SOCIAL JUSTICE IMPACTS OF DETROIT TRANSIT SERVICE REDUCTIONS

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ABSTRACT

Transit cuts and service reductions are an ongoing and widespread problem for Detroit area residents. While reductions have been dispersed throughout the service area, residents who are most dependent on public transit tend to feel the effects more acutely than others. Anecdotal evidence suggests recent reductions disproportionately affect those most dependent on public transit. This study seeks to identify where transit dependent residents are in the Detroit area and to what degree recent service reductions have affected these key areas. The data we collected suggests that transit cuts do affect more transit dependent areas of the city, although not as acutely as we had expected based on anecdotal evidence. We believe further analysis of service reductions over time, as well as not simply relying on DDOT data would provide a more realistic and in-depth assessment of the impacts of transit reductions.

INTRODUCTION TO THE PROBLEM

A scene in the recent documentary, *Detropia*, shows Detroit residents discussing cuts to bus service in the city and the difficulty those cuts create for many working-class residents. One woman in the film indicates that those most affected by transit reductions are those with no other transportation option. Residents who rely primarily on public transportation, such as the bus system, light rail, paratransit, or other modes, out of financial or other need to conduct their daily business are necessarily transit dependent. When cuts are made to transit systems, they can have drastic impacts for low-income residents who don't have a personal vehicle or other means for getting to work.

The Detroit Department of Transportation (DDOT) has been involved in an ongoing process of service reductions. DDOT made three major cuts to public transportation services in less than two years—in April 2011, March 2012, and September 2012—this on top of cuts in 2005 and 2009 (TRU 2011). Many comparable urban areas are experiencing strong growth and investment in public transit services (APTA 2012), and DDOT's service reductions appear to be an outlier. This makes DDOT's reductions all the more deserving of close analysis and scrutiny. A DDOT report analyzing March 2012 route changes—primarily service reductions—found that proposed changes would have a disproportionate impact on minority and low-income residents (City of Detroit 2012). September 2012 reductions were given less consideration because they weren't considered major changes (Bukowski 2012). Meanwhile, Detroit residents continue to be concerned about the impacts of route cuts—particularly on minority and low-income residents.

We investigated March 2012 service changes and their impact on Detroit residents, focusing on those who are most transit dependent. This required an analysis of system changes and their relationship to communities that may be highly transit dependent. Our resulting data allowed us to determine which cuts have the greatest impact on public transit dependent areas of Detroit, and provided a framework for further research to be carried out in the future.

METHODS

DATA

ACS 2006-2010

We collected demographic data from The American Community Survey (ACS) 2006-2010. ACS five-year estimates aggregate demographic data continuously over a five-year period, creating an average for the period. The primary reason for choosing this version of ACS versus a one- or three-year estimate (which provide more current information) is that the five-year estimates are provided for smaller geographies—allowing us to use block groups as our level of analysis (Census Bureau 2008, 9). All of our demographic data represents this five-year average.

Detroit Department of Transportation

Our transit line data was based on information from DDOT[1]. One file that we received was from June 2012 and contained all existing DDOT lines, as well as Imperial Limited, which was eliminated in the March 2012 reductions. An older file was almost identical, but included two lines that had been eliminated prior to March 2012 changes. We also relied on a report released

[1] The most recent shapefile was created by Robert Linn at Data Driven Detroit, using data from DDOT. We received the earlier data from a fellow student who has done work in Detroit and it is also based on DDOT data. We verified both sets of data against route maps on DDOT's website.

by DDOT in April 2012, which documents March 2012 system changes (DDOT 2012). We used it to determine the extent of reductions, which were primarily running time reductions.

TRANSIT DEPENDENCY INDEX

In order to determine a way to measure transit dependency, we looked to US Department of Transportation (USDOT) and the Federal Emergency Management Agency (FEMA) definitions. Based on their definitions and our own input and ideas, we identified four variables for assessment: vehicle ownership, elderly population (over 65), youth population (under 18), and population below the national poverty line (FEMA 2010; FHA 2012; RCIP 2003). For the purposes of our study, we have replaced the last variable with the proportion of the population below the three-city median household income. Our rationale for this decision was that a median income baseline for the area would be more representative of the local cost of living than the national poverty line.

Using block group level data from the US Census Bureau 2006-2010 ACS, we divided each variable into quartiles representing the three-city area (Detroit, Hamtramck, and Highland Park). As Table 1 illustrates, we assigned a 1-4 rating for each variable's quartile, where 1 equals low risk for dependency and 4 equals high risk. We added the quartile scores for each variable t o calculate the summary "TDI Score" for each block group. This became our Transit Dependency Index (TDI) for the entire research area. Figure 1 shows our resulting data by block group for the three-city area. The darker shaded block groups are more transit dependent, while the lighter ones are less transit dependent.

GIS ANALYSIS

Our analysis began with the DDOT bus route shapefiles described above and the DDOT service change report, which we used to determine what routes had been changed (City of Detroit 2012). In addition to full and partial bus route eliminations, this report describes runtime reductions ranging from 2 hours per week to more than 30 hours per week, depending on the route. Runtime reductions were primarily at the end of routes—meaning that the buses do not run as late into the evening. Many routes were also reduced from the beginning of the day, so service starts later in the day. The report separates changes to weekday service from changes to Saturday and Sunday service. In many cases, weekend reductions were more severe than weekday reductions. For example, the Clairmount route was reduced by three hours at the end of the day during the week, and eliminated completely on Saturdays and Sundays.

In order to create a digestible and meaningful portrait of the changes, we assigned categories to the different changes—particularly important for visual impact and to make the changes easier to follow for the reader. The categories we chose are: 1) No change, 2) Less than 15 hours reduced[2], 3) 15 to 30 hours reduced, 4) Over 30 hours reduced, and 5) Full elimination. These categories give equal weight to weekday and weekend cuts, which we felt was important because some Detroit residents work weekends and/or need to access transit on the weekends for grocery shopping and other errands. Once we had determined these categories, we joined the route change data to the DDOT bus line shapefile, which allowed us to assign these categories to routes spatially in GIS.

The second major step was to combine this route change data with the TDI data to determine the populations impacted by route reductions. To accomplish this, we added the bus line data

[2] Hours Reduced refers to the total number of hours removed from the run-time over the course of one week.

to the TDI map (Figure 1, described above). With all the bus route changes and our TDI scores in one map, we selected all Census Block groups, any part of which were within a quarter of a mile of each bus line. This distance was chosen based on a review of previous research within the planning field, which indicates that one quarter mile is the approximate distance the average American will choose to walk instead of drive (Aultman-Hall et al. 1997).

Mean TDI Score and weighted averages

Using the quarter-mile buffer, we analyzed the characteristics of the populations affected by each type of route change. We did this primarily by using GIS to calculate the mean TDI score for the block groups affected by each type of reduction. In order to generate TDI scores more reflective of the actual population, we calculated a weighted mean for the three-city area as a whole, as well as for each service area affected[3]. Table 2 contains the raw averages as well as the weighted averages. Our results did not change the order of transit dependency considerably, but as the two tables indicate, we found a wider spread of scores for the focus areas when we weighted the averages by population.

FINDINGS AND DISCUSSION

Our initial non-weighted results consisted of a fairly narrow range of scores, as seen in Table 2, giving a rough idea of transit dependency in the area. The weighted mean for each area showed greater separation between the affected areas. While the order did not change considerably from non-weighted to weighted, the relative scores were more extreme. The weighted averages also indicated that the entire DDOT service area appears to be slightly more transit dependent than our non-weighted results show. Note also that, as Figure 1 indicates, transit dependency was not concentrated in any noticeable areas—it is highly dispersed geographically.

Our resulting data gave illustrative values for areas affected by route changes. The three-city area had a mean TDI score of 10.25 falling close to the median of possible scores and near our expected outcome. Arranging the mean TDI score of each route change category from low to high, we found route changes tended to affect areas with TDI scores above this average. As Table 2 shows, routes with "No Change" had a mean TDI score of 9.98, while "Eliminated Routes" areas had a mean TDI score of 10.49. Figures 3 through 7 show each of the reduction categories overlaid on the TDI map, giving a visual representation of this data. This indicates that route changes and cancellations tended to affect areas with a higher dependency on public transit, but our results did not exactly fit with our expected findings.

We anticipated "No Change" areas to have the lowest transit dependency, "Eliminated" areas to have the highest transit dependency, and a graduated range in between. Our reasoning was that service reductions would likely fall on areas with lower income and thus areas where ridership was the lowest. Rider's inability to pay the fare would likely render a given route less profitable and subsequently less financially sustainable for DDOT. Instead, we found that effects were not as we expected, with the "15-30 hour reduction" category affecting the most transit dependent areas, and the "Over 30 hour reduction" affecting considerably less transit dependent areas. The "15-30 hour reduction" category impacted the most transit dependent riders—more so than route eliminations or more severe changes. This shows that the even subtle changes have important impacts on the people who depend most on transit. It is useful to

[3] The weighted TDI score was calculated with the following equation: TDI Score=∑(block group TDI score)(block group population)/total population of all block groups in area.

note here that any reduction in bus service for someone who is very transit dependent will have a disproportionate impact on daily life than it will for someone who is less transit dependent, and may have the option to use a different type of transportation.

LIMITATIONS AND ASSUMPTIONS

SCOPE OF ANALYSIS

Economic limitations to DDOT's decision-making process are not explicitly examined in the proposed project. Our research does not aim to condemn route reduction on its face—recent route alterations are driven by economic imperative to reduce service. We acknowledge that service reductions are, if not absolutely necessary, then at least an important aspect of responding to economic crisis. Rather than attempting to assess fiscal decisions, we seek to evaluate recent system changes and cancellations strictly from a social justice perspective.

Due to the nature of Census block groups effectively equalizing the distribution of populations within each block group, our selection method captures some degree of data that is both unintended and nearly unavoidable. In creating a buffer to select all block groups within a quarter mile of the bus lines, some of the block groups selected were only partially within buffer. Figure 2 shows the quarter mile buffer and the resulting selected block groups for one of the route reduction categories. The extent to which this affects our overall results is difficult to determine, however this is a limitation of data we accepted from the beginning.

Feedback from fellow researchers pointed out that we might also have considered "single-mother headed households" as an additional variable in our measurement of transit dependency that might yield stronger results. Given more time it would be useful to see whether this additional variable would alter or strengthen our results. We also discussed the utility of measuring route reductions as a percentage change, rather than a raw amount of time. The scope of our project did not allow us to incorporate these ideas, but further research into this topic might take these factors into account.

DATA

DDOT Service change data only addresses March 2012 reductions. Other service changes have taken place recently—notably in June 2011 and September 2012 (TRU 2011)—that may exacerbate the influence of recent changes. Aggregated, these reductions likely amplify the impacts that we find in this study, although their direct effects may vary.

More narrative analyses of residents' experiences with DDOT service indicate that advertized service may not reflect reality. For example, the North End Woodward Community Coalition (NEWCC) produced several short videos of residents discussing their experiences with Detroit transit service[4]. Some residents describe waiting 2-4 hours for a bus, either because buses were too full or did not arrive on schedule. Our analysis was only able to capture route data provided by DDOT and likely does not reflect such deviations.

CONCLUSION

Our research found that transit reductions have had a widespread impact on Detroit residents, and our analysis illustrates two important reasons for this. The first can be seen in Figure 8, which shows all of the March 2012 cuts to DDOT services. As the map indicates, transit cuts were reasonably dispersed across the city. The scale and breadth of all of DDOT's cuts would

[4] These videos can be found at http://www.youtube.com/user/NorthEndWoodwardCC.

likely capture a representative range of age, income, and vehicle ownership groups throughout the service area, which appears to have been the case. The second reason is the range of TDI scores, and, therefore, transit dependency, across DDOT's service area, as seen in Figure 1. This shows that transit dependency is dispersed across the city—not as concentrated as we expected.

While our results suggest that service reductions were not as highly correlated with transit dependency to the degree that we expected, most route reductions did have impacts on populations that are more transit dependent than the average Detroit resident. This is an important issue for cities like Detroit to address as they reduce existing public services in response to shrinking populations. Developing a system for assessing the impacts of these reductions is an important part of the process of planning for shrinking cities.

It would be useful to further examine whether this has been true over previous reductions—further exacerbating the difficulties for transit dependent riders—or whether this was a unique occurrence. Perhaps areas receiving the most intense service reductions under this cycle were less intensely impacted on the last reduction, and the latest iteration of reductions has been more equitable in relation to past reductions than our narrow analysis shows. This type of question was beyond the scope of our research, but further investigation might provide a deeper understanding of both our results and the justice impacts of transit reductions in the area.

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APPENDIX A: TABLES AND FIGURES

	Elderly Population*	Median Income*	Vehicle Ownership*	Youth Population*	TDI Score**
Block group 1	1	3	2	1	**7**
Block group 2	4	3	1	1	**9**
Block group 3	3	2	2	3	**10**
…	…	…	…	…	**…**

Table 1: Example of combining variables used to calculate Transit Dependency Index Score.
*For each variable, a value of 1 indicates lower risk for transit dependency, whereas a value of 4 indicates higher risk.
**The TDI score is calculated by adding each variable across the table, resulting in a range of possible scores from 4 to 16, with 4 indicating the least transit dependent areas and 16 indicating the most transit dependent areas.

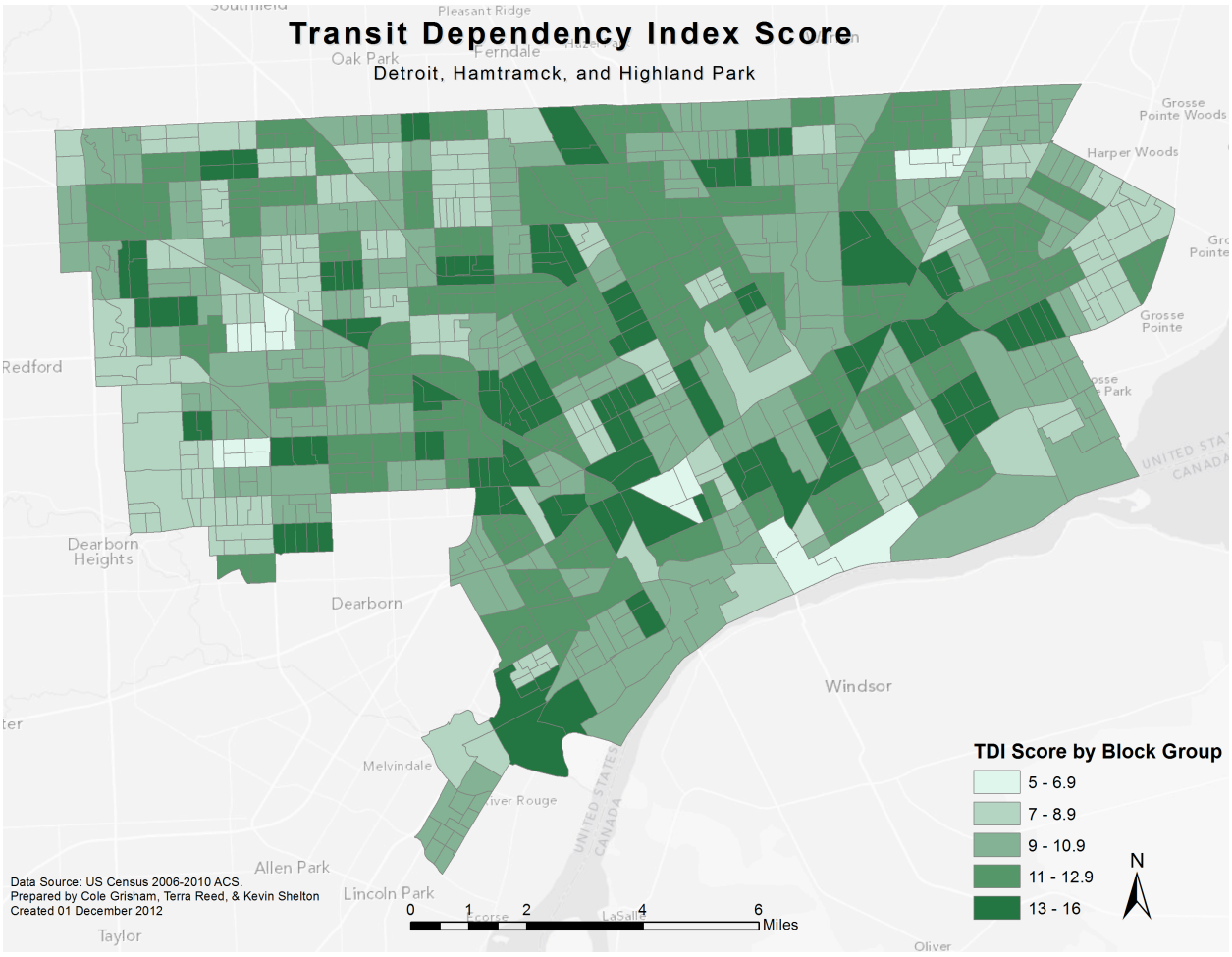

Figure 1: Transit Dependency by Block group in Detroit, Hamtramck, and Highland Park, 2006-2009.

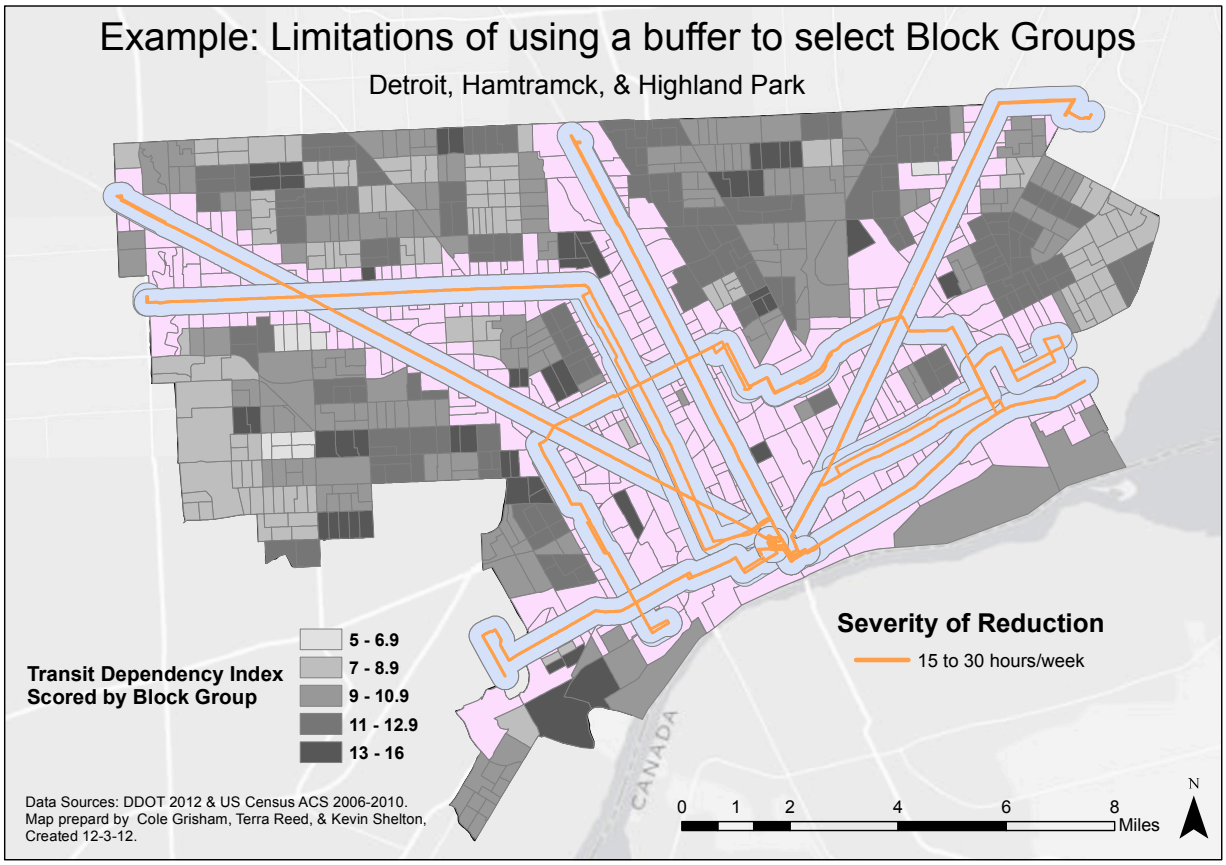

Figure 2: Limitations of using a buffer to select block groups. We selected block groups with any part within the buffer

Route Change	Non-weighted TDI Score	Weighted TDI Score
No Change	9.96	9.98
>30 Hours	9.98	5.15
<15 Hours	10.22	10.3
Eliminated	10.39	10.49
15-30 Hours	10.48	10.52
Three-City Mean	10.18	10.25

Table 2: Median Transit Dependency Index scores by extent of change to route.

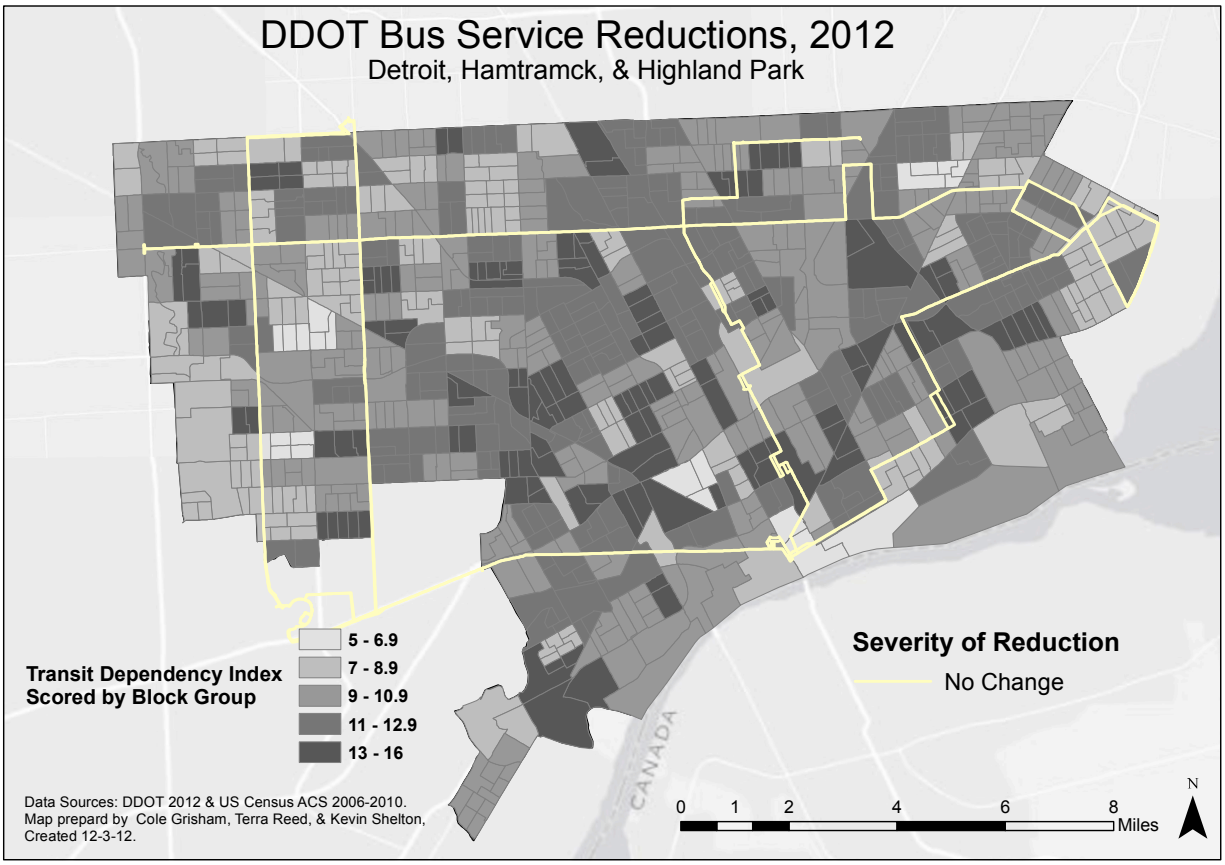

Figure 3: Routes that remained unchanged after March 2012 route changes.

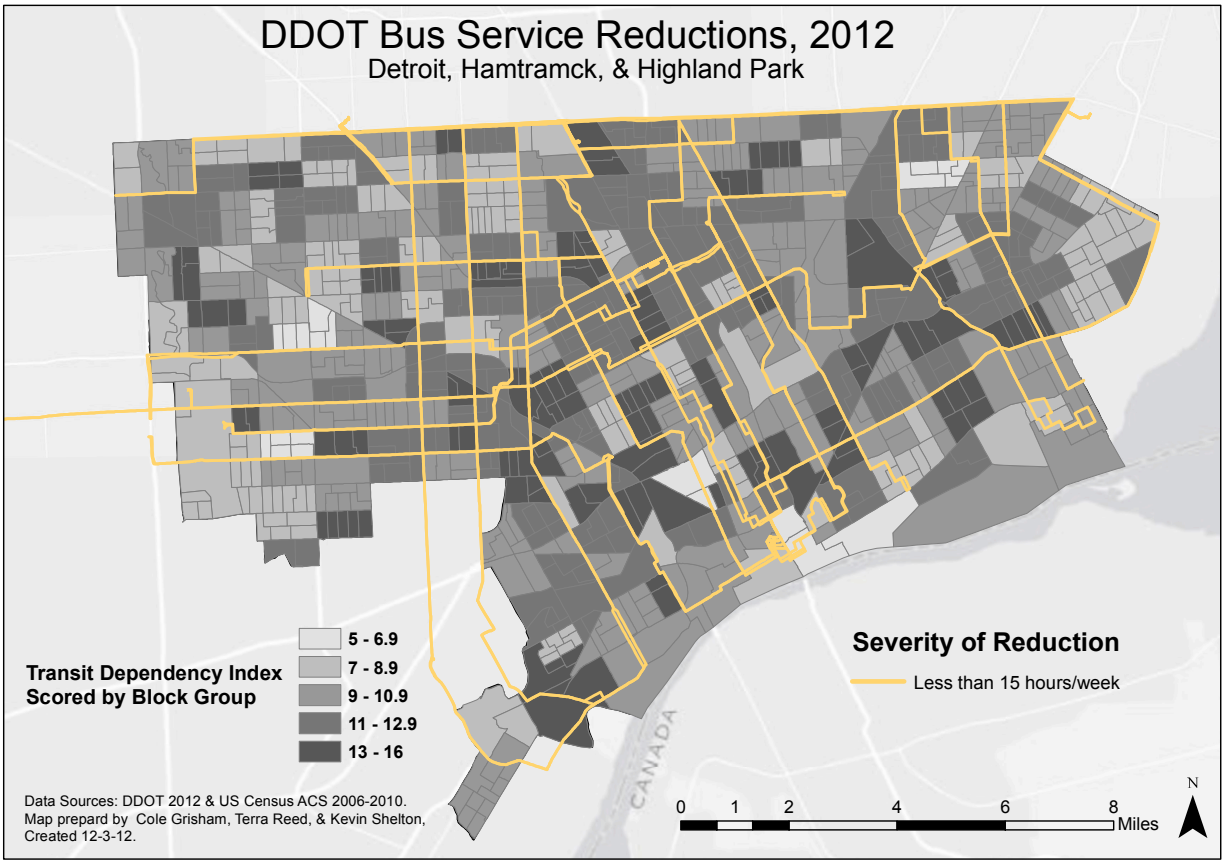

Figure 4: Routes reduced by less than 15 hours in March 2012 changes.

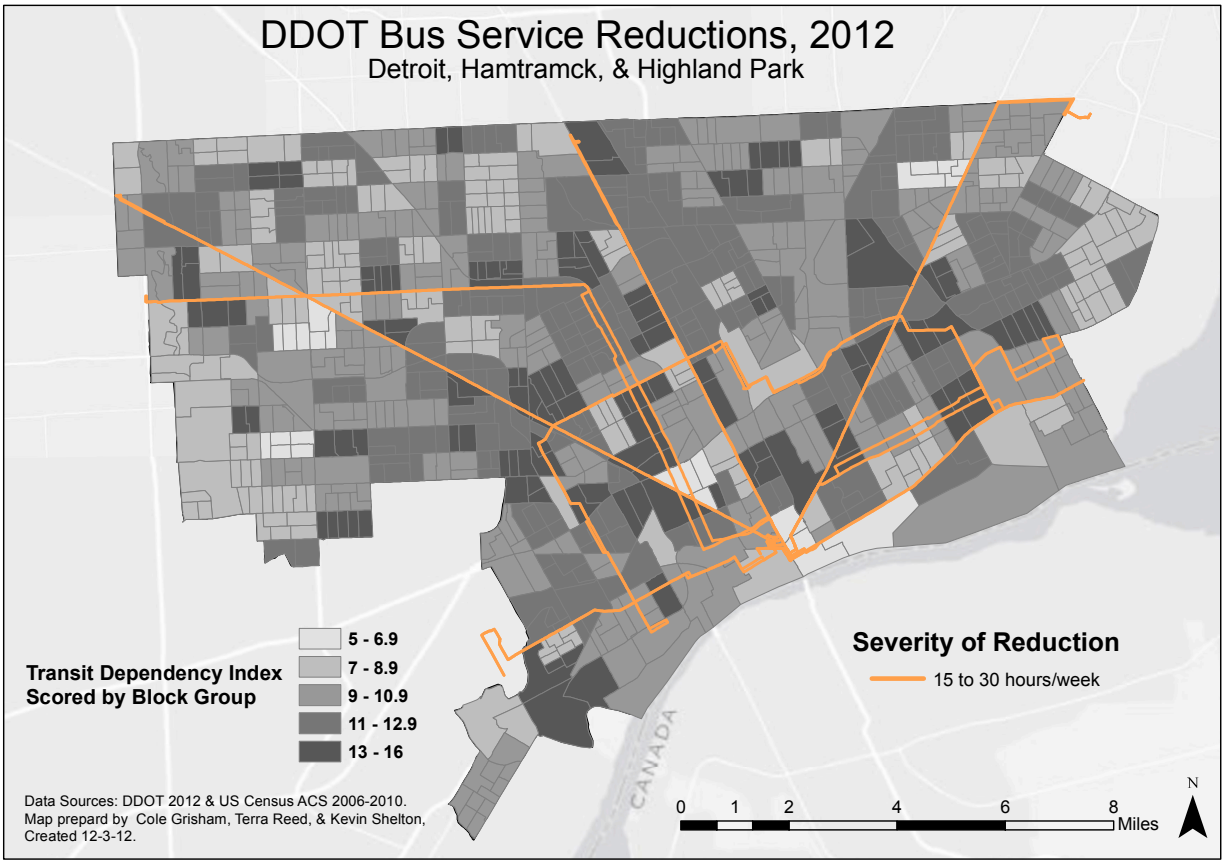

Figure 5: Routes reduced by 15-30 hours in March 2012 changes.

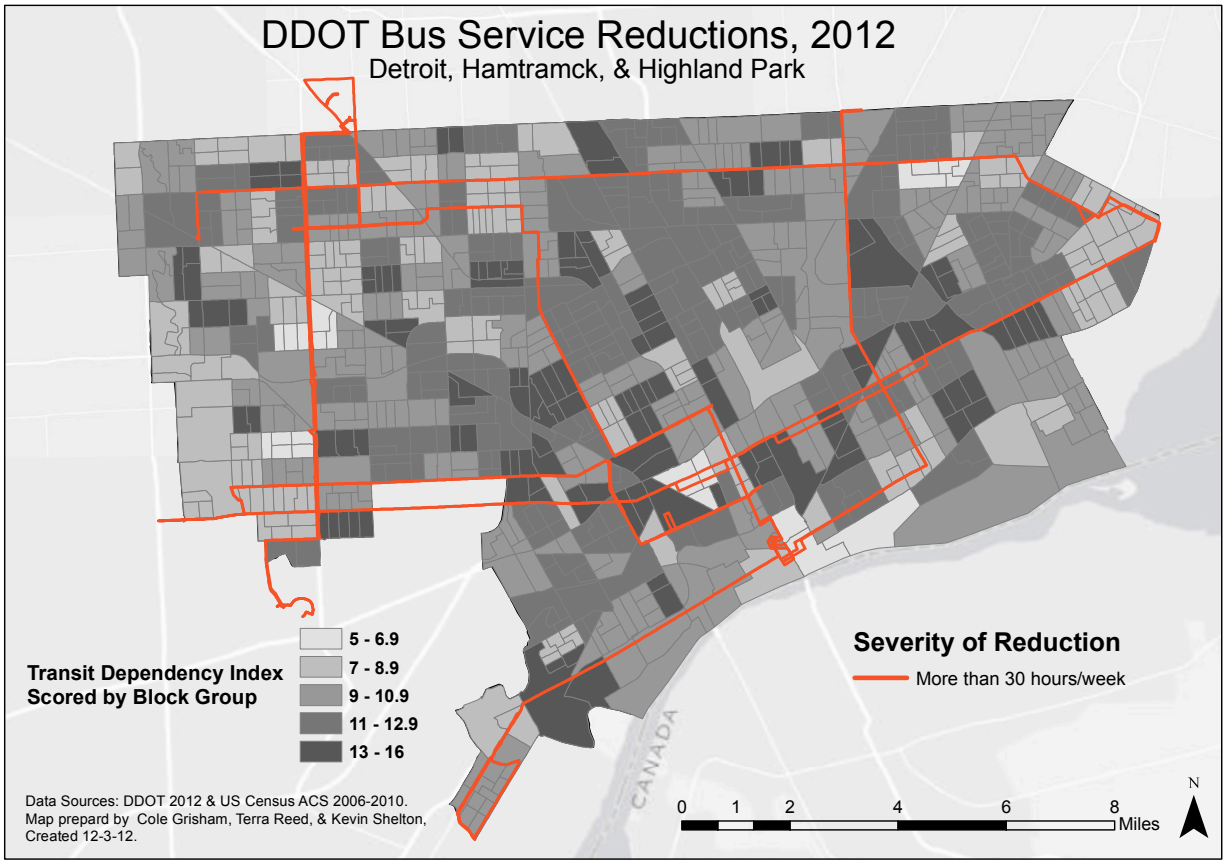

Figure 6: Routes reduced by more than 30 hours in March 2012 changes.

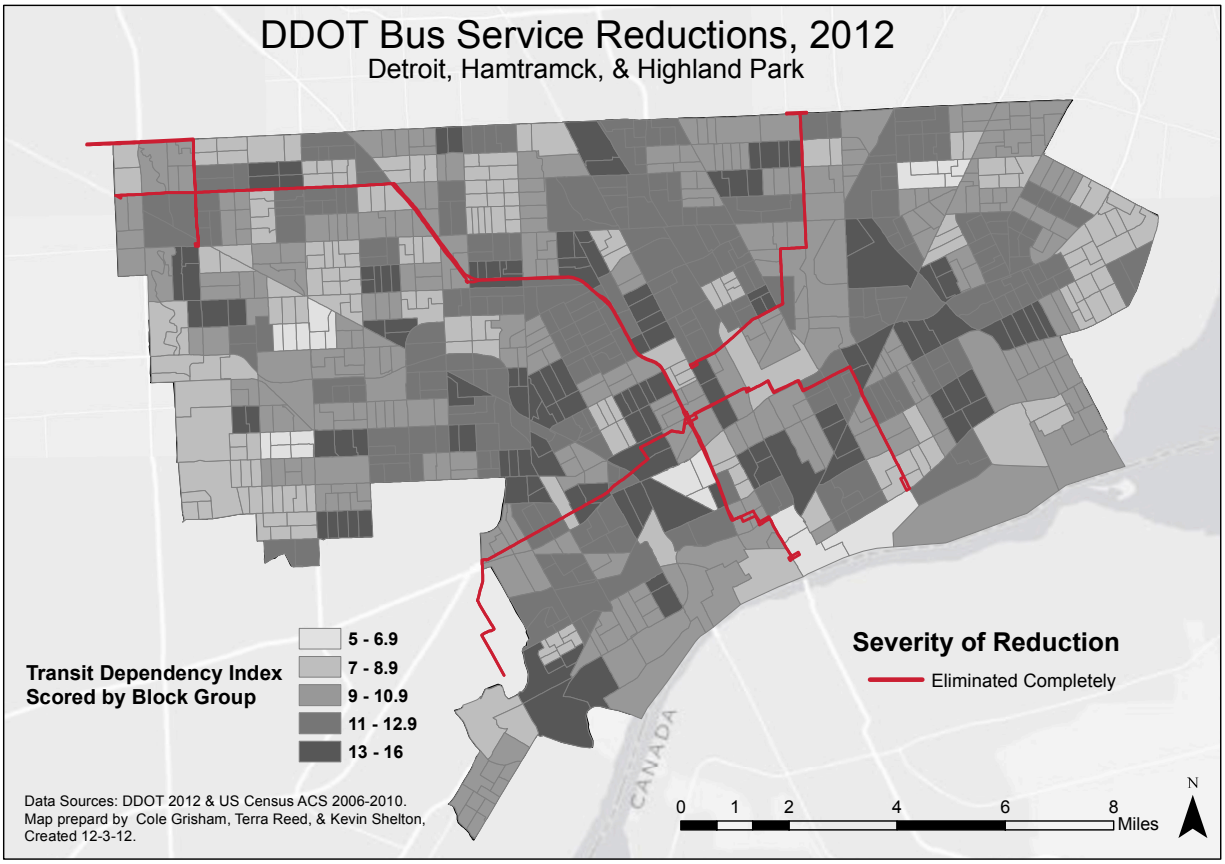

Figure 7: Routes eliminated in March 2012 changes.

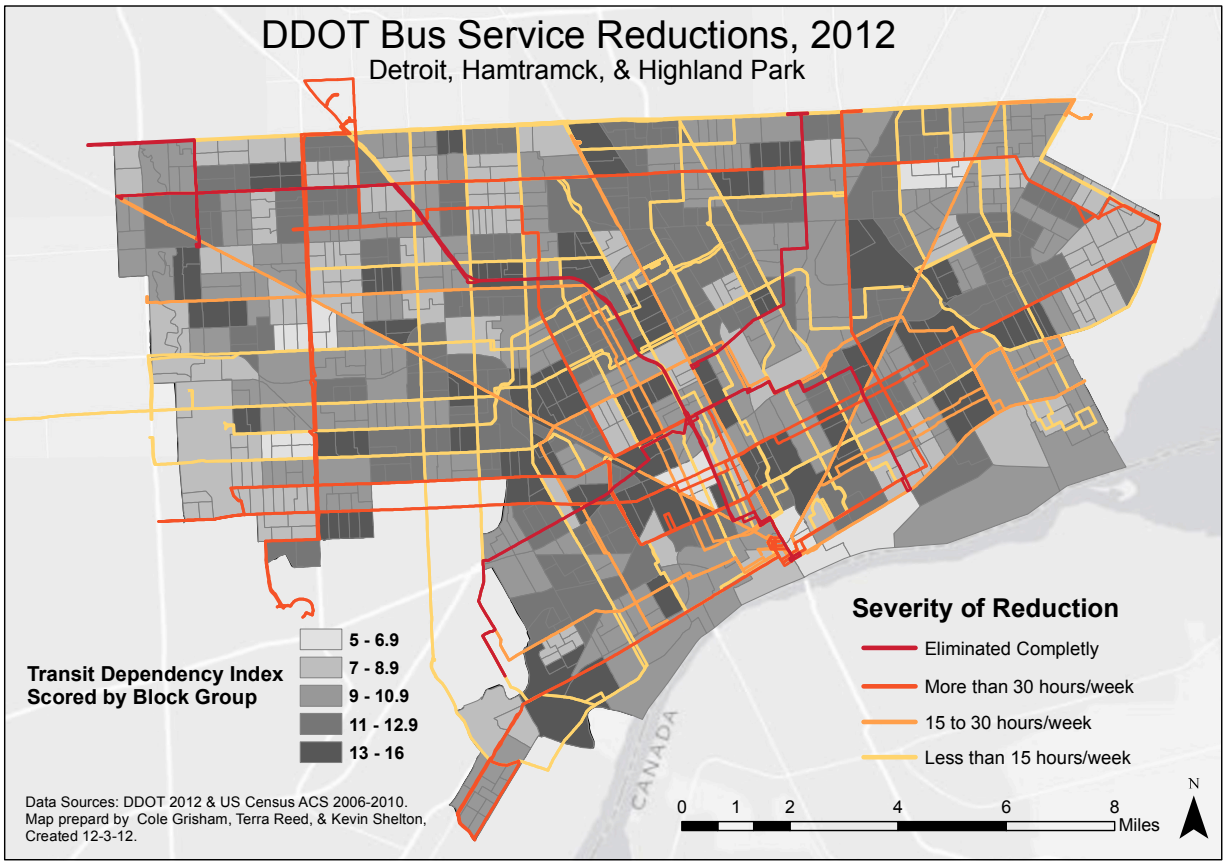

Figure 8: DDOT Bus Service Reductions, by severity of reduction, 2012.