Emerging Technologies and Transit Planning: Moving Bits to Move People

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Mass Transportation in Chicago

CTA - Buses & Rapid Transit for Chicago & 40 Suburbs
Metra - Commuter Rail
Pace - Suburban Buses

Transit Ridership Share

- CTA: 80%
- Metra: 14%
- Pace: 6%
CTA: Chicago Transit Authority

Approximately (as of 4/07):

- 2225 Buses on 2529 Route Miles
- 154 Bus Routes
- 1,190 Rail Cars on 224 Route Miles
- 144 Rail Stations
- 1.6 Million Trips/Day
- $1.13 Billion operating budget (’07)
- About 11,000 employees
Background
Much of Chicago's transit network was developed in the late 1800s by private companies with land interests. The elevated system was eventually electrified and modernized. Horse car, cable car and trolley routes were eventually converted to bus routes.
Historical Ridership

CTA Bus and Rail Ridership Trend, 1906-2007

Annual Passenger Boardings

Year
HOW GUIDE-O-MATIC SYSTEM COULD BE APPLIED TO A CTA BUS

SYSTEM IDENTIFICATION

1. GUIDANCE WIRE
2. MAGNETIC FLUX LINES
3. SENSING UNIT
4. GUIDE BOX
5. RELAY PANEL
6. STEERING CONTROL LINE
7. STEERING MOTOR
8. FUEL ADJUSTMENT CONTROL LINE
9. BRAKING CONTROL LINE
10. OPERATOR CONTROL
11. BEACON CONTROL LOOP
12. BEACON ANTENNA
13. BEACON CONTROL RECEIVER
**Skokie Swift**

**ROUTE:** From Dempster Street, Skokie, to Howard Street L, Chicago, and return.

**TIME:** 6½ minutes nonstop (fastest terminal-to-terminal rapid transit speed in the world).

**SCHEDULE:** Every 10 minutes during rush hours; 30 minute intervals other times. 6 a.m. to 10 p.m. Monday through Friday.

**FARE:** Adults, 45c; children and students, 29c. Includes transfer privilege to all CTA trains and buses.

**PARKING:** 25c all day, in modern new lot at Dempster Station.

**Free Kiss 'N' Ride Area** for delivery and pick-up at station.

**NOTE:** The CTA Bus route, effective April 20, is extended to Old Orchard Shopping Center, via the Dempster terminal, and is co-ordinated with the Skokie Swift.
Recent Ridership

56% of all work trips to downtown Chicago made on Mass Transit.
Ridership up 8 of last 9 years.
70% of CTA Customers have access to alternative transport (i.e. auto).
Recent Challenges & Opportunities

- Changing Customer Habits
- Shifting Land Use/Development Patterns
- Aging Infrastructure
- Funding
Steps Taken to Reshape Planning at CTA

• Systematize approach to planning using service standards.
• Develop information infrastructure.
• Develop human capital.
• Support discourse with tools & data.
CTA’s service planning process is driven by the Service Standards as adopted by the Chicago Transit Board (www.transitchicago.com).

These standards describe five key measures that influence fixed-route service design:

- geographic coverage,
- hours of service,
- frequency of service,
- passenger flow, and
- productivity.

The standards guide the process for public input on proposed service changes. Applying the Service Standards is an ongoing process that allows for continual improvement of the system given available funding resources.
Service Standard Example: Passenger Flow

Passenger Flow determines the number of buses or rail cars needed to accommodate customer demand.

- Maximum load of 60 passengers for 40 ft. bus.
- Maximum load of 93 passengers for 60 ft. (articulated) bus.
- Rail Car load standard is 90 passengers for 50 ft. railcar.

Measured by: Maximum number of customers per vehicle
Chicago Transit Board & Service Standards

CTA Service Planning Process

- AFC Data
- APC Data
- Point Checks
- Ride Checks
- Productivity
- GIS Data
- Traffic Engineering
- Route Information
- Service Plan
- Community Input
- Statutory Requirements
- Other Stakeholders
- Minor Changes
- Major Changes
- Board Approval
- Implementation
- Board Notification
Elements of the CTA Information Infrastructure

- Census Data
- Housing Data
- Land Use Data
- Aerial Orthophotos
- Route Infrastructure
- Schedule Information
- Spatially Intelligent Vehicles
- Performance
- Ridership Data
- Specialized Models
- Field Data
Feeding the Information Infrastructure
Rail Ridership Tracking

Chart (12 Month View)

Rail System 3 Month Rolling Average Ridership, Weekdays

Weekdays (every 6 labeled)

Daily Ridership
3 Month Rolling Average

***Note: light blue represents unofficial data (less than 5 days old)***
Fare-media Data Collection
Use this application to show daily branch ridership and monthly average branch ridership. Creates a stacked area trend of the contribution of each branch over 24 hours.

Data available from January 2001 — March 2004

Select a date (mm-dd-yyyy) 03-19-2004

Stacked Area Graph of Branch Ridership on 3/19/2004 (Friday)
Vehicle-based Data Collection

On-Board Systems Projects

- Radio/AVL System
- UHF Link
- GPS Antenna
- Radio Antenna
- WDOILS
- New Radio
- VLU

Automated Vehicle Maintenance
Automated Stop Annunciation and signs
Wireless data on/off for all
Integrated APC
Odometer, Door & Lift
Smart Signal Priority
On-Board AVL and GPS

= Current  = RFCS Scope  = OBSI Scope  = RAVL Scope
Farebox-based Bus Ridership Tracking

Hourly Rides, #3 King Drive, July 3rd, 2005

- Boardings

Hour
- July 3rd
- Avg July Sunday

Chart Area
Automatic Passenger Counter (APC)  
Bus Ridership Tracking
Related Technology Applications for Transit Service Improvement
Automated Voice Annunciation System

Route 3 to Ontario and Fairbanks

Next stop Michigan and Chicago
Bus-tracking for Management and Customer Information
Computer-assisted Vehicle and Crew Scheduling
### Ridership/Revenue Fare Model

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**Valid Period for passes:**
- V: one week
- T: two week
- S: semi-monthly
- M: monthly
- A: annual, or specific number of days.
Information on passenger flows from origin station to destination station are combined with travel time information for various routing scenarios to calculate a change in passenger-minutes of travel. Separate comparisons are made for the weekday morning rush, evening rush and travel during off-peak.
The OnTrack model (acquired by CTA from Transportation Decision Systems in 2002) was customized for CTA, including all of CTA’s track, station and signal infrastructure as well as rail vehicle performance specifications. The model is event-based and simulates train movements based on track geometry, cab and wayside signal controls and passenger loads.

It is used to analyze various alternative rail routing scenarios to maximize ridership while minimizing potential delay.
Visualization Tools, (such as this use of GIS to illustrate modal preference), are also an important decision support resource.
Public Participation Inputs to the Transit Planning Process at the CTA
Travel Survey Data

Travel Survey Data

Travel Survey Data

Travel Survey Data
Community Workshops
Results
Sub-Regional Service Planning Studies

- CTA engages in systematic changes in bus and rail service through a sub-regional study process - services within a defined geographic area are evaluated in a comprehensive manner.

- Changes on one route may allow for improvements on adjacent or connecting services.

- The overall result is improved service for customers - improvements include ridership increases, better connectivity, reduced transfers, and greater customer satisfaction.

- Four sub-regional studies have been completed: North Suburban/West Rogers Park, South Lakeshore, North Lakeshore and West Side/West Suburban.

- The next areas we will be studying are the Far South/Southeast, Southwest, Northwest and Central Area.
Recent Service Planning Successes

Changes to the South Lakeshore and North Lakeshore were implemented in Fall 2003.

The impact of the first three sub-regional studies has been very positive. Annual ridership has increased by 4.6 percent for the South Lakeshore sub-region, and 5.5 percent for the North Lakeshore sub-region.

Travel times have decreased and customer satisfaction has improved.
CTA is currently pursuing long-term expansion projects that would provide valuable connections to facilitate regional travel. These projects include the following:

- **Circle Line** connecting all CTA rapid transit and Metra commuter rail lines on the periphery of Chicago’s central area
- **Red Line Extension** South
- **Orange Line Extension** South
- **Yellow Line Extension** North
- **Intermodal Transit Center in Central Area**
- **Express Airports Train** premium rail service between downtown and both airports
Lessons Learned

Innovate- Work with academic institutions and private firms to identify creative solutions to transit problems (apply relevant technologies).

Implement- Put sensible solutions into place with the help of internships and key staff hires (develop human capital).

Impact- Apply the tools and techniques here to continue the positive momentum of ridership growth (reshape the planning process and the transit system).
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