Appendix F Accessibility Impacts of Bus Service Allocation Study

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Prepared for the Metropolitan Council by the

Accessibility Observatory at the University of Minnesota

ACCESSIBILITY OBSERVATORY

UNIVERSITY OF MINNESOTA

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Contents

Executive Summary

This report presents the results of an analysis of access to jobs by transit in the Twin Cities metro area under two different potential transit investment scenarios. Accessibility in this context refers to a measure of the potential for interaction between people and destinations in different locations. The accessibility metric employed in this analysis is the number of jobs that can be reached by transit within various travel durations, for departures in the 7–9 AM period.

Accessibility is evaluated for three scenarios. The baseline scenario uses actual transit schedules as of March 2020, plus currently programmed transit network expansions. Scenario I reflects a potential investment scenario where resources are allocated to improve all types of transit trips. Scenario II reflects a potential investment scenario where resources are allocated to improve regional access to transit.

The table below summarizes the results of this analysis, averaged over the worker population in the Twin Cities metropolitan area. Overall, Scenario I provides greater job access improvements to current workers in the area. In Scenario I, area workers can reach 10% more jobs within 30 minutes, while in Scenario II this increase is 1.4%. Scenario I shows the greatest job access improvement for 30-minute trips, while Scenario II shows the greatest job access improvement for 60-minute trips. Averaged over all travel durations, Scenario I provides an 8.4% increase in job access while Scenario II provides a 2.3% increase.

Jobs Access Impact — Scenarios I and II

		Scenario I		**Scenario II**	
Threshold	**Baseline**	Change	% Change	Change	% Change
15 minutes	1,943	+132	+6.8%	+14	+0.7%
30 minutes	20,622	+2,068	+10.0%	+277	+1.4%
45 minutes	72,630	+6,002	+8.3%	+1,795	+2.5%
60 minutes	157,530	+11,316	+7.2%	+5,897	+3.7%
Weighted	5,160	+432	+8.4%	+120	+2.3%

1 Overview

This report presents the results of an analysis of access to jobs by transit in the Twin Cities metro area under two different potential transit investment scenarios. Accessibility in this context refers to a measure of the potential for interaction between people and destinations in different locations. The accessibility metric employed in this analysis is the number of jobs that can be reached by transit within various travel durations, for departures in the 7–9 AM period.

Accessibility is evaluated for three scenarios. The baseline scenario uses actual transit schedules as of March 2020, plus currently programmed transit network expansions. Scenario I reflects a potential investment scenario where resources are allocated to improve all types of transit trips. Scenario II reflects a potential investment scenario where resources are allocated to improve regional access to transit.

Accessibility evaluation relies on detailed travel time calculations and demographic data. Section 2 describes the data sources used and the methodology that was applied to calculate job accessibility. The results of this analysis are presented in Section 3.

2 Methodology

This analysis follows the methodology used in the National Accessibility Evaluation project[1], with data sources updated to reflect current and planned transit service in the Twin Cities area, as well as scenarios for potential service enhancements. The following sections provide a summary of this methodology and the data sources used.

2.1 Data

2.1.1 Employment Data

Employment data for both home and workplace locations for workers in the Twin Cities area, at the Census block level, are provided by the Census Bureau's Longitudinal Employer Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES) data program[2]. Data from LEHD 2017 are used in this study; block-level job counts form the basis of the job accessibility calculations, and block-level resident worker counts allow worker-weighted accessibility aggregation, as outlined in Section 2.2.5.

2.1.2 Transportation Network Data

Three different transit network scenarios are evaluated: Baseline, Scenario I, and Scenario II. Table 1 summarizes the network elements included in each scenario, and additional details are provided in the following sections.

[1] http://access.umn.edu/research/pooledfund/index.html

[2] https://lehd.ces.census.gov/data/

Table 1: Inclusion of Transitways in All Scenario Models

Transitway
D Line
Gold Line
Green Line with Extension
Orange Line
Rush Line
Blue Line with Extension
Riverview Line

2.1.3 Baseline

The baseline network represents current service operated by all transit providers in the Twin Cities region as of March 2020, plus currently programmed network expansions.

2.1.4 Scenario I: Improve Transit Access for All Trip Types

Scenario I reflects a potential investment scenario where resources are allocated to improve all types of transit trips. The goal of this scenario is to expand the range of communities where it is possible to live without a car, and improves access to high-frequency, all-day, all-week service. This scenario prioritizes expanding service to areas of highest transit use potential and maximizing ridership, with special attention given to equitably distributing expanded service to communities of color and low-income populations.

Route changes in Scenario I mostly consist of frequency increases to core routes, with some new and extended routes. Table 2 describes the network changes.

Table 2: New and Modified Transit Routes in Scenario I

Route	**Type of Service Change**
B Line	New Route
E Line	New Route
604 Louisiana Av/Excelsior Blvd	Frequency Increase
Route 614	New Route
Route 540 Extension	Extension
4 New Brighton/Johnson St	Frequency Increase
Route 784	New Route
68 Jackson St/Robert St	Frequency Increase
9 Glenwood/Wayzata Blvd	Frequency Increase
71 Little Canada/Westminster	Frequency Increase
63 Raymond Sta/Grand Av	Frequency Increase
446 Eagan/46th Street LRT	Frequency Increase
11 Columbia Heights/2nd St NE	Frequency Increase
723 Starlite/N Henn Comm College	Frequency Increase
62 Shoreview/Little Canada	Frequency Increase
444 Savage/Burnsville	Frequency Increase
10 Central Av/University Av	Frequency Increase
3 U of M/Como Av	Frequency Increase
74 46th St/Randolph	Frequency Increase
Route 46 Extension	Extension
14 Robbinsdale/West Broadway	Frequency Increase
722 Brooklyn Ctr/Humboldt	Frequency Increase
32 Robbinsdale/Lowry Av	Frequency Increase
65 Dale St/Co Rd B	Frequency Increase
80 Maplewood/White Bear Av	Frequency Increase
17 Minnetonka Blvd/Uptown	Frequency Increase
64 Payne/Maryland	Frequency Increase
HWY 55	New Route
615 Ridgedale/Co Rd 73	Frequency Increase
515 Southdale/66th St	Frequency Increase
18 Nicollet Av/Grand Av	Frequency Increase
23 Uptown/38th St	Frequency Increase
612 Uptown/Excelsior Blvd	Frequency Increase
22 Brooklyn Ctr/Lyndale Av N	Frequency Increase
67 W Minnehaha Av/Raymond Sta	Frequency Increase
61 E Hennepin Av/Larpenteur Av	Frequency Increase
2 Franklin Av/Riverside Av	Frequency Increase

2.1.5 Scenario II: Increase Regional Access to Transit

Scenario II reflects a potential investment scenario where resources are allocated to improve regional access to transit. The goal of this scenario is to strengthen connections to suburban jobs and opportunities throughout the fixed-route transit service area. The scenario prioritizes suburb-to-suburb transit access, reverse-commute services, and job access for suburban residents.

Route changes in Scenario II mostly consist of new and extended suburban routes, with some additional trips on existing routes. Table 3 describes the network changes.

Table 3: New and Modified Transit Routes in Scenario II

Route	Type of Service Change
227 Target Shoreview/Victoria	Frequency Increase
Route 745	New Route
805 Anoka Traveler/Anoka	Frequency Increase
539 Southtown/Normandale	Frequency Increase
MVTA Route 422	New Route
Maple Grove I-94/Hwy 252	New Route
MVTA Apple Valley Transit Expansion	New Route
740 EXPRESS Plymouth/Fernbrook Ln	Frequency Increase
600A SW Transit/Flex Route	Frequency Increase
Route 226	New Route
Gold Line Route 300	New Route
Route 547	New Route
Gold Line Route 302	New Route
Route 729	New Route
Eden Prairie to MSP and MoA	New Route
Route 75 Extension	New Route
SW Hwy 212	New Route
HWY 55	New Route
North MNPLS to Maple Grove	New Route
604 Louisiana Av/Excelsior Blvd	Frequency Increase
426 Burnsville Shuttle	Frequency Increase
446 Eagan/46th Street LRT	Frequency Increase
MVTA Route 471	New Route
Gold Line Route 219	New Route
75 Stryker/Robert	Frequency Increase
723 Starlite/N Henn Comm College	Frequency Increase
Route 817	New Route
Maple Grove Station to Plymouth and Golden Valley	New Route
602 SW Transit/Flex Route	New Route
Maple Grove Station to MPLS	New Route
493 EXPRESS Shakopee/Minneapolis	Frequency Increase

741 EXPRESS Plymouth/Annapolis	Frequency Increase
537 Valley West/Normandale Col	Frequency Increase
716 Zane Av/63rd Av	Frequency Increase
Eden Prairie to South MSP	New Route
542 84th St/76th St	Frequency Increase
225 Deluxe/Roseville	Frequency Increase
EXPRESS Rockford Road/Lancaster Lane	New Route
Route 746	New Route
Gold Line Route 63	New Route
MVTA 169 Connector	New Route
223 Rosedale/Little Canada	Frequency Increase
489 St Paul/Eagan Rev Comm	Frequency Increase
MVTA Dakota County E	New Route
717 Brooklyn Center/Robbinsdale	Frequency Increase
EXPRESS Plymouth Lawndale	New Route
540 Edina/Richfield	Frequency Increase
615 Ridgedale/Co Rd 73	Frequency Increase
Gold Line Woodbury to Oakdale	New Route
Gold Line Route 301	New Route
801 Brooklyn Ctr/Columbia Heights	Frequency Increase
705 Starlite/Winnetka Av	Frequency Increase
Green Line to Burnsville	New Route
SW Hwy 5	New Route
Little Canada TC to Vadnais Heights	New Route
600B SW Transit/Flex Route	Frequency Increase

2.2 Accessibility Calculation

The accessibility results detailed in this report were calculated using a *cumulative opportunities* accessibility metric. In this approach, the accessibility level of a given origin location is determined by the number of opportunities that can be reached within a given travel time threshold. Travel time thresholds of every 10 minutes from 10 to 60, with the additions of 15 minutes, 45 minutes, and 90 minutes, were included in the analysis for each scenario. Comparisons made between the respective scenarios and the base existing conditions are reported for the travel time thresholds of 30, 60, and 90 minutes, as well as for a time-weighted average of the accessibility figures at each 10-minute threshold (see below explanation in Section 2.2.6).

2.2.1 Origins and Destinations

Census blocks, defined in 2010 by the U.S. Census Bureau, were used as origin and destination points for this analysis. In urban areas, census blocks typically correspond to city blocks enclosed by roads. The origin set was composed of the centroid points of all land-containing census blocks within the core-based statistical area (CBSA) of Minneapolis-St. Paul-Bloomington, MN-WI, for a total of 52,956 origin points. The destination set consisted of the centroids of all land-containing census blocks within the same area plus a 60-kilometer buffer surrounding it, for a total of 128,351 destination points.

2.2.2 Travel Time Calculation

Travel time calculations included all components of a transit trip: time spent walking to a stop or station, waiting for a trip departure, traveling on a transit vehicle, walking to and waiting for transfers (if any), and walking to a destination after alighting. An unlimited number of transfers was allowed.

This analysis used the assumption that all walking portions of a trip take place at a speed of 5 kilometers per hour (3.1 miles per hour). On-vehicle travel time was calculated directly from the transit timetables outlined above in Section 2.1.2.

Jobs that can be accessed by walking only are included by default in the accessibility totals; a trip is not strictly required to include a transit component. This allows the most consistent application and interpretation of the travel time calculation methodology. The shortest walking path from an origin to a transit stop/station in some cases passes through potential destinations where job opportunities exist, and these destinations are included even though transit is not required to access them. In other cases, the travel time for walking between two nearby origin and destination points may be shorter than the travel time required to wait for an appropriate transit trip.

2.2.3 Cumulative Opportunities Calculation

Using the travel time calculations destribed above, sets of destinations reachable within 10, 20, …, 60 minutes were identified for each origin and departure time, and the jobs located at the reachable destinations were aggregated to arrive at a single accessibility data point for that origin, travel time threshold, and departure time. For each origin and each travel time threshold, the accessibility data for all 120 departure times were then averaged to provide a single accessibility value indicating the average

number of jobs that can be reached from that origin within the given travel time threshold, between 7 and 9 AM.

2.2.4 Time-Averaged Accessibility

Accessibility by transit is strongly dependent on departure time because of the scheduled nature of transit service. For example, if a transit route's service frequency is 20 minutes, then immediately after a vehicle departs, all destinations become 20 minutes "farther away." To address this and to reflect the influence of transit service frequency on accessibility (which is particularly important if frequencies are to be changed in proposed system improvements), travel times were calculated repeatedly for each origin-destination pair using each minute between 7:00 AM and 8:59 AM as the departure time.

2.2.5 Person-Weighted Average Accessibility

The cumulative opportunities accessibility metric presented here is a *locational* metric rather than an *individual* metric—it describes properties of places within the Twin Cities area, rather than properties of their residents. The value of accessibility, however, is only realized when it is experienced by people. To reflect this fact, when accessibility is averaged across multiple blocks in a larger area, each block's contribution is weighted by the number of workers in that block. The result is a single metric that represents the accessibility value experienced by an average worker in that area. This is the primary metric by which accessibility is measured and compared in this report.

2.2.6 Travel Time Threshold-Weighted Accessibility

In addition to the 30-minute, 60-minute, and 90-minute threshold accessibility metrics, a metric of person-weighted job accessibility averaged over the six 10-minute travel time thresholds (10, 20, etc.) is also presented. In the threshold-weighted average of accessibility, destinations reachable in shorter travel times are given more weight, as they constitute more attractive destinations. A negative exponential weighting factor is used, following the method established in the National Accessibility Evaluation project[3].

[3] http://access.umn.edu/research/pooledfund/index.html

3 Accessibility Results

Table 4 shows metro-wide worker-weighted average accessibility changes for Scenario I and Scenario II from baseline, for the 15-minute, 30-minute, 45-minute, 60-minute, and threshold-weighted metrics. Scenario I shows greater improvements to accessibility than does Scenario II for all metrics. Relative gains for Scenario I peak at the 30-minute threshold with a 10% increase in jobs accessible, a result of a high-frequency network's ability to connect urban job centers in shorter amounts of time. Job access at the longer 45- and 60-minute thresholds is also significantly improved in Scenario I. Scenario II, conversely, has gains peaking at the 60-minute threshold, as it connects more regional employers at the cost of lower frequency. Job access improvements the shorter 15- and 30-minute thresholds are very low in Scenario II.

Table 5 shows average accessibility changes for Scenarios I and II from Baseline for the same metrics as in Table 4, but limited to a half-mile catchment area along all transit alignments. While the absolute accessibility levels and changes are higher, the relative accessibility changes over this more focused area are not significantly different than the changes over the full metro area. This reflects the comprehensiveness of the changes evaluated in both scenarios — because both involve changes throughout the metro area, there are no significant areas in either scenario which do not see some degree of change in job access.

Table 4: Jobs Access Impact — Seven-County Metro Area

		Scenario I		**Scenario II**	
Threshold	**Baseline**	Change	% Change	Change	% Change
15 minutes	1,943	+132	+6.8%	+14	+0.7%
30 minutes	20,622	+2,068	+10.0%	+277	+1.4%
45 minutes	72,630	+6,002	+8.3%	+1,795	+2.5%
60 minutes	157,530	+11,316	+7.2%	+5,897	+3.7%
Weighted	5,160	+432	+8.4%	+120	+2.3%

Table 5: Jobs Access Impact — ½ Mile Service Area

		Scenario I		**Scenario II**	
Threshold	**Baseline**	Change	% Change	Change	% Change
15 minutes	3,225	+223	+6.9%	+23	+0.7%
30 minutes	34,595	+3,505	+10.1%	+457	+1.4%
45 minutes	122,100	+10,162	+8.3%	+2,940	+2.5%
60 minutes	264,656	+19,109	+7.2%	+9,597	+3.7%
Weighted	8,656	+731	+8.4%	+197	+2.3%

Figure 1 and Figure 2 illustrate the regional changes in job access calculated for Scenarios I and II, respectively. While both scenarios involve significant changes in job access throughout the metro area, there are important differences in which locations experience those changes.

Scenario I focuses primarily on adding additional service to current routes, by increasing service frequency and in some cases extending the alignment of existing routes. The map in Figure 1 reflects this focus in broad areas of moderate job access increases throughout the core cities of Minneapolis and Saint Paul, as well as in several first-ring suburbs. Some suburban areas also show strong increase in job access where a few routes are added or extended.

Scenario II, in contrast, focuses primarily on expanding the network to provide new service in areas where transit service had been very low or absent. This shows up clearly in several clusters of high relative access changes in suburban areas where existing routes are extended and many new routes are added. The central urban area, in contrast, generally shows little or no increase in job access.

When interpreting these maps it is important to keep in mind the locational nature of the cumulative opportunities accessibility metric. Job access is measured for each Census block, regardless of the number of people who live there. The access changes illustrated in these maps reflect the relative change for each location, but not the number of people who experience that change. A particular block might have a very high relative access change, but if few people live in that location, that access change will have only a small influence on the overall person-weighted average access figures shown in Table 4 and Table 5. Conversely, lower relative access changes in locations where many people live will have a strong influence on overall person-weighted access.

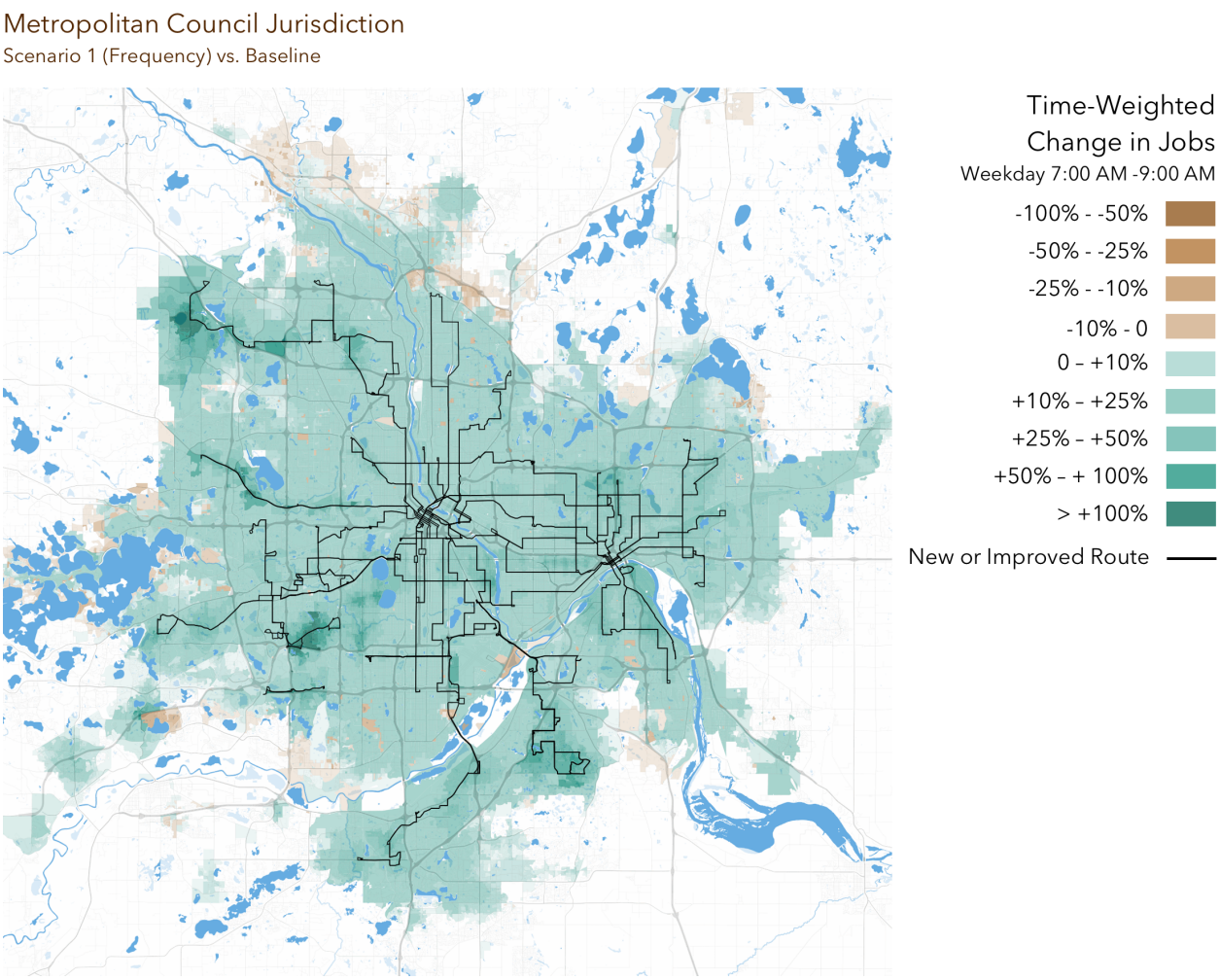

Figure 1: Scenario 1 vs. Baseline[4]

[4]Any areas of negative change depicted in the maps are not reflective of actual accessibility changes under the strictly additive scenarios, and are artifacts of minor GTFS input errors.

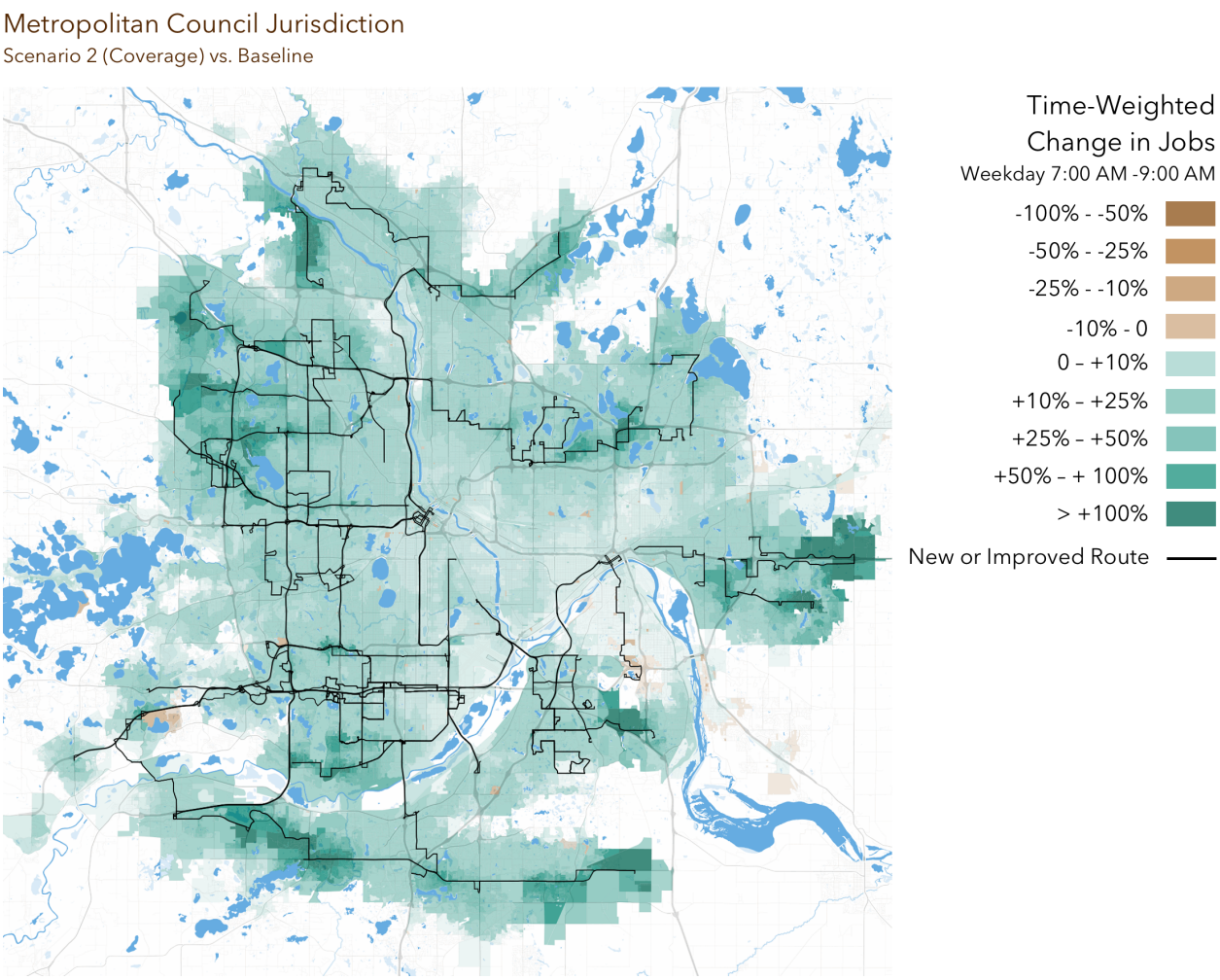

Figure 2: Scenario 2 vs. Baseline[5]

[5]Any areas of negative change depicted in the maps are not reflective of actual accessibility changes under the strictly additive scenarios, and are artifacts of minor GTFS input errors.