Chicago’s Transportation Infrastructure: Integrating and Managing Transportation and Emergency Services

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CITY OF CHICAGO
EMERGENCY MANAGEMENT & COMMUNICATIONS

TRAFFIC MANAGEMENT AUTHORITY

/daz1d/present/uic-igert-data_may2009.ppt
Planning and Operations

What distinguishes planning data and operations data?

a) Planning data is not useful for operations.

b) Operations data is not useful for planning.

c) Both planning and operations data are needed.
Sharing data as a guiding principle

Planning and Research

ATMS

ADUS

Operations and Management

Traveler Information
Outline

1) Link between Planning and Operations Data
2) Assessing Data Quality
3) Examples of Shared Use
   ● Traffic counts, crashes, performance
   ● Signal modernizations and operations
   ● Locating red-light cameras
   ● Prioritizing expressway and arterial improvements
   ● Special users – pedestrians, freight
   ● Chicago Traffic Management Center (TMC)
Two Questions

- What do we mean by “NEXUS”? 
  - Nexus is a connection or link
- What are we “PLANNING”? 
  - Historically we’ve meant new facilities 
  - Here we mean the performance of the transport system 
- Clearly these are linked in terms of GOALS and in the use of DATA
Linking Planning and Operations - 1

Source: FHWA, M&O in the Metro Transportation Plan, 2007
Linking Planning and Operations - 2

Linkage Opportunities

- Transportation Planning Process
- Data Sharing
- Performance Measures
- Congestion Management Systems
- Funding and Resource Sharing
- Institutional Arrangements
- Regional ITS Architecture
- Regional Management and Operations Projects
- Regional Concept for Transportation Operations

Source: FHWA, Getting More by Working Together, 2004
Data Quality Defined

“... the fitness of the data for the purposes that require it”

- Real-time
- Operations, ITS data archive
- Planning, historic, comparative

Data Quality Guidelines

- **Accuracy** – does the data match actual conditions?
- **Confidence** – is the data trustworthy?
- **Delay or timeliness** – is the data ready for use?
- **Availability or accessibility** – can you get the data?
- **Coverage** – does the data have the area, roads, modes, etc. needed?
- **Resolution** – is the scale appropriate?
- **Completeness** – is the data complete?
- **Validity** – has the data been validated?
Data Quality Issues

- Integration of data from multiple sources (Public and Private, different technologies)
- Comparability
- Capable of statistical validation
- Adequate sample size and coverage
- Need for and use of imputed values
To measure (Operations) or project (Planning) performance the data needs:

- to have COVERAGE of the facility, corridor, network being evaluated
- to be MEANINGFUL to travelers, operators, planners
  - Travel times, speeds, delay, reliability
- to be able to compare ALTERNATIVES
- to support INVESTMENT, MANAGEMENT, and OPERATIONS analysis and decisions
Multiple data sources:
- OEMC TMA
- CDOT
- CPD
Traffic Counts – 24-hour counts at over 1,200 locations citywide in 2006 for transportation planning, traffic engineering, operations analysis, and planning studies.
ADT counts can help estimate the # of vehicle passing through Downtown at any time of the day.

**Practical Use: Congestion Pricing**
Crashes – Geographic database of Chicago Police Department Crash Reports for analysis of high crash locations, signal improvement priorities, red-light cameras, safety projects.
Where to install a new signal or a red-light running camera?
Signal Modernizations and Signal Timing
– Prioritize interconnect systems, signal modernizations, and timing optimization based on crash rates, arterial performance data.

City of Chicago Traffic Signal Network
City Wide Traffic Signal Timing Optimization Program
Begin Jan 1, 2006 -- Complete Dec 31, 2010
**Red-Light Cameras** - Angle crash rates calculated from ADT and Crash data to prioritize installations at over 130 intersections.
Arterial Performance Monitoring System (APMS)

- Covers over 300 miles of major arterials
- Includes Strategic Regional Arterials
- A connected network of routes to supplement expressways
- Supports responsive traffic control strategies
APMS uses transit management and operations and other data ...

www.ctabustracker.com
Algorithm and fusion process converts bus probe data to arterial measures
Arterial Traffic Conditions – Used to prioritize capital projects; improve operations; manage incidents, special events, and emergencies.
Inform travelers ...

Sample dataset
Oct. 2, 2008
4:30-4:45pm

- Under 10 mph
- 10-20 mph
- Over 20 mph
...and move traffic away from congested street segments.
**Freight** – Combine APMS with planning inventories of Class I, II, and II truck routes, viaduct clearances, weight limits, and truck restrictions.
Expressway Performance

Current Travel Time Compared to Historic Average by:
- route
- day of week
- time of day

www.gcmtravelstats.com
Expressway Scans for Causal Analysis

Crash Scan (draft)  Congestion Scan

I-290 Congestion Scan, 2007 Tuesday-Thursday
- 50-60 MPH
- 30-40 MPH
- 10-20 MPH
- 40-50 MPH
- 20-30 MPH
- 0-10 MPH

MILE POST
16.5
17.5
18.5
19.5
20.5
21.5
22.5
23.5
24.5
25.5
26.5
27.5
28.5
29.5
30.5

Note: Average speed is shown as a function of time of day (the horizontal x-axis) and location (the vertical y-axis).

Source: Analysis by Chicago Metropolitan Agency for Planning, based on data from Traffic.com.

Prepared by Chicago Metropolitan Agency for Planning
<table>
<thead>
<tr>
<th>City</th>
<th>Congested Hours This Quarter (Hrs:Min)</th>
<th>Congested Hours This Quarter (Min) Change vs. Year Ago</th>
<th>Travel Time Index This Quarter (% Change vs. Year Ago)</th>
<th>Planning Time Index This Quarter (% Change vs. Year Ago)</th>
<th>% Usable Data</th>
<th>Contributing Factors Compared to Previous Year (Peak Period)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pittsburgh, PA</td>
<td>9:17</td>
<td>119</td>
<td>1.29 -0.8%</td>
<td>1.68 1.1%</td>
<td>99%</td>
<td>2.1% -16.3% 14.2% -2.9%</td>
</tr>
<tr>
<td>Chicago, IL</td>
<td>13:05</td>
<td>41</td>
<td>1.44 -3.0%</td>
<td>1.94 -4.1%</td>
<td>100%</td>
<td>3.8% -9.7% -16.6% -4.0%</td>
</tr>
<tr>
<td>St. Louis, MO</td>
<td>1:16</td>
<td>21</td>
<td>1.06 -1.3%</td>
<td>1.25 1.4%</td>
<td>100%</td>
<td>8.5% 100.6% 56.8% -2.4%</td>
</tr>
<tr>
<td>Los Angeles, CA</td>
<td>7:59</td>
<td>-6</td>
<td>1.42 -0.6%</td>
<td>1.78 -0.5%</td>
<td>100%</td>
<td>-0.2% 337.2% -9.5% 3.7%</td>
</tr>
<tr>
<td>Oklahoma City, OK</td>
<td>0:22</td>
<td>-8</td>
<td>1.07 0.1%</td>
<td>1.22 -3.0%</td>
<td>100%</td>
<td>-5.1% 59.2% -3.0% 2.6%</td>
</tr>
<tr>
<td>Salt Lake City, UT</td>
<td>1:02</td>
<td>-14</td>
<td>1.15 0.0%</td>
<td>1.37 -1.3%</td>
<td>100%</td>
<td>3.1% N/A N/A -0.9%</td>
</tr>
<tr>
<td>San Francisco, CA</td>
<td>3:12</td>
<td>-19</td>
<td>1.23 -1.4%</td>
<td>1.49 -1.2%</td>
<td>100%</td>
<td>-2.4% 140.3% -3.5% -0.2%</td>
</tr>
<tr>
<td>Tampa, FL</td>
<td>2:02</td>
<td>-21</td>
<td>1.19 1.1%</td>
<td>1.44 1.2%</td>
<td>100%</td>
<td>1.1% 134.3% 26.2% -4.1%</td>
</tr>
<tr>
<td>Houston, TX</td>
<td>5:19</td>
<td>-22</td>
<td>1.41 -1.0%</td>
<td>1.88 -2.4%</td>
<td>100%</td>
<td>-2.4% -12.0% 0.0% -2.5%</td>
</tr>
<tr>
<td>Philadelphia, PA</td>
<td>6:09</td>
<td>-27</td>
<td>1.29 -1.8%</td>
<td>1.69 -2.3%</td>
<td>99%</td>
<td>0.1% -15.8% -0.2% -1.6%</td>
</tr>
<tr>
<td>Phoenix, AZ</td>
<td>3:54</td>
<td>-42</td>
<td>1.23 -2.6%</td>
<td>1.54 -2.6%</td>
<td>99%</td>
<td>-0.2% N/A N/A -1.3%</td>
</tr>
<tr>
<td>Minneapolis-St. Paul, MN</td>
<td>3:28</td>
<td>-48</td>
<td>1.28 -2.1%</td>
<td>1.68 -2.1%</td>
<td>98%</td>
<td>3.1% 22.4% N/A -1.1%</td>
</tr>
<tr>
<td>Seattle, WA</td>
<td>7:41</td>
<td>-60</td>
<td>1.32 -5.0%</td>
<td>1.76 -5.7%</td>
<td>100%</td>
<td>1.6% N/A -30.0% 2.6%</td>
</tr>
<tr>
<td>Atlanta, GA</td>
<td>5:54</td>
<td>-62</td>
<td>1.37 -3.5%</td>
<td>1.89 -1.9%</td>
<td>85%</td>
<td>1.8% N/A 21.5% -6.7%</td>
</tr>
<tr>
<td>Portland, OR</td>
<td>4:46</td>
<td>-68</td>
<td>1.24 -4.1%</td>
<td>1.63 -6.8%</td>
<td>96%</td>
<td>-7.4% -22.2% N/A 3.6%</td>
</tr>
<tr>
<td>San Diego, CA</td>
<td>1:22</td>
<td>-71</td>
<td>1.20 -5.6%</td>
<td>1.47 -8.7%</td>
<td>100%</td>
<td>0.1% 160.7% -32.3% -1.7%</td>
</tr>
<tr>
<td>Detroit, MI</td>
<td>1:37</td>
<td>-72</td>
<td>1.17 -3.8%</td>
<td>1.52 -2.8%</td>
<td>89%</td>
<td>0.5% -1.2% 6.0% -4.3%</td>
</tr>
<tr>
<td>San Antonio, TX</td>
<td>1:52</td>
<td>-77</td>
<td>1.17 -4.7%</td>
<td>1.52 -2.9%</td>
<td>99%</td>
<td>-5.6% 104.3% -0.6% 6.2%</td>
</tr>
<tr>
<td>Sacramento, CA</td>
<td>3:36</td>
<td>-81</td>
<td>1.23 -6.6%</td>
<td>1.46 -12.1%</td>
<td>100%</td>
<td>-3.6% N/A N/A -13.3%</td>
</tr>
<tr>
<td>Orange County, CA</td>
<td>4:01</td>
<td>-83</td>
<td>1.29 -2.9%</td>
<td>1.62 -2.1%</td>
<td>100%</td>
<td>0.0% N/A N/A 0.2%</td>
</tr>
<tr>
<td>Providence, RI</td>
<td>0:51</td>
<td>-105</td>
<td>1.11 -5.0%</td>
<td>1.31 -11.7%</td>
<td>100%</td>
<td>2.8% 14.9% -12.8% -2.6%</td>
</tr>
<tr>
<td>Boston, MA</td>
<td>4:29</td>
<td>-110</td>
<td>1.24 -6.0%</td>
<td>1.60 -9.2%</td>
<td>100%</td>
<td>2.2% -9.0% -18.7% 0.6%</td>
</tr>
<tr>
<td>Riverside-San Bernardino, CA</td>
<td>1:14</td>
<td>-182</td>
<td>1.21 -7.6%</td>
<td>1.46 -13.3%</td>
<td>100%</td>
<td>-0.4% N/A N/A -2.5%</td>
</tr>
</tbody>
</table>

For the three months ending May 2008, all three national congestion measures declined, concurrent with a 1.4% decline in nation-wide peak period travel demand and a national retail gasoline price increase of 23% (All figures compared to the same period in 2007). Composite hours of congestion per day declined 36 minutes (11%) to five hours and thirty six minutes per weekday. Only three cities (Chicago, Pittsburgh, and St. Louis) out of 23 posted an increase in duration of congestion larger than 15 minutes. National composite travel time index and planning time index also declined 2.6% and 3.4% respectively. While Atlanta and Sacramento posted 6% and 13% declines in peak period VMT compared to 2007, San Antonio was the only city reporting a greater than 5% increase in peak period VMT. Data quality was reliable overall (98% usable).
Chicago TMC ATMS Subsystems

<table>
<thead>
<tr>
<th>1) Incident Management Subsystem (IMS)</th>
<th>2) Video (CCTV) Subsystem</th>
<th>3) Variable Message Sign (VMS) Subsystem</th>
</tr>
</thead>
<tbody>
<tr>
<td>7) Data Warehouse Subsystem</td>
<td>8) External Input Subsystem</td>
<td>9) External Output Subsystem</td>
</tr>
<tr>
<td>10) Workstations Subsystem (GUI)</td>
<td>11) Administrations Subsystem (Login, Permissions)</td>
<td>12) Traffic Signal Subsystem</td>
</tr>
<tr>
<td>13) Arterial Performance Monitoring Subsystem (APMS)</td>
<td>Others?</td>
<td></td>
</tr>
</tbody>
</table>
Contact information,

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dzavattero@cityofchicago.org