks; crosses Interstate 285 – variable traffic patterns
- Number of lanes varies from 1 lane in each direction up to 6 lanes in each direction at highway interchange
- Traffic signals recently re-timed
Treatment Route: Paces Ferry
Control Route: Spring Road
Methodology
Sample Design

- Randomly sample households living in census tracts that include the study routes

- Over-sample off-peak drivers
  - Benefits of new system expected to be greatest off-peak

- Use telephone recruitment survey to identify eligible drivers and schedule their “typical” drive
  - Drivers must regularly drive the route (Tuesday, Wednesday, Thursday, Saturday or Sunday)
  - Respondent not employed by Cobb County, Georgia DOT, USDOT
  - Respondent between the ages of 18 to 75
  - Household owns at least one vehicle
  - Respondent has valid driver’s license
Questionnaire Design

Background survey
• Obtain information on respondents’ driving habits, characteristics of their “typical drive”, importance ratings for roadway attributes

Driver Survey
• Satisfaction ratings (seven-point scale) for:
  – Number of times stopped by a red light
  – Amount of time spent at red lights
  – Coordination of traffic signals along the route
  – Amount of green time for side streets
  – Overall travel speed
• Other satisfaction measures with roadway driving experience:
  – Lane width
  – Quality of road pavement
  – Quality of pavement markings
  – Roadside landscaping
  – Driving behavior of other drivers
  – Availability of turn lanes
  – Overall level of traffic congestion

• Document drive date, time, and route; drive conditions; schedule flexibility; concern with on-time arrival
Pilot Test: September 2004

Wave 1: October 2004 – February 2005

• Send brochure to all eligible households
• Conduct recruitment
• Mail survey materials and $5 incentive to recruited drivers
• Reminder phone call/postcard before the drive
• Drivers complete survey immediately following drive and mail it back (or internet/fax)
Panel maintenance: letter and $2 incentive

Wave 2: April – May 2005

• Re-contact drivers
  – determine eligibility
  – schedule drive

• Mail out survey and $10 incentive

• Reminder phone call

• Drivers complete survey immediately following drive & mail it back (or internet/fax)
Response Rates

Wave 1: 32% response rate
- 1470 drivers recruited (50% recruitment rate)
- 924 complete drive (63% completion rate)
  - 570 Paces Ferry Road; 354 Spring Road

Wave 2: 71% response rate
- 724 drivers re-recruited (out of 840 eligible)
- 594 complete wave 2
  - 380 Paces Ferry Road; 214 Spring Road
Survey Results
Who are the Drivers?

• Both samples well distributed with regard to gender, age, trip purpose

• Paces Ferry drivers tend to be better educated and higher income
  – 39% have graduate degrees (vs. 22% for Spring Road)
  – 46% earn $100K or more (vs. 18% for Spring Road)
Same attributes rated as most important by Paces Ferry and Spring Road drivers:  
• Traffic congestion, driving behavior of others, traffic signal coordination

Attributes rated as least important by both samples:  
• Roadside landscaping, lane width, amount of green time to side streets
Importance Ratings: Background Survey

- Overall Traffic Congestion
- Driving Behavior of Others
- Traffic Signal Coordination
- Amount of Time at Red Light
- # Times Stopped at Red Light
- Road Pavement Quality
- Pavement Markings Quality
- Availability of Turn Lanes
- Overall Travel Speed
- Amount of Green to Side Streets
- Lane Width
- Roadside Landscaping

<table>
<thead>
<tr>
<th>Category</th>
<th>Total</th>
<th>Paces Ferry</th>
<th>Spring Rd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Traffic Congestion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driving Behavior of Others</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Traffic Signal Coordination</td>
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<td></td>
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<tr>
<td>Amount of Time at Red Light</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># Times Stopped at Red Light</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Road Pavement Quality</td>
<td></td>
<td></td>
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<tr>
<td>Pavement Markings Quality</td>
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<tr>
<td>Availability of Turn Lanes</td>
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<tr>
<td>Overall Travel Speed</td>
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<td></td>
<td></td>
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<tr>
<td>Amount of Green to Side Streets</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Lane Width</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roadside Landscaping</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Both Paces Ferry and Spring Road Road drivers:

• Highest satisfaction ratings for:
  - Road pavement quality
  - Lane width
  - Pavement marking quality
  - Availability of turn lanes

• Lowest satisfaction ratings for:
  - Number of times stopped by a red light
  - Amount of time at red lights
  - Driving behavior of other drivers
Despite overall similarities, some differences between the two samples:

• Paces Ferry drivers more satisfied with:
  - Road pavement quality
  - Overall travel speed
  - Traffic congestion
  - Driving behavior of others
Gap Between Importance and Satisfaction
(wave 1)

- Availability of Turn Lanes
- Overall Travel Speed
- Traffic Signal Coordination
- Amount of Green to Side Streets
- Amount of Time at Red Light
- # Times Stopped at Red Light
- Overall Traffic Congestion
- Driving Behavior of Others
- Roadside Landscaping
- Pavement Markings Quality
- Road Pavement Quality
- Lane Width

<table>
<thead>
<tr>
<th>Total</th>
<th>Paces Ferry</th>
<th>Spring Rd</th>
</tr>
</thead>
</table>

# Times Stopped at Red Light
Satisfaction Ratings: Wave 2

• Drivers on both routes continue to be most satisfied with:
  – Road pavement quality
  – Lane width
  – Pavement marking quality
  – Availability of turn lanes

• Differences between Paces Ferry and Spring Road drivers consistent with wave 1. Paces Ferry drivers more satisfied with:
  – Road pavement quality
  – Driving behavior of others
  – Overall level of traffic congestion
Satisfaction Ratings: Wave 1 vs. Wave 2

Treatment group (Paces Ferry):
• Only significant changes in satisfaction: increased satisfaction with lane width and roadside landscaping

Control group (Spring Road):
• Significant increase in satisfaction with roadside landscaping
## Change in Satisfaction Ratings for Paces Ferry Road

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Wave 1</th>
<th>Wave 2</th>
<th>% Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Pavement Quality</td>
<td>5.60</td>
<td>5.59</td>
<td>-0.2%</td>
</tr>
<tr>
<td>Pavement Marking Quality</td>
<td>5.31</td>
<td>5.30</td>
<td>-0.2%</td>
</tr>
<tr>
<td>Lane Width</td>
<td>5.30</td>
<td>5.48</td>
<td>3.4%</td>
</tr>
<tr>
<td>Availability of Turn Lanes</td>
<td>5.21</td>
<td>5.20</td>
<td>-0.2%</td>
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<tr>
<td>Traffic Congestion</td>
<td>5.12</td>
<td>5.02</td>
<td>-2.0%</td>
</tr>
<tr>
<td>Overall Travel Speed</td>
<td>5.11</td>
<td>5.07</td>
<td>-0.8%</td>
</tr>
<tr>
<td>Roadside Landscaping</td>
<td>4.76</td>
<td>5.04</td>
<td>5.9%</td>
</tr>
<tr>
<td>Traffic Signal Coordination</td>
<td>4.72</td>
<td>4.57</td>
<td>-3.2%</td>
</tr>
<tr>
<td>Green Time for Side Streets</td>
<td>4.71</td>
<td>4.68</td>
<td>-0.6%</td>
</tr>
<tr>
<td>Driving Behavior of Others</td>
<td>4.63</td>
<td>4.64</td>
<td>0.2%</td>
</tr>
<tr>
<td>Time at Red Lights</td>
<td>4.49</td>
<td>4.38</td>
<td>-0.4%</td>
</tr>
<tr>
<td># Times Stopped by Red Light</td>
<td>4.40</td>
<td>4.26</td>
<td>-3.2%</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td>5.11</td>
<td>5.14</td>
<td>0.6%</td>
</tr>
</tbody>
</table>
Satisfaction Ratings: Off-Peak Drivers

<table>
<thead>
<tr>
<th>Category</th>
<th>Wave 1</th>
<th>Wave 2</th>
</tr>
</thead>
<tbody>
<tr>
<td># Times Stopped by Red Light</td>
<td>4.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Time at Red Lights</td>
<td>4.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Green Time Side Streets</td>
<td>4.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Traffic Signal Coordination</td>
<td>4.5</td>
<td>4.5</td>
</tr>
</tbody>
</table>

*Note: The data represents the mean score for each category.*
Satisfaction Ratings: Peak Drivers

Mean Score

- # Times Stopped by Red Light
- Time at Red Lights
- Green Time Side Streets
- Traffic Signal Coordination

Wave 1

Wave 2
1. Corridor already functioning at optimal levels

2. Adaptive signal system did not result in reduced travel time or delay (Georgia Institute of Technology Study)

3. Minor problems reported with operation of the adaptive signal system during wave 2 of the study
Conclusions

1. Adaptive traffic signal system may not increase drivers’ day-to-day satisfaction with their roadway driving experience on a corridor that is already optimally-timed

2. The methodology worked as a means of measuring driver satisfaction
   - Good response rates
   - Drivers consistent in their ratings
   - Ratings consistent with observable roadway conditions

3. Drivers least satisfied with aspects of driving experience that are most important to them (i.e. traffic signal coordination)
The authors would like to thank Dr. Joseph Peters, of the ITS Joint Program Office USDOT, for funding the study.

In addition, we gratefully acknowledge the assistance and cooperation of:

- Joe Fletcher and Brook Martin, Cobb County Department of Transportation
- Mshadoni Smith, Federal Highway Administration, Georgia Division Office
- Michael Hunter, Georgia Institute of Technology
Comments or Questions?

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