Performance Measures from a FAST Perspective

TRB Signal Systems Committee
2005 Mid-Year Meeting

Harrah’s Hotel
Las Vegas, Nevada
July 11, 2005

Niel T. Rohleder
Traffic System Manager
Freeway & Arterial System of Transportation
Today’s Presentation

• Uniqueness of FAST
• History of Measuring the Performance of the Arterial Traffic System in Southern Nevada
• Performance Measures Used Today
• Challenges, Pitfalls, and Opportunities
• Ideas for Measuring Performance in the Future
FAST?

• Arterial Traffic Signal Coordination was first mission since 1984 (LVACTS)
• Freeway Operations recently added 2004...slowly coming on line
• Region’s only traffic system operations organization
• All of the region’s entities are members
• Since 2004 administered by the MPO (RTC)
• Multi-jurisdictional/regional focus
• New Regional TMC move was July 1
Quantitative Measures

• Basic analysis
• Travel Time
• Number of Stops
• Average Travel Speed
• Examples from 1992 to prove traffic signal coordination works will follow
Traffic Signal System Study Findings

Non-Coordinated Operation
Coordinated Operation

# of signals in subsystem

Figure 1
Traffic Signal System Study Findings

Non-Coordinated Operation
Coordinated Operation

E. Cheyenne
Civic Ctr.
W. Charleston
Rainbow
E. Sahara
W. Sahara
S. Decatur
W. Flamingo
E. Flamingo
W. Tropicana
E. Tropicana
E. Lake Mead

ARTERIAL SUBSYSTEM

FIGURE 3
Today’s Performance Measures

• Not performed again until 2001 as TPMP
• Labor intensive-costly…$$$ 
• Needs sufficient number of runs
• Performed infrequently, however, it was used while lowering cycle times during system upgrade
• First used stop watch, then On-Board systems, now using GPS technologies
• Easiest for decision makers and public to understand is Travel Time and Stops so these are conveyed extensively as measures
• Also use Emission Based Measures
<table>
<thead>
<tr>
<th>Node #</th>
<th>Length</th>
<th>Node</th>
<th>Travel Time</th>
<th># of Stops</th>
<th>Avg Speed</th>
<th>Total Delay</th>
<th>Time ≤ 0 MPH</th>
<th>Time ≤ 35 MPH</th>
<th>Time ≤ 55 MPH</th>
<th>Fuel (gals)</th>
<th>HC (gr)</th>
<th>CD (gr)</th>
<th>NOx (gr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>Bonneville</td>
<td>Before</td>
<td>30.0</td>
<td>0.5</td>
<td>22.3</td>
<td>6.5</td>
<td>0.0</td>
<td>29.0</td>
<td>30.0</td>
<td>0.0094</td>
<td>0.8124</td>
<td>6.3650</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After</td>
<td>24.3</td>
<td>0.0</td>
<td>22.3</td>
<td>6.5</td>
<td>0.0</td>
<td>24.3</td>
<td>24.3</td>
<td>0.0086</td>
<td>0.8613</td>
<td>6.9417</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Change</td>
<td>-5.7</td>
<td>-0.5</td>
<td>5.2</td>
<td>-5.2</td>
<td>-0.0</td>
<td>-4.7</td>
<td>-0.7</td>
<td>-0.0114</td>
<td>-0.6113</td>
<td>-0.0827</td>
</tr>
<tr>
<td>2</td>
<td>881</td>
<td>Lewis</td>
<td>Before</td>
<td>20.0</td>
<td>0.5</td>
<td>11.8</td>
<td>16.5</td>
<td>5.0</td>
<td>28.0</td>
<td>28.0</td>
<td>0.0081</td>
<td>0.3668</td>
<td>5.4250</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After</td>
<td>11.3</td>
<td>0.0</td>
<td>20.2</td>
<td>-0.7</td>
<td>0.0</td>
<td>11.3</td>
<td>11.3</td>
<td>0.0036</td>
<td>0.3215</td>
<td>3.2257</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Change</td>
<td>-16.7</td>
<td>-0.5</td>
<td>17.4</td>
<td>-17.2</td>
<td>-5.0</td>
<td>-16.7</td>
<td>-16.7</td>
<td>-0.0043</td>
<td>-0.5471</td>
<td>-2.1679</td>
</tr>
<tr>
<td>3</td>
<td>485</td>
<td>Bridger</td>
<td>Before</td>
<td>51.0</td>
<td>1.0</td>
<td>6.4</td>
<td>39.5</td>
<td>28.5</td>
<td>51.0</td>
<td>51.0</td>
<td>0.0123</td>
<td>1.3619</td>
<td>9.8782</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After</td>
<td>12.0</td>
<td>0.0</td>
<td>27.3</td>
<td>3.0</td>
<td>0.0</td>
<td>12.0</td>
<td>12.0</td>
<td>0.0037</td>
<td>0.2693</td>
<td>2.6750</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Change</td>
<td>-39.0</td>
<td>-1.0</td>
<td>20.9</td>
<td>-39.2</td>
<td>-28.5</td>
<td>-39.0</td>
<td>-39.0</td>
<td>-0.0092</td>
<td>-1.9920</td>
<td>-7.2032</td>
</tr>
<tr>
<td>4</td>
<td>481</td>
<td>Carson</td>
<td>Before</td>
<td>23.5</td>
<td>0.5</td>
<td>13.9</td>
<td>12.0</td>
<td>2.5</td>
<td>23.5</td>
<td>23.5</td>
<td>0.0066</td>
<td>0.7005</td>
<td>4.9625</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After</td>
<td>12.7</td>
<td>0.0</td>
<td>25.8</td>
<td>1.3</td>
<td>0.0</td>
<td>12.7</td>
<td>12.7</td>
<td>0.0039</td>
<td>0.3492</td>
<td>3.3927</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Change</td>
<td>-10.8</td>
<td>-0.5</td>
<td>11.9</td>
<td>-10.7</td>
<td>-2.5</td>
<td>-10.8</td>
<td>-10.8</td>
<td>-0.0029</td>
<td>-0.3513</td>
<td>-1.5989</td>
</tr>
<tr>
<td>5</td>
<td>480</td>
<td>Freemont</td>
<td>Before</td>
<td>12.5</td>
<td>0.0</td>
<td>26.2</td>
<td>1.0</td>
<td>0.0</td>
<td>12.5</td>
<td>12.5</td>
<td>0.0056</td>
<td>0.5526</td>
<td>4.7061</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After</td>
<td>14.7</td>
<td>0.0</td>
<td>22.4</td>
<td>3.3</td>
<td>0.0</td>
<td>14.7</td>
<td>14.7</td>
<td>0.0040</td>
<td>0.3155</td>
<td>2.9018</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Change</td>
<td>-2.2</td>
<td>0.0</td>
<td>-3.8</td>
<td>2.3</td>
<td>0.0</td>
<td>2.2</td>
<td>2.2</td>
<td>-0.0010</td>
<td>-0.2371</td>
<td>-1.3943</td>
</tr>
<tr>
<td>6</td>
<td>481</td>
<td>Ogden</td>
<td>Before</td>
<td>47.0</td>
<td>1.0</td>
<td>6.8</td>
<td>36.0</td>
<td>24.0</td>
<td>47.0</td>
<td>47.0</td>
<td>0.0118</td>
<td>1.2785</td>
<td>9.4237</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After</td>
<td>16.0</td>
<td>0.0</td>
<td>20.0</td>
<td>5.0</td>
<td>0.0</td>
<td>16.0</td>
<td>16.0</td>
<td>0.0051</td>
<td>0.5988</td>
<td>4.0019</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Change</td>
<td>-31.0</td>
<td>-1.0</td>
<td>13.2</td>
<td>-31.0</td>
<td>-24.0</td>
<td>-31.0</td>
<td>-31.0</td>
<td>-0.0067</td>
<td>-0.7199</td>
<td>-9.4218</td>
</tr>
<tr>
<td>7</td>
<td>470</td>
<td>Stewart</td>
<td>Before</td>
<td>10.0</td>
<td>0.0</td>
<td>25.7</td>
<td>1.0</td>
<td>0.0</td>
<td>10.0</td>
<td>10.0</td>
<td>0.0048</td>
<td>0.6102</td>
<td>5.0112</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After</td>
<td>22.0</td>
<td>0.7</td>
<td>11.7</td>
<td>13.0</td>
<td>7.0</td>
<td>22.0</td>
<td>22.0</td>
<td>0.0073</td>
<td>0.9762</td>
<td>5.9969</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Change</td>
<td>12.0</td>
<td>-0.7</td>
<td>-14.0</td>
<td>12.0</td>
<td>7.0</td>
<td>12.0</td>
<td>12.0</td>
<td>0.0025</td>
<td>0.2590</td>
<td>5.0957</td>
</tr>
<tr>
<td>8</td>
<td>377</td>
<td>Library</td>
<td>Before</td>
<td>18.5</td>
<td>0.0</td>
<td>26.1</td>
<td>1.5</td>
<td>0.0</td>
<td>17.5</td>
<td>17.5</td>
<td>0.0054</td>
<td>0.4340</td>
<td>4.2342</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After</td>
<td>22.3</td>
<td>0.7</td>
<td>21.6</td>
<td>6.3</td>
<td>1.7</td>
<td>22.9</td>
<td>22.9</td>
<td>0.0076</td>
<td>0.7948</td>
<td>7.8139</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Change</td>
<td>3.8</td>
<td>0.7</td>
<td>-4.5</td>
<td>4.8</td>
<td>1.7</td>
<td>4.5</td>
<td>4.5</td>
<td>0.0022</td>
<td>0.3608</td>
<td>3.5797</td>
</tr>
<tr>
<td>Total</td>
<td>4464</td>
<td></td>
<td>Before</td>
<td>220.5</td>
<td>3.5</td>
<td>13.8</td>
<td>114.0</td>
<td>60.0</td>
<td>218.5</td>
<td>219.5</td>
<td>0.0642</td>
<td>6.5266</td>
<td>50.6266</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After</td>
<td>135.3</td>
<td>1.3</td>
<td>22.5</td>
<td>30.0</td>
<td>8.7</td>
<td>135.0</td>
<td>135.0</td>
<td>0.0435</td>
<td>4.1671</td>
<td>36.4820</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Change</td>
<td>-85.2</td>
<td>-2.2</td>
<td>8.7</td>
<td>-84.0</td>
<td>-51.3</td>
<td>-83.5</td>
<td>-84.5</td>
<td>-0.0207</td>
<td>-2.4595</td>
<td>-13.5446</td>
</tr>
</tbody>
</table>
Travel time for NB 4th Street

<table>
<thead>
<tr>
<th>Time Before and After</th>
<th>60 Second Cycle Travel Time</th>
<th>70 Second Cycle Travel Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>220.5</td>
<td>135.3</td>
</tr>
</tbody>
</table>

38.6% Reduction in Travel Time
### Emissions Before and After Retiming

<table>
<thead>
<tr>
<th>Emmission Type</th>
<th>60 Second Cycle</th>
<th>70 Second Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC (gr)</td>
<td>6.6266</td>
<td>4.1671</td>
</tr>
<tr>
<td>CO (gr)</td>
<td>50.0266</td>
<td>36.4820</td>
</tr>
<tr>
<td>NOx (gr)</td>
<td>3.4597</td>
<td>2.1416</td>
</tr>
</tbody>
</table>

37.1% Reduction in Hydrocarbons  
27.1% Reduction in Carbon Monoxide  
38.1% Reduction in Nitrous Oxide
Other Measures Used

• HCM & V/C Ratios are used for:
  – land development decisions regarding traffic system operations
  – geometric changes on road projects
  – analysis for Transportation Planning and other regional projects

• Safety Analysis of system operations as part of NDOT High-Crash Program…Adjust timing accordingly

• Live CCTV feeds throughout the region’s Arterials used for real-time performance evaluations and changes as needed. (Incident management focus)
  – Staff knowledge is critical for this type
Qualitative or Indirect Performance Measures Used

• Measurement of EVP/TSP Impact to Traffic System Performance
  – Used to enact legislative changes

• Costumer-Based (Qualitative)
  – Number of Calls (complaints) regarding signal timing
  – Time taken to respond to concerns with signal timing

• Performance of resources (Efficiency of operations)
  – Number of traffic signals adjusted per month (staff)
  – Number of system infrastructure work orders per month (staff)
  – System Uptime/Downtime (equipment)

• Developed Baselines…now it’s growing
Example of Qualitative or Indirect Performance Measures

Response Time for Citizen Concerns

Quarter Reported

Number of Days to Respond and Address
Challenges, Difficulties, and Opportunities

• Network Grid configuration
  – Las Vegas Area is a grid layout
  – How to measure
    • Very expensive
    • Very time consuming
    • Modeling has proven inaccurate oftentimes
• How to weight respective metrics
• We live in a political world, especially now
• Reliability measures don’t exist
• No formal report to public yet, need resources
• Need for Arterial Incident Management Measures
More Challenges, Difficulties, and Opportunities

• Existing ITS Archived data not yet on line from the Arterial System Detectors
• No link established between Construction or Work Zones and Traffic System Performance…numerous agencies and priorities
• Need better archiving of data with Central Software
• Needs better Coordination between Incident Responders on arterials and TMC
Future Plans for Activities related to Performance Measures

• Moved in with NHP to closer coordinate with Emergency Responders
• Have pursued UPWP funding for Annual Performance Measurement Program
• AIEMS
  – ITS for Arterial
  – Archived Data User Service FAST ADUS
• “Black Box” Program
  – Commercial, government, and private vehicles
• Tie all agencies operational improvements to our Performance Measure from a regional perspective
More Plans for Activities related to Performance Measures

- Public Response Card by the RTC
- Formal Annual Report Card to the OMC, RTC, and the Public
- Develop Incident Management metrics use and expand on AIEMS
- Public Outreach to better explain the tradeoffs when managing a traffic system
- Performance results on Web Site
“We must recognize that a government's budget is about more than just how much money is spent…it's also about our responsibility to see that those dollars produce results. And, - it's about getting a return on the dollars invested in services. But most important it's about people, their lives and their children.”

Frank H. Murkowski  Governor-State of Alaska
Performance Measures from a FAST Perspective

ANY QUESTIONS?

Niel T. Rohleder
Traffic System Manager (for another 9 days, at least)
Freeway & Arterial System of Transportation