

Understanding Transit Travel Behavior: Value added by Smart Cards

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Outline

- Introduction
- Smart Card Penetration
- Path choice analysis
 - Identifying regular and consistent customers
 - Variability in access stop location
 - Access distance Analysis
- Future work

Introduction

- Understanding path-choice behavior
- Smart Cards: Small but growing segment of Chicago Transit Authority (CTA) customers (Chicago Card and Chicago Card Plus)

Why focus on Chicago Cards?

- Longer life – observe travel patterns over long period
- Address information – home location known in most cases

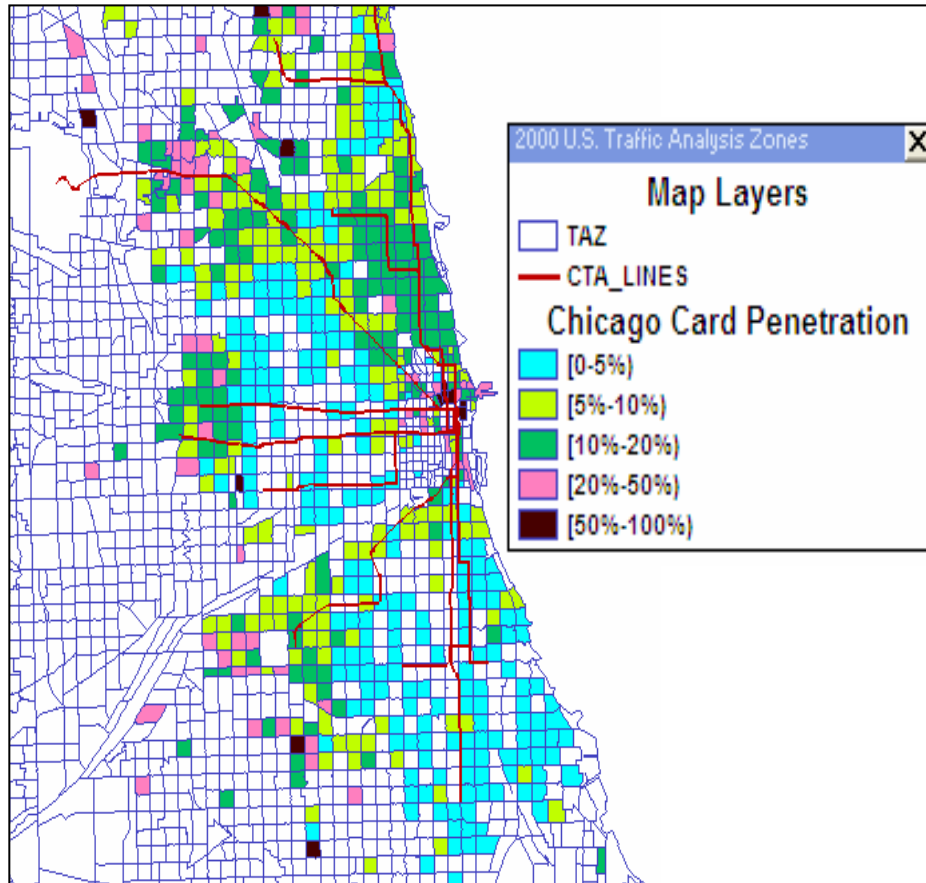
Chicago Card (CC) Penetration

- Spatial distribution of smart cards: Known
- Chicago Card Penetration

$$\text{CC Penetration} = \frac{\text{Chicago Cards customers}}{\text{total transit commuters (work trips)}}$$

- Gives insight into **socio-demographic characteristics** by linking it with census data
- Help determine **targets for sales and promotion**

Chicago Card (CC) Penetration (Sep, 2004)



- Spatial distribution of CC Penetration with rail transit lines
- Correlation between CC Penetration and rail transit lines
- e.g. CC Penetration in range 5% to 10% in northwest

Figure 1: Chicago Card penetration for TAZs where there are at least 5 smart cards

Identifying Regular Customers

- **Frequent:** Use the transit system for at least 3 week days during the week (used for analysis)
- **Time Consistent:** First daily CTA trip begins at approximately same time for at least 3 week days during the week (used for analysis)

Frequent Weekday Consistent Customers Characteristics

- Know the system
- Make regular, repeated, rational choices
- Typically make work trips
- Destination is fixed

Identifying Frequent Weekday Customers

Chicago Card Weekday Customers 59619

Tagging users by frequency of weekday use

Frequency	1 day	2 day	3 day	4 day	5 day
# CC customers	9869	7656	8097	11625	22372

42094 Frequent weekday customers

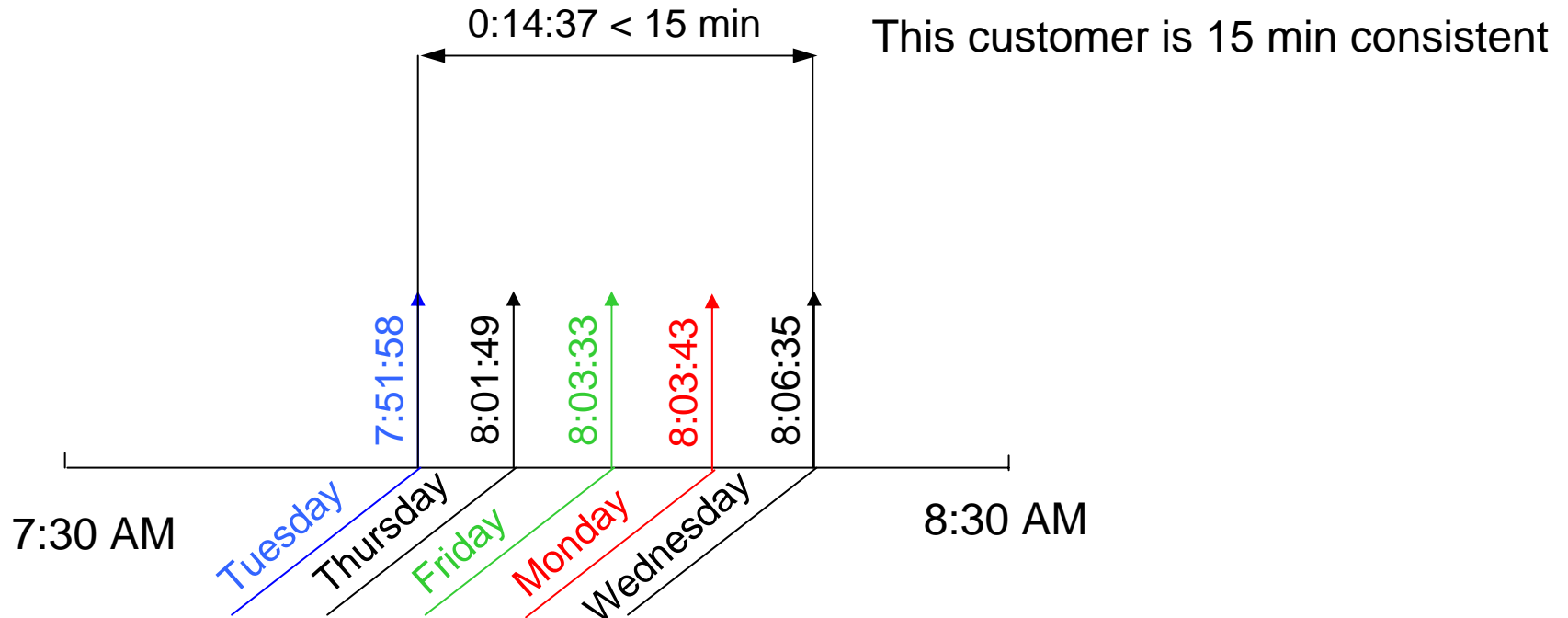
Time Consistency Definition



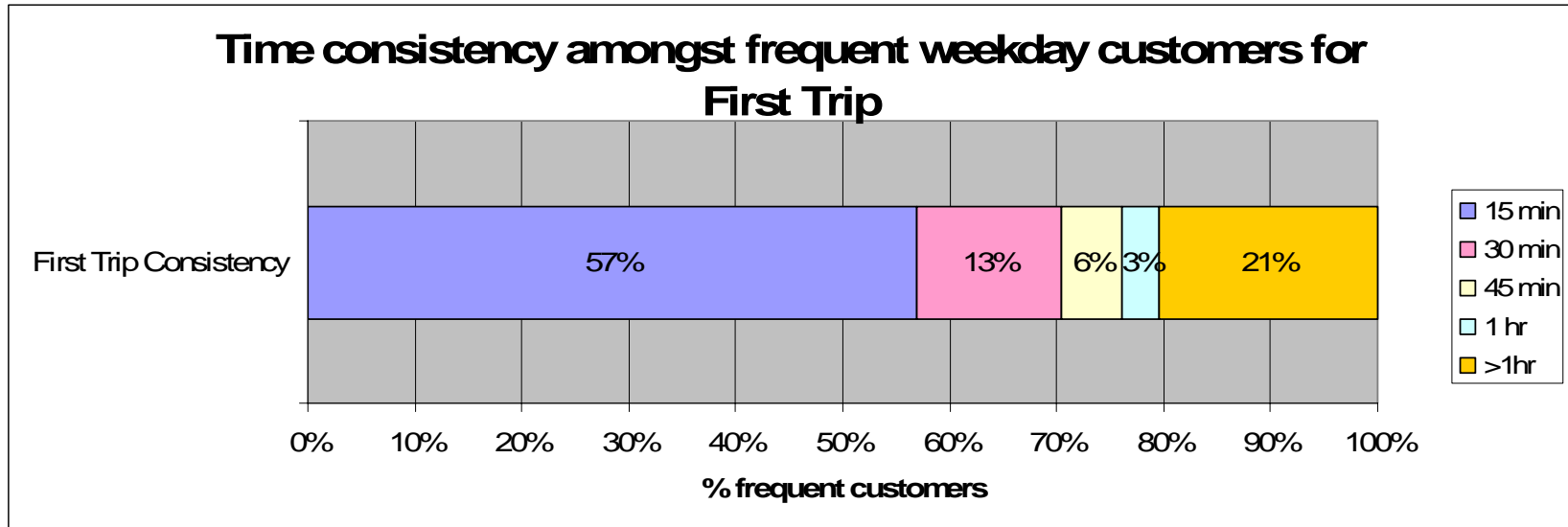
Frequent Customer

Uses CTA system for 3-5 days

Check if he **accessed** the system at a consistent time



Consistency Analysis



- 57% (23989) frequent customers are time consistent within 15 minutes on their first trip
 - Are used for all subsequent analysis in this presentation
- 70% (29633) frequent customers are time consistent within 30 minutes on their first trip

First Trip Analysis

- Customer Classification – Bus, Rail, Mixed
- Access Stop Location
 - Using AFC and AVL data
- Distribution of Access Distance
 - Using TransCAD

Customer Classification

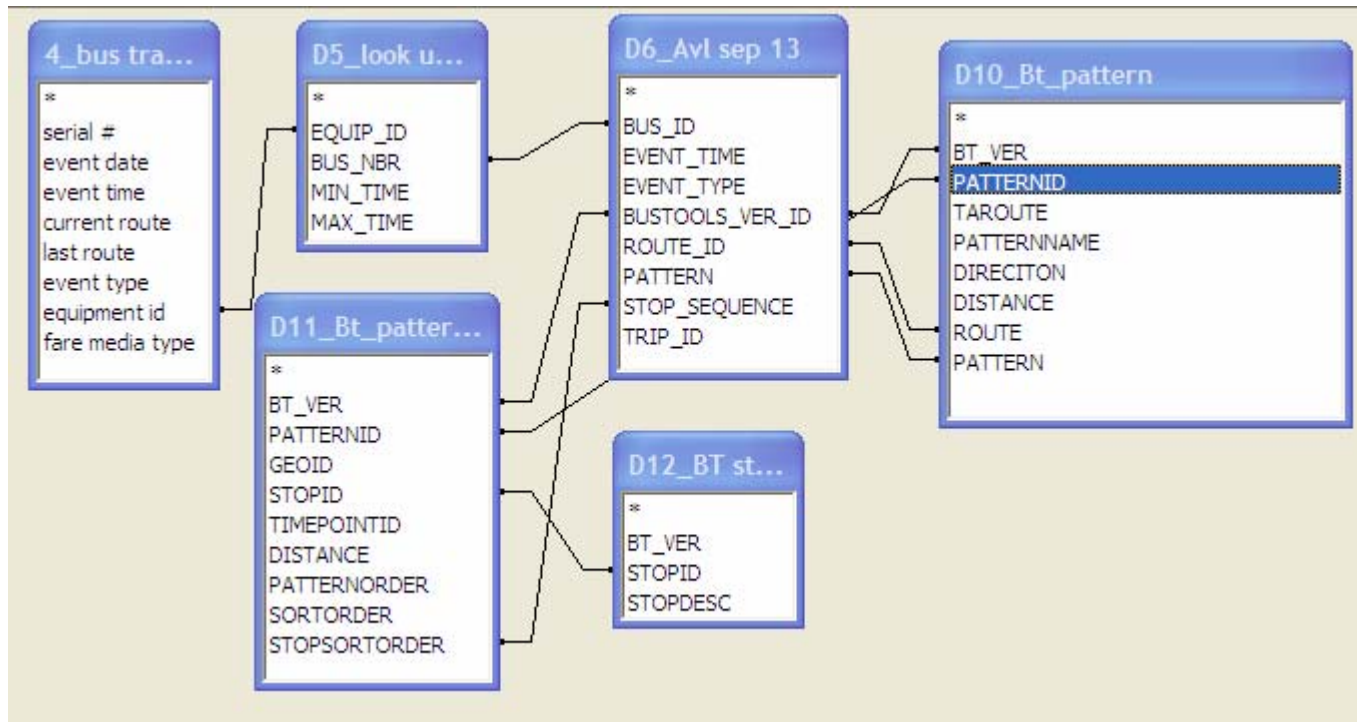
- **Rail:** Use rail for all weekday first trips
- **Bus:** Use bus for all weekday first trips
- **Mixed:** Use both rail and bus for all their weekday first trips

customer type	# Customers	%
Rail	13688	57%
Bus	7034	29%
Mixed	3267	14%
Total	23989	100%

Variation in Boarding Location

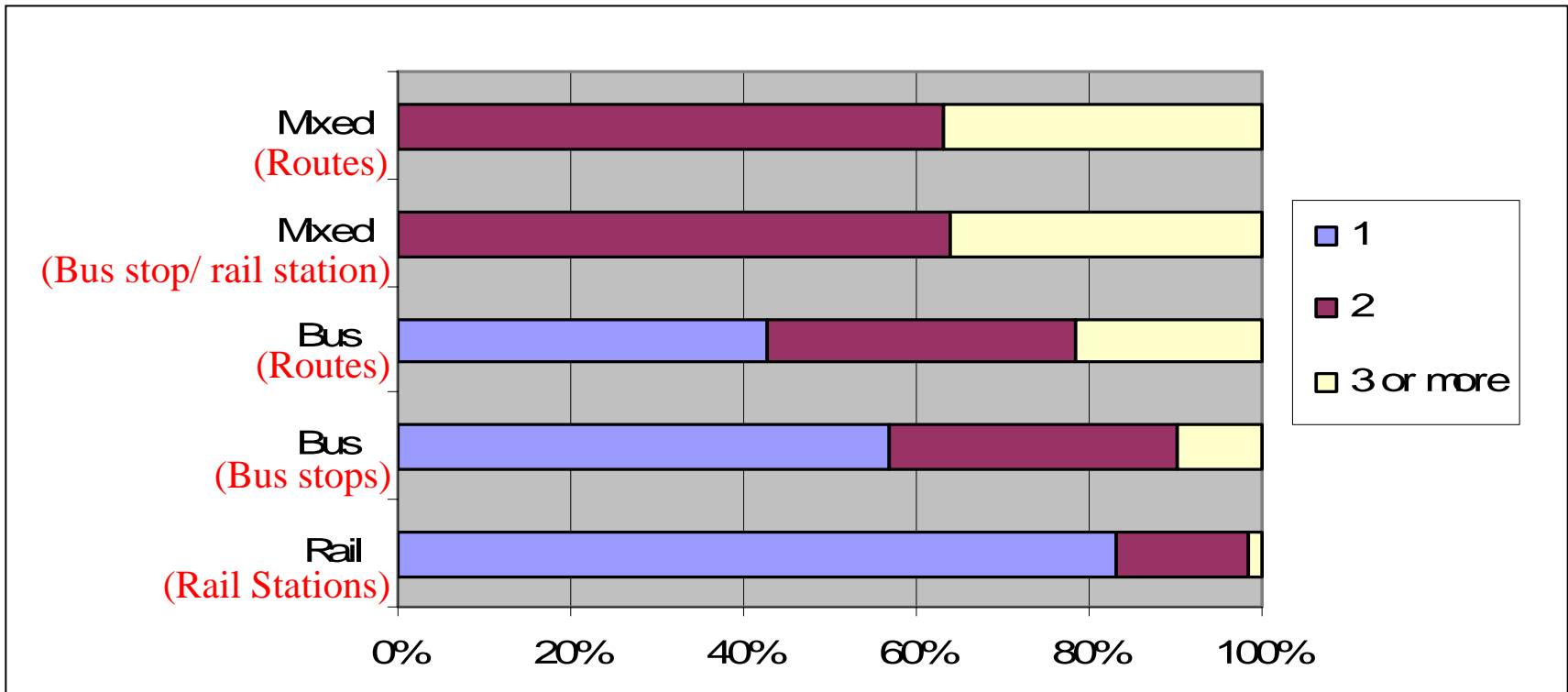
- Boarding location
 - Rail stations: AFC data
 - Bus stops: inferred by AFC-AVL linking
- Variation in boarding station
 - Number of stations/stops used
 - Categorized by customer type (Rail, Bus, Mixed)

Identifying Bus Stops: AFC and AVL



- Multi-table match
- Match rate of 77%

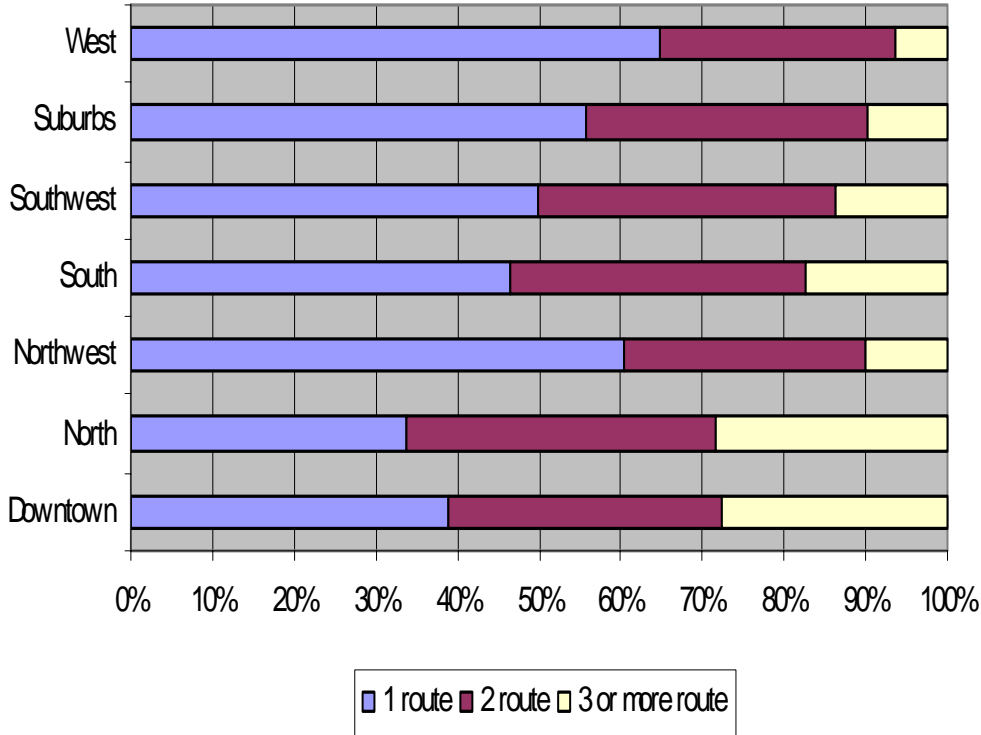
Variations in boarding locations



- Rail customers behavior is less variable
- Route and Stop variability is same for Mixed customers
- Route variability $>$ Stop variability for Bus customers
 - Multiple routes serving the same stop
 - Wrong log in on AFC system

Route Variability for Bus Customers

Number of different routes used by bus customers

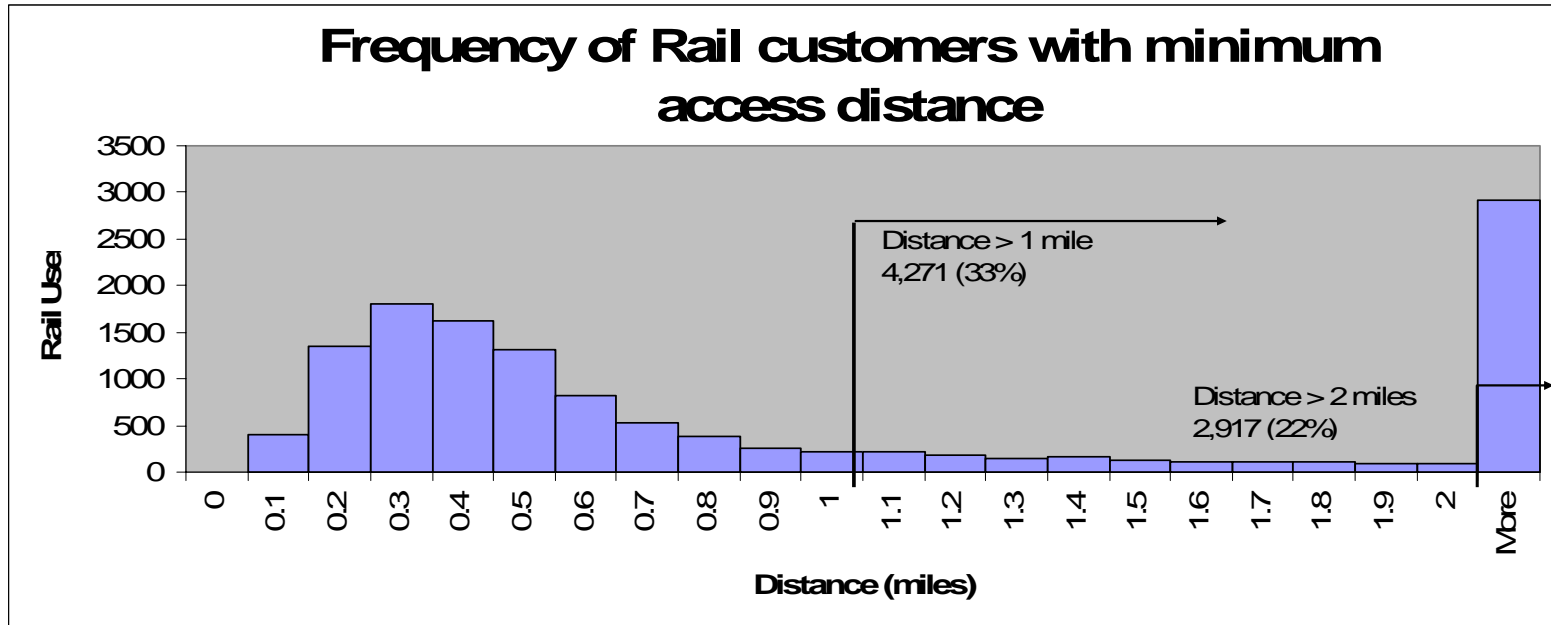


- Route variability differs across regions
- North and Downtown show maximum variability
- Greater number of routes serving same destination!

Access Distance Analysis

- Methodology
- Results

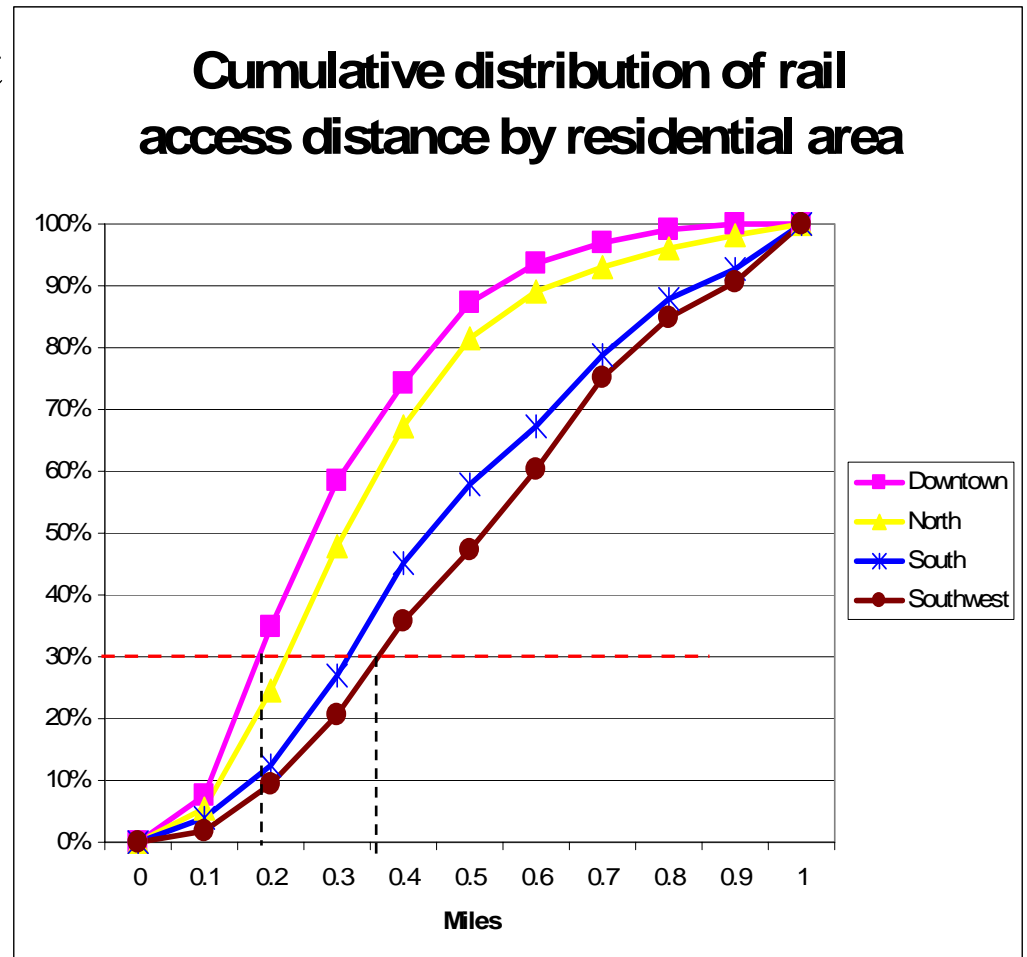
Rail Access Distance Distributions



	Frequent Consistent Rail Customers	%
Total analyzed	12973	100%
Access distance <=1 miles	8702	67%
Access distance <=2 miles	10056	78%
Access distance >1 miles	4271	33%
Access distance >2 miles	2917	22%

Access Distance (≤ 1 mile) by region

- Access distance is smallest for Downtown and North
- Access distance is maximum for Southwest and South



Future work

- Chicago Card
 - Update analysis with more recent CC data
 - Correlation of Chicago card penetration with census data
- Origins and destinations of trips
 - Get bus stop access distance at origin
 - Get variability of boarding locations for return trip
- Model path choice behavior
 - How do card users choose among several options?
 - Policy implications derived from the observed behavior?

Thank you for your attention