Metropolitan Planning Council

TECHNICAL APPENDIX

TOWARD UNIVERSAL MOBILITY:

Charting a Path to Improve Transportation Accessibility

December 2019

TABLE OF CONTENTS

ACCESSIBLE TRANSIT SERVICE INDEX

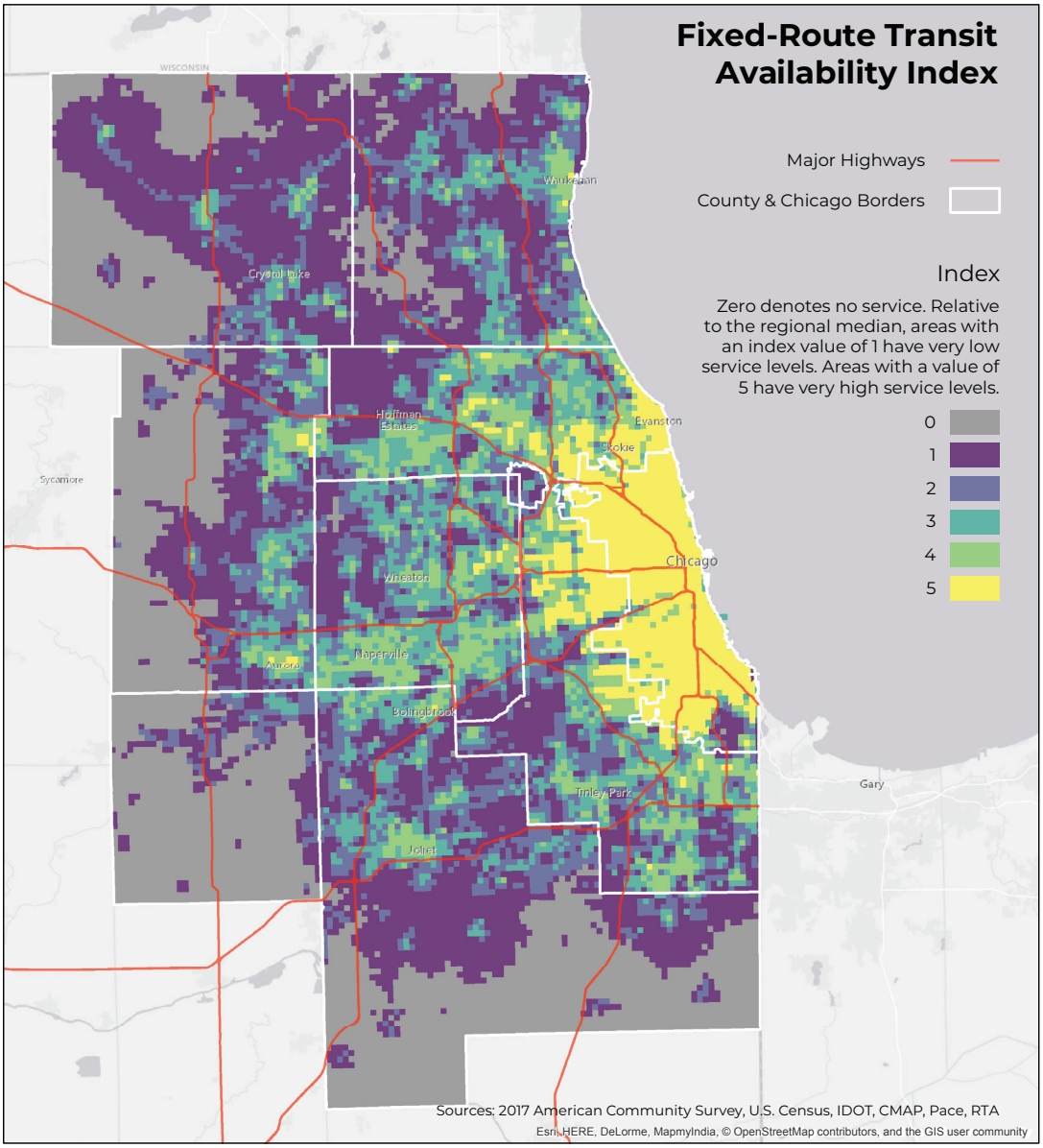
The accessible transit service index has two components that are equally weighted: the fixed route transit availability index and the paratransit index. Each of the component indices have a range of 0 to 5. The unit of analysis is the CMAP subzone. There are 16,443 subzones of roughly equivalent size in the 7-county Chicago region.

Fixed Route Transit Availability Index

The fixed route index is made up of 4 subindicies and is a measure of access to the fixed route system. It is largely derived from CMAP's transit availability index, with some revisions and additions. Due to our belief in the fundamental importance of walkability in facilitating access to transit, we chose to give our walkability measure 50% of the overall index weight.

Subindex	Value Range	Weight
Frequency	0-5	16.66%
Proximity	0-5	16.66%
Connectivity	0-5	16.66%
Walkability	0-5	50%

Figure 1. Map of Fixed-Route Transit Availability Index



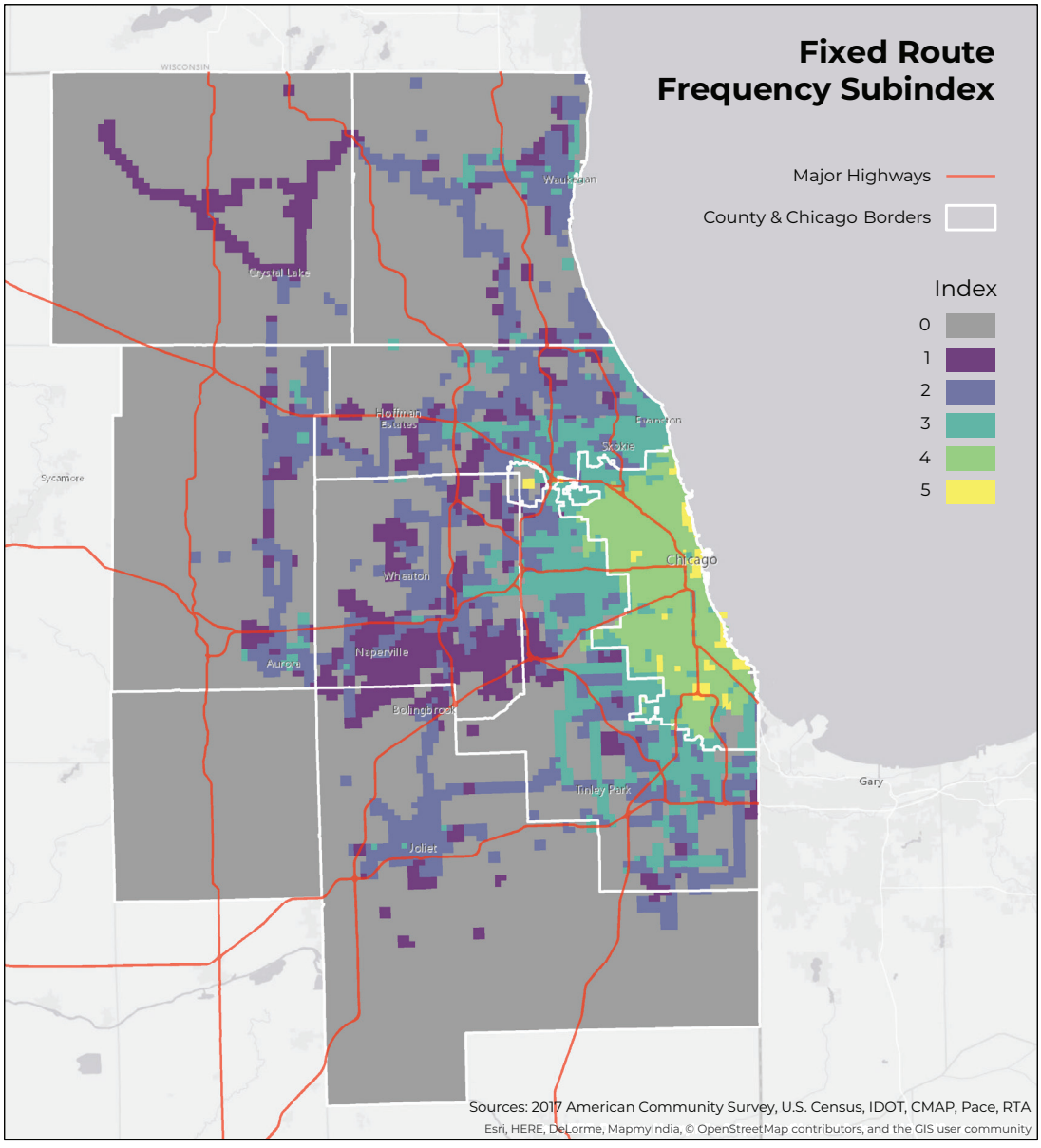
Frequency Subindex

This subindex was adapted directly from CMAP's transit availability index with no modifications. CMAP describes the frequency component as measuring the average number of times a stop in the subzone area is visited by a fixed-route transit service vehicle during one week. The service frequency score for a subzone is the aggregate total of the service frequencies of the individual stops within it.

Table 1. Frequency Subindex Values

Subindex Value	Stops per week
0	No transit service in subzone
1	Less than 100
2	100 – 299.9
3	300 – 999.9
4	1000 – 1999.9
5	2000 or more

Figure 2. Map of Frequency Subindex



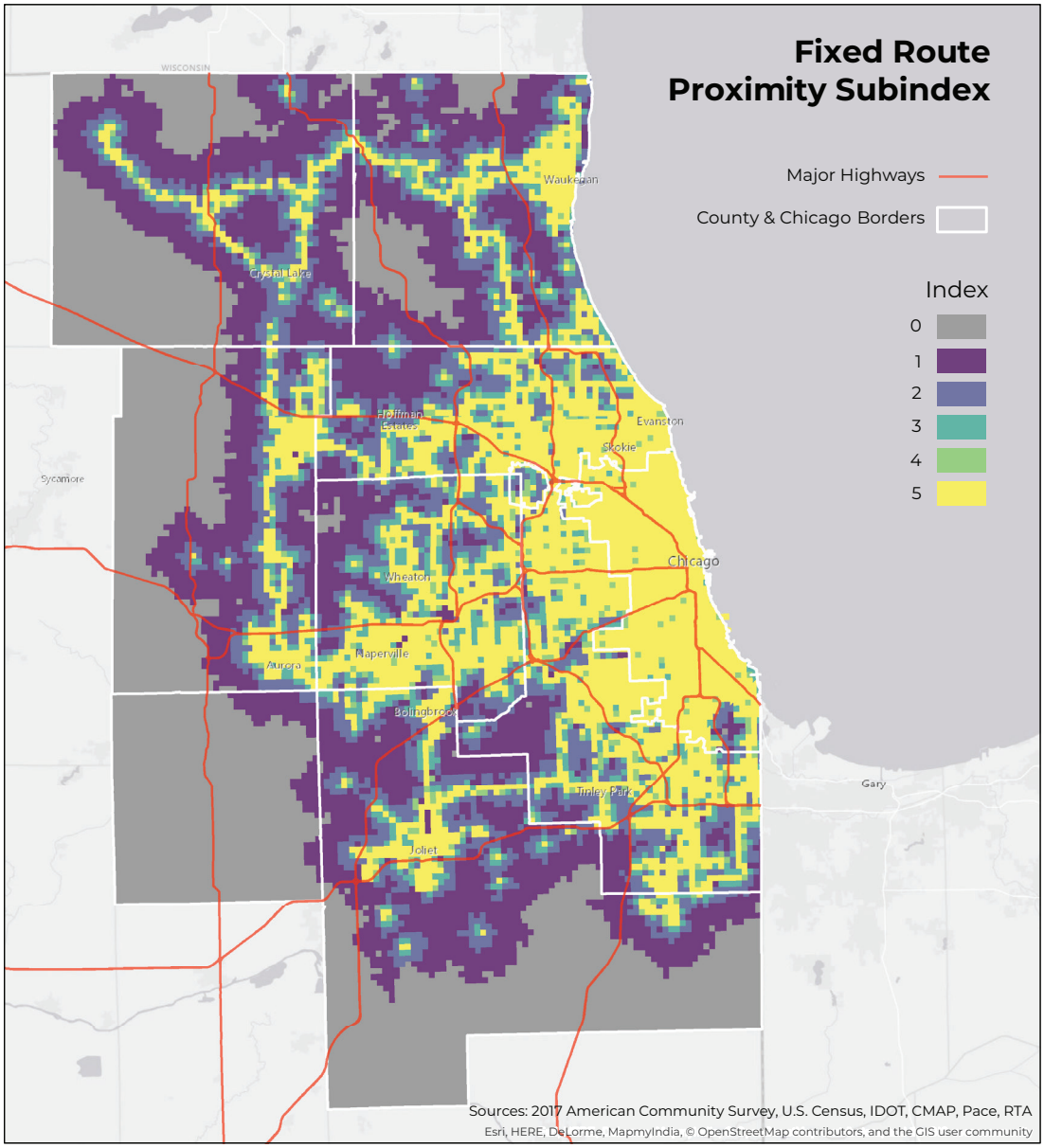
Proximity Subindex

This subindex was adapted from CMAP's transit availability index. It is a measure of the average distance one must travel to reach the nearest transit stop of any kind. For subzones containing transit stops, the proximity score is the average network-based distance one must travel to reach a stop without encountering an earlier stop, weighted by the service frequency at each stop. For subzones without transit stops, the score is the average distance to the 5 nearest stops, weighted by service frequency at each stop. The original component had a minimum score of 1. MPC rescaled it to have a minimum score of zero for any subzone that was 5 miles or more from the nearest transit stop.

Table 2. Proximity Subindex Values

Subindex Value	Average distance
0	5 miles or more
1	2 – 5 miles
2	1.1 – 2 miles
3	0.51 to 1 miles
4	0.26 - 0.5 miles
5	0.25 miles or below

Figure 3. Map of Proximity Subindex



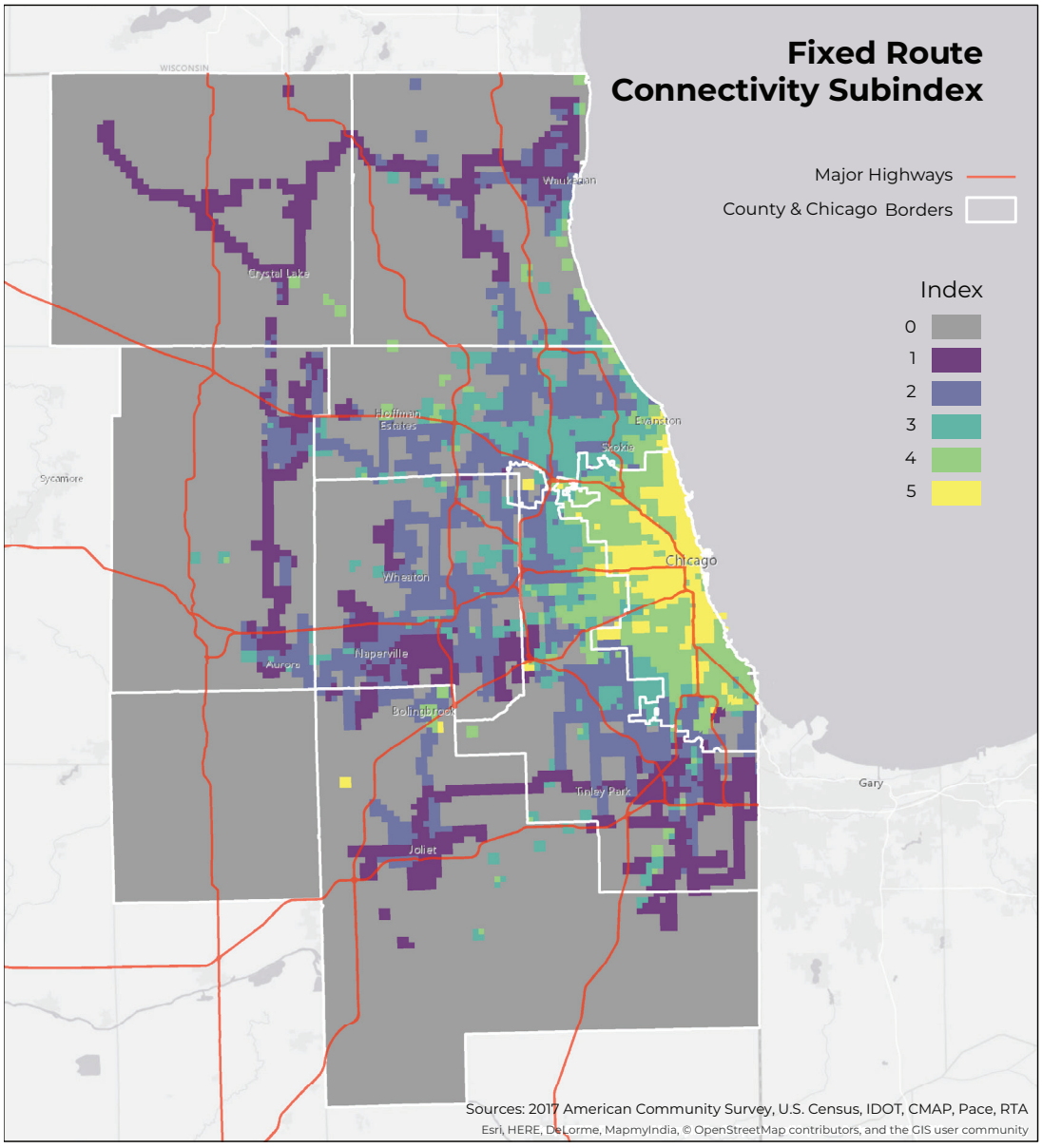
Connectivity Subindex

The connectivity subindex was directly adapted from CMAP's transit availability index without modification. It's a measure of the number of activities that can be reached from each subzone using a single direct transit route without transferring. "Activities" are defined as the sum of people living within the subzone and jobs within the subzone. The connectivity measure is the total number of activities reachable from a given subzone, divided by the area of the destination subzones. Subzones with no transit service are automatically scored zero.

Table 3. Connectivity Subindex Values

Subindex Value	Connected activities per acre
0	No transit service in subzone
1	10 activates or fewer
2	10.1 – 15
3	15.1 – 20
4	20.1 – 40
5	40 activities or more

Figure 4. Map of Connectivity Subindex



Walkability Subindex

The walkability subindex draws from two different CMAP datasets. First, CMAP's walkability index is an estimate of walkability based on environmental factors such as block length and population density, plus presence or absence of amenities like supermarkets or schools. This dataset doesn't incorporate any information about actual pedestrian infrastructure, so it was combined with a newly created regional sidewalk inventory. The inputs from the walkability index that we included are detailed below. For more information on how the values were calculated, please reference CMAP's methodology.

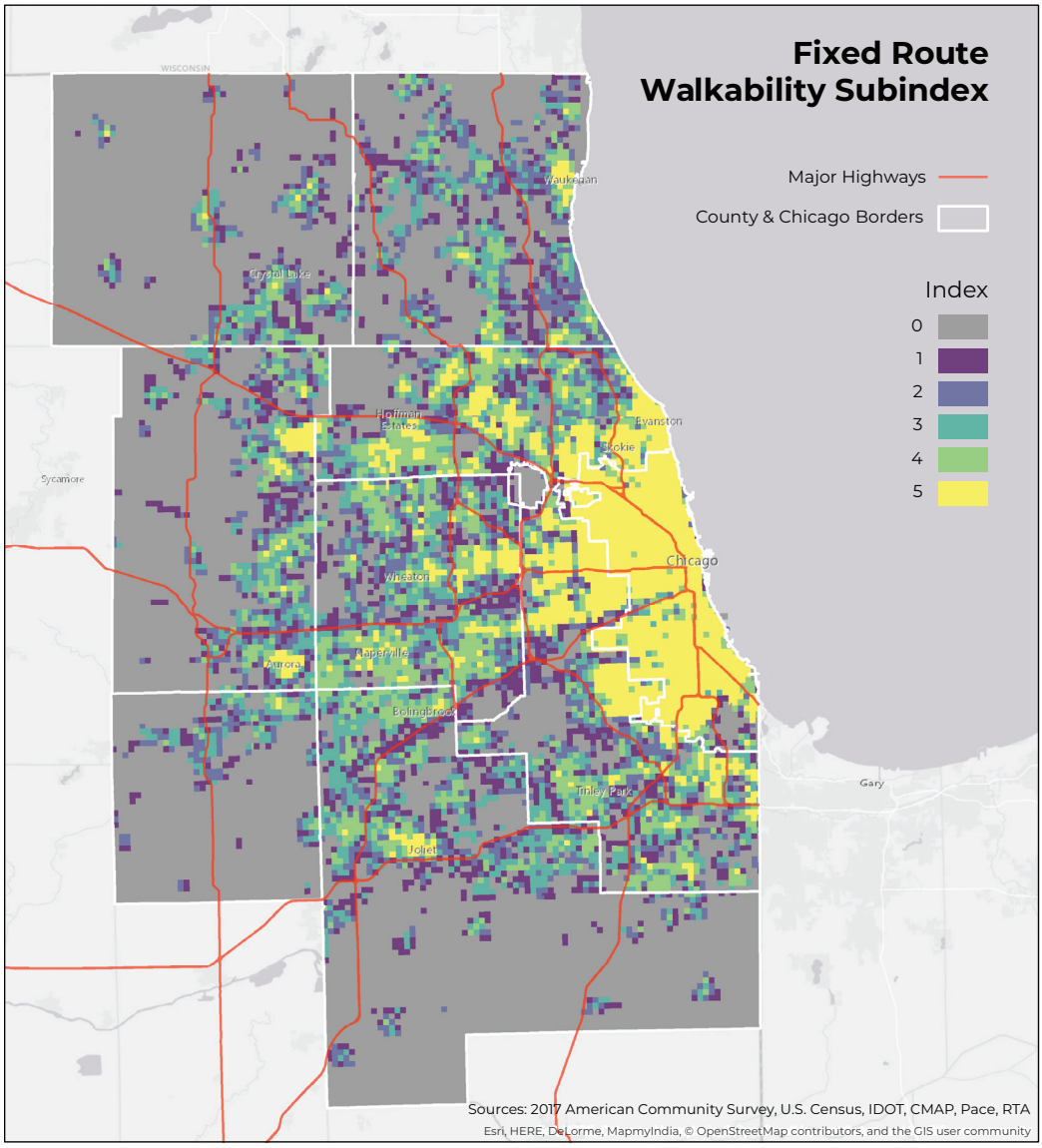
Table 4. Walkability Subindex Values

Amenities Measured	Highest Possible Score	Lowest Possible Score
Supermarkets	10	-10
Libraries	10	0
Schools	10	0
Dun & Bradstreet points	20	0
Total Amenities	50	-10
Other Characteristics		
Average Parcel Size	20	0
Tree canopy coverage	3	0
Block length	5	0
4-way intersection density	20	0
Block size	10	0
Number of Households	20	0
Number of jobs	10	0
Serious and fatal bike/ped crashes	0	-6
Additional fatality penality	0	-5
Less than 5 households penalty	0	-30
Total characteristics	88	-41
Total possible	138	-51

To incorporate data on pedestrian infrastructure, we weighted the walkability score for each subzone based on the completeness of its sidewalk network, derived from the regional sidewalk inventory. The inventory is a dataset of the region's street centerlines (excluding limited access highways) coded "0" for no sidewalks, "1" for sidewalks on one side and "2" for sidewalks on both sides. We looked at the road network in each subzone and assigned a value of 0 to 1. If all roads in a subzone have a sidewalk on one side only, it is scored 0.5. A subzone with a raw score of 100 and 75% sidewalk coverage would have a final score of 75. A subzone with no sidewalks or no roads would have a score of zero, regardless of its walkability score.

To incorporate this component into the index, values with a final walkability score of zero are given a zero. The remaining subzones are assigned 1 through 5 based on score quintiles. Equal quintile groups were used because there was no rationale for other arbitrary breaks in the scoring.

Figure 5. Map of Walkability Subindex



Paratransit Index

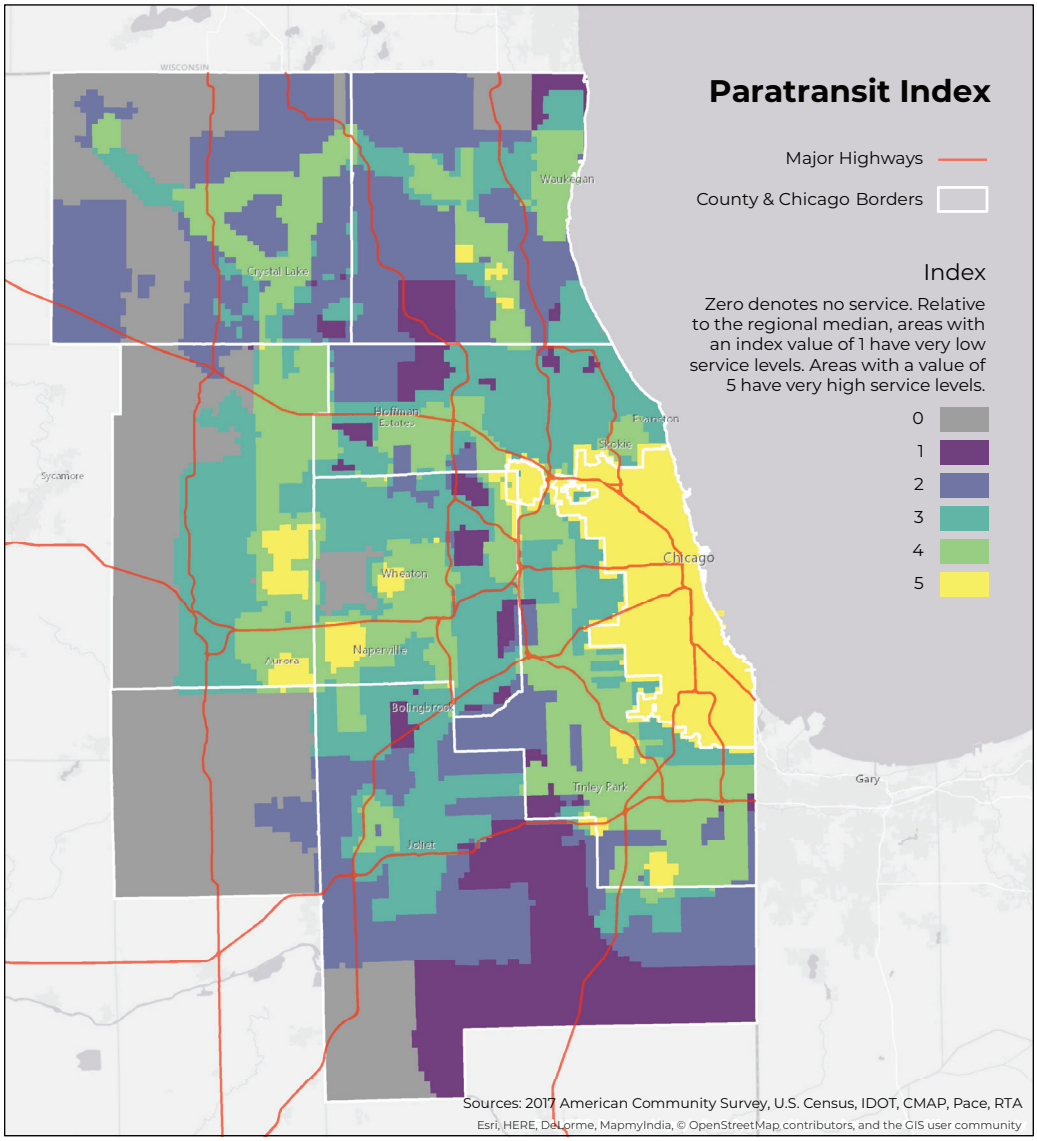
The paratransit index is made up of four subindicies, and is a measure of access to three types of paratransit services: ADA paratransit, Pace OnDemand (formerly Call-n-Ride), and Dial-a-Ride services operated in partnership with Pace. The first step in building this index was to create a complete GIS dataset of these three service types. The ADA paratransit dataset was created by placing a 3/4-mile buffer around all eligible fixed-route stations and stops. Pace OnDemand service areas were provided by RTA. RTA was also able to provide an incomplete dataset for Dial-a-Ride service areas and service conditions. MPC filled in the missing services by consulting Pace's comprehensive list of dial-a-ride services and information provided by coordinated county services such as MCRide, Ride DuPage and Ride in Kane, plus information provided by county DOTs.

The four subindicies of the paratransit index are weighted equally. Each has a different value range, but all four were rescaled to a 0 to 5 range for the final index calculation. This was done so it would be more easily comparable to the fixed route index.

Table 5

Subindex	Value Range	Weight
Service Span	0-1	25%
Call-In Flexibility	0-8	25%
Service Count	0-8	25%
ADA Eligibility	0 or 1	25%

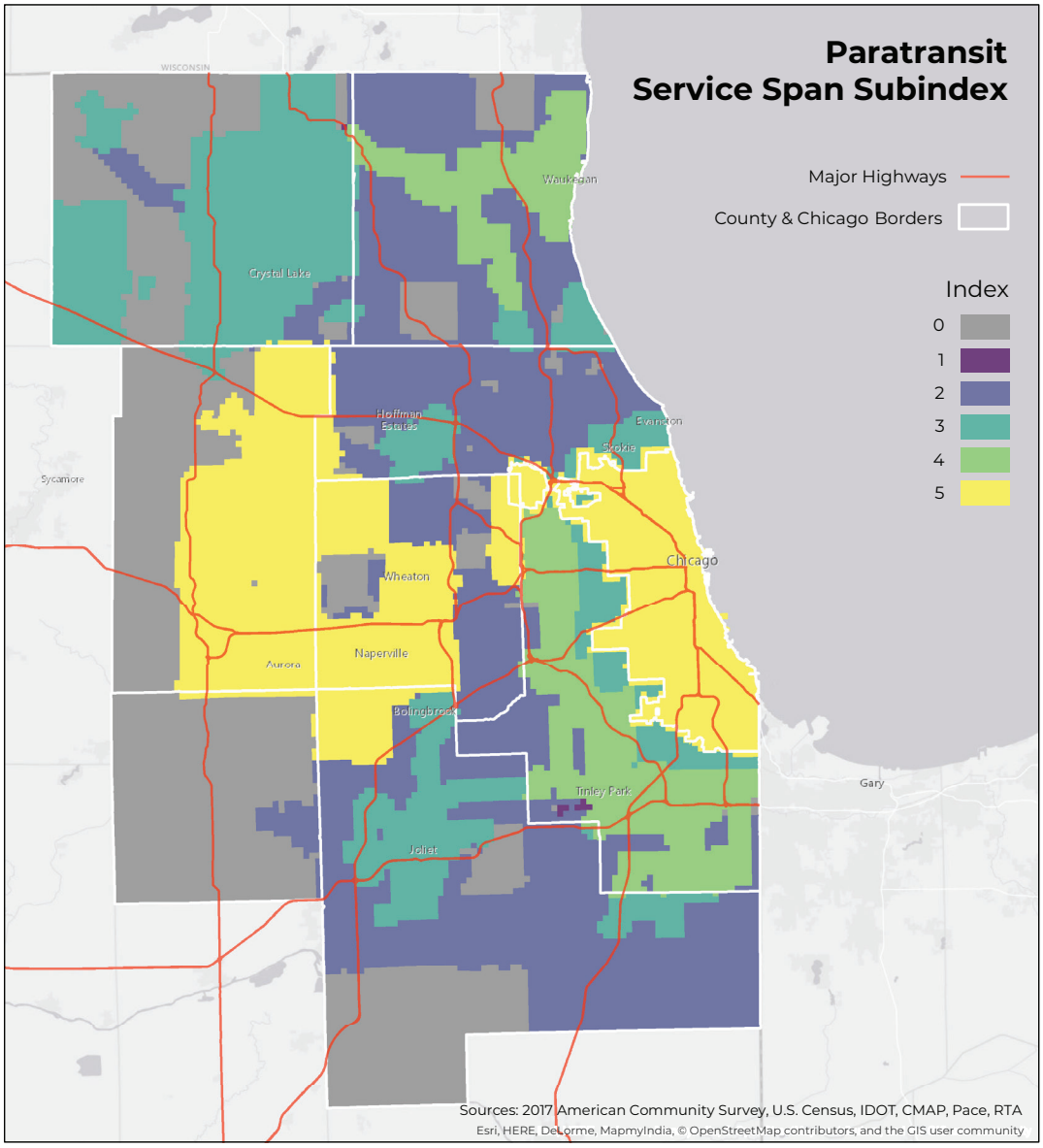
Figure 6. Map of Paratransit Index



Service Span Subindex

The service span is a measure of the hours per week that one of the three service types is available in each subzone. Subzones with 24/7 service have a value of 1. Subzones with no service have a value of zero. Otherwise, the score is the fraction of total hours in a week with service. A subzone with one service available from 9-5 on weekdays would have a score of 40/168, or 0.24. For subzones with multiple services, the maximum value is used.

Figure 7. Map of Service Span Subindex



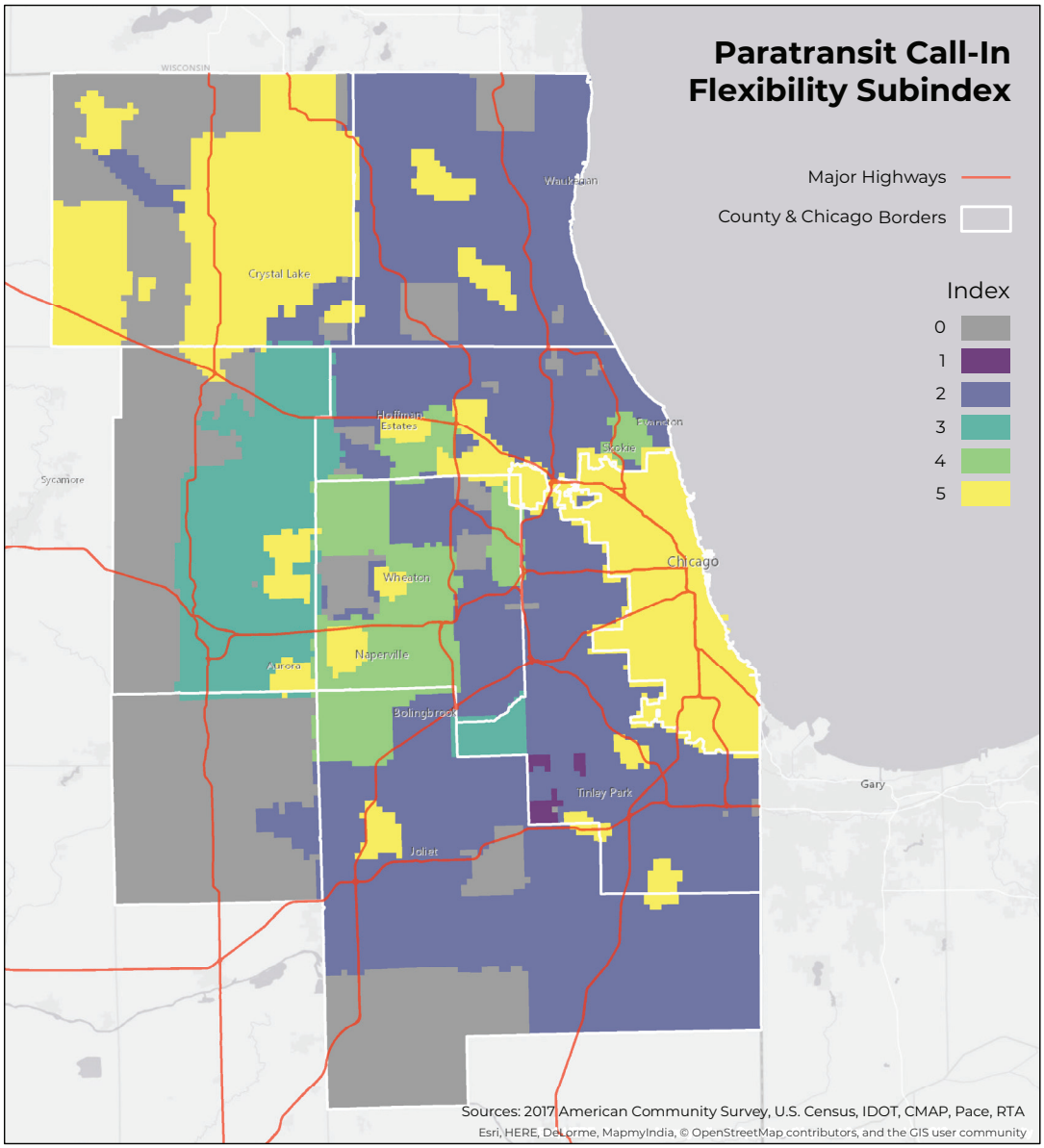
Call-In Flexibility Subindex

The call-in flexibility subindex is a measure of how far in advance a user has to reserve a ride to use the service. Higher values indicate less advance planning necessary, and therefore a more responsive and flexible service. For subzones with multiple services, the maximum value is used.

Table 6. Call-In Flexibility Subindex Values

Component Value	Reservation requirement
0	No service in subzone
1	Not specified
2	2 days
3	1 day
4	Same day
5	2 hours
6	1.5 hours
7	1 hour
8	30 minutes or less

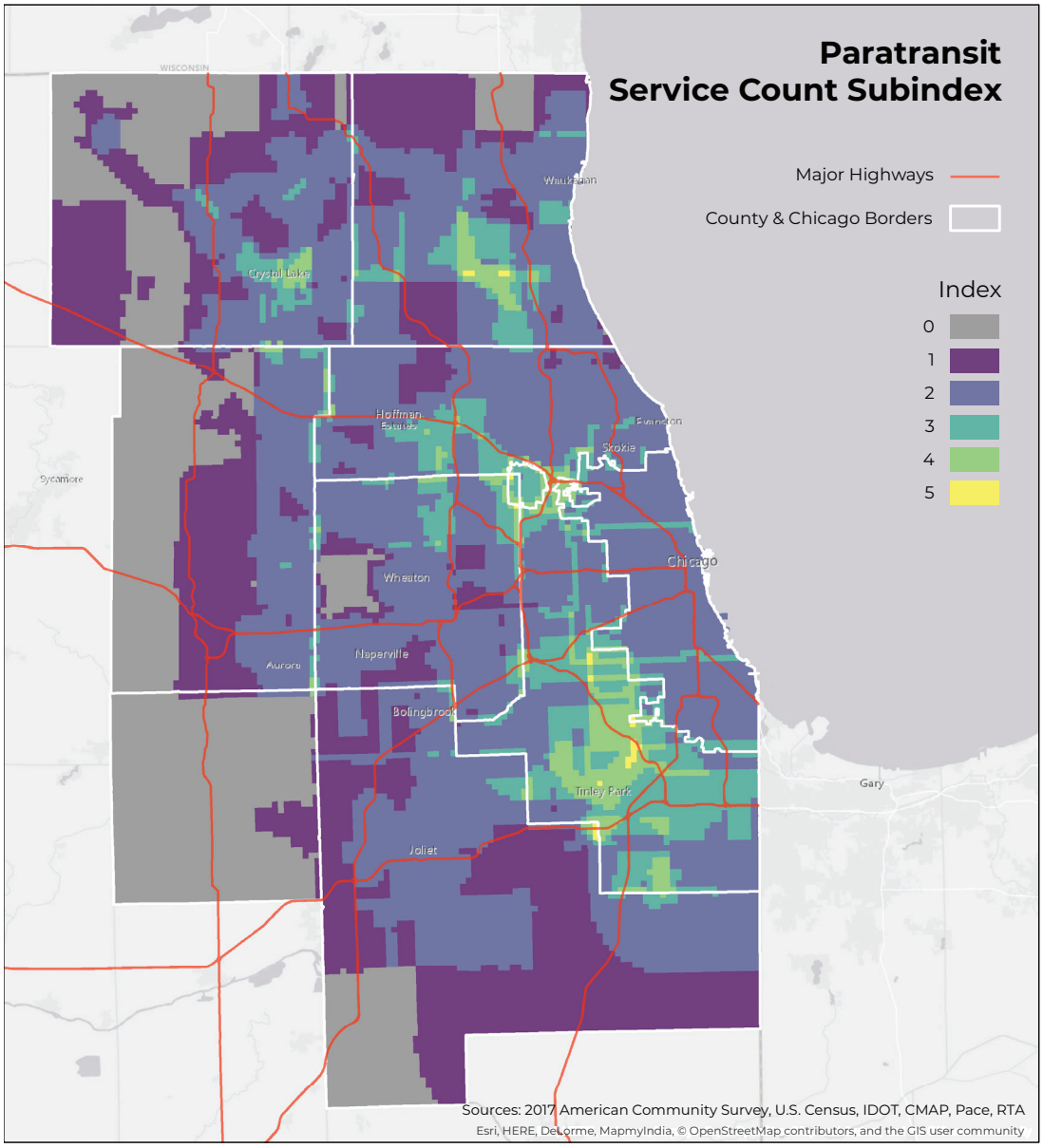
Figure 8. Map of Call-In Flexibility Subindex



Service Count Subindex

This subindex is a simple measure of how many overlapping services are available in each subzone. Values range from 0 to 8. Services typically have a wide range of eligibility requirements, trip purpose allowances and operating hours. The more services that are available, the more likely a rider will have their needs met.

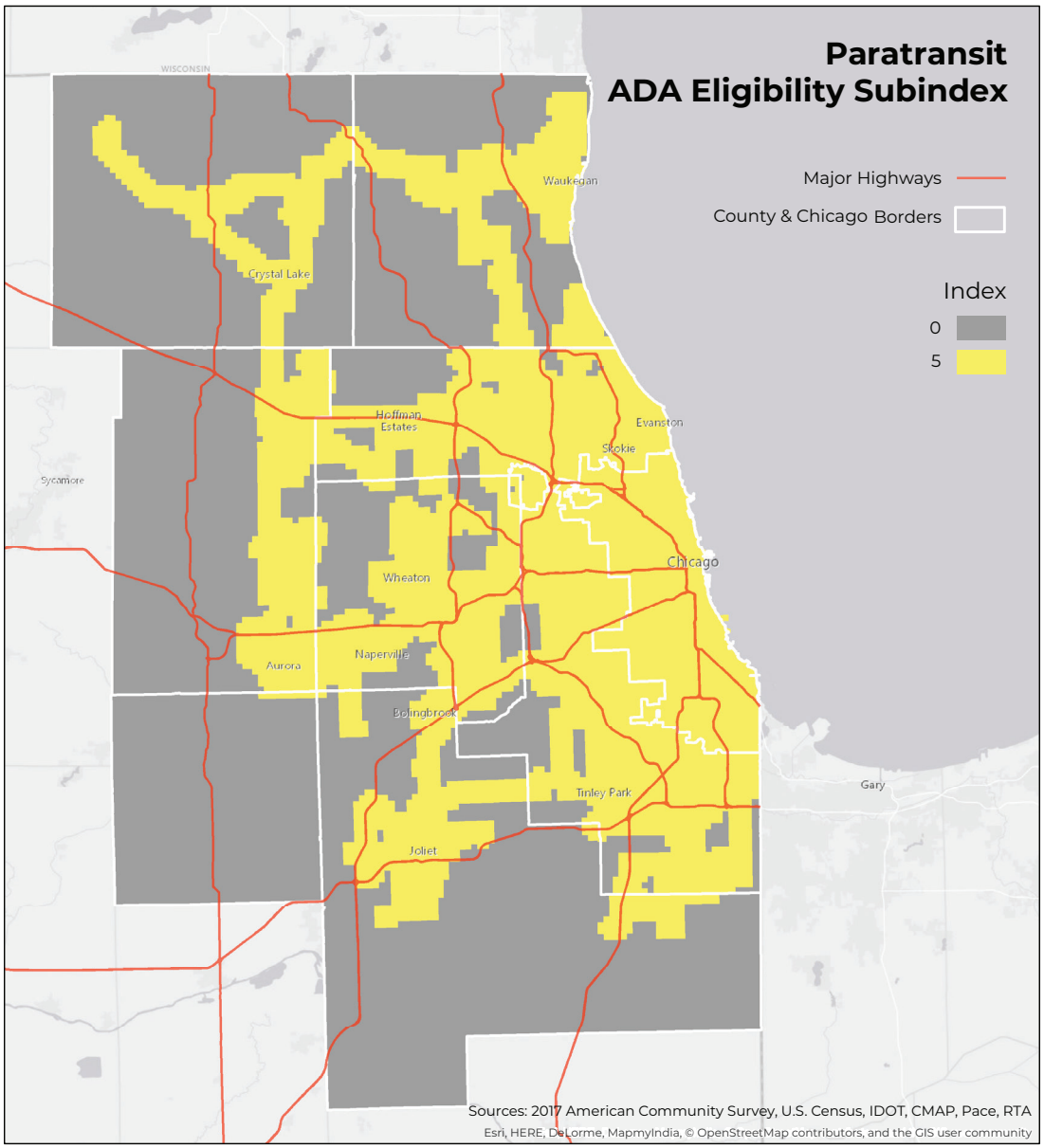
Figure 9. Map of Service Count Subindex



ADA Eligibility Subindex

The final subindex of the paratransit index is a binary measure indicating whether the subzone is within the ADA paratransit service area – generally within ¾ mile of an eligible bus or rail station. This was added as an additional measure because of the important mobility role that ADA paratransit plays for people with disabilities. As an entitlement, eligible riders cannot be refused rides and can be taken door-to-door anywhere within the service area.

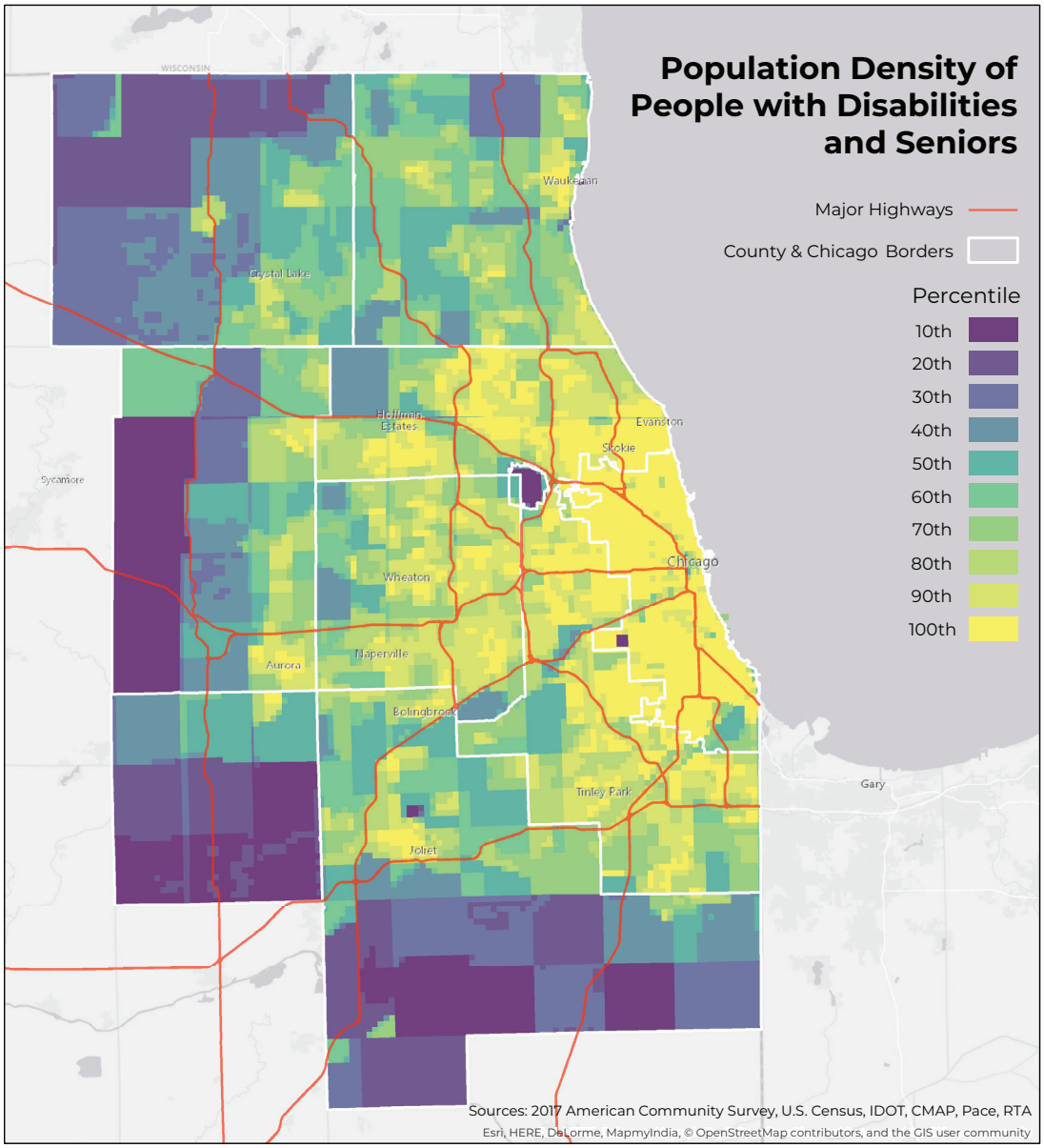
Figure 10. Map of ADA Eligibility Subindex



DEMAND FOR ACCESSIBLE MOBILITY

To understand how existing accessible transportation services match up with the location of people in need, MPC mapped the distribution of people with disabilities and older adults in the 7-county region. We used data from the 2017 5-year ACS estimates at the block group level, the smallest geography currently available. Specifically, we used the count of people with disabilities of any age, plus those over 65 without a disability. To make it comparable with the Accessible Transit Index, we used GIS to merge the block groups with CMAP subzones, then re-aggregated the data to subzones assuming equal population distribution within each block group. For display purposes, we used population deciles.

Figure 11. Population Density for People with Disabilities and Seniors



GAP ANALYSIS

MPC wanted to compare the potential demand for accessible transportation services, measured by the population distribution of people with disabilities and older adults, to the relative supply of those services. To do that, we rescaled the accessible transportation index to range from 0 to 10, then subtracted it from the population deciles described above.

Figure 12

Accessible Transportation Index "Supply"

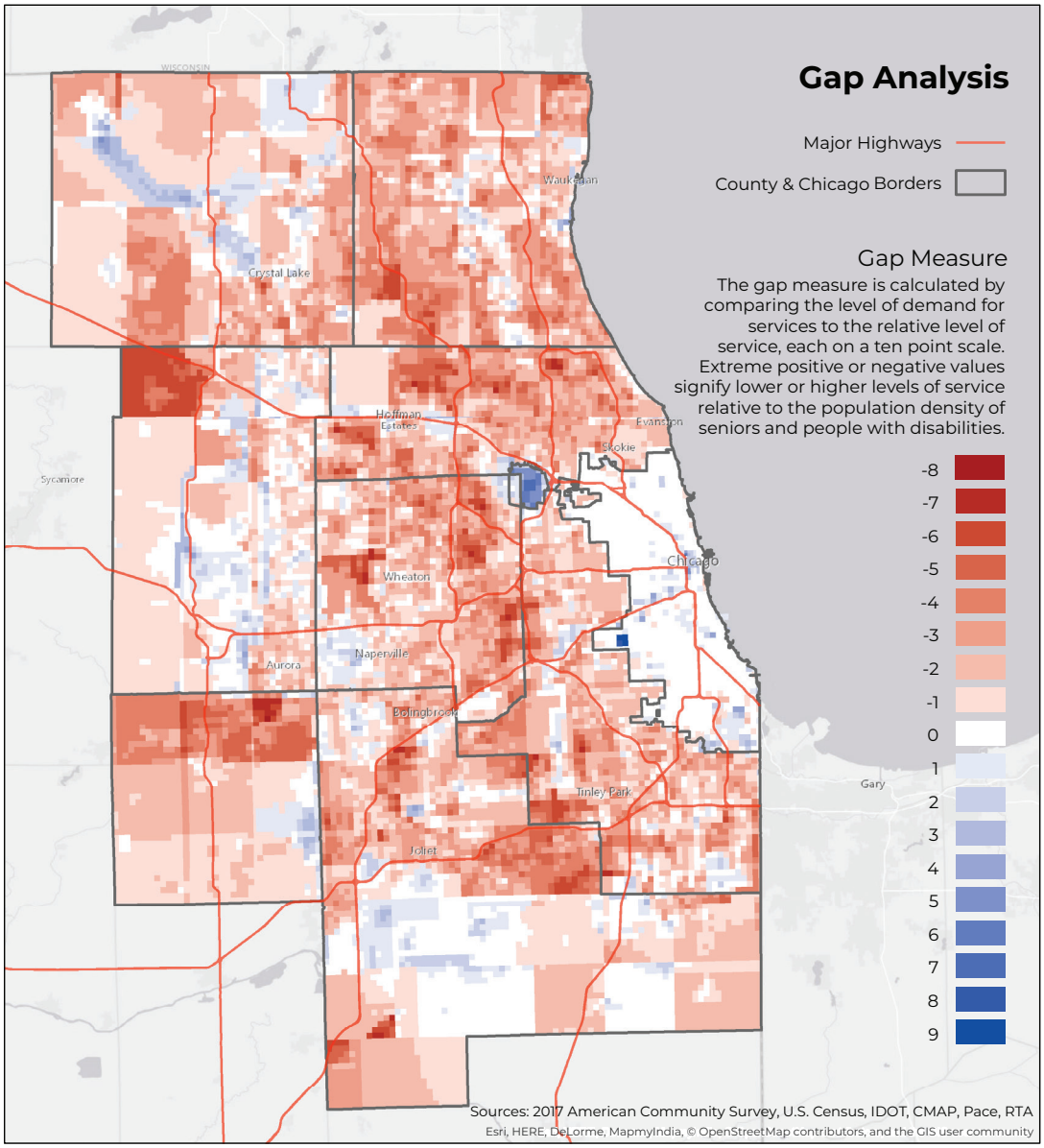
People with Disabilities & Seniors "Demand"

Gap

As the example above shows, a subzone with an accessible transportation score of 6 which is in the 4th decile of our target population would have a gap score of +2. It's important to note that an index score of 5 is not necessarily a sufficient level of mobility services for a subzone in the 5th population decile. This exercise simply allows us to compare relative levels of service with relative levels of the target population. This allows us to see the disparities in accessible transportation services that exist across the region for areas that have similar numbers of people in need of those services.

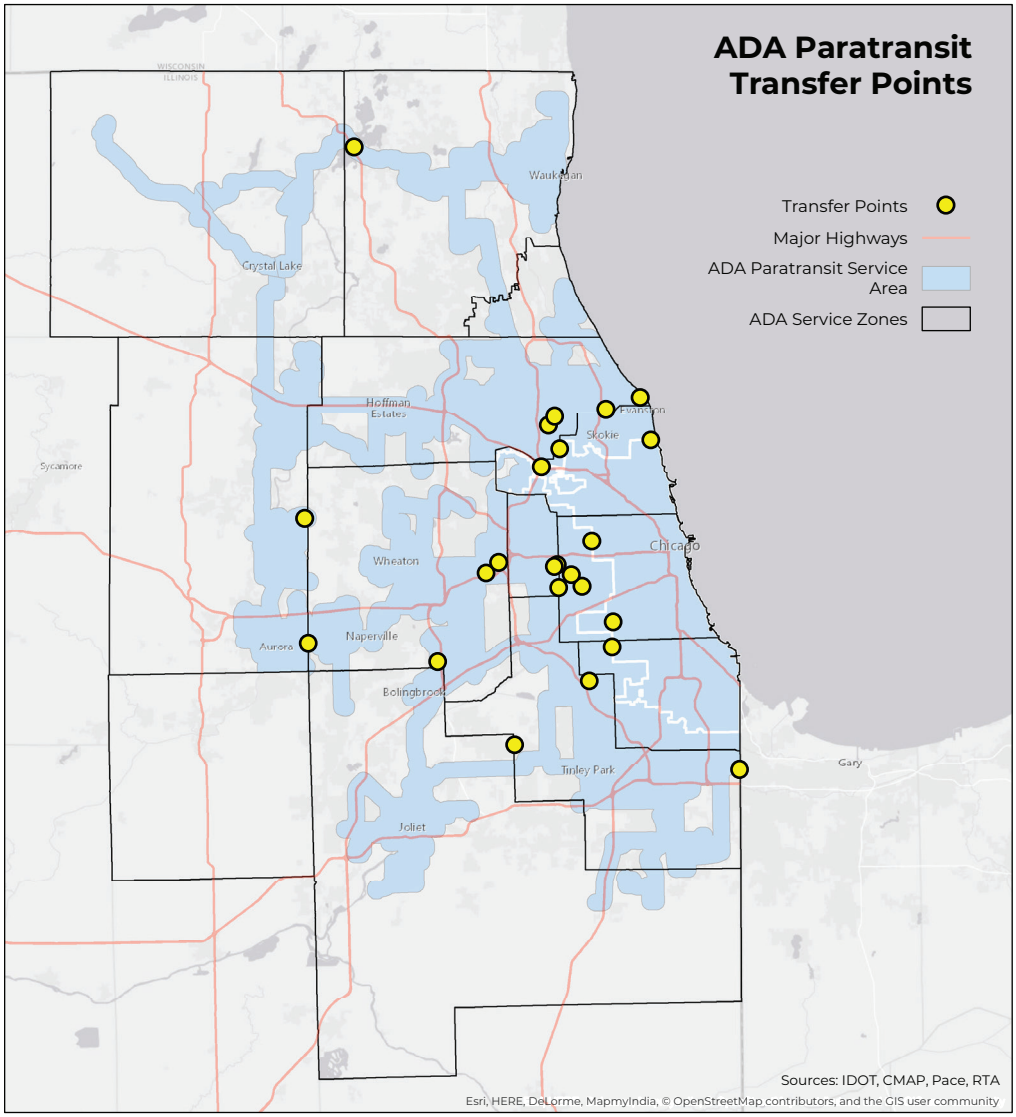
The Gap Analysis should be reviewed with caution as a variety of factors play a role in how the data shows up. In areas with very low population where service are available, the supply of transportation may appear high because demand is so low. Additionally, there may be areas of the region where there are high numbers of people over age 65 who show up as potentially needing accessible public transportation but who may not need or use it because they have access to vehicles or to caregivers to provide transportation. It is important to emphasize that this map alone should not be used to target specific geographic areas in which service adjustments are needed. The map is useful as a general reflection of variation between potential demand across the region.

Figure 13. Map of Gap Analysis



ADA PARATRANSIT TRANSFER POINTS

Figure 14. Map of ADA Paratransit Transfer Points



There are roughly two dozen transfer points located throughout the region. Paratransit users wishing to travel beyond their "home" service area must coordinate with providers in both the zone where they live and the zone to which they are traveling and make the transfer at one of the designated points. There are ten zones in the counties, and three within the city of Chicago. Transfer points are located near the border of two or more zones, frequently located at major destinations like hospitals, malls or bus depots.

SIDEWALK NETWORK COMPLETENESS ANALYSIS

Policies that promote better pedestrian infrastructure and increased walkability are a critical part of achieving universal mobility. Gaps in the sidewalk network, especially in the suburbs, are well known. MPC used CMAP's regional sidewalk inventory to see how those gaps might be impacting access to fixed-route transit.

Figure 15. A small portion of the regional sidewalk inventory

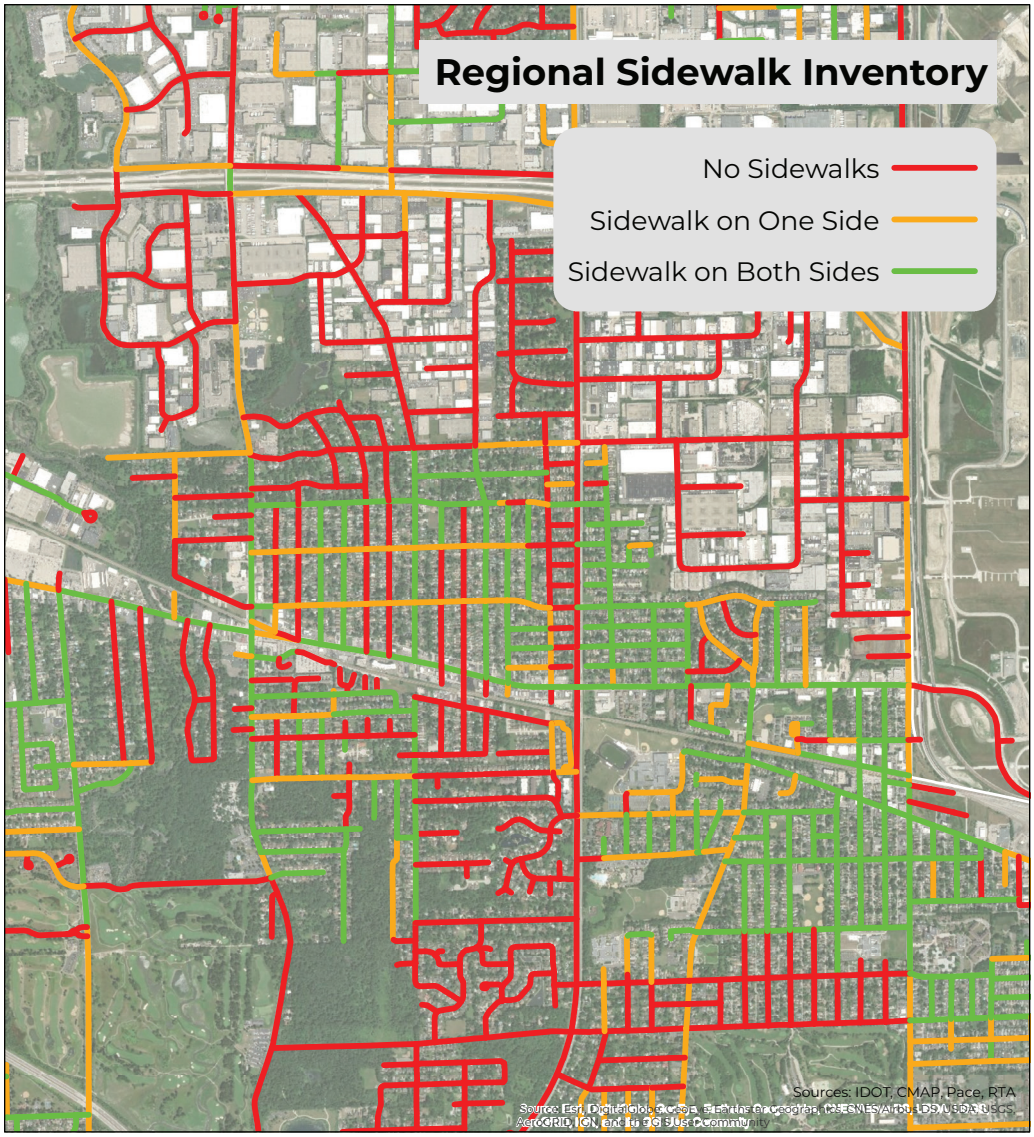
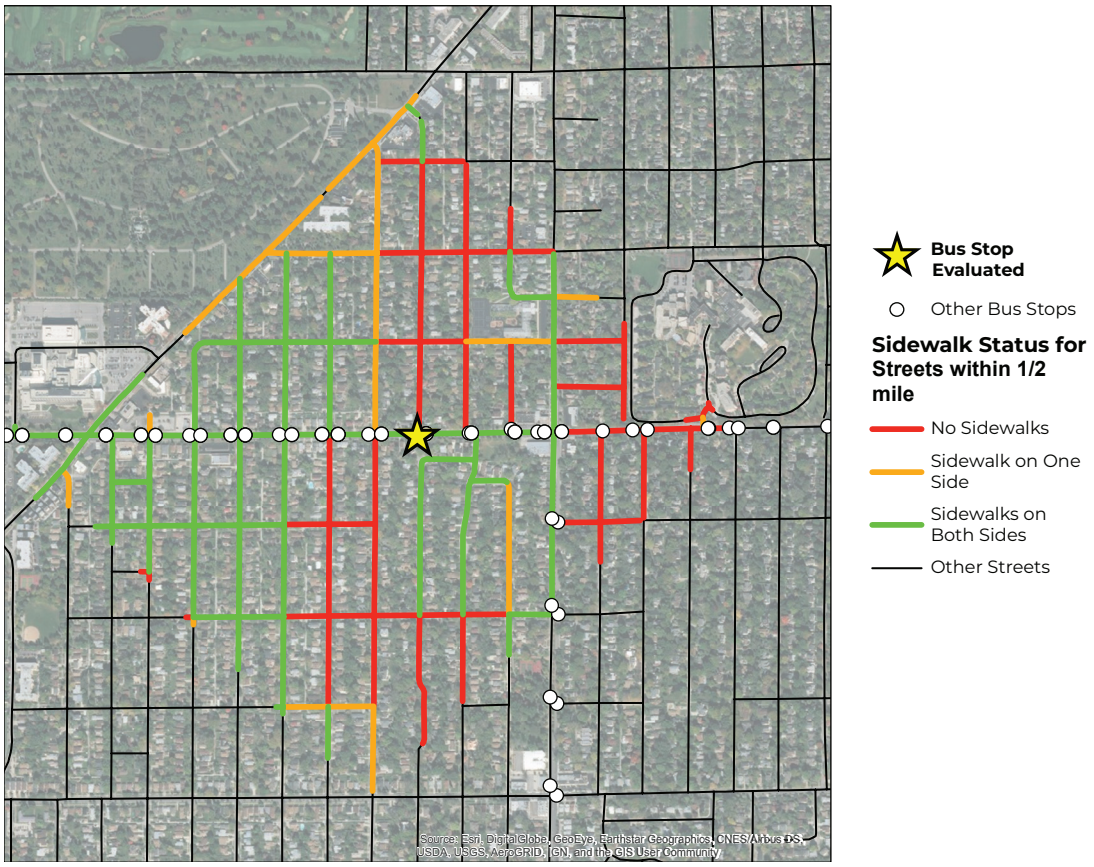


Figure 15 shows a small example of the dataset, which covers the entire 7-county CMAP region. The data comprises of street centerlines for all streets excluding limited access highways. The street segments are coded 0, 1 or 2 for no sidewalk, sidewalk on one side, and sidewalk on both sides. For segments coded "1", there is no information on which side of the street lacks a sidewalk. The dataset also has no information on crosswalks and curb cuts. These limitations make the dataset inappropriate for pedestrian routing, but still allow for a high-level understanding of the pedestrian experience.

Figure 16. An example of a half-mile walkshed around a single bus stop



To calculate the completeness of the sidewalk network for each Pace bus stop, we used Network Analyst in ArcGIS to calculate the walkshed around each bus stop. Figure 16 shows an example of a half-mile walkshed. A fully complete sidewalk network using this dataset would have twice the length of all street centerlines in the walkshed. This stop's sidewalk network completeness was calculated as shown below.

Table 7. Calculating the total sidewalk length for one bus stop

Segment Status	Segment Length (ft)	Sidewalk Length (ft)
0	26,048	0
1	7,807	7,807
2	25,472	50,944
Total	59,327	58,751

Table 8. Calculating the Sidewalk Network Completeness for a single bus stop

Metric	Calculation	Value
Maximum Possible Sidewalk Network Length	59,327 x 2	118,654
Sidewalk Network Completeness	58,751 / 118,654	49.51%

SERVICES INCLUDED IN THE PARATRANSIT INDEX

MPC recognizes that this is an incomplete list of all demand-response services operating in the region. We attempted to compile the most complete dataset with the information that is available.

Service	Type	Service County	Eligibility
Arlington Heights - Rolling Meadows Call-n-Ride	Pace OnDemand	Cook	General Public
Barrington	Dial-a-Ride	Cook	Disabled and Senior
Batavia Call-n-Ride	Pace OnDemand	Kane	General Public
Benton-Zion Township	Dial-a-Ride	Lake	General Public
Bloom Township	Dial-a-Ride	Cook	Disabled and Senior
Bloomingdale Township	Dial-a-Ride	DuPage	General Public
Central Will	Dial-a-Ride	Will	Disabled and Senior
City of Chicago Mobility Direct Chicago Taxicabs	Dial-a-Ride	Cook	Disabled
City of Chicago Taxi Access Pro-gram Chicago Taxicabs	Dial-a-Ride	Cook	Disabled
Crestwood	Dial-a-Ride	Cook	General Public
Downers Grove Township	Dial-a-Ride	DuPage	Disabled and Senior
DuPage Township	Dial-a-Ride	Will	Disabled and Senior
Elk Grove Village	Dial-a-Ride	Cook	General Public
Forest Park	Dial-a-Ride	Cook	Disabled and Senior
Hoffman Estates On Demand	Pace OnDemand	Cook	General Public

Service	Type	Service County	Eligibility
Lemont Township	Dial-a-Ride	Cook	General Public
Leyden Township	Dial-a-Ride	Cook	General Public
Libertyville, Libertyville Township, Mundelein	Dial-a-Ride	Lake	Disabled and Senior
Lyons Township	Dial-a-Ride	Cook	Disabled and Senior
McRide ADA	Dial-a-Ride	McHenry	Disabled and Senior
McRide GP	Dial-a-Ride	McHenry	General Public
McHenry County Midday Intercommunity	Dial-a-Ride	McHenry	General Public
Naperville Aurora Call-n-Ride	Pace OnDemand	DuPage	General Public
Norridge	Dial-a-Ride	Cook	General Public
Northeast Lake	Dial-a-Ride	Lake	Disabled and Senior
Orland Park, Orland Hills	Dial-a-Ride	Cook	General Public
Palatine Township	Dial-a-Ride	Cook	Disabled and Senior
Palos Hills	Dial-a-Ride	Cook	Disabled and Senior
Park Forest	Dial-a-Ride	Cook	General Public
Rich Township	Dial-a-Ride	Cook	Disabled and Senior
Ride DuPage	Dial-a-Ride	DuPage	Disabled and Senior
Ride in Kane	Dial-a-Ride	Kane	Disabled
Ride Lake County Central	Dial-a-Ride	Lake	Disabled and Senior
Ride Lake County West	Dial-a-Ride	Lake	General Public
Round Lake Area Call-n-Ride	Pace OnDemand	Lake	General Public
Schaumburg	Dial-a-Ride	Cook	General Public

Service	Type	Service County	Eligibility
Shields Township	Dial-a-Ride	Lake	Disabled and Senior
Skokie	Dial-a-Ride	Cook	Disabled and Senior
Southeast Aurora Call-n-Ride	Pace OnDemand	Kane	General Public
Southeast McHenry County	Dial-a-Ride	McHenry	General Public
Southwest Will	Dial-a-Ride	Will	General Public
St. Charles - Geneva Call-n-Ride	Pace OnDemand	Kane	General Public
Stickney Township	Dial-a-Ride	Cook	Disabled and Senior
Tinley Park	Dial-a-Ride	Cook	Disabled and Senior
Tinley Park Call-n-Ride	Pace OnDemand	Will	General Public
Vernon Hills - Mundelein Call-n-Ride	Pace OnDemand	Lake	General Public
Vernon Township	Dial-a-Ride	Lake	General Public
Wauconda Township	Dial-a-Ride	Lake	Disabled
West Joliet Call-n-Ride	Pace OnDemand	Will	General Public
Wheaton Winfield Call-n-Ride	Pace OnDemand	DuPage	General Public
Will Ride	Dial-a-Ride	Will	Disabled and Senior
Worth Township	Dial-a-Ride	Cook	Disabled and Senior