ARRIVING AT EMPLOYMENT

AN ACCESSIBILITY ANALYSIS OF DETROIT'S MT. ELLIOT AND SOUTHWEST EMPLOYMENT DISTRICTS

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The Detroit Future City (DFC) strategic framework of 2012 proposes that industrial redevelopment in the Mt. Elliott and Southwest industrial employment districts will provide jobs for the greatest number of unemployed and underemployed residents of Detroit, Michigan. The Detroit Economic Growth Association has used the industrial employment district concept as the basis of an ongoing planning process in the Mt. Elliott area. The existing industrial and freight infrastructure paired with investment from non-profit groups in the Mt. Elliott and Southwest districts makes them prime locations for additional industrial investment. The goal of our study is to evaluate whether new manufacturing jobs in these areas will be accessible to working-age Detroiters who do not have access to a personal vehicle. Using geographic information system (GIS) software, we estimated the number of Detroiters who can reach either industrial district via bus service or walking within an hour of a typical industrial shift.

The Detroit Future City (DFC) strategic framework has identified seven employment districts in the city of Detroit where the highest concentration of job growth is likely to occur within the next fifty years. At present, firms and anchor institutions of Detroit's fastest-growing industries, education and medicine, manufacturing, digital and creative technology, and entrepreneurship, are concentrated within these districts. Approximately half of the jobs available in Detroit are located in these districts, which occupy a combined total of only 15 percent of Detroit's land coverage (DFC, 2012).

Our analysis focuses on the Mt. Elliott and Southwest industrial employment districts. DFC categorizes these districts as centers of global trade and industrial manufacturing. According to DFC, job growth within these sectors will offer employment opportunities to the largest percentage of unemployed Detroiters. Approximately 55 percent of new jobs within all of Detroit's industrial subsectors will be accessible to workers with less than or equal to a high school or equivalent degree (DFC, 2012). Over half of unemployed Detroiters held a comparable level of education in 2013 (US Census Bureau, 2013). Manufacturing jobs are significant because they generally provide higher wages than retail and service sector positions that require similar qualifications (Guenther, 2013).

While DFC is a redevelopment and land use framework intended specifically for the city of Detroit, the workers who could potentially benefit from DFC's proposed industrial districts are not limited to the city's borders. Detroit's neighboring municipalities, including the cities of Hamtramck and Highland Park, are home to tens of thousands of residents with similar employment needs as those of Detroiters. Any transportation or economic development planning that is relevant to the districts would be remiss not to consider the regional implications of the district's redevelopment. While regional considerations merit equal attention, our study will focus on one aspect of the district's redevelopment, that being the accessibility of the districts for Detroit residents.

The benefits of these Industrial Employment Districts cannot be realized if residents are unable to access them. Transit access is particularly important in Detroit because of exceptionally low levels of vehicle ownership (DFC, 2012). Approximately 23 percent of Detroiters, by housing unit, do not own vehicles, compared to nine percent of housing units in Wayne, Macomb, and Oakland counties – which surround Detroit – combined (US Census Bureau, 2013). DFC suggests that the current Suburban Mobility Authority for Regional Transportation (SMART) and Detroit Department of Transportation (DDOT) bus services do not effectively link Detroit's labor force to employment opportunities within the city. Furthermore, residential land use patterns continue to shift within the city, and may no longer match transit coverage (Grengs, 2007).

We used ESRI's GIS software, ArcMap, to estimate where the need for employment and transit service may be highest in Detroit, and how long it would take people in those areas to reach an industrial district job by transit or by walking. The first component of our analysis estimates the spatial distribution of Detroit residents who might benefit from a job opportunity in one of the districts, but are likely

to need public transit service to commute. We used the same indicators found in DFC, which include U.S. Census Bureau estimates of the number of Detroit residents who are of working age (16 to 64), residents who have not worked in the past 12 months, and the number of households that do not have access to a vehicle. Each variable was compiled by Census Block Group.

Next, we identified the spatial coverage of one hour's travel time from any bus stop in the city to a bus stop in either district, by any combination of riding a SMART or DDOT bus, or traveling by foot via city streets. The specific time frames we analyzed were one hour prior to standard industrial shift start times of 8:00 AM, 3:00 PM, and 11:00 PM. Our method captured the variation in transit service to the districts at each shift change for each day of the week. SMART and DDOT's service schedules are generally consistent on weekdays, so we only included Monday, Saturday, and Sunday in our final analysis. Travel time is indexed by intervals of fifteen minutes for each hour time window.

DATA, SOURCES, & ANALYTICAL TOOLS

The demographic data that we used to estimate the potential need for employment and public transit was compiled at the Block Group level using the 2013 American Community Survey 5-year estimates. Jurisdictional boundary and geographic feature shapefiles were Census Tigerline Shapefiles. We used ArcMap's Spatial Analyst extension to produce a raster grid that displays where our selected demographic characteristics were most concentrated. We used the Service Area Tool, available with ArcMap's Network Analyst extension, to generate visual footprints (service areas) that are representative of an hour's travel time or less from any bus stop in the city to any bus stop within an industrial district, traveling by any combination of riding a bus or walking along a street. General Transit Feed Specification (GTFS) data provided by the Southeast Michigan Regional Transit Authority (RTA), and Melinda Morang's Add GTFS Data to a Network Dataset Toolkit (Add GTFS), enabled us to incorporate current SMART and DDOT transit schedules into our service areas. We identified stops within the industrial districts using DFC district boundary data downloaded from the Data Driven Detroit open data site. Potential walking trips were estimated with roadway data downloaded from the Southeast Michigan Council of Governments' (SEMCOG) open data portal.

METHODS

To estimate the total number of Detroit residents who potentially qualify for an industrial job, we compiled the number of residents between the ages of 16 and 64 years by Census Block Group. This demographic generally represents the number of city residents who are of working age. Of the 16- to -64 year-old age group, we included the Census estimated number of individuals who did not work within the past 12 months as a proxy indicator of residents who may benefit from access to a manufacturing job. Unlike unemployment, this category includes teens and adults of working age who are not considered to be a part of the labor force. This distinction is important because Detroit's overall labor force participation rate (65 percent in 2012) is 10 percent below the regional average

(DFC, 2012). Lastly, we used the number of Census Block Group housing units whose residents do not own a vehicle to indicate the level of need for public transit access.

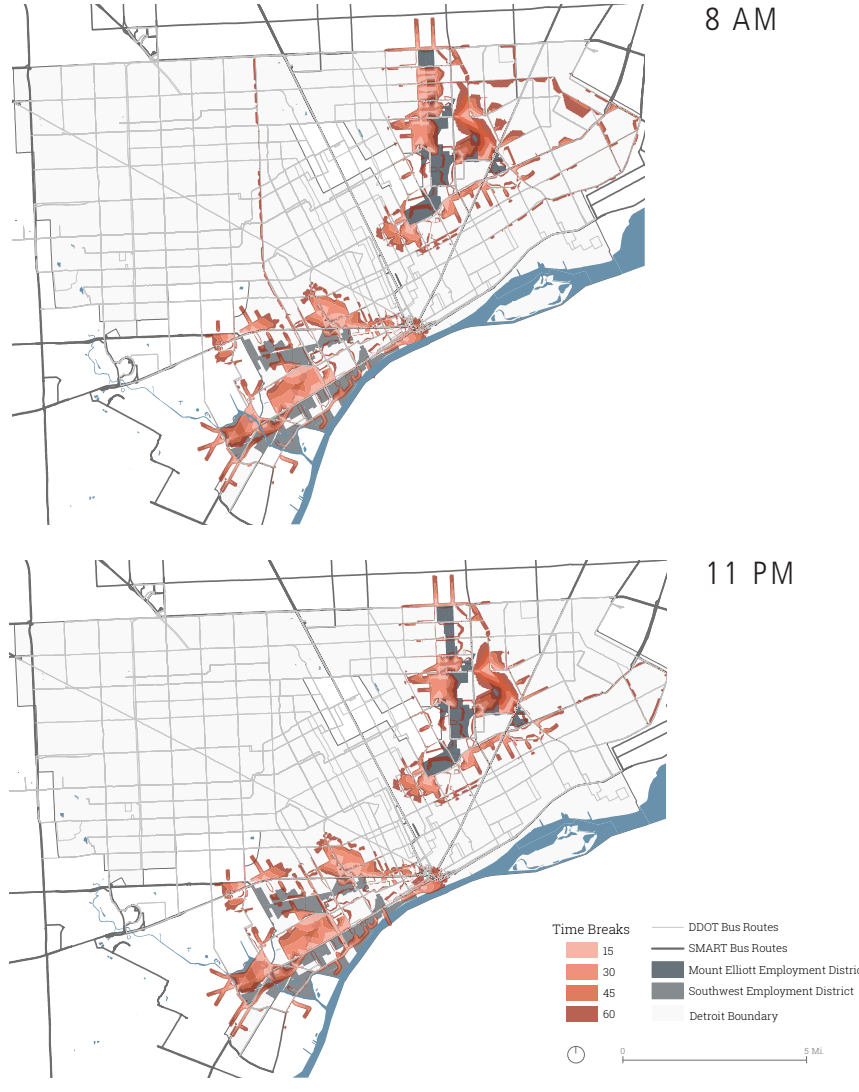
The first step of calculating our one-hour service areas was to build a multimodal network dataset that would allow us to model both pedestrian and transit trip routes to the districts. Multimodal network datasets in GIS can be used to calculate possible trips and travel times between specified locations that rely on two or more transportation modalities, accounting for a variety of user-specified travel constraints. Our dataset models the connectivity between SMART and DDOT bus stops, routes, and local streets within Detroit. We did not include non-motorized paths such as bike lanes or trails, or account for sidewalk condition and availability. Our model assumes that pedestrian travel is possible along any Detroit street.

The Add GTFS Toolkit enabled us to add parameters to our network dataset that generate more realistic travel time estimates. The model treats the SMART and DDOT transit routes and Detroit streets as separate networks of travel. Both networks can be used in a single trip, but the model ensures that bus stops are the only point of transfer between them. Travel parameters along the bus routes are defined by the SMART and DDOT GTFS data. The model calculates trip availability and duration along the bus routes based on scheduled bus departures, arrivals, and travel times between stops. We used the Detroit street network to model pedestrian trips. Trips calculated along the street network are restricted to travel at three miles per hour. Studies have shown this to be an average speed for adult walking trips (Schimpl et al., 2011). Trips that use both the street and transit routes incur a 15-second time penalty for each modal transfer to simulate boarding or exiting a bus.

We then used ArcMap's Service Area feature to calculate the spatial coverage of all possible transit or walking trips within 15, 30, 45, and 60 minutes from any bus stop in the city to any bus stop within either of the Mt. Elliott or Southwest districts. The service areas include any combination of bus and pedestrian travel that can be completed within the specified time frame. The model automatically includes potential transfer times, or a need to walk between intermediate or destination stops to complete a trip. When a transit trip is not available between a bus stop and a district stop, a walking-only trip will be modeled if it can be completed within the timeframe.

The benefits of these Industrial Employment Districts cannot be realized if residents are unable to access them. Transit access is particularly important in Detroit because of exceptionally low levels of vehicle ownership.

To complete our analysis, we identified the block groups that fall within each service area time interval, and totaled the associated numbers of residents who fall within our demographic criteria. We then compared the daily and weekly fluctuation in the number of people who could reach one of the districts in an hour or less. Census Block Groups were included in our service areas if their centroids fell within the service area polygons.



FIGURES 1 - 2
MIKE AUERBACH, KATHLEEN REILLY, AND YUTING SUN | TRAVEL TIME OF TRANSIT AND WALKING TRIPS PRIOR TO 8AM AND 11PM INDUSTRIAL SHIFTS ON MONDAYS. TRIP COVERAGE IS REPRESENTATIVE OF AVAILABLE WEEKDAY TRAVEL OPTIONS. TIME SHOWN IN MINUTES. SOURCES: DATA DRIVEN DETROIT, SOUTHEAST MICHIGAN COUNCIL OF GOVERNMENTS, SOUTHEAST MICHIGAN REGIONAL TRANSIT AUTHORITY, U.S. CENSUS BUREAU.

This method serves as an approximation of walkability. We were unable to determine how residents are distributed within each Block Group, and whether or not those residents live within a reasonable walking distance to a bus stop. Including Block Groups by centroid ensures that at least half of the Block Group falls within the service area.

RESULTS

Our findings are consistent with DFC's assertion that the Mt. Elliott and Southwest industrial employment districts are inaccessible to a large majority of Detroit's workforce by means of transit or walking. We estimate that 91 percent of Detroit residents between the ages of 16 and 64 years, or 471,083 out of approximately 515,523 individuals, would need to walk or travel by bus for over an hour to reach either of the industrial districts in time for a 8:00 AM shift. This estimate is consistent for each day of the week, and reflects the largest number of working-age individuals who could reach the district in an hour or less in time for any shift. Approximately 43 percent of the working-age residents who live outside of the 8 AM one-hour service area of a district have not worked in the past 12 months, according to Census estimates. While the potential variability of the number of people who may not be in need of employment is significant in this estimate, this number is representative of a large portion of Detroit's population who are out of work.

The weekday and weekend morning shifts appear to be accessible to the greatest number of working-age Detroiters traveling by foot or by bus. The majority of the estimated 44,440 working-age residents who live within one hour's travel of an industrial district prior to a morning shift (28,244 people) would need to spend between 30 and 60 minutes in transit to reach a district by 8:00 AM. The 3:00 PM and 11:00 PM shifts are accessible in under one hour to approximately 38,583 working-age Detroiters on weekdays and weekends.

We estimate that 18,126 working-age Detroiters who have not worked in 12 months live within a one-hour walking or public transit commute to an industrial district. Of those residents, approximately 69 percent (12,519 people) live within a 30- to 60-minute service area. The spatial distribution of working-age Detroiters who have not worked in 12 months is proportionate within and beyond the one-hour service areas.

Lack of vehicle access appears to be higher among individuals with 30- to 60-minute commutes than individuals with shorter commutes. The percentage of housing units without vehicle access located within a zero- to 30-minute trip of a district averaged 16 percent for all shifts, or 1,030 of 6,556 housing units. The percentage within a 30- to 60-minute trip was 26 percent for all shifts, representing 3,458 of 13,256 housing units. These percentages are compared to a city-wide rate of 23 percent of housing units without vehicles. For comparison, the average population of the weekly zero- to 30-minute service areas was 14,492 people, compared to an average of 26,115 people within the 30- to 60-minute service areas.

Identifying service gaps that disproportionately affect working-age residents, people out of work, or people without access to vehicles will require a more detailed analysis. The distribution of high-need Block Groups seems to correspond with the spatial distribution of Detroit's population. However, we can generally describe the variation in district access throughout the

city by the demographics of city residents, and the service available to them.

The Block Groups with the highest need for district access are home to an exceptionally large proportion of working-age residents. The median estimate of working-age people in the high-need Block Groups was 1,107 residents, compared to 496 across all Block Groups. Rates of vehicle ownership were also significantly lower. The median percentage of housing units without vehicles was 37 percent, which is 14 percent higher than the city rate. The rate of people who have not worked in 12 months is higher than average but reflects the Detroit-wide trend more closely. Only three of the 30 highest-need Block Groups are within an hour trip of the districts, for any shift.

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Surprisingly, no transit trips of an hour or less are available to either district from Detroit's Central Business District or its surrounding neighborhoods. The neighborhoods surrounding Downtown, Midtown, Eastern Market and the Jefferson Corridor contain the largest concentration of high-need Census Block Groups. Combined, they are home to approximately 31,815 working-age individuals. The percentage of residents who have not worked in 12 months is proportionate to the city-wide percentage, but the lack of vehicle access is significantly greater. Approximately 39 percent of the housing units in the inner-core neighborhoods lack vehicle access.

Northwest Detroit is the largest continuous geographic area without transit service of an hour or less to either district. This area includes the neighborhoods north of Interstate 94, and west of Woodward Avenue. The Livernois Avenue corridor is the exception of this service gap, where transit trips of an hour or less are intermittently available to the Southwest Detroit district throughout the week. Approximately 261,836 working-age residents live in this area of roughly 67 square miles.

CONCLUSION

Our model provides a general estimate of access to the Mt. Elliott and Southwest industrial employment districts, but there are other important dimensions of accessibility that we did not capture. The availability and consistency of return trips are just as important as being able to get to a district in time for the beginning of a shift. Other factors to consider when discussing accessibility include frequency and reliability of the transit trips included in our service areas. Lastly, parcel-level population data would have allowed us to estimate the number of people associated with different travel times with greater accuracy.

There are also limits to our method of estimating walking trips. We were unable to model an average willingness to walk by excluding or penalizing pedestrian trips beyond a certain distance. The model automatically includes all trips that are possible within the

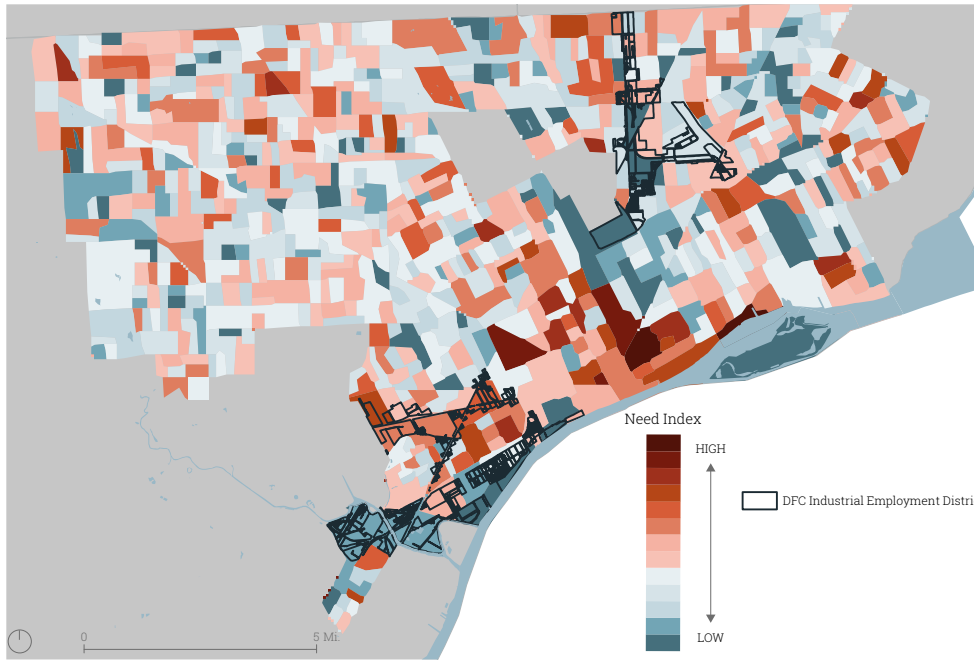

FIGURE 3
MIKE AUERBACH, KATHLEEN REILLY, AND YUTING SUN | TRANSIT NEED INDEX | TRANSIT NEED MAP BASED ON NUMBER OF HOUSEHOLDS WITHOUT A PRIVATE VEHICLE, NUMBER OF WORKING AGE RESIDENTS AND NUMBER OF RESIDENTS WHO HAVE NOT WORKED IN A YEAR DELINEATED BY CENSUS BLOCK GROUP. SOURCE: U.S. CENSUS BUREAU.

specified timeframe, even if they are exclusively walking trips.The model also does not account for pedestrian infrastructure conditions. We assume people would be able to use any Detroit street to walk to a district, regardless of the availability or condition of sidewalks. Even with these limitations, we feel that our estimates of travel times provide a meaningful measure of accessibility for individuals who do not own vehicles.

The accessibility challenges we have identified will come as no surprise to anyone familiar with public transit in Detroit. We hope that mapping the limited access to Mt. Elliott and Southwest districts, and determining the number of people affected by it, will emphasize the importance of public transit in the context of economic development planning. The accessibility of the Mt. Elliott and Southwest districts has important implications for reducing unemployment in Detroit while encouraging job growth. We hope that our analysis provides an initial basis for identifying where proper investment and adjustments to service times, coverage, and frequencies could offer people access to jobs that they currently cannot reach. ▪

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