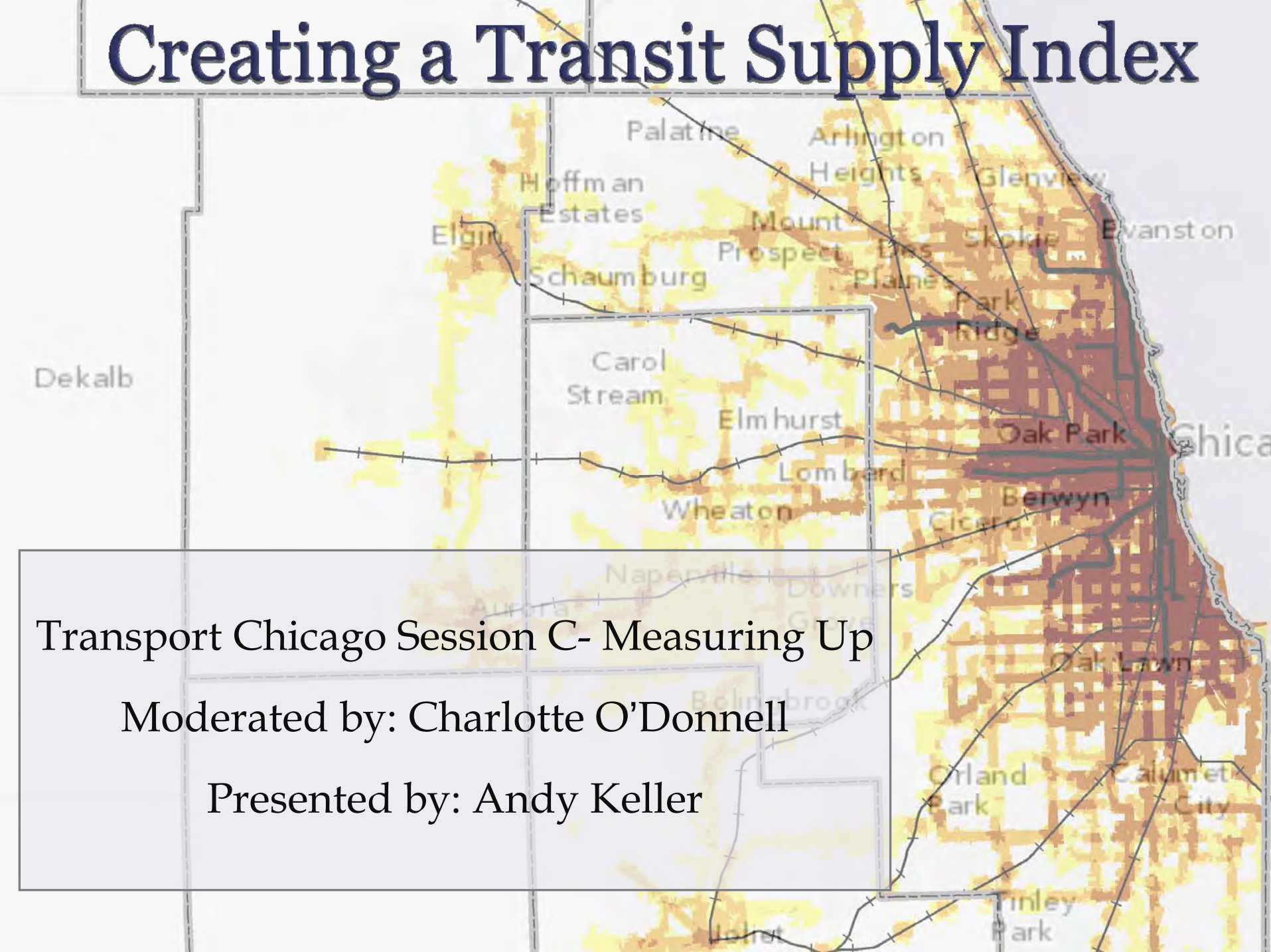
Creating a Transit Supply Index



Transport Chicago Session C- Measuring Up

Moderated by: Charlotte O'Donnell

Presented by: Andy Keller

Presentation Outline

- Purpose
- Framework and Guidelines
- Methodology
- Results
- Next Steps

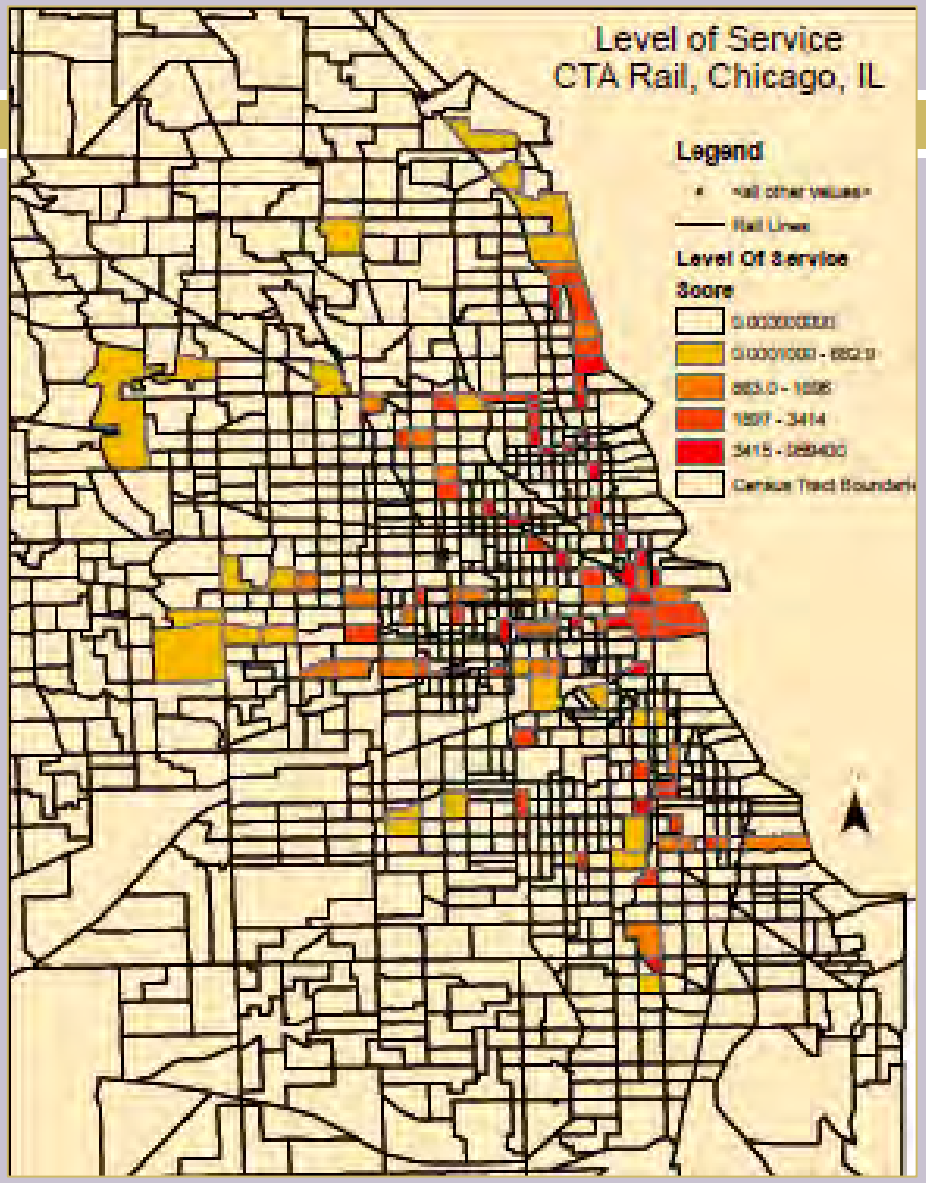
Goals for Transit Supply Index

- Create a metric to measure level of transit service for northeastern Illinois
  - Based on publicly available data
  - Calculated at various geographic regions
  - Useful for analysts but meaningful to non experts
  - Automated process for large transit systems and regular updates

Framework and Guidelines

Framework

- Assignment for Master's course
- Measures net persons served
  - frequency of service x percentage of population served
- Based on frequency counts for CTA rail stations and population data from census blocks



Guidelines

- Guidelines taken from the Transit Capacity and Quality of Service Manual
  - User-based rating system based on frequency of service
  - Suggested Catchment Areas for rail stations and bus stops

What is TSI- (Transit Supply Index)

- Aggregate measure of transit trips supplied by bus and rail in zones normalized by percentage covered in zone
- The TSI is a measure of the frequency of service for a geographic zone
  - TSI=
    - Frequency of Service x (Service Buffer Area/ Total Zone Area)
  - Example 40 buses x .5 miles/ 1 mile = 20 TSI
  - Peak AM Period (6-10 am)
    - Headway for 4 hour period = 60/ (20 TSI/ 4 hours) = 12 minute headways

Example Score for Time Period Between 6-10 am						
Frequency		Coverage			Score	
Route	Buses	Service Buffer Area	Total Zone Area	Percentage of Coverage	TSI	Headway (minutes)
1	24	0.5	1	50%	12	20
2	12	1	1	100%	12	20
3	48	0.5	1	50%	24	10
Total	84	2	1	200%	48	5

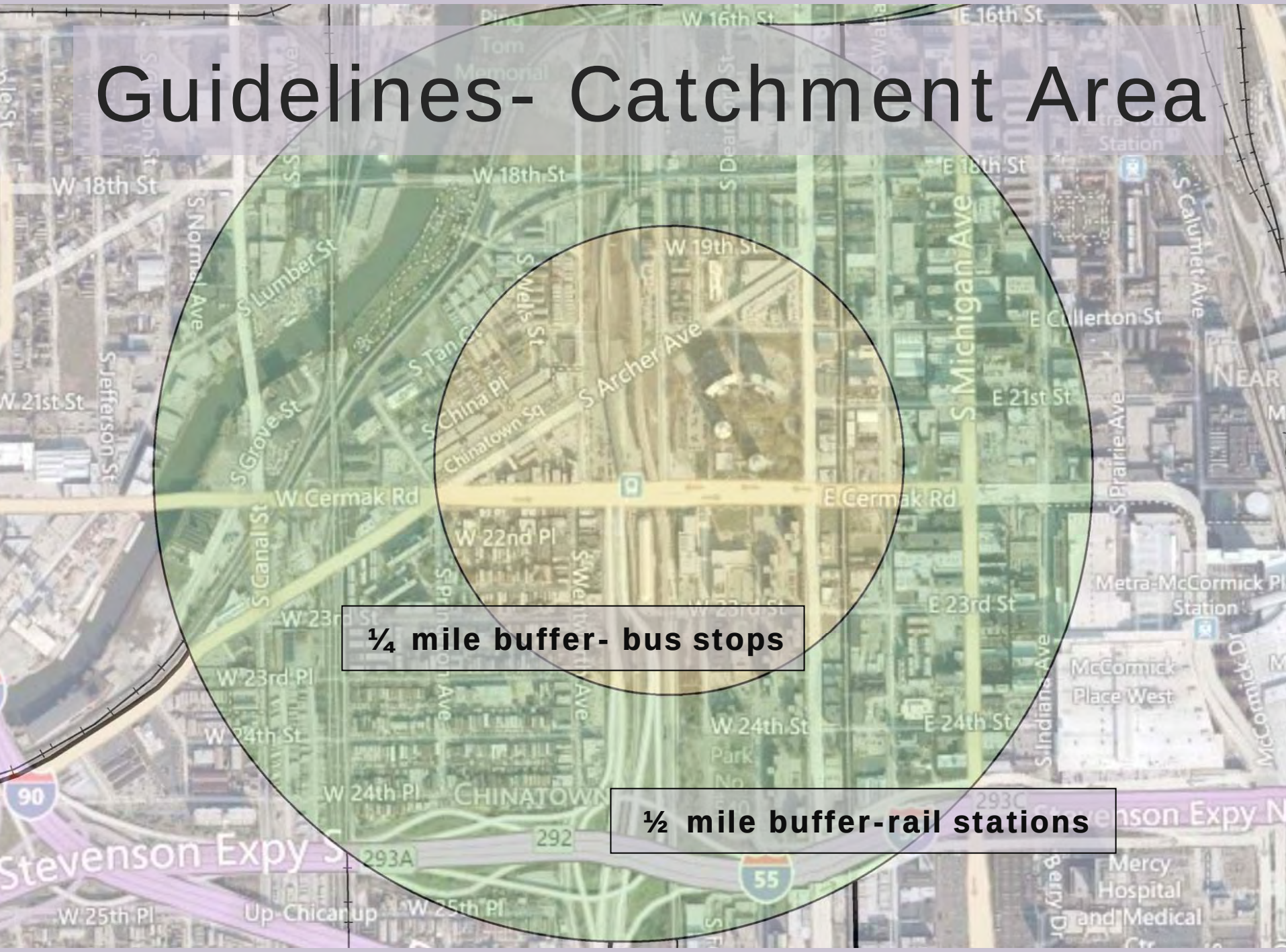
Grade System

- Transit grade based on headways to measure attractiveness of transit to riders
- Previous Example
  - 12 minute headways = B level of service

Exhibit 5-5
Service Frequency LOS: Urban Scheduled Transit Service

LOS	Headway (min)	Veh/h	Comments
A	<10	>6	Passengers don't need schedules
B	10-14	5-6	Frequent service, passengers consult schedules
C	15-20	3-4	Maximum desirable time to wait if bus/train missed
D	21-30	2	Service unattractive to choice riders
E	31-60	1	Service available during hour
F	>60	<1	Service unattractive to all riders

Guidelines- Catchment Area



Data Sources

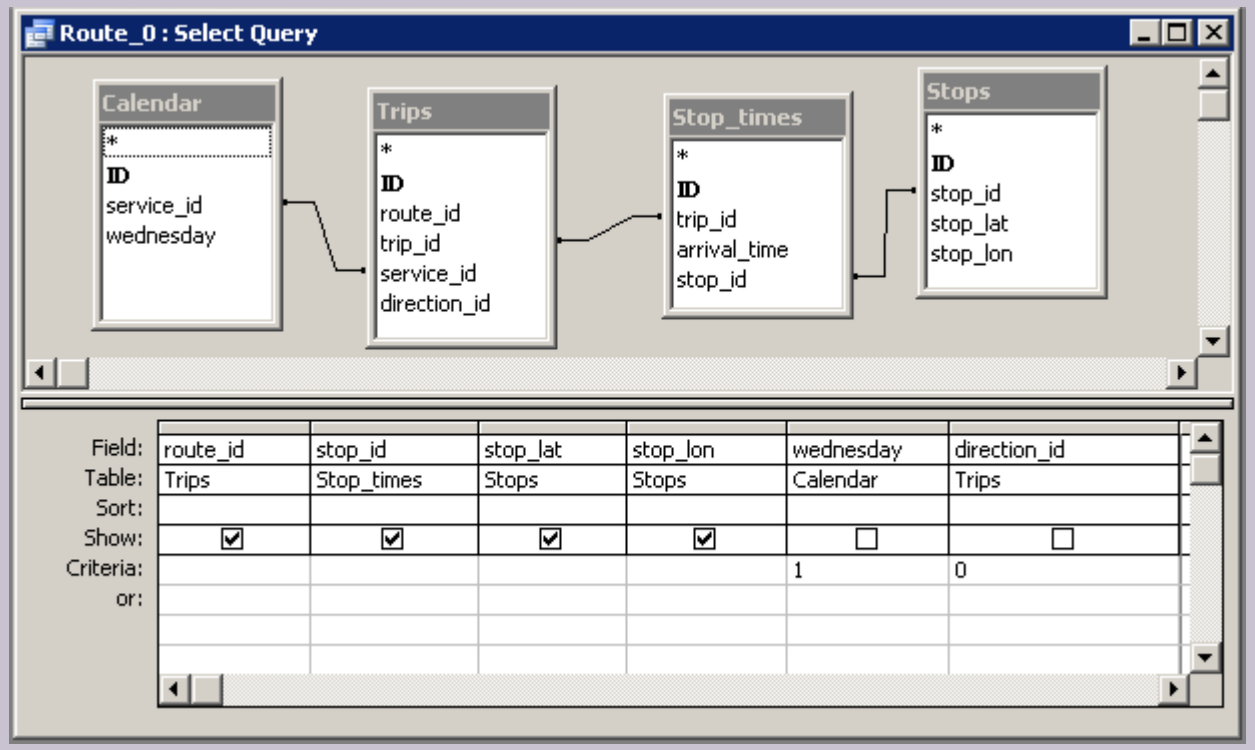
- General Transit Feed Specification
  - Text files used for Google Transit.
  - Geographic coordinates for all transit stops
  - Data for each transit trip that occurs at all stations, for all trips along all routes
  - Universally formatted tables
- Census Tiger Files
  - Shapefiles for census blocks and tracts

Key Questions for TSI

- How can frequency be counted for every stop?
- How large a coverage area is appropriate for each transit stop?
- How to accommodate for areas with overlapping service?

Methodology

Methodology-
Prepare Data for GIS Analysis



- Text files are imported to Microsoft Access and joined based on shared fields
- Records are queried based on day of the week of service and/or time of day

Methodology-
Calculate Frequency by Station and Route

ROUTE_ID	STOP_ID	STOP_LAT	STOP_LON
38690	24380	41.99479	-87.71396
38690	23707	41.99708	-87.71803
38690	23706	41.99857	-87.72050
38690	23705	41.99916	-87.72144
38690	23704	42.00017	-87.72311
38690	23703	42.00123	-87.72481
38690	23702	42.00185	-87.72578
38690	23701	42.00282	-87.72734
38690	23700	42.00352	-87.72847

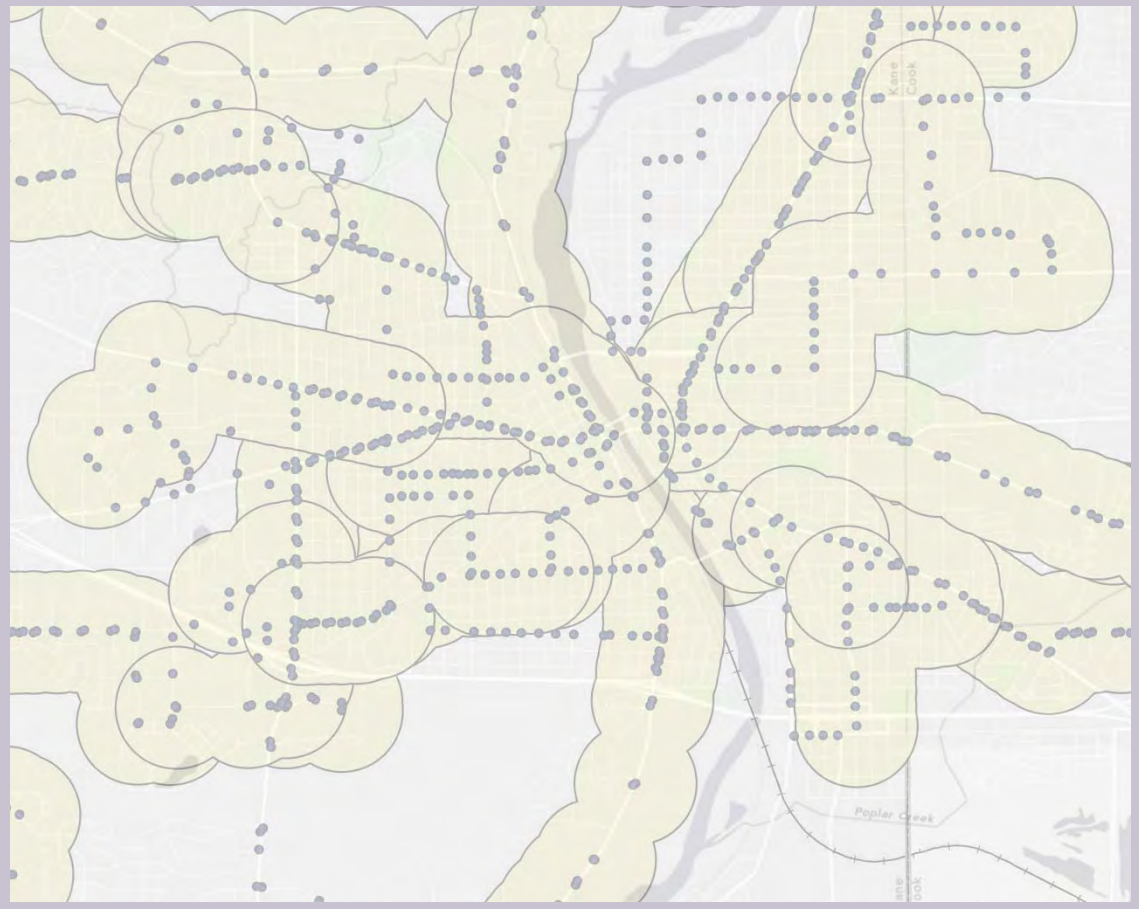
- Remaining Records exported as a database file (dbf) for use in ArcGIS
- Dissolve feature used to calculate frequency of transit trips for each stop by route

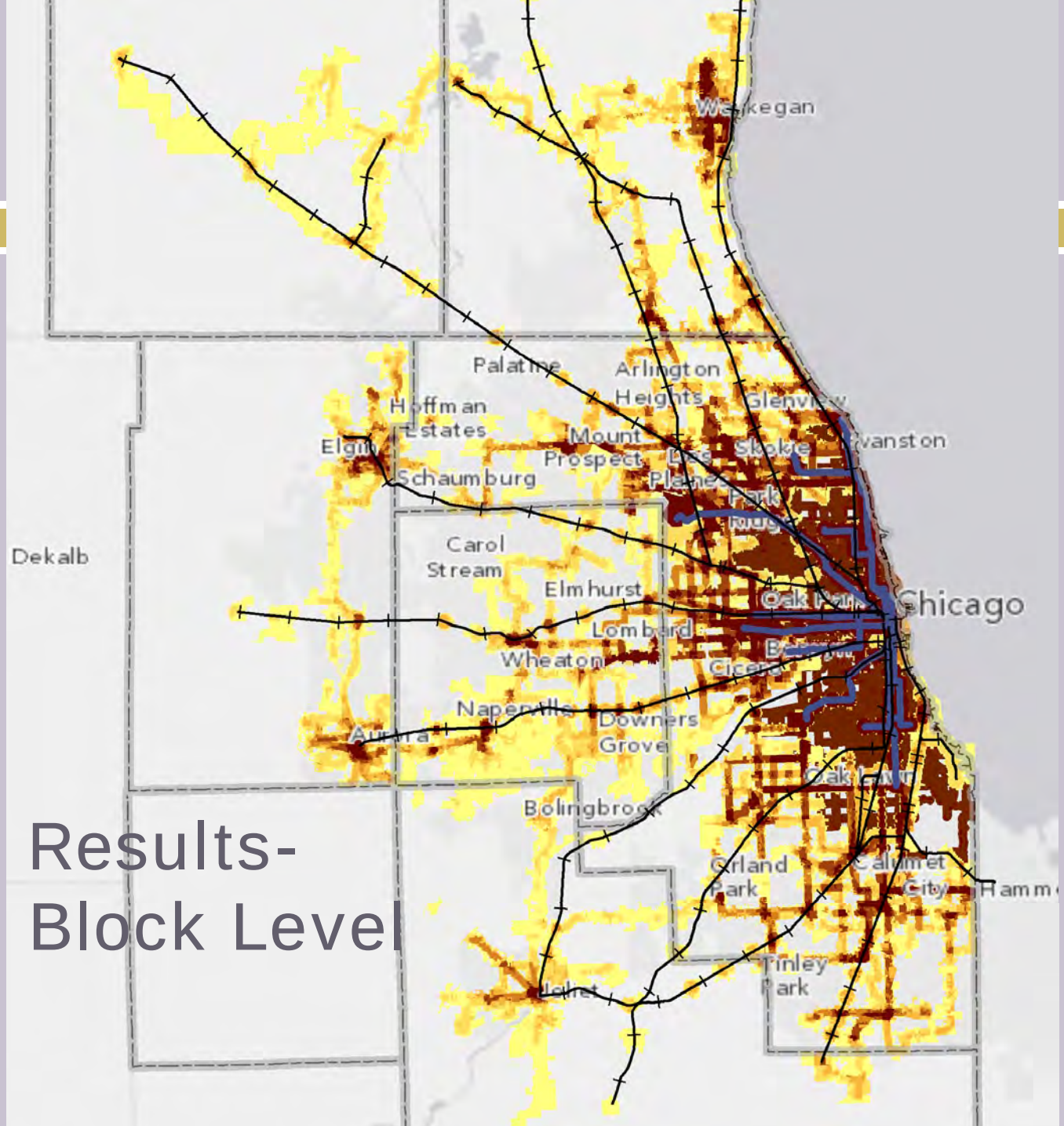
Methodology-
Project Transit Stops

- GIS projects transit stops using X, Y coordinates from GTFS tables

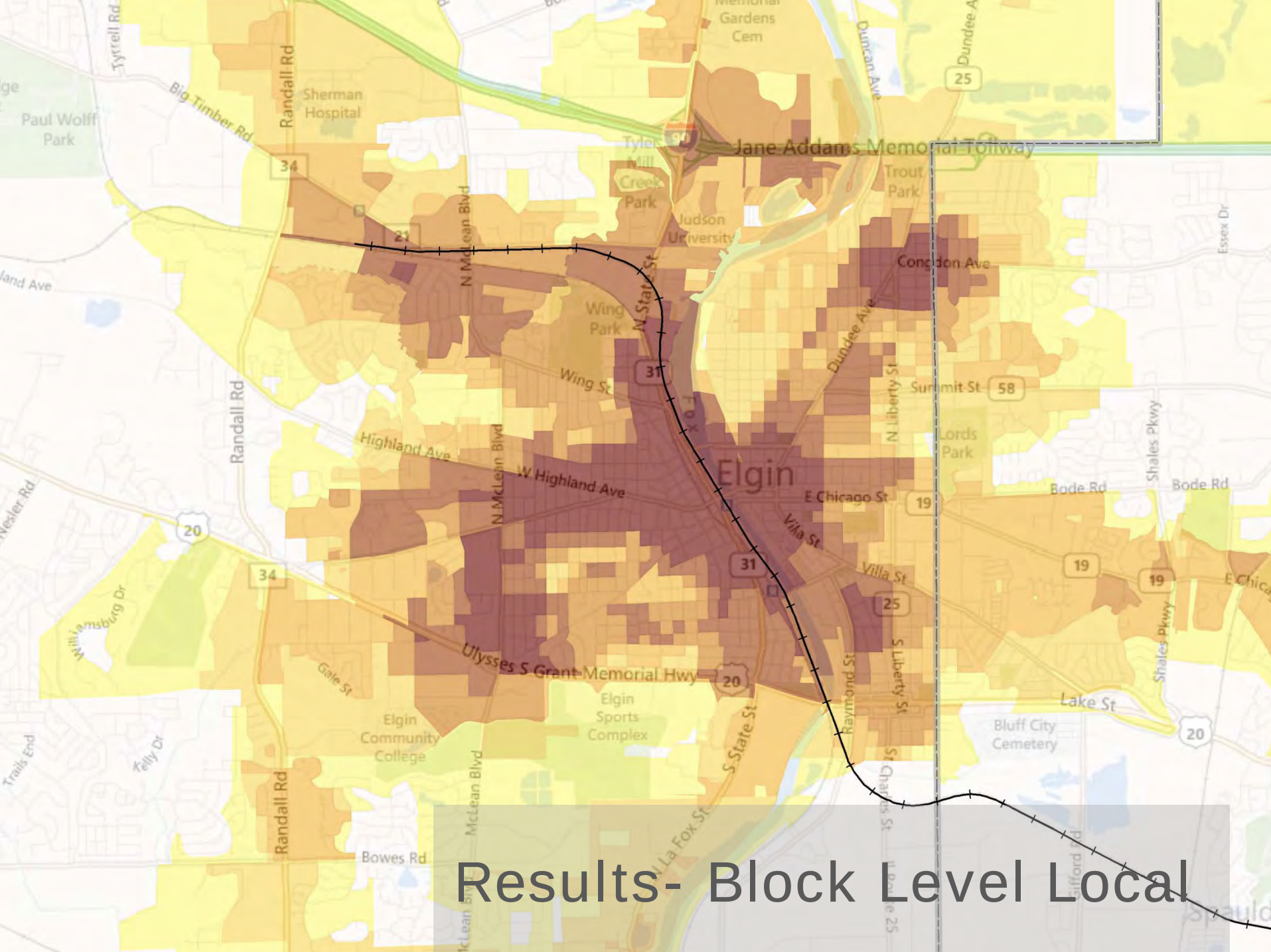
Methodology-
Buffer Transit Stops

- Buffers dissolved by route and frequency
- Overlap areas are given highest frequency





Results- Block Level



Results- Block Level Local

Challenges and Next Steps

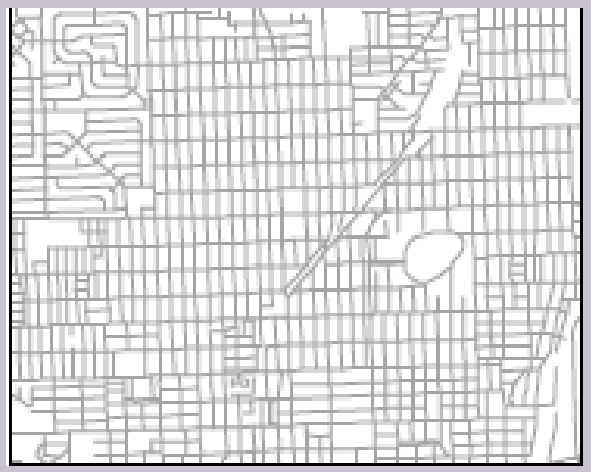
Challenges-
Buffer Transit Stops

- How accurately do the aerial buffers realistically account for catchments areas?
- What factors impact riders willingness to walk to transit?
- How can these factors be accounted for?

Challenges-
Buffer Transit Stops

- Pedestrian Factors (from Transit Capacity and Quality of Service Manual
  - Street network
  - Population factors
  - Street grade (not in Chicago)
- Next Step
  - Adjust buffer based on these factors as recommended in TCQSM

Examples of Street Grids



Grid

Hybrid

Cul-de-sac

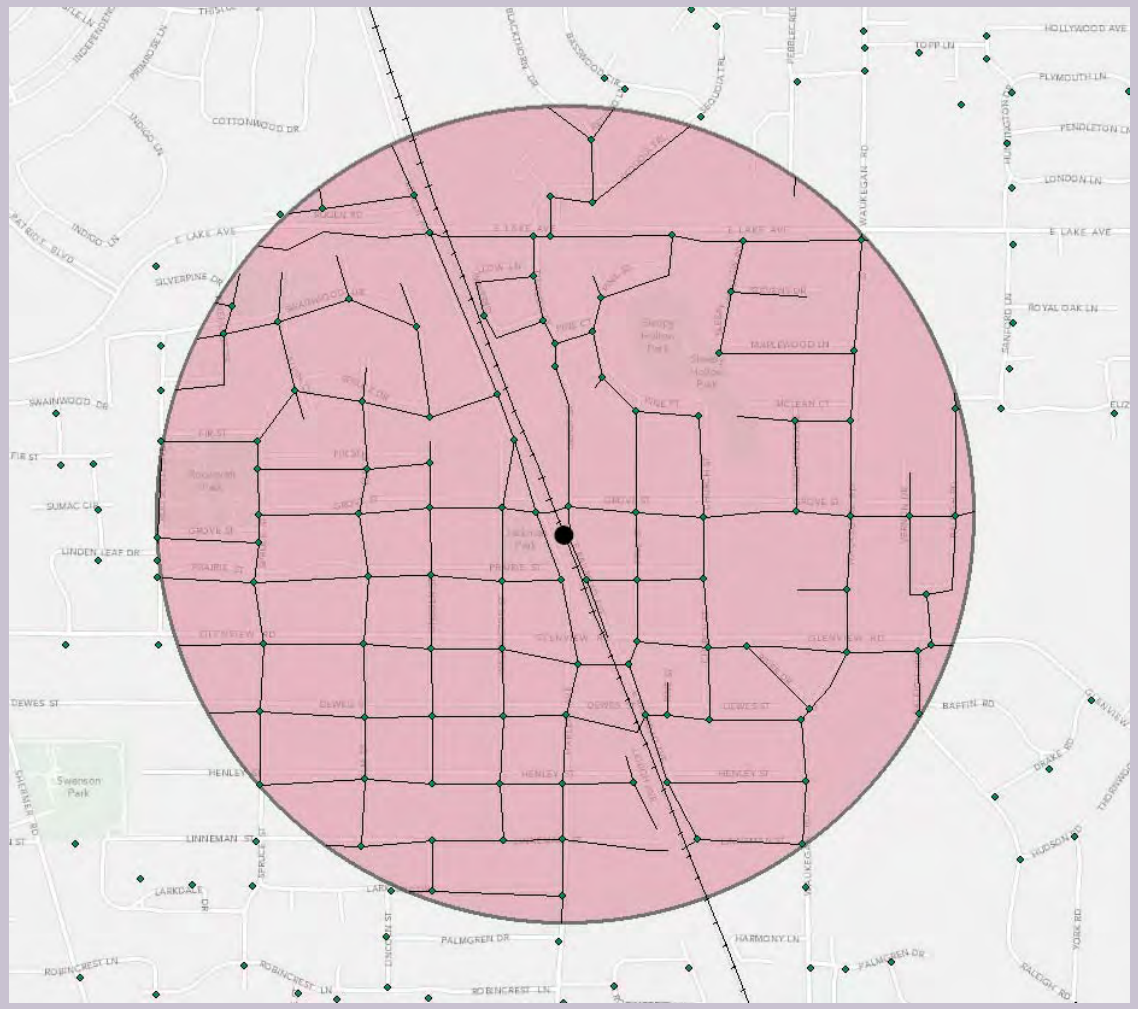
Network Connectivity Index	Street Pattern Type
>1.55	Type 1—Grid
1.30-1.55	Type 2—Hybrid
<1.30	Type 3—Cul-de-sac

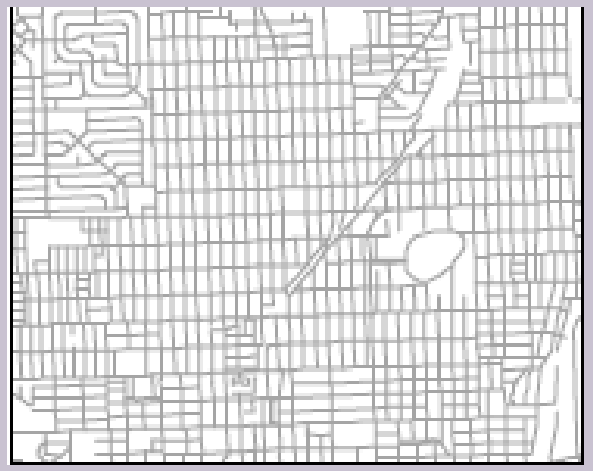
Street Pattern Type	Street Connectivity Factor, f_{sc}
Type 1—Grid	1.00
Type 2—Hybrid	0.85
Type 3—Cul-de-Sac	0.45

Challenges- Adjust Buffers

- Use GIS tools to calculate ratio of street segments to intersections
- Adjust buffers based on network connectivity index (NCI)
- Run visual check to see if results of NCI matches examples of street patterns

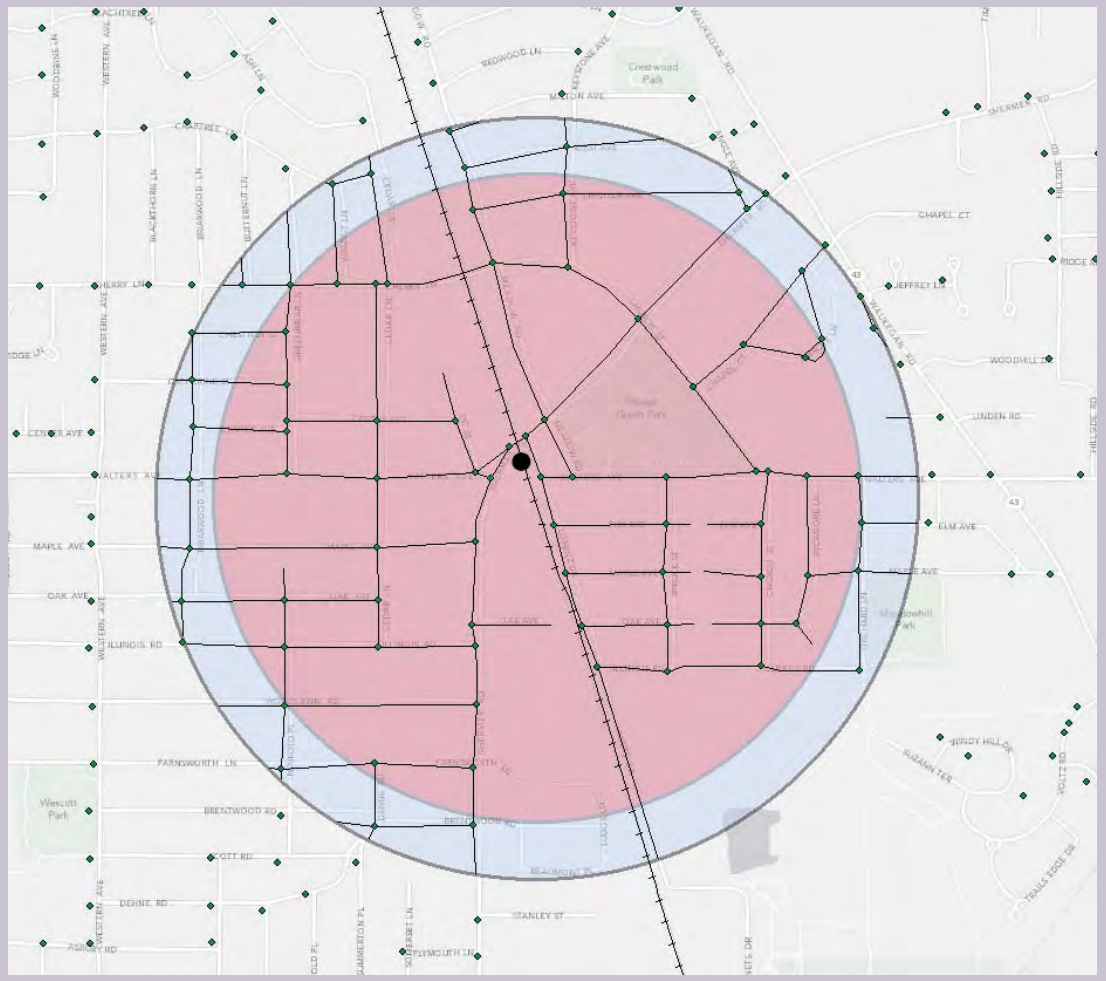
Visual Check- Grid Pattern





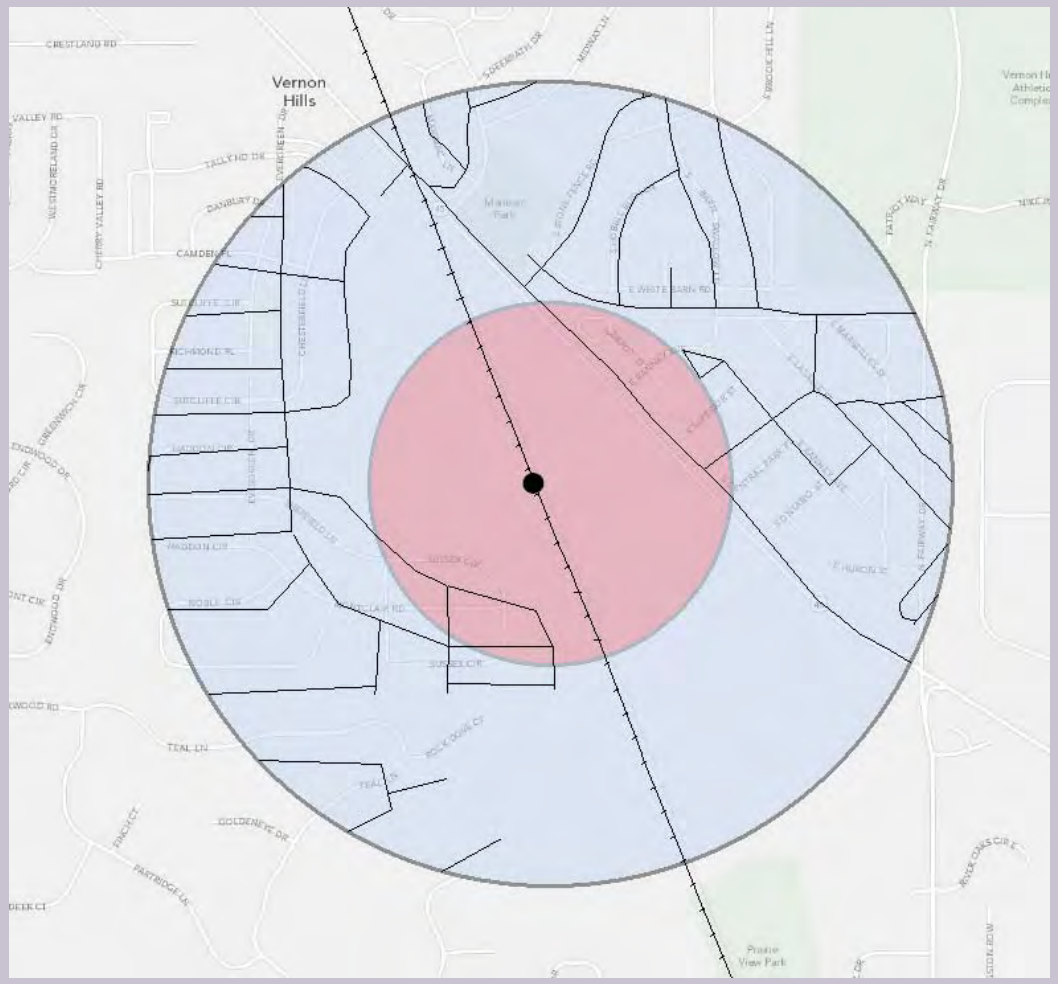
- Buffer matches grid example

Visual Check- Hybrid Buffer



- Buffer matches hybrid example

Visual Checks- Street Patterns



- Buffer matches cul-de-sac example

Next Steps

All transit trips are created equal in the TSI, but…

- Capacity
- Accessibility
- Auto access to transit
- Call-n-Ride

Next Steps

- Incorporate accessibility to attractions
  - Establish transit travel times between zones or stations
  - Create accessibility score based on travel time and access to attractions
    - More attractions = more accessibility
    - Greater travel time = less accessibility

Conclusions

- Who can use the TSI?
  - Transportation planners
  - Government agencies planning facility locations
  - Business owners
  - Real estate professionals