Arterial Street Traffic Congestion Management in Chicago

David Zavattero
Chicago Office of Emergency Management and Communication

58th Annual Illinois Traffic Engineering & Safety Conference

October 22-23, 2009
Traffic Management

- Recurrent Congestion
- Planned Events
  - Special Events
  - Construction
- Non-Recurrent Congestion
  - Incidents
  - Weather
  - Emergencies
  - Demand Spikes
Shared Responsibilities

- CDOT
  - Construction
- OEMC TMA
  - Management and Operations
- Streets and Sanitation BOE
  - Maintenance
- CTA
  - Transit Operations
Management and Operations Tools

- Traffic responsive, adaptive signal systems
- Video detection, surveillance systems
- Signal pre-emption, priority systems
- Computer Aided Dispatch (CAD) systems
- Traveler information systems
- Vehicle navigation, tracking systems
- Enforcement systems - cameras
- Safety systems – traffic calming devices
- Permit, Towing, Snow Command systems and services
Major Incident: Kennedy Oct. 14, 1:00pm

Source: Chicago Tribune
Kennedy Lane Closures
Kennedy Alternate Routes

Crews work to repair key section of Kennedy
The Kennedy Expressway carries more than 300,000 cars per day, second only in the Chicago area to the Dan Ryan Expressway, which carries more than 350,000.

ROAD CLOSINGS
1. Eastbound Eisenhower ramp leading to northbound Kennedy
2. Westbound Eisenhower ramp to northbound Kennedy
3. Northbound Taylor Street exit (not on satellite image)

Alternate routes

IF YOU ARE DRIVING DOWNTOWN
A. From the eastbound Eisenhower: Get off at Damen, take Congress for one block, then turn left onto Ogden.
B. From the northbound Dan Ryan: After 31st Street, get onto Lake Shore Drive.
C. From the north: Approaching downtown, head east to Lake Shore Drive south.

IDOT has placed message board signs along the Kennedy with reroute information.

IF TAKING THE CTA OR METRA
CTA: Extra Red, Blue and Green line service will be available through the morning rush hour.
Metra: Service will not be expanded, but there will be sufficient capacity for extra riders.
Chicago OEMC: Co-Location of Public Safety, Emergency, and Transportation Operations
Unified Command Tools

- Cameras
- Towing
- Signal Timing
- Special Events
- Permitting
- Construction
- Traffic Control

OC
Chicago 911 Center
911 – Police, Fire, Emergency Computer Aided Dispatch
Operations Center

- Command post for coordination of traffic management, incidents response, major events, special projects
- Emergency response
- Centralized authority and accountability
- Congestion mitigation, better traffic flow
- Full utilization of traffic resources
Operations Center
Chicago Incident Center
TO: RICH GUIDICE  
MANAGING DEPUTY DIRECTOR  
CITY OPERATIONS  
FROM: ADRIANA SPADA  
SUBJECT: MONITORING P.M. RUSH HOUR TRAFFIC IN THE CBD  
DATE: 21 NOVEMBER 2006 (TUESDAY)  
TIME: 4:00PM TO 6:30PM  
METHOD: OEMC VEHICLE  
TARGET AREAS: ALL OF CBD  
WEATHER COND: DRY PAVEMENT; 44-49 DEGREES  
OBSERVATIONS: On this coverage date of the CBD the following locations were monitored:  

1= Good  
4= Enforcement Needed  
5= Immediate Attention Needed/Should Be Reviewed By Engineer  

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<tr>
<th>Location</th>
<th>Score</th>
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<td>Michigan / Chicago to Roosevelt</td>
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<tr>
<td>Roosevelt / Michigan to Jefferson</td>
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<td>WB Adams / Michigan to Jefferson</td>
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<td>EB Monroe / Jefferson to Michigan</td>
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<td>WB Madison / Michigan to Jefferson</td>
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<td>EB Washington / Jefferson to Michigan</td>
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<tr>
<td>WB Randolph / Michigan to Halsted</td>
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City Operations Personnel monitor the A.M. and P.M. rush hours with regard to specific streets.  
Look for congestion issues and permit violations.  
Number value is given relative to traffic flow.  
Mitigation measures implemented as necessary.
EVENT ORDERS

Directives outlining the responsibility of specific City Operations personnel for particular events requiring traffic control.

TO: EVENT ORDER GROUP
FROM: Richard Guidice
Managing Deputy Director
City Operations

It is the responsibility of each Deputy to review this order and ensure all affected units within their command receive a copy of this order delineating their responsibilities.

EVENT: The Magnificent Mile Lights Festival and Motorcade

Chicago’s Magnificent Mile is transformed into a winter wonderland for the 10th Annual Magnificent Mile Lights Festival, the nation’s official kick-off to the holiday season.

The Greater North Michigan Avenue Association, in conjunction with the Chicago Tribune and Walt Disney Productions, will synchronize the lighting of holiday decorations with the movement of the motorcade.

The event will end with a fireworks display from a barge moored on the north bank of the Chicago River between Michigan Ave. and Columbus Dr.

DATES/TIMES:
Saturday, November 18, 2006
11:00 a.m. Events begin at the Harris Event Stage – Pioneer Court, 401 N. Michigan Ave.
12:00 p.m. – 6:00 p.m. InterContinental Chicago Chefs ice carvings.
InterContinental Chicago, 505 N. Michigan Ave
5:00 p.m. – 6:00 p.m. Live holiday street entertainment.
North Michigan Avenue, from Oak Street to Wacker Drive
6:00 p.m. – 7:00 p.m. Mickey Mouse leads the illumination of more than one million lights in The Magnificent Mile district.
North Michigan Avenue, from Oak Street to the Chicago River
6:55 p.m. Spectacular fireworks display over the Chicago River after the Magnificent Mile Lights Festival procession.
North Michigan Avenue and the Chicago River
7:00 p.m. – 10:00 p.m. Extended shopping hours at participating Magnificent Mile stores.

LOCATION: Michigan Ave. – Oak St. to Wacker Dr.

ASSEMBLY: The motorcade will assemble on Walton St. between Rush & Dearborn at approximately 1500 hours.

ROUTE: East on Oak St. from Rush St. to Michigan Ave;
South on Michigan Ave. to Wacker Dr.
East on Wacker Dr. to Columbus Dr.
Public Way Permitting

Manage permit process including application, fee payment and enforcement for:

- Public Way Construction
- Public Way Obstructions
- Special Events:
  - Festivals
  - Parades
  - Athletic Activities
  - Block Parties
  - Movie Productions
Chicago TMC Integration

OC
- 911 CAD
- OVS, POD video
- Tow Dispatch

CIC
- Signals, DMS
- Snow Command
- Maintenance Dispatch

Chicago JOC
- Special Events
- Emergencies
- Incident Command

ATMS

CFD/EMS Dispatch

911 Call-takers

CPD Dispatch

Chicago 911 CAD
Video System Tools

- Video Detection
- Video Surveillance
  - Multiple video systems
  - High-bandwidth communications backbone
  - Shared use of cameras
Integration of 1000+ miles of fiber and wireless systems

- OEMC
- CDOT
- CTA
- Private
OVS  CCTV Network Coverage w/ Multiple Networks
Signal System Tools

- Time-based Coordination (Citywide)
- Closed Loop Interconnects (Over 300 CLMATS intersections)
- Centralized Signal Control (Over 400 MIST intersections)
- Semi-actuated and actuated signal control
- Adaptive Signal Control (RT Tracs pilot)
- Transit Signal Priority (Western X49 pilot)

- City-wide signal optimization program
- Smart corridors
- Response plans
- Central control
Chicago Signal Systems in place:

- Over 26,000 intersections
- Over 2,900 Signals
- 476 intersections interconnected in 25 systems
  - MIST (6)
  - CLMATS (19)
Project:
City of Chicago MIST®
Traffic Signal System
http://www.telvent.com

Project Lead:
City of Chicago

Project Team:
City of Chicago OEMC TMA
City of Chicago DOT
City of Chicago BOE
Telvent Transportation, North America
Traffic Control Aides (TCAs)
Project: **CHICAGO TRANSIT SIGNAL PRIORITY PROJECT** – 10 Intersections Western Ave. CTA X49 Route

Organization: City Of Chicago

**Project Team:**
- Office of Emergency Management and Communication - Traffic Management Authority
- Chicago Transit Authority
- Chicago Department of Streets & Sanitation
171 Red-Light Camera Intersections in Chicago

Prioritized based on angle crash rate
Nearly 350 Red-Light Enforcement Systems
265 Intersections with Pedestrian Countdown Signals

Prioritized based on pedestrian activities
Permanent and Portable Arterial DMS
Transit Management Tools

Project:
CTA Bus Tracker
www.ctabustracker.com

Project Lead:
Chicago Transit Authority

Project Team:
CTA Technology Management
CTA Transit Operations
Clever Devices
TMA weekly Traffic & Events Bulletin

- Special Events
- Public Way Construction
- Street closings & traffic impacts
- Distributed to media, city agencies, community groups, condo assoc., etc.
- Distributed to general public via Internet

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**Operator & Traveler Information**

**CITY OPERATIONS**

**TMA WEEKLY TRAFFIC and EVENTS BULLETIN**

*August 11 – August 18, 2006*

*For heat related inquiries, call 311 or visit www.alertchicago.com*

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**TRAFFIC PRIORITIES**

- **The Bud Billiken Parade** on Saturday, August 12 at 10:00 a.m. always attracts many spectators as the 65,000 participants parade down Martin Luther King Drive, from Oakwood to 51st Street, to Ellsworth Drive to 66th Street to Payne Drive and then inside Washington Park. Streets are closed for assembly and route including, King Drive from 31st to 30th Streets, Oakwood between Vincennes and King Drive and Vincennes from 39th to 40th Streets.

- **The LaSalle Bank Chicago Distance Classic** is Sunday, August 13 at 6:30 a.m. step-off at Columbus at Congress. Columbus is closed from Congress to Balbo from early morning on Sunday until 9:00 a.m.; however, Columbus from Balbo to Roosevelt will remain closed until noon. Balbo is also closed from early Sunday morning until 9:00 a.m. from Michigan to Lake Shore Drive. Congress (Michigan-Columbus), Jackson and Monroe from Michigan to Lake Shore Drive and Solidarity Drive (reduced to one lane) will also have brief morning closures. Ten thousand participants are expected as the runners proceed from Columbus north to Grand, west to State, south to Jackson, west to Clinton, south to Van Buren, east to Michigan, south (northbound lanes) to Roosevelt Road, east to LSD, then south to 18th Street and continue south under McCormick Place to 31st. 39th to bike path and return north on bike path into Grant Park. [www.chicagodistanceclassic.com](http://www.chicagodistanceclassic.com)

- **Out of Darkness Walk** is at 6:30 p.m. on Saturday, August 12 at Soldier Field and Lakefront path.

- **Pakistan Independence Day Parade** is August 13 at 12:30 p.m. at Devon between Ridge and Damen. The parade proceeds west on Devon to Claremont and disbands between Claremont and Western.

- **Independence of Ecuador Parade** is August 13 at 12:00 p.m. at North California and proceeds north to Montrose and west to Kimball.

- **The Nike Run Hit Remix** is at 9:00 p.m. on August 17 at Columbus between Balbo and Roosevelt. Columbus is closed from Roosevelt to Balbo from 6:00 p.m. until midnight. The 5-Mile course will start on Columbus Drive just south of Balbo, to 16th, Moe Drive, 31st to Fort Dearborn Drive north through McCormick Place Lakeside Building to Museum Campus Drive and eventually ending on Columbus.

- **Chamber One Pavilion Concerts at Northerly Island** this week include on Friday, August 11 311 with Pepper at 6:30 p.m. (gates open at 6:00 p.m.) On Saturday, August 12 at 7:30 p.m., over 3000 are expected for the Marc Anthony with Marco Antonio Solo concert (gates open at 6:00 p.m.). On Thursday, August 17 at 8:00 p.m., George Benson with Al Jarreau highlights the stage (gates open at 6:30 p.m.). Parking is available via McFetridge. As always, concertgoers are urged to use public transportation to the Roosevelt stop to avoid the traffic delays on Lake Shore Drive and Museum Campus area. CTA runs service after concerts on weekdays and provide
Regional Traveler Information website
www.gcmtravel.com
Arterial Performance Monitoring System (APMS)

- 300 miles of major arterials
- Includes Strategic Regional Arterials
- A connected network of routes to supplement expressways
- Can support responsive traffic control strategies
Probe Data

- Tracking individual units
- Directly measuring travel time, delay
- Several approaches
  - AVL/GPS
  - Transponders
  - Magnetic re-identification
  - Cell phones
  - Bluetooth
  - Others, changing technology
- Varying levels of infrastructure
APMS Data Sources

- 2,300 AVL/GPS Equipped CTA Buses as Probes
- Signal System Detectors
- BlueTooth Probes (Archer Ave. pilot)
- Magnetic Re-Identification Probes (Cicero Ave. pilot)
APMS Components

- Arterial Congestion Advisory
  - Qualitative
  - Travel Time
  - Speed
- Truck Route Advisory
  - Route Restrictions
  - Weight Restrictions
  - Vertical Clearances
- Detour Advisory
  - Construction
  - Closures
  - Incidents
APMS Bus Probe Architecture

Real-Time Data Provider

CTA Realtime Database

APMS Database at CTA

CTA Firewall

City Firewall

Webserver

User

Internet
Geo-fencing bus algorithm

Legend

1 inch equals 0.063 miles

Bus Stops
>
WB  EB

Message Header Location

BUS ID - Speed (mph) - Time

Message Header Data
MESSAGETYPE: 1
BUS_ID: 6811
LATITUDE: 41.954028
LONGITUDE: -87.685094
HEADING: 83
SPEED_MPH: 20 ft/sec
ONROUTE: 1
TIME: 02-Oct-08 16:38:24
APMS Interactive Map Display

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

- Under 10 mph
- 10-20 mph
- Over 20 mph
Sensys Next Generation
Wireless Probe Vehicle Detection
Magnetic Detectors – Cicero Ave Pilot
## Wireless Detector Installation

### Radio Ranges

<table>
<thead>
<tr>
<th>Height of Access Point Relative to Road Surface</th>
<th>Maximum Recommended Range to Sensor</th>
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<tbody>
<tr>
<td>8 - 12 feet (2.4 - 3.7 meters)</td>
<td>75 - 100 feet (22.9 - 30.5 meters)</td>
</tr>
<tr>
<td>16 feet (4.9 meters)</td>
<td>100 - 125 feet (30.5 - 38.1 meters)</td>
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<tr>
<td>20 feet (6.1 meters)</td>
<td>125 - 175 feet (38.1 - 53.3 meters)</td>
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</table>

[Diagram showing Sensys Access Point, Sensys Wireless Sensors, and Sensys Repeater with range annotations]
Two Magnetometer Sensors installed in each lane of traffic
Network Access Point installed at traffic signal controller
Vehicle Occupancy
Vehicle Count

Count Plot - Location unknown
Wed Aug 19 00:00:00 2009 - Thu Aug 20 00:00:00 2009

Count

08/19 08/19 08/19 08/19 08/19 08/19 08/19 08/19 08/19 08/19 08/20 08/20
00:00 02:00 04:00 06:00 08:00 10:00 12:00 14:00 16:00 18:00 20:00 22:00 00:00
Vehicle Speed

![Speed Plot - Location unknown](image)

Wed Aug 19 00:00:00 2009 - Thu Aug 20 00:00:00 2009

- NB1
- NB2
- NB3
- SB1
- SB2
- SB3

Time (h): 00:00 02:00 04:00 06:00 08:00 10:00 12:00 14:00 16:00 18:00 20:00 22:00 00:00

Speed (mph): 0 5 10 15 20 25 30 35 40 45
Lane Data in 15 minute increments

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<th>LANE</th>
<th>OCCUPANCY(%)</th>
<th>VOLUME</th>
<th>SPEED_MED(mph)</th>
<th>SPEED_AVG(mph)</th>
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Future Applications

- Combines magnetic sensors with advanced packet radio technology to create a reliable, accurate and cost-effective wireless vehicle detection system.

- Conventional VOC, System, and Signal Actuation Applications.

- Travel time applications.

- **Vehicle Magnetic Re-Identification** requires installation of five sensors in one lane at two locations.

- Re-Identification configuration reports travel time data by segment.
TrafficCast Wireless
Probe Vehicle Detection
BlueTooth – Archer Ave. Pilot

Trial Period
All 4 units in operation Aug 13 – Sept 13
BlueToad Reader
Travel Time & MAC – Aug 26

Travel time and matched pairs on August 26, 2009
Westbound Archer Ave between 5300 and 3862
Total MAC Address Detected

Recorded MAC addresses during August 21-27 2009

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<thead>
<tr>
<th>Date</th>
<th>BT Unit 1</th>
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Matched MAC Address Pairs

Matched MAC Addresses During August 21-27 2009

Date

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</table>
BlueTOAD™ vs. Ground Truth

Travel time comparison for Archer ave driving test

Lane 1, Lane 2, Lane 3, and Lane 4 are from the closest to the farthest to the BlueToad devices.
APMS Next Steps

- Evaluate Coverage
  - CTA Bus Probe
  - Re-Identification
  - BlueTooth
  - Other?
- Cicero Smart Corridor ATMS
- Integration with Chicago TMC
Cicero Smart Corridor / Midway HAR Architecture

Cicero Ave ITS Project Conceptual Diagram

Input
- MIST Signal System (Cicero Traffic Condition)
- Midway Parking System (Midway Parking Availability)
- 6 Rail Road Gate controllers (Rail Road Gate downtime)
- Other External Systems (Permits, 911 etc)

Output
- Cicero VMS (Existing)
- Cicero VMS (New)
- Stevenson VMS (Existing)
- Stevenson VMS (New)

Integration
- Relational Database
- Cicero/Midway ATMS
- TMC ATMS
- GCM Gateway (Cicero Traffic Condition)

Web Server
- XML File
- Internet
- RTA Kiosk / Web

Other Systems
- City of Chicago / CEMC Network
- HAR

Manual Input (Special Event)
An Overview

- Signal systems
- Traveler information
- Transit and traffic management
- Database development & integration
- 911 Center
- Operations Center
- Chicago Incident Center
- Joint Operations Center
<table>
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<tr>
<th>1) Incident Management Subsystem (IMS)</th>
<th>2) Video (CCTV) Subsystem</th>
<th>3) Variable Message Sign (VMS) Subsystem</th>
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<td>8) External Input Subsystem</td>
<td>9) External Output Subsystem</td>
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<td>11) Administrations Subsystem (Login, Permissions)</td>
<td>12) Traffic Signal Subsystem</td>
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<td>13) Arterial Performance Monitoring Subsystem (APMS)</td>
<td>Others?</td>
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Thanks,

David Zavattero, Deputy Director
Chicago Office of Emergency Management and Communications
(OMEC)
Traffic Management Authority

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